Impacts of Population, Climate Change and Governance on Economic Growth and Sustainable Development in Nigeria

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Abstract

This study conceptualises the diverse pathways of population, climate change, and governance in relation to sustainable Development Goals (SDGs). It also investigates the direction of causality between population, climate change, governance, economic growth and sustainable development in Nigeria for the periods of 1981 - 2017. In addition, the study analyses the impacts of population, climate change and governance on economic growth and sustainable development in Nigeria for the same periods. The conceptual framework reveals that the SDG goals might not be achieved in the presence of negative transgenerational transfers. The Toda-Yamamoto results show that a unidirectional causality runs from population and governance to growth and development. Also, a bidirectional causality exists between climate change and governance while a one-way causality runs from sustainable development to governance. Finally, using ARDL bounds test, the study finds a strong long-run relationship between population, climate change, governance and economic growth as well as sustainable development in Nigeria. Although, only population growth and governance affect the same, in the short run. Therefore, this study concludes that these negative intergenerational transfers are detrimental to the economic growth and sustainable development of Nigeria.

Keywords: Economic growth, Sustainable Development, intergenerational transfers.

1.1 Introduction

Despite the fact that attempts to conduct a national census of international standards have failed in Nigeria and the country's population is not known with precision; still, it is a consensus globally that the population is mostly young and the country is the most populous in Africa. This leads to much economic pressure, as a high dependency ratio implies lower prospects for sustainable development. Hence, the need to exploit the demographic window of opportunity[1] to the country's advantage. According to Olaniyan *et al*. (2012), Nigeria entered this window of opportunity in 2003 and this period is projected to last beyond 2050. Nevertheless, the growth of gross domestic product per capita has remained low compared to the growth rate of population of 3.2 percent which could make Nigeria the third most populous country in the world.

Researchers have opined that building the capacity of the populations via intergenerational transfers like growing knowledge, health, technology, capital stock, good governance, strong institutional framework, among others is paramount (Ibrahim, 2013; Davies, 2016**;** Adegbami and Adepoju, 2017). Nevertheless, the effects of climate change[2], weak governance and poor

[1] Rapid decline in fertility rate, with young dependants moving into working class
[2] Consistent change in weather patterns for a very long period of time, usually decades. It is caused by human induced (anthropogenic) greenhouse gases, mostly carbon dioxide emissions which causes

institutional framework which are tagged negative intergenerational transfers could constitute a demographic disaster[3] for the nation. While climate change is able to exacerbate poverty, weak governance would entrench poverty and, both intra and intergenerational inequities. Studies have shown that the combination of dynamic efficiency[4] and intergenerational transfers[5] make up sustainability;[6] and none is individually sufficient to address sustainable development (Asheim *et al*., 2001; Stavins et al., 2002), yet little attention is paid to the negative intragenerational transfers, especially overpopulation in Nigeria.

Researchers have established the relationship between population growth and sustainable development in the literature (Engelman, 2009; Grossman, 2012); nevertheless, population growth reversal remains the most overlooked stabilising strategy in Nigeria. This is in spite of its consequences[7] which seem to outweigh its anticipated dividends of larger and stronger labour force and productivity, since uncontrolled populations will always have more than enough dependent populations to erode demographic dividend. Furthermore, studies have shown that climate change is human (population) induced, though a global phenomenon. It has the ability to reverse progress towards sustainable development. Nigeria is one of the most vulnerable countries to climate change because of its reliance on the environment for its livelihoods and its poor environmental conditions (Foye, 2018) Factually, about 85 million people live in poverty in Nigeria. Also, the high rate of corruption, irresponsibility in accountability, lack of transparency, the threat to the security of lives and properties, among others, make governance a topical issue of sustainable development (Iyoha, 2015).

These triple troubles are the present status quo that has to be addressed in Nigeria. Hence, this study basically conceptualises the diverse pathways of population, climate change, and governance in relation to sustainable Development Goals (SDGs). It equally investigates the direction of causality between population, climate change, governance, economic growth and sustainable development in Nigeria for the periods of 1980 - 2017. In addition, the study analyses the impacts of population, climate change and governance on economic growth and sustainable development in Nigeria for the same periods.

2. 1 Literature Review

There are several studies on population growth and sustainable development (Clay and Reardon, 1998; McNicoll, 2005; Bartlett, 2006; Engelman, 2009; Adewole, 2012; Grossman, 2012;) and all of them hinge on the negative effect of population on the environment and its resources, both natural and agricultural resources and ensuant poverty and migration. However, Olaniyan et al. (2015) recognises that there could be a dividend from population growth if human capital is developed while Englema (2009) specifically finds that the level of female education reduces birth rates. In addition, there are studies on population and economic growth (Berker, 1999; Rodriguez, 2016; Aidi et al., 2016; Peterson, 2017; Ogunleye et al., 2018). Literature equally abound on the influence of climate change and governance on economic growth, respectively (Fankhauser and Tol, 2005; Dell *et al*.,2008; Mendelsohn, 2009; Rahman *et al*., 2009; Bezabih et al., 2010; Roson and van der Mensbrugghe, 2012; Tol, 2012; Elshennawy *et al*. 2016 and Zhang and Wang. 2013; Emera Jhonsa, 2014; Gani, 2016; Mira and Hammadache, 2017; Setayesh and Daryaei, 2017;

global warming. However, it is measured by average mean temperature of the earth's atmosphere.

[3] Increase in dependency ratio of a country.

[4] Impossibility in making one generation better off without making another worse off.

[5] Transmission of something from one generation to another

[6] Meeting the contemporary needs without compromising the ability to meet future generations' needs.

[7] Environmental degradation, water stress, food insecurity, poor health status, poverty, migration/brain drain, debt, weak governance and poor institutional framework, high illiteracy level,

Hadj Fraj et al., 2018; Liu et al., 2018; Samarasinghe, 2018). While the studies on climate change employ different methods of analysis and find that climate change has a strong relationship with economic growth via diverse pathways (saving, exchange rate, human health, among others), the literature on governance emphasizes a bidirectional relationship between itself and economic growth.

Likewise, researchers have come to a consensus that climate change is detrimental to sustainable development and that the least developed countries are the least responsible for climate change; yet, the most vulnerable. These researchers equally suggest population constriction, monitored adaptation and mitigation policies for sustainable development (See Beg *et al.,* 2002; Smit and Pilifosova, 2003; Common, 2007; Yohe et al., 2007; Damtoft *et al*., 2008; Kyte, 2014; IPCC, 2018). These studies submit that climate change affects the environment- plants, animals and human life. Munasinghe and Swart (2005) in Common (2007) call it the major concern of the 21st century, just like population growth is tagged as the biggest problem by Business Insider (2014). These studies find that population growth increases living standards, the level of consumption and energy use; and depletes natural resources which is corroborated by United Nations (2015)'s report. Moreso, these reports dovetail with climate change concerns, thereby exacerbating development, especially in Nigeria (Foye, 2018).

Finally, there are several studies on governance, and economic growth and sustainable development and all conclude that no reasonable growth and development can be achieved when a nation exhibits bad governance and weak institutional framework (Smit and Pilifosova,2003; Onyekachi, 2013; UNDP, 2014; Guga, 2014; Stojanović, 2016; Ozohu-Suleiman, 2016; Davies, 2016; Adegbami and Adepoju, 2017; Gberevbie et al., 2017; Okaro et al., 2018). Ibrahim (2013) suggests that investment in education and human capital development could stimulate good governance and sustainable development. Interestingly, all the literature independently emphasise population, climate change or governance as a very great concern of the 21st century that has to be addressed. Nevertheless, studies that have looked into the analysis of the effects of these tripartite variables simultaneously are sparse. Furthermore, this paper determines the relative effects of these variables for effective policy recommendation

3.0 Conceptual Framework for Population, climate change and Governance in Relation to Sustainable Development Goals

The sustainable development goals 1-17 are the orange balls in Figure 1 with both positive and negative signs. The positive numbers suggest the achievability of the SDGs while the negative ones suggest otherwise. The 55 blue labels show the links between population, climate change and governance. This conceptual framework reveals that the links between population, climate change and governance, touch on every goal of sustainable development. Not addressing these important variables would result in negative outcomes for SDGs (44 negative blue labels). Find below the list of SDGs for an explicit understanding of Figure 1

1- No poverty
2- Zero hunger
3- Good health and well-being
4- Quality Education
5- Gender equality
6- Clean water and sanitation
7- Affordable and clean energy
8- Decent work and economic growth
9- Industry, innovation, and infrastructure
10- Reduced inequalities
11- Sustainable cities and communities
12- Responsible consumption and production
13- Climate action
14- Life below water
15- life on land
16- Peace, justice, and strong institution
17- Partnerships for the goals

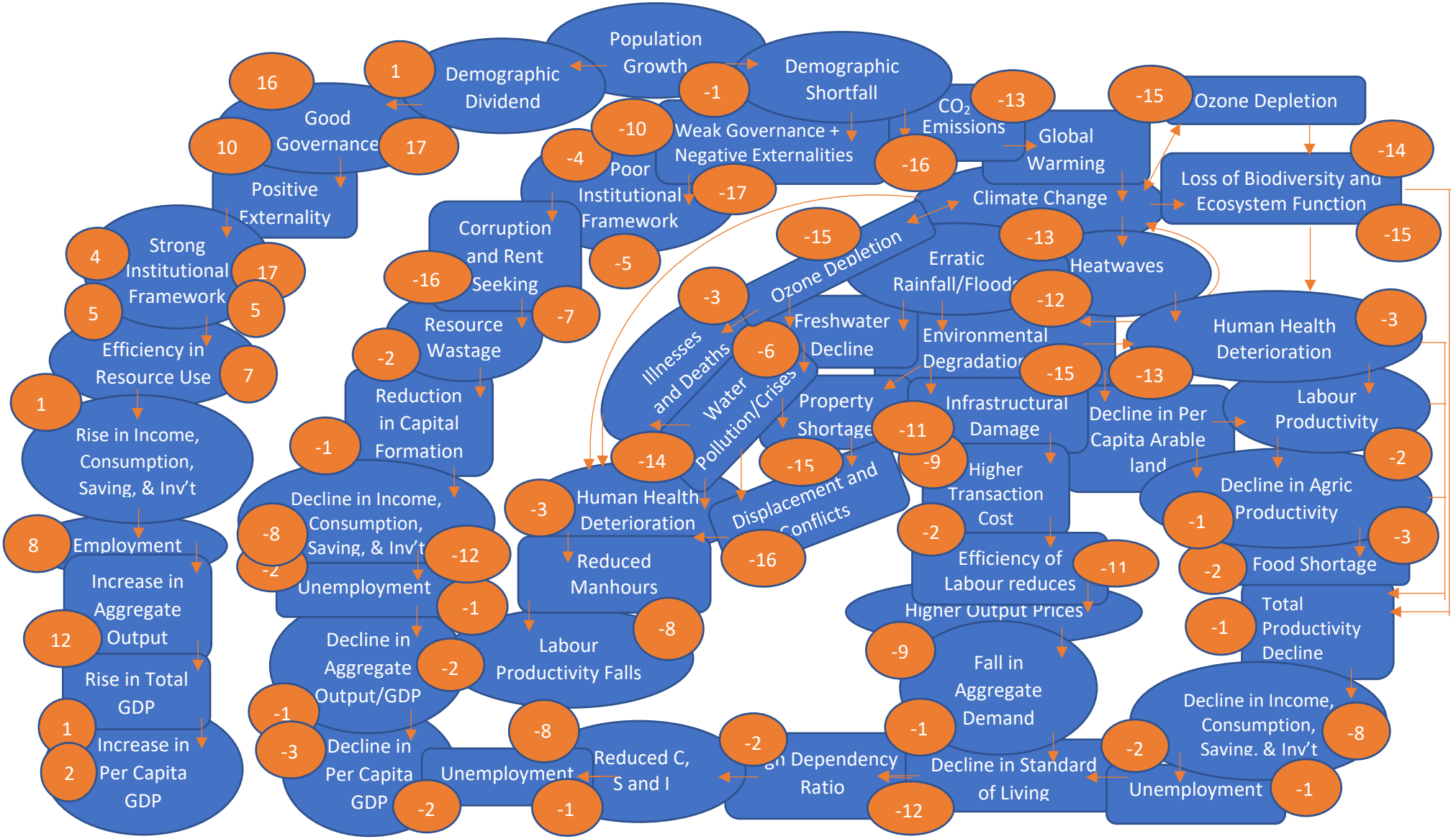

Figure 1: Diverse Pathways of Population, Climate Change and Governance to Sustainable Development Goals
Source: Designed by the Author

3.1 Research Method

The links between population, climate change, and governance, in relation to economic growth, and also sustainable development have been established independently in the literature review and conceptual framework. This study emphasises the need to address these tripartite concerns simultaneously in a study, so as to proffer a systematic policy solution to their intertwined consequences on sustainable development. Therefore, this study employs the Mankiw-Romer-Weil (MRW), 1992 growth theory $\equiv Y(t) = F(K(t), H(t)(A(t)L(t)) = K(t)^{\alpha}H(t)^{\beta}(A(t)L(t))^{1-\alpha-\beta}$, which is a human capital augmented version of the Solow-Swan model for the growth model. However, human capital variables are removed to give allowance for degrees of freedom, given the dynamics of the Vector Autoregressive method and the length of the available data for Nigeria. The study covers a period of 37 years from 1981 to 2017 and data are in log form. Also, the micro-founded growth theory of Ramsey-Cass-Koopmans (RCK) $\equiv Y(t) = F(K(t), (A(t)L(t)) = K(t)^{\alpha}(A(t)L(t))^{1-\alpha}$ is used to capture sustainable development. This theory endogenizes saving, giving strength to the neo-classical theory of capital in the measurement of sustainable development (See United Nations, 2009).

Furthermore, given that climate change is a global phenomenon, this study employs global climate data, following Foye (2018) who found that the impact of the global climate explains better the contemporary issues associated with it.

Equations (1) to (2) are the implicit mathematical representation of the models, first for economic growth and the second for sustainable development.

$$EG_t = f(POP_t + CC_t + GOV_t) \quad (1)$$

$$SD_t = f(POP_t + CC_t + GOV_t) \quad (2)$$

Equations (4) and (5) are the econometric representation of the models above

$$EG_t = \alpha_0 + \alpha_1 POP_t + \alpha_2 CC_t + \alpha_3 GOV_2 + u_t \quad (3)$$

$$SD_t = \beta_0 + \beta_1 POP_t + \beta_2 CC_t + \beta_3 GOV_t + \varepsilon_t \quad (4)$$

where

EG = Economic Growth

SD = Sustainable Development

POP = Population

CC = Climate Change

GOV = Governance

u_t & ε_t= Stochastic error term

3.2 Measurement of Variables and Sources of Data

Table 1: Measurement of Variables and Sources of Data

Variable	Definition / Measurement	Source of Data
Economic growth (EG)	An increase in aggregate economic activities that persists over successive periods. It is measured by real gross domestic product (RGDP) which is the total output of an economy in constant prices and	World Development Indicators, 2019.
Sustainable Development (SD)	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Following the neo-classical capital approach theory, SD is measured by real per capita investment in produced capital.	The Central Bank of Nigeria' statistical bulletin, 2019.
Climate Change (CC)	This is a change in global or regional climate patterns, attributed largely to the increased levels of atmospheric carbon dioxide emissions produced by the use of fossil fuels. It is measured by the variation in global mean temperature	Earth Policy Institute and National Oceanic and Atmospheric Administration database
Population	The number of people in a city/state/country/region/world. Measured by growth in the population of Nigeria.	World Development Indicators, 2019.
Governance	The manner in which power is exercised in the management of a country's economic and social resources for development. It is measured by the average of the estimates for control of corruption, government effectiveness, political stability and absence of violence/terrorism, rule of law, regulatory quality and voice and accountability.	Worldwide Governance Indicators, 2019.

3.3 Descriptive Statistics of variables

Before making inferences from a data set, it is essential to examine all the variables to see the general overview of the data and find out whether there are violations of statistical assumptions. Hence, Table 1 shows the distribution of the data for each variable, measured by skewness,[8] Kurtosis[9] , and Jacque-Bera[10]. The Jacque-Bera values show that all the variables are normally distributed at 0.05 significance level

Table 2: Descriptive Statistics of Variables

	EG	SD	POP	CC	GOV
Mean	34.43	72923.42	124.15	14.46	-1.11
Median	24.22	68766.67	119.26	14.46	-1.12
Maximum	69.78	209299.60	190.87	15.04	-0.99
Minimum	16.21	50461.20	75.44	14.08	-1.27
Std. Dev.	18.10	31518.93	34.32	0.23	0.08
Skewness	0.83	3.09	0.35	0.37	-0.00
Kurtosis	2.21	12.55	1.95	2.85	1.98
Jarque-Bera	5.24	199.66	2.47	0.86	1.60
Probability	0.07	0.00	0.29	0.65	0.45
Sum	1.27	2.70	4.59	535.19	-41.30
Sum Sq. Dev.	11.79	35.80	42.40	1.91	0.23

3.4 Unit Root Tests and Analysis

An attempt is made to test for the order of integration of the variables to characterise their time-series properties. In achieving this, the Augmented Dickey-Fuller (ADF), Phillips Perron (PP) and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) tests are employed. All the variables are stationary at first difference (I(1)) except for GOV (governance) which is stationary at level (I(0)).

Table 3: Unit Root and Stationarity Tests results

SERIES	ADF	PP	KPSS	FINAL
EG	I(1)	I(1)	I(1)	I(1)
SD	I(1)	I(0)	I(1)	I(1)
POP	I(2)	I(1)	I(1)	I(1)
CC	I(1)	I(1)	I(1)	I(1)
GOV	I(0)	I(0)	I(0)	I(0)

3.4 Toda-Yamamoto (TY) Causality Test

Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) Granger-causality test which is based on an augmented vector autoregression (VAR) modeling and a modified Wald test statistic is employed for causality test. This method is superior to the ordinary Granger-

[8] Deviation of the distribution from symmetry
[9] A measure of whether the data is peaked or flat
[10] Combination of skewness and kurtosis

causality test since it does not require pre-testing for the cointegrating properties of the system and thus, avoids the potential bias associated with unit roots and cointegration tests. The maximum lag length for the two models is 2 and the maximum order of integration is one. Therefore, we specify TY and the results show that causality runs from both population and governance to economic growth and sustainable development. This confirms that population and governance have a strong influence on growth and sustainable development. Also, there is a unidirectional causality running from climate change to governance in both models, corroborating the fact that climate change can reverse progress towards growth and development if the institution is weak (See results in Table 3)

Table 4: Toda and Yamamoto Causality Test Result

MODEL 1	**Dependent Variables**			
Independent Variables	**EG**	**POP**	**CC**	**GOV**
EG	---	28.73 (0.00)***	1.42 (0.49)	2.50 (0.29)
POP	22.13 (0.00)***	---	0.69 (0.71)	0.64 (0.73)
CC	1.55 (0.44)	1.67 (0.44)	---	6.13 (0.05)***
GOV	15.7 (0.00)***	1.66 (0.44)	2.09 (0.35)	---
MODEL 2	**Dependent Variables**			
Independent Variables	**SD**	**POP**	**CC**	**GOV**
SD	---	89.43 (0.00)***	1.50 (0.47)	2.96 (0.27)
POP	5.85 (0.05)**	---	0.44 (0.80)	0.39 (0.82)
CC	0.02 (0.99)	0.92 (0.63)	---	7.21 (0.07)*
GOV	0.27 (0.87)	16.29 (0.00)***	1.62 (0.44)	---

***, **and * represent 1%, 5% and 10% significant levels, respectively.

3.5 Empirical Model Specification for ARDL and Bounds Test for Long-Run Relationship

Below is the empirical model specification for ARDL

$$\Delta(EG)_t = \alpha_0 + \sum \beta\alpha_i \Delta(EG)_{t-i} + \sum \beta_i \Delta(POP)_{t-i} + \sum \gamma_j \Delta(CC)_{t-j} + \sum \delta_k \Delta(GOV)_{t-k} + \psi_0 EG_{t-1} + \psi_1 POP_{t-1} + \psi_3 CC_{t-1} + \psi_4 GOV_{t-1} + e_t \quad (5)$$

$$\Delta(SD)_t = \alpha_0 + \sum \alpha_i \Delta (SD)_{t-i} + \sum \beta_i \Delta (POP)_{t-i} + \sum \gamma_j \Delta(CC)_{t-j} + \sum \delta_k \Delta(GOV)_{t-k} + \psi_1 SD_{t-1} + \psi_2 POP_{t-1} + \psi_3 CC_{t-1} + \psi_4 GOV_{t-1} + e_t \quad (6)$$

Where Δ is the difference operator; α_i, β_i, γ_j and δ_k are short-run coefficients, and ψ_1-ψ_4 are the long-run coefficients.

This study employs linear Autoregressive Distributed Lag methodology, as the variables are both I(1) and I(0). The results of the ARDL estimations are tested for serial correlation and stability. The results show that there is no serial correlation in the models, as the probabilities of the F-statistic are 0.48 and 0.15 percent, respectively. This is greater than the 5 percent level of significance. Also, the model was shown to be stable as the blue line was within the bootstrap confidence interval of 95 percent (See Table 5 below)

Table 5: Diagnostic Tests for Estimated ARDL for Bounds Tests

Test	Purpose	P-Value		Decision Rule	Remarks
		EG	SD		
Ramsey Reset	Functional Misspecification	0.48	0.17	P > 0.05	No misspecification error
Breusch-Godfrey	Serial correlation	0.15	0.73	P > 0.05	No serial correlation
Cusum	Stability	<0.05	<0.05	P ≤ 0.05	Model is stable

Source: Author's Computation using EViews 10

3.6 Cointegration Analysis (Bounds Testing Procedure)

This analysis is used to determine whether the long-run coefficients are jointly significant—whether the long-run variables EG(-1)/SD(-1), POP(-1), CC(-1) and GOV(-1)) are cointegrated. The null hypothesis (H_0) is 'there is no cointegration among variables' and for alternative hypothesis (H_1) is otherwise and represented thus:

H_0: $\varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = 0$; H_1: $\varphi_1 \neq \varphi_2 \neq \varphi_3 \neq \varphi_4 \neq 0$

Interestingly, the bounds test results are different for both models, as the models reveal that there is a long-run relationship between the variables considered in this study. The F-statistics for both models are both greater than the Pesaran lower and the upper bounds. Hence, we reject the null hypothesis of no long-run relationship.

Table 6: Wald Cointegration Results for Estimated ARDL

Bounds Test	F-statistic	Pesaran 5% Critical Value	
		Lower Bound	Upper bound
Model 1 (Economic Growth)	6.35	3.23	4.35
Model 2 (Sustainable Development)	22.50	3.23	4.35

3.7 Error Correction Modelling

3.7.1 Long-run ECM Result

The estimated coefficients of the error correction terms (ECT) are negative and significant as expected for both Models 1 and 2 at $p \leq 0.05$ level, and are approximately -0.44 and -0.98, respectively. The significance of the coefficients of error term authenticates that the variables in both models are cointegrated, as reported in the Bounds test results. The value of the error correction term for Model 1 confirms that the speed of adjustment of economic growth to its long-run equilibrium is about 44 percent. This means that 44 percent disequilibrium errors in the previous year are corrected in the current year, suggesting that 100 percent equilibrium is attainable in about 2.30 years. Accordingly, the ECT of -0.98 for Model 2 shows that the speed of adjustment of sustainable development to its long-run equilibrium is very fast at 98 percent, and suggestive that 100 percent equilibrium can be attained in about a year. In other words, for each model, the convergence of the short-run disequilibrium to its long-run equilibrium is achievable in less than three years for Model 1 and about a year for Model 2.

Table 7: Error Correction Results for the Economic Growth Model

Dependent Variable: D(LNEG)		
ARDL		
Variable	Coefficient	P-Value
C	-5.77	0.00
D(LNEG(-1))	-0.04	0.73
D(LNPOP)	11.36	0.66
D(LNPOP(-1))	57.62	0.09
D(LNCC)	0.31	0.62
D(LNCC(-1))	-1.14	0.10
D(GOV)	-0.16	0.02
D(GOV(-1))	-0.04	0.50
ECT(-1)	-0.44	0.00

Table 8: Error Correction Results for Sustainable Development Model

Dependent Variable: D(LNSD)		
ARDL		
Variable	Coefficient	P-value
C	23.86	0.00
D(LNSD(-1))	-0.04	0.68
D(LNSD(-2))	-0.40	0.00
D(LNPOP)	-269.20	0.00
D(LNPOP(-1))	206.55	0.01
ECT(-1)	-0.98	0.00

3.7.2 Short-run ECM Result

Table 9: Long-run ARDL Results

Long-run Estimates				
Variables	**Model 1: Economic Growth Model**		**Model 2: Sustainable Development Model**	
	Coefficient	**Prob.**	**Coefficient**	**Prob.**
LNPOP	1.57	0.00	-0.17	0.21
LNCC	3.84	0.21	-3.01	0.13
GOV	-0.73	0.03	0.46	0.04
ECT(-1)	0.44	0.00	0.98	0.00

These results authenticate that (1) population affects gowth and sustainable development in Nigeria, suggesting that most of the population in Nigeria are dependants and income weighted with too large or fast growing population reduces per capita income; (2) climate change is a global phenomenon that affects lives and livelihoods in the long run, following the definition that it is the change in mean atmospheric temperature of the earth's atmosphere over decades; and (3) the impact of governance is always seen over time in the growth and sustainability of posterity.

3.7.3 Relative Effects of the Results in Table 9

The beta coefficient measures the change in EG or SD that corresponds to a unit change in each explanatory variable, holding other explanatory variables constant and measuring all changes in standard deviation units. This helps to determine the relative effects of the outcome from the different explanatory variables, as we employ the equation below. Note that the estimated betas are selected from the long-run results.

$$\dot{\beta} = \hat{\beta}(S_X/S_Y)$$

where

$\dot{\beta}$ = Beta coefficient

$\widehat{\beta}$ = Estimated beta

Sx = Standard deviation of xth explanatory variable

Sy = Standard deviation of the dependent variable

Table 10: Relative Effects of POP, CC and GOV

ORDER ▼	**EG**	$\dot{\beta}$	**ORDER** ▼	**SD**	$\dot{\beta}$
POP	0.36(0.28/0.49)	0.21	**POP**	-0.32(0.28/0.30)	-0.30
GOV	0.20(0.08/0.49)	0.03	**CC**	0.51(0.08/0.30)	0.14
CC	0.22(0.02/0.49)	0.01	**GOV**	-1.34(0.02/0.30)	0.09

Following the absolute values, the results show that the beta-coefficients of approximately 0.21 and 0.30 for both models submit that population has a major influence on economic growth and sustainable development. Climate change comes next with a beta-coefficient of approximately 0.04 for sustainable development. The same applies to the beta coefficients for governance at 0.03 and 0.14, respectively for both models. Climate change has the least effect on economic growth and sustainable development with beta-coefficients of approximately 0.01 and 0.09 respectively. Nevertheless, this still corroborates the fact that climate change is not only an environmental problem but also a developmental one (Foye, 2014). In all there is a basic suggestion that population, governance and climate change need to be addressed in that order. It proffers that if the issue of weak governance is addressed while pursuing economic growth, then its effect should be minimal in influencing sustainable development negatively.

Table 11: Complete Diagnostic Tests for Estimated Result

Test	Purpose	P-Value		Decision Rule	Remarks
		EG	SD		
Ramsey Reset	Functional Misspecification	0.48	0.17	P>0.05	No misspecification errors
Breusch-Godfrey	Serial correlation	0.15	0.72	P>0.05	No serial correlation
Cusum	Stability	<0.05	<0.05	P≤0.05	Models are stable
Jacque-Bera	Normality	0.83	0.17	P>0.05	Normal distribution
Breusch-Pagan-Godfrey	Heteroscedasticity	0.23	0.57	P>0.05	No Heteroscedasticity

Note: The diagnostic test is a robustness check that authenticates the validity and reliability of the results

4.1 Conclusion and Recommendations

In conclusion, there is a strong long-run relationship between population, climate change, governance, and economic growth as well as sustainable development in Nigeria. However, only population and governance affect the same, in the short run. In addition, unidirectional causality runs from population and governance to growth and development. Furthermore, a bidirectional causality exists between climate change and governance while a one-way causality runs from sustainable development to governance. All these suggest that the negative influence of population, climate change and governance (negative intergenerational transfers) are detrimental to the growth and sustainable development of Nigeria, while if otherwise (negative intergenerational transfers), are advantageous to any economy (See results in Tables 7 and 8).

Furthermore, the relative effects of the variables show that it is very important to reduce the growth of population in Nigeria, as its relative effect is the strongest. Therefore, just like China did, it is important and urgent for Nigeria to adopt a policy that urges urban and rural couples to have not more than two and three children, respectively, as this will help increase per capita income in Nigeria. This suggests that reduction in population and the 17th goal of partnership can improve the welfare of the people and make the other SDGs achievable.

Furthermore, given that climate change is a global phenomenon that Nigeria is very much vulnerable to because of its reliance on the environment for its daily livelihood and also, its sub-optimal macroeconomic environment (very poor state of infrastructure). Therefore, there is the need to improve on adaptation strategies, national ozone programme, National Forestry Development Programme, the presidential afforestation initiative, capacity building, decarbonisation of the economy, amongst others.

Finally, on the issue of governance and institutional frameworks, Nigeria needs to be more committed to transparency at all stages of the decision making and project implementation and monitoring processes. The public sector should show clear accountabilities and responsibilities. Also, Transparency International's (2009) "Integrity Pacts" should be embraced in Nigeria to reduce corruption, waste and fraud. This can be achieved by documenting and publishing contracts and project data.

In all, these recommendations can only yield other SDG results, if the 17th SDG goal (partnerships for the goals) is deployed with a strong commitment by all stakeholders, and with all the negative intergenerational transfers addressed simultaneously, given that all the beta-coefficients are in the same range

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