Population Dynamics, Energy Consumption and Economic Growth in Nigeria

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Abstract
This paper assessed the nexus between population dynamics, energy consumption and economic growth in Nigeria spanning from 1989 to 2020. The empirical paper employed a Granger causality examination test and vector error correction estimation technique. The Granger causality tests found that there is unidirectional interconnection arising from gross domestic product (GDP), energy consumption (ENEG), mortality rate (MORT), and fertility rate (FERT), which turns optimistically to economic growth in Nigeria influences. Also, the VECM technique exposed that the independent variables have undesirable but no substantial influence on GDP within the period of study. Further more, the empirical study recommends that the Nigerian authority be notified to make straight efforts to control Nigeria's disturbing fertility rate.

Keywords: *Population dynamics, Energy Consumption and Economic Growth.*

Introduction

The influence of population dynamics, energy use and economic growth has extensively been documented since Malthus's innovative study in 1798 (Agwanda and Amani 2014). Over the centuries, it has befitted apparent that human capital is a fundamental element in compelling progress and growth. This is because the production needed to arouse economic growth could only be realized in the presence of human capital. In this esteem, a raising populace can be observed as sanctification; particularly if the demographic arrangement comprises of youths who are lively contributors in economic pursuit. Nevertheless, when populace growth outclasses progress, the outcomes can be uncomplimentary; particularly for per capita income (Handbook of Economic growth; (Galore 2005).

A speedy progress in populace could depress per capita incomes from three main means. Firstly, it upsurges the pressure of the populace on natural resources; particularly land. Secondly, it could lead to a shortage of goods and services that repeatedly leads to an upsurge in price (utilization cost). Finally, it leads to a drop in capital accretion and savings because the bigger a family, the greater their expenses, and the lesser their tendency to save (world population review, 2019). According to Dauda & Aziakpono (2015), "population dynamics," a subfield of life sciences, investigates population size and age as driving systems whilst, as indicated by Redmond (2016), who express that population dynamics is the all out human

occupants or a predefined region, like a city, nation or landmass at a given time. Populace progress also undesirably influences poverty and inequality, education, employment health, food, migration, and the environment; all of which forages into economic growth. Other features of populous away from numbers that effect economic results for persons and society as a whole comprise age, geographic, and social movement.

Fast populace expansion can amplify each issue that is scaled by populace numbers. Easing back that development hence can add to facilitating tension on biological systems and regular assets, work with the administration of land and water assets, and work on the possibilities accomplishing a more impartial conveyance of energy, especially in metropolitan regions. Thus, Population dynamics especially with regards to tenacious disparities will have significant effect on advancement processes and on the comprehensive and adjusted development and results in the next few decades. They likewise challenge the limit of nations to accomplish expansive based advancement objectives Rutherford (2002).

Economic growth has been seen as a measure of increase in the economy over a period of time. It is a measure of the yearly progress and expansion in size of the economy or a measure of the relative economic strength/power of a country. GDP, is a dimension of the yearly production of the proportion and labour of all inhabitants and overseas occupants within the geographic limits of a nation comprising its overseas areas such as embassies and obtained soldierly foundations overseas. When gross domestic products are split by the gross domestic products deflator indicator and increase by 100 the outcome is named real gross domestic products. When there is upsurge in real gross domestic products of a nation it enhances the general productivity and we named it economic growth. Thus, Rutherford (2002) characterized economic growth as progress in complete creation of an economy throughout some stretch of time, while; Sichel and Eckstein (1974) describe economic growth as an increase in the economy's capacity to produce goods and services over time. It is a measure of a nation's relative economic strength or power or of the annual growth and progress of the economy. The economic growth is useful to upsurge the incomes of the people, assist the country to bring the joblessness at little level and also helpful in the deliveries of public services. Over the last few decades population growth and economic growth liaison became the heated subject between scholars (Ullah, and A. Rauf 2013).

Energy consumption might, in datum, be credited as a discrepancy indicator between advanced and immature countries. This is because most immature countries are bedeviled by nonexistence of energy, which barely maneuvers progresses in education and health but also growing of initiatives and nationwide progress. Also, failure to comprehend the relationship between energy and economic growth and growth, particularly in emerging countries, might clarify the apparent insignificance in realizing the importance and focus of connection between them. According to Payne James E. (2009), The term "energy consumption" refers to the entire amount of energy required to carry out a task, produce something, or simply live in a building While, Ojinnaka (2008) state that energy use "Primary energy consumption" is used to calculate a nation's total energy demand. It includes the energy sector's consumption, losses during energy conversion (such as from oil or gas to electricity), distribution, and consumption by end users. Therefore, as Nigeria attempts to become one of the twenty biggest nations in the globe by 2030, the part of energy in motivating its progress and expansion must be farther lengthily comprehended. Whilst energy is a main element in all segments and surfaces of a contemporary economy, the rule framework needs that the kind

and way of interconnection between energy use and economic growth be suitably comprehended in directive to design actual energy policy involvements. Energy policy involvements must back the consumption of recognized energy bases whilst raising other prospective sources Payne James E. (2009).

Nigeria popularly referred to as the "Goliath of Africa" (WHO, 2020) has one of the biggest and speediest rising populaces in the African region. Nigeria accounts for about half of West Africa's populace with a projected 202 million individuals (National Bureau of Statistics (2016). At approximately 2021 a huge percentage of Nigeria's populace entails of childhoods that built up about 42.54% of the whole populace. The speedy populace progress in Nigeria has had stern consequences on the country's growth.

Empirically, the empirical appraisals on the connotation between population dynamics, energy consumption and economic growth in Nigeria didn't accomplish unanimity as to the path of interconnection. Thus, According to Barliwala & Reddy (1993), energy consumption and population are inseparable. All countries tussle to attain rapid economic growth due to a nonexistence of resources and their fatigue. As the world's populace rises each year, more and more human actions need energy resources. Thus, the inadequate energy resources might impede economic activity and, as a result, economic growth. Individuals for transportation, agriculture, and industries, among other things, use energy. We can't envision that assuming depleted energy happens on the planet; it can absolutely injure all nations' economy. A decline in energy use can have an influence on economic growth, but a decline in population can perhaps diminish energy demand. According to Shaari, et al. (2013), Ighodaro (2010), Lise & Monfort (2006), a decrease in energy utilization can have an influence on economic increase. As a result, economic growth is strongly influenced by energy utilization. The aim of this study is to examine the linkage between population dynamics and energy consumption on economic growth in Nigeria.

However, this manuscript investigates the connections between population dynamics, energy consumption and other economic variables like; GDP, energy use as a proxy for energy consumption, mortality rate and fertility rate. So, in this paper, our emphasis is on Nigeria's population dynamics within the period of study, with an emphasis on the grounds and concerns of a growing dynamics of Nigeria population. This empirical manuscript is split into five segments. Sector one is the introduction; related Conceptual Interpretation, Theoretical background and literatures are assessed in the second section. Segments three present the data and technique, whilst in section four, results are showed and in the final segment, which is sector five, conclusion is sketched. Therefore, the next fragment will show case empirical literatures.

Conceptual Clarification

Population dynamics

Population dynamics and its effects on economic outcomes have been an age-long debate (Dauda & Aziakpono, 2015). And it has been a subject of major debates in the economic and social science literature. In general, there are strands about the consequence of population growth on the overall economic development of a nation. Nigeria fits in the coalition of the quickest rising nations in the global with a populace of about 185 million persons as at 2016 and 201 million individuals in 2019, by a populace progress rate of 2.61% (Worldometer, 2020). Nigeria is the utmost populated nation in Africa gifted with extensive variety of

natural resources (UNDP, 2017). Nigeria's tall populace is probable to have effects on the economy as it touches an entire variety of socio-economic variables and disarticulation causing from violence, insecurity and riot (Afzal, 2009).

Population is well defined as the entire number of persons living in a certain geographic part or area and is proficient of multiplying (Afzal, 2009). Population progress signifies to an upsurge in size of the populace of a specific area or nation. Population progress of a nation arises only when the total childbirth rate or fertility rate of that nation surpasses the total demise rate or mortality rate. This implies that further live births arise in the nation than deaths thereby crafting the populace to go rise.

Economic Growth

Rutherford (2002) described economic growth as progress in total production of an economy over a period of time, scholars like studies Aidi, Emecheta and Ngwudiobu (2016); Kotani and Kotani (2012); Louzi and Abadi (2011) and Nwosu, Dike and Okwara (2014) to state but few displayed that economic growth is regularly measured by growth in GDP. Whilst population of Nigeria has been rising progressively, certainly and drastically over a period of time; the tendency of economic growth been gross domestic product in Nigeria has experienced high rate of variability/volatility. To back this declaration, dataset from World Bank (2014) shown that gross domestic product has experienced both affirmative and undesirable progress.

However, Economic growth of Nigeria stood muffled since 2015. Recuperating from downturn in 2016 economic growth be around 1.9% in 2018 and stayed steady at 2% in the first partial of 2019 (World Bank, 2020). Economic growth is one indicator of the attainment of a nation's economic expansion. Economic progress exemplifies that in an economy experienced an expansion in nationwide income. National income evaluates the degree to which a nation's economy can create goods and services over a period of time. This rise in the size that will yield goods and services can be signified to as economic growth.

Energy Consumption

Energy doyen's signpost that in the expression of growths in energy utilization there is the need to maintain energy consumption by consuming energy efficient processes. Energy is a crucial variable for progress and keenness. For manufacturer energy is a significant resource and a cost component. For customer energy bills embodies substantial substances in homes financial plan and is specific test for low-income families. Nevertheless, energy is reducing; any disturbances in non-renewable energy supply, punching non renewable- reliant on actions and homes can spearheads to serious increase in energy price.

Academically, several scholars have suggested that if the progress of a nation is hanged on energy consumption and that energy utilization instigate progress without response then there will be a decline in the utilization of energy consumption will threshold the development of a nation (Kumar, 2011; Khalid & Khalid, 2010). In sight of the expansion in energy consumption in the expression of reduced supply the scholar's appraisal empirical studies to establish the core variables answerable for energy demand in other to add to literature on the bases of energy utilization since few current works exist in literature, with inconsistent results. Hence more review on current empirical studies is needed to notify policy makers and scholars as well as examiners in energy and sustainable growth (Khanna & Rao, 2009).

Theoretical framework

It is significant to recollect that, from the inception, scholars had contradictory interpretations on the part that population dynamics; energy consumption plays in driving economic growth. Whilst some trust that population dynamics play a fundamental part in driving economic growth, others think that population is dazed by growth and hence request for economic growth rise. The link between population dynamics, energy consumption and economic growth based on theoretical association could be sketched to one school of economic thought to another. Therefore, this segment hence presents the advancement of the theories underlying populace dynamics, energy consumption and economic growth theory over the years. Thus, the theoretical foundation of this manuscript is anchored in three theoretical frames, namely: the Boserup's Model, Growth Hypothesis and the Neo-classical growth model.

Boserup's Model

This Boserup's theory was propounded by Easter Boserup (1965) who overruled classical (Malthusian population) model and rather fundamentally debated that we could certainly not out undress out food supply. Boserup's ponders populace growth as independent force of exogenous element that instigates technological development in agriculture and assumes that total agricultural manufacture role in the long term that will continuously swing up wards in reaction to populace pressure to uphold production per capita. Mostly, the motive behind Boserup's rejection of classical wide margin is that land production can upsurge due to features. Firstly, Boserup's maintains that upsurges in physical labour input to work lengthier hours will offer enlarged production per hectare. Secondly, in the long-run technological development could lead to enlarge productivity per hectare that will resolve to a modification in the productivity function (see, Dejene, et al., 2001).

Growth Hypothesis theory

This theory outlined a unidirectional interconnection from energy utilization to economic growth. Growth Hypothesis model of energy utilization plays a vital part (affirmative or undesirable) in economic growth, straightforwardly or indirectly across a productivity manner as a counterpart to labor and capital. On the other hand, energy consumption is either the reason or the initiator of economic growth. The rule proposition of this theory advocates that the angle to saving energy might have a undesirable influence on economic growth.
As an instance, In Greece, Obradović and Lojanica (2017) employed a Vector Error Correction model to assess the causal relationships between energy consumption, CO2 emissions and economic growth in Greece and Bulgaria. Their empirical study uncover that growth theory in the long term but in the short term has no connection between energy use and economic growth is discovered for both nations. Tiwari (2011) in his empirical paper also corroborates the growth theory in India by applying an econometrics in VAR and Granger causality technique.

In another development, backing this Growth hypothesis of energy consumption, Chen et al. (2016) applied a VECM spanning from 1993 2010 to examine the link between economic growth, CO2 emissions and energy utilization in 188 emerging and emerged nations. The paper uncovers that there is a presence long-term affiliations between economic growth, energy use and CO2 emissions for all nations. Also, the study found that energy utilization undesirably touches GDP in the globe and emerging nations, but not in advanced nations.

The Growth hypothesis accepts unidirectional connection from energy to economic growth, stressing the vital part energy plays and utilization play on production growth in vital. This affiliation signifies an energy-dependent on economy where no entrance or inadequate entrance to contemporary energy supplies possibly limits free enterprise and economic actions, causing in insignificant economic implementation (Tsani, 2010). In emerging nations in specific, the truth is that energy influences economic growth, just as economic growth prompts an upsurge in energy utilization.

Neo-classical growth model

A neoclassical growth model such as Solow (1956), studies the populace as exogenous (neutral on economic dynamics) following arithmetic form enlargement. Solow (1956) adopts a continuous populace progress and displays how economic growth is touched by population growth. Population growth believed that rises in labour force supply and hence upsurges production per-worker progress rate in one hand; on the other hand, populace growth lessens physical capital per worker; that finally decreases output and production per-worker development. Also, fluctuations in populace growth rates touch the economic growth of the nation, and it could be damaging for economic progress.

The neoclassical growth theory of economic growth is a model of the level and allocation of the national commodity founded on the social endowments of out features, like labour and 'capital', technical circumstances of out, and customer favourites. Pre-Solowian scholars concentrated on the fortitude of long-term equilibrium with assumed endowments of out aspects, but this model was also understood to be concerned by economic growth.

Economic growth has been observed as 'endogenous' in the distinctive neoclassical logic that it hanged on the resolution of the population (a gathering of persons) between saving perceived as the source of capital and present utilization. There was a firm correlation between the part of capital in sharing model and in progress model. The presence of a affirmative rate of incomes hinged on the lack of capital exactly because it embodied on the compensation for a saving choice that, either by authorizing a advanced per capital endowment or by equipping fresh labourers with the normal capital bequest, was fundamental for per capita and total economic progress. This is what we refer to as the 'orthodox concept' of economic growth thought by neoclassical theory of economists.

The obtainable theories appear to oppose each other, offering a flawless overview of the influence of population, energy utilization and dislocation on the economic growth of developing economies, comprising Nigeria. It is tough to oversimplify about Nigeria's prospect economic evolution outlooks given its rising population in the expression of involuntary shift. Thoughts vary on the appeal of population progress. Certain scholars observe fast population progress as a real problematic, whilst others observe it as a anticipate advantage (Afzal, 2009).

Literature Review

The rising empirical literature on the linkage between population dynamics, energy consumption and economic growth lack robust outcome Hence, There are few empirical analyses that attempt to assess more on population dynamics, energy consumption and economic growth. Scholar like Tessema, H. F. (2022) used panel data from 43 countries in sub-Saharan Africa from 1990 to 2022. The empirical study investigates the impact of

population and economic growth in sub-Saharan Africa using a fixed-and-random-effects approach. The paper revealed a one-to-one relationship between GDP per capita growth and population growth, suggesting demographic expansion is benefiting the economy.
Shen and Shen (2021) applied a fixed effect estimator spanning from the 2011 to 2019 to examine how population change affected the growth of 31 provinces in China. The empirical paper shows that economic growth is positively and significantly predicted by population structure, though there are regional discrepancies in the results. Further more, the paper suggested that there is a need to encourage fertility in order to increase the population of the labour force.

Abdulrazaq (2020) examines the relationship between energy use, economic growth and population growth in relation to carbon emissions in Africa from 1989 to 2018. Using Dynamics Least Squares (DOLS) and Granger causality approach, Africa is found to have higher energy. Utilization, economic growth, population growth Contribution of CO2 emissions
In Nigeria, Bashir et al (2019) applied an Automated Distributed Delay (ARDL) approach for the period 1970-2017 to explore the impact of net population growth on economic growth. Empirical study shows a negative and significant long-run association between economic growth and net population growth in Nigeria. Furthermore, the analysis found evidence of a one-way link from net population growth to economic growth in Nigeria

Peter and Bakari (2018), employed a panel data analysis from the period of 1980 to 2017 to examine the Impact of Population Growth on Economic Growth in Africa. The study applied a GMM approach to uncover how population growth positively predicts economic growth, while the fertility rate adversely impacts on the predicted variable.

Empirical Literature on the nexus between energy consumption and Economic growth

From the period of 2015 and 2021 Güler et al, (2022), employed 30 EU nations to examine the electricity utilization and economic growth. The manuscripts employed a ADRL approach to discover that there is bi-directional interconnection between electricity utilization and economic growth. The analysis further postulate new insights into understanding the electricity use and economic growth relationship by recommending that an rise in electricity utilization during the COVID-19 epidemic reduces economic growth. More so, the empirical analysis found that there is a tougher undesirable influence of electricity use on economic growth due to the virus infection justification strategies such as lockdowns and business' closures that force individuals to deeply consume domestic electricity witin the period of study.

From the period of 1971 to 2014, Ali, et al, (2020), adopted FMOLS and DOLS approach to investigates the nexus between electricity utilization and economic growth in in Nigeria. The paper uncover that the electricity utilization compelled economic growth as as Nigeria deeply reliant on energy (electricity) use. Also, a unidirectional connection from urbanization to electricity utilization and economic growth was uncovered but the long-term empirical results disclosed urbanization obstructs growth a condition that develops policy insinuations

Simionescu et al. (2019), used Granger Causality econometric method from the period of 1987-2015 to explore the nexus between electricity from renewables utilization and economic

growth from EU Union to find that electricity from renewables use applies affirmative but low influence on economic growth. In addition, the analysis upheld the inattentive of the underlying relationship between electricity from renewables consumption and economic growth EU Union Nations.

In Iceland, Faisal,et al, (2018) examine the nexus between economic growth on electricity use spanning from 1985-2016. The paper applied a econometric approach of VECM to find an nonappearance of granger causality connection between electricity utilization and economic growth in Iceland. The analysis, nevertheless, resolved that the achievement of energy conventional procedure does not apply undesirable influence on economic growth.

Zaghdoudi (2017) adopted a Dynamic Ordinary Least Squares technique and Auto-Regressive Distributed Lag spanning from 1990-2015 to examine the relation between economic growth and electric power utilization in Poland. It was established from the empirical outcome that optimistic substantial short-term and long-term effects of economic growth on electric power utilization.

Given the empirical appraisal atop, it can be resolved that the empirical studies for the energy use, economic growth and population dynamics interconnection remains indecisive as varied outcome were uncovered between the numerous analyses. This difference in the results could be credited to numerous characters as estimation approaches, model description, data characters and progress level of the nation. This empirical literature have observed the tendencies in conformation studies within previous 5 years and have re-assessed how empirical analysis in the field of energy consumption, economic growth and population dynamic have transformed and is still transforming. Thus, according to the present discussion over preceding analyses in the part of population dynamics, energy that have a optimistic result on economic growth, only in certain instances has undesirable or non-negative results. Considerably. To acquire more about how this result arises, few investigations on the linkage between population dynamics, energy consumption and economic growth has been measured, and the exploration is still on, but still remains to be perceived. There are gaps in the literature as there are no present econometric studies or techniques on vector error correction model (VECM) in the part of population dynamics, energy consumption and economic growth neither Nigeria nor Africa. This begins as a zone worthy of more study and could be well assumed out in terms of its noticeable influence on academic knowledge. This is what this manuscript seeks to discover.

METHODOLOGY

This study used quasi-experimental research design approach for the data analysis. Data for this study were the annual time series data ranging from 1989 through 2020. The variables include gross domestic product, Energy consumption, Mortality rate and Total fertility Rate. This was because the data required mainly secondary data on variables were all sourced from the World development indicators (WDI).

Model Specifications

Thus, we express the model as follows;

GDP= f (ENEG, **MORT, FERT**) (1)

Transforming equation 1 above to econometric method, we have:

$$\mathbf{RGDP} = \boldsymbol{\beta} + \boldsymbol{\beta_1}\mathbf{ENEG} + \boldsymbol{\beta_2}\mathbf{MORT} + \boldsymbol{\beta_3}\ \mathbf{FERT} + \ \boldsymbol{\mu t} \quad (2)$$

Where

RGDP = Nigeria Real Gross Domestic Products
ENEG = Energy use as a Porxy for Energy Consumption
MORT = Mortality rate
FERT= Total fertility Rate
μ = Error Term
$\beta_1 - \beta_4$ = Coefficient of Independent Variables to the Dependent Variable
β_0 = Regression Intercept

Definition of variables

Based on hypothetical questions, available data, and the need to maintain degrees of freedom, we used time-series data on four variables from the period 1989 to 2020, discussed below, and selected for the empirical variables to clarify the real GDP adjustments and to be assessed per capita against gross domestic product (GDP), energy consumption (ENEG), mortality rate (MORT) and fertility rate (FERT), All the Data were sourced from the World development indicators (WDI).

Methods of Data Analysis

In order to estimate the regression model, E-views econometrics and statistical package will be used. The procedure involves specifying the dependent and independent variables; in this case, gross domestic product (GDP) is the dependent variable while energy consumption, Mortality rate, and Total fertility Rate is the independent variables. The main tool of analysis is the Granger causality test and vector error correction estimation technique for a period of 34 years, annual data covering 1989– 2020. Statistical evaluation of the global utility of the analytical model, so as to determine the reliability of the results obtained were carried out using the coefficient of correlation (r) of the regression, the coefficient of determination (r^2), the student T-test and F-test.

Vector Error Correction (VEC) Technique

Co-integration analysis provides a test for spurious correlation. Finding co integration between apparently correlated I(1) series validate the regression but failure to find co integration is an indication that spurious correlation maybe present thus invalidating the inferences drawn from such correlation. Co-integration is a prerequisite for the error correction mechanism. Since co-integration has been established, it is pertinent to proceed to the error correction model. The VECM is of this form

$$\Delta y_t = \alpha\beta y_{t-1} + \sum_{i=1}^{j=1} \Gamma_j \Delta y_{t-1} + \pi + \varsigma_t, t = 1,....., T$$

Where Y_t is a vector of indigenous variables in the model, α is the parameter which measures the speed of adjustment through which the variables adjust to the long run values and the β is the vectors which estimates the long run cointegrating relationship among the variables in the model. π is the draft parameter and is the matrix of the parameters associated with the exogenous variables and the stochastic error term.

ANALYSIS AND DISCUSSION OF FINDINGS

Table 1: Presentation of ADF Unit Root Test

Variable	ADF Statistics	MacKinnon @ 1%	MacKinnon @ 5%	MacKinnon @ 10%	Order of Int	Conclusion
Presentation of Unit Root Test at Level						
D(GDP)	-0.710307	-3.661661	-2.960411	-2.619160	1(0)	Accept HO

D(MORT)	-0.715053	-3.661661	-2.960411	-2.619160	1(0)	Accept HO
D(ENEG)	-1.654988	-3.661661	-2.960411	-2.619160	1(0)	Accept HO
D(FERT)	-1.191066	-3.661661	-2.960411	-2.619160	1(0)	Accept HO
D(GDP)	-0.710307	-3.661661	-2.960411	-2.619160	1(0)	Accept HO
Presentation of Unit Root Test at Difference						
D(GDP,2)	-7.369870	-3.679322	-2.967767	-2.622989	1(1)	Reject HO
D(MORT,2)	-7.746849	-3.679322	-2.967767	-2.622989	1(1)	Reject HO
D(ENEG,2)	-6.068552	-3.689194	-2.971853	-2.625121	1(1)	Reject HO
D(FERT,2)	-8.598095	-3.679322	-2.967767	-2.622989	1(1)	Reject HO
D(GDP,2)	-7.369870	-3.679322	-2.967767	-2.622989	1(1)	Reject HO

Source: Extract from E-view 9.0 (2022)

ADF test sets a selection criterion that the null hypothesis of a unit root is rejected in favor of the stationary alternative in each case if the t-statistic is lesser than the critical value; also the p-value is less than the critical value of 5% (Chipote & Makhetha-Kosi, 2014). At first sight, the study opted for the ADF test to check the series and it is observed that the variables were non-stationary at levels. However, after the first difference, we found both the series to become stationary (table 1). Therefore, there is a possibility to investigate the existence of a long-run relationship among the variables by the use of Johansen cointegration testing procedures

Table 2: Unrestricted Cointegration Rank Test (Trace)

Series: GDP MORT FERT ENEG

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.715479	67.06014	47.85613	0.0003
At most 1	0.371779	29.35173	29.79707	0.0562
At most 2	0.294642	15.40583	15.49471	0.0516
At most 3 *	0.151663	4.934322	3.841466	0.0263
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
None *	0.715479	37.70842	27.58434	0.0018
At most 1	0.371779	13.94590	21.13162	0.3695
At most 2	0.294642	10.47151	14.26460	0.1828
At most 3 *	0.151663	4.934322	3.841466	0.0263

Source: Extract from E-view 9.0 (2021)

The results in table 2 of both trace and Trace tests revealed that there is one cointegrating equation. This suggests that there is a long-run relationship between the variables used in this study.

Table 3:Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
MORT does not Granger Cause GDP	30	607.967	6.E-22
GDP does not Granger Cause MORT		4.51164	0.0212
FERT does not Granger Cause GDP	30	0.76640	0.4753
GDP does not Granger Cause FERT		6.11889	0.0069
ENEG does not Granger Cause GDP	30	1.31850	0.2855
GDP does not Granger Cause ENEG		0.98381	0.3879

Source: Extract from E-view 9.0 (2022)

Table 3 presents the granger causality test of the variable that means the predictive power of each of the variables. Economic theory guarantees that there is always Granger Causality in

at least one direction (Asari et al., 2011). This study rejects the null hypothesis if the probability value is less than 5 %, otherwise, it does not reject the null hypothesis if the probability value is more than 5%. It is found that there is a unidirectional causality running from GDP to MORT, POP to GDP and GDP to FERT

Table 4: VAR Lag Order Selection
Criteria
Endogenous variables: GDP MORT FERT
ENEG

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1079.582	NA	3.35e+27	74.72981	74.91840	74.78887
1	-996.7527	137.0971	3.38e+25	70.12087	71.06384	70.41620
2	-943.4573	73.51089*	2.77e+24*	67.54878	69.24611*	68.08036*
3	-925.6077	19.69605	2.95e+24	67.42122*	69.87293	68.18907

* 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

The most popular of the information criteria are the Akaike information criteria (AIC), and Bayesian information criteria (BIC) (Stock and Watson, 2012). Since the value proposed by both AIC, HQIC is lag 2, the optimal lag length in this study is 2.

Table 5: Vector Error Correction Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	0.567923	0.334574	1.697453	0.1117
D(GDP(-2))	-0.019673	0.290337	-0.067760	0.9469
D(GDP(-3))	-0.008211	0.042085	-0.195108	0.8481
D(MORT(-1))	1.65E+08	14056638	11.70272	0.0000
D(MORT(-2))	-85795177	49978264	-1.716650	0.1081
D(MORT(-3))	-10134842	46014119	-0.220255	0.8289
D(FERT(-1))	10119263	1.17E+08	0.086482	0.9323
D(FERT(-2))	-30562469	95021208	-0.321638	0.7525
D(FERT(-3))	89388768	92762934	0.963626	0.3516
D(ENEG(-1))	5.91E+09	1.67E+10	0.353024	0.7293
D(ENEG(-2))	-8.88E+09	1.71E+10	-0.518182	0.6124
D(ENEG(-3))	8.04E+09	1.54E+10	0.521381	0.6103
ECM(-1)	0.106654	0.109854	0.970867	0.3481
C	-8.05E+08	1.70E+09	-0.473137	0.6434
R-squared	0.988322	Mean dependent var		-1.18E+10
Adjusted R-squared	0.977478	S.D. dependent var		3.63E+10
S.E. of regression	5.45E+09	Akaike info criterion		47.98164
Sum squared resid	4.15E+20	Schwarz criterion		48.64774
Log likelihood	-657.7429	Hannan-Quinn criter.		48.18527
F-statistic	91.14141	Durbin-Watson stat		1.585677
Prob(F-statistic)	0.000000			

Source: Extract from E-view 9.0 (2022)
The study found that 97.7 percept variation in the dependent variable was explained by the independent variables. The model is statistically significant based on the validity of f-statistic and probability. The speed of adjustment in the first equation is approximately 10.7 percent per period towards the long-run equilibrium. This means that there is a low speed of adjustment of gross domestic product that may reflect a low pressure on the variable in restoring to the equilibrium in the long run due to any shocks or disturbance (Chipote & Asrat, 2016). Base on validity of lag 2, the study found that the independent variables have negative but no significant effect on gross domestic product over the periods covered in the study.

Conclusion
This study aims to examine the relationship between population dynamics and economic growth in Nigeria. The study used annual time series datasets covering from 1989 to 2020 using Granger Causality Text and Vector Error-Correction Approach based on data availability. However, it is clear from both theoretical and empirical perspectives that the impact of economic growth and population dynamics is still a contentious issue that has yet to be determined in the literature. To fill this gap, this study examined the impact of population dynamics and economic growth in Nigeria. Overall, the Granger causality tests found that there is unidirectional causality arising from gross domestic product (GDP), energy consumption (ENEG), mortality rate (MORT), and fertility rate (FERT), which translates positively impact to economic growth in Nigeria. Further more, the vector error correction estimation technique discovered that the independent variables have negative but no significant effect on gross domestic product over the periods covered in the study. As a result of the findings, the Nigerian government is advised to make direct efforts to control Nigeria's alarming fertility rate. Efforts should also be made to improve the quality of the Nigerian workforce through greater investment in education and skills programs to increase productivity in Nigeria.

Back from exploration considering the results achieved above. This study recommend that the failure of previous attempts by the Nigerian government to checkmate the rapidly growing population as well as the associated socio-economic dilemmas in the country, as noted by Adewole (2012) and Odusina (2011). In this study, the researchers attempted to establish the link between population dynamics and economic growth in Nigeria. Some of the conclusions drawn from these results include: that the fertility rate in Nigeria is still unacceptably high compared to many other nations; that the Nigerian economy has failed to maximize the benefits of international trade and cooperation; that Nigeria as a nation has been unable to use its vast population to increase labor force and productivity, and that its vast population is characterized by high levels of poverty and unemployment (overwhelming among the youth).

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