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ANALYSIS OF THE IMPACT OF FERTILITY, MORTALITY AND NET MIGRATION ON NIGERIA'S ECONOMIC GROWTH

ABSTRACT

This study aimed to analyses the impact of fertility, mortality and net migration on Nigeria's economic growth. Annual data was obtained from the Central Bank of Nigeria, World Development Indicators (WDI), United Nations Children's Fund (UNICEF) and United Nation – World Population Prospect for the year 1986-2023. Various techniques of analysis were employed for in the study in the pr-estimation; Augmented Dickey-Fuller (ADF), the Philip-Peron (PP) unit root test and Philip-*Peron (PP) unit root test with breaks to determine the stationarity status* of the data series. In addition, Autoregressive Distributed Lag Error Correction modelling procedure was further adopted to analyses the relationship between fertility, mortality and net migration on Nigeria's economic growth, and post estimation for diagnostics test was conducted. The study established that Mortality is having a negative and significant impact, fertility is having a positive and significant impact on the economy in the long run. Net migration has a positive impact on the economy both in short and long run. The study further recommends government and relevant stakeholders should ensure accessible and affordable family planning services awareness on antenatal and postnatal care to boost economic growth. The Nigerian Diaspora Commission must engage and empower overseas citizens to contribute to national development.

Keywords: *Economic Growth, Fertility, Mortality, Net Migration,* JEL classification: J13, I12, F22, 040

1. Introduction

The Population of any country provides the pool of labor needed in the production chain of goods and services. Every economy of the world aims to achieve the macroeconomic goals of price stability, economic growth, full employment, favorable balance of payment and improved standard of living, among others. The demographic components and structure of an economy plays a crucial role in the achievement of these macroeconomic goals. Population and economic growth generally refer to the study of the consequences of population trends on socioeconomic growth and development, human welfare, and the natural environment (Hirschman, 2004 as cited by Emmanuel, 2015).

In Nigeria, respecting the ideal case as in any economy, the size, structure and components of population (demography) determine many factors such as its potential supply of labour (skilled and unskilled), market demand, ability to consume and cause a rise in aggregate demand and the growth of GDP, its geopolitical importance, increased tax revenue base of the economy, among others. It also has the potential to generate market competition, efficiency and innovation. According to World Development Indicator (WDI, 2021), the population of Nigeria has grown tremendously from independence to date. In 1960, the population figure stood at about 45 million to 122 million in the year 2000, 158 million in 2010 and about 227 million in 2024.

Establishing relationship between demography and economic growth has therefore been fundamental to the policy makers in different countries. Several studies have been conducted on the issues relating population growth, demographic structure and economic growth in different countries of the world, at various time periods, adopting varying techniques: Foreign studies include Bloom et al. (2000), Climent and Meneu (2003), Song (2013), Jorge et. al (2016), Reham (2018), Adisu (2019), James (2019), among others. Domestic studies (Nigeria) include Nwosu et al., (2014), Tartiyus et al., (2015), Aidi et al. (2016), Akinbode et al. (2017), Ogunleye et al. (2018), David (2019), Joshua and Dauda, (2020), among others. However, studies have shown no agreement on whether population growth (which is a function of fertility, mortality and net migration) is beneficial or detrimental to the economic growth in the developing countries. For example, Nwoso et al. (2014), Tartiyus et al. (2015), Ogunleye et al. (2015), Aidi et al. (2016) documented a negative relationship between population and economic growth. Given this scenario, there is thus a need to assess the impact of demography on economic growth in Nigeria.

Reviewed studies pointed were limited by not including control variable on economic growth proxied by GDP, non-performance of post estimation diagnostic checks to warrant the usage of such findings for policy formulation and prescription to the reportage of mixed findings. It is imperative to disentangle demography in to components as fertility, mortality rates and net migration Therefore, this study aimed to analyses the impact of fertility, mortality and net migration on Nigeria's economic growth.

2. Literature review

2. Literature Review

2.1 Review of Conceptual Literature

2.1.1 Demography

In the submission of Max Planck Institute for Demographic Research (MPIDR, 2013), demography is the scientific study of populations that examines the size and composition of populations according to diverse criteria: age, ethnicity, sex, union (marital or cohabiting) status, educational attainment, spatial distribution, and so forth. McDonald (2014) defined demography as the scientific study of human populations. Demography is concerned also with the outcomes for populations of the occurrence of 'demographic' events. Most basically, it is concerned with a population's size, age structure and geographic distribution which are the outcomes of the events of birth, death and migration.

2.1.2 Population Growth Components in Nigeria

As Highlighted by Jennifer et al (2015), in dealing with total birth, death and net migration, the fundamental measurements demographers use is rates. The population growth components include; Birth (Fertility) Death (Mortality) and Migration (in migration and out migration).

Fertility

Fertility refers to the actual production of offspring, rather than the physical capability to produce which is termed fecundity While fertility can be measured, fecundity cannot be. Fertility is one of the determinants of population growth. The level of childbearing has been historically high in Nigeria mainly due to early childbearing, low modern contraceptive prevalence rate and low female education (NPP 2021). Demographers measure the fertility rate in a variety of ways, which can be broadly broken into period measures and cohort measures. Period measures refer to a cross-section of the population in one year. Cohort data on the other hand, follows the same people over a period of decades. Both period and cohort measures are widely used.

Mortality

Mortality is a simply the event of occurrence of death in a defined population during a specified interval. Mortality is the number of deaths for a given area during a given period. Childhood diseases such as malaria, acute respiratory tract infections, diarrhea, and vaccine preventable diseases (measles, tuberculosis, diphtheria, polio, whopping cough, tetanus) constitute the most common morbidity most infant and child deaths occur because of these diseases.

Migration

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Migration is a demographic process that involves movement of people between places, and so contributes to population change along with fertility and mortality. Migration takes two forms, internal and international. Internal migration includes rural to rural, urban to rural, rural to urban as well as urban to urban. International migration involves movement across boarder.

2.1.3 Economic Growth.

Economic growth simply refers to increase in a country's production or income per capita. It is usually measured in terms of Gross National Product (GNP) or Gross National Income (GNI) used interchangeably, as an economy's total output of goods and services. According to Leszek Balcerowicz (2001), economic growth is a process of quantitative, qualitative and structural changes, with a positive impact on economy and on the population's standard of life, whose tendency follows a continuously ascendant trajectory. Balami, (2006) defined economic growth as the increase in output of an economy's capacity to produce goods and services needed to improve the welfare of the country's citizens. Growth is seen as a steady process which involves raising the level of output of goods and services in the economy, e.g rise in Gross Domestic product (GDP). Growth is seen as a steady process of increasing the productive capacity of the economy and hence, increasing national income, being characterized by higher rates of increase of per capita output and total factor productivity, especially labor productivity.

2.2 Theoretical literature review

Malthusian population theory and neoclassical growth theory provide complementary frameworks for analyzing Nigeria's economic growth in relation to fertility, mortality, and migration. Here's how these theories underpin such a study.

2.2.1 Malthusian Population Theory

Malthus's theory posits that population growth outpaces resource availability, leading to poverty and stagnation unless checked by "positive" (famine, disease) or "preventive" (fertility control) factors. In Nigeria, this is evident in the agricultural sector's inability to match rapid population growth, transforming the country from a food exporter to a net importer Umar and Usman (2017). The model's prediction of resource strain aligns with Nigeria's challenges that high fertility rates (5.3 births per woman in 2023) exacerbate pressure on limited resources, hindering GDP growth Umar & Usman, (2017). While mortality rates have declined due to healthcare improvements, persistent infant and maternal mortality partially reflect Malthusian "positive checks" Issa, (2003). Modern adaptations of Malthusian theory emphasize sustainable development and human capital. For instance, Ehrlich and Jinyoung (2005) show how demographic

transitions falling fertility and mortality can shift economies from stagnation to growth, a pathway relevant to Nigeria's development goals (Ehrlich & Jinyoung, 2005).

Neoclassical Growth Theory

Neoclassical theory, pioneered by Solow and Swan (1956), attributes long-term growth to labour, capital, and technology. Its production function Y=AF(K,L)Y = AF(K,L)Y=AF(K,L) highlights technology (A) as the key driver of productivity, offsetting diminishing returns from capital and labour Mierau & Turnovsky, (2011). For Nigeria, this framework suggests investments in education and health (e.g., reducing child mortality) enhance labour productivity, as shown in Issa's (2003) model linking human capital to demographic transition.

Net migration influences labour supply and remittances, affecting capital accumulation and technological adoption demonstrate that demographic shifts (e.g., falling fertility) alone cannot explain economic growth unless paired with technological progress a critical insight for Nigeria, where innovation rates remain low (Mierau & Turnovsky, 2011).

The synthesis for Nigeria's context indicates high fertility strains resources (Malthusian), but neoclassical models advocate redirecting resources from child-rearing to human capital investments Issa, (2003). Reduced mortality extends productive lifespans, boosting labour quality (neoclassical), yet rapid survival-rate improvements may temporarily increase dependency ratios (Malthusian) (Ehrlich & Jinyoung, 2005; Issa, 2003). Neoclassical theory frames migration as a labour-market equilibrator, potentially alleviating resource pressures (Malthusian) through remittances and skill transfers (Mierau & Turnovsky, 2011).

2.3 Empirical literature review

3. Methodology

A quantitative research design was adopted for this study, annual data was obtained from the Central Bank of Nigeria, World Development Indicators (WDI), United Nations Children's Fund (UNICEF) and United Nation – World Population Prospect for the year 1986-2023. As a prerequisite to avoiding spurious regression as pointed by Granger and New Bold (1974), data analysis techniques in this study employed Augmented Dickey-Fuller (ADF), the Philip-Peron (PP) unit root test and Philip-Peron (PP) unit root test with breaks to determine the stationarity status of the data series.

Autoregressive Distributed Lag – Error Correction modelling procedure was further adopted to analyses the relationship between fertility, mortality and net migration on Nigeria's economic growth. Post estimation for diagnostics include test for; serial correlation, heteroskedasticity, normality and model stability test.

3.1 Model specification

In order to come up with a model specification that achieves the objectives of the study, the following model presented by Aidi et al., (2016) was adopted and modified.

This study models the variables as follow:

$$RGDP = f(FRT, MRT, NMGR, GFCF).$$
(1)

To aid interpretation of the results in proportionate terms using elasticities and to ensure estimating standardized data series, the variables are expressed in natural logarithmic form. Following the recommendation by Gujarati and Porter (2009) for the use of log-linear (log-log) model in measuring growth rate of any economic variable, the log-log transformation of the functional form of the econometric model is specified as follows:

$$lnRGDP_t = \alpha_0 + \alpha_1 FRT_{t-1} + \alpha_3 MRT_{t-1} + \alpha_4 NMGR_{t-1} + \alpha_5 lnGFCF_{t-1} + \varepsilon_t....(2)$$

Since the result of the bound test reveals the existence cointegration among the variables, both the short run and long run ARDL model was estimated. The ARDL model and the ECM procedures is specified in equation 3 and 4;

Where; p, q_1 , q_2 , q_3 , q_4 are lag orders for each variable, α_0 is the intercept, and ε_t is the white noise error term. Since cointegration (long-run equilibrium) exists among the variables, the ARDL model can be reparametrized into an ECM form that captures both short-run dynamics and long-run equilibrium as shown in equation 4;

$$\Delta lnRGDP_{t} = \alpha_{0} + \sum_{i=1}^{p-1} \phi_{i}^{*} \Delta lnRGDP_{t-i} + \sum_{j=0}^{q_{1}-1} \beta_{j}^{*} \Delta FRT_{t-j} + \sum_{k=0}^{q_{2}-1} \gamma_{k}^{*} \Delta MRT_{t-K} + \sum_{l=0}^{q_{3}-1} \delta_{l}^{*} \Delta NMGR_{t-l} + \sum_{m=0}^{q_{4}-1} \theta_{m}^{*} \Delta lnGCFF_{t-m} + \sum EC_{t-1} + u_{t} \dots$$
(4)

Where; Δ denotes the first difference operator,

 $EC_{t-1} = lnRGDP_{t-1} - \beta_1 FRT_{t-1} - \beta_2 MRT_{t-1} - \beta_3 NMGR_{t-1} - \beta_4 GFCF_{t-1}$ is lagged error correction term representing the long-run equilibrium residual, λ is the error correction coefficient (speed of adjustment), expected to be negative and significant and u_t is the error term in the ECM.

Table 1: Va	Table 1: Variables Description and Sources				
Variable	Description	Source			
LnRGDP	Log of Real Gross Domestic Product (Proxy for Economic Growth).	Central Bank of Nigeria			
FRT	Fertility rate	World Development Indicators			
MRT	Mortality rate	United Nations Children's Fund			
NMGR	Net migration rate	UN World Population Prospect			
lnGFCF	Log of Gross Fixed Capital Formation (Proxy for Physical Capital).	World Develop ment Indicators			

Source: Author's computation

4. Results and Discussions

	Augme	Augmented Dickey-Fuller Test		Phillips-Perron Test		Гest
	at level	at first diff		at level	at first diff	
	prob	prob	Oder of int	prob	prob	Oder of int
LRGDP	-0.58203	-3.8039***	I(1)	-0.49084	-3.7019***	I(1)
FERT	-1.32412	-3.8977***	I(1)	1.270838	-3.3614**	I(1)
MORT	-2.5689**	-	I(0)	-3.5025***	-	I(0)
NMGR	-3.0294**	-	I(0)	-4.9126***	-	I(0)
LGFCF	-1.72721	-10.088***	I(1)	-2.11076	-8.2348***	I(1)

Table 2: Results of Unit Root Test

Source: Source: Authors Computation using E-views 10; Note: ***, ** and * denote level of significance at 1%, 5% and 10% respectively.

Table 1 above present the unit root test result for both the Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) procedures. The results revealed that LRGDP, FERT and LGFCF were not stationary at level in both tests conducted but afterward stationary at the first difference, whereas MORT and NMGR were found to be stationary at level in both tests conducted. This test result conform to the requirement of the application of ARDL modeling procedure which holds that none of the time series observed be stationary at second difference I(2).

Variables	t-Statistic	P-value	Break Point
NMGR	-11.2928	0.01	2010
LGFCF	-6.16183	0.01	1999

Table 3: Perron Unit Root Test with Structural Break

Source: Authors computation using Eviews 10.

Perron (1997) proposed a unit root test in the face of structural break in a series. According to him, the break point date is selected based on Dickey-Fuller minimum t-statistic, and the lag length is selected using the F-statistic max lag. Base on the trend plot of the data series, net migration rate (NMGR) and gross fixed capital formation (LGFCF) shows evidence of break. The break point on net migration is year 2010. Gross fixed capital formation has 1999 as its break point. The year 1999 saw a transition from military to civilian administration in Nigeria. The transition was accompanied by an increase in the share of public spending and hence of gross fixed capital formation.

Dependent Varia	able	Function	F-statistic	Conclusion
LRGDP	lrgdp(lrgd	p/fert,mort,nmgr,lgfcf)	8.790529	Cointegrated
	1 7 7 1	10/	504	100/
Asymptotic Critic	cal Value	1%	5%	10%
Lower bound I(0))	3.74	2.86	2.45
Upper bound I(1)		5.06	4.01	3.52

Table 4: Output of ARDL Bounds Testing Procedure

Source: Authors computation using Eviews 10.

Following the result of the unit root test that confirmed variables stationarity at level and first difference, the ARDL bounds test is applied. The output revealed the existence of long run equilibrium relationship among the observed series (do not drift too far apart). The series co-movement was consolidated from the F-statistic value of 8.790529 which is higher than the upper critical value (at the more conventional 5%) of 4.01 in accordance with the Pesaran et. al., (2001) critical values.

Table 5: Short run impact of the coefficient using ARDL approach.

	51		115		
Variable	Coefficient	Std. Error	t-Statistic	Probability	-
С	7.320344	1.001525	7.309199	0.0000	-
D(FRT)	-0.31535	0.239427	-1.31709	0.2014	
D(MRT)	0.001976	0.003054	0.647009	0.5243	
D(NMGR)	0.680684	0.115292	5.903986	0.0000	
D(LGFCF)	-0.00647	0.030061	-0.21534	0.8315	
ECT(-1)	-0.47641	0.066102	-7.20722	0.0000	

Short run Coefficients

Source: Authors computation using Eviews 10.

From Table 5 above, the impacts of short run of the coefficients have been conducted employing the ARDL-ECM mechanism. In the short run, fertility, mortality, and gross fixed capital formation have been found to have no significance statistically on economic growth in Nigeria. Net migration rate in the short run has a positive and statistical impact on economic growth. The error correction term coefficient estimated as -0.47, is significant and takes the correct sign implying the speed of adjustment to equilibrium. Approximately, about 47% of the disequilibrium from previous year's deviation (shock) converges back to the long run equilibrium in the current year. The duration for adjustment from disequilibrium to a steady state (equilibrium) after computation shows the error correction term posits it will take an estimated period of 209 years, 9 months for the model to return back to equilibrium.

]	Long run Coefficie	nts	
Variable	Coefficient	Std. Error	t-Statistic	Probabilit
FRT	0.802792	0.31503	2.5483	0.0183
MRT	-0.02473	0.004426	-5.587632	0.0000
NMGR	1.437686	0.676286	2.125856	0.0450
LGFCF	-0.17356	0.181488	-0.9563	0.3493

Table 6: Long run impact of the coefficient using ARDL approach.

Source: Authors computation using Eviews 10.

From Table 6, In the long run, the coefficients of fertility and net migration have a positive and statistical impact on economic growth of Nigeria. This means, fertility and net migration accelerates the pace of economic growth. The coefficient of mortality was found to have a negative effect on economic growth of Nigeria while gross fixed capital formation has no statistical impact on economic growth.

Test	Test statistic	Test Statistic	Probability
Serial correlation	Breausch-Godfrey LM Test	0.660048	0.5277
Heteroskedasticity	Breausch-Pagan-Godfrey	0.473619	0.9022
Normality	Jaque-Bera	2.039443	0.3607
Functional form	Ramsey RESET Test	0.461931	0.6489

Table 7: Post Estimation Diagnostic Tests

Source: Authors computation using Eviews 10.

To ensure the reliability of the model estimates for policy prescription, the diagnostic tests have been conducted and presented in table 7. The Breusch-Godfrey LM test type of serial correlation showed that the variables are serially uncorrelated with each other. Similarly, the heteroskedasticity (Breausch-Pagan-Godfrey) test unveiled homoskedastic nature of disturbance term in the equation. The Jaque-Bera test reveal that the residuals are normally distributed. Further in the post estimation diagnostic, the Ramsey RESET test confirmed correctness of the functional form used.

Model Stability Test



Fig 1: CUSUM and CUSUM OF SQUARES

Source: Author's computation using Eviews 10.

From the above figure, both the CUSUM and CUSUMQ test have been carried out and lies within the 5% boundary in both tests established the model is dynamically stable.

5. Conclusion and Recommendations

In conclusion, this research work is set to broadly examine the impact of fertility, mortality, and net migration on economic growth. The study concludes that fertility improves economic growth in the long period. However, it should be managed in such a way that it doesn't reduce savings, productivity and ultimately growth of the Nigerian economy. Mortality reduces the pace of economic growth, reducing preventable death therefore imply an increase in economic growth. Net migration is of importance towards improving economic growth in Nigeria through diaspora remittances, employment generation, and skill development among others. Gross fixed capital formation has no appreciable contribution to economic growth. This could be due to corruption and misplacement of priorities in developing the fixed capital.

In line with the findings and conclusion, the study recommends government at all levels, through the National Population Commission shall ensure the availability, accessibility and affordability of family planning services to help improve the share of fertility to economic growth in the short run. Federal government through National Orientation Agency (NOA), National Primary Health Care Development Agency should key in specialized strategy to enlighten citizens on the need for antenatal and post-natal care to reduce mortality. States and local governments should also onboard traditional leaders to serve as a vehicle for stepping down the orientation. The federal government through the Customs and Immigration services should

strengthen more (via visa fees) the migration laws to ensure that both immigrants and emigrants are properly checked and certified to be allowed in or out for productive activities only. The federal government through the Nigerians in Diaspora Commission shall be committed to creating the needed platform to engage, enable and empower Nigerians in the Diaspora towards national development.

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