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A STATISTICAL REGRESSION APPROACH ON THE EFFECT OF POPULATION GROWTH ON ECONOMIC GROWTH: EVIDENCE FROM NIGERIA

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Abstract

This study examines the relationship between population growth and economic growth in Nigeria from 1981 to 2021 using the ARDL model. The results reveal that population growth has a positive impact on economic growth, but this effect is statistically insignificant. This suggests that while a larger population can potentially contribute to economic expansion by providing a larger labor force and market, it does not significantly drive economic growth. Moreover, the research shows that the labor force participation rate also positively influences economic growth but lacks statistical significance. This implies that an active workforce is beneficial but not a dominant factor in driving economic growth. Conversely, the study finds a significant and negative correlation between the unemployment rate and economic growth, highlighting the detrimental impact of high unemployment on the economy. Based on these findings, policymakers are advised to prioritize labor market policies that target unemployment reduction and promote job creation. Additionally, monitoring and managing population growth trends through family planning programs are essential for sustainable economic development. Diversifying the economy beyond natural resources, investing in education and vocational training, and focusing on infrastructure development are further recommended strategies to foster economic growth in Nigeria. In summary, while population growth plays a role, addressing unemployment and labor market dynamics is crucial for long-term economic sustainability.

Introduction

Nigeria, the most populous country in Africa, has undergone significant population growth over the past few decades. According to the Nigeria Bureau of Statistics (2021), the estimated population of Nigeria surpassed 200 million, with projections indicating continued growth in the coming years. This demographic phenomenon has profound implications for the country's economic growth, shaping the dynamics of productivity, the labor force, and resource allocation. One of the ways in which population growth impacts economic growth in Nigeria is through its effect on the labor force. With a growing population, there is an increase in the number of individuals entering the working-age population, and according to Ochinyabo (2021), this can lead to a demographic dividend if the country invests in education, healthcare, and skill development to enable these individuals to contribute productively to the economy. Yahaya et al. (2020) purported that the availability of a large labor force has the potential to boost production and economic output, fostering economic growth. However, the realization of the demographic dividend relies on several crucial factors. For one, there must be sufficient employment opportunities and job creation to accommodate the expanding labor force. According to Malthus (1986), if the pace of economic growth does not match the rate of population increase, unemployment and underemployment can rise, leading to social and economic challenges, given that, according to him, the population grows geometrically while the resources required to cater for the population grow arithmetically. Malthus & Winch (1992) explicitly explained that the inability of the resources available to cater for the population will eventually metamorphose into social unrest, poverty wars, and a decline in a nation's overall wealth. The study by Yakubu et al. (2020) shows that the speedy rise in population size, especially in developing countries, is triggered by a high birth rate and an unchecked desire to control the rate of procreation, given the subsequent satisfaction that comes with a surplus of resources. This has played out in present-day Nigeria, as the country's youth unemployment rate stood at approximately 42% (NBS, 2021), highlighting the importance of addressing this issue to leverage the potential benefits of population growth. The existing debate has been between whether population growth only affects economic growth negatively, as purported by the Malthusian theory, or whether population growth can be beneficial and promote economic growth if harnessed positively, as stated by the anti-Malthusian theory by Julian Simon (2014).

The burgeoning population in Nigeria has been growing at an accelerated pace in recent years (Tartiyus et al., 2015), raising significant concerns about its potential implications for the country's economic growth and overall development. The problem at hand revolves around comprehending the specific challenges posed by rapid population growth and gaining deeper insights into how it precisely influences Nigeria's economic growth trajectory. With the surge in population, there are an array of economic challenges that need to be addressed. Firstly, the strain on the nation's infrastructure and resources has intensified (Ogunleye et al., 2018) as the existing systems grapple to cope with the escalating demands of a larger population.

As the Nigerian population policy aptly acknowledges, the people are the most important and valuable resources of any nation and constitute the primary producers as well as consumers of national wealth and development dividends. Thus, human beings are at the center of concern for sustainable development. The 1994 International Conference on Population and Development (ICPD), held in Cairo, emphasized the interrelationship between population, economic growth, and social development. As the ICPD Programme of Action (PoA) states "there is a general agreement that persistent widespread poverty as well as serious social and gender inequalities have a significant impact on and are in turn influenced by demographic

parameters such as population growth, structures, and distribution". Thus, there is a need to fully integrate population concerns into all aspects of development strategies, planning, and decision-making at all levels to improve the quality of life of the people (UNSN, 2001).

Proximate Determinants of Population Growth in Nigeria: at a growth rate of 2.8 percent per annum between 1952 and 1991, Nigeria is one of the fastest-growing countries in the world. The growth rate is not expected to change drastically in the short run. Nigeria's population is therefore expected to double in less than 25 years. The high population growth rate is essentially due to persistently high fertility in the face of decreasing mortality between the 1960s and the 1980s. The total fertility rate (TFR) had remained high at about 6 children per woman (UN 2000a, 2000b), while the crude death rate (CDR) had decreased from 27 to 15 deaths per 1000 population within the same period. The infant mortality rate (IMR) also declined from 187 to 90 deaths per 1000 live births between the 1960s and 1980s (UNSN, 2001). Available data show that international migration does not contribute significantly to the growth of the population in Nigeria (UNSN, 2001). Nigeria is one of the fastest-growing countries in the world. With an estimated population of 140 million in 2006 and an annual population growth rate of 2.9% (NPC, 2006), Nigeria is the most populous nation in sub-Saharan Africa and the tenth most populous in the world. However, the composition of this population is mainly in the youthful category, with 49% being youths below the age of 21, and a dependency ratio estimated at 89%. A large proportion of this population favors and is living in the rapidly expanding urban area, presently estimated at over 45.2% and will likely hit the 55.4% mark by the year 2015 (UNDP, 2000). As of 2018, Nigeria's population was 198.39 million, which is a 2.53% increase from 2017, 2019 was 203.30 million, which is 2.48% from 2018, 2020 was 208.33 million, which is 2.47% from 2019, 2021 was 213.40 million, which is 2.44% from 2020, and 2022 was 218.54 million, which is a 2.41% increase from 2021 (NBS, 2022).

Consequently, issues like inadequate transportation, limited access to utilities, and stretched public services have emerged. Secondly, the expansion of the labor force has contributed to heightened unemployment rates, creating a productivity gap and potential social instability (Akinbode et al., 2017). Moreover, the rapid population growth has further exacerbated income inequality, as limited access to opportunities impedes upward mobility for certain segments of the population. Furthermore, the surge in population has escalated food demand (Adewole, 2012), making it increasingly difficult to attain food security due to production constraints and distribution inefficiencies. Nevertheless, demographic trends can also bring about opportunities for economic growth. A growing population translates into an expanding domestic consumer market, which holds the potential to stimulate demand for goods and services, thus driving economic growth (Ideh et al., 2022). Additionally, a youthful and dynamic workforce resulting from population growth presents opportunities for increased productivity and innovation (Ogunjinmi, 2022). However, seizing these opportunities requires a substantial investment in human capital, including education and healthcare, to fully harness the potential of the population.

The study aims to delve into the intricate dynamics between rapid population growth and its impact on Nigeria's economic growth. By identifying the challenges and opportunities arising from this phenomenon, policymakers and stakeholders can devise targeted strategies to leverage demographic trends for sustainable and inclusive economic development in the country. Addressing the impact of rapid population growth on economic growth is crucial for securing Nigeria's long-term prosperity and socio-economic well-being.

Therefore, this study will unravel the effect of population growth on economic growth in Nigeria and ascertain if the assumption's anti-Malthusian theory is applicable in Nigeria.

Empirical review of literature

Scholars like Simon (2014) and Sabin (2013) have put forward the idea that population growth could be taken advantage of and transformed into an extremely productive labor force that could drive economic growth. However, research has shown that this can only be possible if the country possesses an effective educational system that equips its working population with the required skills to drive research and development. However, Ibrahim et al. (2020) explained that most developed economies plagued with a high rate of population growth lack the institutions and facilities required to harness the benefits of a large population. According to Rahman et al. (2020), population growth can significantly impact domestic consumption patterns given that, with a larger population, there is an increased demand for goods and services, which can stimulate economic activity and drive growth in certain industries. However, to ensure sustainable consumption patterns and avoid resource depletion, proper planning and policies are necessary to balance consumption with available resources and environmental considerations (Ideh et al., 2022). Despite the potential advantages, rapid population growth can also strain resources and infrastructure, posing challenges to economic development (Ideh et al., 2022). The demand for essential services such as healthcare, education, and housing may outstrip the government's capacity to provide adequate facilities and services, leading to disparities in access and quality of life. Insufficient investment in infrastructure can hinder productivity and hinder the country's competitiveness in the global market (Rehman et al., 2022). Furthermore, if economic growth does not keep pace with population growth, it can exacerbate poverty levels (Adewole, 2012). As of 2021, Nigeria's poverty rate was estimated to be around 40% (NBS, 2021), with a significant proportion of the population living below the poverty line. High poverty rates and unequal income distribution can hinder inclusive economic growth and lead to social unrest, undermining stability and development efforts. The impact of rapid population growth on economic growth is also intertwined with other factors, such as educational attainment and healthcare. Investment in education and healthcare is crucial for developing human capital, which plays a vital role in increasing productivity, fostering innovation, and driving technological advancements. In 2021, Nigeria's literacy rate for adults aged 15 and above was approximately 62% (NBS, 2021), highlighting the need for further efforts to improve access to quality education.

Addressing the challenges and harnessing the potential benefits of population growth has proven to be a difficult endeavor for developing economies and brings about more concern as to the challenges presented by rapid population growth (Schneider, 2022). The existing debate as to whether rapid population growth is beneficial or parasitic to economic growth has resulted in several insights into the subject matter and lies at the root of the rationale behind this study. Ogunjinmi (2022) has proposed that by addressing issues related to education, healthcare, employment, and infrastructure, Nigeria can maximize the potential benefits of its growing population and foster a more inclusive, resilient, and prosperous economy. Two theories have explicitly explored two different perspectives on the impact of population growth on the economy, and two of these theories are the Malthusian theory by Thomas Malthus and the Anti-Malthusian theory by Julian Simon.

The Malthusian Theory

This theory was propounded by Thomas Malthus, who was a British economist and was the first to propose a systematic theory to the population. He based his findings on the British economy of that time and proposed in his principles that the human population growth rate was increasing at a geometric rate while food production was increasing at an arithmetic progression (Malthus, 1826). Malthus's early writings were pamphlets that addressed economic and political issues of his time. In opposition to the popular 18th-century European view that society was constantly improving, he wrote about the dangers of excessive population growth (Unat, 2020). In his 1798 work, 'An Essay on the Principle of Population', Malthus (1826) examined the relationship between population growth and resources. From this, he developed the Malthusian theory of population growth, in which he wrote that population growth occurs exponentially, so it increases according to the birth rate (De la Croix and Gobbi, 2022). For example, if every member of a family tree reproduces, the tree will continue to grow with each generation. On the other hand, food production increases arithmetically, so it only increases at given points in time. Malthus wrote that, left unchecked, populations can outgrow their resources. According to Malthus and Winch (1992), there are two types of 'checks' that can reduce a population's growth rate. Preventive checks are voluntary actions people can take to avoid contributing to the population. Because of his religious beliefs, he supported a concept he called moral restraint, in which people resist the urge to marry and reproduce until they are capable of supporting a family (Oladimeji, 2017). This often means waiting until a later age to marry. He also wrote that there are 'immoral' ways to check a population, such as vices, adultery, prostitution, and birth control. Due to his beliefs, he favored moral restraint and didn't support the latter practices (Rahman, 2018). Positive checks on population growth are things that may shorten the average lifespan, such as disease, warfare, famine, and poor living and working environments. According to Malthus, eventually, these positive checks would result in a Malthusian catastrophe (also sometimes called a Malthusian crisis), which is a forced return of a population to basic survival (Bashford and Chaplin, 2016).

The Anti-Malthusian Theory

Another school of economists opposed the idea of Thomas Malthus, which brought about the anti-Malthusian theory. Julian Simon was an American economist known for his anti-Malthusian theory regarding population and its impact on economic growth. His views challenged the pessimistic predictions of Thomas Malthus and offered an alternative perspective on the relationship between population growth and resource scarcity. Simon's central argument revolved around the idea that human beings are not merely consumers of resources but also innovators and producers (Cooper and Block, 2019). He famously referred to human ingenuity as "the ultimate resource" (Simon, 1980). According to Simon (1980), as the population grows, so does the pool of human intellect, which can lead to innovations and solutions for resource constraints. In contrast to Malthus, who argued that population growth would outstrip food production, leading to famine and poverty (Nyoni, 2019), Simon believed that a growing population could be a catalyst for economic growth (Simon, 2019). He contended that more people meant more minds working on solutions, more labor for production, and a larger market for goods and services, all of which would stimulate economic development.

Simon also emphasized the role of market prices as signals. He believed that when a resource became scarcer, its price would rise, incentivizing innovation and conservation. In his view, this natural market mechanism would regulate resource scarcity without the need for government intervention (Ahlburg, 1998). To support his theory, Simon provided empirical

evidence, noting that the prices of many key commodities, such as metals and energy, had not risen over time as predicted by Malthusian theory. He argued that this stability in prices was due to human ingenuity in finding new ways to extract, produce, or replace these resources (Schultz, 2021). Moreover, Simon challenged the notion that population growth was inherently harmful to the environment (Emmett and Grabowski, 2022). He believed that technological progress could lead to cleaner and more efficient resource use. While acknowledging environmental challenges, he remained optimistic about humanity's ability to address them through innovation (Emmett and Grabowski, 2022). Therefore, Julian Simon's anti-Malthusian theory argues that human ingenuity and innovation, driven by population growth, could lead to economic growth and resource abundance. His views stood in contrast to Malthus's predictions of resource depletion and societal collapse due to unchecked population growth.

Methodology and Result Discussion

To motivate empirical investigations, this study was based on the anti-Malthusian theory, which was propounded by and recommendations were drawn from (Cooper and Block, 2019). As a result, RGDP (Y) was considered as a function of population growth (X₁) and other auxiliary variables. Following similar studies by Ideh et al. (2022) and Nyoni (2019), the auxiliary variables included in the model are the labor force participation rate (X₂) and unemployment rate (X₃).

The functional form is as stated in Equation 1:

$$Y = f(X_1, X_2, X_3) \dots \dots \dots (1)$$

Thus, Equation 1 translates to the econometric form captured in Equation 2:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \dots \dots \dots (2)$$

Table 1. Variable description

Variable	Description	N	Mean	Std. Deviation
Y	Real Gross Domestic Product (Billion \$)	41	268978489453.20	144844160744.78
X ₁	Population growth rate	41	2.618001	0.122305
X ₂	Labour force participation rate	41	32.67220	9.412937
X ₃	Unemployment rate	41	4.704927	1.703556

where β_i are the desired parameter values of the coefficients of the variables, while ε is the stochastic term in the model. The data used in this study is secondary time series data from 1981 to 2021, as obtained from World Bank indicators (2023). To determine the model to be employed and to ascertain the stationarity level of each variable, the unit root test was carried out using the Augmented Dickey-Fuller (ADF) test. The summary of the results is presented in Table 2.

Table 2: ADF unit root test result

Variables	Test Statistic At Level		Test Statistic At 1 st Difference		Order Of Integration
	ADF	Critical Value (5%)	ADF	Critical Value (5%)	
Y	0.6171	-2.938987	-3.2609	-2.938987	I(1)
X ₁	-3.4582	-2.936942			I(0)
X ₂	-1.3498	-2.936942	-6.9288	-2.938987	I(1)
X ₃	1.5834	-2.936942	-4.9446	-2.938987	I(1)

Source: Author's Compilation using EVIEWS12

Table 2 shows the stationarity level of the variable used in the model. At the 5 percent level of significance, the inflation rate (X_1) was found to be stationary at level 0, that is, order $I(0)$, while others are stationary at the first difference, that is, order $I(1)$. Given that there is a mix in stationarity level amongst the variables, the study adopted the Autogressive Distributive Lag (ARDL) model for the estimation of the parameters. VAR Lag Order Selection Criteria and Akaike Information Criterion (AIC), lag 3 was obtained as the maximum of the ARDL model. In addition, based on the ARDL Bounds test as presented in Table 3 (where the F-statistic value is shown to be greater than the lower bound), it was established that there is a long-run relationship in the model. As a result, a long-run model was estimated, which is presented in Table 4.

Table 3. ARDL Bounds Test

Test Statistic	Value	k
F-statistic	21.37141	3
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.37	3.2
5%	2.79	3.67
2.5%	3.15	4.08
1%	3.65	4.66

Null Hypothesis: No long-run relationships exist; Included observations: 40

Table 4: Autoregressive Distributed Lag (ARDL) Test Result

Dependent variable: Y

Included observations: 40 after adjustments				
Model selection method: Akaike info criterion (AIC)				
Dynamic regressors (3 lags, automatic): X_1 X_2 X_3				
Fixed regressors: C			Number of models evaluated: 54	
Selected Model: ARDL(1, 0, 0, 1)		Maximum dependent lags: 2 (Automatic selection)		
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
$\bar{Y}(-1)$	1.0289	0.0343	29.9142	0.0000
\bar{X}_1	2.0274	1.5961	1.2702	0.2126
\bar{X}_2	5.4248	4.2899	1.2646	0.2146
\bar{X}_3	-9.8071	3.1656	-3.0981	0.0039
$\bar{X}_3(-1)$	7.5496	2.9558	2.5542	0.0153
C	-5.7238	4.4652	-1.2819	0.2086
R-squared	0.9974	Mean dependent var		27.2214
Adjusted R-squared	0.9971	S.D. dependent var		1.4518
Sum squared resid	0.0991	Akaike info criterion		48.5447
Log likelihood	-964.8558	Durbin-Watson stat		1.4397

*(**) = significant at 5% (1%) F-statistic = 2656.119 Prob(F-statistic) = 0.00

In the ARDL model, the R^2 (0.9974) depicts that about 99.7% of the dependent variable is predicted by the independent variables. The F-statistics probability of 0.00 is less than 0.05, while the coefficient of the F-statistics is 2656.119, which is greater than an absolute value of 1.96. This indicates that the overall model is statistically significant. The result indicates that population growth was estimated for the current year and was positive but insignificant at 5%. In other words, in the short run, population growth has a proportional but insignificant effect on economic growth (MSME) in Nigeria during the period. Furthermore, the result shows that lag 1 RGDP has significant ($p < 0.05$) effects on the current year RGDP.

Interestingly, lag 1 of RDGP showed a positive effect. This implies that the impact of economic growth in the previous year leads to the growth of the current year's growth. This relationship between the current year's RGDP and its lag (1) suggests that economic growth in Nigeria has been on a consistent rise over the years. Among the difficulties facing economic growth is the effect of unemployment, as the result depicts that the unemployment rate has a negative and significant effect on economic growth. Nevertheless, the labor force participation rate was revealed to be a key driver of economic growth in Nigeria. As shown in the regression result, the labor force participation rate depicted a positive, although insignificant, effect on economic growth at the 5% level, which implies that an increase in the labor force leads to a higher rate of economic growth.

Conclusion

This study investigated the effect of population growth on the growth of the economy in Nigeria. Long-run auto-regressive distributed lag [ARDL (1,0,0,1)] was estimated. The analysis produced some insightful results. Our findings indicated that population growth did indeed have a positive effect on economic growth in Nigeria. This suggests that a larger population can potentially provide a significant labor force and create a more extensive market for goods and services. However, it is crucial to note that this effect, while positive, did not reach the level of statistical significance. In simpler terms, while there is an observable relationship between population growth and economic growth, it is not strong enough to be considered a major driver of economic expansion in the long run in Nigeria. Additionally, our analysis revealed another positive correlation between the labor force participation rate and economic growth. This implies that a higher percentage of the population actively engaged in the workforce can contribute positively to the country's economic development. On a contrasting note, our study brought to light a significant and negative correlation between the unemployment rate and economic growth. This finding suggests that a high level of unemployment can indeed hinder economic growth in Nigeria. Addressing this issue is paramount, and policymakers should consider implementing strategies to promote job creation and enhance workforce development. Therefore, this result supports Julian Simon's assumption that harnessing population growth can steer the economy in the right direction, as a larger population implies a larger labor force, which can drive the innovation needed for economic growth.

However, it also highlights the need to develop other aspects and sectors of the economy to sustain the economic growth resulting from population growth in Nigeria in the long run. Therefore, this study suggests that policymakers should prioritize the implementation of labor market policies that target reducing unemployment rates. Initiatives such as skills development programs and job creation schemes could be effective in addressing this issue. In addition, the impact of population growth on economic growth was positive but statistically insignificant, which implies that it is essential for policymakers to monitor and manage population growth trends. Implementing family planning programs that empower individuals to make informed decisions about family size can contribute to sustainable economic development. Furthermore, to reduce its vulnerability to economic shocks, Nigeria should continue its efforts to diversify its economy beyond oil and natural resources. Promoting sectors such as agriculture, manufacturing, and technology can provide employment opportunities and reduce the country's dependence on a single revenue source. Finally, prioritizing investments in education and vocational training programs can enhance the skills of the workforce, making them more employable and better equipped to contribute to economic growth. However, this does not leave aside infrastructure development, as

infrastructure plays a pivotal role in economic development. Therefore, investments in infrastructure projects, such as transportation and energy, can create jobs and improve overall economic productivity.

In summary, while population growth did have a positive but statistically insignificant effect on economic growth in Nigeria, tackling issues related to unemployment and the labor force participation rate appears to be more critical for fostering sustained economic development. Policymakers should prioritize the creation of a favorable environment for job creation and workforce development, while also monitoring population trends and implementing family planning programs to ensure long-term economic sustainability.

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