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IMPACT OF POPULATION HEALTH STATUS ON PRODUCTIVITY OUTCOMES IN SUB-SAHARAN AFRICAN COUNTRIES

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Abstract

This study examined the effects of population poor health status proxied by malnutrition rate and access to safe drinking water on productivity outcomes disaggregated into total factor productivity, labour productivity and economic performance in thirty-three Sub-Saharan African countries. The decline in overall productivity level and human capital accumulation in the sub-region unlike in many other developed regions of the world as a result of incidence of non-fatal undernourishment and water borne diseases which have impaired the productivity of the labour force necessitated the study. The Generalized Method of Moments estimation technique was employed in obtaining the numerical coefficients due to the endogeneity nature of the health variables. After analyzing the descriptive statistics, panel Granger causality tests, the Levin, Lin and Breitung panel unit root tests at levels and differences, the Pedroni and Kao residual cointegration tests were applied to test for the existence of long run relationship among the variables. Data for the study which covered the period, 2000-2019 were extracted from the World Development Indicators database of 2020 and Food and Agricultural Organization database of 2020. The empirical results revealed that the health variables were insignificant in determining the sub-region's overall productivity level, positively correlated with Gross Domestic Product growth rate and significantly influenced the labour productivity level of the sub-region. The study therefore recommended that Government in the sub-region should implement food policy programmes to ameliorate the high incidence of malnutrition in addition to provision of clean pipe-borne water in areas and communities where water sources are contaminated or potable water is inaccessible due to the direct impact of these health variables on human labour.

Key words: Health, productivity outcome, malnutrition, Gross Domestic Product and Sub-Saharan Africa

JEL classification: E24, I15 and J24

1.0 Introduction

Improving the living standards of a people is one of the core objectives of policy makers around the world. A global benchmark of living standards is the ability of a citizen to earn income and profits from work or economic activity in order to use same to meet his day to day needs. These income and profits earned from employment or other economic activities when aggregated, represent the cumulative worth of the goods and services produced within a country as well as production capacity of the factors of production used in producing them.

As Harris (1999) puts it, although income, level of productivity and living standards are distinct concepts, all three concepts are severely correlated as taken together, they represent the level of productivity or growth rate which translate to the improvement or decline in the living standards of individuals in a country. While most economists agree that human capital is an important factor that significantly impacts economic productivity, the concept (human capital) has mostly been attributed to cover primarily education and skills. However, a body of literature has more recently developed and started paying increased attention to health as an equally important component of human capital (Elsa and Sala-i-Martin, 2003). Improvements in health which improves the quantum of human capital has been identified as a critical catalyst to economic growth and development in macroeconomic literature. Specifically, the neoclassical endogenous growth model posits that, growth in human capital (knowledge) impacts positively on output per worker in the long run (Romer, 1986). Studies such as Madsen (2016), Sengupta (2017) and Adeshina et al (2019) also show evidence of correlation between human health, productivity and economic growth.

Similarly, Grossman's human capital model suggests that quality of health significantly influences human capital development through the additional working time and utility derived from good health (Grossman, 1972; 2017). Good health does not only improve an individual's consumption and productive capacity in the short run, but it also improves returns from investment in productive activities in the long run Somi et al. (2009). Novignon et al. (2012) provided evidence to show that poor health status has significant negative influence on both current and future welfare of households.

The populations of many of the poorest countries in the world suffer from the greatest degree of poor health. Murray and Lopez (1996) estimate the per capita disability adjusted life years (DALYs) lost in various regions of the world due to premature mortality and years lived in disability adjusted for severity. Their study revealed that the estimated figures are lowest in developed countries at about 0.17 DALYs per capita, they range from 0.2 to 0.4 DALYs per capita in various regions of the developing world and reach close to 0.6 DALYs per capita in Sub-Saharan Africa. Some of the world's lowest life expectancies in many cases less than 50 years, are experienced in those Sub-Saharan African countries that typically also suffer from extreme low levels of per capita income, poor health and often negative economic growth rates (Lvovsky, 2001). There have been robust empirical work of the impact of health on economic growth and productivity in developed countries in the literature, however only a few studies like Cole and Neumayer (2004) who used morbidity measures of health have been carried out on developing countries. This paper fills the gap in the literature by examining the morbidity measures of health using access to safe portable water and malnutrition as proxies of health and other control variables on productivity outcome disaggregated into total Factor productivity, labour productivity and growth rate of GDP in thirty three Sub-Saharan African Countries for the period 2000-2019. The Generalized Method of Moments (GMM) was employed as the estimation technique because it conforms to the estimation techniques used in the literature, it controls for autocorrelation and it solves the problem of endogeneity usually associated with health variables. The rest of this paper is organized as follows: section two addresses the review of empirical literature, section three deals with the theoretical frame work, model specification and methodology employed. Section four focuses on the empirical analysis of the results obtained while section five concludes the paper.

2.0 Review of Empirical Literature

In the literature, several studies abound on the relationship between health and economic growth particularly in the developed countries. Few studies on developing economies and country specific cases with positive relationship between health variables and economic growth exist in the literature.

The empirical literature on the impact of health on productivity outcome draws largely from the experience of developed countries. The rich economic history of these countries that have experienced different phases of economic growth provides substantive evidence concerning the productivity impact of increased life expectancy and reduced morbidity over the last few centuries in Europe and the United States (Costa & Steckel 1995). However, Costa and Steckel (1995) also stresses the importance of long-run dynamics and demonstrated that improvements in health in developed countries which began about two centuries ago in what is now developed countries of Europe and America is still evolving. An understanding of the key drivers of this long-run dynamics would no doubt be relevant for our study on Sub Saharan Africa. To this end, we therefore review some studies from the historical economic literature of these regions in earlier periods as well as a quick review of the empirical evidence from more recent periods.

Fogel (1991) showed that historical trends in countries in Western Europe on two measures related to nutrition, i.e., the height and weight of adults (BMI – Body mass index). These (height and weight) two variables taken together, provide different information about the health of citizens. While adult height reflects the sufficiency of child nutrition at an early age, the weight reflects adequacy in the nutrition of adults. Drawing on evidence from Norway, Fogel (1991) examined records to establish a relationship between the height, weight and risk of mortality among citizens in Norway. Fogel successfully predicted that the decline in the rate of mortality estimates the proportion of the decline in mortality in the country which he attributed to changes in these selected measures since the 18th century. Umoru and Omolara (2013) also chronicled their findings on the subject. According to the researchers, health capital is both a result and a determinant of labour and hence income level. The study examined the impact of health capital on labour productivity in Nigeria using the generalized method of moment technique and found that health capital has a significant positive relationship with labour productivity. The mechanism is that richer nations have on average healthier workforce. The healthiness of the country's labour force determines importantly, her level of productivity and hence economic growth (Weil, 2004). Labour productivity being the ratio of a volume measure of output to a volume measure of input, uses hours worked, labour force jobs and number of individual employment as measures of inputs. By intuition, labour productivity will vary as a function of the health capital of the economy amongst other factors of production and the efficiency with which these inputs are utilized. This provides the basis for diversity in labour productivity growth across regions, with production levels showing life-size split between advanced and developing countries. For example, GDP per capita grew fastest in East Europe, followed by Asia, then North America, and Western Europe but lowest in Latin America and Africa (Iverson, 2006). Cole and Neumayer (2006) in their work to determine the impact of poor health on total factor productivity, argued that the link through which health affects growth is via total factor productivity- which is the total usage of capital and labour in the production process. They identified three indicators of health that are inimical to the growth and development of developing countries as malnutrition, malaria

and water borne diseases. However, they found the impact of poor health on total factor productivity to be negative and significant. These three indicators of health have to a large extent, been the bane of development in the African sub region with about 90% of all malaria related deaths in the world occurring in the African Sub region.

A large body of empirical literature on the interactions between health and productivity of the labour force exist. These studies can be divided into those with a micro or individual focus and those with a macro or national focus. The key findings from the micro/individual level research are documented as follows: healthy workers are more productive; healthy workers and family members contribute to output by reducing absenteeism; ill health reduces hourly wages; lowers expenditure on health care by households freed up resources for other productive activities like food and education and contributes to development; lower infant and child mortality in households lowers the family size and deepens investment on each child; ill-health generates poverty; income and education are key determinants of health (Gupta, 2006). Other studies with evidences of micro focus include Eggoh, Houeninvo, & Sossou (2015) - a study on African Countries; Sarwar, Alsaggaf & Tingqiu (2019) – using World-level data and Siddique, Mohey-ud-din & Kiani (2020) - a study on Middle-Income Countries.

The micro links logically translates into macro links between health and productivity and growth. At the aggregate level, Bloom and Canning (2000) identified four pathways by which health can affect productivity namely; a healthy labour force may be more productive because workers have more physical and mental energy and are absent from work less often; individuals with a longer life expectancy may choose to invest more in education and receive greater returns form their investments; with longer life expectancy, individuals may be motivated to save more for retirement, resulting in a greater accumulation of physical capital; and improvement in the survival and health of young children which may in turn provide incentives for reduced fertility and result in an increase in labour force participation leading to increase in per capita income if these individuals are accommodated by the labour market. Evidences can be drawn from the findings of various studies which include, Siddique, Mohey-ud-din & Kiani (2018); Rana, Alam, & Gow (2020); Pasara, Mutambirwa & Diko (2020); and Bloom, Khoury, Kufenko, Prettner (2020). Drawing from empirical evidences, physical and mental health of individuals or of a given population are essential for labour productivity, capital accumulation and economic growth of any nation. Thus, general literature exists in the area of human health, productivity and economic growth but there is literature gap in terms of population health and productivity particularly with respect to Sub-Saharan Africa. This research is designed to fill this gap.

3.0 Research Method

Theoretical Framework

The endogenous growth model explains that balanced growth is positively influenced by knowledge spillover, human capital (in the form of health and education), research and development (R&D), through their influence on the technical progress. Technological progress in this model is therefore endogenised and can be explained by some factors. Based on this model Lucas (1988) put forward an endogenous growth model where human capital is a major driver of output growth. Lucas theorized that economic growth

Y is a function of capital stock (K), labour productivity (A) and labour units (L). The production function may be of the form:

$Y_{(t)} = K_{(t)}^{\alpha}(A_{(t)}L_{(t)})^{1-\alpha}$ - - - - - - - - 1

Where A(t)L is effective labour with α and (1-α) as relative shares of K and AL respectively in output. Now with the technical progress or labour productivity (A) being entirely explained by the stock of human capital, say H, that is, human capital increases labour productivity

$A=H$ - - - -- - - - - - 2

Consider an economy where population does not grow, i.e. n = 0 [where n is the growth rate of the population], there are constant returns to scale to the produced inputs in both goods and research sectors. Furthermore, Research and Development (R&D) uses labour and the existing stock of human capital, but not physical capital, whereas goods production uses labor, human and physical capital. The production function for labour productivity is given by:

$\acute{A}_{(t)} = Ba_{l}LA_{(t)}$ - - - - - - - 3

and since all physical capital is used to produce goods, goods production is

$Y_{(t)} = K_{(t)}^{a}[(1-a_1)LA_{(t)}]^{1-a}$ - - - - - - - 4

Where $\acute{A}_{(t)}$ denotes a derivative of labour productivity with respect to time [that is, $\acute{A}_{(t)}$ is a shorthand for $\frac{dA(t)}{dt}$; B is a shift parameter [which accounts for all other factors affecting rate of change of labour productivity other than labour and labour productivity]; a_1 and 1- a_1 denote the fraction of labour used in labour productivity and goods production, respectively; and *a* represents the elasticity of output with respect to capital stock, while 'L, A, K and Y are labour force, labour productivity, capital stock and output, respectively. Notice that time (t) enters the 'model continuously in line with [the prescriptions of] the endogenous growth theory. The savings rate is assumed to be constant, so that:

$k_{(t)} = sY_{(t)}$ - - - - - - - - - 5

Equation (4) is important to this study because it introduced capital stock, labour and labour productivity as (macroeconomic) determinants of output. Since model (4) is a mathematical model, we need to change it to an econometric model by exponentially introducing the error term as thus:

$Y_{(t)} = K_{(t)}^{a}[(1 — a_1)LA_{(t)}]^{1-a} e^{\mu_{(t)}}$ - - - - - - 6

where $\mu_{(t)}$ is error term, which entered the model exponentially for two main reasons: First, for the model's error term after transformation to follow normal distribution with zero mean and homoscedastic variance, that is $\mu \sim (0,\delta)$**,** as it is required for valid statistical inference.

If $\mu_{(t)}$ had entered model (6) multiplicatively such as in $Y_{(t)} = K_{(t)}^{a}[(1 - a_1)LA_{(t)}]^{1-a}\mu_{(t)}$, it is then the model's log-error that will follow normal distribution, that is $\ln \mu \sim N(0,\delta^2)$,

in which case μ must follow the log-normal distribution with mean $\mathbf{e^{\delta 2/2}}$and variance $\mathbf{e^{\delta 2}}$ ($\mathbf{e^{\delta 2}}$ - 1) which has implications to the statistical inference of the model's findings. Second, $\mu_{(t)}$ entered model (6) exponentially for it to be intrinsically linear (in parameter) regression model because if it had entered additively such as in $Y_{(t)} = K_{(t)}^{\ a}[(1-a_1)LA_{(t)}]^{1-a} + \mu_{(t)}$, there is no way to transform the model so that the transformed model becomes linear in the parameters (Gujarati & Porter, 2009). Thus, to show that model (6) is actually a suitable growth model for this study and to enable the use of linear regression estimation technique such as Generalized Method of Moments (GMM) rather than "trial-and-error" or 'iterative' methods of nonlinear regressions, we log-transform model (6) as thus:

$$\ln Y_{(t)} = \ln[K_{(t)}^{\alpha}[(1-a_1)LA_{(t)}]^{1-\alpha}e^{\mu_{(t)}} \quad - \quad - \quad - \quad - \quad - \quad - \quad 7$$

So,

$$\text{In}Y_{(t)} = \alpha \ln K_{(t)} + (1-\alpha)\ln(1-\alpha_l) + (1-\alpha)\ln L + (1-\alpha)\ln A_{(t)} + \mu \text{Ine} \quad - \quad - \quad 8$$

Then,

$$\text{In } Y_{(t)} = \alpha_0 + (1-\alpha)\ln A_{(t)} + \alpha \ln K_{(t)} + (1-\alpha)\text{In}L_{(t)} + \mu_{(t)} \quad - \quad - \quad - \quad 9$$

Where $\alpha_0 = (1-\alpha)\ln(1-\alpha_l)$ = a constant, and lne =1

Then again, to measure output per man, a measure of labour productivity, we will use per capita income derived in growth model by dividing model (4) by the labour, L, as thus:

$$\frac{Y(t)}{L(t)} = \frac{k(t)^{\alpha}\left[(1-\alpha_l)LA(t)\right]^{1-\alpha}}{L(t)} \equiv \frac{Y(t)}{L(t)} = K(t)^{\alpha}\left[(1-\alpha_l)LA(t)\right]^{1-\alpha}\left[L(t)\right]^{-1} \quad -- \ - \ -- \ 10$$

$$Then, \frac{Y(t)}{L(t)} = K(t)^{\alpha}(1-\alpha_l)^{1-\alpha}A(t)^{1-\alpha}L(t)^{1-\alpha-1} \quad -- \ - \ - \ - \ 11$$

$$i.e \frac{Y(t)}{L(t)} = K(t)^{\alpha}(1-\alpha_l)^{1-\alpha}A(t)^{1-\alpha}L(t)^{-\alpha} \quad ----- \ 12$$

$$y(t) = K(t)^{\alpha}(1-\alpha_l)^{1-\alpha}A(t)^{1-\alpha}L(t)^{-\alpha}\ \ell^{\omega(t)} \quad ------ \ 13$$

Where: *y(t)* denotes output per man [a proxy for productivity of labour], and where $\omega_{(t)}$ is the error term introduced exponentially into the model for the same reason as in model (3.6).

Log-transformation of model (3.13) yields:

$$\ln y(t) = \ln\left[K(t)^{\alpha}(1-\alpha_l)^{1-\alpha}A(t)^{1-\alpha}L(t)^{-\alpha}\ell^{\omega(t)}\right] \quad --------- \ 14$$

$$\ln y(t) = \alpha \ln K(t) + (1-\alpha)\ln(1-\alpha_l) + (-\alpha)\ln L(t) + (1-\alpha)\ln A(t) + \omega \ln \ell \quad -------- \ 15$$

$$Thus, \ \ln y(t) = \alpha_1 + (1-\alpha)\ln A(t) + \alpha \ln K(t) + (-\alpha)\ln L(t) + \omega(t) \quad ------- \ 16$$

Where $\alpha_1 = (1-\alpha)\ln(1-\alpha_l)$ = a constant, and where $\ln \ell = 1$.

Now, assume the growth rate of labour to be equal to zero, that is, $\frac{d \ln L(t)}{dt} = \frac{dL(t)}{dt} \Big/ L(t) = n = 0$, then the two most interesting models for this study — models (3.9) and (3.16) — will reduce, respectively to:

$$\ln y(t) = \alpha_0 + (1-\alpha)\ln A(t) + \alpha \ln K + \mu(t) \quad \text{------} \quad 17$$

and,

$$\ln y(t) = \alpha_1 + (1-\alpha)\ln A(t) + \alpha \ln K(t) + \omega(t) \quad \text{------} \quad 18$$

Note that transformations that yielded equations (3.17) and (3.18) were done also to justify the rationale behind the logging of some variables in this study. Finally, substituting equation 3.2 or 3.3 into either 3.17 or 3.18, so that human capital H and by consequence, health enters the model, we have

$$\ln y(t) = \alpha_0 + (1-\alpha)\ln H(t) + \alpha \ln K + \mu(t) \quad \text{--------} \quad 19$$

and,

$$\ln y(t) = \alpha_1 + (1-\alpha)\ln H(t) + \alpha \ln K(t) + \omega(t) \quad \text{------} \quad 20$$

Thus the equations 19 or 20 will serve as the fundamental equation adopted for this study. It simply shows that human capital in the form of health is an important determinant of productivity.

Empirical Model Specification

Drawing from Lucas (1988) model in the theoretical framework above, this study investigates the impact of health on productivity in Sub-Saharan African countries. Adopting the model as specified by Cole and Neumayer (2006) with a slight modification we have:

Y = f (X; LAB, GFCF, AGR, TRAD, INF) - - - - - - 21

Where:

Y = is the dependent variable which will represent Total Factor Productivity (TFP), Labour Productivity (LP) and Economic Performance (GDPGR)

X = An indicator of health which would be malnutrition (MNU) and access to safe water (ASW) which will be used in separate estimation.

LAB= Labour Growth in the Sub-region

GFCF =Growth of Gross Fixed Capital formation

AGR =Share of Agriculture in GNP

TRAD = Trade Openness

INF= Rate of inflation

4.0 Empirical Analysis and Results

In this section we present the Panel unit root tests both at levels and first differences using the Im, Pesaran & Shin (IPS) and Fisher Augmented Dickey-Fuller (ADF) methods; the Panel Cointegration tests using the popular Pedroni residual tests to test for the long run relationship between the dependent and independent variables and finally an analysis of the relationship between the health variables and productivity outcomes using the Generalized Method of Moments (GMM) estimation technique.

Table 1: Im, Pesaran & Shin and Fisher Augmented Dickey-Fuller Panel Unit Root Tests at Levels

	Im, Pesaran & Shin			Fisher Augmented Dickey-Fuller		
	Null Hypothesis: Unit root (assumes individual unit root process)					
Variable	**W-Statistic**	**Probability**	**Remarks**	**Chi-Square Statistic**	**Probability**	**Remarks**
TFP	-1.32155	0.0932	Stationary	89.4606	0.0289	Stationary
LP	5.47391	1.0000	Non-stationary	32.5072	0.9998	Non-stationary
GDPGR	-6.34458	0.0000	Stationary	154.395	0.0000	Stationary
MNU	-5.23932	0.0000	Stationary	139.034	0.0000	Stationary
ASW	-1.57311	0.0578	Stationary	66.4773	0.4604	Non-stationary
LLAB	4.39750	1.0000	Non-stationary	40.0642	0.9952	Non-stationary
LGFCF	-0.65797	0.2553	Non-stationary	69.4981	0.3605	Non-stationary
AGR	-1.57068	0.0581	Stationary	84.5828	0.0614	Stationary
TRAD	-0.67350	0.2503	Non-stationary	74.9252	0.2113	Non-stationary
INF	-8.29484	0.0000	Stationary	193.948	0.0000	Stationary

Source: Results Extract from EViews 10

As shown in Table 1, the Im, Pesaran & Shin unit root tests revealed that total factor productivity, gross domestic product growth rate, prevalence of malnutrition rate, access to safe drinking water, agricultural output share of GDP and inflation rate are stationary at levels but labour productivity, log of labour growth, log of gross fixed capital formation and trade openness are non-stationary at level. Based on the Fisher Augmented Dickey-Fuller tests, it was discovered that total factor productivity, gross domestic product growth rate, prevalence of malnutrition rate, agricultural output share of GDP and inflation rate are stationary at levels while labour productivity, access to safe drinking water, log of labour growth, log of gross fixed capital formation and trade openness are non-stationary at level.

The Im, Pesaran & Shin and Fisher Augmented Dickey-Fuller Panel Unit Root Tests at Differences

It was observed that based on the Im, Pesaran & Shin unit root tests labour productivity, log of labour growth, log of gross fixed capital formation, agricultural output share of GDP and trade openness are difference stationary. By means of the Fisher Augmented Dickey-Fuller tests, the results showed that labour productivity, access to safe drinking water, log of labour growth, log of GFCF, agricultural output share of GDP and trade openness are difference stationary.

Panel Co-integration Tests

Following is the analysis of the panel cointegration tests using the Pedroni cointegration techniques.

Table 2: Pedroni Residual Co-integration Test for Total Factor Productivity Model Augmented with Prevalence of Malnutrition Rate

Series: TFP, MNU, LLAB, LGFCF, AGR, TRAD, INF

Alternative hypothesis: Common AR coefficients (within-dimension)				
	Statistic	**Probability**	**Weighted Statistic**	**Probability**
Panel v-Statistic	-0.743146	0.7713	-2.459329	0.9930
Panel rho-Statistic	4.877932	1.0000	4.451438	1.0000
Panel PP-Statistic	-3.438823	0.0003	-5.431147	0.0000
Panel ADF-Statistic	0.134687	0.5536	0.165404	0.5657
Alternative hypothesis: Individual AR coefficients (between-dimension)				
	Statistic	**Probability**		
Group rho-Statistic	6.483261	1.0000		
Group PP-Statistic	-5.294095	0.0000		
Group ADF-Statistic	2.523923	0.9942		

Source: Results Extract from EViews 10.

As Table 2 shows, the Pedroni residual cointegration test for total factor productivity model augmented with malnutrition prevalence rate indicates that the null hypothesis of no cointegration cannot be rejected at the 5 percent level of significance. This is because eight out of the eleven test statistics as revealed in the table are not significant at the 5 percent level.

Pedroni Residual Co-integration Test for Total Factor Productivity Model Augmented with Access to Safe Drinking Water:
The Pedroni residual cointegration test for total factor productivity model augmented with access to safe drinking water shows that the null hypothesis of no cointegration cannot be rejected at the 5 percent level of significance. This is because eight out of the eleven test statistics as revealed in the results are not significant at the 5 percent level.

The Pedroni Residual Co-integration Test for Labour Productivity Model Augmented with Prevalence of Malnutrition Rate:
Pedroni residual cointegration test for labour productivity model modified with prevalence of malnutrition rate shows that the null hypothesis of no cointegration cannot be rejected at the 5 percent level of significance. This is because none of the eleven test statistics, as shown in the result, is significant at the 5 percent level.

Pedroni Residual Co-integration Test for Labour Productivity Model Augmented with Access to Safe Drinking Water:
As Table 6 shows, the results of Pedroni residual cointegration test for labour productivity model modified with access to safe drinking water show that the null hypothesis of no cointegration cannot be rejected at the 5 percent level of significance. This is because eight out of the eleven test statistics, as revealed in the table, are insignificant at the 5 percent level.

The Pedroni Residual Co-integration Test for GDP Growth Rate Model Augmented with Prevalence of Malnutrition Rate:
The results show that the Pedroni residual cointegration test for GDP growth rate model adjusted with prevalence of malnutrition rate indicate that the null hypothesis of no cointegration cannot be accepted at the 5 percent level of significance. This is because six out of the eleven test statistics, as shown in the result, are significant at the 5 percent level.

Table 3: Pedroni Residual Co-integration Test for GDP Growth Rate Model Augmented with Access to Safe Drinking Water

Series: GDPGR, ASW, LLAB, LGFCF, AGR, TRAD, INF

Alternative hypothesis: Common AR coefficients (within-dimension)				
	Statistic	**Probability**	**Weighted Statistic**	**Probability**
Panel v-Statistic	-2.672560	0.9962	-5.734162	1.0000
Panel rho-Statistic	3.345910	0.9996	4.262920	1.0000
Panel PP-Statistic	-15.39816	0.0000	-13.09770	0.0000
Panel ADF-Statistic	-2.427490	0.0076	-3.964100	0.0000

Alternative hypothesis: Individual AR coefficients (between-dimension)				
	Statistic	**Probability**		
Group rho-Statistic	6.001526	1.0000		
Group PP-Statistic	-23.04239	0.0000		
Group ADF-Statistic	-1.709803	0.0437		

Source: Results Extract from EViews 10.

The Pedroni residual cointegration test for GDP growth rate model adjusted with access to safe drinking water, as shown in Table 3, reveals that the null hypothesis of no cointegration cannot be accepted at the 5 percent level of significance. This is because six out of the eleven test statistics, as revealed in the table, are significant at the 5 percent level.

Analysis of the Estimated Generalized Method of Moments (GMM) Models

Presented below are the results of the three estimated models for the study - The analyses of the total factor productivity model, labour productivity model and GDP growth rate model using the GMM estimation method

Table 4 Analysis of the Relationship between TFP and Health Variables

Dependent Variable: Total Factor Productivity		
Independent Variable	**Estimated Coefficient**	
Constant	0.062179 (1.037)	0.003276 (0.048)
One year lagged value of total factor productivity	-0.390632*** (-4.870)	-0.374208*** (-4.728)
Prevalence of malnutrition rate	4.91E-05 (0.212)	-
Access to safe drinking water	-	0.000415 (1.726)
Log of labour growth	-0.000766 (-0.108)	0.006938 (0.861)
Log of gross fixed capital formation	-0.004178 (-0.725)	-0.008387 (-1.456)
Agricultural output share of GDP	-3.28E-05	3.22E-05

	(-0.375)	(0.343)
Trade openness	-0.000199**	-0.000196**
	(-1.988)	(-1.982)
Inflation rate	-1.95E-05***	-1.99E-05***
	(-9.057)	(-9.261)
Summary Statistics		
R-squared	0.944	0.872
Adjusted R-squared	0.930	0.870
Instrument rank	14	14
J-statistic	3.931	2.599
Probability (J-statistic)	0.137	0.273

Note: t-statistics are in parentheses; *, ** & *** indicate significance at 10%, 5% & 1% respectively.

Source: Results Extract from EViews 10.

From Table 4, the coefficient of determination of the total factor productivity model augmented with prevalence of malnutrition rate, R-squared (R^2) is about 0.94 and the adjusted R-squared ($\bar{R}^2$) is 0.93. The R-squared implies that about 94 percent of the systematic variations in total factor productivity are explained by the regressors in the model. The adjusted R-squared indicates that about 93 percent of the systematic changes in the dependent variable are attributable to the explanatory variables. The J-statistic has a value of 3.93 with an associated probability value of 0.14. This implies that the instruments used are not correlated with the disturbance terms. Thus, the over-identifying restrictions of the model are valid and the model is adequate.

On the other hand, the R-squared (R^2) and adjusted R-squared ($\bar{R}^2$) of the total factor productivity model augmented with access to safe drinking water are approximately 0.87. This shows that 87 percent of the systematic variations in total factor productivity are explained by the independent variables in the model. Hence, the explanatory power of the model is lower compared to when it is augmented with prevalence of malnutrition rate. The J-statistic is 2.60 with a probability of 0.27. This indicates that null hypothesis that over-identifying restrictions of the model are valid cannot be rejected. Hence, the model is adequate.

From the total factor productivity model augmented with prevalence of malnutrition rate, the signs of all the estimated coefficients but inflation rate did not conform to their theoretical expectations. Lagged total factor productivity has a negative significant effect on its current value. Malnutrition prevalence rate has no significant impact on total factor productivity. Labour growth does not have any significant effect on total factor productivity. GFCF has no significant impact on total factor productivity. The share of agriculture in GDP does not significantly affect total factor productivity. The coefficient of trade openness is negative and significant at the 5 percent level. It indicates that trade

openness has an adverse effect on total factor productivity. Inflation rate has a negative coefficient and it is significant at the 1 percent level. It implies that lower inflation rates will enhance total factor productivity.

Alternatively, as shown in the total factor productivity model augmented with access to safe drinking water, the coefficients of access to safe drinking water, labour growth, agricultural output share of GDP and inflation rate are properly signed. Lagged total factor productivity, gross fixed capital formation and trade openness did not conform to their a priori signs. The lagged value of total factor productivity has a negative significant impact on its current value. Access to safe drinking water has a positive but insignificant effect on total factor productivity.

As shown in Table 5, the labour productivity model augmented with prevalence of malnutrition rate, the R-squared (R^2) and adjusted R-squared ($\bar{R}^2$) are about 0.72. These indicate that the explanatory variables account for about 72 percent of the systematic variations in labour productivity in the model. The J-statistic is 1.99 with a probability value of 0.37. This shows that the instruments used in the model are uncorrelated with the error terms. Thus, the over-identifying restrictions of the model are valid and the model is adequate. Then again, the R-squared (R^2) of the labour productivity model modified with access to safe drinking water is approximately 0.73 and the adjusted R-squared ($\bar{R}^2$), 0.72. Based on the adjusted R-squared, 72 percent of the systematic variations in labour productivity are attributed to the independent variables in the model. The J-statistic is 3.86 with a probability of 0.14. This indicates that null hypothesis that over-identifying restrictions of the model are valid cannot be rejected. Hence, the model is valid.

Table 5 Analysis of the Relationship between Labour Productivity and Health Variables

Dependent Variable: Labour Productivity		
Independent Variable	**Estimated Coefficient**	
Constant	201.9365*** (6.507)	122.4005*** (3.682)
One year lagged value of labour productivity	-0.001045 (-0.016)	0.011278 (0.175)
Prevalence of malnutrition rate	-0.455152*** (-4.165)	- -
Access to safe drinking water	- -	0.392794*** (3.514)
Log of labour growth	-90.38036*** (-13.930)	-85.25162*** (-12.932)

Log of gross fixed capital formation	70.25703***	69.70668***
	(14.388)	(14.190)
Agricultural output share of GDP	-0.095132**	-0.061628
	(-2.359)	(-1.423)
Trade openness	-0.055113	-0.055249
	(-1.232)	(-1.243)
Inflation rate	0.002099**	0.001548
	(2.155)	(1.584)
Summary Statistics		
R-squared	0.723	0.726
Adjusted R-squared	0.719	0.723
Instrument rank	14	14
J-statistic	1.994	3.861
Probability (J-statistic)	0.369	0.142

Note: t-statistics are in parentheses; *, ** & *** indicate significance at 10%, 5% & 1% respectively.

Source: Results Extract from E-Views 10.

As can be observed in the labour productivity model augmented with prevalence of malnutrition rate, only malnutrition prevalence rate and GFCF satisfy their economic criteria signs. All other variables in the model do not meet their a priori signs. Lagged labour productivity has an insignificant impact on its current value. Malnutrition prevalence rate has a negative significant impact on labour productivity. This suggests that high prevalence rates of malnutrition will retard labour productivity in the economy. On the other hand, as depicted in the total factor productivity model augmented with access to safe drinking water, "Access to safe drinking water" has a positive significant effect on labour productivity. This implies that more access to safe drinking water enhances labour productivity.

The Analysis of the Relationship between GDP Growth Rate and Health Variables

From the GDP growth rate adjusted with prevalence of malnutrition rate, the R-squared (R^2) value is about 0.86 and the adjusted R-squared ($\bar{R}^2$) is 0.85. The $\bar{R}^2$ implies that about 85 percent of the systematic variations in GDP growth rate are explained by the independent variables in the model. The J-statistic has a value of 2.79 with an associated probability value of 0.22. This implies that the instruments used are uncorrelated with the error terms. Thus, the over-identifying restrictions of the model are valid. On the other hand, the R-squared (R^2) and adjusted R-squared ($\bar{R}^2$) of the GDP growth rate model augmented with access to safe drinking water are approximately 0.91 and 0.89

respectively. The adjusted R-squared shows that 89 percent of the systematic variations in GDP growth rate are accounted for by the explanatory variables in the model. The J-statistic is 1.55 with a probability of 0.42. This indicates that null hypothesis that over-identifying restrictions of the model are valid cannot be rejected. Hence, the model is adequate.

From the GDP growth rate model augmented with prevalence of malnutrition rate, the signs of all the estimated coefficients but lagged GDP growth rate and prevalence of malnutrition rate conform to their theoretical expectations. Lagged GDP growth rate has a negative significant effect on its current value. The most striking result to emerge is that malnutrition prevalence rate has a positive significant impact on GDP growth rate. This finding is counterintuitive.

Findings and Policy Implications

The findings ascertained that poor health status is significant and it negatively impacts on labour productivity in the sub-region. This finding indicates that labour productivity is determined by prevalence rate of malnutrition and access to safe drinking. Consequently, as revealed in the findings, 1 percent rise in prevalence of malnutrition rate will result in about 0.5 percent drop in labour productivity. Also, if the population with access to safe portable water is increased by 1 percent, labour productivity will rise by 0.4 percent. Nonetheless, it is somewhat surprising that the research also found that poor health has no significant effect on total factor productivity - with the evidence from the result suggesting that prevalence rate of malnutrition and access to safe drinking water are no determinants of the overall economy's productivity; and also that poor health has a positive significant effect on economic performance - implying that the two measures for poor health (prevalence of malnutrition rate and access to safe portable water) do not support the economic notion that poor health retards economic performance. These two findings are rather counterintuitive and therefore should not be taken seriously. These unexpected results could be explained with the inaccurate nature of data from Sub-Saharan Africa.

The crucial results of this research that labour productivity is adversely affected by poor health measures - prevalence rate of malnutrition but enhanced by increase in the access to safe drinking water should be considered seriously for policy implications. Governments in the Sub-Saharan Africa within the sample period have not done enough to reduce prevalence rate of malnutrition and did not do enough to increase the access to safe drinking water. However, these are imperative if labour productivity in the sub-region is to be enhanced.

5.0 Summary, Conclusion and Recommendations

Summary and Conclusion

The main goal of this study was to determine the effect of poor health on productivity in Sub-Saharan Africa. It was revealed in this study that poor health status has a negative significant impact on labour productivity. To be precise, malnutrition prevalence rate constitutes a drag to labour productivity while access to safe drinking water enhances productivity of labour. Contrary to expectations, this study found out that malnutrition prevalence rate and access to portable water had insignificant impact on overall economy's productivity or total factor productivity. These findings do not give credence

to the fact that the overall productivity level of the economy is influenced by the population suffering from malnutrition.

Recommendations:

Based on the empirical findings of this study, the following recommendations have been proffered:

- The important research finding of this study is that labour productivity is affected by the proportions of the populace that are malnourished and that have access to safe portable water. Thus, to enhance labour productivity there is need for governments (a) to implement food policy programmes to ameliorate the high incidence of malnutrition among the populace in the region; (b) to provide clean pipe-borne and/or bore-hole water in areas where water sources are contaminated or potable water is inaccessible.
- The unexpected results of this study suggest that malnutrition prevalence rate and access to safe drinking water are no determinants of economy's productivity implying that there is, therefore, no intense need for governments and/or other relevant stakeholders to tackle the problem of overall economy's productivity considering prevalence rates of malnutrition and the population with access to safe drinking water. These results may have come about due to inadequacies of data in the Sub-Region and so, governments should still continue to make efforts towards alleviating the effects of poor health variables that are capable of retarding the overall productivity of the economy.

For these controversial findings, further studies need to be carried out in order to validate or refute them. On the whole, governments in the Sub-Saharan African should continue to make concerted efforts towards alleviating the effects of poor health variables on labour productivity or the impacts of poor health that may retard the overall productivity of the economy.

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CAPITAL INFLOWS, AGRICULTURAL OUTPUT AND ECONOMIC GROWTH IN NIGERIA: LESSONS FOR POLICY

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Abstract

The study examined the effect(s) of capital inflow, agricultural output on economic growth in Nigeria. *The study embraced annual time-series data spanning from 1986 to 2019 and employed the fully modified ordinary least square (FM-OLS) technique. Variables used in the study are gross domestic product per capital income (LGDPPC), foreign direct investment inflow (FDI), official development assistance (LOAD), agricultural output (LAGROUT) and exchange rate (EXR). The study showed that exchange rate (EXR) is negative and statistically significant, while on the contrary, foreign direct investment inflows (LFDI) also showed a negative and statistically not significant in the model. Consequently, the study discovered that positive and significant relationship exists between agricultural output (LAGROUT) and official development assistance (LOAD) for the period of study. The finding showed that the coefficient of interaction between agricultural output and foreign direct investment (LAGROUT* LFDI) is significant and has the expected sign. The study therefore, recommended that government should put in place a strategy for attracting more foreign investors capable of generating a higher volume of private investment that can have a significant impact on agricultural output.*

Keywords**: **Gross domestic product per capital income, foreign direct investment inflow, official development assistance, agricultural output and FM-OLS.

JEL Classification: A1, E13, F13

1.0 Introduction

There is no state in the world without the aim of accomplishing economic growth and development. However, this can only be possible if a country has sufficient resources at its disposal (Chimobi & Igwe, 2010). In many under-industrialized countries (Nigeria inclusive), the resources to finance the prime level of economic development are in short supply. Consequently, this validates the need for external source of finance. Therefore, capital inflow is the amount of capital coming into a country, and it includes foreign direct investment (FPI), foreign portfolio investment (FPI) and debt capital flows. According to Udensi (2015), external capital inflows involve the increase in the amount of money available from external or foreign sources for the purchase of local capital assets such buildings, land and machines.

Asiebu (2003) noted that capital inflow is the movement into a country of capital resources for the purpose of investment, trade or business production, and it has significant role for every national economy, regardless of its level of development. For the advanced countries, it is necessary to support sustainable development while for the developing economies; it is use to increase accumulation and rate of investments to create conditions for accelerated economic growth. For the transition countries, it is useful to carry out the reforms necessary to open the economy (Edwards, 2004), to transit the past long term problems and to create conditions for stable and continuous growth of GDP (Razin, 2001), as well as integration into the global economy (Boskovska, 2006). Capital inflow can help developing countries in economic development by furnishing them with necessary capital and technology which will be used to harness their local resources required for radical development in infrastructure needed to measure up with developed countries, (Aladejana *et al*., 2021).

Over the past two decades, Nigeria has witnessed influx of external capital in all the vital sectors of the economy. According to UNCTAD and World Investment Report (2020), FDI flows to Nigeria amounted to $38.77 billion in 2017 and $6.4 billion, $3.3 billion and $2.6 billion in 2018, 2019 and 2020 respectively. Despite that Nigeria is the third host economy for capital inflow in Africa, yet levels of her citizens access to basic physical infrastructure such as clean water and improved sanitation, electricity and (paved) roads in Nigeria are inadequate, given its income levels and rapidly growing population which has considerably limited efforts towards achieving inclusive growth, sustainable development, and poverty reduction. In an attempt to create a suitable climate for inflow of external capital investment and growth within the economy, and to stimulate her economic recovery efforts from a prolonged and severe recession, Nigerian government introduced the Structural Adjustment Programme (SAP) in 1986. The programme incorporates trade and exchange reforms reinforced by monetary and fiscal measures, which were geared towards diversifying export base by stimulating domestic production and discouraging the use of imported inputs for local production. The supply side of the package seeks to enhance aggregate output with special emphasis on agro/agro-allied and manufacturing sectors for which specific policy measures were designed. The implementation of SAP was expected to bring about some improvements in the economy. Moreover, the volume of investment inflow is far lower than the annual population growth rate.

Prior to 1960, when the nation got its independence, agriculture was at the forefront of the Nigerian economy, contributing among others in the provision of food, raw materials

for industry and employment opportunities for the populace. Iddrisu, Immurana & Halidu (2015), argued that agricultural sector growth would drive growth in the economy because the sector is a major employment of labor and contributes a lot to Nigeria's gross domestic product (GDP). Since the oil boom days, the sector has been retarded due to under funding and neglect by government and consequent mass exodus of able bodied youths from the rural to the urban areas in search of non-existent white collar jobs. The weakness of this sector weakens the prospects for the rural poor, while high food inflation adversely impacts the livelihoods of the urban poor. This further reduces employment in agriculture and puts pressure on existing urban jobs. Following the oil price collapse in 2014-2016, combined with negative production shocks, the GDP growth rate dropped to 2.7% in 2015, and 2016 during its first recession in 25 years, the economy contracted by 1.6% and growth is too low to lift the bottom half of the population out of poverty. In order to bridge this gap, Nigerian government needs to invest its capital inflow on agricultural sector in order to improve the welfare and standard of living of the citizenry and well place Nigeria up with their 1st world counterparts, (Aladejana, Oluwalana, Alabi & Bolaji (2021). Therefore, this study will examine the effect(s) of capital inflow, agricultural output on economic growth in Nigeria.

The Statement of the Problem

Developing countries resort to capital inflow, ideally, to bridge up any resource availability gap in tackling pressing and essential economic needs that tend to improve on the welfare and standard of living of their citizens, Nigeria is not unique in these experiences. Studies have shown that Nigeria is one of the top recipients of capital inflows in Africa. According to UNCTAD (2007), 70% of capital inflow to West Africa and 11% of Africa's total capital inflows goes to Nigeria and she is ranked among the first five recipients of capital inflow in Africa. Even African Economic Outlook indicated that Nigeria recorded over US$6.4billion of both FDI and FPI in 2013; this is second to South Africa (Akanyo & Ajie, 2015). Regardless of the large share of capital inflow, poverty is deep and pervasive, with about 70 percent of the population in absolute poverty. Infrastructure decay is significant; health sector is moribund compare to international standard, Aladejana, Oluwalana, Alabi and Bolaji (2020).

On the other hand, a significant amount of research has been conducted in developed countries and emerging economies to prove and establish the relationship between capital inflow and economic growth nexus. Previous indigenous studies such as (Akinlo, 2004; Ayanwale, 2007; Osinubi and Amaghionyeodiwe, 2010; Danladi & Akomolafe, 2013, Adeleke *et.al,* 2014; Otto & Ukpere, 2014; Babalola *et.al,* 2012; Umoh, *et.al,* 2012, Okafor et al., 2016; Olaleye, 2015; Chigbu *et al.*, 2015; Akanyo & Ajie, 2015; Okafor et al., 2015; Adegboye *et al.*, 2014; Obiechina and Ukeje, 2013), apart from differences in the data's, the sampling period, and methodologies adopted explain the inconclusive results. It had focused mainly on the relationship between foreign capital inflows and aggregate output (economic growth), neglecting the impact of foreign capital inflow on agricultural output growth. Consequently, policy recommendations that emanated from these studies were aggregate-based rather than sector-specific. This neglect might have hampered the level of investment and growth on agricultural sector, which are capable of generating sustainable growth and productive employment opportunities, (UNDESA, 2010).

Also, studies like Okon & Saliu, 2017; Adofu *et al.*, 2015; Olorunfemi *et al.*, 2013, examined the relationship between manufacturing sector and economic growth whereas, Nwosa, (2011), Adeniyi *et al*., (2015), Waliu, (2017), Yilmaz and Marius, (2018) and currently Amassoma and Azeez, (2020) investigate direct effects of capital inflow, financial deepening on economic growth, both formal and the latter ignored the important role agricultural output can play in the relationship between capital inflows and economic growth. Consequently, capital inflows, agricultural output and economic growth has not been seriously considered in Nigeria. Hence, this study seeks to fill the gap. In the light of the above, there is the need to approach the issue of capital inflow-output growth relationship from the agricultural perspective, and examine the interaction effects of capital inflow and agricultural output growth in Nigeria. The outcome of this will provide policymakers with appropriate policy recommendations on channeling of future capital inflow to the sectors that are capable of integrating larger percentage of the population in the growth process, if the much needed capital is deployed.

2.0 Literature Review:

Under this section we review relevant theory and empirical studies pertaining to foreign capital inflows and economic growth.

Theoretical Review

The Neoclassical Theory

The neoclassical economists argue that external inflow influences economic growth by increasing the amount of capital per person. However, because of diminishing returns to capital, it does not influence long-run economic growth. Bengos and Sanchez-Robles (2003) assert that even though external inflow is positively correlated with economic growth, host countries require minimum human capital, economic stability and liberalized markets in order to benefit from long-term external inflows. Growth in neoclassical theory is brought about by increases in the quantity of factors of production and in the efficiency of their allocation. In a simple world of two factors (labour and capital), it is often presumed that low-income countries have abundant labour but scarce capital.

Empirical reviews

In Nigeria the agricultural sector still remains the most important sector of the economy despite it neglect, it is however no news before oil, the sector was the pillar of the Nigeria's economy providing employment and source of livelihood for the increasing population and accounting for over half of the GDP of the country. Ekienabor *et al*. (2016) reported a positive relationship between FDI and manufacturing sector (output) in Nigeria. Chigbu *et al.* (2015) examined the impact of capital inflows on economic growth of developing economies; the case of Nigeria, Ghana and India. The causal relationship was tested using Granger causality and OLS method was used to estimate the model. The findings reveal that capital inflows have significant impact on the economic growth of the three countries. Also, Nwosa (2015), Ezeanyeji and Ifebi (2016) and Opoku, Ibrahim, and Sare (2018) examined the impact of foreign direct investment on sectoral performance in Africa countries. Result showed that FDI has contributed

significantly to the performance of the telecommunications sector in terms of its contribution to the Gross Domestic Product of Nigeria. Moreover, Owen (2017) analyzes the effect of capital flows on economic growth in sub-Saharan Africa, using a system of generalized methods of moment (GMM) model; the study finds that portfolio equity has a positive effect on economic growth. In contrary to the above, study by Ikechi (2015), Orji et al. (2015) and Adofu *et al.* (2015) reported a different result that FDI impacted negatively on manufacturing sector output and manufacturing value added respectively. The negative results may be because the manufacturing sector was affected by factors such as high cost of foreign exchange for procuring raw materials and machineries required for production, availability of financial capital, technological underdevelopment, shortage of technical man power and foreign domination.

Again, Okafor, Ugochukwu, and Chijindu, (2016). Investigated the relationship between foreign capital inflows and economic growth in Nigeria, and Toda Yamamoto causality estimation techniques was employed to determine the relationship between foreign capital inflow and economic growth. The result revealed that there is bi-directional causality running from GDP to FDI as well as from FDI to GDP but a unidirectional causality from FPI to GDP. Furthermore, the joint causation between all the components of foreign capital inflow indicates that increase in foreign capital causes GDP to increase positively. In most resent literature, Ikpesu and Okpe (2019), Balogun, Okafor and Ihayere (2019) and Badwan and Atta (2020), investigated the effect of capital inflows and exchange rate on agricultural output. The findings indicate that in the short run and long run, private capital inflow and public capital inflow positively affect the country agricultural output. The study also revealed that exchange rate depreciation would cause agricultural output to decline in the short and long run. Consonance to the above, Anidiobu, Paschal, Onyia, and Onwumere (2020) investigated the impact of foreign capital inflow on economic growth in ECOWAS Sub-Region. The outcomes showed foreign inflows had a negative, but significant effect on real GDP growth rate. The implication was that external debt did not enhance economic growth in the sub-region during the study period.

3.0 Research methods

Theoretical Framework

The study adopted the conventional neo-classical growth production function. The neo-classical production function links the aggregate output in period t with inputs or factors of production.

Expressing the neo-classical production function in the form of Cobb–Douglas production

$Y_t = A_t \ \mathrm{K}t^{\alpha}\mathrm{L}t^{\beta}$ ---------- *equation (1)*

where Y_t represents agricultural output (AO) at time *t*, while At represents total factor productivity, K_t capital stock (domestic investment) and L_t labor stock, α and β are the output elasticities of capital and labor, respectively.

According to the endogenous and neoclassical growth model, capital inflow (Private and Public inflows) operates through the total factor productivity (*A*) since capital inflows can stimulate growth provided there is an increasing return to production that would

enhance output Taurai (2014). Hence, total factor productivity is a function of capital inflow.

A_t=f (CAPI) ----------*equation (2)*

Thus, combining equations. 1 and 2, the Cobb–Douglas production function is expressed as

$Y_t = CAPI_t K_t^{\alpha} Lt^{\beta}$ ----------*equation (3)*

Where CAPI is capital inflows (Private and Public inflows).

Following similar studies, additional variable such as real effective exchange rate was employed to capture the efficiency of economic activity. Empirical studies have shown that real effective exchange rate affects agricultural output (Abdullahi, 2014; Iddrisu, Immurana & Halidu, 2015; Oyinbo, Abraham and Rekvot, 2014 and Wondemu & Potts, 2016).

Hence, the Cobb–Douglas production function is modified and, thus, expressed as

$Y_t = CAPI_t Kt^{\alpha} Lt^{\beta} REXR_t$----------*equation (4)*

Model Specification

The study adopted the conventional neo-classical growth production function, and the need to examine the direct relationship between capital inflow and agricultural output on economic growth in Nigeria, and using gross domestic product per capital income (GDPPC) as dependent variable, while foreign direct investment inflow (FDI), official development assistance (ODA), agricultural output (AGROUT) and exchange rate (EXR) as dependent variable in the model. Thus, the capital inflow-agricultural output model is specified as:

GDPPC = f (FDI, ODA, AGROUT, EXR) ---------- *equation (5)*

Equation (1) is re-written in semi log-linear form as:

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_t$---------- *equation (6)*

Whereas, RGDP = Real gross domestic product; the indicators of Capital inflow are: -(FDI = Foreign direct investment inflow, and ODA = Official development assistance). AGROUT = agricultural output, and EXR = exchange rate, and error term as (ε),

β_1, β_2, β_3, & β_4, = the coefficient of the independent variables, and *U*= Error terms

Econometrically, equation (3.2) is written as:

Model 1

$ln\,\text{GDPPC}_t = \beta_0 + \beta_1 lnFDI_t + \beta_2 lnODA_t + \beta_3 lnAGROUT_t + \beta_4 EXR_t + U_t$----- *equation (7)*

Model 2

$lnGDPPCI_t = \beta_0 + \beta_1 lnFDI_t + \beta_2 lnODA_t + \beta_3 lnAGROUT_t + \beta 4 lnFDI_t * InAGROUT_t + \beta_5 lnODA_t * InAGROUT_t + \beta_6 InEXR_t + U_t$---------- *equation (8)*

A priori Expectation: $\beta 1<0$, $\beta\ 2<0$, $\beta 3<0$, $\beta 4>0$

Data and Sources

The study is based on annual Nigeria country-level data obtained from the World Bank, Central Bank of Nigeria statistical bulletin, Annual reports and statistics, and the National Bureau of Statistics of Nigeria which spanned from 1986 to 2019. The study applied fully modified ordinary least square (FM-OLS) techniques to investigate capital inflows, agricultural output and economic growth nexus in Nigeria.

4.0 Presentation and Analysis of Results

Descriptive Statistics

Table 1 Descriptive Statistics Result

	LAGROUT	LEXR	LFDI	LGDPPC	LOAD
Mean	7.799926	4.092414	12.54326	6.911735	20.29427
Median	8.430747	4.795544	12.42209	6.678342	19.65615
Maximum	10.37049	5.726848	18.39229	7.993620	23.15968
Minimum	3.575225	0.703394	6.600958	5.598422	17.87802
Std. Dev.	2.065537	1.404380	2.938104	0.765970	1.430227
Skewness	-0.621839	-0.857670	0.017239	0.036309	0.157577
Kurtosis	2.141362	2.554378	2.595076	1.446230	1.764122
Jarque-Bera	3.140492	4.318838	0.227085	3.326779	2.236737
Probability	0.207994	0.115392	0.892666	0.189496	0.326813
Sum	257.3976	135.0497	413.9277	228.0873	669.7110
Sum Sq. Dev.	136.5261	63.11309	276.2385	18.77473	65.45758
Observations	33	33	33	33	33

***Source*:** Researcher's Computation, (2021).

Table 1 shows the summary of descriptive statistics of the variables included in the model. The mean value for LAGROUT variable is 7.799926 with standard deviation of 2.065537 Whereas, exchange rate (LEXR), foreign direct investment (LFDI), gross domestic per capital income (GDPPPC) and official development assistance (LODA) have the mean value of 4.092414, 12.54326, 6.911735 and 20.29427respectively.The standard deviation are 1.404380, 2.938104, 0.765970 and 1.430227 respectively.

Analysis of Capital Inflows, Agricultural Output and Economic Growth in Nigeria.

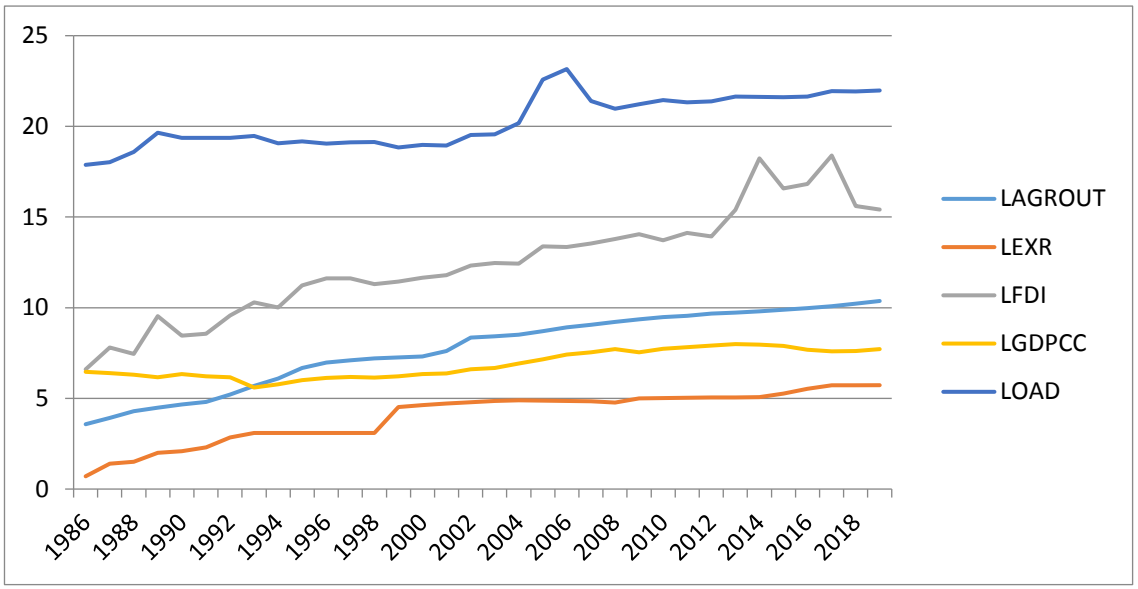

Figure 1: Agricultural output, Exchange rates, foreign direct investment inflow, gross domestic product per capital income and official development assistance
Source: Source: Researcher's Compilation (2021)

The figure 1 above showed the values in logarithm for all the series. A cursory look at the figure revealed that all the series exhibited cyclic trend throughout the period under study. There was sharp rise for gross domestic product per capital income (LGDPPC) in 1992 and the exchange rates (LEXR) were at the lowest 1993 to 1998. There was sharp rise in agricultural output (LAGROUT) from 2004 to 2006. Foreign direct investment inflow (LFDI) has exhibited a moderate cyclic trend than the other series. One fact to draw from these trends is that the official development assistance (LOAD) line seemed to be steeper in nature than others, which provided some evidence from possible interaction between official development assistance (LOAD) and agricultural output LAGROUT based on the exchange rate.

Preliminary Test

Test for Stationarity

In order to establish the order of integration of the variables of interest, the study employed Augmented Dickey Fuller (ADF) test and reported the result for the unit root test in Table 2

Table 2. Results of Unit Root Test at Level using ADF

Variables	ADF Test		Level	1st difference	Remark
	Level	1st			
LAGROUT	(3.308930)	(5.710599)	1(0)*	1(1)**	S

LEXR	(2.648614)	(5.711702)	1(0)*	1(1)**	S
LFDI	(1.113593)	(2.795338)	1(0)*	1(1)**	S
LGDPPC	(0.289732)	(4.582189)	1(0)*	1(1)**	S
LOAD	(1.142875)	(5.435010)	1(0)*	1(1)**	S
@ level 0.05:		-2.954021			
@ 1st difference @ 0.05:		-2.957110			

***Source*:** Researcher's Computation, 2021.

As shown in the Table2, the agricultural output (LAGROUT), exchange rate(LEXR), foreign direct investment inflow(LFDI), gross domestic product per capital income(LGDPPCI) and official development assistance (LOAD) data series were not stationary at level i.e. 1(0)*,as the 5% critical value was greater than ADF test (t-Statistic) in the model for the period 1986-2019 whereas all the variables (i.e., agricultural output (LAGROUT), exchange rate(LEXR), foreign direct investment inflow(LFDI), gross domestic product per capital income(LGDPPCI) and official development assistance (LOAD) data series were found to be stationary at 1st difference i.e. 1(1)** at 5% critical value greater than ADF test (t-statistic) in the model. Thus, this implied that the unit root test shows that the variables were stationary within the model for the period of the study.

Results for Co-integration Test

Table 3 Empirical Results of Unrestricted Co-integration Rank Test (Trace)

Variables	**Trace Statistic**	**0.05 Critical Value**	**Hypothesized No of CE(S)**	**Prob****
LGDPPC	86.95699	69.81889	None *	0.0012
LAGROUT	47.65527	47.85613	At most 1	0.0522
LEXR	27.63289	29.79707	At most 2	0.0871
LFDI	11.08180	15.49471	At most 3	0.2065
LOAD	3.909975	3.841466	At most 4*	0.0480

***Source*:** Researcher's Computation, 2021.

Table 3 above revealed agricultural output (LAGROUT), exchange rate (LEXR), foreign direct investment inflow (LFDI), gross domestic product per capital income (LGDPPCI) and official development assistance (LOAD) in Nigeria were co-integrated in the model using unrestricted co-integration rank test (trace), with the values of unrestricted co-integration test-trace is greater than the value of critical value at 5% level of significance. The test statistics indicates that the hypothesis of no co-integration among the variables is rejected. Thus, the variables were co-integrated in the model for the period of the study in Nigeria.

Regression Results of Fully Modified Ordinary Least Square (FM-OLS)

Table 5 the Empirical Results of FM-OLS Technique

Dependent Variable: LGDPPC

Method: Fully Modified Least Square (FM-OLS)

Variable	Coefficient	Std. Error	Prob.
LAGROUT	0.504380	0.219926	0.0302*
LEXR	-0.505200	0.243941	0.0484*
LFDI	-0.018914	0.086333	0.8283
LOAD	0.318359	0.110726	0.0080**
C	-1.144309	1.724134	0.5127
R-Square 0.797906			
Durbin Watson stat: 1.562947			

Significant at 10 %(*); 5 %(**) levels.

***Source*:** Researcher's Computation 2021

The regression results for gross domestic product per capital income (LGDPPC) model showed that coefficients of all the explanatory variables are positively signed except foreign direct investment inflow (LFDI) and were all statistically significant at 5% level. The regression result revealed positive and significant relationship between agricultural output (LAGROUT) and official development assistance (LOAD) in the model in Nigeria for the period between 1986-2019. Interestingly, the out-come supports the findings of Simon-oke and Abraham (2019), Taham, (2008) Orji, Eigbirewolen and Ogbuabor, (2014) and Fredrick and Abraham, (2019) to mention a few. Also, *ceteris paribus*, the results showed a robust negative and significant relationship between exchange rate (LEXR) and gross domestic product per capital income (LGDPPC. The results prove that a unit per cent decrease in exchange rate brings about 5 per cent increases in gross domestic product per capital income (LGDPPC) in Nigeria. The result showed that foreign direct investment inflow (LFDI) has a negative relationship in the model and not statistically significant; and this is not in agreement with aprior expectation. However, if all the explanatory variables excluded from the estimated model, the value of the constant is revealed at -1.144309 with a value negative. This means that the intercept value ($\propto_0$) is still negative in the model over the estimated years between 1986 to 2019

Test for the goodness of the model (Coefficient of Determination (R^2)

The values of R-square (R^2), are normal for the model, for example, the R square for gross domestic product per capital income model was 79%, showing that the variables (foreign direct investment inflow (LFDI), agricultural output (AGROUT) and exchange

rate (LEXR) captured in the model explained 79 per cent of the systemic variation in gross domestic product per capital income (LGDPPC) in the economy.

Regression Results of Interaction Fully Modified Ordinary Least Square (FM-OLS)

Table 6 the Empirical Results of FM-OLS Technique

Dependent Variable: LGDPPC

Method: (Interaction) Fully Modified Least Square (FM-OLS)

Variable	Coefficient	Std. Error	Prob.
LAGROUT	1.069393	0.972644	0.2825
LEXR	-0.238646	0.132837	0.0850
LFDI	-0.924063	0.231637	0.0005
LOAD	0.745537	0.471465	0.1269
LAGROUT*LFDI	0.088146	0.023306	0.0009***
LAGROUT*LOAD	-0.069735	0.057193	0.2346
C	-1.883668	7.611199	0.8066
R-Square 0.905812			
Durbin Watson stat: 1.5630950			

Significant at 10 %(*); 5 %(**); 1 %(***) levels.

***Source*:** Researcher's Computation 2021

The coefficient of determination increases with the inclusion of interaction terms; this showed that the interaction terms contribute to the performance of the model. The coefficient of interaction between agricultural output and foreign direct investment (LAGROUT*LFDI) is significant and has the expected sign. This showed that agricultural output cum FDI contributed to the growth of the economy in the period under review. One fact to draw from here is that for agriculture to play its role in the economy, it must be supported with investment from abroad. On the other hand, the coefficient of agricultural output cum official development assistance (LODA) (LAGROUT*LOAD) is not significant and does not have the expected sign. A good reason for this result may be that the larger part of the official development assistance (LOAD) to Nigeria is not channeled to agriculture.

Post- Diagnostic Test

Table 7 Wald Test

Test Statistic	Value	df	Prob.
F-statistic	102.6836	(6,26)	0.000
Chi-square	610.1013	6	0.0000

Source: Researcher's computation (2021)

The Wald Test is introduced to check if the independent variables jointly influenced the dependent variable. The F Statistic is 102.6836 and its probability value is 0.000; which showed that the probability value (0.000) is less than the 0.005 level of significance. It can be concluded that independent variables jointly influenced the dependent variable.

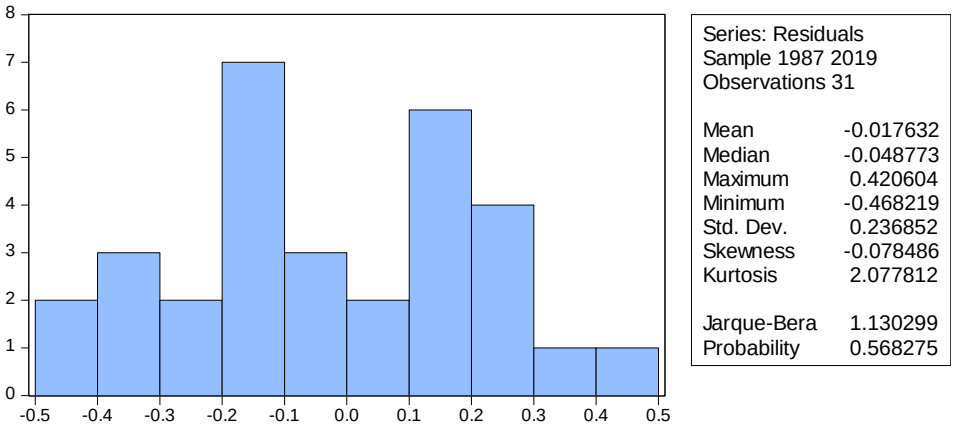

Figure 2 showed the normally test for the model. The Jarque – Bera is 1.130299 and the corresponding p- value is 0.5683. Since the p- value is greater than the 0.05 level of significance, it is therefore concluded that there is no problem of normality in the residual.

5.0 Summary, Conclusion and Policy Implications

The paper examined the effect(s) of capital inflow, agricultural output on economic growth in Nigeria, and data spanned from 1986 to 2019 sourced from the World Bank, Central Bank of Nigeria statistical bulletin, Annual reports and statistics, and the National Bureau of Statistics using fully modified ordinary least square (FM-OLS) estimation technique. The finding shows that the variables were co-integrated in the model using Johansen Co-integration test at 5% level of significance. The coefficient of regression result revealed positive and significant relationship between agricultural output and official development assistance in the model. The results are generally consistent with the previous findings such as Simon-oke and Abraham (2019), Orji, Eigbirewolen and Ogbuabor, (2014) and Fredrick and Abraham, (2019). Furthermore, coefficient showed a negative relationship between exchange rate and gross domestic product per capital income in the model and statistically significant. The study discovered that foreign direct investment inflow showed a negative and not significant in the model. Finally, the coefficient of interaction between agricultural output and foreign direct investment is significant and has the expected sign in the model. One fact to draw from here is that for agriculture to play its role in the economy, it must be supported with investment from abroad.

Recommendations

In order to address the aforementioned challenges the study, therefore, recommends that government should employ a more restrictive monetary policy to suppress the adverse effect that could emanate from inflationary pressure which can distort proper channeling

of capital inflows into the country and as well put in place a strategy for attracting more foreign investors capable of generating a higher volume of private investment that can have a significant impact on agricultural output.

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CORRUPTION AND INSECURITY IN NIGERIA: THE IMPLICATIONS FOR INDUSTRIALIZATION.

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Abstract

The objective of this paper is to examine the impact of corruption and insecurity on the industrialization in Nigeria. Data were sourced from Central Bank of Nigeria (CBN) statistical bulletin and bureau of statistics from 1990 to 2020.The Error Correction Models (ECM) technique was employed. The results showed that the disequilibrium in the economy can be adjusted back to equilibrium at a speed of 145% In essence the ECM result shows that industrialization model respond to a deviation from the long run equilibrium. Therefore, the following recommendations were made thus; the rule of law should be strengthened and Law enforcement agents should be equipped adequately to deal with the problem of insecurity and terrorism. There must be zero tolerance for corruption by the government and corrupt individuals who use their ill-gotten wealth to sponsor acts of terrorism should be prosecuted accordingly.

Keywords: Corruption; Insecurity; Industrialization

JEL Classification: F52, E22 and G38

1.0 Introduction

It would appear that the seeming increasing incidence of the twin evils of corruption and insecurity in Nigeria may not only be posing great challenge to governance but may also be hindering the drive for industrialization and impede economic growth in the country. This has made the matters of corruption and security issues of public concern. Arguably, the greatest hindrance to industrial development especially in the third world countries has been corruption and insecurity. The challenges of insecurity and corruption specifically explain the annual budgetary allocation to defense, in a bid to ensure security of lives properties. Consequently, the Transparency International and the Institute for Economics and Peace (IEP) respectively have sequentially rated Nigeria low as regards corruption and security matters. Perhaps an implication of this is that foreigners and even indigenes of Nigeria may consider the country a highly corrupt and unsafe place to live in or do legitimate business.

It has been asserted that the inability of government to provide a secure and conducive environment that effectively ensure the protection of lives, properties and enables peaceful environment for the conduct of business has contributed do the growing apathy among Investors in Nigeria (Anekwe, Ndubuisi-Okolo & Anigbogu, 2015).

It has also been noted that the menace of corruption in Nigeria is fundamentally a creation of the country's extremely individualized materialistic culture which accentuates struggle by individuals to gain as much wealth as they can without concern to how much wealth was acquired (Political Bureau Report, 1987) .Mba-Afolabi (1999), postulated that this situation has led individuals and groups of persons to pursue various illegal and anti-social means of making wealth. Similarly, according to Kwaja (2009) as cited by Osaretin (2013), 'clearly the institutional fragility of the state in terms of its inability to manage diversity, corruption, rising inequality between the rich and the poor, gross violations of human rights… have been the underlying causes of violent conflicts in Nigeria since the enthronement of democratic rule'.

Corruption and Insecurity are real menace to industrialization because businesses thrive tremendously in an atmosphere devoid of vindictiveness, economic, social, religious and political morass. .Corruption and insecurity is a real risk to human existence, economic growth and development. It seems that the government in Nigeria has not been doing enough to stem the tide of insecurity in the country. This is unfortunate because as provided for in the constitution of Nigeria, "The security and welfare of the people shall be the primary aim of government". It is thus obvious that the Government of Nigeria, by international customary law and by the provisions of the Nigeria Constitution has the duty of ensuring the security and wellbeing of the country and those of its residents. The government appears to be failing in this task in the face of the challenges Nigerians are weary and losing confidence in the ability of the government to tame the insurgency.

In financial or economic terms, the fight against the insurgents has impacted heavily on the nation's finance and economy. In 2013, for example, the government stated that the country spent 27% of its budget on internal security (Akpan, 2014:2). Both corruption and insecurity seems to be factors that are interwoven. For example, it has been suggested that endemic corruption in the country may have also had a place in the chronicle of why the Boko Haram sect were able to achieve so much in Nigeria (Odo, 2015). In a report by the Human Rights Watch in 2012, a Boko Haram spokesman quoted in the report explained that it was able to successfully carry out the August 2011 bomb attack on the UN office in Abuja because 'luckily for us, security agents were not out to work diligently but to find money for themselves and the N20 or N50 that was politely given to them gave us a pass' (Odo, 2015, p.52)

The predicament in which corruption and security challenges have led this nation is indescribable. It is an irony that citizens, of Nigeria- a nation gifted with both human and natural resources- travel in droves out of the country in search of greener pastures. Invariably, it is crystal clear that the current state of industrialization in Nigeria is mostly a function of government failure and careless attitude towards the poor masses. This is showcased by the inability of government to deliver public services and to provide basic needs for the masses like shelter, food and clothing. The dearth of basic needs occasioned by visionless and corrupt leaders in Nigeria has created a pool of frustrated people who are ignited easily by any event to be violent. The argument here, is that, Nigeria has the resources to provide for the needs of her people, but corruption in public offices at all

levels has made it impossible for office holders to focus on the provision of basic needs for the people. Nigeria earns a great deal of revenue through oil sales, but fails to use these earnings to meet the needs of her people and to develop basic infrastructure as well as the economy. When these situations exist, crime rate is bound to rise and the security of lives and properties cannot be guaranteed. Without security, the economic, social and political stability of the nation is in jeopardy. Corruption and Insecurity in the country not only affect foreign direct investment and business activities, it also affects business confidence and stability as numerous firms' losses confidence in establishing businesses in some states in Nigeria. What then can we do to curb the incidences of the twin evil of corruption and insecurity in Nigeria? This has been a continuous fundamental question that requires pragmatic assessment. This is the crux of the matter and the focus of this study. The broad objective of this study is to examine how corruption and insecurity have adversely hindered industrialization growth in Nigeria. The study spans over a period of thirty one years (1990 – 2020) both years inclusive. This has been determined by the availability of secondary data derived especially from Transparency International and the Institute for Economics and Peace (IEP). The study also has a national coverage for maximum utility.

2.0 Literature Review

Adebisi, Azeez, and Oyediji (2017) carried out a study on an appraisal of Boko Haram's insurgency on the agricultural sector in Nigeria. They adopted the time series data analysis research method from 1994 − 2013, while descriptive statistics and t-test were used to analyze the secondary data before and during the insurgency. The result of their findings showed that agricultural value added to the GDP was high before Boko Haram disruption and has reduced during the period of insurgency. Based on their findings, the study recommends that government should take legal and justifiable action to ensure that the ills caused by Boko Haram to the agricultural sector are addressed and farmers encouraged with better incentives to go back to farm.

Bandyopadhyay, Sandler and Younas (2014) investigating the impact of terrorism on Foreign Direct Investment and Gross Domestic Production of 78 developing countries for 1980-2013 and applying a system-GMM estimator to a dynamic panel, consisting of eight three year averages of all variables. They conclude that domestic terrorism has a negative and significant impact on FDI as a share of GDP.

Nwagbosa (2012), opined that, insecurity everywhere is a risk factor which business owners and managers dread and wish to avoid by relocating their businesses elsewhere. In the case of Nigeria, there is also evidence of some businessmen and manufacturing companies having to relocate particularly from the North in recent time, to other peaceful parts of the country. Adewale (2011), in investigating the crowding-out effects of corruption in Nigeria, concluded that the accumulation of the nation's economic resources for personal benefits, had contributed mainly to capital leakages from Nigeria for illegal deposits abroad. He further pointed out that the contributing effects of corruption on poverty and poor infrastructural development is more worrying.

Ujah and Eboh (2006) reported a study by World Bank on investment climate in nine African countries in which it was found that 29% of business operators in Africa and 36% in Nigeria perceived insecurity as a major constraint on investment. This situation has the damaging consequence of giving signal to the international community that

Nigeria is not a safe and secure place and as such not suitable for investment and business activities. In that case, foreign firms and entrepreneurs would decline to invest and this is particularly important in view of the efforts being made to create the desired atmosphere to attract foreign direct investment. So, it is a strong disincentive to business investment as it scares away potential investors. This is because such environments or economies are considered high risk zones due to the high level of uncertainty about the safety of investment and lives of the managers and their staff.

Stewart (2004) analyzed the effect of conflict and insecurity on development for twenty five countries between 1960 – 1995 and found that economic growth was almost always affected, agricultural sector was badly hit, exports were negative, production fell, there was a shift from international to domestic markets, imports went up dominated by military expenditure and essential consumption goods, usually leading to a shortage of foreign exchange for economic inputs., consumption per head fell, government revenue as a share of GDP mostly fell and foreign and private investments including government investment fell.

3.0 Research Method

For this study, the research design is quasi-experimental. In this type of design, like the experimental design method used in the natural sciences, researchers depend on data analysis techniques as a method of control. Specifically, it adopted the time - series type of the quasi-experimental design. This is because the time - series design is the most predominant design employed in the social sciences. In terms of strategy, this study employed the econometric technique of Ordinary Least Square Multiple Regression (OLS), Unit Root Test, and Co-Intergration. Our choice of OLS is informed by its quality of Best, Linear, Unbiased and Efficiency (BLUE). Unit Root test will be used to test for stationarity, while Co-intergration will be employed to test for long run relationship among the variables.

3.1 Model Specification

The theoretical framework of this work is rooted on the Endogenous growth theory. Endogenous growth theory developed in the 1980s, as a response to criticism of the neo classical growth model. According to Lucas (1988) Romer (1990) and Rebelo (1991) the theory holds that policy measures can have an impact on the long-run growth rate of an economy.

Following the theoretical propositions explored in the theoretical literature, the current study thus employs the pro-poor growth model adopted by Mahbub (1997). His model is specified thus:

GDP = f(DCI,TRI)……(1)

GDP = á0 +á$_1$DCI+ á2TRI + åi ……..…… (2)

Where: GDP = Gross Domestic Product, DCI= Discomfort Index, TRI= Terrorism Risk Index, á$_0$ = intercept, â$_1$= co-efficient of foreign reserves

The Model was slightly modified by adding Corruption Perception Index, Government expenditure on security and total Military spending. This gave birth to model 3 and 4 below

3.2 The Model

IND_t= f(CPI, GES, MIL)…… (3)

Linearizing the function gives multiple regression equation below as:

$IND_t = bo + b_1CPI_{t-1} + b_2GES_{t-1} + b_3MIL_{t-1} + U_t$….. (4)

Apriori Expectation b_0, b_1, b_2, $b_3 > 0$

Where,

IND = Industrialization (proxy by Manufacturing Sector's Output)

CPI = Corruption Perception Index

GES = Government Expenditure on Security

MIL= Military Spending

a_0 = Constant, $b_1 – b_3$ = Coefficients, t = is the time trend, Ut = Error Term

3.3 Data Required

Besides some relevant but not captured data, the following data will be required for our analysis; these include the following:

- data on Gross Domestic Products in US dollar for 31years (1990 – 2020)
- data on Nigeria Manufacturing Sector Output in US dollar for 31years (1990 – 2020)
- data on Nigeria Corruption Perception Index for 31years (1990 – 2020)
- data on Total Government Expenditure on Security for 31years (1990 – 2020)
- data on Military Spending for 31years (1990 – 2020)

3.4 Sources of Data

The data that will be used for this study will come primarily from secondary sources. That is, data will come principally from the publications of the Central Bank of Nigeria's (CBN) Annual Reports and Statement of Accounts; Economic and Financial Review: and Principal Economic Indicators. Furthermore, publications from the National Bureau of statistics (NRS): Annual Abstract of Statistics and the International Financial Statistics (IFS) published by the International Monetary Fund (IMF)

3.5 Model Estimation Techniques

Empirical investigations will be carried out on the basis of a sample of 31 annual observations covering the period 1990 – 2020. Five (5) variables will be considered in this study: Two basic techniques were employed in the analysis of the study. They are descriptive as well as econometric method of analysis (Ordinary Least Square OLS). In order to achieve this, the study used unit root test, co-integration modeling technique to analyze the relationship.

3.5.1 Descriptive Statistics

This is one of the methods economist normally use to investigate the cause-effect relationship between variables is through descriptive statistics. Descriptive statistics is that type of statistics that involves organizing, summarizing and presenting data in a meaningful form or usable format. Thus, in this research simple line graphs will be employed to analyze the trends on some of the variables in the study between 1990 and 2020.

3.5.2 Ordinary Least Squares (OLS)

While Econometric analysis shall be employed to vindicate the second and third objectives; to examine how corruption and insecurity affected industrialization and economic growth in Nigeria since 1900 – 2020. The regression model will establish the relationship among our variables of interest. The value of R^2 (Coefficient of multiple determination) and other test such as F-test; T-test shall be conducted to show the directional relationship among our endogenous and exogenous variables in question.

3.6.3 Unit Root (Stationarity) Test.

Also, because of spurious regression that may likely occur when OLS techniques are used especially, when the variables included were non-stationary therefore, we shall test for the stationary characteristics of the data. The order of integration (unit root) tests will be conducted for each variable. The order of integration test is used to identify whether or not data are stationary. Dickey-Fuller (AD); Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) test will be used.

3.6.4 Co-integration.

It has been observed that virtually, the body of statistical estimation theory is based on asymptotic convergence theorems which assume that data series are stationary. However, econometric tools are increasingly being brought on non-stationary data which are not even asymptotically consistent with the notions of convergence. Furthermore, far from being a special case, non-stationary is extremely common in Economic time-series. There are two tests for co-integration. The first is the Engle-Granger methodology and the second is Johansen's methodology. In our analysis, we shall focus on the Johansen's methodology.

3.6.5 Error Correction Model:

The ECM established the dynamic relationship, as well as indicate the speed of adjustment from the short-run to the long-run equilibrium state. When the variables were found to be cointegrated, an ECM model was developed.

4.0 Presentation of Results and Discussion

4.1 The Unit Root (Stationarity) Results

Macroeconomic data usually exhibit stochastic trend that can be removed through only differencing. We employed the Augmented Dickey Fuller (ADF) and Phillips Perron (PP) test the order of integration of the variables. The unit root tests were run for all the series at both level and first difference and, with constant and trend in the equation. As usual, the appropriate lag level applied in the unit root test follows the SIC criterion. The results of the ADF test are presented in the table below.

Table 1: Stationarity of the Time Series Data (ADF)

Variables	ADF Statistical with Intercept	Probability	Order of Integration
NDI	-5.340203*	0.0002	I(1)
CPI	-2.979497*	0.0560	I(1)
GES	-4.932730*	0.0011	I(1)
MIL	-4.066866*	0.0039	I(1)

*Source: Author's Computation*significant at 5 percent level*

Table 2: Stationarity of the Time Series Data (PP)

Variables	Phillips-Perron test statistics	Probability	Order of Integration
NDI	-2.972559*	0.0495	I(1)
CPI	-5.695865*	0.0001	I(1)
GES	-4.932730*	0.0011	I(1)
MIL	-4.077175*	0.0038	I(1)

*Source: Author's Computation *significant at 5 percent level*

The unit root result above shows that all the variables were stationary at first difference i.e. I(1) series. The result from the stationary test therefore calls for long-term relationship.

4.2 Johansen Co-Integration Test

The co-integration test establishes whether a long-run equilibrium relationship exist among the variables. To establish co-integration, the likelihood ratio must be greater than the Mackinnon Critical Value 5% levels of significance. Cointegration is a long-run relationship that exists among two or more variables. To establish cointegration, we employ the Johansen cointegration test as shown in table 3 below.

Table 3: Johansen Co- Integration Test Results

Date: 10/07/21 Time: 20:49
Sample (adjusted): 1998 2009
Included observations: 12 after adjustments
Trend assumption: Linear deterministic trend
Series: IND CPI GES MIL
Lags interval (in first differences):

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.991044	78.23096	47.85613	0.0000
At most 1	0.743469	21.64640	29.79707	0.3186
At most 2	0.357182	5.320316	15.49471	0.7739
At most 3	0.001465	0.017594	3.841466	0.8944

Trace test indicates 1 cointegratingeqn(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 *	0.991044	56.58456	27.58434	0.0000
At most 1	0.743469	16.32608	21.13162	0.2064
At most 2	0.357182	5.302722	14.26460	0.7032
At most 3	0.001465	0.017594	3.841466	0.8944

Max-eigenvalue test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Author's Computation

Using the trace statistics, table 3 shows one co-integrating equations at 5% significance levels. These implied that long run relationship exists among the variables. This led to the rejection of the hypothesis of no co-integration. Cointegration is a prerequisite for the error correction mechanism. Since cointegration has been established, it is pertinent to proceed to the error correction model.

4. 3 Error Correction Representation (Short- run)

This section deals with error correction estimation of the relationship among the series, since we have evidence of cointegration among the series through Johansen Cointegration Test. The ECM results are depicted as follows:

Table 4: ECM Result for IND Model

Dependent Variable: D(IND)
Method: Least Squares
Date: 10/09/21 Time: 04:01
Sample (adjusted): 1998 2008
Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.109449	0.429328	4.913376	0.0161
D(CPI)	0.784377	0.698394	1.123115	0.3432
D(CPI(–1))	0.620918	0.854495	0.726649	0.5200
D(GES)	-1.15E-05	5.98E-06	-1.921904	0.1504
D(GES(–1))	-2.65E-07	3.09E-06	-0.085835	0.9370
D(MIL)	-0.009418	0.012334	-0.763567	0.5007
D(MIL(–1))	0.043364	0.017547	2.471314	0.0900
ECM2(–1)	–1.452415	0.254119	5.715497	0.0106

R-squared	0.959351	Mean dependent var	1.551818
Adjusted R-squared	0.864504	S.D. dependent var	1.583167
S.E. of regression	0.582761	Akaike info criterion	1.913182
Sum squared resid	1.018830	Schwarz criterion	2.202560
Log likelihood	-2.522500	Hannan-Quinn criter.	1.730769
F-statistic	10.11469	Durbin-Watson stat	1.993927
Prob(F-statistic)	0.041866		

Source: Author's Computation

From the above tables (4), we derived the ECM equations:

$IND_t = 2.109449 + 0.620918CPI_{t-1} - 2.65E\text{-}07GES_{t-1} + 0.043364MIL_{t-1} - 1.452415ECM_{t-1}$

4. 4 Stability Test

The stability test is conducted to confirm the stability of the coefficients of the independent variables. The CUSUM Test was used to test the firmness of the coefficients.

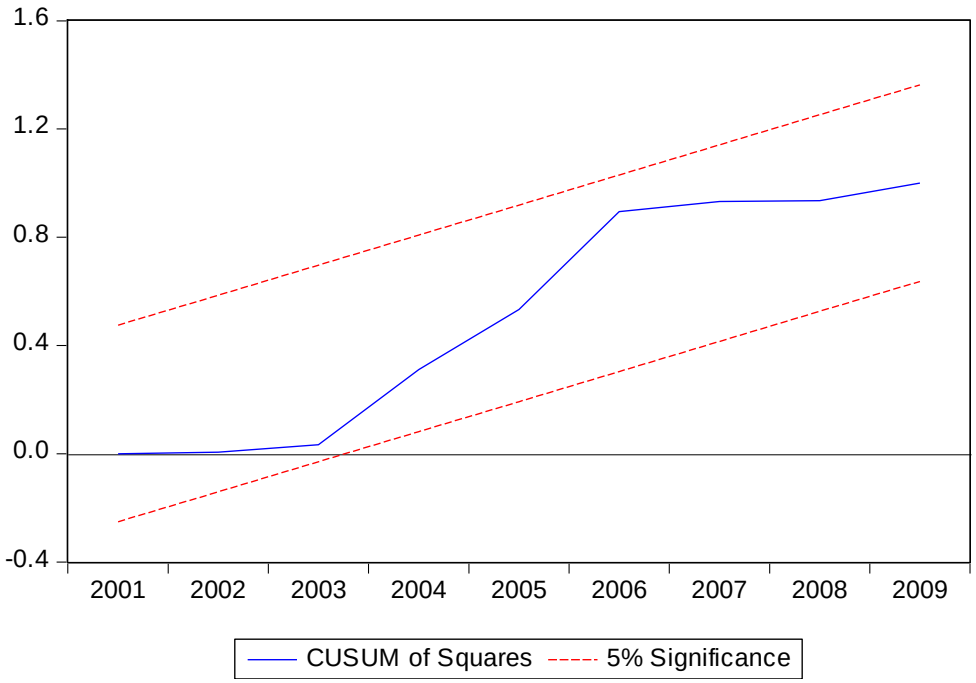

Figure 4. 4: CUSUM Test for IND Model
Source: Author's Computation.(E-View 9.0)

The result obtained from the stability test for the two models above showed that there is evidence of stability of the coefficient at 5% level of significance in CUSUM test since the cumulative sum is inside the area between the two critical lines.

4.5 Implication of Empirical Results

Industrialization: for industrialization proxy by manufacturing sector's output, the ECM result indicates that corruption perception index and military spending have positive but insignificant effects on industrialization in Nigeria; an increase perception index rating means a reduction in corruption level. A reduction level of corruption by higher index rating perhaps as a result of sound institutional legal framework will act as a booster to industrialization and hence increase manufacturing output. In like manner, military spending also has a positive impact on industrialization which invariably means that an increase in military spending could bring down the level of insecurity and thereby pave way for a conducive, articulated and peaceful atmosphere for business activities. This in the long run will boost industrialization in positive direction. However, security expenditure has a negative and insignificant relationship with industrialization. An excessive security expenditure is an indication of a high level of insecurity thus a major disincentive to investors. The ECM coefficient exhibited the hypothesized negative sign (–1.452415). The speed of adjustment to long run steady state is about 145 per cent. Importantly, it is statistically significant at 5 per cent level. The variables in the model explained about 96 per cent of total variation in IND. The entire ECM model is significant as evident from the F-statistic value of about 10.11469 and a corresponding probability value of 0.041866. The Durbin Watson value of 1.993927is approximately 2 which is the benchmark, an indication of the absence serial autocorrelation in the model.

5.0 Conclusion and Summary of findings

5.1 Summary of the Findings

The study focused on investigation of industrialization amidst corruption and insecurity in Nigeria. It set out a conceptual framework for analyzing the terms involved in the study such as industrialization, corruption and security situation in Nigeria, its forms as well as its levels. Efforts were made to explain the impact of the twin evil of corruption and insecurity on industrialization efforts, it is widely known that the development and productivity level of the industrial sector through adequate investment has an apparent impact on economic growth. Time series data were collected from 1990 to 2020 on Industrial Output, Corruption Perception Index rating, Total Expenditure on security and Total Spending on Military and to show the relationship empirically with the use of Error Correction Mechanism (ECM). It was found out that about 96% systematic variation in IND could be attributed toCorruption Perception Index rating, Total Expenditure on security and Total Spending on Military.

The effects of corruption and insecurity on industrialization are countless. Corruption and insecurity therefore pose a serious industrial development challenge to the nation as they threaten the developmental efforts of Nigeria as a nation. Since corruption gives birth to insecurity, there is need to first eliminate corruption also reduce the level of insecurity in Nigeria. The study showed that corruption, insecurity and other related variables could have a positive impact on industrialization in Nigeria, but their impacts on the dependent variable (IND) were not statistically significant

5.2 Conclusion

The prevalence of corruption and insecurity in any environment constitutes threat to lives and properties, hinders business activities, and discourages local and foreign investors, all of which strangle and retard the level of industrialization, the socio-economic growth and development of a country.

Good governance, transparency, accountability and the rule of law are necessary if the fight against corruption and by extension insecurity is to be achieved. Corruption and insecurity need to be eliminated from Nigeria to be able to effectively play its role as the giant of Africa and a force to be reckoned with globally. Eradicating corruption and insecurity from Nigeria is a task that should not be left to the government alone; all hands must therefore be on deck if the country is to be purged of this twin evil.

5.3 Recommendations

On the basis of the above summary, the following recommendations are made:

- The rule of law should be strengthened and Law enforcement agents should be equipped adequately to deal with the problem of insecurity and terrorism.
- There must be zero tolerance for corruption by the government and corrupt individuals who use their ill-gotten wealth to sponsor acts of terrorism should be prosecuted accordingly if found guilty.
- Federal government should provide the enabling environment for people to work

especially in the area of security of lives and property. This is against the back-drop that no meaningful investment activity can thrive in the face of corruption and insecurity.

- The donor agencies like the World Bank, UNDP, UNESCO, etc. should also be encouraged to inject funds into the security sector.
- The government and the private sector must join hands by mobilizing resources to furnish all security institutions and equip them with adequate facilities, bullets, war equipment, and modern instruments in order to improve the security of life and that of properties through human capital development and to ensure sustainable growth and development.
- Finally, government expenditure on human capital development should be increased to curtail insecurity, rather than excessive security expenditure to checkmate insecurity.

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THE SOCIO-ECONOMIC IMPACT OF CORONAVIRUS PANDEMIC IN SUB-SAHARA AFRICA

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Abstract

Following the increasing wave of global pandemic, this study examines the Socio-Economic impact of Coronavirus Pandemic (using its growth implications) in Sub-Sahara Africa (SSA) using the GMM technique of analysis. The study centred on 17 SSA countries from January to December, 2020. The findings revealed that Coronavirus pandemic exerts negative impact on socio-economic conditions and macroeconomic variables like unemployment, poverty rate, economic growth, household welfare, social vices amongst others. The results also showed that government expenditure significantly increased during the period in a bid to curb the pandemic. Household welfare degenerated and was negatively affected with high poverty rate. The work recommended that the government of affected nations provide adequate relief support to cushion the effect of loss of income to the poor and vulnerable, invest in the health sector to curb infectious and pandemic diseases.

KEYWORDS: COVID-19, Economic growth, Poverty, Socio-economic, Unemployment

JEL Codes; C23, C33, O11, R11

1.0 Introduction

The soaring cases of Coronavirus (COVID-19) pandemic with fatalities at global, national and local levels triggered economic downturn in many economies including the Sub-Sahara Africa (SSA) due weak infrastructural facilities and poor welfare policy. This has become worrisome and a source of deep concern to economists, policy makers and the citizens at all levels. Reports from National Centre for Disease Control (NCDC 2020) and Worldometer report (2020) show a rising trend in the cases of infected persons on daily basis depicting the catastrophic transmission nature of the pandemic across the globe. Records from Sub-Saharan Africa depict similar trend nature of the pandemic. COVID-19 has spread across the globe and it was first reported in Wuhan, China in December 2019. The pandemic is projected to have devastating effects on the global economy which is projected to contract sharply by 3 per cent, while the economy of SSA would contract by 1.6 per cent in 2020. Furthermore, World Bank has projected that the African economy on the aggregate would contract by 2.6 per cent, with adverse

effect on the employment rate. Similarly, businesses in Africa would be significantly affected by the COVID-19 pandemic as high proportion of businesses would go under (World Bank, 2020). AFDB (2020) predicted an economic contraction for the continent of 3.4%. Covid-19 has posed serious public health challenges across the world with high rate of infections and fatality. The rampaging Covid-19 pandemic has adversely affected Sub Sahara Africa and the entire world both socially, politically and economically. Globally, the economic activities of enterprises and organizations have been seriously affected. More troublesome is the ravaging spike of the second wave of the corona virus with the fear of increased infections, customers' loss of revenue, inherent economic recession and heightened insecurity which in turn reduces consumption and spending (Ngutsav & Ijirshar, 2020). Thus, Covid-19 crisis has affected adversely several sectors of the economy such as manufacturing, sports, agricultural, education, banking, aviation, hospitality and transportation etc.

The pandemic has had a devastating effect on the economy. In fact, three months after the outburst of the pandemic, the economic growth of Sub-Saharan Africa was projected to regress from +2.4% in 2019 to between –2.1 and –5.1% in 2020 (Calderon, et al 2020), with imminent recession. Although, African countries have put a number of control measures to check the spread of the virus. These measures include: closure of schools, restriction of domestic and international travel, use of protective equipment and hand hygiene as well as imposition of curfews and lockdowns (World Bank, 2020). These measures have affected SSA economies in various ways including global supply chains. This is likely to have socio-economic implications for Sub Saharan economies and other indices of the continental development as it affects a whole range of socio-economic variables. This study examines socio-economic impact of (COVID-19) Pandemic in Sub Sahara Africa with Community experiences.

This study is organized into five sections. Section one is the introduction and section two contains literature review, while section three x-rays the methodology; Section four is the analysis of results of findings. Finally, section five contains discussion of policy implication, recommendations and conclusion as well as suggestions for further study.

2.0 Literature Review

Coronaviruses diseases is an infectious disease caused by severe acute respiratory syndrome coronavirus which was first discovered in Wuhan, China in December 2019 and has become a global pandemic (Yonar, Yonar, Tekindal & Tekindal, 2020) and (Stanley, Ayodeji & Stanley, 2020). With its high mutation rate, coronaviruses are zoonotic pathogens that are present in humans and various animals causing infections in respiratory, gastrointestinal, hepatic and neurologic systems (Gilbert, 2020). Some of the reviewed studies suggest that a pandemic-induced socioeconomic downturn will put pressure on businesses and banks' loan portfolios and can lead to a large withdrawal of deposits, particularly in poor and developing countries (Beck, 2020; Lagoarde-Segot & Leoni, 2013).

Ajibo, Chukwu and Okoye (2020) investigated Covid-19 and lockdown experiences in Nigeria in 2020. Their findings revealed that Covid-19 had catastrophic impact on the Nigerian economy and individual wellbeing. Furthermore, a qualitative study by Ajibo (2020) examined the effect of Covid-19 on Nigerian socio-economic wellbeing and

health sector pandemic preparedness in 2020; the outcome showed that Covid-19 had distressing impact on the socio-economic wellbeing of Nigerians; the health sector was poorly equipped and unprepared to handle the pandemic.

Ngutsav and Ijirshar (2020) asserted that, the COVID-19 pandemic has had a devastating effect on the Nigerian economy in numerous ways, particularly in the supply and demand sides of SMEs. Thus, on the supply-side, firms experience a decrease in the supply of labour, because employees may fall sick, yet they have to look after their children or some dependents, schools are shut down and people's movement are restricted in order to curtail the spread of the pandemic. This situation affects capacity utilization. Also, in terms of demand-side, there is a probability of an abrupt and dramatic loss of demand and in consequence, revenue for SMEs. This limits the ability of SMEs to function, and this leads to serious liquidity shortages. In addition, consumers loss income, there is fear of being infected by the pandemic, as well as fear of uncertainty which makes consumers to reduce spending and consumption. In fact, the effects are further deepened by employees' layoff and inability of companies to pay salaries. Moreover, a lot of businesses have been affected by low demand for their services and products and supply chain disruptions as a result of weakened consumer purchasing power due to the pandemic (Ngutsav and Ijirshar, 2020).

Sopko et al (2020) affirmed that COVID-19 pandemic appears to have had a devastating effect on social security especially in developing economies like Nigeria. They further stated that the pandemic has paralyzed virtually all economic activities of organisations and enterprises, affected the demand and supply sides of the organisations and enterprises and therefore leaving employees with the likelihoods of survival via social security packages. Thus, SMEs have significantly laid off several employees, reduced their monthly expenses on employees' welfare and worsened the state of social security of workers.

In fact, the world is undergoing a global crisis different from what we are used to in terms of currency, financial and debt crises (Salisu et al., 2020). Markets and investors are facing a high degree of uncertainty due to both financial and physical effects of the pandemic (Baek et al., 2020). The outspread of the pandemic has significantly raised the uncertainty surrounding economic activities and this would upturn the financial institutions' hesitancy to make loans available.

Shruthi & Ramani (2020) carried out a research on statistical analysis of impact of COVID-19 on India's commodity markets, by depending on the current environment and using it to assess the public health actions, fiscal policies, and contracting procedures that were executed during the period. The study evaluated the unpredictability transmission over the financial crisis. Newly established connection in instinct response variance and functions test to everyday data from January 2020 were implied. Statistics were divided into two intervals (pre-COVID period and the post-COVID period) in order to acknowledge the consequence of the food cost crisis.

Salisu et al. (2020) carried out a study on COVID-19 global fear index and the predictability of commodity price returns. In the study, the global fear index (GFI) for the COVID-19 pandemic was subjected to empirical analysis by examining its predictive power in the likelihood of price returns of commodity during the pandemic. All the territories and regions of countries in the globe were considered in construction of the

index. The results disclosed an indication of a positive relationship between the global fear index and commodity price returns. This result confirms that commodity returns upsurges as COVID-19 related fear rises.

Udmale et al. (2020) carried out a study on global food security in the context of COVID-19: A scenario based exploratory analysis. The study recognised the foremost players in the world food equilibrium and probable implications of COVID-19 on the cereal supply in the globe and Sustainable Development Goal (SDG) - 2 (zero hunger). The study showed that four developing countries from Asia, fifteen from Africa, six from Oceania and ten from Latin America are the key countries that are prone to changes in food supply shocks. The study came to the conclusion that the present COVID-19 pandemic may probably cause temporary food insecurity across such susceptible countries. In addition, the pandemic's impact may lengthen as a joint effect on food security and upturn poverty, slowdown the economy and impede food access and supply, beyond 2020.

All Continent reported cases of coronavirus. In Africa, Egypt was the first to confirmed covid-19 case on 14 of February, 2020. China is the leading commercial partner for African countries and this accounted for the fast importation of the disease fast spread. Joint external evaluation and SPAR metrics were both designed to quantify every country's functional capability, without accounting for any indirect factors that might compromise the control of developing plagues, like environmental, demographic, political conditions and socioeconomic. Also infectious disease account factors for these and inform epidemic risk index, developed by the EU joint research centre in partnership with World Health Organization to report different effect combined of every country's widespread transmission risk, vulnerability, infrastructure, capacity and coping. Egypt, Algeria, and South Africa were the countries at highest importation risk from China, with moderate to high SPAR capacity scores (87, 76, and 62, respectively) and IDVI (53, 49, and 69, respectively (UNDP 2020). Hitherto, there is no treatment option or vaccine for this viral disease that arose suddenly. In general, with this information, there is no effective treatment to treat coronavirus (COVID-19) infection. SARS-CoV and MERS-CoV particles are being tested for coronavirus in vitro and human based trials (Giordano et al 2020)

At the end of November 2020, Nigeria has recorded over 61,000 cases of the coronavirus infections. This same trend of spread has been observed and recorded in most of the Sub Sahara Africa. The virus keeps spreading day and night, though the minister of health in Nigeria, Dr Osagie Ehanire, announced various non-pharmaceutical approach and safety measures to the diseases (NCDC, 2020). The surge of the coronavirus pandemic has been aggravated by the spike of the second wave which continued unabated with high fatality and severity. This calls for concern to all and sundry.

3.0 Research Methodology

3.1 Theoretical Framework and Model Specification

Given the growth implications of the COVID 19 pandemic on the Sub Saharan economies, the endogenous growth model propounded by Romer (1994) and Lucas (1988) will be adopted in the study. This model is generally referred to as the *AK* model, which is simply expressed as $Y = AK \ldots\ldots (1)$. Where Y is national output, K is the aggregate capital and A is a constant that measures the quantity of output produced for

each unit of capital. It is important to note that capital in this context is not subjected to the principle of diminishing returns as capital is made up of both human and physical capital. Although human or knowledge capital exhibits increasing returns to scale; the physical capital which is in the form of plant and equipment exhibits decreasing returns to scale. Todaro (2012) derived the mathematical equivalence of the endogenous growth model. However, it was simplified further by the researchers as follows:

$Y_t = F(K_t, L_t)$ 1

In the model, each industry exhibits constant returns to scale, however, the economy-wide capital stock; $K^{ß}$ enables the entire economy to exhibit increasing returns to scale.

$Y_i = AK_i^{\alpha} L_i^{1-\alpha} K^{ß}$ 2

By symmetric assumption across industries

$Y = AK^{\alpha+ß} L^{1-\alpha}$ 3

Differentiating (1) wrt time, we have

$$\dot{Y} = \frac{\partial Y}{\partial K} \cdot \frac{\partial K}{\partial t} + \frac{\partial Y}{\partial L} \cdot \frac{\partial L}{\partial t} 4$$

From (3) $$\frac{\partial Y}{\partial K} = A(\alpha+ß)K^{\alpha+ß-1} \cdot L^{1-\alpha} \quad 5$$

$$\frac{\partial Y}{\partial L} = A(1-\alpha)K^{\alpha+ß} \cdot L^{1-\alpha-1} \quad 6$$

Connecting (4), (5), (6) together, produce relation (7)

$$\dot{Y} = A(\alpha+ß)K^{\alpha+ß-1} \cdot L^{1-\alpha} \cdot \frac{\partial K}{\partial t} + A(1-\alpha)K^{\alpha+ß} \cdot L^{1-\alpha-1} \cdot \frac{\partial L}{\partial t} \quad (7)$$

$$\dot{Y} = A(\alpha+ß)K^{\alpha+ß} \cdot \frac{\partial K/\partial t}{K} \cdot L^{1-\alpha} + A(1-\alpha)K^{\alpha+ß} \cdot L^{1-\alpha} \cdot \frac{\partial L/\partial t}{L} \quad (8)$$

Factor out $Y = AK^{\alpha+ß} \cdot L^{1-\alpha}$ in (3) from (8)

$$\dot{Y} = AK^{\alpha+ß} \cdot L^{1-\alpha}\left[(\alpha+ß) \cdot \frac{\partial K/\partial t}{K} + (1-\alpha) \cdot \frac{\partial L/\partial t}{L}\right] \quad (9)$$

Replace Y in (9)

$$\dot{Y} = Y\left[(\alpha+ß) \cdot \frac{\partial K/\partial t}{K} + (1-\alpha) \cdot \frac{\partial L/\partial t}{L}\right] \quad (10)$$

Divide through (10) by **Y**

$$\frac{\dot{Y}}{Y} = (\alpha+ß) \cdot \frac{\partial K/\partial t}{K} + (1-\alpha) \cdot \frac{\partial L/\partial t}{L} (11)$$

Recall that $\partial K/\partial t = \dot{K}$ *and* $\partial L/\partial t = \dot{L}$

Therefore $$\frac{\dot{Y}}{Y} = (\alpha+ß) \cdot \frac{\dot{K}}{K} + (1-\alpha) \cdot \frac{\dot{L}}{L} (12)$$

Recall that at steady state, $\Delta K/K = \Delta Y/Y = sA$, *and* $\frac{\dot{L}}{L} = n$, *thus* $\frac{\dot{Y}}{Y} = \frac{\dot{K}}{K} = g$

By substituting into 12, we have

$$g = (\alpha+\beta) \cdot g + (1-\alpha) \cdot n$$

$$g - (\alpha+\beta) \cdot g = (1-\alpha) \cdot n$$

$$g(1 - (\alpha+\beta)) = (1-\alpha)n$$

$$g = \frac{(1-\alpha)n}{(1 - (\alpha+ß))}$$

$$g = \frac{(1-\alpha)n}{(1 - \alpha - ß))}; \quad \textbf{13}$$ subtract the growth rate of labour force from *(13)*

$$g - n = \frac{(1-\alpha)n}{(1 - \alpha - ß))} - n$$ *by L.C.M*

$$g - n = \frac{ßn}{(1 - \alpha - ß)} \quad 14$$

Equation 14 suggests that the growth rate of per capita income will rise perpetually as driven by forces (capital and knowledge based contributions to output) within the model. It will be developed upon to capture governmental presence. Recall that government revenue is generally classified as a fiscal variable. Fiscal policy has persistently been used to influence economic activities in many developing and developed countries. Fiscal policy can influence private investment and in turn the performance of an economy through three main channels. These channels are essentially fiscal policy variables, namely: public investment, government deficits and cost of capital. These policy variables are cleverly modified and incorporated in the model specification section.

Given the availability of panel data in the study, we do some important modifications and adjustments of the endogenous growth model as developed by Romer (1994). For instance, we incorporated the federal revenue, the capital stock and labour employment and contribution to national output. Hence, from equation 1, we present a functional equation specified below:

$$Yi = f(RSi, KSi, LESi,) \quad 15$$

Where, ***Yi*** is real gross domestic product. *RSi*is revenue allocation. *KSi* is capital stock. *LESi* labour employment. The econometric specification is shown below as:

$$Y_{it} = \pi_1 + \pi_2 RS_{it} + \pi_3 KS_{it} + \pi_4 LES_{it} + U_{it} \quad 16$$

$$i = 1, 2, 3, 4, 5, 6, \ldots 17$$

$$t = 1, 2, 3, \ldots, 12$$

Where ***i,*** denotes the cross section identifier for country and ***t,*** denotes the time identifier for each month. In the model, the maximum of *N*-cross sectional observations is 17, while a maximum of *T* time periods is 12. Since each country has same number of time series (i.e., 12 months) observations, then the only recommendable technique to be adopted for the study is the balanced panel. The assumptions that the independent variables are non-stochastic and that the error term *Uit*is $E(Uit) \sim N(0, \sigma^2)$ are valid in the study.

Introducing the control variable such as the household welfare (HHW) which was captured by private consumption per capita, equation 16 becomes:

$$Y_{it} = \pi_1 + \pi_2 RS_{it} + \pi_3 KS_{it} + \pi_4 LES_{it} + \pi_5 HHW_{it} + U_{it} \qquad 17$$

The main econometric analysis will involve the Generalized Method of Moments (GMM) technique with preliminary analyses which include: trend analysis, descriptive statistics, Augmented Dickey-Fuller and Phillips Peron (PP) unit roots test and Granger Causality test (Ohiomu & Ogbeide-Osaretin, 2020).

3.2 Data Sources

The data for the study was obtained from the 'worldometer' records, and World Development Indicators as well as country's specific database for 17 countries in SSA for twelve months (from January – December 2020). These include: Cote d'Ivoire, Ghana, Liberia, Nigeria, and Sierra Leone from West Africa: Uganda, Ethiopia, Rwanda, Kenya, and Tanzania East Africa: Namibia, Angola, Botswana, Lesotho, Congo DR, Mozambique and South Africa from Southern Africa. The choice of these countries was entrenched on the availability of data and also the researchers ensured that the different parts of SSA are covered in this work.

4.0 Presentation of Results and Discussion of Findings

This section presents and interprets the GMM estimation results on the socio-economic impact of coronavirus in SSA following preliminary tests using descriptive statistics, panel stationarity tests.

4.1 Descriptive Statistics

Table 1 below provides the descriptive cornices statistics of the variables used for the analysis in order to reveal some underlying features. The table shows that the average monthly output value 27,569.37.The maximum and minimum values of the variable suggest that there is a wide gap during the period under study. This is confirmed by the high standard deviation value of 37,734.90 which indicate that many of the values are highly dispersed from the mean. The Jarque-Bera (J-B) value is highly significant at the 1 per cent level indicating that the density function of the series is not normally distributed. The null hypothesis of the J-B test is that the variable is normally distributed; hence we reject the null hypothesis and accept the alternative hypothesis that the series is non-normally distributed. The skewness is positive at 1.28 and indicates that the output figures for most of the states lie to the left of (are less than) the mean value. The kurtosis value is high at 3.32 and indicates the presence of extreme values which may generate heteroskedastic variations in the data. The data set is highly leptokurtic and shows that extreme outliers in the output values may generate heterogeneity issues in the analysis. Similar description applies to other variables in the model.

Table 1: Descriptive Statistics

	Y	RE	KS	LES	HHW
Mean	27569.37	5153.387	18255.22	1131912.	20.31299
Median	6102.422	753.7047	5696.390	526122.9	14.25754
Maximum	127762.5	25079.72	94144.96	4256414.	76.75887
Minimum	144.8312	14.47117	94.33000	6876.000	0.224801
Std. Dev.	37734.90	7536.495	26975.26	1245136.	18.03428
Skewness	1.279906	1.337830	1.702754	0.816662	1.658008
Kurtosis	3.322978	3.431295	4.639801	2.489151	4.827382
Jarque-Bera	10.54017	11.62986	22.62019	4.637126	22.69753
Probability	0.005143	0.002983	0.000012	0.008415	0.000012
Sum	1047636.	195828.7	693698.3	43012650	771.8938
Sum Sq. Dev.	5.27E+10	2.10E+09	2.69E+10	5.74E+13	12033.70

Source: Authors compilation from E-views

The low values of skewness of most variables reveal that most of the states' averages are around the mean value. The J-B values for all the series are significant at the 1 percent level and indicate that the series are not normally distributed. This outcome clearly shows that the use of panel data analysis procedure for the estimation of the relationships in this study is appropriate considering the heterogeneity in all the data series.

4.2 Panel Stationarity Test

In this section, we check for the unit root (stationarity) properties of the individual variables. To do this, we apply a summary of the major panel unit root tests methods of Levin, Lin & Chu (LLC), Im, Pesaran & Shin (IPS), ADF Fisher Chi-Square and PP Fisher Chi-Square. This is due to the fact that the LLC and IPS (the two major panel unit root tests commonly used in the literature) may produce conflicting stationarity results for some of the variables, making it difficult to take a decision on the whether the variable is stationary or not. The summary of the tests is presented in table 2 below.

Table 2: Summary of panel unit root tests

Variable	LLC Test/ (Probability)	IPS Test/ (Probability)	ADF Fisher/ (Probability)	PP Fisher/ (Probability)	Remark
Y	-5.72276 (0.0002)	-5.21455 (0.0001)	81.1634 (0.0004)	122.158 (0.0003)	Stationary I(1)
RE	-5.42322 (0.0001)	-6.43654 (0.0000)	98.8134 (0.0002)	181.457 (0.0000)	Stationary I(1)
KS	-3.16202 (0.0011)	-4.41230 (0.0001)	72.2877 (0.0002)	132.624 (0.0004)	Stationary I(1)
LES	-3.11155 (0.0013)	-4.78113 (0.0000)	76.4228 (0.0000)	161.537 (0.0000)	Stationary I(1)
HHW	0.32154/ (0.4860)	-5.35281 (0.0000)	82.6177 (0.0002)	131.217 (0.0001)	Stationary I(1)

The probability value are indicated in parenthesis
Source: Authors compilation from E-views

The stationarity tests reveal that all the variables are integrated at order one (that is, after first differencing).

4.3 Co-integration Test

Table 3: Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.751372	110.1983	68.71889	0.0000
At most 1 *	0.569386	60.09357	46.55613	0.0024
At most 2	0.399685	29.76201	28.99707	0.0505
At most 3	0.192626	11.39118	14.89471	0.1886
At most 4	0.097380	3.688341	4.341466	0.0548
Trace test indicates 2 cointegratingeqn(s) at the 0.05 level				
'* denotes rejection of the hypothesis at the 0.05 level'				
'**MacKinnon-Haug-Michelis (1999) p-values'				

Co-integration Rank Test (Maximum Eigenvalue)				
Hypothesized		**Max-Eigen**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None *	0.751372	50.10471	32.77687	0.0003
At most 1 *	0.569386	30.33156	28.28434	0.0216
At most 2	0.399685	18.37083	22.33162	0.1166
At most 3	0.192626	7.702837	13.76460	0.4097
At most 4	0.097380	3.688341	3.641456	0.0548
Max-eigenvalue test indicates 2 cointegratingeqn(s) at the 0.05 level				
'* denotes rejection of the hypothesis at the 0.05 level'				
'**MacKinnon-Haug-Michelis (1999) p-values'				

Source: Authors compilation from E-views

The results show that both trace test and Max-Eigen value test indicated that there are at least two co-integrating vector in the model as shown in table 3. This implies there is a long run relationship among the variables.

We further conduct a panel co-integration test to confirm if the variables have long-run relationships using the Kao co-integration tests. The Kao test in Table 4 below reveals that there is co-integration and long-run relationship between all the variables in the model. The null hypothesis of no co-integration is rejected at the 5 percent level of significance.

Table 4: Kao Co-Integration Test

Null Hypothesis: No co-integration

	t-Statistic	**Prob.**
ADF	1.940174	0.0262
Residual variance	4662.212	
HAC variance	456.1776	

Source: Authors compilation from E-views

Based therefore, on a majority of the results from the Kao, Trace statistics and Maximum Eigen value, we conclude that there is a long run relationship between the variables.

4.4 The GMM Results

The panel data estimation procedure employed in this section assumes that the biases in the pooled data could either come from cross-sectional heterogeneity or time series (periodic) variations. The estimation of the model is also carried out using the System GMM. The summary of the estimation results, the Hansen test and the GMM are contained in Tables 5 below.

Table 5: The GMM Estimation Results

	GMM
Explanatory Variable	**Coefficient/(p-value)**
RE	4.800727 (0.0000)
KS	3.780938 (0.0002)
DKS	5.434727 (0.0000)
LES	2.46713 (0.0002)
HHW	-6.52147 (0.0004)
C	-95.2788 (0.0647)
Diagnostics and Summary Measures	
R-squared	0.662288
Adjusted R-squared	0.583234
F-statistic	n/a
Prob(F-statistic)	n/a
Durbin-Watson stat	1.452434
Hansen Test **(p-value)**	4.626541 (0.052023)

Source: Authors compilation from E-views 9

The result shows that the model passed the Hansen test of valid instrument and the null hypothesis was accepted that all instruments are valid given a Hansen/J statistics of

4.626541 and a probability of (0.052023). The model was well fitted given an R^2 of 0.66223488 indicating that 66% of the variation in the dependent variable is accounted for by the explanatory variables. The DW statistics was 1.452434. This outcome does not threaten the model given that the use of GMM technique of estimation can also correct the occurrence of heteroscedasticity and serial correlation that may occur in this model.

On close examination of the relationship and impact of the independent variables, the result showed that HHW came with a negative significant impact on Y. As a result of the pandemic, the economies degenerated to the extent that household welfare in SSA is adversely affected and impoverished.RE, KS and LES showed a positive significant impact on Y. Although the positive relationship was against our expectation during this coronavirus pandemic, they were also found significant indicating that policy measures towards reducing the impact of the pandemic should focus on these variables. The coefficient of RE indicates the need to enhance the revenue generation of governments in the SSA economies.

Similarly, the degree of capita stock variable passes the significance test at the 1 per cent level and has a positive coefficient of 3.78 signifying that a unit increase in KS will cause a far more than proportional increases in Y. The LES variable is equally significant at the 1 per cent level and positively signed. This conforms to a priori expectation of a significant positive relationship between labour employment and economic growth. As the coronavirus pandemic slowed down the economic growth, it also leads to loss of jobs and increase unemployment through lockdowns in the various economies in SSA. The control variable in the model (HHW) is significant but negatively signed.

4.5 Discussion on the findings and policy Implication

The outcome of the study showed that coronavirus exhibited negative and substantial impact on socio-economic conditions and macroeconomic variables like unemployment, poverty rate, and economic growth, amongst others in Sub Sahara Africa. The government of the affected countries should embark on massive productive investments to reinvigorate and re-engineer their economies. Government revenue generation reduced drastically as a result of coronavirus, restrictions in movements, pandemic protocols and business lockdowns. This invariably affected the revenue allocated to the tiers of government in SSA with negative impact on output. The SSA countries should diversify the revenue base of their economies to cushion the effect of unprecedented shock due to the pandemic. Productive investments in agriculture, rail construction, aviation, mining, hospitality, amongst others are highly recommended in SSA countries.

The results also showed that government expenditure significantly increased during the period in a bid to curb the pandemic. This has led to unplanned borrowing thereby increasing the debt stock with excruciating debt burden in SSA countries. Household welfare degenerated and was negatively affected with high poverty rate in Sub Sahara Africa. The level of development in these SSA countries deteriorated as a result of the pandemic. Consumption per capita of the citizens was eroded by the pandemic especially the vulnerable in the society. Palliatives and assistance in the form of transfer payments to the vulnerable in the society are recommended for the SSA countries.

5.0 Summary, Conclusion, and Recommendations

5.1 Summary

The study examined the Socio-Economic impact of Coronavirus Pandemic (using its growth implications) in Sub-Sahara Africa (SSA) using the GMM technique of analysis. The study focused on 17 SSA countries from January to December, 2020. The findings revealed that Coronavirus pandemic exerts negative impact on socio-economic conditions and macroeconomic variables like unemployment, poverty rate, economic growth, household welfare, social vices amongst others. The results also showed that government expenditure significantly increased during the period in a bid to curb the pandemic. Household welfare degenerated and was negatively affected with high poverty rate.

5.2 Conclusion

This study set out its objective to examine socio-economic impact of (COVID-19) Pandemic in Sub Sahara Africa. In order to estimate the coefficients of the variables employed in the study, several econometric tests were conducted using panel data on generalised methods of moments (GMM). The findings revealed that Coronavirus pandemic exerts negative impact on socio-economic conditions and macroeconomic variables like unemployment, poverty rate, economic growth, social vices amongst others.The socioeconomic impact of pandemic the SSA and world is enormous and recurrent. Predicament, hardship, massive job losses and foregone income for self-employed workers are common features recorded by the researchers from the field. From the various countries, there exists underlying inequality in access to resources and technology and this has amplified the impact of the crisis on certain segments of society, including those living in informal sectors and those in vulnerable employment. Community experiences are tremendous and quite enormous throwing up negative influences on major socio-economic indicators of living; social vices, insecurity, gender based violence, poverty, unemployment, despondency, and business loses were recurrent phenomena during the study. The pandemic erased the progress made over the last decade in terms of health, education and income in SSA and the entire globe.

5.3 Recommendations

- The study recommends that the governments of the SSA should provide the enabling protective preventive environment coupled with health policies that will help curb infectious and pandemic diseases to entrench sustainable growth and development in SSA. Reducing inequality and ensuring greater equity with respect to capacity and access to resources and technology during Covid-19 and post-Covid-19 recovery phase has the potential to mitigate the negative impact of the pandemic and build resilience to future shocks following the reported spike in the second wave of corona virus.

- The study also recommends that The SSA countries should diversify the revenue base of their economies to cushion the effect of unprecedented shock due to the pandemic, provide an enabling environment for the real sector to grow, provide adequate relief support to cushion the effect of loss of income to the poor and vulnerable, invest in the health sector with implementable health policies that will

help curb infectious and pandemic diseases which negatively impact on sustainable development and growth in SSA.

- Palliatives and assistance in the form of transfer payments to the vulnerable in the society are recommended for SSA countries.
- Finally, the SSA countries should carry out productive investment schemes in their economies to generate employment and stimulate growth

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INTEREST RATE CONCERNS IN FINANCIAL DEEPENING PROCESS: EMPIRICAL EVIDENCE FROM NIGERIA

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Abstract:

Financial deepening is expected to come with increase in financial assets, thereby making it an ideal pathway for finance-deficit countries like Nigeria. Since the adoption of the Structural Adjustment Programme (SAP), little improvements were noticeable, despite the liberalization of the country's financial sector. This is why it set to empirically determine the impact of interest rates on financial deepening, as proxied by private sector credit to GDP ratio (CPSR). The study used data from 1981 to 2020, and the Autoregressive Distributed Lag (ARDL) techniques, and found strong evidence of long-run relationship between interest rates and financial deepening. The findings of the study revealed that there a theoretical and positive relationship between interest rate spread, lending rate, broad money ratio and real interest rates with financial deepening, except for monetary policy rate. The study concluded that interest rate levels in Nigeria are impediments to financial deepening, and recommends the appropriate controls and management of interest rate drivers, such as money supply and inflation.

Keywords: Interest rate, Credit, Financial deepening, Financial Liberalization, ARDL, Nigeria

JEL classification: E430; E510

1.0 Introduction

Clearly, one of the most well-known research topic in finance, economics and development is financial deepening and how it impacts on economic growth. Financial deepening is based on the reason that if the financial system is liberalized, it will position it to become more competitive and efficient to support economic growth (Nwanna & Chinwudu, 2016). This is the thought behind conceptualizing financial deepening as the expansion of financial assets to boost savings for investment (Nzotta & Okereke, 2009). One of the major presumptions of financial deepening is a proficient and liberalized financial system means that economies that don't have it are shallow and less developed (Okoli, 2012). McKinnon (1973) and Shaw (1973) were the main promoters of financial liberalization in the early 1970s, where they contended that a liberalized financial sector goes before increase in savings, investments and economic growth (Orji, Ogbuabor & Anthony-Orji, 2015). Financial liberalization theory further sets that low levels of economic growth, investment and savings can be brought about by negative real interest rates, implying that rising interest rates would encourage financial liberalization to increase both savings and investment levels (Hye & Wizarat, 2013). This brings about the prominence of private sector credit, because it is the most logical way of transmitting interest rates and savings to investment and economic growth.

Private sector credit is a significant way for financial development and growth. The financial liberalization framework of McKinnon (1973) and Shaw (1973) for economic development and growth obviously emphasized the place of private investment through private credit. While interest rates can be charged on people who borrow funds from banks, financial liberalization model identified four ways through which financial repression or interest rate ceilings upsets economic growth: (i) decreased savings because of inclination for current consumption; (ii) low–yielding investment opportunities; (iii) probability of bank customers borrowing at low interest rates; and (iv) the reluctance low-income entrepreneurs to borrow at higher lending rate (Fry,1978).

To this end and upon the solution by the International Monetary Fund (IMF), Nigeria liberalized its interest rates framework. Before the liberalization of interest rates which began in 1986, monetary authorities (that is Central Bank of Nigeria, CBN) directly oversaw and controlled interest rates in Nigeria. Obinna (2020) availed that the period was characterized by the CBN fixing interest rates (that lending and deposit rates) dependent on monetary policy drives, rather than market mechanisms. Interest rate strategy was controlled to economic areas that the then government had prioritized and preferred. On these grounds, the Central Bank of Nigeria controlled fixed interest rates at concessionary rates. As indicated by Obinna (2020), these rates were concessionary because they frequently fall beneath the minimum rediscount rate. With respect to less-favoured sectors, they were left to source funds through market conditions (that is, with the non-concessionary rates).

The main goal of liberation was to help increase savings for investment through credit to the private sector, however the growth of the depth of private sector credit is not yet not enough for investment and economic growth in Nigeria (Nnanna, Okafor, & Odoko, 2004). After liberalization in 1986, the growth of private sector depth increased from 10.08% to 12.2% in 1986 and 1987, respectively. There was negative growth of -15.0% in 1989, - 19.4%, -23.6% in 1994 and 1995. After years of turbulence, the growth rate increased phenomenally after the consolidation reform by 39.1% in 2007, 59.0% in 2008

and 16.3% in 2009. However, the absolute ratio of private sector credit was 11.16% in 2019 and increased marginally to 12.13% in 2020. This means it is not out of place to regard interest rate dynamics as concerns or preconditions necessary for the implementation of financial liberalization as well as its benefit. On the basis of this concern, this study is designed to find out the influence of interest rates on financial deepening in Nigeria.

The basic reason for liberalizing the financial sector was to deepen it, meaning the increase of financial assets and its support to private business firms (Nwafor, Ferdinand & Charles, 2017). McKinnon (1973) and Shaw (1973) posited that removing the repressive elements in the financial sector, such as interest rate control, will enhance the savings and deposit mobilization and efficient credit allocation to deserving economic units. However, no one envisaged that interest rates will be concerns for financial deepening. To begin, Eichengreen (2001) availed that interest rate can instigate financial instability and capital misappropriation. Over the years, empirical literature made disturbing findings with regards to interest rate and financial intermediation, especially in less developed countries, including Nigeria. The study of Levine and Renelt (1992) revealed that average real interest rate of 0.5% and above are most likely supports growth than countries where real interest rates is lower than 0.5%. The same cannot be said of Nigeria. Later on, Okwuchukwu and Ariwa (2017) revealed that real interest rate to have negative and significant impact in the Nigerian economy. The average real interest rate for Nigeria for 1981 to 1985 was -14.36%, and -42.64% for 1986 to 1999. Although, the rate increased to 5.34% for the period 2000 – 2018, there is need to empirically examine if this affect financial deepening.

Again, Odhiambo (2009) has found interest rate liberalization to have significant impact on economic growth through financial deepening; the study fell short in showing the dynamism of interest rate structure on financial depth. Gbenga, James and Adeyinka (2019) asserted that the tightening of monetary policy through increased interest rates lead banks to reduce credit supply. Interest rate spread, which has been described as an indicator of the efficiency of the financial intermediation process (Sheriff & Amoako, 2014) has remained higher than 5% in Nigeria. Similarly concern was drawn by Ogwumike and Ofoegbu (2012) that the outcome of deposit rates from financial liberalization has not been encouraging depositors to save, and the growing deposits is only a result of the absence or unreliability of alternative investment opportunities. However, most of the related studies reviewed for this study concentrated on the impact of real interest rate, which was the theoretical position of the McKinnon (1973) and Shaw (1973) financial liberalization hypothesis, this study should not discount the significance of other components of interest rates in the interest rate structure. This leads to the discovery that studies have neglected the impact of interest rate structure on financial deepening.

The relationship between interest rates and financial deepening is a complex one, not only because there are short and long-term interest rates, but also because financial deepening is a process with many dimensions. This study will rely on the depth of private sector credit, which is measured as private sector credit to gross domestic product ratio, as our indicator of financial depth. In the light of these, the study's objectives are to examine:

i. The relationship between lending rates and depth of private sector credit in Nigeria.
ii. The relationship between interest rate spread and depth of private sector credit in Nigeria.
iii. The relationship between real interest rates and depth of private sector credit in Nigeria.
iv. The relationship between monetary policy rates and depth of private sector credit in Nigeria.
v. The relationship between ratio of broad money supply to gross domestic product and depth of private sector credit in Nigeria.

2.0 Literature Review.

Theoretical Review

The McKinnon (1973) and Shaw (1973) theoretical framework has been the basis for financial reforms in many developing countries, including Nigeria. Although the reform did make some gains, numerous challenges still exist. High interest rates support savings but at the same time limits credit access by businesses that are unable to borrow at such rates. The cost of credit has been the main imperative to business development growth for many years in Nigeria. As a follow-up to adopting financial liberalisation, many countries responded with interest rate deregulation, credit control removal, removal entry barriers into the banking industry, commercial banks autonomy, removal of public ownership of banks and liberalizing flows of international capital (Odhiambo, 2010). Of the six aspects of financial liberalization, interest rate liberalization is the most outstanding. In Nigeria, there could be a lot of concern about the structure of interest rate. For instance, low savings rate is known to be detrimental to deposit mobilization (Ojeaga, & Odejimi, 2014; Raza, Hena & Saeed, 2017). This issue is compounded by high interest rate that that can hinder private sector credit (Aftab, Jebran, Ullah & Awais, 2016), and high interest rate spread being describe as an indicator of an inefficiency of financial intermediation (Sheriff & Amoako, 2014).

Empirical Review

Extensive related but not particularly the same studies have been conducted regarding interest rate liberalization and on interest rates on financial deepening over the world. The subsection gives a rundown of related study findings that have been done in various countries of the world. Egbetunde, Ayinde and Balogun (2017) analyzed the structural interaction between interest rate liberalization and growth performance of Sub Saharan African (SSA) economies for the period 1980-2013. The study empirically found that trade openness and price stability are significant variables for interest rate liberalization and economic growth in SSA economies. The Finding from the study further affirms the hypothesis of McKinnon and Shaw (1973). This result is in variance with the findings of Munir, Awan and Hussain (2010) for Pakistan, where financial liberalization did not positively impact private sector investment and credit due to persisting negative real interest rate and high inflationary condition in Pakistan.

In a study by Obamuyi and Demehin (2012) for Nigeria spanning 1973 to 2009, the impact of interest rate reforms on financial deepening showed the existence of long run relationship between interest rates and financial deepening in Nigeria. The outcome of the analysis was a positive and significant one. The analysis relied on tools cointegration

and vector error correction model (VECM) to determine the long and the dynamics from the short run model.

Odhiambo (2009) examined how financial deepening and economic growth react to the interest rate reforms in Kenya, with two models: dynamic Granger causality and financial deepening model. Annual time series data covering 1969 to 2006 were used for the study. With cointegration and the error-correction model (ECM), the study found strong support for the positive influence interest rate liberalization has on financial depth in Kenya. The conclusion of the study was that interest rate liberalization increased economic growth through financial depth in Kenya. In a related research interest rate reforms, financial development of banks and economic growth, Odhiambo (2010) utilized cointegration and error-correction models to substantiate a strong positive influence of interest rate reforms on South Africa's financial development.

Furthermore, Aftab, Jebran, Ullah and Awais**(2016) examined**the long and short term impact of interest rate on private sector credit for Pakistan from 1975 to 2011. The study applied the Autoregressive Distribution lag model for the purpose of establishing possible long and short term relationship. The results revealed a negative and significant impact of interest rate on private sector credit in both the long and short run. The results also indicated a positive significant effect of inflation on private sector credit in the long and short run.

Okwuchukwu and Ariwa (2017) used time series to determine the impact of financial system liberalization, Savings and Investment on the Nigerian economy. The study found that financial liberalization, proxied by real interest rate, had significant and negative impact on the economy of Nigeria. The result further showed that the dummy variable which captured the liberalization policy was however not statistically significant. Using OLS to examine the influence of liberalizing interest rate on savings, investment and GDP growth in Ghana, Asamoah (2008) found that the increase in interest rate in post liberalization years led to a proportional increase in savings and a consequent positive impact on GDP growth from January 2000 to June 2003.

Akpansung and Waziri (2018) ventured to determine the efficacy or order wise financial liberalization policies and economic growth in Nigeria, between 1986 and 2014. The study used the ARDL bounds test technique and unrestricted form of error correction model. The study's findings showed that financial liberalization indicators significantly impact on economic growth in the short run and the long run. Banam (2010) investigated the impact of financial liberalization and found in his study that significantly and positively on economic growth in Iran. The study used Johansen cointegration test from 1965 to 2005. Proxies for financial liberalization or restraints index include reserve requirements, directed credit and interest rate controls.

Owumere, Okore and Imo (2012) explored the influence interest rate liberalization have on savings and investment in Nigeria. By utilizing the OLS approach, the study found that interest rate liberalization adversely and significantly influence investment in Nigeria. In the same vein, Majed and Ahmed (2010) who ventured to determine how real interest rate liberalization impact on Jordanian investment between 1990 and 2005, found that that interest rate liberalization adversely influence investment. From sample of 119 countries which comprised developed and developing countries covering the period 1974-1989, Levine and Renelt (1992) found that countries with average real interest rate

below 0.5% tended to grow more slowly than countries with average real interest rates above 0.5%. In addition they found that countries with severely depressed interest rates tend to have low investment rates. With interest rate as proxy for financial liberalization, Ubesie (2016)'s study on the effect of financial sector liberalization found that financial liberalization had insignificant positive influence on Nigeria's economic growth between 1980 and 2013.

Gaps in Literature

The empirical works reviewed were carefully selected as the closet to the objectives of this study, thus not discounting that that there are loads of related empirical works on interest rates and financial deepening. The literature reviewed, reveals so many empirical studies have so far been done on the effects of interest rates liberalization on economic growth, investment or savings across the world. With regards to the objectives of this study, no study from the reviewed considers the influence of interest rate dynamics on financial deepening in Nigeria. Moreover, studies on the significance of interest rates have got scholarly attention in recent times, the reason why this study is important. This study, therefore, intends to fill this gap. Again, this study is unique by setting financial deepening as an end rather than a means as other researchers have done in the past. Even where similar studies were carried out (see Odhiambo, 2009; Obamuyi & Demehin, 2012), the findings on the impacts of interest rates on financial deepening were inconclusive with gaps.

3.0 Research Methodology.

This study examines the effect of interest rates on financial deepening in the Nigerian. The study hypothesized that interest rates do not significantly affect financial deepening in Nigeria. To test the hypothesis, annual time-series data from 1981 to 2020 were obtained from the Statistical bulletin of the Central Bank of Nigeria 2020 and the World Bank Data 2020. Model of the study is built on previous empirical researches and employed the econometric techniques of Augmented Dickey-Fuller (ADF) unit root test, Autoregressive Distributed Lag (ARDL) Bounds testing technique and its Error Correction form.

The choice of variables is informed by the works of Obamuyi and Demehin (2012), Odhiambo, (2009) and Odhiambo (2010). However, this study made some modification by modelling interest rate on the ratio of private sector credit to gross domestic product (CPS/GDP) as against the ratio of broad money supply to gross domestic product (M2/GDP) used by Obamuyi and Demehin (2012), Odhiambo, (2009) and Odhiambo (2010). This study also expanded the scope of interest rates by incorporating interest rate spread, real interest rate, broad money supply ratio to GDP and monetary policy rates in addition to the norminal lending rate used by the anchor scholars. The inclusion of broad money supply (M2) is justified on the grounds the interest plays an important role in savings mobilization (Obamuyi & Demehin, 2012) and a direct indicated of money supply in circulation. A real measure of the size of financial assets and development can be provided by the ratio of M2/GDP, so the ratio aligns with the development of financial systems. The ratio also increases as instruments of savings spreads with increase in liquidity, and vice versa. This gives rise to the functional financial deepening model:

$$CPSR = f\begin{pmatrix} lendingrate, broadmoney, \\ \text{interest rate spread, real interest rate,} \\ \text{monetary policy rate} \end{pmatrix}$$

By coding and expanding the function, the equation for this study is reformulated in as:

$$CPSR = \alpha + \beta_1 IRS + +\beta_2 LR + \beta_3 MPR + \beta_4 MSSR + \beta_5 RIR + \mu \ldots\ldots\ldots (3.2)$$

Where,

CPSR - private sector credit to GDP ratio

IRS - interest rate spread, defined as deposit rate minus lending rate

LR - lending rate

MPR - monetary policy rate

MSSR - broad money supply to GDP ratio

RIR - real interest rate defined as lending rate minus inflation

α - Intercept of the model,

β_1 - β_5 - Coefficient of variables

μ - represents the residual.

Technique of Analysis

Out of the numerous econometric methods proposed for estimating the long-run equilibrium (cointegration) among variables, this study is utilizing the autoregressive distributed lag (ARDL) modelling approach advanced by Pesaran, Shin and Smith, (2001). The ARDL is favourable due to its allowance for small sample study and usefulness when the variables are integrated at different orders not exceeding one order (Ibukun & Aremo, 2017). The ARDL (*a, b, c, d, e, f*) model used for the bounds test takes this form as postulated by Nwachukwu, Adebayo, Shettima, Anigwe and Udechukwu-Peterclaver (2016):

$$\begin{aligned} \Delta CPSR_t = \ & \alpha_0 + \beta_1 \sum_{i=1}^{n} \Delta\, CPSR_{t-1} + \beta_2 \sum_{i=1}^{n} \Delta\, IRS_{t-1} + \beta_3 \sum_{i=1}^{n} \Delta\, LR_{t-1} \\ & + \beta_4 \sum_{i=1}^{n} \Delta\, MPR_{t-1} + \beta_5 \sum_{i=1}^{n} \Delta\, MSSR_{t-1} + \beta_6 \sum_{i=1}^{n} \Delta\, RIR_{t-1} + \alpha_1 CPS_{t-1} \\ & + \alpha_2 IRS_{t-1} + \alpha_3 LR_{t-1} + \alpha_4 MPR_{t-1} + \alpha_6 MSSR_{t-1} + \alpha_6 RIR_{t-1} + \mu_t \end{aligned}$$

The long-run relationship among the variables in the system is done using the bounds test (Pesaran, Shin & Smith, 2001). This test follows a non-standard distribution and based on Wald or F-statistic. The decision rules are to accept the null hypothesis ($\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0$) of no cointegration if the calculated F-statistic is less than the lower bound critical value; and reject the null hypothesis if the calculated F-statistic it is greater than the appropriate upper bound critical values, implying the presence of

cointegration. In the event that the calculated F-statistic lies between the lower and upper bounds, the result is declared inconclusive.

Consequent to determining cointegration in the chosen model, the following long-run model for financial deepening can be estimated:

$$CPSR_t = \alpha_1 + CPSR_{t-1} + \alpha_2 IRS_{t-1} + \alpha_3 LR_{t-1} + \alpha_4 MPR_{t-1} + \alpha_6 MSSR_{t-1} + \alpha_6 RIR_{t-1} + \mu_t$$

The Akaike Information Criteria (AIC) will be used to determine the optimal structure for the ARDL model. After determining the ARDL (*a, b, c, d, e, f*) model and respective long-run parameters, the next thing will be to formulate the error correction model as part of estimating the dynamics in the short-run.

$$\Delta CPSR_t = \alpha_0 + \beta_1 \sum_{i=1}^{n} \Delta CPSR_{t-1} + \beta_2 \sum_{i=1}^{n} \Delta IRS_{t-1} + \beta_3 \sum_{i=1}^{n} \Delta LR_{t-1} + \beta_4 \sum_{i=1}^{n} \Delta MPR_{t-1} + \beta_5 \sum_{i=1}^{n} \Delta MSSR_{t-1} + \beta_6 \sum_{i=1}^{n} \Delta RIR_{t-1} + \alpha_1 ECT_{t-1} + \mu_t$$

The error correction model shows the speed of adjustment needed to restore the long run equilibrium following a short run shock. The coefficient of the error correction term in the model is a_1 is and must be negative and significant for the return back to long-run equilibrium to hold. The CUSUM and CUSUMSQ tests will be used to determine the stability of the residuals of the model at 5 % significant level.

4.0 Presentation of Results and Empirical Analysis

Descriptive Statistics

This section presents the descriptive characteristics of the time series data used and the result is presented in table 1 below.

Table 1. Descriptive Statistic.

	CPSR	IRS	LR	MPR	MSSR	RIR
Mean	9.5887	6.3225	17.7575	13.0658	15.7241	0.1966
Median	8.1319	6.9596	17.5692	13.2500	13.2132	3.6669
Maximum	22.2672	11.0642	31.6500	26.0000	25.4481	18.1800
Minimum	4.9480	0.3167	8.9167	6.0000	9.0633	-65.8572
Std. Dev.	4.2985	2.8050	4.8427	4.1004	5.3703	14.7859
Skewness	1.2757	-0.5908	0.2094	0.6692	0.6784	-2.5862
Kurtosis	4.0240	2.5779	3.6903	4.2311	1.8589	11.9120
Jarque-Bera	11.9677	2.4925	1.0321	5.2355	4.9761	168.1160
Probability	0.0025	0.2876	0.5969	0.0730	0.0831	0.0000

Sum	363.9858	240.2557	674.7852	496.5000	597.5157	7.4695
Sum Sq. Dev.	683.6551	291.1245	867.7199	622.0855	1067.1020	8089.0460
Observations	40	40	40	40	40	40

Source: Author's computation 2021

The descriptive statistics, as shown in Table 1, revealed that the average value of private sector credit ratio is 9.58%. However, the average value interest rate spread, lending rate, monetary policy rate, broad money supply ratio and real interest rate are 6.32%, 17.76%, 13.07%, 15.72% and 0.19% respectively.

The asymmetries of data series, as indicated by skewness around its mean, showed that all the variables, but for interest rate spread and real interest rate, are positively skewed. Positive skewness means that the distributions of data series have long right tails. The peakedness or flatness of the distribution, or Kurtosis, showed that CPSR, LR, MPR and RIR are leptokurtic (peaked upward relative to normal), while IRS and MSSR are platykurtic (flat peaked distribution relative to the normal). Finally, the Jarque-Bera test for normality showed that all the data series, except CPSR and RIR, were normally distributed.

Stationarity Test - Augmented Dickey Fuller

The use of ARDL models is indifferent to pre-testing of series for unit root problems, because it accommodate I(0) and I(1) variables, but because of the condition that does not accommodate series that are integrated of order 2, the test for unit root becomes important (Ibukun & Aremo, 2017). Table 2 below presents the results of the Augmented Dickey and Fuller unit root test.

Table 2: Order of Integration

Variables	Unit Root Tests - Augmented Dickey Fuller			Order of Integration
	Absolute Test Statistic with intercept	Absolute Critical Values @ 5%	Remark	
CPSR	5.3525	2.9511	no unit root	*I*(1)
LR	5.3179	2.9484	no unit root	*I*(1)
IRS	6.3843	2.9484	no unit root	*I*(1)
RIR	7.1595	2.9434	no unit root	*I*(0)
MPR	3.2129	2.9434	no unit root	*I*(0)
MSSR	4.5939	2.9458	no unit root	*I*(1)

Source: Author's computation 2021

ADF tests suggest that CPSR, LR, IRS and MSSR series have unit roots at level, and became stationary at the first difference. The ADF Test showed that RIR and MPR were stationary at level and first differences.

Lag Length Selection Criteria

Since the computation of F-statistics for co-integration with the ARDL Bounds test is very sensitive to lag length, the result of appropriate lag length for our model is given in

table 3 shows the result for the appropriate lag length. The Akaike Information Criterion (AIC) criterion has been used for stationarity and so the lag order of 3 is selected.

Table 3: Lag Length Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-556.4372	NA	3656804.	32.13927	32.40590	32.23131
1	-470.8683	136.9102	222412.8	29.30676	31.17318*	29.95105
2	-416.3980	68.47702*	93700.57	28.25131	31.71752	29.44785
3	-361.7945	49.92321	56674.49*	27.18826*	32.25425	28.93703*

Source: Author's computation 2021

ARDL Bounds Test for Cointegration

The calculated F-statistic was 7.693998 (see table 4), and has a consequence for the ARDL
bound test for cointegration (that is, a long-term relationship). The null hypothesis of no co-integration is rejected because the absolute F-statistic turned out to be greater than both the upper bound (3.79) and lower bound (2.62) at a 5 percent significance level.

Table 4: Result of ARDL Bounds Test for Cointegration

Test Statistic	Value	K
F-statistic	7.693998	5
Critical Value Bounds		
Significance	I(0) Lower Bound	I(1)Upper Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Source: Author's computation 2021

After establishing the existence of cointegration between financial deepening and interest rate variables, the earlier specified long-run equation in levels form will be estimated and presented in table 5.

Table 5: Long-run Coefficients, dependent variable is CPSR

Levels Equation
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IRS	0.086522	0.118146	0.732333	0.4760
LR	0.196260	0.143609	1.366622	0.1933
MPR	-0.484134	0.166738	-2.903561	0.0116

MSSR	0.426952	0.054125	7.888283	0.0000
RIR	0.119874	0.027520	4.355816	0.0007

EC = CPSR - (0.0865*IRS + 0.1963*LR -0.4841*MPR + 0.4270*MSSR + 0.1199*RIR)

Source: Author's computation 2021

From table 5, the coefficients of interest rates show the percentage change in financial deepening variable due to changes in interest rates. Results show that monetary policy rate, only broad money supply ratio and real interest rate had significant relationship with financial deepening in Nigeria. Although monetary policy rate had negative significant relationship with financial deepening, this did not cast any surprise away from theoretical expectations. Gbenga, James and Adeyinka (2019) asserted this popular position that monetary tightening, reflected by increase in interest rates, induces financial institutions to cut back credit supply. This is further affirming the theoretical position of McKinnon (1973) and Shaw (1973) that interest rate control translates to financial repression. It was expected that money supply would have a positive influence on financial deepening, which was the outcome of our estimate. Changes in money supply ratio translated to about 42.7% increase in financial deepening. This finding agrees with the position of Otalu, Aladesanmi and Mary (2014) that money supply has statistical influence on banks' credit creation. This is despite the growing domestic debt profile of government in the banking sector.

Real interest rate was found to have a significant positive impact on financial deepening. Estimated results show that a change in real interest rate propels financial deepening by about 11.99%. Analysis of interest rate spread in Nigeria shows that real interest rate has been rising. From the period 1981-1986, just before the commencement of the Structural Adjustment Programme (SAP), real interest rate averaged -14.36%, meaning that inflation rates for that period was overwhelmingly higher than lending rate.

Figure 1: Real Interest Rates for Nigeria

Source: Author's from World Bank Data

In the following average period of 1987-1999, when liberalization was fully adopted and just before the adoption of universal banking, real interest rate was about -2.61%. It continue to rise to 4.25% for the period 2000-2006, just before banking consolidation reform, and then 7.39% for post consolidation reform till 2020. A significant real interest

rate on financial deepening is an affirmation of the theoretical position of the financial liberalization theory that "high level of real interest rates increases the level of financial deepening" (Eke, Eke & Inyang, 2015). We agree with De Gregorio and Guidotti (1995) that interest rates are not a good indicator of financial repression or distortion. Finally, lending and real interest rates had no statistical significance on financial deepening in Nigeria. The average rate of lending rate of 17.76% in table 1 is considered too high to support private sector credit. This is in agreement with Ekpo (2016; 2017) who posits that high lending rates are discouraging to to private investors in Nigeria. On the other hand, the insignificant impact of interest rate spread is not surprising as its high level has been described as an indicator of an inefficient financial intermediation (Sheriff & Amoako, 2014). The inefficiency comes from a situation where high lending rates encourages banks to lend and low deposit rate is discouraging savings.

ARDL Short-Run Dynamics

After establishing and estimating the ARDL long-run model, the need to estimate the error correction model within the ARDL framework becomes sacrosanct. Table 6 shows the estimates of the error correction of financial deepening model.

Table 6: Error Correction Model Estimate

ARDL Error Correction Regression				
Dependent Variable: D(CPSR)				
Selected Model: ARDL(3, 0, 3, 3, 3, 3)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	5.952487	0.768824	7.742326	0.0000
D(CPSR(-1))	0.757396	0.128275	5.904488	0.0000
D(CPSR(-2))	0.397882	0.157198	2.531078	0.0240
D(LR)	-0.16921	0.082688	-2.046371	0.0600
D(LR(-1))	-0.276686	0.103328	-2.677735	0.0180
D(LR(-2))	0.156634	0.067261	2.328746	0.0354
D(MPR)	-0.226252	0.073488	-3.078744	0.0082
D(MPR(-1))	0.044664	0.098585	0.453048	0.6575
D(MPR(-2))	-0.126913	0.069103	-1.836583	0.0876
D(MSSR)	0.462063	0.073332	6.300998	0.0000
D(MSSR(-1))	0.182785	0.108805	1.679933	0.1151
D(MSSR(-2))	-0.215899	0.104472	-2.066577	0.0578
D(RIR)	0.116183	0.016949	6.854886	0.0000
D(RIR(-1))	-0.102427	0.018638	-5.495481	0.0001
D(RIR(-2))	-0.044799	0.013498	-3.318864	0.0051
ECT(-1)*	-1.185339	0.149754	-7.915247	0.0000
R-squared	**0.939107**	**F-statistic**	**19.53475**	
Adjusted R-squared	**0.891033**	**Prob(F-statistic)**	**0.000000**	
Durbin-Watson stat	**2.345199**			

Source: Author's computation 2021

The negative coefficient of the error correction term (ECT) implies that our financial deepening model converges to its long-run equilibrium at 118.53% speed of adjustment. The probability of the F-statistics of 0.000000 indicates an overall significance of the model, and a Durbin-Watson statistics of 2.345199 means the model is not suffering from first order autocorrelation.

Diagnostic Tests

Diagnostic tests show that residual series are normally distributed, homoskedastic and no serial correlation. The tests involved are Jacque Berra for normality, ARCH and Berusch-Godfrey for serial correlation as well as LM test.

Table 6: Diagnostic Tests Estimates

Diagnostic Tests	Probability of F-Statistics	Remark
Jarque-Bera	0.8563	Normal distribution
Heteroskedasticity Test: Breusch-Pagan-Godfrey	0.8338	Homoskedastic distribution
Breusch-Godfrey Serial Correlation LM Test:	0.4758	No Serial Correlation

Source: Author's computation 2021

The p-value of the F-statistic in all the three tests were greater than 0.05, it means that the null hypotheses is accepted. Hence we conclude that the data series are normally distributed, homoskedastic and not serially correlated.

Stability Tests.

In the first instance, the absence heteroscedasticity in the model is a kind of stability in its own sense because it indicates that the variances of the data series are stable with time. However, further substantiation of our model stability can be done with the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) to test the stability of the long-run coefficients and short-run dynamics. Figure 2 and 3 show the graphical results of CUSUM and CUSUMSQ.

Figure 2: CUMSUM Test

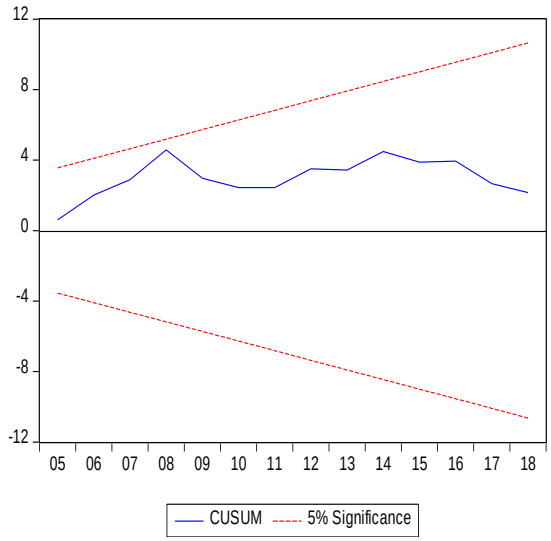
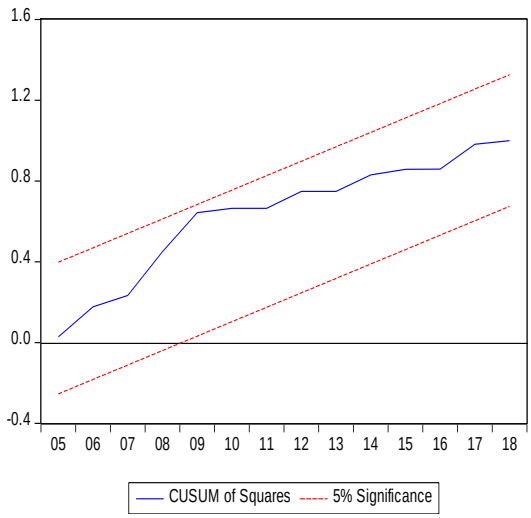


Figure 3: CUMSUM of Square Test



From figures 2 and 3 above, it can be seen that the plots of both the CUSUM and CUSUMSQ fall within the 5% boundaries, and proving the stability of model coefficients of interest rates have effect on financial deepening in Nigeria. The model is stable and suitably specified since none of the two tests statistics deviated away from the 5 percent bounds level.

5.0 Summary, Conclusion and Recommendations

The prospect of financial deepening model in Nigeria has created worries for researchers, having seen a lot of studies on financial deepening and economic growth. The conception of this study is that financial deepening should be an end, owing to the desirability of it from policy-makers and the academics. For a developing country like Nigeria, where the gap of finance for growth has been emphasized, it is only within logical reason to hold private sector credit high in this regard. That is why the study relied on modelling financial deepening with CPSR. The interest rate level has been thought of to be disincentive to private sector credit. A benchmark rate of over 12% in recent time, couple with rising inflation rates, is enough to ignite study interest in this area. Hence, this study investigates the impacts of interest rates on financial deepening in Nigeria through the application of the ARDL and ECM for the period, 1981 to 2020. The ARDL results showed that there was cointegration between financial deepening and interest rate variables: real interest rate, lending rate, monetary policy rate, interest rate spread and ratio of broad money supply. The related ECM was negative and significant, confirming that long-run relationship exists in the model.

One implication of this study is that Nigeria can increase the level of financial depth through increased credit allocation to private sector by the financial institutions. All the impediments of domestic private sector credits, such as government borrowing from banks and high rising lending rate, should be given priority attention. Furthermore, this means reducing crowding out of private sector in credit market is quite positive to private sector credit. Monetary policy is required to play an important function here. The Central Bank of Nigeria (CBN)'s Monetary Policy Rate (MPR) is a significant framework for lending rate levels in Nigeria. As much as money supply is important in controlling the national inflation rate, naira exchange rate depreciation continue to make this policy direction of the CBN a fruitless control. Regarding financial depth, the conclusion we have is that financial deepening in aggregate terms should not just be appreciated without critically understudying the structure of interest rates that has far reaching implications on savings and credit supply.

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DETEMINANTS OF DOMESTIC PRIVATE INVESTMENT: EMPIRICAL EVIDENCE FROM NIGERIA'S DOMESTIC MACROECONOMIC VARIABLES

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Abstract:

Domestic private investment is a great driver of sustaining the capital stock and productive capacity of serious economies. Nigeria for instance has relied on it resolve her macroeconomic problems, particularly those concerning growth, welfare and development. For this purpose, this study set to determine the influence of domestic macroeconomic factors on domestic private investment for Nigeria from 1981 to 2020. The ARDL methodology was utilized to estimate the study's parameters. The related ECM was negative and significant, confirming that long-run relationship exists in the model. Economic growth and private sector credits were negatively related to domestic private investment, while inflation, lending and savings rates were not significant in causing domestic private investment. This study recommends less public borrowing from banks in order not to crowd out the private sector and reduce the pressure on lending, as well as strengthen institutional framework to control credit diversion for investment purposes and also inflationary pressures on future values of investment decisions.

Keywords: Private Investment; Domestic Macro economy, Flexible Accelerator Model, ARDL

JEL classification: E22; E600

1.0 Introduction

Investment is a significant and important unit of aggregate demand and an important resource for economic growth as it helps to increase the productivity of the economy. How domestic investment promotes economic growth was discussed in the study of Ayeni (2016).He stressed the importance of macroeconomic factors in boosting private investment in Nigeria. The fundamental challenge that developing countries have being facing is the way to increase investment rates domestically (Agidew, 2014). That means the questions of what policies to formulate are significant in affecting the domestic private sector given the limited amount of FDI in the developing regions. When policies are established, they are expected to create conducive encouragement to domestic investors (Ghura& Goodwin 2000).

According to Oyedokun and Ajose (2018) posits that real domestic investment implies increased expenditure on capital stock in the economy, through the acquisition of income-generating and capital-producing assets within the domestic economy. Other proponents of domestic investment like Uremadu (2006) and Adegbike and Owulabi (2007) have advocated that developing countries rely more on domestic investment instead foreign direct investment (FDI). This does not undermine the significance of FDI as they are seen to benefit host countries in the speed up of economic growth and development (Oyedokun & Ajose, 2018). The preference for domestic investment over foreign direct investment includes that foreign loans are not ideal strategies for growth because of their adverse effects on the balance of payment of domestic economies, from loan servicing with domestic resources as well as the exposures to foreign exchange risk (Oyedokun & Ajose, 2018). Subsequently, for the geometric acceleration of growth and development of developing economies, domestic investment is not just important but an essential condition for the provision of domestic resources to fund domestic investment.

On the part of the Nigerian government, a lot of policy interests have being made to promote private investment (Ekpo, 2016). To begin with, the First National Development Plan of 1964 was a response to generally correct the non-performance of the domestic private sector and reduce the reliance on foreign capital inflows; the Second National Development plan of 1970-74 similarly sought to reinvigorate the abilities of private sector to drive development through financial and entrepreneurial skills; and the Structural Adjustment Programmes (SAP) that was to enhance the growth of the private sector by way of reducing the dominance of unproductive public sector investments (Ekpo, 2016). In same vein, successive governments have proposed and implemented many economic reform policies, all targeting framework to boost private-sector-driven economic development.

Despite all these policy initiatives, domestic investment rate is not still impressive in Nigeria. Hence, this study set out to examine the influence of domestic macroeconomic on domestic private investments, as it relates to Nigeria. This study employed the autoregressive distributed lag (ARDL) model on time series data collected from 1981 to 2020. The domestic macroeconomic variables covered include inflation, lending rate, growth of gross domestic product, savings rate and private sector credit rate.

It is no more secret that private investments are needed to address the challenges of sustainable economic growth in developing countries because public investments alone are insufficient. Private investments are necessary to complement public investment. As pointed out by policymakers, private investment is an essential element of pro-poor sustainable economic growth (Combey, 2016). In addition, the African Development Bank has advocated that African countries that are facing economic challenges must have domestic investment make up at least 35 percent of Gross Domestic Product (GDP), out of which 23 percent must be private investment (Combey, 2016), thus, making private sector development one of its core priorities. African countries have not committed favourably to these requirements, neither have any appreciable drive been recorded.

For instance, Nigeria has continued to struggle to exceed the required threshold of 23 percent domestic private investment. The share of private investment in GDP which was 50.9.6% in 1987 gradually fell to 36.58% in 1996%, 26.17% in 2006 and 19.01% in 2018, before increasing marginally to 24.11% and 28.65% in 2019 and 2020, respectively. It is the believe of this study that domestic macroeconomic factors have far

reaching significant impact that has been ignored, especially from academic scholars. For instance**,** Oshikoya (1994) opined that developing countries have high inflation problem which negatively influence private investment. Inflation can discourage the accumulation of funds that can be used for investment because of its adverse effect on the value of money. Ekpo (2016) also asserted that interest rate can affect the general economy and particularly private investment, through the rate of savings, credit form banks and the ability of borrowing for investment by the private sector. Ekpo (2016) also stressed that both government and high interest rate had affected bank-based private sector credits in Nigeria. Even a situation of high gross domestic product but bearing on low per population income and high unemployment rate in Nigeria is detrimental to private investment development.

There is one significant study (Ayeni, 2016) that has dealt with macroeconomic factors on domestic investment in Nigeria. However, this study seeks to make some adjustment to Ayeni (2016)'s study. First, his study never created a dichotomy between domestic and foreign-based macroeconomic factors, hence his inclusion of real exchange rate. For the purpose of policy recommendations, it is better to create a dichotomy between them. Secondly, while the ARDL modelling technique is comprehensive in handling series that have been confirmed to be cointegrated, Ayeni (2016) still relied on the Johansen Cointegration Test. And finally, this study is an improvement on Ayeni (2016) which was based on data series from 1979 to 2012, while this study takes it beyond to 2020, thereby accommodating new macroeconomic influences. The purpose is to offer a better understanding of the domestic private sector investments in Nigeria.

The organization of this paper is as follows: next section offers an overview of the theoretical and empirical literature. Section three expose the methodological approach and section four presents date, results, discussion, and an analysis of the date. Concluding remarks and policy recommendations are provided in the last section.

2.0 Literature Review

Theoretically, the impact of the domestic macroeconomy on investment depends on various factors. Ghura and Goodwin (2000) stated that empirical literatures on investment modelling from four known approaches: the flexible accelerator model, associated with Keynes (1936); the Jorgenson (1971)'s neoclassical model; Tobin's Q model traced to Tobin (1969) and the expected profits model with its variants. Investment was described in the Accelerator theory to be responsive changes for increased product demand (**Sisay, 2010).** In this study, we employed the flexible accelerator model, which is essentially a partial adjustment model and, just like the adaptive expectations model, it is a theoretical justification of the Koyck model.The fundamental idea in flexible accelerator model is that firm's investment comes from the gap between available capital stock and the capital stock they desire to meet increased demand (Ghura & Goodwin, 2000). Macroeconomic influences are strongly related to the theory of flexible accelerator.

The Accelerator theoryof investment has gone through a few advancementsfrom its inflexible form to its adaptableversion (Sissay, 2010). The theory explains that changes in the demand for produce drive firm's investment decisions (Song, Liu & Ping, 2001). This infers that firms' investment expenditures are dependent on their

outputs, which is a function of demand (Sissay, 2010). At the point where output changes, capital stock will likewise change: $K_t - K_{t-1} = v\ (Y_t - Y_{t-1})$

Nonetheless, the above mathematical expression is straightforward but naive form of the accelerator model. The flexible accelerator theory, or the capital stock adjustment model, was developed to improve on the major shortcomings of the simple accelerator model by introducing the adjusted time lag phenomenon. The development of flexible accelerator theory was attributed to Chenery (1952), Goodwin (1948) and Koyck (1954), but the approach of Koyck (1954) was the most widely accepted. The flexible accelerator framework permits the inclusion of cost of external finance, internal funds as well as outputs to determine the fraction of capital stock needed investment (Chirinko, 1993).

Blejer and Khan (1984) proposed the influences of macroeconomic factors on firms' investment decisions. For instance, the influences Inflation, interest rates and cost of capital, and exchange rate policies and movements have been identified in literatures (Erden & Holcombe, 2005; Greene & Villanueva, 1991; Chetty, 2004; Lafrance & Tessier, 2001; Athukorala & Sen, 1995; Pindyck & Solimano, 1993). Macroeconomic variables can reduce or increase the available finance for private sector investment and then affecting the speed of firms moving to their desired investment levels. These macroeconomic variables have been introduced into the flexible accelerator model because of their ability to directly cast uncertainty on investment. Uncertainty about the future may influence firm-level investment decisions. Since domestic macroeconomic variables are within monetary control in Nigeria, we hypothesize that domestic macroeconomic variables should have significant impact on domestic private investment in Nigeria, while holding foreign factors constant.

2.1 Empirical Review

*Mose, Jepchumba and Ouru (2020) investigated the Macroeconomic Determinants of domestic private investment behaviour*in Kenya, Rwanda, Burundi over the period 2009-2018. The study used the Modified Flexible Accelerator hypothesis to show the relationship between private investment and macroeconomic variables. With the use of random effect model, the results showed that credit availability had positive and statistically significant impact on private investment in Kenya, Rwanda, Burundi hence confirming the significance of domestic credit.

Agbarakwe(2019) set out to study the determinant of investment in Nigeria for the period 1980 to 2018. The selected macroeconomic variables were interest rate, government expenditure, inflation rate, and exchange rate. The study's main objective was to find out how these macroeconomic variables impact on private investment in Nigeria. The method adopted for the study wasthe Autoregressive distributed lag model technique. The result obtained showed thatboth exchange rate and interest rates have negative impact on private investment while government expenditure positively impact on private investment. The result means that the selected macroeconomic variables satisfy the apriori expectations.

Agidew (2014) investigated the macroeconomic drivers of domestic private sector investment with the panel data set from the period of 2000 to 2012. The study found that the main factors for the variability of domestic private investments were macroeconomic factors including variations in exchange rate movements, output, fiscal and monetary

policies and real per capita growth. Ayeni (2014) conducted a study to determine private investment in Nigeria with the ARDL Cointegrating technique. The research revealed that private sector credits, inflation rate, real interest and exchange rates and aggregate demand (GDP) did not effectively impact on private investment in Nigeria. Combey (2016) conducted a panel study about the West African Economic and Monetary Union (WAEMU) on private investment drivers in the region from 1995 to 2014. Study results showed results showed a short-run impact from aggregate demand conditions (gross domestic product and output gap) on private investment, and long-run impacts from political stability indicators and domestic product.

Michael and Aikaeli (2014) used the Error Correction Model to determine the time series of private investment in Tanzania for the period 1975 to 2010. Private investment was defined to depend on credit to private sector, exchange rate, lending rate, degrees of openness, GDP growth and public investment. From the results, credit to private sector, public investment, and GDP growth were significant determinants of private investment growth, while interest rate, degree of openness and exchange rate reported weak influences. With multivariate ECM technique, Sisay (2010) discoveredprivate investment in Ethiopia to be positively influenced by FDI, return to capital, infrastructural facilities, trade openness/liberalization and domestic market; and negatively by political instability, macroeconomic uncertainty and government activities. The study's scope was from 1950 to 2003.

With the annual time series data from 1970 to 2011 and ARDL, Konor (2014) studied the determinants of private sector investment in Ghana. The results showed gross domestic product had long-run influence on private investment, while inflation exert short-run influence. Private investment was discovered to be influenced by exchange rate in both the long and short-run dynamics. Agu (2015) determined to find out the drivers of private investment in Nigeria from 1970 to 2012. The analysis used the error correction model to establish that investment has been hampered in Nigeria by high lending rate, poor public expenditure, low savings, political instability and inadequate infrastructure. Atoyebi, Adekunjo, Kadiri and Falana (2012) empirically examined the pattern of domestic investment during 1970 to 2010 timeframe. The study's analysis relied on the Johansen (1988) technique for cointegration and granger causality test. Results from the study showed that growth in private investment are best explained by changes in political situation as represented by a dummy variable representing investment climate. They inference that the overall measure of macroeconomic instability and political situation serves as an hindrance to private investment.

Attefah andEnning (2016) analyzed the drivers of private investment in Ghana with time series running from 1980 to 2010, and with multiple linear regression. It was uncovered that factors that significantly affectprivate investment in Ghana were corporate tax, democracy, public investment, economic openness, external debt and credit to the private sector. They asserted that factors such as, real interest, inflation, real exchange and GDP growth rates, were not statistically significant on private investment.

2.3 Gap in the Literature.

The empirical works reviewed were carefully selected as the closet to the objectives of this study, thus not discounting that that there are loads of related empirical works on

macroeconomic determinants of private investment (Ayeni, 2014; Agidew, 2014; Konor, 2014; Combey, 2016). The literature reviewed, reveals so many empirical studies have so far been done on the effects of macroeconomic as well as general determinants of private investment, but none has dwelled on dichotomizing domestic from foreign macroeconomic factors. With regards to the objectives of this study, no study from the reviewed has explicitly considered the influence of domestic macroeconomic on domestic private investment Nigeria. This study, therefore, intends to fill this gap.

3.0 Research Methodology

Theoretical Framework

This study examines the effect of domestic macroeconomic factors on domestic private investment in the Nigerian. The study hypothesized that domestic macroeconomic variables does not have any significant effect on domestic private investment in Nigeria. To test the hypothesis, annual time-series data from 1981 to 2020 were obtained from the Statistical bulletin of the Central Bank of Nigeria 2020 and the World Bank Data 2020. Model of the study is built on previous empirical researches and employed the econometric techniques of Augmented Dickey-Fuller (ADF) unit root test, Autoregressive Distributed Lag (ARDL) Bounds testing technique and its Error Correction form.

In this study, we relied on the flexible accelerator model to chart the path for building our operational model because of its leverage because of its flexibility to adjust desired capital (Latruffe 2004). The model is essentially a partial adjustment model and a theoretical justification of the Koyck model (Gujarati, 2003). Under the partial adjustment process, capital stock is adjusted only toward a proportion of its desired stock, since the adjustment is not instantaneous. According to Lamont (2000), lagged investment captures the effect of investment lags such as delivery lags, planning lags and construction lags, which may cause actual investment to be negatively correlated with current returns. With the lag operations brought in, the Autoregressive distributed lag modelling becomes an ideal modelling option, but that will be after subjecting our data series to the prerequisite operations.

The choice of variables is informed by the works of Sissay (2010).According to Sissay (2010), the unrestricted lag structure of the flexible accelerator model tends to cause multicollinearity problem in estimations and generates misleading results of investment. In addition, many potential determinants such as interest rates and other macroeconomic variables were not considered (Song, Liu & Ping, 2001; Sessay, 2010). This gives rise to the simple model proposed by Sessay (2010).

Model Specification

According to the flexible accelerator theory of investment behaviour, actual investment is a function of changes in demand or output.

$$INV = f(\Delta GDP)$$

However, the model is usually employed with modifications; i.e., simplifying the lag structure and inclusion of other characteristics to which researchers are interested in.

Following this practice, we have also considered other variables in addition to demand; i.e., inflation, interest rates, saving and private sector credit (Sessay, 2010). That is,

$$INV = f(GDP, \text{inflation}, \text{interest rates}, \text{saving and private sector credit})$$

Since data difficulty in developing countries is a known problem in empirical research (Oshikoya, 1994; Ghura & Goodwin, 2000; Sessay, 2010), the proxy for macroeconomic factors defined above will be adopted for this study. Therefore, the equation for this study is reformulated in semi-log form as;

$$InPINV = \alpha + \beta_1 InSAV + +\beta_2 InINF + \beta_3 InLR + \beta_4 GDP + \beta_5 InCPS + \mu \dots\dots\dots (3.2)$$

The idea of using a semi-log model is accommodate the negative value of growth of gross domestic product. A semi-log model is specified when there is partial logarithmic transformation of the series in the model. The model is particularly considered when dealing with series that cannot be logged, such as the possible negative series we are likely to obtain.

Where,

InPINV - Natural logarithm of private investment to GDP ratio

InSAV - Natural logarithm of aggregate savings to GDP ratio

InINF - Natural logarithm of inflation rate

InLR - Natural logarithm of lending rate

GDP - real growth of gross domestic product

InCPS - Natural logarithm of private sector credit to GDP ratio

α - Intercept of the model

β_1 - β_5 - Coefficient of variables,

μ - represents the residual.

The *a priori* expectations of the equation estimates are as follows: $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 < 0$, $\beta_4 > 0$, $\beta_5 > 0$.

Technique of Analysis

Out of the numerous econometric methods proposed for estimating the long-run equilibrium (cointegration) among variables, this study is utilizing the autoregressive distributed lag (ARDL) modelling approach advanced by Pesaran, Shin and Smith, (2001). The ARDL is favourable due to its allowance for small sample study and usefulness when the variables are integrated at different orders not exceeding one order (Ibukun & Aremo, 2017). The ARDL (*a, b, c, d, e, f*) model used for the bounds test takes this form as postulated by Nwachukwu, Adebayo, Shettima, Anigwe and Udechukwu-Peterclaver (2016):

$$\Delta InPINV_t = \alpha_0 + \beta_1 \sum_{i=1}^{n} \Delta InPINV_{t-1} + \beta_2 \sum_{i=1}^{n} \Delta InSAV_{t-1} + \beta_3 \sum_{i=1}^{n} \Delta InINF_{t-1} + \beta_4 \sum_{i=1}^{n} \Delta InLR_{t-1} + \beta_5 \sum_{i=1}^{n} \Delta GDP_{t-1} + \beta_6 \sum_{i=1}^{n} \Delta InCPS_{t-1} + \alpha_1 InPINV_{t-1} + \alpha_2 InSAV_{t-1} + \alpha_3 InINF_{t-1} + \alpha_4 InLR_{t-1} + \alpha_6 GDP_{t-1} + \alpha_6 InCPS_{t-1} + \mu_t$$

The long-run relationship among the variables in the system is done using the bounds test (Pesaran, Shin & Smith, 2001). This test follows a non-standard distribution and based on Wald or F-statistic.

The decision rules are to accept the null hypothesis ($\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0$) of no cointegration if the calculated F-statistic is less than the lower bound critical value; and reject the null hypothesis if the calculated F-statistic it is greater than the appropriate upper bound critical values, implying the presence of cointegration. In the event that the calculated F-statistic lies between the lower and upper bounds, the result is declared inconclusive.

Consequent to determining cointegration in the chosen model, the following long-run model

for financial deepening can be estimated:

$$PINV_t = \alpha_0 + \alpha_1 InPINV_{t-1} + \alpha_2 InSAV_{t-1} + \alpha_3 InINF_{t-1} + \alpha_4 InLR_{t-1} + \alpha_6 GDP_{t-1} + \alpha_6 InCPS_{t-1} + \mu_t$$

The Akaike Information Criteria (AIC) will be used to determine the optimal structure for the ARDL model. After determining the ARDL (*a, b, c, d, e, f*) model and respective long-run parameters, the next thing will be to formulate the error correction model as part of estimating the dynamics in the short-run.

$$\Delta InPINV_t = \alpha_0 + \beta_1 \sum_{i=1}^{n} \Delta InPINV_{t-1} + \beta_2 \sum_{i=1}^{n} \Delta InSAV_{t-1} + \beta_3 \sum_{i=1}^{n} \Delta InINF_{t-1} + \beta_4 \sum_{i=1}^{n} \Delta InLR_{t-1} + \beta_5 \sum_{i=1}^{n} \Delta GDP_{t-1} + \beta_6 \sum_{i=1}^{n} \Delta InCPS_{t-1} + \alpha_1 ECT_{t-1} + \mu_t$$

The error correction model shows the speed of adjustment needed to restore the long run equilibrium following a short run shock. The coefficient of the error correction term in the model is a_1 is and must be negative and significant for the return back to long-run equilibrium to hold. The CUSUM and CUSUMSQ tests will be used to determine the stability of the residuals of the model at 5 % significant level.

4.0 Presentation of Results and Empirical Analysis

Descriptive Statistics

Logarithmic transformations of data series are extremely famous in econometrics on the grounds thatmany economic time series data display strong trending pattern and taking the

common (or natural) logarithm of series effectively linearizes the exponential trending pattern (assuming any) (Asteriou & Hall, 2007; Ibukun & Aremo, 2017). Since this study is making use of time series data, we will begin our analysis from the point of representing descriptive characteristics of our data in table 1, before transforming our series to natural logarithm.

Table 1. Descriptive Statistic

	PINV	CPS	GDP	INF	LR	SAV
Mean	36.2204	11.0526	3.1751	2.6856	21.8751	9.0583
Median	35.3155	8.2093	4.2130	2.5428	21.4438	8.7052
Maximum	89.3861	20.7733	15.3292	4.2882	36.0900	23.2454
Minimum	14.1687	5.9173	-13.1279	1.6842	10.0000	3.3356
Std. Dev.	19.5725	5.3777	5.5385	0.7009	6.0926	3.7573
Skewness	0.9872	0.8754	-0.8701	0.8356	-0.0360	1.5005
Kurtosis	3.6208	1.9629	4.5398	2.7812	2.8024	6.7623
Jarque-Bera	6.7824	6.5566	8.5485	4.4983	0.0700	36.6707
Probability	0.0337	0.0377	0.0139	0.1055	0.9656	0.0000
Sum	1376.3730	419.9995	120.6533	102.0542	831.2520	344.2160
Sum Sq. Dev.	14174.0300	1070.0160	1134.9630	18.1765	1373.4200	522.3302
Observations	40	40	40	40	40	40

Source: Author's computation 2021

The descriptive statistics, as shown in Table 1, revealed that the average value of domestic private investment is ₦36.22b. However, the average value of private sector credit ratio, growth of gross domestic product, inflation, lending rate and savings ratio are 11.05%, 3.18%, 2.69%, 21.89% and 9.06% respectively. The asymmetries of data series, as indicated by skewness around its mean, showed that all the variables, except GDP, are positively skewed. Positive skewness means that the distributions of data series have long right tails. The peakedness or flatness of the distribution, or Kurtosis, showed that PINV, GDP and SAV leptokurtic (peaked upward relative to normal), while CPS, INF and LR are platykurtic (flat peaked distribution relative to the normal). Finally, the Jarque-Bera test for normality showed that all the variables except INF and LR, were normally distributed.

Stationarity Test - Augmented Dickey Fuller

The use of ARDL models is indifferent to pre-testing of series for unit root problems, because it accommodate I(0) and I(1) variables, but because of the condition that does not accommodate series that are integrated of order 2, the test for unit root becomes important (Ibukun & Aremo, 2017). Table 2 below presents the results of the Augmented Dickey and Fuller unit root test.

Table 2: Order of Integration

Variables	Unit Root Tests - Augmented Dickey Fuller			Order of Integration
	Absolute Test Statistic with intercept	Absolute Critical Values @ 5%	Remark	
lnPINV	5.4152	2.9458	no unit root	*I(1)*
lnINF	3.3530	2.9434	no unit root	*I(0)*
GDP	3.9351	2.9484	no unit root	*I(0)*
lnCPS	5.5148	2.9458	no unit root	*I(1)*
lnLR	6.1364	2.9484	no unit root	*I(1)*
lnSAV	5.6045	2.9458	no unit root	*I(1)*

Source: Author's computation 2021

ADF tests suggest that lnPINV, lnCPS, InLR and InSAV variables have unit roots at level, whereas they become stationary at the first difference, while ADF Test for InINF and GDP were stationarity at level and first differences.

Lag Length Selection Criteria

Since the computation of F-statistics for co-integration with the ARDL Bounds test is very sensitive to lag length, the result of appropriate lag length for our model is given in table 3 shows the result for the appropriate lag length. The Akaike Information Criterion (AIC) criterion has been used for stationarity and so the lag order of 3 is selected.

Table 3: Lag Length Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-133.6908	NA	0.000118	7.982329	8.248960	8.074370
1	-26.51977	171.4736	2.09e-06	3.915416	5.781833*	4.559703*
2	17.93369	55.88435*	1.56e-06	3.432361	6.898565	4.628894
3	64.65008	42.71212	1.48e-06*	2.819996*	7.885986	4.568775

Source: Author's computation 2021

ARDL Bounds Test for Cointegration

The calculated F-statistic was 5.8879 (see table 4), and has a consequence for the ARDL bound test for cointegration (that is, a long-term relationship). The null hypothesis of no co-integration is rejected because the absolute F-statistic turned out to be greater than both the upper bound (3.79) and lower bounds value (2.62) at a 5 percent significance
level.

Table 4: Result of ARDL Bounds Test for Cointegration

Test Statistic	Value	K
F-statistic	5.887898	5
Critical Value Bounds		
Significance	I(0) Lower Bound	I(1)Upper Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Source: Author's computation 2021

After establishing the existence of cointegration between financial deepening and interest rate variables, the earlier specified long-run equation in levels form will be estimated and presented in table 5.

Table 5: Long-run Causality Estimates, dependent variable is ln PINV

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	-0.026543	0.009459	-2.806184	0.0109
LNCPS	-1.043471	0.140581	-7.422539	0.0000
LNINF	0.188254	0.101603	1.852847	0.0787
LNLR	0.057917	0.232833	0.248749	0.8061
LNSAV	0.250183	0.159617	1.567393	0.1327

Source: Author's computation 2021

From table 5, the coefficients of domestic macroeconomic factors show the percentage change in domestic private investment variable due to changes in domestic macroeconomic factors. Results show that only GDP and lnCPS had negative and significant relationship with Nigeria's domestic private investment. Ekpo (2016) posits that the reason why GDP could be having negative impact on investment is low per capita income. In addition to the position of Ekpo (2016), we think that trading rather than manufacturing constitute the activities of most businesses in Nigeria. It means that domestic private investment is not influenced by the nature of economic activities in Nigeria.

It was expected that CPS would have a positive influence on domestic private investment but the negative estimates of the coefficient is not denying its significance ($p=0.0000<0.05$), but the influence of the volume of credit allocation to the private sector. Ekpo (2016) attributed the reason for low credit allocation in the economy to government borrowing and high interest rate. Also, Ouattara (2005) asserted that credit to the private sector can be negatively related to private investment, inferring that increments in credit to the private sector did not improve private investment. Weak institutional operating conditions and dearth of experienced personnel were few reasons. On the side of above proof, Mbaye (2014) expressed that private sector credits do not go to finance new investments owing to the level of poverty. A lot of borrowers would divert

borrowed funds to settle other personal issues such as education, healthcare and basic necessities. As a result private sector credit is negatively related to private investments.

ARDL Short-Run Dynamics

After establishing and estimating the ARDL long-run model, the need to estimate the error correction model within the ARDL framework becomes sacrosanct. Table 6 shows the estimates of the error correction of financial deepening model.

Table 6: Error Correction Model Estimate

ARDL Error Correction Regression				
Dependent Variable: D(LNPINV)		**Selected Model: ARDL(3, 0, 0, 3, 3, 0)**		
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	2.385818	0.369198	6.462163	0.0000
Δ(LNPINV(-1))	-0.212935	0.134341	-1.585033	0.1286
Δ(LNPINV(-2))	-0.403542	0.148269	-2.721698	0.0131
Δ(LNINF)	0.021581	0.027636	0.780908	0.4440
Δ(LNINF(-1))	-0.077436	0.026092	-2.967746	0.0076
Δ(LNINF(-2))	-0.050817	0.031384	-1.619184	0.1211
Δ(LNLR)	0.394844	0.112809	3.500103	0.0023
Δ(LNLR(-1))	0.526256	0.106584	4.937464	0.0001
Δ(LNLR(-2))	0.280501	0.082971	3.380704	0.0030
ECT(-1)*	-0.525088	0.079017	-6.645241	0.0000
R-squared	**0.679231**			
Adjusted R-squared	**0.563754**			
Durbin-Watson stat	**1.795583**			
F-statistic	**5.881955**			
Prob(F-statistic)	**0.000207**			

Source: Author's computation 2021

The negative coefficient of the error correction term (ECT) implies that our domestic private investment model converges to its long-run equilibrium at 52.51% speed of adjustment. The F-statistics probability of 0.000207 implies that there is overall significance of the model, and Durbin-Watson statistics of 1.7956 conveys that the model is not in danger of first order autocorrelation.

Diagnostic Tests

Diagnostic tests show that residual series are normally distributed, homoskedastic and no serial correlation. The tests involved are Jacque Berra for normality, ARCH and Berusch-Godfrey for serial correlation as well as LM test.

Table 6: Diagnostic Tests Estimates

Diagnostic Tests	Probability of F-Statistics	Remark
Jarque-Bera	0.978359	Normal distribution
Heteroskedasticity Test: Breusch-Pagan-Godfrey	0.767000	Homoskedastic distribution
Breusch-Godfrey Serial Correlation LM Test:	0.060400	No Serial Correlation

Source: Author's computation 2021

The p-value of the F-statistic in all the three tests were greater than 0.05, it means that the null hypotheses is accepted. Hence we conclude that the data series are normally distributed, homoskedastic and not serially correlated.

Stability Tests

In the first instance, the absence heteroscedasticity in the model is a kind of stability in its own sense because it indicates that the variances of the data series are stable with time. However, further substantiation of our model stability can be done with the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) to test the stability of the long-run coefficients and short-run dynamics. Figure 1 and 2 show the graphical results of CUSUM and CUSUMSQ.

Figure 1: CUMSUM Test

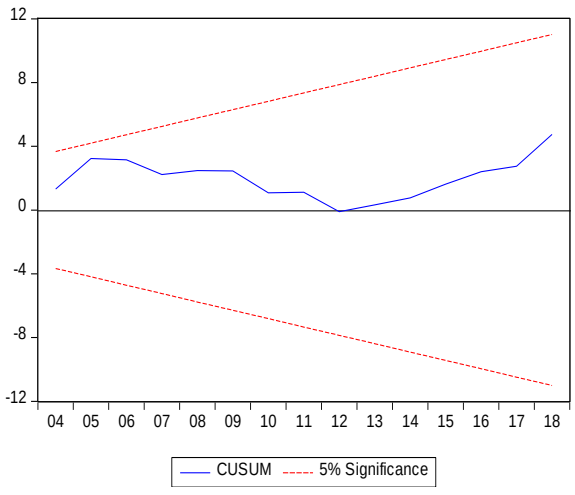
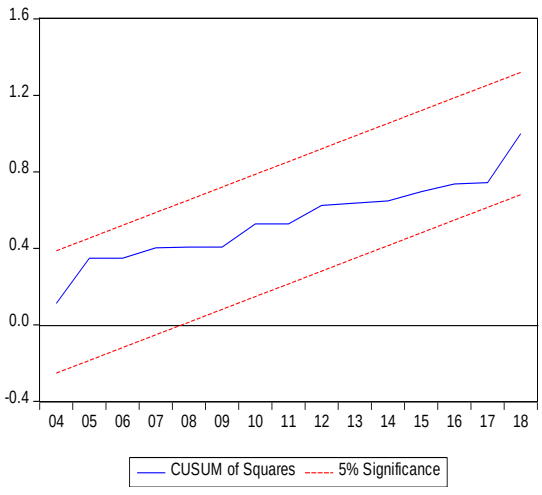


Figure 2: CUMSUM of Square Test



Source: Author's computation 2021

From figures 1 and 2 above, it can be seen that the plots of both the CUSUM and CUSUMSQ fall within the 5% boundaries, and proving the stability of model coefficients of interest rates have effect on financial deepening in Nigeria. The model is stable and suitably specified since none of the two tests statistics deviated away from the 5 percent bounds level.

5.0 Summary, Conclusion and Recommendations

The prospect of having a domestic private investment model in Nigeria has created worries for researchers, policy-makers, academics, and foreign investors, having seen a lot of studies on the determining factors of domestic private investment. This study examines the determinants of domestic private investment in Nigeria with ARDL and ECM from 1981 to 2020. The long-run relationship between domestic private investment and explanatory variables such as growth of gross domestic product, private sector credits, inflation, lending rates and savings rates was established by the ARDL bounds test. The related ECM was negative and significant, confirming that long-run relationship exists in the model. One implication of this study is that Nigeria can increase the level of domestic private investment through increased credit allocation to private sector by the financial institutions. All the impediments of domestic private investment, such as government borrowing from banks and high rising lending rate, should be given priority attention. Besides, this implies reducing crowding out of the private sector in credit market. The Monetary Policy Rate (MPR) of the Central Bank of Nigeria (CBN) is a significant framework for lending rate levels in Nigeria. As much as money supply is important in controlling the national inflation rate, naira exchange rate depreciation continue to make this policy direction of the CBN a fruitless control.

Regarding growth of the economy, the conclusion we have is that economic growth in aggregate terms should not just be appreciated without critically understudying the structure of economic activities that drive domestic private investment. This study made a significant discovery that will be an empirical backing to the claims that Nigeria is more or an import-dependent country. It is noteworthy to state here that industrialization through manufacturing output is the most reliable model for a less developed country seeking to develop. Industrialization helps to absorb a country from external shocks, which is the more reason why this study is particular on domestic private investment rather than foreign direct investment.

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CLIMATE CHANGE, AGRICULTURAL OUTPUT AND ECONOMIC DEVELOPMENT IN NIGERIA

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Abstract
The study examined the impact of climate change on agricultural output and economic development in Nigeria. Autoregressive distributed lag (ARDL) technique with E-views was used on secondary time series data obtained from Central Bank of Nigeria (CBN) Statistical Bulletin (various issues) and World Development Indicators (WDI) for the period 1981 to 2018. Finding reveals that climatic changes essentially lead to dramatic declines in agricultural output in Nigeria. However, the study shows that shocks to rainfall are the most critical. Other factors such as government spending in agriculture, exchange rate, inflation, capital accumulation and labour input were also shown to have long run impacts on agricultural production in Nigeria. The study also finds that agricultural output has very effective dynamic impact on economic development in Nigeria. The study recommends that government should increase spending in order to boost agricultural output of climate tolerant crop varieties which is a key tool for adapting agriculture to a changing climate; and Adaptation strategies, which are short and long-term changes to human activities that can help to respond to the effects of changes in climate.

KEY WORDS: Climate Change, Agricultural output and Economic Development
JEL Codes: O13, Q01 and Q47

1.0 Introduction

Agriculture in Nigeria is largely rain-fed; this implies that any unfavourable or extreme change in climate is likely to impact negatively on agricultural output. This could be in terms of effects on crop growth, availability of soil water, flood, drought, soil erosion, etc in soil fertility. Another negative force is dependence on weather which affects the increase in agricultural produce. Nigeria Agriculturists or farmers still depend on rainfall only to produce instead of the use of irrigation that supplies water all through the year. Agricultural activities in Nigeria are sometimes plagued by extreme weather conditions such as draught and flooding during the raining season.

Agriculture has been found to be highly sensitive to weather and climate variables, like temperature, precipitation, etc. and to extremes such as droughts, floods and severe storms. World's climate over the centuries has been in constant change, with rainfall, rather than temperature, being the most relevant climatic limiting factor of food production ((Molua 2002, Warren, 2005). Hence, any alteration in the climatic condition due to human activities which may likely limit the volume of rainfall has the potential to pose severe consequences on overall agricultural output.

Nigeria is blessed with very diverse and rich vegetation capable of supporting large population of livestock and has estimated surface water volume of about 267.7 billion cubic meters and underground water of about 57.9 billion cubic meters. The ecological zones in Nigeria are also very diverse with the semi-arid Sudan (Sahel) zone, Guinea Savannah and Derived Savannah zone as well as Forest and Mangrove (high rainfall, moist sub-humid and very high humidity) zone. A few variations exist within each ecological zone. The ecology and trends in precipitation in a region determines what kind of farming system the people will practice, their food preference and how they make use of natural resources in their environment (Azih, 2008, Aregheore, (2011).

Climate change is any significant long-term change in the expected patterns of average weather of region (or the whole Earth) over a significant period of time. It is about non-normal variations to the climate, and the effects of these variations on other parts of the Earth. These changes may take tens, hundreds or perhaps millions of years. It should be noted that the activities of man are the major cause of climate change due to population explosion, advancement in technology and uncontrolled exploitation / utilization of natural resources among others. Evidences of climate change to include: rise in temperature and drought, increase in annual rainfall during wet season, shorter rainy season and longer dry season, increasing cases of dry spells and drought, unpredictability of rainfall, change in the distribution of rainfall in wet season, excessive dryness during dry season and increasing temperature in wet and dry seasons likewise the harmattan period.

These effects have also resulted to some impacts such as flooding, erosion, drought, the decline in agricultural activities, migration leading to crises among farmers and herds - men hunger and poverty among others. Climate change has become a headline issue in policy statements from donors, governments and civil society actors. In the agricultural sector, most agencies have started re-thinking their agricultural portfolios in relation to the projected climate change impacts. It could be argued that climate change presents a window of opportunity to open up policy spaces for dealing with uncertainty and complexity of agri-food systems. Future impacts are projected to worsen as the temperature continues to rise and as precipitation becomes more unpredictable. Among the many adverse impacts of climate change, the risk to agriculture is considered most significant (Cline 2007; Dinar, Hassan., Mendelsohn & Benhin, 2008; Kurukulasuriya & Mendelsohn 2008a, b; Seo et al. 2009).

Agriculture is the engine of economy-wide performance because the sector growth exhibits a higher multiplier than growth in other sectors especially in countries where its sector share is large. (Tiffin and Irz, 2006). Despite the growing knowledge of climate change and its impacts on agriculture, many uncertainties resulting from flooding and, desertification remain. To address these issues the following research questions and hypothesis are formed.

i) Does climate change affect agricultural output in Nigeria?
ii) Does climate change affect economic development in Nigeria?

Hypotheses
Ho1: climate change does not affect agricultural output in Nigeria.
Ho2: climate change does not affect economic development in Nigeria.

In the light of the above, the objective of this work is to find out the impact of climate change in terms of temperature rise, rainfall, etc., on agricultural output and economic development in Nigeria. This paper is organised into five sections. Section 1 is the introduction, Section 2, examines the linkages among agriculture, climate change and economic growth and frames this paper in the context of other papers in the literature. Section 3 presents the model and how the parameters are estimated while Section 4 describes the data and analysis of key findings. Section 5 concludes the study.

2.0 Literature Review

According to Adejuwon (2004) the issue of climate change has become more threatening not only to the sustainable development of socio-economic and agricultural activities of any nation but to the totality of human existence. Overcoming challenges posed by climate change related to agricultural production which in turn affect economic development will depend on farmer's use of technology. (Kurukulasuriya & Mendelsohn 2007, 2008a; Hassan & Nhemachena 2008).

Climate change manifests itself with temperature increases, changes in precipitation, a rise in sea levels thereby increasing the intensity of such natural hazards as storms, floods and droughts. (IPCC 2007). Abul Quasem et al (2011) stated in a study that climate change could reduce crop yield and areas vulnerable to drought could become marginal for cultivation thus posing a threat to national food security and exports earnings. Increasing temperatures will result in enhanced evapotranspiration, leading to a reduction of the water availability. An increase in the magnitudes of the storms will result in an increase in the frequency of floods and flood damage which in turn will increase salt intrusion causing less amount of water available to use in agriculture.

Kurukulasuriya and Mendelsohn, (2006), assessing the impact of climate change on African cropland from 11 countries involving over 9000 farmers, they found that net farm revenues fall as precipitation falls or as temperatures warm across all the surveyed farms. Edame, Anam, Fonta & Duru (2011) examines the economic impact of climate change (CC) on food security and agricultural productivity in Sub Saharan Africa (SSA). And noted that agriculture is particularly vulnerable to climate change. Projections to 2050 suggest both an increase in global mean temperatures and increased weather variability, with implications for the type and distribution of agricultural production worldwide, also stated that increased intensity and frequency of storms, altered hydrological cycles, and precipitation variance also have long-term implications on the viability of current world agro ecosystems and future food availability. Climate change has been described as the most significant environmental threat of the 21st century.

Odusola & Abidoye (2015) examined the impact of temperature and rainfall volatility on economic growth in 46 African countries. Employing the Bayesian hierarchical modeling approach which allows them to estimate both country level and Africa-wide impact of climate change and extreme events on economic growth in Africa. The finding shows that a 1° Celsius increase in temperature leads to 1.58 percentage points decline in economic growth while temperature shock reduces economic growth by 3.22 percentage points. A 1 percent change or shock in rainfall leads to a 6.7 percent change in economic growth. The impact of temperature changes across the 46 countries ranges from -1.24 percent to -1.82 percent in GDP. There are proximity effects on the impact.

Odejimi & Ozor (2019) in their study, can climate change affect agricultural output in Nigeria? Using the Ordinary Least Square technique, covering a period of 1981 – 2017, reveals that climate change impact on agricultural production have positive relationship with government expenditure, exchange rate, rainfall and agricultural output while negative relationship with temperature and inflation.

3.0 Research Methodology

Model Specification

The particular model specified in this study is based on the formulation by Mall, Gupta and Sonkar (2017) and also adopted by Ekpenyong Ogbugau (2015). The model therefore specifies a dynamic relationship between climate change and both agricultural production and economic production in Nigeria. The dynamic relationship is based on the fact that climate change may not only exert one round of effect on agricultural output or development, rather the effects may be self-reinforcing over time (Ayinde, Muchie & Olatunji, 2017). Moreover, two equations are specified for both agricultural output and development. Climate change is captured by temperature and rainfall in the country as also demonstrated in Kumar and Gautam (2014) and Masters and Wiebe (2000). In the development equation, agricultural output is included as one of the explanatory variables, while inflation, exchange rate, capital formation and labour force are also included.

The model is specified as:

GDPPC = f(AGOP, INF, EXR, GFCF, LABF)

(1)

Where GDPPC growth = GDP per capital (used to proxy economic growth)

AGOP = Agricultural Output

INF =Inflation Rate (measured as the consumer price index)

EXR = Exchange Rate

GFCF = Gross Fixed Capital Formation

LABF = Labour Force

For the agricultural output equation, the specification is:

AGOP = f(TEMP, RFALL, GEA, INF, EXR, GFCF, LABF)

(2)

Where TEMP = Average Annual Temperature

RFALL = Rainfall

GEA = Government Expenditure on Agriculture

In the econometric form, the models are specified as:

$$GDPPC_t = \alpha_0 + \alpha_1 AGOP_t + \alpha_2 INF_t + \alpha_3 EXR_t + \alpha_4 GFCF_t + \alpha_5 LABF_t + U_1 \quad (3)$$

$$AGOP_t = \beta_0 + \beta_1 TEMP_t + \beta_2 RFALL_t + \beta_3 GEA_t + \beta_4 INF_t + \beta_5 EXR_t + \beta_6 GFCF_t + \beta_7 LABF_t + U_2 \quad (4)$$

Apriori expectation: $\alpha, \alpha_4\ \alpha_5, > 0;\ \alpha_2, \alpha_3 < 0, \beta_1, \beta_2, \beta_3, \beta_4, < 0;\ \beta_5, \beta_6 > 0$

3.3. Estimation Technique

Given the dynamic nature of climate change effect on agriculture and development the goal of the study, the Autoregressive Distributed Lags (ARDL) approach to cointegration relationship modelling is adopted. The (ARDL) approach to cointegration is based on the

methodology outlined in Pesaran and Shin (1999). The main advantage of this procedure is that it can be applied regardless of the stationary properties of the variables in the sample and allows for inferences on long-run estimates, which is not possible under alternative cointegration procedures. The ARDL/Bounds Testing methodology of Pesaran & Shin (1999) and Pesaran *et al*. (2001) have a number of features that give it some advantages over conventional cointegration testing. In relation to the current study, the expanded ARDL model that explains dynamic relationship between agricultural output and development in Nigeria is specified as:

$$\begin{aligned}\Delta gdppc_t = {} & \alpha_0 + \phi gdppc_{t-1} + \delta_1 agop_{t-1} + \delta_2 inf_{t-1} + \delta_3 exr_{t-1} + \delta_4 gfcf_{t-1} \\ & + \delta_5 labf_{t-1} \\ & + \sum_{i=1}^{p-1} \psi_i \Delta \text{gdppc}_{t-i} + \sum_{i=1}^{q_1-1} \varphi_1 \Delta agop_{t-i} + \sum_{i=1}^{q_1-1} \varphi_2 \Delta inf_{t-i} \\ & + \sum_{i=1}^{q_1-1} \varphi_3 exr_{t-i} + \sum_{i=1}^{q_1-1} \varphi_4 \Delta gfcf_{t-i} + \sum_{i=1}^{q_1-1} \varphi_1 \Delta labf_{t-i} + \delta ECM_{t-1} \\ & + \xi_t \qquad (5)\end{aligned}$$

The model for agricultural output is specified as:

$$\begin{aligned}\Delta agop_t = {} & \alpha_0 + \phi agop_{t-1} + \delta_1 temp_{t-1} + \delta_2 rfall_{t-1} + \delta_3 gea_{t-1} + \delta_4 inf_{t-1} \\ & + \delta_5 exr_{t-1} + \delta_6 gfcf_{t-1} + \delta_7 labf_{t-1} \\ & + \sum_{i=1}^{p-1} \psi_i \Delta agop_{t-i} + \sum_{i=1}^{p-1} \varphi_1 \Delta temp_{t-i} \\ & + \sum_{i=1}^{p-1} \varphi_2 \Delta rfall_{t-i} + \sum_{i=1}^{p-1} \varphi_3 \Delta gea_{t-i} + \sum_{i=1}^{p-1} \varphi_4 \Delta inf_{t-i} + \sum_{i=1}^{p-1} \varphi_5 \Delta exr_{t-i} \\ & + \sum_{i=1}^{q_1-1} \varphi_6 \Delta gfcf_{t-i} + \sum_{i=1}^{q_1-1} \varphi_7 \Delta labf_{t-i} + \delta ECM_{t-1} \\ & + \xi_t \qquad (6)\end{aligned}$$

The conditional long-run model can then be produced from the reduced form solution of (5 & 6), when the first-differenced variables jointly equal zero. The adjustment to long run long run value of the dependent variable is determined by the cointegrating equation. Also, the values of short-run dependent variables (GDPPC and AGOP) are given by the $\varphi_i s$, while the values of dependent variables are represented as $\frac{\varphi_{it}}{1-\varphi_{it}}$ for tax-to-income tax effort estimations.

3.4 Diagnostic Tests

The application of the ARDL technique presupposes that, certain properties of the time series data employed in the analysis possess qualities. These qualities will be tested based on the diagnostic testing procedure.

Testing for Stationarity

The Augmented Dickey-Fuller (ADF), Phillip-Perron (P-P) and the Kwiatkowski–Phillips–Schmidt–Shin (*KPSS*) unit roots test will be used to test for stationarity. The use of a non-stationary variable is used in regression analysis results in spurious relationship. This would lead to poor forecasts. The ADF and P-P tests take the unit root to be null hypothesis Ho: $\rho = 1$ which is then tested against one-side alternative H_1: $\rho < 1$. For the KPSS test, the null hypothesis for the test is that the data is stationary, while the alternate hypothesis for the test is that the data is not stationary.

Co-integration Tests

If a linear combination of variables is stationary, then, the relationship between dependent variable and a linear combination among these variables can be thought to be co-integrated. The test for long run relationship between the dependent variable and each of the independent variables is the cointegration test. The null hypothesis of non-existence of a long-run relationship is defined by testing the hypothesis [based on the general form of the ARDL model in equation (5 & 6) above]:

$$\Phi = \delta_1 = \ldots = \delta_k = 0$$

This test is the bounds testing procedure introduced by (Pesaran et al., 1996), along with the critical value bounds for these tests. The test is performed by comparing the F-statistic computed from the ARDL equation with the upper and lower 90, 95 or 99 percent critical value bounds (F_U and F_L). In the case where the F-statistic lies below the lower bound, the long run relationship may be rejected. On the other hand, if the F-statistic is higher than the upper bound of the critical value band the null of no long run relationship between the variables can be rejected irrespective of their order integration.

3.5 Sources of Data

Annual data covering the period 1981-2018, were used in this study. The data were obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin (various issues) and World Development Indicators (WDI), 2018.

4.0 Presentation of Results and Empirical Analysis

Table 1: Descriptive Statistics

	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Kurtosis	J-B	Prob.
GGDPPC	1.631	1.494	11.751	-9.889	4.271	-0.102	3.295	0.199	0.905
GAGOP	5.880	4.107	55.578	-4.382	9.180	4.456	24.718	849.606	0.000
GEA	17.002	7.060	65.400	0.010	20.145	0.907	2.499	5.456	0.065
LRFALL	4.539	4.548	4.721	4.278	0.091	-0.671	3.447	3.086	0.214
TEMP	93.906	93.985	112.247	72.067	8.201	-0.398	3.147	1.039	0.804
EXR	93.749	106.711	306.921	0.672	90.735	0.826	3.022	4.208	0.122
INF	64.169	56.350	111.720	35.200	20.646	0.812	2.616	4.290	0.117

GFCF	25330.810	10823.690	85749.700	1190.563	25408.200	0.969	2.444	6.267	0.044
LABFP	56.835	56.500	61.830	54.600	1.785	1.100	3.761	8.353	0.015

Source: Author's computation 2021

Data description also involves examining the initial patterns of relationship among the variables in the study that is shown in Table 1. The Table shows that GDP per capita has a significant positive relationship with all the variables except inflation rate where the relationship mis negative. The same relationship is demonstrated by agricultural output. This shows that agricultural output is closely related with GDP per capita growth. As the agricultural sector expands, GDP per capita is also noted to expand also over time. The two climate change variables of rainfall and temperature have a very high positive correlation of 0.89 which is also significant at the percent level. This shows that both climate change variables can exert similar impact on agriculture at any given year.

4.2 Unit Root and Cointegration Analysis

Two tests of stationarity were employed in this study in order to analyse unit roots. The results are presented in levels and first differences. This enables us to determine, in comparative terms, the unit root among the time series and also to obtain more robust results. Table 2 presents results of Augmented Dickey Fuller (ADF) and Philip-Perron (PP) tests in levels and first differences without taking into consideration the trend in variables. The reason for this is that an explicit test of the trending pattern of the time series has not been carried out. The results indicate that each of the variables (apart from the climate change variables) possesses both ADF and PP values that are less than the 95 percent critical values for the level series and greater than the critical value for the differenced series. In all cases, the variables in level form were non-stationary but their first differences were found to be stationary. However, the variables of climate change were stationary in levels since there tests show significance of both the ADF and PP in the levels form. This shows that some variables are integrated of order 0 and others are integrated at order 1 (i.e. I[0] and I[1]). It is therefore appropriate to use the ARDL-based cointegration analysis to estimate the relationships between the variables Guest and Swift (2008).

Table 2: Unit Root Test for Variables

Variable	ADF Test		Phillip-Perron Test		Order of Integration
	Levels	*First Difference*	*Levels*	*First Difference*	
LGDPPC	1.954	-45.14*	1.137	-37.67*	I[1]
LGOP	-2.329	-6.155*	-2.298	-6.157*	I[1]
LGEA	-0.002	-5.393*	-0.002	-6.393*	I[1]
LTEMP	-3.33*		-3.975*		I[0]
LRFALL	-5.10*		-5.182*		I[0]
LEXR	-1.054	-4.449*	-0.883	-6.836	I[1]

LINF	-1.74	-5.887*	-1.174	-10.47*	I[1]
LGFCF	-1.003	-4.924*	-1.376	-8.372*	I[1]
LLABF	-1.374	-6.266*	-1.366	-7.843*	I[1]

*Note: * indicates sigsisignificant at 5 percent* Source: Author's computations 2021

Given that the study focuses on error correction processes in the ARDL procedure, test for a common stochastic trend is also conducted in this study. In terms of the effects of the main climate change and other variables on development in Nigeria, the study proposed the test of long term autoregressive pattern of relationship. This is because the variables are integrated of different orders. Table 3 shows the result of the Bounds test of long run effects for the ARDL specifications for the two equations. The evaluation of the results is based on the critical F-statistic values for the lower and upper bounds as also reported in the results. The F values for the tests are both greater than both the lower and upper Bounds values at the 5 percent levels. According to the empirical output of the F-values in both panels of Table 4 therefore, it can be seen that the null hypothesis of no long-run relationship between GDPPC and the entire determinant variables is rejected for each of the structural component and the total effort at the 5 percent level. These results are similar for AGOP equation. These results reveal that for each of the equations, the determinant variables had strong long run relationships with the dependent variable. Apparently, both GDPPC and agricultural output are in Nigeria move in tandem with the determinant variables in the long run.

Table 3: Bonds Test Results

GDPPC equation			**AGOP equation**		
Test Statistic	Value	K	Test Statistic	Value	k
F-statistic	4.39	5	F-statistic	5.60	6
Critical Bounds Value					
Significance	I0 Bound	I1 Bound	Significance	I0 Bound	I1 Bound
10%	2.26	3.35	10%	2.12	3.23
5%	2.62	3.79	5%	2.45	3.61
2.50%	2.96	4.18	2.50%	2.75	3.99
1%	3.41	4.68	1%	3.15	4.43

Source: Author's computation 2021

4.3 Regression Results

The result of the cointegrated equation for the AGOP equation is presented in Table 4. The goodness of fit statistics is impressive and show that the equations are appropriately estimated. The adjusted R-squared value 0.996 and suggests that over 99 percent of the systematic variations in AGOP is captured by the explanatory variables. The F-value also passes the significances test at the 1 percent level which shows that a strong dynamic relationship actually exists between AGOP and all the independent variables combined. The D.W. statistic is also appropriate and indicates absence of autocorrelations in the estimates.

It should be noted that the results of the cointegrated equations show both the short run cointegrated and the long run estimates. In the short run results, the coefficients of all the various lags of temperature fail the significance tests at the 5 percent level. This shows that temperature has no significant impact on agricultural production in the short run. In other words, changes in temperature may not change agricultural output within a short period. On the other hand, the first lag of rainfall has a significant negative impact on AGOP at the 1 percent level. This indicates that shocks in rainfall effectively tend to immediately reduce agricultural output in the country. Thus, while rainfall has immediate impact on agricultural output, temperature changes do not exert such impact. Similar short run results were found by Gautam and Sharma (2012) for other developing economies.

Table 4: Cointegrated Results for AGOP

Variable	**Coefficient**	**t-Statistic**	**Prob.**
D(LTEMP)	-0.191	-0.297	0.774
D(LTEMP(-1))	-1.285	-2.152	0.064
D(LTEMP(-2))	1.186	1.429	0.191
D(LRFALL)	0.043	0.597	0.567
D(LRFALL(-1))	0.292	4.553	0.002
D(LGEA)	0.031	2.508	0.037
D(LGEA(-1))	0.032	3.917	0.004
D(LGEA(-2))	-0.069	-8.715	0.000
D(LEXR)	-0.045	-1.989	0.082
D(LEXR(-1))	-0.044	-1.914	0.092
D(LEXR(-2))	-0.089	-4.051	0.004
D(LINF)	-0.300	-6.372	0.000
D(LINF(-1))	-0.193	-4.428	0.002
D(LGFCF)	0.060	5.346	0.001
D(LGFCF(-1))	0.040	2.600	0.032
D(LGFCF(-2))	-0.034	-2.295	0.051
D(LLABF)	0.542	0.899	0.395
D(LLABF(-1))	0.586	1.112	0.298
ECM(-1)	-0.592	-10.483	0.000
Adjusted R-squared = 0.996	F stat = 489.5	D.W. stat 2.268	
Long Run Coefficients			
Variable	Coefficient	t-Statistic	Prob.
LTEMP	-0.662	-2.227	0.026
LRFALL	-0.979	-6.289	0.000
LGEA	0.143	6.352	0.000
LEXR	0.027	0.848	0.421
LINF	-0.470	-7.709	0.000
LGFCF	0.132	4.903	0.001
LLABF	2.348	4.488	0.002
Constant	6.494	0.632	0.545

Source: Author's computation 2021

While the coefficient of current government expenditure on agriculture (GAE) has a significant positive impact on AGOP in the short run the coefficients of lagged GEA have significant negative impacts on AGOP. This shows that government spending on agriculture only boosts the sector immediately. The delayed impact is negative. This may be explained by the high levels of corruption in the sector that renders government expenditure in the sector ineffective in most cases. The coefficients of exchange rate and inflation are all negative at the different lags, suggesting that exchange rate increases or depreciation of the naira as well as rising prices both tend to reduce agricultural output in the short run. The capital component has significant impact on the output but the labour component fails the significance test. This shows that in Nigeria, capital is more important than labour in terms of ensuring short run boost in agriculture.

The coefficient of the ECM term for each of the estimation results has the expected negative sign and highly significant at the 1 percent level. This shows that long run equilibrium is stable and that any short run deviation from long run equilibrium level will always be restored on the bases of the climate change variables and other factors in the model. The coefficients of the ECM term is however moderate and reveals that adjustment to long run equilibrium is rather slow. Only about 59 percent of the adjustment is complete within the first period.

In the long run results, the steady-state impacts of each variable on AGOP are demonstrated. The long run coefficients of both climate change variables of temperature and rainfall possess negative signs. This shows that climate change has an unequivocal negative impact on agricultural output in Nigeria in the long run. From the result, a 1 percent increase in temperatures will lead to a 0.662 percent drop in agricultural output. In the same vein, a one percent shock in rainfall will also lead to a 0.979 percent fall in agricultural output in the country. These results are similar to those of Kumar and Gautam (2014) for Asian countries, Slater, Peskett, Ludi and Brown (2007) for other tropical countries, Ekpenyong & Ogbuagu (2015) and Enete (2014) for Nigeria. The impact of rainfall shock is larger than that of temperature shock. This shows that long run development of the agricultural sector depends heavily on how well the economy is able to adapt to temperature changes. Government expenditure is shown to have a significant positive impact on agricultural output in the long run. In the same vein, both labour and capital have significant impacts on agricultural output in the long run. Thus, though labour was not important in the short run estimates, it is a significant factor in ensuring steady state improvement in agricultural output in Nigeria.

The results of the economic development equation are reported in Table 5. The equation has AGOP as one of the independent variables. The optimal lag structure for the estimation (based on the SBC) is 1. From this variable, the indirect effect of climate change on the economy may also be observed. In the short run results, the coefficient of AGOP is significant at the 1 percent level. The coefficient is also positive which shows that agricultural output has a significant positive impact on economic development in Nigeria even in the short run. Boosting agriculture tends to immediately raise the livelihoods of individuals in Nigeria. This outcome is plausible since the results have shown that over half of the Nigerian population is linked to agricultural production in Nigeria. Apparently, boosting agriculture is a veritable means of ensuring immediate improvement in the economic fortunes of millions of Nigeria. The result also shows that

shocks to climate may indirectly hamper economic development in Nigeria in the short run. The coefficient of capital formation is also significant in the short run results, which shows that critical relevance of capital in boosting the economy in Nigeria.

Table 5: The development equation

Variable	Coefficient	t-Statistic	Prob.
D(LAGOP)	0.216	3.738	0.001
D(LEXR)	-0.024	-1.957	0.060
D(LINF)	0.003	0.157	0.877
D(LGFCF)	0.030	3.635	0.001
D(LLABF)	-0.590	-1.507	0.143
CointEq(-1)	-0.313	-5.504	0.000
Adjusted R-squared = 0.998	F stat. =2891.956	D.W. stat. = 2.043	
Long Run Coefficients			
Variable	Coefficient	t-Statistic	Prob.
LAGOP	0.689	8.502	0.000
LEXR	0.012	0.586	0.563
LINF	0.009	0.158	0.876
LGFCF	0.095	2.840	0.008
LLABF	-0.171	-0.289	0.775
Constant	4.070	1.690	0.102

Source: Author's computation 2021

The coefficient of the ECM term for each of the estimation results has the expected negative sign and highly significant at the 1 percent level. This shows that long run equilibrium is stable and that any short run deviation from long run equilibrium level of GDPPC will always be restored on the bases of the climate change variables and other factors in the model. The coefficients of the ECM term is however low at -0.313. There is therefore evidence that adjustment to long run equilibrium will be quite slow in the Nigerian economy on the basis of agricultural development.

In the long run result, the coefficient of AGOP is also very significant at the 1 percent level. This shows the super effect that agricultural development has on the Nigerian economy. This effect occurs at both the short run and the long run. Also, shocks to the climate may also reduce economic performance at any given time in the country. The coefficient of GFCF is significant and shows that capital formation is essential for ensuring log run development in the Nigerian economy.

In order to test the stability of cointegration parameters, the L_c test formulated by Nyblom (1989) and Hansen (1992) is employed based on the estimations. According to Balcilar Eyden, Inglesi-Lotz, and Gupta, (2013), the "Nyblom-Hansen statistic tests for parameter constancy against the alternative hypothesis that the parameters follow a random walk process". From the results in Table 6 (also shown in Figure 1), there is clear

indication of parameter stability in each of the equations. This is demonstrated by the insignificant values for the Hansen L_c coefficients in the estimation. Thus, a significant and stable long run relationship is shown to exist between agricultural output and economic development in Nigeria. Also, the respective J-B and LM tests for the normality and serial correlation show that the residuals are normally distributed and are devoid of serial correlation.

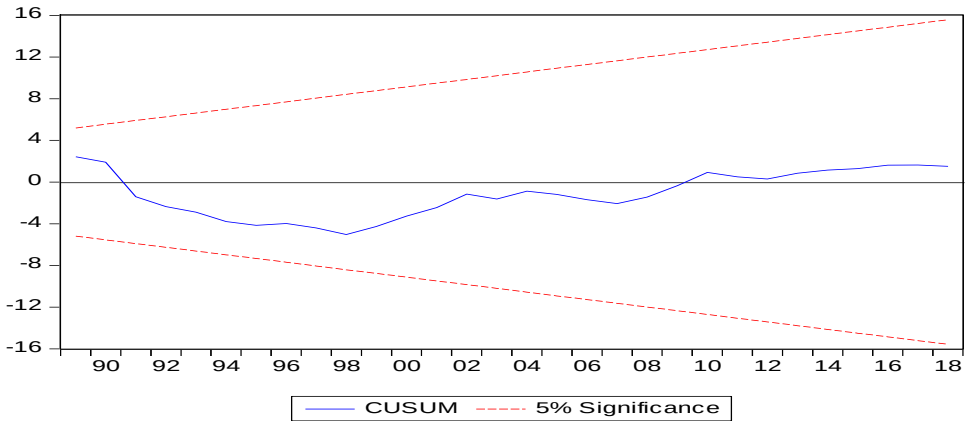
Table 6: Test of Stability of Cointegration Parameters

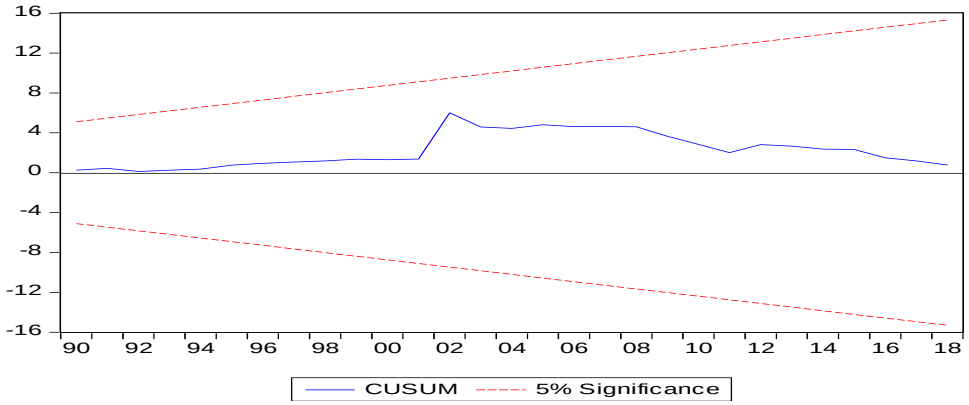
Variable	GDP per capita	Services sector	Employment
$L_c$value	0.343	0.412	0.378
Bootstrap p value	0.123	0.078	0.097
Normality test (J-B)	2.207 (p = 0.332)	0.404 (p = 0.132)	0.191 (p = 0.908)
Serial Correlation LM Test	0.943 (p = 0.404)	0.943 (p = 0.404)	0.943 (p = 0.404)
Heteroskedasticity test	0.952 (p = 0.491)		

Source: Author's computations 2021

Finally, robustness checks are provided by testing the stability of the estimated data set across the cross sections in the sample. This helps to eliminate doubt about possible outlier regression for any of the groups in the sample. The chart in Figure 4 shows the result of the CUSUM of squares test. It can be seen that the CUSUM of squares line for the result lies entirely within the dotted 5 percent significance bound line throughout the chart. This reveals that the estimation is stable within the analysis.

Figure 1: CUSUM tests for AGOP and GDPPC results





5.0 Summary, Conclusion and Recommendation

In this study, the relationships between climate changes, agricultural output and economic development in Nigeria was empirically examined. It is argued that climate change can affect the economy through agricultural production, while agricultural output can explain growth prospects in the Nigerian economy. Data used covers the period 1981 to 2018, while a dynamic framework was developed for the relationships. Apparently, the effects of climate change on the agricultural sector can be more than one round, which implies that the structure of the relationships is dynamic. Thus, the autoregressive distributed lags (ARDL) technique was adopted in the estimation of the relationships. From the empirical estimations, the study found that shocks to rainfall are the most critical climate change factor that affects agricultural output in Nigeria. The effect of rainfall was negative and significant in both the short run and the long run, while that of temperature was only significant (and negative) in the long run. Also, the impact of rainfall on agricultural output was shown to be stronger in terms of size than that of temperature. In general, however, the study shows that climatic changes essentially lead to dramatic declines in agricultural output in Nigeria. Other factors such as government spending in agriculture, exchange rate, inflation, capital accumulation and labour input were also shown to have long run impacts on agricultural production in Nigeria. The study also finds that agricultural output has very effective dynamic impact on economic development in Nigeria. The impact is both short term and long term, therefore suggesting that climate change can have an indirect impact on economic development in Nigeria through agricultural output variation.

Recommendations

Certain policy directions can be obtained from the empirical analysis in this study. These include the following:

- The study has shown that agricultural spending can help to boost the sector production in the long run. This means that government expenditures can be directed at addressing climate impacts whose effects may be more profound on the agricultural sector.
- The study shows that shorter term shocks from increased climate variability might be experienced much sooner and are likely to be severe for tropical areas. Therefore, Adaptation strategies, which are short and long-term changes to human activities, can help to respond to the effects of changes in climate. In the agricultural sector in Nigeria, adaptation will require cost-effective investments

in water infrastructure, emergency preparation for and response to extreme weather events, development of resilient crop varieties that tolerate temperature and precipitation stresses, and new or improved land use and management practices.

- Crop breeding for development of new climate tolerant crop varieties is a key tool for adapting agriculture to a changing climate. Cropping system development is another tool that can help agriculture adapt. For example, the use of crop mixtures that have several crops growing at one time can help systems exhibit greater durability during periods of high water or heat stress.
- The basic mechanism that can ensure long term development in the country is a self-reinforcing growth process whereby output is reinvested in both inputs as well as Research and Development.

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MISERY INDEX AND ECONOMIC GROWTH: EMPIRICAL EVIDENCE FROM THE WEST AFRICAN MONETARY ZONE (WAMZ)

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Abstract

The paper investigated the impact of Misery index on economic growth in the West African Monetary Zone (WAMZ) from 2000 to 2020. To achieve the objectives of the study, the panel ARDL/PMG technique was employed; also Granger Causality test was carried out to ascertain the direction of causation between the variables used. We used Gross Domestic Product growth rate (GDP_GR) proxy for economic growth as the dependent variable, Misery Index (MIX) and Foreign Direct Investment (FDI) were used as independent variables. The cross-sectional dependency test revealed the presence of cross-sectional dependency at a 1% level of significance for the variables used. The unit test results were observed to be statistically significant at both the level and first difference based on this further empirical analyses were conducted. The empirical observation indicated that there is a long run relationship between variables employed in the model, Misery index was found to be impeding economic growth while Foreign Direct investment enhances economic growth in WAMZ countries. A unidirectional Causality was observed to run from misery index to economic growth. The paper however concludes that policy should be geared towards reducing unemployment and inflation rates as their increases adversely affect economic growth in WAMZ countries.

Keywords: Misery Index, Economic Growth, West African Monetary Zone, Panel ARDL
JEL Classification: B41, C01, E21, E31

1.0 Introduction.

As developing nations tend to work towards attaining economic comfort and advancement, they are faced with the twin problem of increasing rates of unemployment and inflation. Unemployment is one of the macroeconomic ills affecting countries in Africa, which could be classified into voluntary and involuntary. Voluntary unemployment arises when people refuse to take up employment because they have other means of livelihood while on the other hand involuntary unemployment prevails when persons are unable to find jobs at the current wage level even when they are willing to work receiving less than the current wage rate.

According to the World Bank (2021) and National Bureau of Statistics (2021), the unemployment rate increased from 10.6 % in 2012 to 22.6 % in 2018, 33.30% in the

fourth quarter of 2020, 34.9% in the third quarter of 2021 and its projected to increase to about 53% in 2022 in Nigeria while Gambia unemployment rate in 2019 stood at 8.9 % which increased to 9.6% in 2020. Liberia recorded unemployment rate of 2.32% in 2000, however there was a fall in 2015 to 2.08% since then it had been on an increase, and in 2018 it increased to 2.94% and 3.3% in 2020 respectively. Ghana as a country experienced its highest peak of the unemployment rate in 2000 (10.36%); it declined to 4.12% in 2019 and increased slightly to 4.52% in 2020. In Sierra-Leone unemployment rate has been on the increase from 3.44% in 2000 to 4.16% in 2010, a further increase to 4.6% in 2020.

The increasing rate of unemployment in developing nations and measures to reduce it to its minimum has been an issue in developing economies in West Africa (Folawewo & Oluwafemi, 2017) it has been of great concern to both policymakers and scholars in developing economies in trying to find measures of reducing the increasing rate of unemployment. This is why unemployment rate is regarded as a key determinant of the well-being of an individual in the labour market, it is also an important tool used by policymakers to capture the state of the economy in general, in order indicate the clear state of the economic situation of a country (Bryne &Strobl, 2004). Several macroeconomic factors have been seen to greatly affect the prevailing level of unemployment in every economy, among which is the gross domestic product (GDP).

As unemployment in development, economies have been a problem, so as a persistent increase in prices of commodities and services have been its pair. Economies of the world tend to pay much attention to inflation and unemployment; all economies will always intend to keep them both on a low rate mostly on a single-digit rate because this will tend to bring about stability in the macroeconomic policies of the country (Gylych &Isik, 2016**).** Inflation in Nigeria was 6.93% in 2000, it rose to 13.72% in 2010 and 14.2% in 2020, 16.4% in 2021 while in Ghana inflation rate in 2000 was 25.19% and fell to 10.71% in 2010, and 9.95% in 2020. The Liberian inflation rate had been fluctuating over the past years, in 2002 it was 14.16%, it fell to 7.27% in 2010, since 2010 a consistent increase has been experienced, from 9.86% in 2014 to 23.56% in 2018 and 26.97% in 2019(World Bank, 2021 and National Bureau of Statistics, 2021).The dilemma between unemployment rate and inflation rate gave rise to the issue of misery index.

The misery index was first cited by Okun's in 1962, in explaining the economic performance of the average citizen by adding the seasonally adjusted unemployment rate to the annual inflation rate. The objective of this paper is to evaluate the impact of the misery index on economic growth in the West African Monetary Zone within the timeframe of 2000 to 2020, based on the six countries that make up the West Africa Monetary Zone which are Nigeria, Gambia, Liberia, Sierra Leone, Guinea and Ghana.

The paper is constrained to five out of the six countries as a result of insufficient data for Guinea. This paper however shows high level of uniqueness as it examines the impact of the misery index on economic growth from a wide perspective, quite different from previous studies that are country specific (Wang, Shah, Ali , Abbas &Ullah, 2019) and (Ubah, Bowale, Ejemeyovwi, Jacobs, Adeleye &Ihayere, 2021). This paper however contributes to literature as its treat English Speaking ECOWAS countries in isolation. This paper is made up of five sections, immediately after section one, section two treats

literature review, section three contains the Methodology, theoretical and empirical models, Section four treats Presentation and Discussion of Result and five concludes the paper.

2.0 Review of Theoretical and Empirical Literature

Misery index which is also known as economic discomfort index (EDI), this index was invented by an American economist named Arthur Okun (Cohen, Ferretti, Mclntosh & Bryan, 2016); it is a situation where unemployment and inflation is on the increase.

Where MIX_t economic discomfort index or Misery Index is at a given time (t), U_t is Unemployment rate at a given time (t), and $\boldsymbol{\pi}_t$ represent current inflation. Hence Misery index is expressed as: $MIX_t = U_t + |\pi_t|$ 1

Where π_t is the rate of change of the consumer price index, and is expressed as an Absolute value, recognizing that deflation is as harmful as inflation (Lovell &Tien, 2000).

Various theories have considered the relationship between misery index and economic growth of which are the Koun's law, and Philips curve.

Okun (1962) pointed out that there exist a negative relationship between unemployment and output level in the economy, this postulation later became what we called Koon's law (Lancaster & Tulip, 2015). This relationship is mathematically expressed as:

$$U_t - U^* = \theta(Y_t - Y^*) \quad 2$$

U is unemployment rate and Y_t is the logarithm of the level of real GDP. According to Okun U^* is 'full employment' while Y^* 'potential output'. This law which is best known as Okun's rule of thumb which provides empirical evidence on the issues relating to unemployment and growth by saying a 2% increase in output is as a result of 1% decrease in unemployment, this means that increase in labour participation at a given time period will result to output increase increasing by twice that amount. . However Okun's law made it clear that the relationship varies from country to country given the time duration under consideration as a one-point increase in the cyclical unemployment rate results to a two percentage points of negative growth in real GDP.

Misery and its effect on economic growth is most captured by the theory of Philip curve which was proposed by William Philip in 1958 in his study "The relation between unemployment and the rate of change of money wage rates in the United Kingdom (1861–1957) the study indicated the existence of an inverse relationship between inflation rate and unemployment rate, simply put the lower the unemployment rate in an economy, the higher the rate of inflation".

Ubah *et al*, (2021) investigated the nexus between misery index and economic growth in Nigeria between 1987 -2017, the study revealed that there exists a negative relationship between misery index and economic growth, the Autoregressive Distributed Lag (ARDL) was used for the model, the study was constrained to only Nigeria, the effect of misery index on other West Africa countries were not taken into consideration.

Munir, Asghar and Rehman(2017) analyzed the interrelationship among crime, misery index and institutional quality in Pakistan from 1985 to 2015 ,VECM was used to explored short run and long-run dynamics and Toda Yamamoto was used to ascertain if there exist a causal relationship, the results indicated that there exists long-run relationship between crime and misery, institutional quality, human capital, population and GDP per capita, however the result failed to treat misery index in isolation.

Ayisi, Minlah, Adu and Sam (2013) evaluated the inflation threshold for Ghana from 1965 to 2011. Their study indicated a strong significant negative linkage between inflation and growth up to the inflation threshold of 21% beyond that was positive; hence, there exists a "V" relationship between inflation and growth in Ghana. The finding also revealed a single digit inflation target for Ghana.

Chisti, Ali, and Sangmi (2015) analyzed the impact of inflation on per capita income of emerging economies between 1999 to 2011, five major emerging countries: Brazil, Russia, India, China and South Africa (BRICS) were considered, the empirical findings revealed that the independent variable (inflation) did not statistically influenced the dependent variable (Per capita income) in the three countries which are India, Brazil and South Africa. However, the independent variable was statistically significantly significant for China and Russia but unemployment and inflation were observed to be positively related to economic growth within the timeframe of the study.

Ihensekhien and Asekome (2017) examined the issue of youth unemployment and economic growth in low-income countries of SSA based on annual time series data from 1991 to 2013. The study revealed that during the period that the average GDP growth rate was 3.8% and the youth unemployment rate was 9.4% and that there exist a negative relationship between these variables, also that Okun'slaw exists in low-income countries of SSA.

Diakhoumpa (2020) looked into effect of economic growth and inflation on unemployment in Senegal, the findings showed that there exist a negative long-run and short-run relationship between unemployment and inflation in both periods, a Granger causality relationship was found to exist between unemployment, economic growth and inflation.

Gylych *et al,* (2016) investigated if there exists a relationship between economic growth, inflation and unemployment, in ten (10) selected countries of ECOWAS form (2001-2014) and assessed the effects of unemployment in the selected members' states. The study used a model in which inflation and unemployment were the dependent variable and independent variables. Ordinary least square (OLS) technique was used for the study, result from the study reflected that both unemployment and inflation were observed to have positive influence on economic growth. The study went further to indicates that unemployment does not affect the economic growth of the ECOWAS members countries, rather inflation does affect economic growth, the shortcomings of the study was that inflation and unemployment was not aggregated to make up the misery index.
Ihensekhien and Erhi (2017) x-ray economic growth and unemployment categories from Nigeria within the period of 1991 to 2015, such as total unemployment, youth unemployment, male unemployment and female unemployment respectively. The

empirical findings indicated that there is a reverse of Okun's law in Nigeria; the simulation analyses conducted revealed that reduction in the categories of unemployment rate would lead to higher economic rate in Nigeria.

Akay and Oskonbaeva (2020) investigated the relationship that exists between misery index and economic growth in some selected 16 transition countries from 1996 to 2017 using panel ARDL. The study observed that there is a long-run relationship between misery index and economic growth, and concluded that misery index deteriorate economic growth and recommends that inflation and unemployment should be checked so as to attain the desired level of growth. Aigheyisi and Ebiaku (2016) studied the interrelationships among unemployment, inflation and economic growth in Nigeria from 1981 to 2013. The two-stage least square and vector auto regression (VAR) were the estimation techniques used for the study, the findings showed that the variables were interrelated, there exist a long-run among the variables, however, broad money growth was noticed to be inflationary, and the position of Phillip curve was validated in the study.

Jeke and Wanjuu (2021) examined the economic impact of unemployment and inflation on output growth in South Africa from 1994 to 2019. Autoregressive Distributed lag (ARDL) method was used; the study findings show that inflation depresses real GDP while human capital and physical capital promotes real GDP. The paper suggested that unemployment could be best tackled through increase labour productivity as well as investment in human capital, but the study was limited to South Africa.
Ihensekhien and Akunga (2019) studied the nexus between misery index and foreign direct investment in Nigeria from 1981 to 2017, the parsimonious error correction model revealed that there exists an inverse relationship between misery index and foreign direct investment and exchange rate in Nigeria. The variables were observed to be statistically significant and relevance for policy making as indicated by the t-ratios.

Gaps in the Literature
Based on the review of literature the paper was able to identify the following gaps in the literature. Several of the studies were on individual countries specific, the issue of the West African Monetary Zone was not found in existing literature, the previous methodologies applied were basically the ordinary least square technique, and the timeframe of the previous study was observed not to be current. Hence, this paper hopes to fill these identified gaps concerning the West African Monetary Zone to add to the existing literature in this area of knowledge.

3.0 Research Methodology

3.1 Theoretical Framework

Different theories try to explain issues concerning the misery index and its effect on economic growth based on individual effect as indicated in the Keynesian theory of unemployment and the monetarist theory of inflation (Friedman, 1968). Okun's law gives the individual effect of unemployment on output and Philip curve shed some light on the tradeoff that exists between unemployment and inflations (Clark &Laxton, 1997 and Nurudeen, 2017).
The Phillip curve theory state that with economic growth come inflation, which in turn leads to creation of more jobs and a decrease in unemployment. This means that inflation

and unemployment have an inverse relationship, higher unemployment rate is associated with lower inflation rate and lower unemployment rate is associated with higher inflation. To attain the desired level of economic growth the monetary and fiscal policy of government is seen as the dual mandate to promote maximum sustainable employment and price stability in a country. By maximum sustainable employment we mean the highest level of employment that the economy could sustain keeping inflation stable.

3.2. Method of Data Collection.

This study made use of secondary data from National Bureau of Statistics, World Bank development indicators and International Monetary Fund database.

3.3 Model Specification

The paper adopted the models of (Ubah *et al*, 2021), (Munir *et al*, 2017) and (Gylych *et al*, 2016), GDP growth rate as a proxy for economic growth and misery index which is the summation of unemployment rate and inflation rate. However, this paper adopts this by adding foreign Direct investment as explanatory variable to analyse the effect of the misery index on economic growth in West African Monetary Zone(WAMZ).Whilst subscript t represents the year, t = 2000, …, 2020.

The implicit form of the model is specified as:

$$GDP\_GR = F(MIX, FDI) \quad (1)$$

Re-stating equation 1 in its explicit form:

$$GDP\_GR = \beta_0 + \beta_1 MIX_{It} + \beta_2 FDI_{it} + \nu_{it} \quad (2)$$

Where $\nu_{it} = u_{it} + \xi_{it}$

Where GDP_GR = Gross domestic product growth, MIX= Misery index, FDI = Foreign Direct Investment.

3.3.1 Apriori Expectation

MIX: an increase in misery index will reduce economic growth hence exists an inverse relationship.

FDI: an increase in foreign direct investment wills to an increase in economic growth, hence there exists a positive relationship between foreign direct investment and economic growth.

3.4 Estimation Techniques

The Panel Autoregressive Distributed Lags, specifically Pooled Mean Group (ARDL/PMG), is used to estimate the empirical models. The panel ARDL/PMG technique is best for the model because of the attractive econometric advantages it has over other estimation techniques as it accommodate variables with missed of integration, such as I(0), I(1) or both, but not I(2). Since this study used small sample size, the panel ARDL/PMG technique is very effective. Results from its estimates showed both short and long run coefficients simultaneously. The panel ARDL/PMG produces results with unbiased estimates even in the presence of endogenous covariates. And it is also effective even if different optimal lag lengths exist between variables. The basic ARDL model can be specified as:

$$GDP\_GR_{It} = \beta_{it} + \sum_{k=1}^{m} \delta_{ik} GDP\_GR_{it-k} + \sum_{k=1}^{m} \gamma_{ij} MIX_{it-k} + \sum_{k=1}^{m} \gamma_{ij} FDI_{it-k} + U_{1it} \quad 3$$

Where GDP_GR_{it} is the dependent variable; MIX_{it-k} and FDI_{it-k} are the vector of independent variables; δ_{ik} represent the coefficient on the lags of the dependent variable; γ_{ij}' is the coefficients on the current and lags of the independent variables; U_{1it} represent the error term

4.0 Presentation and Discussion of Results.

4.1 Cross-Section Dependency Test

The results of cross-sectional dependence tests is presented in the in Table 1, below seen in Table 1, all the LM tests indicated the presence of cross-sectional dependence at a 1% significance level for the variables

Table 1: Cross-Sectionary Dependency Test

Variables	Breusch-Pagan LM	Pesaran scaled LM	Bias-corrected scaled LM	Pesaran CD
GDP_GR	16.048(0.000)	1.352(0.000)	1.227(0.000)	0.851(0.000)
MIX	200.600(0.000)	42.620(0.000)	42.495(0.000)	14.163(0.000)
FDI	45.916(0.000)	8.031(0.000)	7.906(0.000)	4.349(0.000)

Source: Author's computation (2021) based on data from the Central Bank of Nigeria database and world development indicator (WDI) Note: Econometric estimation was conducted using EViews 10. Software

Table 1 show that, all the LM tests indicate the presence of cross-sectional dependence at a 1% significance level for the variables.

4.2 Panel Unit root

To test for stationarity of the variables, panel unit root tests are employed, the result of the unit root test is presented in Table 2

Table 2: Panel Unit root test

Tests assuming a common unit root process		Tests assuming individual unit root process
Variables	Breitung t-stat.	PP-Fisher Chi square statistic
GDP_GR	-1.571 1(0)	42.817 1(0)
MIX	-2.461 1(0)	26.494 1(0)
FDI	-1.684 1(0)	52.791 1(0)

Source: Author's computation (2021) based on data from the Central Bank of Nigeria database and world development indicator (WDI) Note: Econometric estimation was conducted using EViews 10. Software.

Based on the above tests carried out, the null hypothesis of the presence of unit root is rejected

For all the variables considered, hence they were observed to be significant at levels and first difference when subjected to PP-Fisher chi-square and Breitung unit root test respectively.

4.3 Panel Co-integration test.

The Johansen Fisher Panel Co-integration was also conducted to ascertain if the variables are co-integrated. The Summary of the results is presented in table 3.

Table 3: Pedroni Residual Co integration Test with no deterministic trend

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-2.97	0.99	-2.79	0.99
Panel rho-Statistic	0.10	0.54	0.22	0.58
Panel PP-Statistic	-8.40	0.00	-8.93	0.00
Panel ADF-Statistic	-6.23	0.00	-6.23	0.00

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	1.12	0.86
Group PP-Statistic	-11.94	0.00
Group ADF-Statistic	-5.99	0.00

Source: Author's computation (2021) based on data from the Central Bank of Nigeria database and world development indicator (WDI) Note: Econometric estimation was conducted using EViews 10. Software

Using the Pedroni Residual Co integration Test with no deterministic trend assumptions, four co-integration outcomes were found out of eight observations within dimension and two co-integrating outcomes were found out of three observations between dimensions, we can hereby conclude by saying out of eleven outcome results given six co-integrating outcomes were found, hence there exist panel co-integration among the variables.

Table 4: Pedroni Residual Co integration Test with Deterministic intercept and trend

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-2.97	0.99	-2.79	0.99
Panel rho-Statistic	0.10	0.54	0.22	0.58
Panel PP-Statistic	-8.40	0.00	-8.93	0.00
Panel ADF-Statistic	-6.23	0.00	-6.23	0.00

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	1.120	0.86
Group PP-Statistic	-11.94	0.00
Group ADF-Statistic	-5.99	0.00

Source: Author's computation (2021) based on data from the Central Bank of Nigeria database and world development indicator (WDI) Note: Econometric estimation was conducted using EViews 10. Software.

Using the Pedroni Residual Co-integration Test with Deterministic intercept and trend assumptions, four co-integration outcomes were found to be significant out of eight outcome within dimension and two co-integrating outcomes were found to be significant out of three outcomes between dimension, we can hereby conclude by saying out of eleven outcomes results given six co-integrating outcomes were found, hence there exist panel co-integration among the variables.

Table5: Pedroni Residual Co integration Test with no deterministic trend or intercept.

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-1.04	0.85	-0.88	0.81
Panel rho-Statistic	-1.91	0.03	-1.81	0.04
Panel PP-Statistic	-4.48	0.00	-4.52	0.00
Panel ADF-Statistic	-4.65	0.00	-4.73	0.00

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	-0.92	0.17
Group PP-Statistic	-5.74	0.00
Group ADF-Statistic	-5.87	0.00

Source: Author's computation (2021) based on data from the Central Bank of Nigeria database and world development indicator (WDI) Note: Econometric estimation was conducted using EViews 10. Software

Using the Pedroni Residual Co integration Test with no deterministic trend or intercept assumptions, Six co-integration outcomes were found to be significant out of eight outcomes within dimension and two co-integrating outcomes were found to be significant out of three observations between dimension, we can hereby conclude by saying out of eleven outcome results given eight co-integrating outcomes were found, hence there exists panel co-integration among the variables.

4.3 Granger Causality test.

It is important for policy recommendation and forecast to establish a directional relationship between or amongst variable. Granger Causality test is one of the tools in Econometrics that is blessed with the attribute to establish whether or not variables of time series could predict each other, Granger (1969). Hence Granger Causality test is carried out to show if there exists a causal relationship between or amongst variables.

Granger (1969) causality test in this study is used to retest the misery index causal relationship with economic growth for five West Africa Monetary Zone Countries. The null hypothesis for this test states variable A doesn't granger cause variable B, and vice versa. The null hypothesis is rejected if the sum of the estimated parameters is statistically significant to make inferences. Granger causality test can be unidirectional causality or Bidirectional causality, unidirectional causality occurs when one variable is significant in causing the other and Bidirectional causality occurs when the two variables cause each other (Gujarati & Porter, 2009). The result of the causality test is shown below in Table 6.

Table 6: Pairwise Granger Causality Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.
FDI does not Granger Cause GDP_GR	95	0.80	0.4507
GDP_GR does not Granger Cause FDI		0.29	0.7467
MIX does not Granger Cause GDP_GR	95	3.16***	0.04
GDP_GR does not Granger Cause MI		0.06	0.94
MIX does not Granger Cause FDI	95	0.68	0.50
FDI does not Granger Cause MI		1.68	0.19

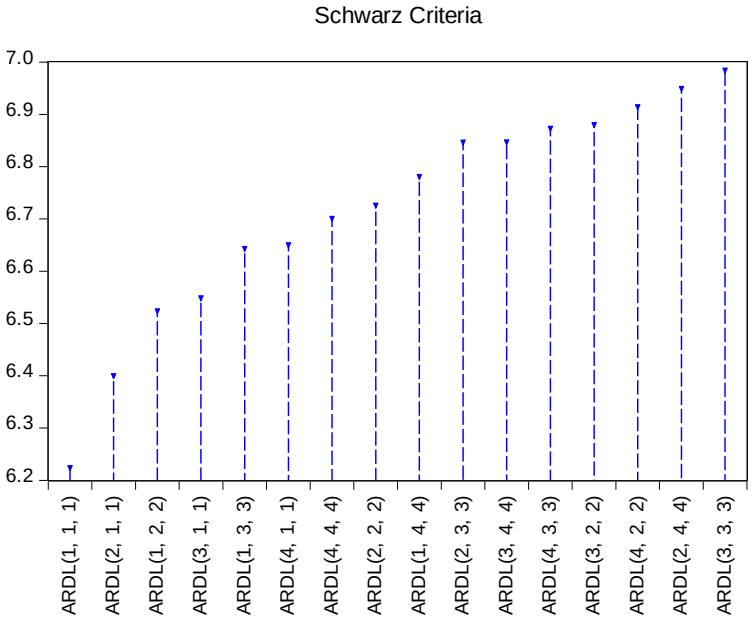
Note: *** indicate rejection of null hypothesis at 5 percent level of significance.
Source: Author's computation (2021) based on data from the Central Bank of Nigeria database and world development indicator (WDI) Note: Econometric estimation was conducted using EViews 10. Software.

The result of the Granger causality test above revealed that there is no bidirectional or unidirectional causation between Foreign Direct Investment and Economic Growth in the West Africa Monetary Zone. However, for the misery index and economic growth in the West African Monetary Zone there exists a unidirectional causation, these was seen from the result as we reject the null hypothesis that the misery index does not Granger cause economic growth. Granger causation result for misery index and foreign direct investment indicated that there is no bidirectional or unidirectional causation between the two variables. The result from the causality test revealed that misery index impeded on economic growth greatly in the West African Monetary Zone within the period of the study.

4.4.1 Model selection Criteria.

The model selection criteria for using Panel Auto Regressive lag Distribution (ARDL) is shown in the table below:

Table 7: Schwarz model selection criteria.



Source: Author's computation (2021) based on data from the Central Bank of Nigeria database and world development indicator (WDI) Note: Econometric estimation was conducted using EViews 10. Software

From the diagram above using Schwarc Criteria (SC) ARDL (1, 1, 1) was shown to be the best.

4.4.2 Empirical Result.

The result of the estimation of the model using Panel Auto Regressive lag Distribution (ARDL) give the Schwarc lag selection Criteria is shown in the table below:

Table 8: Result PMG/ARDL Technique

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
MIX	-0.02	0.01	-2.80	0.01
FDI	2.21	4.83	4.57	0.00
	Short Run Equation			
COINTEQ01	-0.92	0.21	-4.41	0.00
D(MIX)	0.09	0.18	0.53	0.60
D(FDI)	2.51	2.24	0.11	0.91
C	4.36	1.99	2.18	0.03

Source: Author's computation (2021) based on data from the Central Bank of Nigeria database and world development indicator (WDI) Note: Econometric estimation was conducted using EViews 10. Software

The result of the PMG/ARDL shows that the coefficient of misery index (MIX) negatively influences economic growth in the long-run but in the short-run misery index

positively influenced economic growth. The result revealed that in the short-run and long-run the foreign direct investment was observed to positively impact economic growth within the period of the study, further more misery index and foreign direct investment were observed to be statistically significant at the 5% level. The empirical findings obtained are somehow similar to that of Ademola & Badiru (2016) that there exists a long-run relationship between economic growth variable and that of unemployment and inflation.

5.0 Summary, Conclusion and Recommendations

The paper has explored the impact of misery index on economic growth in the West African Monetary Zone. The PMG/ARDL technique was employed based on time duration between 2000 and 2020 to achieve the objective of the paper. The Variables used are Gross Domestic Product growth rate (GDP_GR) proxy for economic growth, Misery index (MIX) which is the summation of unemployment rate and inflation rate and Foreign Direct Investment (FDI). The Panel unit root and co-integration tests conducted established the existence of long-run relationship. Given the existence of the long-run relationship the Panel Autoregressive Distributed lags (Pooled Mean group) model was estimated.

Furthermore, the results of the PMG/ARDL indicated that the coefficient of the misery index (MIX) negatively influences economic growth in the long-run however in the short-run misery index was found to positively influence economic growth, the result did not support that of Ihensekhien and Akunga (2019) that indicated an inverse relationship. However the negative influence of misery index on economic growth in the West African Monetary Zone in the long- run was found to be statistically significant in the long-run; the finding is similar to that of Ihensekhien and Asekome (2017) in Low-income countries of SSA nevertheless, the short-run analysis was observed to be statistically insignificant.

The Foreign Direct Investment (FDI) variable was found to positively influence economic growth both in the long-run and the short-run analysis. However, the positive influence of foreign direct investment on economic growth in the West African Monetary Zone in the long- run was found to statistically significant while in the short-run positive influence was insignificant.

From the result of the Panel Granger causality test, a unidirectional causal relationship was found flowing from misery index to economic growth. The findings of the study posit that misery index impedes economic growth in the West African Monetary Zone within the period of the study.

The policy implication of the findings, member countries of the West African Monetary Zone are advised to keep the misery index(unemployment rate plus inflation rate) as low as possible, because misery indexes are observed to have to harm economic growth in the Zone. To attain the desired level of economic growth, unemployment rate should be kept as low as possible. A well- trained labour force will lead to increase in employment; hence fiscal expenditures of individual countries should be geared toward human capital development as this would help to reduce the unemployment rate in the Zone. Also the monetary policy of individual countries within the Monetary Zone should be targeted at

curtailing the inflation rate in order to keep the misery index as low as possible within the Zone.

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NAIRA EXCHANGE RATE CHANGES AND NIGERIA'S NON-OIL SECTORAL OUTPUT PERFORMANCE

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Abstract
This study investigates the influence of real exchange rate on the non-oil output performance of the Nigerian economy covering the period 1986 to 2019. The study applied the OLS in a modified IS-LM framework. The result indicates that there is inverse relationship between non-oil output and exchange rate in the long run and direct relationship in the short run. The ECM result show that deviations from long run equilibrium could be easily adjusted. The implication of findings is that policy makers must consider achieving a stable and realistic exchange rate in order to influence a stable long run output performance. The study recommends the inclusion of foreign investments in agriculture, manufacturing and service sectors to capture external influences on non-oil output as naira depreciates or appreciates

Key Words: Exchange Rate; Non-oil output growth; Government Expenditures.
***JEL classification**: F41, F43, H50.*

1.0 Introduction
The idea of a clean energy placed a challenge on energy scientists to identify the best alternatives to fossil fuel. This factor coupled with current world energy politics and covid -19 pandemic upheavals has placed the oil market on the path of weak trend, which is not conducive for revenue generation to achieve sustainable economic growth. This trend has renewed the urgency for diversifying the country's export base, from oil to non-oil. Former diversification policies (efforts) were targeted at the achievement of high export growth rate as documented in the Nigeria's Export Incentives and Miscellaneous Provisions decree of 1986. Though, targeted at high export growth rate, these policy efforts were constrained by several factors, chief among them include changes in Naira exchange rate, low investment in non-oil sector and variations in relative pricing, in addition to several unproductive non-economic government policies. Factors such as poor investment in non-oil sector were due to increases in the world oil market prices over the last decades. As oil price move up, non-oil output growth exhibited a show of decline relative to total GDP. This had an inverse effect on cocoa, cotton, and rubber production, to the extent that most plantations were cleared for subsistence agriculture. By the close of the 1980s export of groundnuts, rubber, timber, cocoa, cotton, hides and skin among others has disappeared into history.

Generally, oil created disincentives for non-oil productions through its impact on factor prices, exchange rates and rising wage in the public sector. As world oil price show an increasing trend, the naira exchange rate experience appreciation and non-oil output

declines. The rise or fall in exchange rate affects non-oil production through labour wages, and other factor inputs which adversely affects the competitiveness of exports of goods in the international non-oil markets. The relationship between output growth and exchange rates is quite important for developing economies due to its place in production and as an engine of trade flows. The essence of exchange rate policies is to correct imbalances, enhance competitiveness and increased revenues. To this extent, the main policy thrust of foreign exchange policy is derived from the broad macroeconomic objectives to achieve internal and external balance in an economy within the shortest possible time. Internal balance according to Adewuyi, (2005) refers to the level of economic activity consistent with the satisfactory management of inflation, while external balance refers to balance of payment equilibrium. In the midst of other variables, exchange rate policy in any given country has been frequently identified as a major factor in explaining the general adverse macroeconomic condition.

Exchange rate fluctuations influence domestic prices through their effects on aggregate supply and demand. Import competing firms might increase prices in response to foreign competitor's price increase in order to boost profit margins. A great number of Nigerian producing firms depend on imported factor inputs in form of equipment, plants and machineries, chemicals among other materials. It can therefore be argued that a sound exchange rate policy and an appropriate rate are crucial conditions for improving the economic performance of the country. Mohammed (2013) explained that the risks associated with frequently changing exchange rates are major impediments for countries striving to grow and develop by expanding export products outside the **oil** sector.

The basic problems under review show that countries with vast natural resources endowments face more hurdles in the development process than countries with fewer natural resources (lack of abundance), according to Hassanov and Samadova (2011). The point at issue is, resources endowed countries periodically enjoy windfall revenues which results in some cases to undesirable consequences such as the Dutch disease. The study of Corden (1984), explained that under Dutch disease, the appreciation of a country's real exchange rate caused by rise in the export of a booming resource sector, draws capital and labour away from other sectors of the economy such as manufacturing and agriculture. This leads to decline in the productivity of the non-oil sectors. Appreciating exchange rate enhances oil production at the expense of non-oil production for export. However, in addition to the Dutch disease influence on growth and development on the non-oil sectors, the weak trend of oil market is often due to ''the clean energy challenge'', politics and covid-19 pandemic upheavals which are not conducive for generation of oil revenue necessary to support sustainable economic growth and development of the nation. In order to stimulate the non-oil production for export (revenue), the major focus of the naira exchange rate policy must be targeted at producing competitive output and prices through abolition of export licenses, retention of foreign currencies and repatriation of profits. Besides these incentives, the economy may continue to depend on oil for foreign exchange revenue without any significant increase in agriculture and manufacturing sector's output, keeping the nation underdeveloped.

The basic aim of this study, seek to investigate the non-oil sector output responses to exchange rate changes in Nigeria. The specific objectives are to determine; (a) exchange

rate effect on non-oil output growth performance and (b) the nature of impact of non-oil sector government expenditures on gross domestic product performance.

2.0 Literature Review

Exchange rate refers to the price of one unit of (domestic) currency in terms of another (foreign) currency. Exchange rate plays a key role in international transactions. It is the major connecting link between the price systems of the world economies (Anyanwu & Oaikhenan 1995). The non-oil production implies commodities produced that are not relating to petroleum (crude oil) such as; Services, Agricultural and Manufacturing products. Services here imply educational, health, construction and economic services. Economic growth refers to steady increases in real gross domestic product or national product over time.

2.1. An Overview of Exchange Rate Policies in Nigeria

The essence of exchange rate reform is to stimulate exports growth over imports in order to achieve higher economic growth. Some scholars such as Taye (1999) and Adewuyi (2005) believe that exchange rate depreciation promotes export expansion and ease out balance of payments difficulties through increases in the relative prices of imports and making export products more competitive and attractive in production. On the other hand, Anyanwu & Oaikhenan (1995) argue that exchange rate changes have no effect on real variables in the long run. They are of the view that exchange rate changes affect real magnitudes through real balance effect in the short run, but leaves all real variables unchanged in the long run.

Revenues generated from the non-oil production powered the Nigeria economy from independence to the end of the civil war. As oil becomes prominent, the percentage contribution of non-oil to GDP dropped from 100% to 73% by 1971. The non-oil contribution further dropped to 40.07% by 1973 as an after effect of the oil politics of the Arab/Israeli war. The non-oil contributions to total GDP by 1981 and 1991 stood at #4.73 Billion and #18.33 Billion, representing 35.6% and 18.15% impacts respectively. Its impact further dropped to 16.5% in the year 2000 and 14.43% and 11.56% in the year 2004 and 2006 respectively. By 2016 the sector had an all-time high contribution of 52.04% to total GDP. This was so because crude oil price crashed as most European countries were resorting to electric and solar energy sources. However, the percentage contribution to total GDP further dropped to 49.13% by the end of 2020. Ever since, agricultural contributions to total GDP started to dwindle at an average annual rate of 2.2% (Adewuyi, 2005). As petroleum price soared, crude oil production gained prominence among revenue sources and became a major point of reference in the national gross domestic production. Manufacturing and the service sector on the other hand, contributed minimally in relation to oil. The Non-oil sectors offer varied opportunities for development of Nigeria beyond oil with respect to the downward trend of oil prices in recent times. Export of non-oil products is very vital for the nation as it has opportunities to diversify production into high technology. Be that as it may, Mkpado (2013) also observed that non-oil sector is overlooked as sources of export diversification in policy making.

Exchange rate in Nigeria has gone through fluctuations between two regimes namely: the fixed and the flexible regimes. At independence, there was a fixed exchange rate

arrangement in which currencies were linked to gold, but crashed with the Britton woods system in the early 1970s. Following the collapse of the Britton woods system many African economies took to free float and tied their currency to Special Drawing Rights. Nigeria operated the fixed exchange arrangement in line with the IMF per value system. Thus, the Nigerian currency was pegged at par to the British pound Sterling, and later to the dollar in the basket of currencies. The Nigeria's Pounds was changed to Naira in 1973. The naira exchange rate at this point facilitated the importation of factor inputs needed for construction and development projects. This importation triggered the erosion of the country's external reserves. By the end of 1970s, the nation's total GDP growth rate started to decline at an average of 2.96% into the 1980s. Mohammed (2013) explained that various policies were put in place to reverse this trend but to no avail.

The failure of these macroeconomic policies prompted the Nigerian Government to adopt the Structural Adjustment programme (SAP) in 1986, with the major aim of achieving a realistic exchange rate. To further enhance this objective, the Second-Tier Foreign Exchange Market (SFEM) was introduced to enhance the determination of the value of the overvalued naira. To boost the performance of SAP, the dual exchange rate polices was introduced. The hardship that accompanied this policy prompted the government to reintroduce the foreign exchange regulation with the official rate pegged at #22 to the dollar. This policy was short lived with the introduction of the Autonomous Foreign Exchange Market (AFEM) in March, 1995 with the promulgation of Decree17 and the abolition of exchange control act of 1962. During AFEM regime, the CBN was stipulated to intervene in the market at short notice to stem market failure. Despite the huge amount of foreign exchange which the CBN supplied at various intervention points to the foreign exchange market, the impact was not reflected in the performance of the non-oil sector of the economy. This development necessitated a change in policy by July 2002, when the demand pressure in the foreign exchange market mounted and resulted in further depletion of Nigeria's external reserves level.

Based on the above, the CBN introduced the Dutch Auction System (DAS) to replace IFEM. This time it was designed to achieve a realistic exchange rate by stemming the excessive demand for foreign exchange and conservation of the external reserves. This market regime was made up of two parties comprising of the CBN and the Authorized dealers who were responsible for buying and selling of foreign exchange. The CBN in this arrangement determines the amount of foreign exchange to sell at the amount the dealers are willing to buy. This regime enhanced the relative stability of the naira, with respect to the dollar as it caused the naira to fluctuate within a single digit band.

2.2. Empirical Literature

The stability or volatility of a nation's foreign exchange rate is an important variable in explaining an economy's financial position. Theoretical literature shows that exchange rate volatility has economic costs on productivity and consumption of non-oil products through pricing. This has attracted scholars' attention and made governments to monitor the exchange rates of domestic currency. For instance, Hasanov and Samadova (2013) carried out an investigation on the impact of the real exchange rate on non-oil exports in Azerbaijan using Vector Error Correction Model. Their result suggests that real exchange rate has negative impact on non-oil export performance. In the Nigeria scenario, Adewuyi (2005) examined the impact of exchange rate on macroeconomic aggregates

on the economy. Employing annual time series data, they examined the possible relationship between the real exchange rates and GDP growth using simultaneous equations and vector autoregressive model. Their results show that there is no direct relationship between the real exchange rate and GDP growth.

Anifowose, (2021), applying the Non-Linear Autoregressive Distributed Lag Model (NARDL) approach to examine asymmetric relationships on the effect of exchange rate on economic growth in Nigeria, found that in the long-run, economic growth is positively affected by positive shocks to exchange rate. Also. Ribeiro, McCombie, and Lima (2019), examined the relationship between real exchange rate and economic growth in 54 developing countries. The empirical result showed that the impact of real exchange rate on economic growth in developing countries was negatively signed.

In their study, Adelowokan, Adesoye and Balogun (2015) examined the relationship between exchange rate volatility on investment and economic growth in Nigeria, the study found exchange rate to exhibit negative relationship with investment and growth. Khandare (2017) empirically assessing the exchange rate and economic growth nexus for the Indian economy. The study found that both exchange rate and interest rate exert statistically insignificant negative effect on Indian economy. Bakare (2011) employed the ordinary least square regression method to investigate the consequences of foreign exchange reforms on the performance of non-oil private investments in Nigeria. His result showed a significant but negative relationship between foreign exchange rate and non-oil private domestic investment in Nigeria.

Yaqub (2010) in his study examines the exchange rate volatility and output performance in Nigeria. Adopting the modified IS-SM Framework he estimated the behavioural equation using SUR technique on data generated from CBN for the period 1970 – 2007. The results obtained indicated that exchange rate had significant contradictory effects on agriculture and manufacturing sectors. Anthony, Jonathan, Chiamaka and Onyinye (2018) in their study, examined exchange rate movements and the manufacturing sector of Nigeria for the period 1981 to 2016. The study revealed that exchange rate, government expenditure, and foreign direct investment have positive relationship with manufacturing output.

More so, Ogunmuyiwa and Adelowokan (2018) measured the impact of exchange rate on industrial output in Nigeria from 1986 to 2016, using industrial output and exchange rate data from CBN. The result showed that exchange rate has a significant positive effect on industrial output in Nigeria. Akinlo and Adejumo (2014) investigate the impact of exchange rate volatility on non-oil exports in Nigeria, between 1986 and 2008. The results show that exchange rate volatility and foreign income have significant positive effects on non-oil exports in the long run. Their result further shows that imports have a statistically negative effect on exports in the long run.

Gaps in Literature

From the reviewed studies concerning the Nigerian economy, literature concentrated on the effects of exchange rate on one sector or aggregate trade performance with respect to balance of trade such as the study of Oladipupo, and Onotaniyohuwo (2011). They are block analysis and did not separate the long-run from the short-run. To this extent, this

study covers the long-run and short-run effects of exchange rate changes on non-oil disaggregated sector output. This variant is important because contributions of non-oil sector output to total gross domestic product (GDP) in terms of civil welfare, employment and revenue generation varies. The outcome is expected to have enormous implications for economic growth and performance of the nation.

3.0 Research Materials and Methods

3.1. Theoretical Framework

The theoretical framework for this study as adapted from Kandil (2004), is the modified IS-LM framework. In this framework, output is assumed to be determined in three markets within the economy. These consist of the goods market, the money market and the foreign exchange market. All three must simultaneously be in equilibrium for an economy to be in equilibrium. The achievement of this equilibrium is the objective of exchange rate management. Following Yaqub (2010) the equilibrium equation condition in the goods, money, and external sectors could be summarized as follows: $Y_t = \alpha_0 + \alpha_1 E_t + \alpha_2 I_t + \alpha_3 M_t + \alpha_4 G_t$ - - - - - - - - - - (1) Where: Y = output; E = exchange rate; I = Real Investment; M = net export; G = government expenditure. From equation (1) a change in exchange rate affects output directly through import and export, and indirectly by changes in income due to changes in exchange rate. The effect of exchange rate depreciation on output depends on the elasticities of imports of factor inputs and exports of commodities. The strength of the income elasticities of import and export on the other hand, determines the effect of exchange rate depreciation (appreciation). Where the elasticity of export with respect to income is greater than the elasticity of import with respect to income may have positive response, otherwise negative.

3.2. Model Specification

This study adapts Yaqub (2010) and Hassanov & Samadova (2013) and modifies equation (1) to accommodate sectoral representations in order to model the output equations for the various sectors selected for the study (Manufacturing, Agriculture, and Services). Beginning the specification with the functional form for the impact of exchange rate on non – oil sector output of the Nigerian economy we present the following:

$$GDP = f(EXT, GEA, GMF, GSV) - - - - - - - - - - - - (2)$$

Where; GDP = Non oil Sector GDP; EXT = Real Exchange Rate; GEA = Government Expenditure on Agriculture; GMF = Government Expenditure on Manufacturing; and GSV = Government Expenditure on Services. Non-oil Output is also expected to respond positively to government expenditure. All variables are expressed in their logarithms.

3.2.1. Agricultural Sector Output Specification

Beside weather conditions, agricultural output is a function of the theoretical form of equation 1 as specified above. The sector's output equation could be specified in a linear form as follows. $GDP_a = \beta_0 + \beta_1 EXT + \beta_2 GEA + \beta_3 GMF + \beta_4 GSV + U_1$ - - - - - - (3)

Where; GDP_a = Agricultural Sector contribution to Non-Oil Output

3.2.2. Manufacturing Sector Output Specification

This specification is a modification of equation 3 by including government capital expenditure as a proxy for imports of manufacturing inputs. This is because importation

of factor inputs affects manufacturers output. The sectors output equation hence could be specified as follows: $GDP_m = \beta_0 + \beta_1 EXT + \beta_2 GEA + \beta_3 GMF + \beta_4 GSV + U_1$ - - - - - - - - (4)

GDP_m = Manufacturing Sector contributions to NON-oil Output

3.2.3. Services Sector Output Specification

The basic equation is modified by government non- oil capital expenditure other than those on manufacturing and agriculture. Hence, we include capital expenditure on social and economic services, finance, banking, building and construction. The service equation can be specified as:

$GDPs = \beta_0 + \beta_1 \beta_1 EXT + \beta_2 GEA + \beta_3 GMF + \beta_4 GSV + U_1$ - - - - - - - (5)

Where; GDPs = Services Sector contributions to NON-oil Output

Finally, by modification, following Yaqub (2010) and Hassanov & Samadova (2013) output equation we modify and rewrite equation 1 in log linear terms with respect to equation 3, 4, & 5. The reduced form of the equations expressed in natural log form to

explain the effect of exchange rate on non-oil output is presented as:

$LogGDP = \beta_0 + \beta_1 LogEXT + \beta_2 LogGEA + \beta_3 LogGMF + \beta_4 LogGSV + U$ - - - - - - (6)

Where: LogGDP = Log of Total non-oil Gross Domestic product; LogGEA = Log of government expenditure on Agriculture; LogGMF = Log of government expenditure on Manufacturing; LogGSV = Log of government expenditure on Services

3.2.4. The Error Correction Mechanism (ECM)

From equation 6, the ECM can be specified as follows:

$LogGDP = \beta_0 + \beta_1 LogEXT + \beta_2 LogGEA + \beta_3 LogGMF + \beta_4 LogGSV + \beta_5 ECT_{t-1} + U_t$ - - - (7). *Where*, ECT_{t-1} is the error correction term. The parameter β_5 measures the speed of adjustment to the equilibrium and is expected to be negative ($\beta_5 < 0$).

3.3. Estimation Procedures

All the variables in the model are expressed in their logarithm format. The data frequency covers the period between 1986 to 2019 and were obtained from the CBN Statistical Bulletin, CBN Annual Report and Statement of (various years). In order to examine the impact of the selected variables on non-oil GDP performance, the study followed a four-step procedure.

4.0 Presentation and Analysis of Results

First, the data series were tested for stationarity using the Augumented Dickey-Fuller (ADF) test. All variables are found to be integrated of same order *I*(1) as shown below

Table 1: Results of Unit Root Test for Variables

VARIABLES	LEVEL	FIRST DIFF	5% CRIT	1% CRIT	ORDER OF INTEGRATION
GDP	-0.916	-3.94	-2.88	-3.49	I (1)
EXT	-0.636	-11.28	-2.88	-3.49	I (1)
GEA	-1.720	-10.70	-2.88	-3.49	I (1)
GMF	-1.516	-11.068	-2.88	-3.49	I (1)
GSV	-0.966	-8.905	-2.88	-3.49	I (1)

SOURCE: Authors compilation from E-views output

The ADF test statistics were compared against the Mackinon critical values at 5% and 1% level, the result show that all variables are stationary. Having established the order of integration of the variables we applied the Johansen (1988) technique to determine whether there exists a long run linear equilibrium. Next, we tested for long run relationship using the Johansen Cointegration testing procedures. Following this is the estimation of the long run equation and finally the ECM model. The Johansen Cointegration test result is presented below:

Table 2. Cointegration Test Results

Unrestricted Cointegration Rank Test (Trace)					Unrestricted Cointegration Rank Test (Maximum Eigenvalue)		
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 CritValue	Prob.**	MaxEigen Statistic	0.05 CritValue	Prob**
None *	0.356145	90.41593	69.81889	0.0005	47.55045	33.87687	0.0007
At most 1	0.186273	42.86548	47.85613	0.1359	22.26214	27.58434	0.2072
At most 2	0.136075	20.60334	29.79707	0.3828	15.79713	21.13162	0.2369
At most 3	0.043427	4.806215	15.49471	0.8291	4.794955	14.26460	0.7675
At most 4	0.000104	0.011260	3.841466	0.9152	0.011260	3.841466	0.9152

Trace test and Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values

SOURCE: Authors compilation from E-views output

The test result as presented in above Table, examines the joint movement of the variables in the long run. The estimation results provide evidence of statistical long run equilibrium between non-oil gross domestic products (GDP), real exchange rate (EXT), government expenditure on agriculture (GEA), government expenditure on manufacturing (GMF), and government expenditure on services (GES) in the Nigerian economy. From the result, both the trace and the Max-Eigen test statistic(s) indicate that there is one cointegrating equation at the 5% level of significance. The result show that the null hypothesis of no cointegration (None) can be rejected using either the λ-Trace or λ-Max

statistic. Both statistics are greater than the Mackinnon critical values. The reported PV of 0.0005 and 0.0007 for λ-Trace and λ-Max statistics which is less than 5% is also confirmation of the cointegrating relationship. Similarly, the null hypothesis of 'At most 1' and 'At most 2' cannot be rejected as λ-Trace (42.86) and λ-Max (22.26) statistics are less than their Mackinnon critical values of 47.856 and 27.584 respectively. Again, the PV's of both instruments are not significant in explaining the null hypothesis. Hence, we accept the alternative hypothesis of at least the presence of 'At most 1' cointegrating equation(s). These results indicates that there is a cointegrating relationship between non-oil GDP, Real exchange rate, Government expenditure on agriculture, Government expenditure on Manufacturing and Government expenditure on Services.

Table 3 Result of Long Run Cointegrating Equations

Cointegrating Equation	**Log likelihood**	**521.8765**		
Normalized cointegrating coefficients (standard error in parentheses)				
GDP	**EXT**	**GEA**	**GMF**	**GSV**
1.000000	**-0.067537**	**0.410896**	**-0.324330**	**-1.473418**
	(0.08161)	**(0.07097)**	**(0.08596)**	**(0.10369)**

SOURCE: Authors compilation from E-views output

The above table, show the cointegration equation which normalize cointegrating coefficients. It indicates that a 1% increase in exchange rate (appreciation) decreases non-oil output productions by 6.75% in the long run, with all other factors remaining constant. Also, a 1% increase in GEA will bring about a 41.09% increase in non-oil production. The result indicates that GMF and GSV have inverse effect with non-oil output in the long run as they influence GDP by 32.43% and 147.34% respectively.

4.1. Long Run Model Estimation Result

Having established the presence of cointegration among the variables of study, we proceed to estimate the long run OLS model (Equation 6) and then generate the residuals for the ECM model (Equation 7) in order to capture the short run behaviour of non-oil production. The resulting coefficients of estimated equation 6 represent long run elasticities. The result is presented as follows:

Table 4. Long Run Regression Result with GDP as Dependent Variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	**1.082990**	**0.174854**	**6.193666**	**0.0000**
EXT	**-0.064467**	**0.025107**	**-2.567702**	**0.0116**
GEA	**0.047103**	**0.021746**	**2.166047**	**0.0325**
GMF	**-0.077774**	**0.028739**	**-2.706194**	**0.0079**
GSV	**0.952518**	**0.037088**	**25.68267**	**0.0000**

R-squared 0.9679 Adjusted R-squared 0.9667 F-statistic 808.34
Prob(F-statistic) 0.0000 Durbin-Watson stat 1.7878

Source: Author's compilation from regression output.

The result shows that EXT and GMF have an inverse relationship with non-oil output. GEA and GSV show a direct relationship with nonoil output. This result confirms the cointegrating normalizing equation with the exception of GSV whose sign changed to positive. The result shows that all the estimated coefficients are statistically significant as their PV's are less than 5%. The result indicates that a unit change in EXT and GMF independently with other factors remaining constant will be accompanied by -0.064467 and -0.077774 changes in GDP respectively. Also, a unit increase in GEA and GSV individually, with other factors constant will be accompanied by 0.047103 and 0.952518 increases in GDP respectively. These variables explain over 96.79% variation in GDP. The Prob(F-Statistic) significantly supports this. The reported DW statistic of 1.7878 suggests the absence of autocorrelation.

The residual of the estimated regression output was tested for unit root using the ADF test. The resultant ADF statistic of -3.94 is less than the Mackinnon critical value of -2,88 at 5% level of significant. This with a PV of 0.0025 implies that the residuals are stationary.

4.2. Error Correction Model

The ECM model captures the short run relation between the variables of study and the non-oil GDP. The coefficients of the variables in the regression output represent the short run elasticities, while the coefficient of Error Correction Term (ECT) represents the speed of adjustment from disequilibrium to equilibrium. The estimated ECM model could be presented as follows:

Table 5. Result of Short Run Error Correction Model

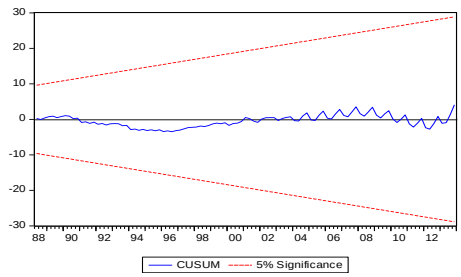
Dependent Variable: D(GDP)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.025065	0.009082	2.759703	0.0068
D(EXT)	0.024585	0.058388	0.421062	0.6746
D(GEA)	-0.005038	0.028008	-0.179863	0.8576
D(GMF)	-0.049424	0.064843	-0.762206	0.4476
D(GSV)	-0.378990	0.207127	-1.829744	0.0701
ECT(-1)	-0.707360	0.087896	-8.047727	0.0000
R-squared	0.485940	Durbin-Wat	1.869641	
Adjusted R-squared	0.461461			
F-statistic	19.85124	Prob(F-Stat)	0.000000	

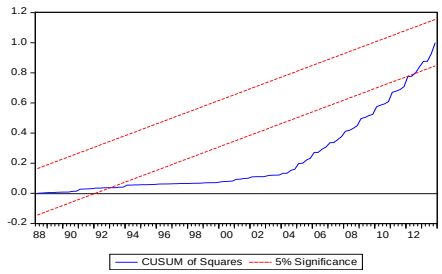
Source: Author's compilation from E-views Output

The result in the table above shows that the value of exchange rate (EXT) has a direct effect on GDP. This suggests that exchange rate depreciation will stimulate non-oil production in the short run. Since the value is small it will require an appreciable depreciation of currency to stimulate a significant effect on non-oil output. This may be explained by the fact that foreign exchange needs other than for non-oil productions domestically crowd out those of non-oil production. This is in conformity with the findings of Omojemite & Akpokojie (2010).

Government expenditures on Agriculture (GEA) is shown to be inversely related to GDP at the short run. Though not significant the sign of the coefficient (-0.005) is at variance with that obtained in the long run. The coefficient of GEA may be negative and insignificant for the fact that government do not spend directly on the business of agriculture, giving room to leakages and corrupt practices within the short run. Again, agriculture needs a long gestation beside other factors. From the result, a unit increase in Government expenditure on Manufacturing (GMF) and Services (GSV) will lead to reduction in non-oil GDP by -0.049424 and -0.37899 units respectively with all other factors remaining constant in the short run. Again, the coefficients are not statistically significant. The one period lagged error correction term (ECT_{t-1}) is negative and statistical which conforms to a'priori expectations. This supports the presence of an equilibrium relationship among the variables. The ECT shows that a deviation from long run equilibrium is corrected by about 0.70736 units (70.74%) in the next quarter ceteris-paribus.

The R^2 suggests that the variables explain 48.59% variations in the non-oil output given an adjusted R^2 of 46.14%. The DW statistic of 1.8686 suggests the absence of autocorrelation in the model. The result of recursive test of stability show a case of relative stability with CUSUM at 5% significance, but show some variance instability with CUSUM of SQUARES as shown.





5.0 Summary, Conclusion and Recommendations

This paper has presented an empirical study of the naira exchange rate changes and Nigeria's non-oil sectoral output performance through three sectoral channels, such as government expenditures on agriculture, manufacturing and services. These Sectors were selected because they are basic requirements for the growth of non-oil production. The findings show that Exchange rate has direct relationship with non-oil output productions in the short run, but indirect significant relationship in the long run. This means that exchange rate depreciation (i.e. increase in nominal value say by 1) will stimulate non-oil production in the short run, while, exchange rate depreciation in the long run, will bring about a reduction in output of the non-oil sectors. The possible explanation of this could be that factor inputs for agriculture, manufacturing and services becomes expensive and discourage domestic investments and production of non-oil products. More so, from the ECM model result, appreciating exchange rate (i.e. decreases in nominal values of exchange rate say by -1 unit) reduces non-oil output (say by 0.0245065 units). Finally, the results show that increases in the value of government expenditure on the non-oil sectors leads to reduction in output as exchange rate appreciates.

The main implication of the findings of this study, is the fact that policy makers must seek to achieve realistic exchange rate always, in order to influence long run non-oil output production. Finally, the inclusion of foreign investments in agriculture, manufacturing and service sectors in further studies should be encouraged to capture external influences on non-oil output as naira depreciates or appreciates.

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INFRASTRUCTURE, HUMAN CAPITAL DEVELOPMENT AND ECONOMIC GROWTH IN NIGERIA: AN EMPIRICAL INVESTIGATION

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Abstract

This study investigated the impact of infrastructure and human capital development on economic growth in Nigeria. It also explored whether the interaction between infrastructural and human capital development enhanced economic growth in Nigeria. The study employed the ARDL estimation method in analyzing time series data covering the period 1990 to 2020. The study found that the individual effect of infrastructure and human capital development failed to impact growth in Nigeria. The interaction term between infrastructure and human capital slightly impacted growth at the 10 percent level of significance. The study recommends that Nigeria should formulate and implement economic policies that promote investment in infrastructure and human capital development to accelerate economic growth in Nigeria.

Keywords: Infrastructure, Human Capital, Economic Growth, Nigeria, ARDL
JEL Classification: F43, J24, O18

1. Introduction

Infrastructure and human capital development have been seen as important factors used to drive growth in every economy. They are essential inputs in the production process that stimulate growth in different sectors of the economy. Investment in infrastructure and human capital accelerates the rate of growth of both private and public output. It has been argued that infrastructure facilitates learning which leads to improved human capital in a country, thereby increasing productivity and economic growth (Shafiq, 2007; Ajakaiye & Ncube, 2010; Pietak, 2014; Uda & Ebi, 2017). The theoretical basis to investigate the impact of infrastructure and human capital development on economic growth is well documented in the neoclassical and endogenous growth theories (Solow, 1956; Romer, 1986; Lucas 1988).

Infrastructure creates enabling conditions for the functioning of production processes as well as for the living of humans. Infrastructure can be perceived from two interconnected

dimensions; the social and economic dimensions. The social infrastructure dimension comprises social services like the provision of education, information, town and country planning, health services, and other social welfare services in the society. The economic infrastructural dimension covers a group of hard-core economic activities which relate to the production of energy and power, transportation services, water and communication services, and others (Ayodele & Falokun 2003).

The Infrastructural facilities available for use in a country help the process of human capital development. Human capital is often used to mean education, health, and other human capabilities that can enhance productivity. The quality and volume of output produced in a country depend on the capabilities of human capital. It has been stressed that the differences in the level of socio-economic development across nations are attributed not so much to natural resources and endowments and the stock of physical capital but to the quality and quantity of human resources (Anyanwu, Adam, Obi & Yelwa, 2015).

Nigeria is immensely endowed both in natural and human resources. Human capital and infrastructure are still developing in Nigeria. It is expected that it takes the advantage of its large human population and invest in physical infrastructure to accelerate economic growth and development. Human capital and infrastructure development have been found to play a crucial role in harnessing the gains of foreign direct investment (FDI) in the host country by creating the ability to absorb, assimilate and diffuse imported technology (Anochiwa & Maduka, 2016).

The majority of previous empirical studies investigated the separate impact of infrastructure and human capital development on economic growth. A reasonable number of those empirical studies found that infrastructure and human capital development separately have significant positive effects on economic growth (Ogbaro & Omotoso, 2017; Boztosun, Aksoylu & Ulucak, 2016; Pelinescu, 2015; Kaupa, 2015; Anochiwa & Maduka, 2014). Tsaurai and Ndou (2019) found a positive impact of the interaction term between human capital and infrastructure in transitional countries. As far as the authors are aware, there is no existing study that has investigated the impact of the interaction between infrastructure and human capital development on economic growth in Nigeria.

The current study addresses the long-run and short-run effects of infrastructural and human capital development on economic growth using the ARDL estimation approach. The findings from the study may guide the authorities in Nigeria in terms of drafting proper infrastructure and human capital development policies that can enhance economic growth and development.

The remaining part of the study is organized as follows: Section 2 describes the conceptual, theoretical, and empirical literature on the relationship between infrastructure, human capital development, and economic growth. Section 3 is the research methodology which describes the theoretical framework, model specification, estimation technique, and sources of data. Section 4 covers empirical data analysis. Section 5 presents the conclusion and policy recommendations. Section 6 is the reference list.

2. Review of Related Literature

The review of the related literature covers the conceptual, theoretical, and empirical literature on infrastructure, human capital development, and economic growth.

2.1. Review of Conceptual Literature

In this study, three main concepts are identified; infrastructure, human capital development, and economic growth. Each of the three concepts is discussed in the following sub-sections.

2.1.1. Infrastructure

The term infrastructure describes the basic physical systems of a nation such as transportation, communication, power, sewage, and water (Tsaurai & Ndou, 2019). These systems require huge investments and are vital for economic growth and development. Infrastructural facilities are mainly provided by the government. In a few cases, some private organizations provide infrastructure in the locations where they operate. Infrastructure can be broken down to include schools, health, and hospitals, as well as economic facilities, namely, energy, digital communication, transport, and water. They are vital components needed for a modern society to facilitate and enhance economic growth (Ogbaro & Omotoso, 2017; Ighodaro, 2019; Seidu, Young, Robinson & Ryan, 2020).

2.1.2. Human Capital Development

Human Capital is the collective skills, knowledge, and intangible assets individuals acquire to create economic value (Tsaurai & Ndou, 2019). Human capital according to Schultz (1993) can be described as a tool for enhancing competitive advantage. Human Capital can be developed through the process of human empowerment. Human capital is affirmed a major source of economic growth. The inadequate government spending on human capital development results in poor quality of labour (Uda & Ebi, 2017).

2.1.3. Economic Growth

Economic growth refers to the sustained increase in the inflation-adjusted market value of goods and services produced in a country over time. Conventionally, it is measured as the percentage increase in real gross domestic product (GDP) usually in per capita terms. Thus economic growth can purely be defined as the increase in real GDP per capita. This measure of growth is quite common in growth theories such as the Solow growth model, endogenous growth theory and has been used in numerous empirical growth studies (Adamu, Ighodaro & Iyoha, 2012; Iyoha & Oklim, 2017). The endogenous growth theory maintains that growth is generated by forces or factors within the economic system. In other words, growth results primarily from endogenous and not external forces. The theory identifies investment in human capital, innovation, and knowledge as significant drivers of growth (Romer, 1986).

2.2. Impact of Infrastructure and Human Capital Development on Economic Growth: Theoretical Literature

Some theoretical literature explains the impact of infrastructure and human capital development on economic growth. Under the exogenous growth model, as supported by Mahembe and Odhiambo (2014), foreign technological infrastructure which flows

alongside FDI is an input into the production function, enhances human capital accumulation, and promotes economic growth in the domestic economy.

The neoclassical growth model which was supported by Sahoo et al. (2012) argued that more investment in public and social infrastructure enhances education levels, health systems, and human resources in the country, thereby increasing productivity and economic growth. Also, Banerjee et al. (2012) noted that investment in transportation infrastructure reduces trade costs and enhances market mix which leads to convergence in prices, price stability, efficient allocation of resources, and trade expansion.

The endogenous growth theory includes a mathematical explanation of technological advancement. The model incorporates a new concept of human capital, the skills and knowledge that make workers productive. The endogenous growth theory supports constant returns to capital and emphasized that the rate of growth depends on the types of capital a country invests in. Investment the government embarks on can be in road, rail, electricity, or water infrastructure to achieve a high rate of growth (Tsaurai & Ndou, 2019).

Agenor (2006) proposed a theory of long-run development based on public infrastructure as the main engine of growth. The theory emphasized that the government's investment in infrastructure and on health services can effectively raise labor efficiency, thereby leading to increase production of both commodities and health services. The theory proposed a reliable power grid to enable firms to switch to more advanced machines and sophisticated equipment. That Infrastructure would lead to a faster pace of output growth and sustained development in productivity.

2.3. Impact of Infrastructure and Human Capital Development on Economic Growth: Empirical Literature

The majority of the studies on this topic focused on the individual impact of infrastructure and human capital development on economic growth. The most recent work that investigated the interaction between infrastructure and human capital development on economic growth is credited to Tsaurai and Ndou (2017). They investigated the individual impact of infrastructure and human capital development on economic growth in transitional economies. He also explored whether the interaction between infrastructural and human capital development enhanced economic growth in transitional economies. The study mainly used a dynamic panel generalised methods of moments (GMM) approach by Arellano and Bond (1995), a framework that takes into account the dynamic nature of economic growth data and addresses the endogeneity issues normally associated with economic growth regression functions. Panel data analysis approaches such as pooled ordinary least squares (OLS), and fixed and random effects were also used for comparison purposes and robustness tests. According to the dynamic GMM framework, the interaction between infrastructure and human capital development improved economic growth in transitional economies, in line with theoretical and empirical predictions. Random effects and pooled OLS show that the interaction between infrastructural and human capital development had a negative effect on economic growth, whilst according to the fixed effects approach, the interaction between these two variables had an insignificant positive influence on economic growth in transitional economies. Considering that the results from a dynamic panel GMM are considered to

be more accurate due to the approach's ability to address the endogeneity problem and the dynamic nature of economic growth data, the current study recommends that transitional economies should implement policies that improve human capital development in order to enhance infrastructural development's ability to influence economic growth.

Uda and Ebi (2017) investigated the impact of the interaction between infrastructure and human capital on industrialization in Nigeria using time series data from 1970 to 2014 using the ordinary least squares (OLS) estimation technique. The parsimonious results suggested that gross domestic investment, electricity supply, and trade openness are the required elements to accelerate the pace of industrialization in Nigeria. This implied that providing an adequate and stable supply of electricity, deepening public and private investments as well as opening the economy to the vagaries of international trade has short and long-termed lasting effects on industrial development. The policy perspective is that government should prioritize the generation and distribution of electricity, increase the quantum of investments in road infrastructure, and opening of the economy in order to accelerate the pace of industrialization in Nigeria.

Anochiwa and Maduka (2014) examined the individual role of human capital and infrastructure on economic growth in Nigeria within a cointegration and error-correction modeling framework during the period 1970-2010. Human capital is found to be positive and statistically significant to growth. The infrastructure variable (electricity) is positive but statistically insignificant. The study recommended the formulation of economic policies that favour human capital and infrastructure development in Nigeria.

Seidu, Young, Robinson, and Ryan (2020) examined how infrastructure funding impacted economic growth and how best the UK could maximize the potential by building on existing work. The research method was based on interviews carried out with respondents involved in infrastructure operating across various sectors. The findings showed that investment in infrastructure was vital in the UK as it stimulated economic growth through employment creation due to factor productivity. However, investment needed to be directed to regional opportunity areas with the potential to unlock economic growth and maximize returns whilst stimulating further growth to benefit other regions. There was also a need for policy consistency and to review UK infrastructure policy to streamline the process and to reduce cost and time overrun, with Brexit likely to impact negatively on infrastructure investment.

Ebu, Ezike, Shitile, Smith, and Haruna (2019) re-examined the link between infrastructure development and output growth in Nigeria for policy formulation and implementation. They employed the Granger causality test based on the time series vector error correction model (VECM) to reinvestigate the nexus between infrastructure investment and economic growth in Nigeria, using quarterly data from 1997:Q1 to 2017:Q4. The study accepted the infrastructure–growth hypothesis that increased financial infrastructure and infrastructure stock stimulate growth in Nigeria. It was recommended that economic policy should be formulated to improve the physical infrastructure as well as human capital formation for sustainable economic growth.
Ighodaro (2019) considered electricity, ICT infrastructure and their growth impact on Gambia, Ghana, and Nigeria for the period 1990 and 2017. There were mixed results

among the variants of ICT infrastructure used. The negative impact of access to electricity on economic growth of Nigeria may have a spillover effect to the other West African countries in the estimation and a two-way effect on economic growth. It was recommended that government should ensure that the bottleneck and corruption in the electricity sector be controlled. Internet usage should be encouraged through price reduction in all the countries except the Gambia where internet usage has a negative link with economic growth.

Ogbaro and Omotoso (2017) examined the role of infrastructure development in promoting economic growth in Nigeria over the period 1980-2015. The study found positive and significant effects of total air transport infrastructure, communication infrastructure, power, and total rail lines on economic growth with estimated elasticities of 0.035, 0.016, 0.141, and 0.132, respectively. The study recommended that it would be worthwhile for the Nigerian government and policymakers to implement policies geared towards the development of infrastructure. It also recommended Public-Private Partnership in infrastructure development to accelerate economic growth.

Kaupa (2015) studied the effect of water supply infrastructure and electricity infrastructure on economic growth in South Sumatera province analysing time series data from year 2001 to 2013. The result provided clear evidence that electricity infrastructure and water supply infrastructure were significant and both positively affect per capita output in the province. On the other hand, road infrastructure did not show any significant impact on growth. Overall, the results were consistent with the widely-accepted idea in policy research that infrastructure plays an important role in promoting growth. It was recommended that infrastructure investment should be promoted to enhance growth in South Sumatera province.

In the same vein, Usman and Adeyinka (2019) examined the random effect of human capital development on the economic growth of ECOWAS member states for the period of thirty-seven years; 1980-2016. The finding revealed that human capital development had an effect on economic growth in the ECOWAS region. It was recommended that ECOWAS governments should devour to make economic policies that favour human capital development to accelerate the growth of the region.

Essang (2018) investigated the impacts of ICT and human capital on economic growth in the ECOWAS sub-region. The study employed fixed-effect model in analyzing annual panel data set on fourteen ECOWAS countries from 1985 to 2012. The findings of the study showed that ICT and human development indices had a significant positive effect on economic growth in ECOWAS. The study recommended that education must be taken more and more seriously as well as the health conditions of people or workers as this would have a greater positive effect on economic growth in ECOWAS. It further recommended that human development index should be backed by the development in ICT to meet up with the contemporary world demand.

Boztosun, Aksoylu and Ulucak (2016) examined the basic approaches to human capital and further investigated the relationships between human capital and economic growth. The study analyzed time series data with cointegration and causality tests by using the data of Turkey for the period 1961-2011. The findings revealed a dual causality

relationship between human capital and economic growth variables. It was recommended that human capital variable should be improved to enhance economic growth in Turkey. Pelinescu (2015) investigated the impact of human capital on economic growth in the European Union (EU). The study estimated a panel data set stretching from 2000 to 2012 using pooled ordinary least squares (POLS). The empirical findings showed a statistically significant positive relationship between GDP per capita and innovative capacity of human capita and qualification of employees as expected according to economic theory. Unexpectedly, education expenditure had a negative influence on GDP per capita. The study recommended that innovative capacity of human capita and qualification of employees be enhanced to boost GDP per capital growth.

Anyanwu, Abam, Obi and Yelwa (2015) examined the impact of human capital development on economic growth in Nigeria. Using ARDL estimation framework, time-series data which covered the period 1981-2010 was analysed. The findings showed that human capital development indicators had a positive impact on economic growth in Nigeria within the reviewed periods. Further evidence indicated that equilibrium was fully restored for any distortion in the short run. Based on the findings, the study recommended that the government should invest more in human capital development process in Nigeria.

2.4. Gap in Literature

The literature is crammed with studies which investigated the separate impact of infrastructure and human capital development on economic growth, no study that the authors are aware of has so far explored whether the interaction between infrastructure and human capital development enhances economic growth in Nigeria. This identified gap the study seeks to close.

3. Methodology

In this section, the theoretical framework, model specification, method of data analysis, and sources of data used in the study are presented.

3.1. Theoretical Framework

The theoretical model adopted in this study to examine the impact of infrastructure and human capital development on growth is the endogenous growth model. The choice of endogenous growth model stems from its ability to explain the intrinsic characteristics of economies that cause them to grow over an extended period of time. It holds that economic growth is as a result of the effects of internal factors rather than external factors. It attempts to explain the Solow residual, that is, factors such as infrastructure and human capital taken for granted in the neoclassical growth theory. It assumes that both private and public investment in infrastructure and human capital increase factor productivity (Lee and Anis, 1992).

In the endogenous growth model (Romer, 1994), the firm's production function depends on capital (K_t), labour(N_t) and technology(A_t) which are the endogenous input. The production function of an individual firm denoted by subscript i is as follows:

$Y_{it} = f(K_{it}, N_{it}, A_t)$ ----------[1]
Where Y represents output (GDPPCGR), K is capital, N represents labour, A is total factor productivity (technical progress) and t stands for time.

By adopting the determinants of total factor productivity (A) we have:
$A = f(HCD, INFR, SAV, TOPN, INFL)$ ----------[2]
HCD is human capital development proxied by secondary school enrolment, INFR is infrastructure proxied by electricity supply, SAV represents gross domestic savings, TOPN denotes trade openness and INFL represents inflation.
Substituting equation 2 into equation 1, labour is represented by the level of employment (EMP) and capital is represented by gross fixed capital formation (GFCF) yields:
$GDPPCGR = f(GFCF, EMP, INFR, HCD, SAV, TOPN, INFL)$ ----------[3]

3.2. Model Specification

The empirical model for the study is specified as follows:
$GDPPCGR = f[GFCF, EMP, INFR, HCD, INFR * HCD, SAV, TOPN, INFL]$---------[4]
The interaction term (INFR*HCD) between infrastructure (INF) and human capital development HCD is included in the empirical model to estimate its impact on growth. The above function can be stated in econometric form as follows:
$GDPPCGR = \beta_0 + \beta_1 GFCF + \beta_2 EMP + \beta_3 INFR + \beta_4 HCD + \beta_5 INFR * HCD + \beta_6 SAV + \beta_7 TOPN + \beta_8 INF + \varepsilon$ ---------- [5]

Equation 5 above can be stated in ARDL form as follows

$$\Delta GDPPCGR_t = \beta_0 + \beta_1 GDPPCGR_{t-i} + \beta_2 GFCF_{t-i} + \beta_3 EMP_{t-i} + \beta_4 INFR_{t-i} + \beta_5 HCD_{t-i} + \beta_6 INFR * HCD_{t-i} + \beta_7 SAV_{t-i} + \beta_8 TOPN_{t-i} + \beta_9 INFL_{t-i} + \sum_{j=1}^{p} \gamma_1 \Delta GDPPCGR_{t-1} + \sum_{j=0}^{p} \gamma_2 \Delta GFCF_{t-1} + \sum_{j=0}^{p} \gamma_2 \Delta EMP_{t-1} + \sum_{j=0}^{p} \gamma_2 \Delta INFR_{t-1} + \sum_{j=0}^{p} \gamma_3 \Delta HCD_{t-1} + \sum_{j=0}^{p} \gamma_4 \Delta INFR * HCD_{t-1} + \sum_{j=0}^{p} \gamma_5 \Delta SAV_{t-1} + \sum_{j=0}^{p} \gamma_6 \Delta TOPN_{t-1} + \sum_{j=0}^{p} \gamma_7 \Delta INFL_{t-1} + \emptyset ECM_{t-1} + \varepsilon_t$$ --- [5

3.3. Sources of Data

The annual secondary data set covering the period from 1990 to 2020 was sourced from the World Bank Development Indicator (2021). Data for the study was collected on gross domestic product per capita growth rate (GDPPCGR), gross fixed capital formation (GFCF), Employment of labour (EMP), infrastructure (INFR), human capital development (HCD), gross domestic saving(GDS), trade openness(TOPN) and inflation(INFL). The scope of the study is determined by data availability for all the variables chosen for the study.

3.4. Method of data Analysis

The autoregressive distributed lag (ARDL) model was employed in data analysis. The choice of the autoregressive distributed model was informed by the nature of the data for the study. The data failed to follow the same order of integration. Prior to the estimation of the ARDL model, we performed preliminary data analysis to ascertain the stationarity

status and confirm if a long run relationship existed among the variables for the study. We employed two unit root tests (ADF & PP) in the study. The ARDL bounds co-integration test was applied to determine the existence of a long-run relationship among the variables. Some diagnostics tests (stability tests and serial correlation tests) were carried out to evaluate the goodness of the estimated models.

4. Empirical Results and Discussion

This section presents the empirical results of data analysis and discussion.

4.1. Descriptive Statistics

The descriptive statistics describe the variables in terms of their averages, maximum values, minimum values, standard deviation, skewness, kurtosis, J.B, and probabilities to ascertain if the variables are normally distributed or not.

Table 1: Descriptive Statistics of the variables

Variable	Mean	Max.	Min.	Std. Dev.	Skewness	Kurtosis	J.B	Prob.	Observ.
GDPPCG	1.6886	12.4575	-4.4571	3.9600	0.4371	3.2522	1.0691	0.5859	31
INFR	46.893	59.30000	27.30000	7.82984	-0.4724	2.4854	1.4947	0.4735	31
HCD	90.487	102.1081	77.87340	6.5830	-0.0297	2.3416	0.5644	0.7541	31
INFR*HCD	4247.2	5232.990	2361.220	776.200	-0.7061	2.3641	3.0985	0.2124	31
INFL	18.055	72.83550	5.388008	16.647	2.13116	6.4098	38.484	0.0000	31
TOPN	36.890	53.27796	20.72252	8.6757	0.00504	2.3982	0.4678	0.7914	31
SAV	33.304	59.02455	15.84586	12.1247	0.4515	2.1679	1.9476	0.3776	31
EMP	14.230	20.13000	10.32000	3.4928	0.2681	1.4568	3.2250	0.1993	31
GFCF	2.2854	40.38866	-23.7467	12.5001	0.3794	5.0602	5.8251	0.0543	31

Source: Authors' Computation using Eviews 11

Table 1 shows the descriptive statistics of the variables for the study. The growth rates of gross domestic product per capita lie between 12.45747 and -4.457078. The standard deviation was 3.960024 and the average growth rate was 1.688564 from 1990 to 2020. The coefficient of skewness, kurtosis and the Jarque-Bera statistic with a probability of 0.585933 indicated that the variable followed a normal distribution. All the independent variables followed a normal distribution pattern except inflation and gross fixed capital formation with probabilities of 0.0000and 0.05433 respectively. Majority of the variables considered for this study are normally distributed based on the coefficient of skewness, kurtosis, and the Jarque-Bera statistics probability values which are more than 5 %.

4.2. Unit Root Tests

Table 2: Summary of Unit Root Tests

Variable	ADF (Probabilities) Level	ADF (Probabilities) 1st.Difference	Phillips – Perron/ (Probabilities) Level	Phillips – Perron/ (Probabilities) 1st. Difference	Remark
GDPPCGR	-3.278003 (0.0251)	N/A	-3.444120 (0.0171)	N/A	Stationary I(0)
INFR	-.6.0423 (0.0000)	N/A	-6.042257 (0.0000)	N/A	Stationary I(0)

HCD	-2.137697 (0.5051)	-4.2231 (0.0001)	-2.255937 (0.1921)	-4.577668 (0.0011)	Not- Stationary I(1)
INFR*HCD	-2.551250 (0.1141)	-6.815055 (0.0000)	-2.579297 (1083)	-7.605417 (0.0000)	Not- Stationary I(1)
INFL	-2.061671 (0.2606)	-4.442520 (0.0015)	-2.329218 0.1698)	-4.429305 (0.0016)	Not- Stationary I(1)
TOPN	-2.958552 (0.0506)	N/A	-2.958552 (0.0506	N/A	Stationary I(0)
SAV	-4.317513 (0.0095)	N/A	-6.952592 (0.0000)	N/A	Stationary I(0)
EMP	0.494120 (0.9834)	-3.704963 (0.0099)	0.494120 (0.9834)	-3.515984 (0.0153)	Not-Stationary I(1)
GFCF	-10.10287 (0.0000)	N/A	-10.39587 (0.0000)	N/A	Stationary I(0)

Note: Probabilities in parenthesis. N/A- not applicable
Source: Authors' Computations using EViews 11

Table 2 presents the unit root tests. The variables considered for the study were not integrated in the same order. The two-unit root tests (ADF and PP) employed showed that five variables (gross domestic product per capita growth rate (GDPPCGR), infrastructure (INFR), trade openness (TOPN), saving (SAV) and gross fixed capital formation (GFCF) were stationary at level. While the other four variables (human capital development (HCD), the interaction term between infrastructure and human capital development (INFR*HCD), inflation (INFL), and level of employment (EMP) were not stationary at level, but they became stationary after the first difference. Following the differences in the order of integration found in the variables, it appeared unnecessary to proceed with the traditional cointegration tests and cointegration estimations (Eagle and Granger, 1987; Maddala and Kim, 1998; Stock and Watson, 1993). By the features of the variables and our sample size, the ARDL approach appeared more appropriate.

4.3. Lag Length Selection Criteria

The test results of the different lag length selection criteria are reported in Table 3. After a careful examination of the different lag length selection criteria, lag one was selected based on the Akaike Information Criterion (AIC) which has the lowest value.

Table 3: Lag Order Selection Criteria
Included observation 31

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-495.8737	N/A	5.63e+08	37.17583	37.46380	37.26146
1	-399.5203	142.7458*	6924686*	32.70521*	34.72095*	33.30459*
2	-376.6024	23.76673	28577873	33.67425	37.41778	34.78740

Source: Authors Compilation from EViews 11

4.4. Test of Co-integration

Table 4: ARDL Bound Test for Co-integration

Test Statistics	Computed value	Significance level	Bound Critical values	
F-statistic	5.875643		Lower Bounds I(0)	Upper Bounds I(1)
		10%	1.85	2.85
		5%	2.11	3.15*
		1%	2.63	3.77

Note: *level of significance at 5%
Source: Authors Compilation from EViews 11

The co-integration test result based on the ARDL bound testing approach is presented in Table 4.4. The ARDL bounds Co-integration testing approach is employed to test for co-integration in a case where the variables for the study are integrated in mixed order (Narayan & Smith, 2005). The results show that the F-statistic computed value (5.875643) is higher than the upper bound critical value (3.15) at the 5% level of significance. The hypothesis of no long-run relation is rejected. This indeed indicates that all the selected independent variables and GDPPCGR are bound by a long-run relationship.

4.5. Long Run Coefficient Estimates

Table 5: Long run coefficients
Dependent variable: GDPPCGR
Model selection Method: AIC

Independent Variables	Coefficient	Std. Errors	t- Statistic	Probabilities
C	105.0931	89.62654	1.172567	0.2657
GDPPCGR(-1)	-0.091357	0.198272	-0.460766	0.6539
GFCF	0.097374	0.046064	2113910	0.0542**
GFCF(-1)	-0.117405	0.041302	-2.842583	0.0160**
EMP	2.185512	0.902494	2.421637	0.0339**
EMP(-1)	-2.083572	0.913281	-2.281414	0.0434**
INFR	0.413086	1.533084	0.269448	0.7926
INFR(-1)	-3.332009	1.872824	-1.779136	0.1028
HCD	0.691138	0.798704	0.865325	0.4053
HCD(-1)	-1.610023	0.979954	-1.642959	0.1286
INFR*HCD	-0.011197	0.017367	*0.644727	0.5323
INFR*HCD(-1)	0.038799	0.021164	1.833258	0.0939*
SAV	-0.448533	0.124595	-3.599921	0.0042***
SAV(-1)	0.134947	0.109693	1.230222	0.2443
TOPN	0.147971	0.096109	1.539617	0.1519
TOPN(-1)	0.096783	0.081161	1.192472	0.2582
INFL	-0.082604	0.051645	-1.599449	0.1138
	R-Squares:	0.884568		
	Adjusted R-Squares:	0.716668		
	D.W :	2.285902		
	Prob(F-Statistic) :	0.004022		

Note: 3 asterisks = 1 % significance level, 2 asterisks = 5% significance level and 1 asterisk = 10 % significance level.
Source: Authors Compilation from EViews 11

From the long-run model estimation result presented in Table 4, the value of the coefficient of determination (R- Squared) is 0.8846; indicating that about 88 % of the systematic variation in gross domestic product per capita growth rate (GDPPCGR) is captured by the explanatory variables included in our model. The remaining about 12 % is accounted for by other variables not included in the model. The F-statistic with a probability value of 0.004022 indicates that a significant relationship exists between GDPPCGR and the explanatory variables included in the model. The value of the Durbin Watson (DW) statistic of 2.285902 suggests that there are no effects of autocorrelation in our estimated model. This makes our result reliable for policy decision-making.

The individual effect of the explanatory variables on the dependent variable is determined based on the coefficients and p-value of the variable. The results show that Capital (GFCF) is statistically significant at the 5% level. This is based on its probability value estimated at 0.0542. The coefficient of GFCF is 0.097; this shows that a one-unit increase in GFCF will lead to about 0.097 unit increase in GDPPCGR. This result is in agreement with the findings of Ashakah and Ogbebor, 2020 and Ikhide, 2021. The first lag of GFCF is significant but negatively related to GDPPCGR. It is contrary to our a priori expectation. The results also show that Labour (EMP) is significant at the 5% level. This is based on its probability value of 0.0339. The coefficient of EMP is 2.185. It shows that a one-unit increase in EMP will lead to about 2.2 unit increase in GDPPCGR. This result is in agreement with Ikhide, 2021. The first lag of INFR*HCD is statistically significant at the 10% level. The coefficient of INFR*HCD which is estimated at 0.0387 shows that a one-unit increase in INFR*HCD will lead to about 0.0387 unit increase in GDPPCGR. This result is in line with the findings of Tsaurai and Nduo (2019) that found a positive and significant impact of INFR*HCD on growth in transitional countries.

The coefficient of saving is estimated at -0.4485 with a probability value of 0.0042. This indicates that savings is significant at the 1% level. This result indicates that as savings increases by one unit, GDPPCGR decreases by 0.4485. This result is contrary to the result obtained by Jagadeesh (2015) and Gidigbi and Dango(2020) who found a positive and significant relationship between savings and economic growth in Botswana and Nigeria respectively.

Infrastructure (INFR) has a positive relationship with growth (GDPPCGR) in Nigeria but failed to impact growth statistically. This result is in agreement with Anochiwa and Maduka, 2014 that investigated the impact of infrastructure and human capital development on industrial output in Nigeria. The insignificant impact of infrastructure on growth can be attributed to the poor and inadequate infrastructural development in Nigeria. Human capital development (HCD) has a positive relationship with growth (GDPPCGR) in Nigeria but also failed to impact growth statistically. This result is contrary to our a priori expectation and the findings of Anochiwa and Maduka, 2014, Anyanwu, Abam, Obi and Yelwa, 2015, Usman and Adeyinke, 2019 and Onyeoma, 2020. The insignificant impact of human capital development can be attributed to the nature of human capital development in Nigeria. For instance, Professor Chris Analo once complained of the quality of the Nigerian educational system when he asserted that 95% of Nigerian graduates are not employable (The Guardian, 2018). Some persons suggest that many Nigerian graduates lack the relevant skills needed in the labour market

hence they do not adequately contribute to the production process and growth of the economy.

The coefficient of TOPN has a positive sign but not statically significant as it failed to pass the significance test at the 5% and 1% levels. This result is in disagreement with Ogbebor and Ohiomu (2018) and Uda and Ebi, 2017 who found positive relationships between TOPN and growth in ECOWAS and Nigeria respectively. The coefficient of inflation has the expected negative sign but is not statistically significant at the 1% and 5% significant levels. This result is in line with Kasidi and Mwakanemela, 2013 who found a negative relationship between inflation and growth.

Short Run Adjustment and Impact

Table 6: ECM representation of the ARDL model
Dependent variable: D(RGDPGR)

Independent Variable	Coefficient	Std. Errors	t-statistics	Probabilities
C	-1.105958	0.696166	-1.588640	0.1330
D(GDPPCGR(-1))	-0.356987	0.198441	-1.884422	0.0790*
D(GFCF)	0.118808	0.036393	3.264571	0.0057***
D(EMP)	1.666712	0.962717	1.731258	0.1039
D(INFR)	2.042873	1.669610	1.223564	0.2400
D(INFR(-1))	0.190214	0.208895	0.910570	0.3769
D(HCD)	1.347917	0.879556	1.532496	0.1462
D(INFR*HCD)	-0.028036	0.018689	-1.500108	0.1543
D(SAV)	-0.464728	0.121996	-3.809373	0.0017***
D(TOPN)	0.162692	0.082539	1.971084	0.0675*
D(INFL)	-0.133081	0.049177	-2.706164	0.0163**
ECM(-1)	-0.993966	0.460833	-2.156888	0.0476**
	R-Squares:	0.701815		
	Adjusted R-Squares:	0.483146		
	D.W :	1.700769		
	Prob(F-Statistic) :	0.019171		

Note: 3 asterisks = 1 % significance level, 2 asterisks = 5 % significance level
Source: Authors Compilation from EViews 11

Table 5 presents the error correction estimate of the ARDL model. The coefficient of the ECM variable is found to be negative and statistically significant at a 5% level confirming the existence of a long-run relationship among the variables used in the study. The coefficient of the ECM for the co-integrating equation with ΔRGDPPCGR as the dependent variable shows a very high speed of adjustment back to the equilibrium position, with about 99% of disequilibrium in the previous year returning to the long-run equilibrium in the current year. A scrutiny of the results showed that gross fixed capital formation (GFCF), savings (SAV), inflation (INFL), and trade openness (TOPN) are all statistically significant at the 1%, 5% and 10% level respectively. The signs of variables (GFCF, TOPN, INFL) are in agreement with the a priori economic expectations except saving with an opposite a priori economic expectation. The value (1.79936) of the Durbin

Watson (D.W) suggests there is no first-order serial autocorrelation in the estimated model.

4.6. Diagnostics and Stability Test

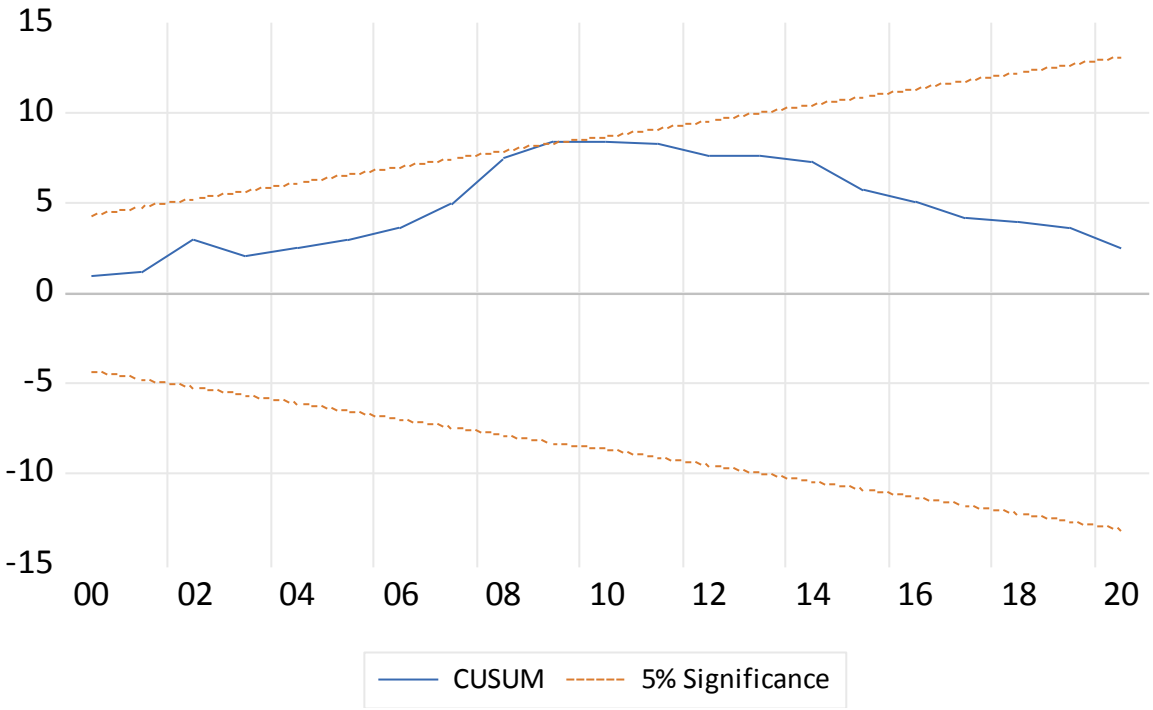
The Breusch-Godfrey Serial Correlation LM test was employed to test for the presence of serial correlation in the model. The SUCUM and SUCUM of Squares tests were used to test for the model stability. The results are as follows:

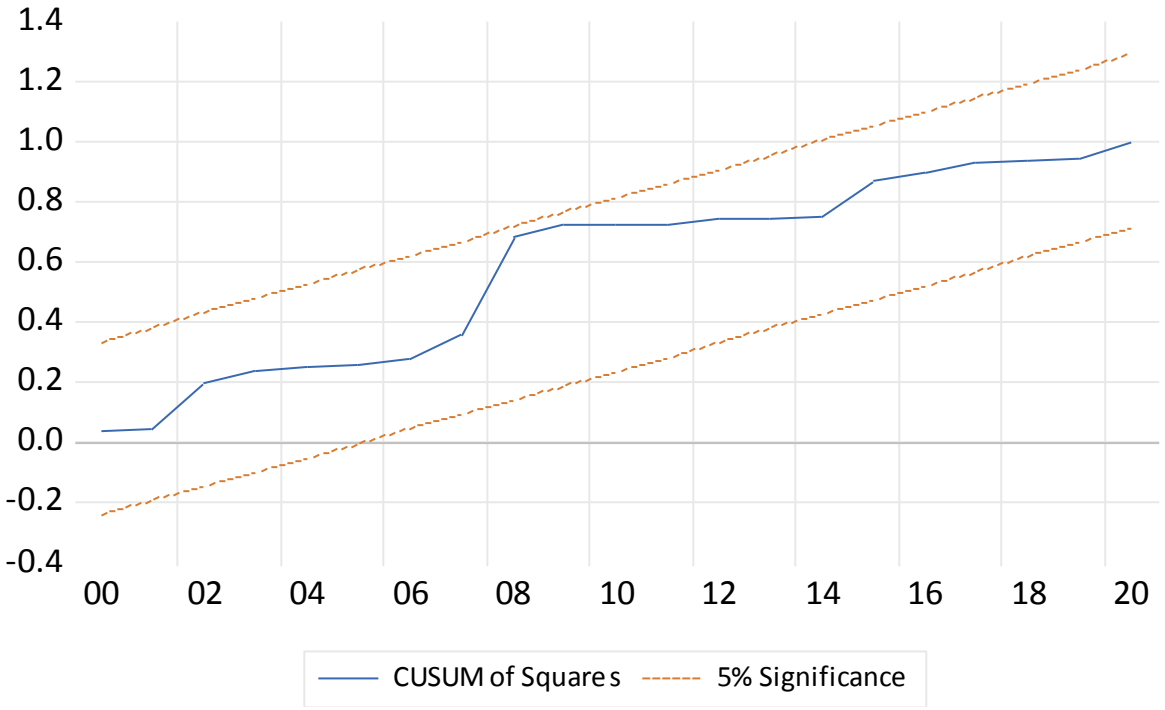
Table 7: Breusch-Godfrey Serial Correlation LM test
Null Hypothesis: No Serial Correlation

F- Statistics	2.101135	Prob. F(2,17)	0.3553
Obs*R-Squared	5.433438	Prob. Chi-Square(2)	0.1898

Source: Authors Compilation from EViews 11

Figure 1: Plots of SUCUM and SUCUM Square test of coefficient stability





From the diagnostic test results, there is no evidence of serial correlation, it shows the model is well specified in the ARDL specification (see table 7). The stability of the long-run coefficient is tested by the short-run dynamics. Once the ECM model given in table 5 had been estimated, the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests were applied to assess parameter stability (Pesaran and Pesaran, 1997). Figures 1 plot the results for CUSUM and CUSUMSQ tests. The results showed the absence of any instability in the coefficients since the plot of the CUSUM and CUSUMSQ statistic falls inside the critical bands of the 5% confidence interval of parameter stability (Iheanacho, 2017).

5.1. Conclusion and Policy Recommendations

Conclusion

This paper investigated the impact of infrastructure, human capital on economic growth in Nigeria using the autoregressive distributed lag (ARDL) model in data analysis. The study analysed time-series data from 1990 to 2020. The data analysed was collected on gross domestic product per capita growth rate as the dependent variable, gross fixed capital formation, employment, infrastructure, human capital development, trade openness, gross domestic saving, and inflation. The empirical results revealed that infrastructure (INFR) and human capital development (HCD) failed to impact growth in Nigeria. This can be attributed to the nature of human capital and inadequate infrastructure development in Nigeria. The first lag of INFR*HCD impacted growth slightly at the 10 percent significance level. The results revealed that infrastructure and human capital development have not impacted growth separately in Nigeria. The results of the study confirmed that Nigeria's growth has been retarded by the unproductive expenditure in human capital development and infrastructure over the years.

Policy Recommendation

Based on the findings of this study, certain policy recommendations can be made to improve public and private investment in infrastructure and human capital development.

- Government should allocate adequate funds (in the national budget) to the education sector of the Nigerian economy and carry out reforms in the learning curricula to make knowledge acquired more relevant to industries and production processes in general. This fund will be used to acquire the needed teaching facilities to enhance learning in the educational system. The funds will also be used to make regular and adequate payments to teaching and non-teaching staff to enable them to deliver quality services.
- Government should make adequate provisions for infrastructure development in the rural and urban settlements in Nigeria.
- Infrastructure and human capital development require huge capital investment. This study recommends public-private partnership and private participation in the provision of infrastructure and in human capital development.
- Government should provide regular control to ensure the funds provided for education and infrastructure are well utilized for the intended purposes.

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TAX COMPOSITION AND ECONOMIC GROWTH: THE NIGERIAN EXPERIENCE

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ABSTRACT

This is a quantitative research that examined the effect of composition tax (petroleum profit tax, value added tax, company income tax, and customs and excise duties tax) and its impact on the Nigeria economy (GDP). The study used secondary data obtained from various Central Bank of Nigeria (CBN) statistical bulletin, Federal Inland Revenue Service (FIRS) from 1990 to 2020 and Autoregressive distributed Lag Model (ARDL) technique for the empirical estimate. The empirical findings revealed that CIT has a positive and statistically significant impact on infrastructural development, VAT was seen to have a negative and statistically significant impact on economic growth. Further, CED is seen to have a negative and statistically significant impact on economic growth and PPT has a positive and statistically significant impact on economic growth. In view of the findings, it was recommended among others that there is the need for government to intensify its strategies in the area of towards collection of tax revenue due to the low contribution of tax revenue to GDP over the period of study. This can be done through blocking all loopholes in our tax laws as well as bringing more prospective tax payers into the tax net (especially the informal sector). Also, there should be stringent penalty imposed on any individual or corporate body who indulge in any form of tax malpractices irrespective of states, if the positive correlation between tax revenue and economic growth should be maintained.

KEYWORDS: Autoregressive distributed Lag, Company income tax, Customs and excise duties tax, Economic growth, Petroleum profit tax, Value added tax

1.0 INTRODUCTION

The concept of tax and its governance has received considerable intellectual and theoretical attention in the literature back to the ancient history of creation prior to civilization. In practice, many developing countries appear to face severe budgeting pressures with rising demand for expenditures given the limited scope for raising extra government revenue. Specifically, the revenue system that are placed in many developing countries themselves generate strong impediments to efficiency, expansion of the

economy, growth of tax base, equity and the achievement of development objectives (Kesavarajah, 2016). Hence, tax reform has become a central public policy and development planning which has been placed by many governments in practice in recent period. The importance of taxation in promoting economic growth and development as well as the survival of many nations cannot be overemphasized. Through it, government ensures that resources are channelled towards important projects in the society. Many developed and developing economies around the world believe that no nation can truly develop without developing its tax system. Consequently, many countries have embarked on tax reforms and restructuring with a view to developing a tax system that maximizes government revenue without creating dis-inventiveness for investment as described by Ehigiamusoe (2014).

Emmanuel (2010) observed that the realization was dawned on Nigeria's government at a very critical period when its main source of revenue for decades, oil, witnessed an unprecedented crisis and decline due to general fall in the prices of oil at the international market. This affected the overall revenue of the country and the general performance of government at various levels, especially as it concerns execution of capital projects, which to a large extent, is key to national development. Consequently the Federal government came up with a National Tax Policy which seeks to provide a set of guidelines, rules and modus operandi that would regulate Nigeria's tax system and provide a basis for tax legislation and tax administration in the country. The primary objective of revamping, restructuring and reforming the Nigerian tax system is to make it the main source of revenue generation for the government. Government is an economic agent which collects money through taxation and spends on education, subsidies, infrastructure, government consumption, etc. However, despite all these government expenditures, economic growth is in retarding level. In general, the provision of social and physical infrastructure through government expenditure can improve productivity through a more skilled workforce and efficient allocation of resources. Therefore, issues relating to criteria for the allocation of government expenditure among different sectors and implementing appropriate tax policies are of special policy relevance which is directly related to the country's growth and development. In the wake of this, Kesavarajah (2016) posit that understanding the channels through which public finance instruments, such as tax policy, expenditure policy, and overall budgetary policy could affect long term output growth would help policy makers to ascertain how to redirect public expenditure and revenue, and to give more attention to the components of the tax revenue which promote growth.

The relationship between tax composition (distribution of revenue by type of tax) and economic growth has received both theoretical and empirical attention. The findings in the specific literature have shown that taxes affect the allocation of resources and may often generate behavioural distortions of economic agents. When it comes down to economic growth, economic theory states that it is generated by three production factors: labour, capital and technological progress, which are related to each other through a production function. Taxes could alter the economic decisions regarding these factors, and thus adversely/positively affect economic growth (Zipfel & Heinrichs, 2012).

Many analysts as posited by Ehigiamusoe (2014) have argued that the Nigerian tax system is repugnant to economic growth and development, that more reform is needed

to reposition the system for utmost efficiency. On the other hand, some analysts have deposited that the Nigerian Tax System is an agent of economic growth due to the reforms and restructuring which took place in the system in recent times. While most of the previous studies have investigated the growth effect of tax policy focusing on OECD countries, analyses considering a tax composition effect on the Nigerian economy have been rather scant. The erroneous generalization and inconclusive evidence of researches, and considering the gargantuan tax proceeds from all sectors in the Nigeria economy, most especially the oil sector as well as its ever increasing nature which many believe has not yielded desirable impact on the lives and living standard of an average Nigerian. This has made the issue of economy growth effect of different types of taxation especially of a country especially Nigeria open for further research. This in fact informed the basis of this research. Therefore the study seeks to examine the effect of tax composition (petroleum profit tax, value added tax, company income tax, and customs and excise duties tax) on Nigeria economy growth.

2.0 LITERATURE REVIEW

Conceptual Review

Economic growth can be defined as an increase in the production of goods and services in an economy. In other words economic growth can occur when a nation experienced Increases in capital goods, labour force, technology, and human capita. It can be measured in nominal or real (adjusted for inflation) terms. Traditionally, aggregate economic growth is measured in terms of gross national product or gross domestic product (GDP). Economic growth is an increase in the production of economic goods and services, compared from one period of time to another.

Tax a compulsory contribution levied by the government on workers' income and business profit to state revenues, or added to the cost of some goods, services, and transactions. Taxation can be seen as the imposition of compulsory levies on individuals or entities by governments in almost every country of the world. Taxation is used primarily to raise revenue for government expenditures, though it can serve other purposes as well like bridging the gap between the rich and the poor. The principal method by which a government gains revenue into its budget can be referred to as taxation.

Theoretical Review

The Lifeblood Theory also known as Government and taxation elaborates that taxation is need of the government as blood is need of the body. Thus, the government cannot work without revenue similarly; the body cannot stay without blood. Another interpretation of this theory is that the system of taxation works as circulation of blood throughout the body like the money circulates within the subject. This theory emphasises the importance of taxation to any economic system. Taxation is the life wire or engine of growth of successful government.

The Benefit Theory: This theory principally states that, tax should be paid in accordance with the benefits derived from the available good and services. This implies that an individual pay this tax in accordance with the benefit taken by a person from the facilities provided by the government. The short comings of the benefit theories include the following: (i) every single person’s benefit could not be counted (ii) It was also against

the principle of tax to establish a connection between benefits conferred and benefits derived.

The Ability to pay theory: This theory is also referred to as the sacrifice theory. It was formulated on the basis of a maxim "Individual produce according to his ability, consume according to his needs". This implies that taxable individual has to pay the government according his capability and also spend on his self-according to his needs. The ability to pay theory enables one to sacrifice to give. The theory is based on two main ideas: The minimum and the maximum sacrifice, it is difficult to sacrifices a huge amount but the minimum willing to sacrifices is justifiable to a reasonable extent

The Expediency Tax theory asserts that every tax proposal must pass the test of practicality. It must be the only consideration weighing with the authorities in choosing a tax proposal. Economic and social objectives of the state and the effects of a tax system should be treated irrelevant (Bhartia, 2009). Anyafo (1996) explained that the expediency theory is based on a link between tax liability and state activities. It assumes that the state should change the members of the society for the services provided by it. This reasoning justifies imposition of taxes for financing state activities by inferences, provides a basis, for apportioning the tax burden between members of society. This proposition has a truth in it, since it is useless to have a tax which cannot be levied and collected efficiently. In addition, the administrative set up may not be efficient to collect the tax at a reasonable cost of collection.

Empirical Review

Okey (2021) carried out an investigation on the effect of Nigerian taxation system on Nigerian economy from 1999 t0 2017. Ordinary Least Square method of regression was adopted for data analysis The regression result revealed that there is a significant positive relationship between the independent variables (PPT, CIT) and Gross Domestic Product. However the relationship between Value Added Tax and Gross Domestic Product is negative. It is recommended that government should provide enabling environment for companies to generate more revenues. Government should also reduce the VAT rate to encourage consumption of certain goods.

Adegbie, Nwaobia, & Osinowo, (2020), studied non-oil tax revenue on economic growth and development in Nigeria. The study employed ex-post facto research design and Macro data for the period 1994Q1-2017Q4 representing seventy six (76) observations. The study discovered that non-oil taxes (custom and excise duties, capital gain tax, company income tax, tertiary education tax and value added tax) have significant effect on economic growth. This study concluded that non-oil taxes significantly influenced both economic growth and economic development in Nigeria.

Uhuaba & Siyanbola (2020) study examined Nigeria's tax structure and economic development from the standpoint of infrastructural deficiencies. The study employed a survey research design using a structured questionnaire administered to senior tax practitioners and senior staff of the Federal Inland Revenue Service. A total of 85% of the questionnaire administered were retrieved while descriptive and inferential statistics were used for the data analysis. The study found that the tax structure had a significant positive effect on infrastructure in Nigeria. The study recommended that investors

critically and objectively study and understand the tax base dynamics and tax rates as they affect their taxable income from their investments.

Owino (2019) examined the effect of custom and excise duties on economic growth in Kenya for the period 1973 to 2010. The study adopted a correlation research design based on its ability determine the strength and direction of relationships between variables while the theoretical framework was anchored on endogenous growth model.

Yahaya and Bakare (2018) evaluated the effect of petroleum profit tax and company income tax on Nigerian economy growth. Their study employed the Fully Modified Least Square (FMOLS) Regression Technique over a 34 years period (1981-2014). It was found that petroleum profit tax (PPT) has positive significant impact on gross domestic product (GDP) in Nigeria with the Adjusted R^2 of 87.6% which directly enhanced growth in Nigeria. The study then concluded that PPT and CIT serves as the major source of revenue to the Nigeria economy, and contribute to the growth of Nigeria economy.

Okoro and Onatuyeh (2018) investigated the nexus between value-added tax and economic growth in Nigeria. The study used secondary data and Ordinary Least Square regression technique for the empirical estimate. The result of the analysis shows that value-added tax is negatively related to economic growth. To test the robustness of the result, the study substituted the dependent variable with total tax revenue and total federally collected revenue. Both results were negative and statistically significant. The negative relationship shows that there are leakages arising from the poor administration of value-added tax in Nigeria.

Oghuma (2017) focused on Value Added Tax (VAT) and economic growth in Nigeria. It employed time series survey of data covering a lapse period of twenty years (1994-2013). The statistical tool employed was simple linear Ordinary Least Square (OLS) regression. The study found that VAT is statistically significant, suggesting that VAT has positive relationship with economic growth in Nigeria.

Andre Gbato1 (2017) empirically tested impact of taxation on long-run growth of a sampled 32 countries in sub-Saharan Africa. The results indicated a zero effect of taxation on long-run growth and the results suggested a significant negative effect of indirect taxes and taxes on individuals in short term. Consequently, the use of taxation as an instrument of intervention is not appropriate in the region. The countries of the region could therefore increase their growth, if the design of fiscal policy rests solely on logic of fiscal neutrality

Madugba and Joseph (2016) examined the relationship between Value added tax and Economic development: in Nigeria. The study covered 18years period between 1994 and 2012 and multiple regression was used for the analysis. The result of the empirical estimate showed a negative significant relationship between value added tax revenue and Gross domestic product. Also, the result showed a positive significant relationship between Gross domestic product and Total consolidated revenue.

Etale and Bingilar (2016) examined the impact of companies' income tax, value-added tax on economic growth (proxy by gross domestic product) in Nigeria. The period under

study span from 2005 to 2014 and Ordinary Least Squares (OLS) technique was employed for the estimates. The results of the analysis showed that both company income tax and value-added tax have significantly positive impact on economic growth.

Ofishe (2015) empirically analyzed the impact of Value Added Tax (VAT) on economic growth (GDP) in Nigeria from 1994 – 2012. The Ordinary Least Square techniques were used to estimate three models in line with the formulated hypotheses. The results from the models revealed a strong positive significant impact of VAT on economic growth as proxy by GDP in Nigeria. It also revealed that there is positive relationship or impact of VAT on total tax revenue over the period studied

Abdullahi, Madu and Abdullahi (2015) examined the evidence of petroleum resources on Nigeria economic using simple linear regression model from 2000 to 2009 and found that petroleum has a direct and positive significant relationship with the Nigeria economy. The study therefore concluded that, petroleum has been the mainstay of Nigeria economy since it discovery and it constitutes the major source of our foreign reserves and main source of development capital.

Usman and Adegbite (2015) examined the impact of petroleum profit tax on economic growth in Nigeria with special concern of causality among petroleum profit tax, money supply, interest rate, inflation rate and economic growth. Johansen co-integration and the Granger causality tests using data spanning the period 1978-2013 was used for the estimate. Results showed that petroleum profit tax has positive significant impact on GDP both in the short run and in the long run.

Adejare (2015) analyses the effect of corporate tax on revenue profile and also examines the impact of corporate tax revenue on economic growth in Nigeria. The study employed secondary data from 1993 to 2013 with multiple regressions analysis. The empirical estimates shows that, corporate income tax has positive significant impact on revenue profile in Nigeria with the Adjusted R^2 of 95.3% which directly enhanced growth in Nigeria. The study therefore draw a conclusion that this is so because Government derives revenue from corporate tax in discharging their obligation by providing funding for infrastructure, education and public health this invariably enhances economic growth in Nigeria.

Naomi and Sule (2015) studied the company income tax in the light for alternative financing for sustainable development in Nigeria. The study employed Ordinary Least Square (OLS) method and co-integration test over the period 1987–2013 to analyse the long run relationship between company income tax and revenue generation in Nigeria. The study concluded that there is a positive and significant relationship between company income tax and revenue generation in Nigeria.

Having done an in-depth literature review, this study has no doubt added to the extant literature in a very robust manner in terms of methodology with the use of a more dynamic technique in terms of the use of ARDL. Also, the study is very apt especially in this period where the revenue generated from the citizens is not commensurate with government provision of the basic necessity of the people. Furthermore, this study is very much current in its applicable literature and estimated analysis thus, very relevant for policy reference.

3.0 METHODOLOGY

This study utilizes time-series research design. The justification for choosing the design is due to the fact that the method provides discovery on trends and patterns of change. This is to enable us establish the possible impact of tax composition (proxy by personal income tax, petroleum profit tax, value added tax, company income tax, and customs and excise duties tax) revenue on economic growth (proxy by GDP) over a time period. The study employed a time series data covering a period of 1990 – 2020.

This study adopts the Expediency Tax theory and to enables us to assess the extent to which the Nigeria tax system conforms to this scenario where the link between tax liability and economic activities are linked. If applicable, such a characterization will enhance accurate tax revenue projection and targeting specific tax revenue sources given an ascertained profile of economic development. It assists in estimating a sustainable revenue profile thereby facilitating effective management of a country's fiscal policy, among others. This is because the expediency theory focuses on the fact that taxes are collected to achieve economic objective which enhances the growth and development of a country in all its spheres.

Model Specification

In order to examine the impact of tax composition on the economic growth of Nigeria, the following function was used.

The model is specified below:

$EG = f(TC)$…….. (i)

$GDP = f(PPT, VAT, CIT, CED)$…….. (ii)

$GDP = \beta_0 + \beta_1 PPT + \beta_2 VAT + \beta_3 CIT + \beta_4 CED + \mu$……. (iii)

Where;

EG = Economic growth (proxy by GDP)

TC = Tax composition (proxy by PIT, PPT, VAT,CIT and CGT)

PPT = Petroleum profit tax

VAT = Value Added Tax

CIT = Company income tax

CED = Customs and excise duties tax

β_0 is constant while and $\beta_1 - \beta_5$ are coefficients of the different independent parameters respectively

μ: Error term or Stochastic term

Apriori expectation: $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5 > 0$

Given the dynamic relationship between tax and economic growth a dynamic specification is provided for the econometric specification:

$$RGDPG_t = \alpha_0 + \delta_1 PPT_t + \delta_2 VAT_t + \delta_3 CIT_t + \delta_4 CED_t + \sum_{i=1}^{p-1} \psi_i \Delta \mathrm{RGDPG}_{t-i} + \sum_{i=1}^{q_1-1} \varphi_1 \Delta PPT_{t-i} + \sum_{i=1}^{q_1-1} \varphi_2 \Delta VAT_{t-i} + \sum_{i=1}^{q_1-1} \varphi_3 \Delta CIT_{t-i} + \sum_{i=1}^{q_1-1} \varphi_4 \Delta CED_{t-i} + \theta ECM_{t-1} \xi_t$$

Apriori expectation: $\delta_1, \delta_2, \delta_3 < 0$; : $\delta_4, \delta_5 > 0$; also, $\varphi_1, \varphi_2, \varphi_3 < 0$ $\varphi_4, \varphi_5 > 0$

Where θ is the error correction term that is expected to lie between 0 and 1 (in absolute values) and negative in order to ensure cointegration in among the variables. The coefficients δ_is are the long run coefficients, while φ_is are the short run coefficients.
The use of ARDL become essential because irrespective of whether the underlying variables are I(0) or I(1) or a combination of both, ARDL technique can be applied. This helps to avoid the pretesting problems associated with standard cointegration analysis which requires the classification of the variables into I(0) and I(1). This means that the bound cointegration testing procedure does not require the pre-testing of the variables included in the model for unit roots and is robust when there is a single long run relationship between the underlying variables. Since each of the underlying variables stands as a single equation, endogeneity is less of a problem in the ARDL technique because it is free of residual correlation (i.e. all variables are assumed endogenous). Also, it enable us analyze the reference model. When there is a single long run relationship, the ARDL procedure can distinguish between dependent and explanatory variables. That is, the ARDL approach assumes that only a single reduced form equation relationship exists between the dependent variable and the exogenous variables (Pesaran, Smith, and Shin, 2001). The major advantage of this approach lies in its identification of the cointegrating vectors where there are multiple cointegrating vectors.

4.0 DATA PRESENTATION AND ANALYSIS OF RESULT

The discussion of the study is based on the outcomes of the empirical results derived from the data. The preliminary analysis is first presented using graphical analysis to examine the trend performance of the variables. Next the unit root test is presented to examine the stationarity conditions of the data using the Augmented Dickey Fuller (ADF) test and the Philip-perron (PP) test. The co-integration test is also conducted using the Johansson procedure and the bounds test dynamic co-integration procedure. The empirical estimation employed the Autoregressive distributed Lag Model (ARDL). To examine the response of GDP to tax innovations or shocks, we employed the impulse-response functions. The result of the analysis is presented below.

Table 1: Descriptive Statistics

	CED	CIT	GDP	VAT	PPT
Mean	535542.9	441543.6	32749.95	7661845	3635.475
Median	87900	46200	22449.41	199850	2204.721
Maximum	10125900	5516900	69023.93	65635352	18366.31
Minimum	1616	403	13779.26	7261	13.5238
Std. Dev.	1673719	1031905	18889.2	20213869	4327.13
Skewness	5.289594	3.761781	0.801592	2.371507	1.64309
Kurtosis	30.78497	17.82306	2.141006	6.791944	5.554522
Jarque-Bera	1362.716	426.0041	5.099938	36.87502	26.70869
Probability	0.000	0.000	0.0178084	0.000	0.000002
Sum	19815087	16337112	1211748	1.84E+08	134512.6
Sum Sq. Dev.	1.01E+14	3.83E+13	1.28E+10	9.40E+15	6.74E+08

Source: Researchers compilation (2021).

The summary/ descriptive statistics is presented for the variables as shown in the table above. As observed, VAT has a mean value of 7661845(nm) with standard deviation value of 20213869 indicating significantly high volatility in VAT revenue within the period under review. Maximum and minimum values are 65635352(nm) and 7261.00(nm) respectively. CIT has a mean value of 441543.6 (nm) with standard deviation of 1031905 also indicating significantly high volatility in CIT revenue within the period under review. The Maximum and minimum values are 5516900(bn) and 403(bn) respectively. CED has a mean value of 545542.9 with standard deviation of 1673719. Maximum and minimum values are 10125900(bn) and 1616(bn) respectively. GDP mean value of 32749.95 with standard deviation of 18889.2. The Maximum and minimum values are 69023.93 and 13779.26. PPT has mean value of 3635.475 (bn) with maximum and minimum values of 18366.31(bn) and 13.5238(bn) respectively The Jacque-bera statistic and the p-value indicate that the series are normally distributed and the presence of outliers are unlikely in the series and their residuals. For example, CIT has p-value of 0.000, VAT has p-value of 0.000, CED has p-value of 0.000, GDP has p-value of 0.017 and debt has p-value of 0.000.

Table 2: Unit root test Results

Unit root test at levels			
	ADF-Test Statistic	95% Critical ADF Value	Remark
VAT	1.7881	-2.96	Non-stationary
CIT	2.9573	‘’	‘’
CED	3.9403	‘’	‘’
GDP	2.3891	‘’	‘’
PPT	1.8372		
Unit root test at 1st difference			
	ADF-Test Statistic	95% Critical ADF Value	Remark
VAT	3.1688	2.96	Stationary
CIT	6.4613	‘’	‘’
CED	4.8813	‘’	‘’
GDP	7.4777	‘’	‘’
PPT	6.9632		

Source: Researchers compilation (2021).

The Augmented -Dickey Fuller (ADF) test is employed in order to analyze the unit roots. The results are presented in levels and first difference. This enables us determine in comparative terms, the unit root among the time series and also to obtain more robust results. The result indicates that all of the variables at levels except for CIT and CED have ADF values that are less than the 95% critical ADF value of 2.96. The implication of this is that the time series for these variables are stationary in their levels. Moving forward, we take the first differences of the respective variables and perform the unit root test on each of the resultant time series. The rationale behind this procedure is that Box and Jenkins (1976) have argued that differencing non-stationary time series will make it attains stationarity. The result of the unit root test on these variables in first differencing shows that the ADF values in absolute terms is greater than the 95% critical ADF values. With these result, all variables are adjudged to be stationary. Thus we accept the hypothesis that the variables possess unit roots. Indeed the variables are integrated of order one i.e. I(1) with ADF values of 3.16988 for VAT, 6.4613 for CIT, 4.8813 for CED and then 7.4777 for GDP and 6.96 for PPT.

Table 3: Co-integration Test (Trace Statistics)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
r = 0*	0.926747	90.13013	47.85613	0.000
r ≤ 1*	0.70763	37.85351	29.79707	0.0048
r ≤ 2*	0.476187	13.25878	15.49471	0.1057
r ≤ 3	0.016186	0.326366	3.841466	0.5678

Source: Researchers compilation (2021).

Table 4: Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
r = 0*	0.926747	52.27662	27.58434	0.000
r ≤ 1*	0.70763	24.59473	21.13162	0.0156
r ≤ 2*	0.476187	12.93241	14.2646	0.0803
r ≤ 3	0.016186	0.326366	3.841466	0.5678

Source: Researchers compilation (2021).

Following the unit root test results shown in table 2 which indicate that the time series variables are integrated of order one I(1), the next step is to examine whether or not there is at least one linear combination of the variables that is integrated of order zero, I(0), and hence, if there exists a stable and non-spurious cointegrated relationship in the long run between time series variables . The Johansen approach determines the number of cointegrated vectors for any given number of non-stationary variables of the same order. The study utilizes the Johansen co-integration methodology in conducting the co-integrating properties of the data. Using the trace and maximum Eigen-value statistics, the results for the test rejects the null hypothesis that there is no co-integrated vector and hence the variables are co-integrated. With this result, we proceed to specify the long run equation.

Table: 5. ADRL Long Run Result: ARDL (1, 1, 3, 3, 3)

Variable	*Aprori sign*	*Beta, standard error p-values*
C		0.4725* (0.04681) [0.0000]
Log CIT		0.4725* (0.04681) [0.0000]
Log VAT		-0.15227*

		(0.0482) [0.0002]
Log CED		-0.09582* (0.0238) [0.0101]
Log PPT		0.13688* (0.0365) [0.0134]

Source: Researchers compilation (2021).

The long run ARDL results reveal the structural coefficients of the tax variables and their relationship with economic growth. The coefficient and p-values for CIT; 0.4725 {0.000}, reveals that CIT has a positive and statistically significant impact on growth at 5% level. The result suggests that an increase in CIT has a positive impact on economic growth and with a 1% rise in CIT resulting in a 4.7% increase in growth. The coefficient and p-values of VAT; -0.15227{0.00}, reveals that VAT has a negative and statistically significant impact on growth at 5% level. Specifically, a 1% increase in VAT results in a decline in growth by 1.5%. The coefficient and p-values of CED, -0.09582 {0.000} reveals that CED has a negative and statistically significant impact on growth at 5% level. Specifically, the estimate suggests that a 1% increase in CED will cause a decline in growth by about 0.9%. The coefficient and p-values of PPT, 0.0048 {0.9316} reveals that PPT has a positive and statistically significant impact on growth at 5% level. Specifically, a 1% increase in PPT results in an increase in economic growth by 1.37%.

Table 6. ADRL ECM Result

Variable	*Beta, standard error* *p-values*	Variable	*Beta, standard error* *p-values*
C	4.4274* {0.3047} (0.0000)	*dLog VAT(-1))*	0.06825* (0.0059) [0.000]
dLog CED	-0.0398* (0.0045) [0.0003]	*dLog VATT(-2))*	0.06204 (0.0066) [0.000]
dLog CIT	-0.0051* (0.0126) [0.7015]	*dLog PPT*	0.0072 (0.0067) [0.3177]
dLog CIT(-1))	0.2121 (0.0263) [0.0005]	*dLog PPT(-1))*	-0.0805* (0.0077) [0.000]
dLog CIT(-2))	-0.11539 (0.01648) [0.0000]	*dLog PPT(-2))*	-0.0698 (0.0088) [0.000]
dLog VAT	-0.0141* (0.0017) [0.0004]	*ECM (-1)*	-0.6401 (0.0445) [0.000]
R^2 = 0.984, Adj R^2 = 0.966, S.E of regression = 0.007, F-stat = 0.966, p(f) Stat=0.000, Durbin Watson =2.05			

Source: Researchers compilation (2021)

The ARDL short run error correction model (ECM) long run ARDL results reveals the structural coefficients of the tax variables and their relationship with economic growth. The short run coefficients reveals that dlog-CED is negative (-0.0398) and statistically significant impact on infrastructural development at 5% level and hence in the short run, the effects of CED on growth shows a negative outcome. The short run coefficients reveals that dlog-CIT is negative (-0.0051) and statistically significant impact on growth at 5% level and hence in the short run, the effects of CIT on infrastructural development shows a negative outcome. Looking further at the dynamics, dlog-$CIT_{(-1)}$ has a positive (0.2121) and statistically significant impact on infrastructural development at 5%, dlog-$CIT_{(-2)}$ then shows a negative effect (-0.1154) and statistically significant impact on infrastructural development at 5%. The short run coefficients reveals that dlog-VAT is negative (-0.0141) and is statistically significant impact on infrastructural development at 5% level and hence in the short run, the effects of VAT on infrastructural development shows a negative outcome. Looking further at the dynamics, dlog-$VAT_{(-1)}$ has a positive (0.06825) and statistically significant impact at 5%, dlog-$VAT_{(-2)}$ then shows a negative effect (0.06204) and statistically significant impact at 5%. The short run coefficients reveals that dlog-PPT is positive (0.0072) and has a statistically significant impact at 5% level and hence in the short run, the effects of PPT shows a positive outcome. Looking further at the dynamics, dlog-$PPT_{(-1)}$ has a negative (-0.0805) and statistically significant impact at 5%, dlog-$PPT_{(-2)}$ also shows a negative effect (-0.0698) and statistically significant at 5%. The error correction estimate ECM(-1) has the expected negative coefficient (-0.6401) which is statistically significant at 5% and is an indication of the speed with which the short run deviations will be corrected and thus converge into the long run and as observed, the result denotes that 64% of the short-run short run fluctuations will be corrected within one year.

5.0 Summary, Conclusion and Recommendation

The importance of tax revenue in the rapid growth of both developed and developing countries cannot be overemphasized. Yet, while Organization of Economic Cooperation Development countries collect, on average, 34% of their gross domestic product as tax, some developing countries achieve only half this rate. In most developing economies, a low tax-revenue/GDP ratio prevents these nations from the responsibility of ruthless disbursement on programs. Globally, government has intensified efforts to increase non-oil tax revenue as part of their broader fiscal consolidation strategies. The increases in tax revenues in African Countries reflect continuing efforts to mobilize domestic resources, effect tax reforms and modernize tax system and administration. For Nigeria, the need for tax revenue for sustainable development cannot be over emphasized. Indeed huge fund is required now than ever to meet with employment and infrastructural development gap in Nigeria. However the fact that Nigeria government over the years based its budget preparation on the prevailing international market situation of crude oil which had remained volatile, and therefore made it imperative for Government to begin to develop alternative sources of income outside the oil sector and thereby making the non-oil sector attractive and thus improve the taxation and revenue from non-oil sectors.

The study examines tax composition on economic growth in Nigeria. The taxes examined are Value added tax (VAT), Customs and excise duties tax (CED), Company income tax (CIT) and petroleum profit tax (PPT). The empirical estimation employed the Autoregressive distributed Lag Model (ARDL). To examine the response of GDP to tax

innovations or shocks, we employed the impulse-response functions and the variance decomposition procedure. The results of the analysis showed that that CIT has a positive and statistically significant impact on growth at 5% level. VAT has a negative and statistically significant impact on growth at 5% level. CED has a negative and statistically significant impact on growth at 5% level and PPT has a positive and statistically significant impact on growth at 5% level. From the empirical analysis above, the result shown that in the long run; Companies Income Tax (CIT), VAT and Custom Excise Duties (CED) do not contribute positively to economic growth.

Firstly, there is the need for government to intensify its strategies towards collection of tax revenue this is due to the low contribution of tax revenue to GDP over the period of study. This can be done through blocking all loopholes in our tax laws as well as bringing more prospective tax payers into the tax net (especially the informal sector). Secondly, there should be stringent penalty imposed on any individual or corporate body who indulge in any form of tax malpractices irrespective of states, if the positive correlation between tax revenue and economic growth should be maintained. Thirdly, Government through Federal Inland Revenue Service should create an effective and reliable data base for every viable persons to minimize (if not eliminate) the incidence of tax evasion. Fourthly, there should be constant review of existing tax laws just as it is obtained in the United State of America and other advanced economics, so as to keep the act in pace with the economic reality.

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