Economic Growth Response to Shocks in Demographic Changes and Domestic Savings in Nigeria

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Abstract
The study examined economic growth response to unanticipated shocks in demographic changes and domestic savings in Nigeria using annual time series data from 1986 to 2022. The study utilized Cholesky Impulse Response on the basis of the Vector Autoregression (VAR) model analysis as its estimation technique. The study revealed that economic growth responded positively to changes in population growth, working age population ratio and demographic dividend as changes in demographic components. Similarly, it was also revealed that economic growth responded negatively to changes in other demographic changes components like; old age dependency ratio, young age dependency ratio and net migration rate. In addition, it was found that economic growth responded positively to changes in public domestic savings and private domestic savings. This means that an increase in public and private savings mobilization resulted to increase in economic growth of the Nigerian economy. Based on the findings of the study, it was recommended that; policymakers should implement measures to encourage active population growth through incentives such as tax breaks, maternity leave, and other social programs aimed at promoting family growth. The government should, therefore, focus on creating more job opportunities for the working age population in the country, through policies such as investment in infrastructure, entrepreneurship development, invest in education and training programs to improve the skills and knowledge of the working age population, thus promoting demographic dividend. Finally, policymakers should, therefore, encourage savings mobilization by implementing policies such as tax breaks for saving, financial literacy campaigns, and incentives for private sector investment in infrastructure development.

Key Words: Economic Growth, Unanticipated Shocks, demographic Changes and Domestic Savings

1.0 Introduction

The importance of demographics changes on domestic savings and economic growth is well documented in extant studies. Many established literatures reveal a positive relationship between demographic changes and economic growth (Akpansung & Peter, 2020). According to World Bank (2022), one explanation for such a link is that domestic savings rate tends to be relatively high for demographic composition when it experiences its high earnings, and relatively low when a demographic composition anticipates relatively low earnings, such as during retirement.

Variations in the age composition of a population may then determine variation in domestic savings rates, over time and across countries, holding other things equal. Similarly, on the link between demographic changes, savings and economic growth, Nuguyen and Lam (2018) have it that there is a level of interaction among demographic changes components, domestic savings and economic growth. This is because excess of demographic change component such as; working age population ratio over the dependency population enhances domestic savings and consequently economic growth.

Nigeria as leading Africa's economy and most populated country has the highest number of older people in the continent and the 19th highest across the globe, with the population of Nigerians aged 65 and above projected to triple by 2050 (Population Reference Bureau [PRB], 2022). In Nigeria,

Nelson and Ken (2019) using the life-cycle hypothesis provided a direct theoretical relationship between demographic changes (aging) and saving behavior in relation to economic growth.

In considering a snapshot of the domestic savings profile across age groups for different regions in Nigeria, it was obvious domestic savings increases for middle-age groups compared with younger ones. In the study by Ogunjimi and Oladipupo (2018), using the life-cycle pattern, it was reported that individuals at age 60 or older do save at a lower rate than those in the immediately younger age groups in Nigeria. Similarly, Okijie and Effiong (2021) submitted that domestic savings is low for younger groups, high for middle age groups, and again low among old age groups in Nigeria.

Relatively, Tartiyus, Dauda and Peter (2019) also noted that the increasing old age dependency ratio, decreasing young dependency ratio, and shrinking share of working-age population in an aging economy like Nigeria generate substantial effects on individual as well as aggregate consumption, domestic saving, employment and economic growth. This is because retired people save less, an aging society like Nigeria with increasing proportion of retirees would experience a decline in aggregate domestic savings, which in turn leads to lower capital formation and reduces economic growth (Daniel & James, 2022).

Although the demographic development of population aging inevitably leads to a reduction in future economic growth, the shrinking volume in labor force may countered by improvement in productivity (Nelson & Ken (2019). Given the life-time saving profile, an elderly person would have less income and save less than a middle-age worker does. As a result, in an aging economy where there is an enlarging proportion of elders and relatively small and shrinking working-age population, one would expect that population aging would affect aggregate savings and capital formation (Okijie & Effiong, 2021). The baseline simulation indicates a decaying trend of economic growth.

The relationship between demographic changes and economic growth may be further complicated by unanticipated shocks. For example, a sudden increase in the number of refugees or migrants put pressure on the labor market and reduce domestic savings in an economy which Nigeria is not excluded. Similarly, an unexpected economic shock, such as economic recession or financial crisis in recent times due to cashless policy implementation led to a decline in domestic savings and lower levels of investment vis-à-vis economic growth in the Nigerian economy.

Given the potential complexity of the relationship between economic growth, demographic changes, and domestic savings, empirical studies are needed to shed light on the key drivers of economic growth and inform policy decisions. A study on the economic growth response to unanticipated shocks in demographic changes and domestic savings would contribute to this important area of research. It was on the basis of this background that the paper sought to examine the economic growth response to shocks in demographic changes and domestic savings in Nigeria.

2.0 Literature Review

Conceptually, economic growth refers to the increase in the production and consumption of goods and services in an economy over a period of time (Rutger & Jeroen, 2020). It is typically measured by the growth in gross domestic product (GDP), which is the total value of all goods and services produced in a country. Economic growth is generally considered to be a positive development as it can lead to higher standards of living, increased employment opportunities, and improved access to goods and services (Jehan and Khan, 2020).

It can be driven by a variety of factors, including technological advancements, improvements in infrastructure, and increases in productivity and efficiency. However, economic growth can also have negative consequences, such as increased pollution and environmental degradation, greater income inequality, and the depletion of natural resources. As such, policymakers must balance the benefits of economic growth with the potential costs and strive for sustainable growth that benefits all members of society (Usman & Timothy, 2020).

On the other hand, unanticipated shocks refer to unexpected and sudden events that disrupt the normal functioning of a system or an economy (Ogunjimi & Oladipupo, 2018). These shocks can

come from various sources, such as natural disasters, economic crises, political instability, technological failures, and pandemics. From a conceptual standpoint, unanticipated shocks can be viewed as external disturbances that create a disturbance to the equilibrium of an economic system. Unanticipated shocks in demographic changes refer to unexpected changes in the size, structure, and distribution of the population (Rutger, &Jeroen, 2020).

Some examples of unanticipated shocks in demographic changes include; sudden increase in immigration; a sudden influx of immigrants into a country can create a shock to the labor market, housing market, and public services. This shock can lead to changes in wages, housing prices, and government policies. Aging population: An unexpected increase in the elderly population can create a shock to the healthcare system, pension system, and labor market. This shock can lead to increased healthcare costs, changes in retirement policies, and labor shortages.

Unanticipated shocks in domestic savings refer to unexpected changes in the amount, behavior, and distribution of savings within an economy (Nguyen and Lam, 2018). Some examples of unanticipated shocks in domestic savings: sudden increase in household savings; a sudden increase in household savings due to a crisis or uncertainty can create a shock to the financial system and the economy. This shock can lead to changes in interest rates, credit availability, and investment. Decline in savings rate; an unexpected decline in the savings rate can create a shock to the economy's growth and stability. This shock can lead to changes in investment, inflation, and borrowing costs.

Domestic savings according to Yakubu and Charles (2019) has to do with postponing present consumption expenditure in both public and private sectors till future time within an economy. It is the fraction of the gross income of both public and private sectors which has not been used up on consumer goods and services within a local economy (Usman & Timothy, 2020). Domestic savings refers to the amount of money that individuals, households, and businesses save from their disposable income after meeting their consumption needs. It represents the portion of income that is not spent on immediate consumption but rather set aside for future use.

Previous empirical studies such as Kumar (2022) examined the influence of demographic changes on macroeconomic outcomes in India using time series from 1990 to 2020. The study used Generalized Method of Moments (GMM) as its technique of estimation. The estimation results showed that population growth and age dependency ratio have inverse relation with the growth in real GDP and per capita income, and positive relation with inflation. Also it was revealed that increase in working age population contributed to higher economic growth in India. The study concluded that an aging population is deflationary in nature though improves the current account balance while the declining age dependency ratio offers a demographic dividend for India, the realization of the same would require an environment empowering the labour force with right skills and enabling their gainful employment in productive uses. Unfavourably, this previous study is limited in geographical scope as it was carried out in India, as a departure from this previous study, this current study will be carried out in Nigeria.

Wang and Conesa (2022) examined the role of demographics and migration for the future of economic growth in China from 2013 to 2030. The simulations result suggests that the rapid aging of its population and the decrease of rural migration significantly decelerate urban labor force and economic growth starting around 2020. Through a counterfactual with a fixed age distribution, the study found that population aging is responsible for the deceleration of economic growth between 2020 and 2040. Furthermore, substantial relaxation of labor market segmentation and financial constraints faced by private enterprises improve efficiency substantially and delay this process of growth deceleration by one decade. Critically, as a departure from this previous study, the current study intends to fill this gap geographically by considering the case of Nigeria.

Okijie and Effiong, (2021) investigated the determining factors of population growth in Nigeria, along with the effect of infant mortality on fertility rate by using ordinary least squares regression and threshold regression analysis in achieving the set objectives. The data covered from 1970 to 2017. The result of the study revealed that the determining factors of population growth in Nigeria are crude birth rate and infant mortality rate. The study also reveals a positive and significant effect of infant mortality

on fertility rate. The study concluded that there is need to maintain an optimal population growth that will be consistent with the available resources is sustainable economic development is to be achieved.

Jehan and Khan (2020) examined demographic changes and economic growth in Pakistan with the case capital stock role using time series data from 1960 to 2017. In this regard, the demographic change was captured by taking four alternate measures, namely population growth, dependency ratio and working age population ratio. In order to examine the channel effect, first the direct impact of demographic changes on physical capital is estimated. The impact of demographically induced capital stock on economic growth is estimated. The study used Fully Modified Ordinary Least Squares (FMOLS) technique. The study revealed that the total negative impact was highest in the case of dependency, which means that higher dependency is the most threatening demographic change for economic growth. The least harmful demographic change was young age dependency. Moreover, the empirical findings highlighted the importance of capital stock as the mediating channel in the demographic change and economic growth relationship. The study recommended effective long term policies to increase youth employment and to enhance savings for maximizing the benefits of demographic dividend. Critically, as a departure from this previous study, the current study intends to fill this gap geographically by considering the case of Nigeria.

Akpansung and Peter (2020) examined demographic changes and economic growth of Sub-Sahara Africa: A System GMM Approach investigates the impact of demographic changes on economic growth of sub-Sahara African (SSA) countries using annual data between 1980 and 2019. The results based on System Generalized Method of Moments (SGMM) estimation technique revealed that urbanization rate and aging-population (65 + years) have positive and significant impact on economic growth of SSA countries, while unemployment rate exerts a significant negative impact. The study concluded that urbanization is very significant in reducing unemployment in the rural areas and promoting economic growth, therefore its importance should not be exaggerated. The study recommended that SSA countries should put urbanization at the heart of their socio-economic policies and programmes so that it can extend economic opportunities and potentials to the rural areas, which will serve as impetus for rapid economic growth of the SSA countries.

Le and Park (2020) used panel regression model and panel continuous threshold model to investigate the effects of demographic change on economic growth of OECD and non-OECD countries (consisting of 27 advanced economies and 44 emerging economies) over the period, 1981-2014. The result found a significant difference of impact of demographic change on the economic growth of OECD and non- OECD countries. In a study using a panel data of 172 countries for the period 1960 to 2019, Hu, Lei and Zhao (2020) found that aging population has a significant negative impact on economic growth. A one percentage point increase in the ratio of population aged 65 + can decrease economic growth rate by about 2.6 percentage points.

Meanwhile, Ukpolo (2020) empirically measure the economic association between population growth and economic growth in Africa using Johansen Co-integration and Granger-Causality techniques. The study is based on annual time series data collected on the variables of concern from the two selected countries (Nigeria and Cote d'Ivoire). The estimation results showed that the variables are co-integrated, that is, long-run relationship existed between the variables in Nigeria but not in Cote d'Ivoire. The results further revealed a negative long-run causal relationship between the two variables of concern in Nigeria (i.e population growth negatively affects economic growth) in the long-run. In Cote d'Ivoire, the results showed that population growth causes economic growth only in the short-run. This is contrary to the study of Kothare (1999). In another related study, Bloom, Canning and Finlay (2020) empirically examined the relationship between aging population and economic growth in Asia between 1960 and 2018 relying on both descriptive statistics and fixed (dynamic) panel regression model. The variables used in the study include RGDP per capita, capital stock, average secondary school enrolment, trade openness, life expectancy and dummies (used to proxy regions in Asia). The findings of the study include a negative relationship between aging population and economic growth; a positive relationship

between economic growth and capital stock, trade openness and other institutional variables included in the regression model.

Also, Singh, Mittal, Sharma and Smarandache (2020) embarked on an empirical study to identify the determinants of population growth in Rajasthan, India between 1991 and 2019. The study was based on the use of multivariate analysis even though the researchers employed the use of multiple regression analysis to establish the linear relationship between the regressand (population growth) and the regressors (crude birth rate, crude death rate, total fertility, infant mortality rate, female-male ratio, per capita expenditure on medical and public health, education attainment among others). The results revealed among other things that only few of the regressors incorporated in the model namely: total fertility, infant mortality rate and crude death rate have significantly influenced population growth during the period investigated.

Rutger and Jeroen (2020) investigated the impact of population dynamics (age-structure) on economic growth in developing countries from 1997 to 2018. The variables included in the model are asset (wealth) index (used as proxy for district GDP), GDP per capital growth, growth rate of working-age share, urbanization rate, landlocked, life expectancy, trade openness. The result of the study revealed a robust positive effect of working age population on growth rate of GDP. Therefore, the researchers recommended the need for government to create conducive investment environment as this will provide more employment that can absorb the growing youth population.

Also, Dao (2020) examined the relationship between population and economic growth in Africa using data that covered selected forty-five (45) African economies. The researcher employed the used of panel data regression analysis for the study, among the variables listed in the model include fertility rate, per capita GDP growth, trade openness, dependency ratio (old and young) among others. The researcher deduced from the findings that the relationship between population growth and per capita GDP growth is linear and negative. The findings further revealed that fertility rates have a negative impact on economic growth and also that old dependency ratio positively affects per capita GDP growth. In addition, Kotani and Kotani (2020) embarked on an empirical research to understand the effect of net migration on population-economic growth relationship in Indonesia between 1993 and 2005 using ordinary least square (OLS) regression techniques on annual time series data obtained on variables listed in the model such as GDP, population growth, lagged value of fertility rate and net migration. The study revealed that lagged fertility does not affect the economic growth in the two-variable regression; however, the study further revealed a significant negative relationship between population growth and economic growth upon the inclusion of net migration as a variable in the model. The researcher therefore concluded that net-migration is a key determinant of economic growth.

Similarly, Akintunde (2020) examined the relationship between population dynamics and economic growth in sub-Saharan African from 1975 to 2017 using five-year average. The researchers employed the use of both pooled OLS and dynamic panel techniques on data obtained from thirty-five (35) countries in the sub-Saharan countries. Among the variables listed in the model include gross capital formation (as a percentage of GDP), gross domestic product per capital, primary school enrolment, mortality rate, fertility rate among others. The empirical research result revealed that total fertility rate has a negative impact on economic growth while life expectancy at birth was found to have a positive relationship with economic growth during the considered period. The researchers concluded that for economic growth and development to be achieved in studied economies, population growth must be properly addressed.

In studies related to Pakistan, Hussain (2019) analyzed the impact of demographic variables on economic growth from 1972 to 2016. The study used Fully Modified Ordinary Least Squares (FMOLS) to analyze the data. The study revealed that both infant mortality rate and total fertility rate negatively affected the GDP growth of the country, while the growth rate of the labour force had an insignificant impact on economic growth. In another study, Choudhry and Elhorst (2019) who examined the impact of demographic transition on economic growth of Pakistan using time series data for the period of 1974-2018, the study utilized Ordinary Least Squares technique of regression analysis to analyze the data.

The study reported a positive impact of demographic transition on economic growth in the long run but a negative impact in the short-run. Critically, as a departure from this previous study, the current study intends to fill this gap geographically by considering the case of Nigeria.

In a further study, Kelley and Schmidt (2019) examined the impact of population on growth rate using a sample of 86 developing countries with the use of panel data from 1960 to 2017. The study included variables such as; age dependency ratio, and population size and density, as alternative demographic regressors. The study used Panel regression to analyze the data. The study reported a positive impact of a working age population on growth rates of output per capita and output per worker for a sample of 86 developing countries over the study period. The study also established that demographic change accounts for 20 percent change in per capita income growth. Critically, as a departure from this previous study, the current study intends to fill this gap geographically by considering the case of Nigeria.

Tartiyus, Dauda and Peter (2019) evaluated the impact of population growth on economic growth in Nigeria from 1980 to 2016 given that the impact of population growth on economic growth has been contentious in the literature. The data were analyzed using descriptive statistics as well as regression analysis. The result revealed that there is a positive relationship between economic growth (proxy by GDP growth) and population, fertility and export growth while negative relationships were found between economic growth (proxy by GDP growth) and life expectancy, and crude death rate. Similarly, it was recommended among others that the average population growth rate of Nigeria should be maintained since it is found to impact positively on economic growth in Nigeria within the period of study and that measures should be adopted to check the crude death rate of Nigeria as it affects economic growth negatively.

Considering the case of Mexico, Garza-Rodriguez, Andrade-Velasco, Martinez-Silva, Renteria-Rodriguez and Vallejo-Castillo (2019) analyzed the dynamic relationship between population growth and economic development, through a structural break co-integration analysis for the period 1960-2017. The Gregory-Hansen co-integration test confirmed the existence of a long run equilibrium. Based on the results of this test, using 1985 as the year in which the structural break occurs in the cointegrating equation and therefore the inclusion of a dummy variable for this year in the VECM developed in the study, results obtained suggested that in the short run, economic growth has a negative effect on population growth, while in the long run, population has a positive effect on per capita GDP and per capita GDP also positively affects population.

Also, Dao (2019) examined the economic effects of the demographic transition in developing countries. Based on data from the World Bank and using a sample of forty-three developing countries, the least-squares estimation technique in a multivariate linear regression was applied. The findings suggest that the growth rate of per capita GDP is linearly dependent upon population growth, both the young and old dependency ratios, the mortality rate, and whether or not the rate of population growth is less than 1.2 percent per year. Using interaction variables in light of the severe degree of multicollinearity among explanatory variables, it was found that per capita GDP growth linearly depends on population growth, the old dependency ratio, the mortality rate, and the interactions between population growth and both the young and old dependency ratios, between population growth and whether or not the rate of population growth is less than 1.2 percent per year, and the interaction term between the young dependency ratio and whether or not the rate of population growth is less than 1.2 percent per year.

Also, Shaari, Rahim and Rashid (2019) examined relationship among population, energy consumption and economic growth in Malaysia from 1991 to 2017. The study applied Unit Root Test, Cointegration Test, Granger Causality Test and the results indicated that one co-integrating equation exists, suggesting the long-term relationship among population, energy consumption and economic growth in Malaysia. Results of Granger causality performed suggested that population has an effect on energy consumption and energy consumption contributes to economic growth in Malaysia A reduction in energy consumption can harm the economic growth. Therefore, any policy to reduce energy consumption should be revised.

It is in line with the above assertions that Ali, and Amin (2019) empirically test the impact of population growth on economic development of Pakistan for period of 1975-2018 using the ARDL technique. The result of the model shows that the impact of population is positive and significant but the problem associated with huge population growth is the flood of newly produce work force, its management and providing different facilities even basic needs become a challenge for government and policy makers. To tackle the issue this study incorporated unemployment rate and expenditure made on health and education to the model in-order to investigate the impact of population growth directly and indirectly on economic growth in Pakistan. The results of the study indicated that Population growth has positively and significantly contributed to economic development but negatively affected by unemployment rate. Although on one hand; population growth increases economic growth but on the other hand it creates a problem of unemployment and leads to lacking of educational and health facilities. Thus, the government is advised to utilize this additional workforce efficiently as a policy tool to achieve high and desired level of growth.

In Uganda for instance, Klasen and Lawson (2019) examined the link between population and per capita economic growth, and poverty by combining both a macro and micro-econometric approach, using panel data. Uganda is argued to have one of the highest population growth rates in the world. The findings of the study suggest that both theoretical considerations and strong empirical evidence suggest that the currently high population growth puts a considerable break on per capita growth prospects in Uganda. Moreover, it contributes significantly to low achievement in poverty reduction and is associated with households being persistently poor and moving into poverty. This is therefore likely to make substantial improvements in poverty reduction, and per capita growth, very difficult.

As a corollary from the above, Aidi, Emecheta, and Ngwudiobu (2019) investigated the relationship between population dynamics and economic growth in Nigeria using time series data spanning from 1970 to 2016. The data were analyzed using ordinary least square estimation technique. The result revealed among other that all the core variables (i.e. fertility, mortality and net-migration) of the study are inversely related to economic growth during the investigated period. The study further revealed that gross fixed capital formation (GFCF) and savings are strong drivers of economic growth in Nigeria. Sequel to the findings, the Nigerian government is advised to make direct efforts toward checking the alarming fertility rate in Nigeria. Also efforts should be made to improve the quality of Nigerian labour force through more substantial investment in education and skills acquisition programmes so as to improve productivity in Nigeria.

Consequently, Mohsen and Chua (2019) examined effects of population growth on the economic growth: A Case Study of Syria from 1980-2017. The study applied co-integration test and The Granger causality test and the result indicates bidirectional short-run causality relationships between trade openness, investment, population and GDP. There are also bidirectional long-run causality relationships between investment, population and GDP, and unidirectional long-run causality relationship running from trade openness to GDP. The study result indicates that population has the biggest effect on the GDP, thus it was suggested improving the quality of the human capital in the country. It is essential for the Syrian Government to upgrade the quality of human capital in the country by improving the quality of the education system, health services, the standard of living, and the quality of life.

2.1 Gap in Literature

In literature, there is limited empirical studies on economic growth response to unanticipated shocks in demographic changes and domestic savings in Nigeria as much attention was given to the response of economic growth to demographic changes component like population growth in the study conducted by; Jehan and Khan (2020), Okijie and Effiong, (2021), Wang and Conesa (2022), Kumar (2022) while little attention was given to the effect of unanticipated shocks in demographic changes and domestic savings on economic growth in Nigeria. The bid to address this gap motivated this current study.

Most studies on the relationship between demographic changes and economic growth in Nigeria have focused on the population growth rate and the dependency ratio, neglecting the effects of other components of demographic changes on economic growth. It is in a bid to ascertain a well-informed policy in this area of research interest that necessitated the incorporation of key components of demographic changes like; old age dependency ratio and young age dependency ratio, and working age population, demographic dividend and net migration rate in order to identify policies that could promote higher level of sustainable economic growth in the face of demographic changes and domestic savings mobilization in the Nigerian economy.

2.2 Theoretical Framework

One possible theoretical framework to analyze the economic growth response to unanticipated shocks in demographic changes and domestic savings in Nigeria is the Romer growth model of endogenous growth theory. This is because the Romer growth model propounded by Paul Romer in 1986 stated that economic growth depends on population growth (demographic components) and capital accumulation (gross domestic savings) within an economy which Nigeria is not an exception.

The study adopted this theory because Romer endogenous growth theory is an economic theory which argues that economic growth is generated within a system as a direct result of changes in internal factors, not external factors. Considering the internal factor, the theory explained that when the government and the private sector within an economy invest their savings on demographic composition of human capital, innovation, and knowledge, the nation's growth aspiration is enhanced.

3.0 Methodology

The study utilizes time series data which span the period of 1986 to 2022.

Table 3.1: Variables, Description and Sources

Variable	Description	Sources	Unit of Measurement
RGDP	It is the money value of all final goods and a service produced by normal residents as well as non-residents in the domestic territory of a country, but does not include factor income earned from abroad at constant price.	Central Bank of Nigeria Statistical Bulletin, 2022	Billion
WAP	It is the share of the working age population in total population (age of 18-64years)	National Population Commission, 2022	No Unit
OAD	It is the ratio of the number of elderly people at an age when they are generally economically inactive (age of 65 and above)	National Population Commission, 2022	No Unit
YAD	It is the ratio of the number of young people at an age when they are generally economically inactive (under 15 years of age)	National Population Commission, 2022	No Unit
DMD	It is the economic growth brought on by a change in the structure of a country's population.	National Population Commission, 2022	Billion
NMR	It is the difference between the number of immigrants and number of emigrants.	World Development Indicator, 2022	Percentage
PDS	It is government revenue through taxes, minus government expenditures on goods and services minus transfers	Central Bank of Nigeria Statistical Bulletin, 2022	Billion
PPS	It is the difference between disposable income and consumption expenditure	Central Bank of Nigeria Statistical Bulletin, 2022	Billion

Source: Researcher's Compilation, 2022

The study utilized Vector Autoregression (VAR) with the help of its impulse response function (IRF) test to ascertain economic growth response to unanticipated shocks in demographic changes and domestic savings in Nigeria. Thus, Vector Autoregression (VAR) model could be specified to analyze the dynamic relationships between the dependent variable, Real Gross Domestic Product (RGDP), and the independent variables, population growth rate (PGR), working age population ratio (WAP), old age dependency ratio (OAD), young age dependency ratio (YAD), demographic dividend (DMD), net migration rate (NMR), public domestic savings (PDS), and private domestic savings (PPS).

In this study, VAR (Vector Autoregression) model is considered a suitable choice for analyzing the response of economic growth to unanticipated shocks in demographic changes and domestic savings in Nigeria for several reasons; multiple variables: VAR models can analyze the relationships between multiple variables simultaneously. In this case, the economic growth, demographic changes, and domestic savings are likely to be interdependent, and a VAR model can capture these relationships

effectively. Dynamic interactions: VAR models can capture dynamic interactions between variables, allowing for the analysis of the short-run and long-run effects of shocks on economic growth.

This is particularly useful in this case as demographic changes and domestic savings can have both immediate and delayed effects on economic growth. Ability to handle non-stationary data: The economic growth, demographic changes, and domestic savings are likely to be non-stationary, meaning they do not have a constant mean and variance over time. VAR models can handle such data by differencing the variables or applying suitable transformations. Finally, forecasting: VAR models can be used to make forecasts of future economic growth responses to demographic changes and domestic savings shocks. This can be useful for policymakers and other stakeholders in Nigeria to plan for the future and make informed decisions.

The VAR model for this study can be specified as follows in Equation [1] to Equation [9],

$$RGDP_t = \alpha_0 + \sum_{i=1}^{p} \delta_i RGDP_{t-1} + \sum_{k=0}^{p} \beta_k PGR_{t-k} + \sum_{k=0}^{p} \beta_k WAP_{t-k} + \sum_{k=0}^{p} \beta_k OAD_{t-k} + \sum_{k=0}^{p} \beta_k YAD_{t-k} + \sum_{k=0}^{p} \beta_k DMD_{t-k} + \sum_{k=0}^{p} \beta_k NMR_{t-k} + \sum_{k=0}^{p} \beta_k PDS_{t-k} + \sum_{k=0}^{p} \beta_k PPS_{t-k} \quad \text{.....1}$$

$$PGR_t = \alpha_0 + \sum_{i=1}^{p} \delta_i PGR_{t-1} + \sum_{k=0}^{p} \beta_k RGDP_{t-k} + \sum_{k=0}^{p} \beta_k WAP_{t-k} + \sum_{k=0}^{p} \beta_k OAD_{t-k} + \sum_{k=0}^{p} \beta_k YAD_{t-k} + \sum_{k=0}^{p} \beta_k DMD_{t-k} + \sum_{k=0}^{p} \beta_k NMR_{t-k} + \sum_{k=0}^{p} \beta_k PDS_{t-k} + \sum_{k=0}^{p} \beta_k PPS_{t-k} \quad \text{.....2}$$

$$WAP_t = \alpha_0 + \sum_{i=1}^{p} \delta_i WAP_{t-1} + \sum_{k=0}^{p} \beta_k RGDP_{t-k} + \sum_{k=0}^{p} \beta_k PGR_{t-k} + \sum_{k=0}^{p} \beta_k OAD_{t-k} + \sum_{k=0}^{p} \beta_k YAD_{t-k} + \sum_{k=0}^{p} \beta_k DMD_{t-k} + \sum_{k=0}^{p} \beta_k NMR_{t-k} + \sum_{k=0}^{p} \beta_k PDS_{t-k} + \sum_{k=0}^{p} \beta_k PPS_{t-k} \quad \text{.....3}$$

$$OAD_t = \alpha_0 + \sum_{i=1}^{p} \delta_i OAD_{t-1} + \sum_{k=0}^{p} \beta_k RGDP_{t-k} + \sum_{k=0}^{p} \beta_k PGR_{t-k} + \sum_{k=0}^{p} \beta_k WAP_{t-k} + \sum_{k=0}^{p} \beta_k YAD_{t-k} + \sum_{k=0}^{p} \beta_k DMD_{t-k} + \sum_{k=0}^{p} \beta_k NMR_{t-k} + \sum_{k=0}^{p} \beta_k PDS_{t-k} + \sum_{k=0}^{p} \beta_k PPS_{t-k} \quad \text{.....4}$$

$$YAD_t = \alpha_0 + \sum_{i=1}^{p} \delta_i YAD_{t-1} + \sum_{k=0}^{p} \beta_k RGDP_{t-k} + \sum_{k=0}^{p} \beta_k PGR_{t-k} + \sum_{k=0}^{p} \beta_k WAP_{t-k} + \sum_{k=0}^{p} \beta_k OAD_{t-k} + \sum_{k=0}^{p} \beta_k DMD_{t-k} + \sum_{k=0}^{p} \beta_k NMR_{t-k} + \sum_{k=0}^{p} \beta_k PDS_{t-k} + \sum_{k=0}^{p} \beta_k PPS_{t-k} \quad \text{.....5}$$

$$DMD_t = \alpha_0 + \sum_{i=1}^{p} \delta_i DMD_{t-1} + \sum_{k=0}^{p} \beta_k RGDP_{t-k} + \sum_{k=0}^{p} \beta_k PGR_{t-k} + \sum_{k=0}^{p} \beta_k WAP_{t-k} + \sum_{k=0}^{p} \beta_k OAD_{t-k} + \sum_{k=0}^{p} \beta_k YAD_{t-k} + \sum_{k=0}^{p} \beta_k NMR_{t-k} + \sum_{k=0}^{p} \beta_k PDS_{t-k} + \sum_{k=0}^{p} \beta_k PPS_{t-k} \quad \text{.....6}$$

$$NMR_t = \alpha_0 + \sum_{i=1}^{p} \delta_i NMR_{t-1} + \sum_{k=0}^{p} \beta_k RGDP_{t-k} + \sum_{k=0}^{p} \beta_k PGR_{t-k} + \sum_{k=0}^{p} \beta_k WAP_{t-k} + \sum_{k=0}^{p} \beta_k OAD_{t-k} + \sum_{k=0}^{p} \beta_k YAD_{t-k} + \sum_{k=0}^{p} \beta_k DMD_{t-k} + \sum_{k=0}^{p} \beta_k PDS_{t-k} + \sum_{k=0}^{p} \beta_k PPS_{t-k} \quad \text{.....7}$$

$$PDS_t = \alpha_0 + \sum_{i=1}^{p} \delta_i PDS_{t-1} + \sum_{k=0}^{p} \beta_k RGDP_{t-k} + \sum_{k=0}^{p} \beta_k PGR_{t-k} + \sum_{k=0}^{p} \beta_k WAP_{t-k} + \sum_{k=0}^{p} \beta_k OAD_{t-k} + \sum_{k=0}^{p} \beta_k YAD_{t-k} + \sum_{k=0}^{p} \beta_k DMD_{t-k} + \sum_{k=0}^{p} \beta_k NMR_{t-k} + \sum_{k=0}^{p} \beta_k PPS_{t-k} \quad \text{.....8}$$

$$PPS_t = \alpha_0 + \sum_{i=1}^{p} \delta_i PPS_{t-1} + \sum_{k=0}^{p} \beta_k RGDP_{t-k} + \sum_{k=0}^{p} \beta_k PGR_{t-k} + \sum_{k=0}^{p} \beta_k WAP_{t-k} + \sum_{k=0}^{p} \beta_k OAD_{t-k} + \sum_{k=0}^{p} \beta_k YAD_{t-k} + \sum_{k=0}^{p} \beta_k DMD_{t-k} + \sum_{k=0}^{p} \beta_k NMR_{t-k} + \sum_{k=0}^{p} \beta_k PDS_{t-k} \quad \text{.....9}$$

Where:

$RGDP_t$ represents the Real Gross Domestic Product at time t, PGR_t represents the Population Growth Rate at time t, WAP_t represents the Working Age Population Ratio at time t, OAD_t represents the Old Age Dependency Ratio at time t, YAD_t represents the Young Age Dependency Ratio at time t, DMD_t represents the Demographic Dividend at time t, NMR_t represents the Net Migration Rate at time t, PDS_t represents the Public Domestic Savings at time t, PPS_t represents the Private Domestic Savings at time t, α_0 is the intercept, α_1 is the autoregressive coefficient of RGDP, β_1 to β_8 are the coefficients of the independent variables ε_t is the error term at time t

The VAR model allows us to estimate the contemporaneous and lagged effects of each independent variable on the dependent variable, as well as the dynamic interactions between the variables over time. The model can be estimated using standard econometric techniques, such as maximum likelihood or least squares, and can be used to test hypotheses about the causal relationships between the variables.

4.0 Result and Discussion

Table 1: Unit Root

Variables	ADF Statistic at level	ADF Statistic at first difference	Critical values of 5% at level	Critical values of 5% at first difference	P-values at level	P-values at first difference	Order of integration
RGDP	-1.533	-5.222	-2.965	-2.973	0.513	0.001*	I(1)
PGR	-1.328	-8.221	-2.965	-2.973	0.082	0.040*	I(1)
WAP	-3.487	- 1.785	-2.965	-2.973	0.001*	0.562	I(0)
OAD	-2.349	-9.234	-2.965	-2.973	0.366	0.000*	I(1)
YAD	-1.587	-6.123	-2.965	-2.973	0.238	0.001*	I(1)
DMD	-3.454	- 2.056	-2.965	-2.973	0.010*	0.471	I(0)
NMR	-1.345	-7.435	-2.965	-2.973	0.450	0.000*	I(1)
PDS	-1.922	-7.564	-2.965	-2.973	0.422	0.014*	I(1)
PPS	-1.752	-6.457	-2.965	-2.973	0.073	0.021*	I(1)

Source: Researcher's Computation using Eviews 9.5, 2023

Note: * indicates significant at five percent level of significance.

The study carried out ADF unit root test as showed on Table 1 to determine whether the variables are stationary or not using the Augmented Dickey Fuller (ADF) Statistic. Obviously, the ADF unit root test results on Table 1 showed that all the variables of interest; Real Gross Domestic Product (RGDP), demographic changes proxy by its components like; population growth rate (PGR), working age population ratio (WAP), old age dependency ratio (OAD), young age dependency ratio (YAD), demographic dividend (DMD) and net migration rate (NMR) as well as Public Domestic Savings (PDS) and Private Domestic Savings (PPS) maintained mixed order of stationarity as some were stationary at level while others were stationary at first difference. The unit root test is relevant to this study because it accounted for the order of integration of the variables of interest in the process of making choice of the VAR as the estimation technique. Hence, the mixed order to stationarity of the variables and non-cointegration of the variables induced the choice of VAR estimation technique.

Table 2: Co-integration Test Result

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.854	109.040	125.615	0.300
At most 1 *	0.710	21.658	95.754	0.400
At most 2 *	0.577	18.284	69.819	0.109
At most 3 *	0.485	42.139	47.856	0.047
At most 4	0.380	24.855	29.797	0.167
At most 5	0.206	8.094	15.495	0.455
At most 6	0.001	0.042	3.841	0.837

Trace test indicates no cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.854	17.383	46.231	0.100
At most 1 *	0.710	13.374	40.077	0.220
At most 2	0.577	20.144	33.876	0.130
At most 3	0.486	23.283	27.584	0.162
At most 4	0.381	16.761	21.132	0.184
At most 5	0.206	8.0517	14.265	0.374
At most 6	0.001	0.042	3.841	0.837

Max-eigenvalue test indicates no cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Co-integration Test Result on Table 2 showed that the trace test statistics indicates no co-integrating equations at 5% level of significance while the Max-Eigen value indicates no co-integrating equations at 5% critical level, this implies that the co-integration of the variables showed that there was no long run relationship among the variables of interest in this study.

Table 3: VAR Lag Length Selection Result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1476.534	NA	1.553	84.773	85.084	84.881
1	-1356.140	185.751	2.772	80.693	83.182*	81.552
2	-1286.626	79.444*	1.236*	79.522*	84.188	81.132*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

From the lag selection results in Table 3, lag two was selected by the entire selection criterion. Hence, lag one shall be used to estimate the VAR model.

Table 4: Vector Autoregression (VAR) Result

	RGDP	PGR	WAP	OAD	YAD	DMD	NMR	PDS	PPS
RGDP(-1)	0.581	117.498	-19.265	-34.771	-36.424	0.035	-0.701	9.643	4.524
	(0.325)	(58.069)	(8.616)	(11.130)	(11.327)	(0.216)	(0.659)	(2.499)	(0.707)
	[1.788]	[2.023]	[-2.235]	[-3.124]	[-3.216]	[0.162]	[-1.063]	[3.859]	[6.390]
RGDP(-2)	0.459	108.139	15.665	68.456	69.502	0.020	0.349	0.670	0.829
	(0.197)	(35.197)	(5.223)	(6.747)	(6.865)	(0.130)	(0.399)	(1.515)	(0.429)
	[2.331]	[3.072]	[2.999]	[10.147]	[10.122]	[0.155]	[0.874]	[0.442]	[1.932]

Summary Statistics: R-Squared = 0.88 Adj. R-squared= 0.75 F-statistic = 6.61

Table 4 showed the vector autoregression result. Based on the summary statistic of the VAR result, the R-squared value of 0.88 means that 88% of the total variation in Real Gross Domestic Product (RGDP) as proxy for economic growth was explained by demographic changes proxy by its components like; population growth rate (PGR), working age population ratio (WAP), old age dependency ratio (OAD), young age dependency ratio (YAD), demographic dividend (DMD) and net migration rate (NMR) as well as Public Domestic Savings (PDS) and Private Domestic Savings (PPS) while the remaining 12% unexplained was captured by the error term.

The value of Adjusted R-squared of 0.75 implies that 75% of the systematic variation in Real Gross Domestic Product (RGDP) as proxy for economic growth was explained by demographic changes proxy by its components like; population growth rate (PGR), working age population ratio (WAP), old age dependency ratio (OAD), young age dependency ratio (YAD), demographic dividend (DMD) and net migration rate (NMR) as well as Public Domestic Savings (PDS) and Private Domestic Savings (PPS) while the remaining 25% unexplained was captured by other key variables that were not incorporated into the model. Given that the F-statistic value of (6.61) was greater than its tabulated value of 4.45 at 5% level of significance, it means that overall parameter estimates in this study were statistically significant within the study period.

Table 5: VAR Impulse Response of RGDP (Economic Growth)

Response of RGDP: Period	RGDP	PGR	WAP	OAD	YAD	DMD	NMR	PDS	PPS
1	7.801	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.932)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2	-6.873	0.692	3.509	-2.209	-1.686	1.399	-0.486	0.827	1.692
	(2.685)	(1.810)	(2.236)	(1.397)	(1.441)	(1.428)	(1.835)	(0.589)	(0.839)
3	7.710	1.041	8.914	-0.98	2.190	0.790	-0.517	0.690	0.497
	(5.072)	(2.882)	(3.006)	(1.88)	(2.158)	(1.818)	(2.621)	(0.664)	(0.970)
4	-7.503	0.318	2.870	-2.102	2.040	2.858	-1.357	2.765	3.057
	(5.528)	(3.676)	(3.899)	(2.446)	(2.814)	(2.789)	(3.390)	(1.163)	(1.416)
5	0.360	1.903	0.357	0.936	-1.686	1.072	0.927	1.520	1.119
	(5.501)	(3.864)	(3.904)	(2.477)	(3.028)	(2.984)	(3.501)	(1.929)	(1.745)
6	9.426	6.376	2.122	-2.844	-3.262	1.598	-1.590	5.196	4.143
	(7.043)	(3.984)	(5.003)	(3.666)	(4.151)	(3.068)	(2.966)	(2.671)	(1.856)
7	-7.555	2.927	0.153	-0.075	-0.989	1.031	3.881	5.740	3.543
	(11.792)	(5.460)	(6.970)	(5.123)	(5.793)	(3.864)	(4.193)	(3.298)	(2.147)
8	6.413	4.819	1.235	-0.470	-0.037	1.992	2.933	2.693	1.256
	(13.576)	(7.105)	(6.320)	(4.062)	(5.065)	(3.682)	(4.609)	(3.350)	(2.210)
9	13.282	5.884	4.529	-1.380	0.856	0.216	-2.403	2.283	2.657
	(10.581)	(7.486)	(5.845)	(4.097)	(4.765)	(3.773)	(4.383)	(2.912)	(2.124)
10	-5.775	2.951	4.673	-3.189	3.446	2.508	5.736	1.794	0.306
	(10.599)	(7.352)	(6.877)	(5.400)	(6.130)	(4.461)	(5.129)	(4.715)	(3.228)

Table 5 and figure 1 show Cholesky Impulse Response of economic growth proxy by RGDP to unanticipated shocks in demographic changes components likepopulation growth rate (PGR), working age population ratio (WAP), old age dependency ratio (OAD), young age dependency ratio (YAD), demographic dividend (DMD) and net migration rate (NMR) as well as Public Domestic Savings (PDS) and Private Domestic Savings (PPS). Based on the response to Cholesky One S.D. innovations expressing the response of RGDP to changes in demographic changes components, it was revealed that economic growth proxy by RGDP responded positively to changes in demographic changes components like; population growth rate (PGR), working age population ratio (WAP), demographic dividend (DMD) while it responded negatively to changes in other demographic changes components like; old age dependency ratio (OAD), young age dependency ratio (YAD) and net migration rate (NMR).

It was further revealed that economic growth responded positively to changes inPublic Domestic Savings (PDS) and Private Domestic Savings (PPS). This implied that economic growth responded both positively and negatively to unanticipated shock in demographic changes components while it economic growth responded positively to unanticipated shock in public domestic savings and private domestic savings in the Nigerian economy.

5.0 Findings

The study aimed to investigate how unexpected shifts in demographic factors and domestic savings influence economic growth in Nigeria. Employing Cholesky Impulse Response and VAR model analysis, the study examined the effects of unforeseen changes in demographic components (such as population growth rate, working-age population ratio, old age dependency ratio, young age dependency ratio, demographic dividend, and net migration rate) as well as public and private domestic savings on economic growth. This finding is similar to that of Kumar (2022), Rutger and Jeroen (2020) and Hussain (2019) who revealed existence of a positive relationship between demographic changes variables and

economic growth. However, the finding is in contrast to that of Wang and Conesa (2022) and Jehan and Khan (2020) who showed existence of a negative relationship.

Results showed that economic growth responded positively to an increase in population growth rate, indicating that a higher rate led to economic expansion. Similarly, a rise in working-age population ratio contributed to economic growth, suggesting the importance of a larger workforce for economic advancement. Moreover, an increase in demographic dividend, which represents the working-age population's productivity, correlated with economic growth enhancement. This finding is in line with that of Kumar (2022) who revealed existence of positive relationship between demographic changes variables and economic growth.

Conversely, economic growth reacted negatively to changes in other demographic components, namely, old age dependency ratio, young age dependency ratio, and net migration rate. Increases in these ratios resulted in decreased economic growth during the study period. This finding is similar to that of Wang and Conesa (2022) who revealed a negative relationship between demographic changes variables and economic growth.

The study also revealed that economic growth was positively influenced by both public and private domestic savings. This finding emphasized the significance of mobilizing savings to foster economic growth in Nigeria.

In conclusion, the research indicated that favorable demographic changes, particularly in population growth rate, working-age population ratio, and demographic dividend, along with increased domestic savings, could bolster economic growth in Nigeria. Conversely, negative responses to certain demographic shifts underscored potential challenges to growth.

5.1 Conclusion

The findings of this study provide crucial insights into the factors that influence economic growth in Nigeria. Firstly, the study highlights the importance of population growth rate, as it positively affects economic growth in the Nigerian economy. Therefore, policymakers need to take measures to encourage population growth in Nigeria to help sustain economic growth in the long term. Secondly, the study emphasizes the importance of working age population ratio as a crucial determinant of economic growth in Nigeria. An increase in working age population ratio positively affects economic growth, and therefore, policymakers need to focus on creating more job opportunities for the youth population to increase the working age population ratio in the country. Thirdly, the study reveals that demographic dividend has a significant positive effect on economic growth in Nigeria. As such, policymakers should implement measures to promote demographic dividend in Nigeria by investing in the education and training of the youth population.

Fourthly, the study highlights the negative impact of old age dependency ratio, young age dependency ratio, and net migration rate on economic growth in Nigeria. Policymakers need to address these issues to minimize their negative effects on economic growth in the country. Finally, the study shows that public and private savings mobilization has a positive impact on economic growth in Nigeria. Policymakers should, therefore, encourage the promotion of savings mobilization to increase investment in the economy and drive economic growth.

In conclusion, this study provides policymakers with valuable insights into the key drivers of economic growth in Nigeria. By taking appropriate measures to address the issues highlighted in this study, policymakers can help to sustain and improve economic growth in Nigeria in the long term.

5.3 Recommendations

Based on the findings of the study, the following policy recommendations are proposed to promote economic growth in Nigeria:

- Since the study found that population growth rate has a positive impact on economic growth, policymakers should implement measures to encourage population growth. This could be done by

providing incentives such as tax breaks, maternity leave, and other social programs aimed at promoting family growth.

- The study revealed that working age population ratio has a positive effect on economic growth. Policymakers should, therefore, focus on creating more job opportunities for the youth population to increase the working age population ratio in the country. This could be achieved through policies such as investment in infrastructure, entrepreneurship development, and job training programs.

- Given the importance of demographic dividend to economic growth policymakers should invest in education and training programs to improve the skills and knowledge of the youth population, thus promoting demographic dividend.

- The study revealed that old age dependency ratio and young age dependency ratio have a negative impact on economic growth. Policymakers should address these issues by implementing policies that encourage the elderly population to remain economically active, such as reducing retirement age or providing incentives to continue working. Additionally, policies aimed at reducing teenage pregnancy could help reduce the young age dependency ratio.
- The study found that public and private savings mobilization has a positive impact on economic growth. Policymakers should, therefore, encourage savings mobilization by implementing policies such as tax breaks for saving, financial literacy campaigns, and incentives for private sector investment in infrastructure development.

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