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## **Journal of Economics and Allied Research (JEAR)**

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The journal publishes articles quarterly (March, June, September and December Issues). The journal can also publish more than four times a year depending on the rate of submission and also based on editorial board's decision. Articles involving cross sectional, cross country, time series and panel studies are welcome. In selecting articles for publication (from articles that have passed the review process) the journal will try to strike a balance among the subject areas and methodological approaches. In order to facilitate the speed of acceptance, articles addressing current economic problems or challenges with specific policy relevance will be given priority.

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**DISCUSSION OF FINDINGS (5) CONCLUSIONS AND RECOMMENDATIONS (6)  
REFERENCES (7) APPENDIX (if any)**

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# CLIMATE CHANGE MITIGATION AND GENDER INEQUALITY NEXUS: EVIDENCE FROM SUB-SAHARA AFRICA

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## **ABSTRACT**

While efforts and policy have been pursued towards adapting to and mitigating against climate change towards achieving sustainable development, the role of gender has not been given the required attention. This study is aimed at determining the impact of closing the gender gap on the mitigation of climate change. The panel least square estimated method was employed spanning from 2008 to 2020 and on some countries in Sub-Saharan African. Agriculture nitrous oxide emission as a % of total emission (AN2O) and CO<sub>2</sub> emissions from gaseous fuel consumption as a % of total (CO<sub>2</sub>FE) were used to capture climate change. Various measures of gender gap showed a substantial impact on climate change. While female tertiary enrolment, female to male labour participation ratio, and government national expenditure % of GDP were negatively related with agriculture nitrous oxide emission as a % of total emission and agricultural sex employment ratio had a positive relationship with climate change. The study thus, advocates among others the increase of females in the engagement of non-agricultural activities as well as an increase in female tertiary education to mitigate climate change

**Keywords:** Climate change, gender gap, mitigation, panel data, Sub-Saharan

**JEL CLASSIFICATION:** C23, O15, Q01, Q56

## **1. INTRODUCTION**

Climate change remains a threat to the effective achievement of the global Sustainable Development Goals (particularly SDGs 1 and 2). UN reported a climate disaster cost of \$250 billion to \$300 billion per annual between 2003 and 2013 (United Nations Development Programme (UNDP), 2016). Climate change can hamper all developmental efforts starting from impediments to agricultural production as a result of flooding and drought which has resulted in food insecurity. For instance, in 2017, disasters and floods as a result of climate change displaced 18.8 million people, About 132 million people of the global poor are estimated to be living in areas with high flood risk in 2018, while climate change is estimated to drive 68 million to 132 million into poverty by 2030 (Global Report on Internal Displacement. 2018; World Bank, 2021). Climate disasters have also been seen to increase gender-based violence (GBV) (sexual harassment and violence), domestic violence, sexual exploitation of children, and human trafficking (UN Women, 2016). The agricultural sector, the poor and slighted group of individuals are affected most by climate change because of their weak resilience and high vulnerability has given their high dependence on natural resources and a high poverty level of which is more among females.

With the realities of climate change which started in 1979, the global economy has not been silent about it. Several conferences (world climate conference by the World Meteorological

Organization of 1979, Intergovernmental Panel on Climate Change (IPCC) in 1988, and the most critical steps of the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, and the Kyoto protocol of 2005) have been held seeking for the way out. Although these yielded remarkable success over the years, but not in all regions and this has been as a result of some factors which may have not been accounted for before now.

Gender inequality among other forms of inequalities has tenaciously shackled global developmental efforts including climate change mitigation. Data showed in 2018 that the global labour force participation rate for men was as high as 75% as compared to the low rate of participation of 48.5% for women (International Labour Organization (ILO), 2018). Also, while the global unemployment rate for men was 5.5 %, that of women was 6.2% and the share of women to men in informal employment (including agricultural workers) was 7.8% higher than that of men with 1/3 of women's global employment being in the agricultural sector and accounting for only 12.8% of agricultural landholders. Access to finance is also very low, about 58% in comparison to 65% for men representing (Food and Agriculture, (FAO), 2015; ILO, 2018) yet females are bearing the brunt of coping with climate change associated shocks, stress and pollution, and are 14 times more likely than men to die during a disaster (Center for International Environmental Law & CARE International, 2015).

However, the effect of climate change differs across regions and countries. Africa has been noted to be likely the continent most vulnerable to climate change (Parry et al, 2007). This was confirmed by Sarkodie and Strezov (2019) in their studies on 192 United Nations that the region most vulnerable to climate change in Africa. Gender inequality has also been found to be prevalent in Sub-Saharan Africa irrespective of various efforts at achieving gender equity. The region has the highest Gender Inequality Index of 0.527 in 2015 (UNDP, 2016). UNDP (2010), noted that in 2008, as measured by Gender Inequality Index, the deficits as a result of gender inequality were 73.5% for Sub-Saharan Africa as compared to the World deficit of 56%. There is limited or no access to all productive resources such as credit, agricultural inputs, formal employment, and education. There are little or no legal rights to access or own land. Females are engaged more in non-formal employment than formal. The International Labour Organization (ILO) (2011) showed that in 2009, employment of men to women is 62.9% and 81.2% in Sub-Saharan Africa while ECA in Gender sustainable development report (2015) showed that in 2011, women's share in nonagricultural paid employment in Sub-Saharan African was 39.6%.

Analysis of gender and climate is a recent issue of policy debates in the analysis of climate and environmental change. But, only a few studies have examined the adaptation impact of gender (Tacoli et al., 2014, Fawzy, et al, 2020). This may be associated with the recent widespread accepted fact that the poorest and the women are the worst hit by climate change. However, the potentials of women to substantially contribute to the mitigation of climate change has received less attention in the different climate change mitigation strategies designed and implemented. To the best of our knowledge, there has not been an empirical study on the impact of gender inequality in the mitigation of climate change. Vital links are assumed to be found between climate change and gender inequality. While climate change can reduce the progress towards gender equality and pose a hitch to the achievement of development, gender inequality can aggravate the effects of climate change.

Hence, it becomes imperative to investigate the connectivity between climate change mitigation and gender inequality towards achieving sustainable development in Sub-Saharan Africa. Thus we may ask: How is gender inequality related to climate change mitigation? Hence, the objective of this study is to determining the impact of closing the gender gap on the mitigation of climate change in Sub-Saharan African. The research will prove valuable for addressing gender gaps in climate change mitigation. It can be argued that if gender equality

initiatives are incorporated into climate change mitigation actions, poverty and inequality will be reduced and sustainable development in Sub-Saharan African can become achievable. Hence, this study is crucial as it is set to fill the gap in the literature on Sub-Saharan Africa by answering the above questions. The study intends to employ a panel data framework where the data was analyzed using the Panel Least Square regression approach.

## **2. LITERATURE REVIEW**

### **2.1 Conceptual Literature**

#### **Conceptualization of Climate, Climate change, and climate change mitigation**

Climate is defined as the average weather or the mean and variability of temperature, precipitation, or wind over a period ranging from months to thousands of years (IPCC, 2018). Climate change is stated as the increasing temperatures and weather patterns, which is resulting in environmental degradation having social and economic impacts. This is usually a result of greenhouse gas emissions which result in the trapping of heat by the earth's atmosphere resulting in global warming (Yue & Gao, 2018). These greenhouse gasses include nitrous oxide (N<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and fluorinated gases among which are perfluorocarbons (PFCs) and sulfur hexafluoride (SF<sub>6</sub>) (UNFCCC, 2008). There are two major channels through which greenhouse gases are generated: the human activated and natural systems. However, human activities have a greater impact on the climate.

The natural systems include forest fires, permafrost, volcanoes, earthquakes, etc while the human factors are majorly energy usage and production activities of man among which are industrial activities, poor agricultural activities, and domestic energy use. Data showed that of the 55.3 GtCO<sub>2</sub>e amount of global greenhouse gas emitted in 2018, CO<sub>2</sub> fossil as a result of energy production and activities of the industries accounted for about 68% while land use and agricultural activities accounted for 6.4% (United Nations Environmental Programme, 2020). Thus, human activities accounted for about 74% of total greenhouse gas. In the analysis and response to climate change two concepts/approaches are obvious; mitigation and adaptation. 'Mitigation' is concerned with withstanding or opposing or trying to put an end to factors that cause climate change. Thus, climate change Mitigations are all efforts to reduce or prevent the emission of greenhouse gases (Lambrou & Piana, 2006). Mitigation measures are actions that are taken to reduce and curb greenhouse gas emissions. These include the use of new technologies and renewable energies, as well as changing human practices and consumption. The aim is to significantly reduce/avoid human interference with the climate system thereby stabilizing the greenhouse gas levels towards ensuring good living climate conditions for food production and sustainable economic development (National Aeronautics and Space Administration (NASA), 2021). Adaptation on the other hand is concerned with building the capacity to react to or withstand the crush of climate change. Its measures are actions that concentrated on reducing the vulnerability of the effects of climate change. Its objective is to reduce human vulnerability to the harmful aftermath of climate change such as sea-level encroachment, extreme weather situations, or food insecurity. It is also concerned with making the most use of what is now available/advantageous opportunities of climate change (for instance, longer growing seasons or increased yields for some regions). Thus, while mitigation is concerned with the causes of climate change, adaptation addresses its impacts.

#### **Concept of gender inequality**

Gender is defined as a socially constructed role, opportunities, and responsibilities that have to do with men and women. It can also be defined as the unseen power structures that govern the relationships between the sexes. According to UNDP (2010), the inequality between the sexes is not a result of biological points but resolved by the learned and inequitable social treatment

(UNDP, 2010). Gender equality is stated in various ways but inclines to five main components: unequal distribution in rights, privileges, values, circumstances, outcome, and agency. Gender equality occurs when there is equity in some key dimensions: accumulation of *endowments*, the use of those endowments to *access economic opportunities* and generate *returns* (*education, health, land, etc*), and their application to take actions, or *agency*, affecting individual and household wellbeing.

### **Gender and climate change**

Before now there has been little focus on gender-climate change mitigation. Nevertheless, since human behaviour and activities are the driving causes of climate change, studies around mitigation must also be gender-sensitive. Climate change/ climate change mitigation actions and gender is concerned with human activities which are predominant in the agricultural sector and the industrial sector. Data showed that the agricultural sector is dominated by women, particularly in rural areas. Women learn to play a greater role in the management of natural resources and nutrition. Women's involvement in agricultural capacity is most common in regions most adversely affected by the impacts of climate change, especially Sub-Saharan Africa and Asia. Hence, the responsibility of mitigating climate highly falls on their shoulders (Canadian International Development Association, 2002). However, required and/or customary laws usually restrict women's property and land rights. This often makes access to credit and agricultural extension services difficult for them. In addition to this, reducing their spur to engage in environmentally sustainable farming practices as well as making long-term land rehabilitation investments. Rodenberg (2009) noted that women have deficiencies in the rights over land for the means of production. They also suffer from technology, information, finances, and training, e.g., in climate mitigation and prevention of disaster. From studies, women and children are 14 times more likely to lose their lives in a natural disaster (Araujo, et al, 2007). Hence, they are highly needed in the reduction of the causes of climate change.

## **2.2 Theoretical Literature**

**Functionalist theory:** Put forward by Talcott Parsons in the 1940s and 1950s, it posits that gender inequality is an act of creating division of labour between genders with the aim of maximization resource. It believes that the women are should take care of the home and the men basic needs of the family (Ewubare & Ogbuagu, 2017). This role of women in taking care of the house, often open them to the use of more of energy than men.

**Feminist theory:** This is an opposite of the functionalist theory and argues against gender inequality. To the feminist theory, gender inequality is a simultaneous actions towards the benefit of the family and the economy irrespective of the genders. This was based on the Intra-household bargaining of husbands and wives model that gender's preferences differ (Prettnner & Strulik, 2017).

## **2.3 Empirical Literature**

There exist a dearth of literature on gender inequality and climate change mitigation. Although some studies were carried out on the adaptability or vulnerability of climate change as it relates to gender. Among the very few studies are the studies carried out by Dankelman (2002) where it was strongly argued that climate change does not only need technology as a solution but also equity in welfare and distribution. Hence in exploring the linkage between environment and gender, a positive and negative relationship was found between gender and climate change .Umar and Ibrahim (2011) assessed the perception level of farmers to climate change. They made use of 63 random farmers in Nasarawa State, Nigeria, and found that the knowledge of climate change is high among the farmers. As a result of this, the farmers tend to moderately practice organic farming although not deliberately mitigate climate change.

In another study, Alexander (2011) examined the understanding of researchers to the vulnerabilities to climate change in Africa particularly women that depends more on the natural environment. The result of the study showed 46 of Africa's nations, women account for at least 40% of agricultural workers. It was also found that there is a strong relationship between climate change and environment-based livelihoods, thereby being related to gender. The determinant of the demand of renewable energy and the intensity of carbon emission in sub-Saharan Africa as a means of mitigation of Co<sub>2</sub> emission was investigated on by Asogwa, Ugwuanyi and Anumudu (2018). They employed the principal component analysis and it was revealed that population density was a major condition for the regeneration of renewable energy.

In a more recent studies, Adzawla, Azumah, Anani, and Donkoh (2019) investigated the gender aspect of climate change adaptation using descriptive statistics on 300 farmers in two districts in Ghana. The outcome showed that climate change has affected the lives of many, particularly females. Remarkable differences were found in the adaptation of males and females. Also, using a survey of 99 participants, seven focus group discussions, and 13 in-depth interviews in a coastal community in Vietnam, Phan, Jou and Lin (2019) investigated the main cause of gender inequality in their ability to adapt to climate change emphasizing on the role of social capital. Climate change was noted to have exacerbated gender inequality. The outcome showed that gender norms are the main reason for division and interactions of men and women in formal and informal networks. They thus recommended that attention be paid to gender issues (reducing gender imbalance) in the formulation of policies on climate change. Agu, Obodochi and Ugwu (2021) analyzed the impact of Co<sub>2</sub> emission, and temperature change as measures of climate change on the productivity and labour supply of farmers in Nigeria. Using OLS method of estimation, temperature change and rainfall positively impacts on the productivity of the agricultural sector in Nigeria. CO<sub>2</sub> emissions was found to have a significant and positive impact on Nigeria's agricultural output. Following Agu et al, (2021) is the analysis of the effect of the consumption of renewable energy in the decarbonization of Nigeria's energy carried out by Onyechi and Ejiofor (2021). The Fully Modified Ordinary Least Squares estimation method was employed and the outcome of the study revealed that trade openness and Co<sub>2</sub> emission from non-renewable energy are positively and significantly related with the consumption of renewable energy consumption. On the other hand, urban population, GDP per capital and oil rent do not have significant impact the consumption of renewable energy.

#### **2.4 Research Gap and Value Addition**

The outcome from previous researches has shown that it is important to eliminate gender inequalities in climate issues. For example, some studies (Haigh & Vallely, 2010) noted that the workload for women increases when the climate becomes bad (unfavourable) and they are more in poverty. This is also attributed to inequality in all areas of life. Hence reducing the gender gap can help increase their empowerment and reduce their vulnerability to climate change. However, the best way to reduce the vulnerability is to reduce/ put an end to its occurrences. Thus, an effort to eliminate gender inequalities requires a specific gender-based policy. Agriculture and greenhouse gasses have been identified to be a major cause of climate change. It has also been established that women are more in these activities.

Therefore, it is crucial to recognize that gender inequality is one of the overriding causes of climate change. It has also been proved that the gainful empowerment of women will reduce their poverty level (Ogbeide-Osaretin, & Uwaifo, 2020), reduce their pressure on the environment, improve social and environmental quality, and thus, mitigating climate change. Lambrou and Pianna, (2006) and Mignaquy, (2020) observed that the inclusion of gender in all demission of climate change policy including taking responsibility to mitigate climate

change need to be made. Despite, these and the relevance of the relationship between gender equality and climate change mitigation a review of the previous literature showed that there is a paucity of empirical research to prove this relationship. Rather, studies on climate change and gender had been on vulnerability. The particular relevance of the need for a study of this in Sub-Saharan African is the high level of poverty and gender gap in the region as well as a high level of pressure on the environment from this region. These gaps in the literature have propelled the necessity of undertaking this research.

### 3. METHODOLOGY

#### 3.1 Econometric Model Specification

This study is based on the functionalist theory. It is model on a panel data framework to enable us to account and isolate the effects of countries specific time-unchanging characteristics specifically the level of development. Wooldridge (2002) also showed the relevance of using panel data to solve the problem of omitted variable. The conventional form of panel data framework is given as:

$$y_{it} = \alpha_{it} + \beta_i X_{it} + \mu_{it} \quad (1)$$

$$\mu_{it} = \mu_i + \nu_t + \varepsilon_{i,t} \quad (2)$$

with  $y_{it}$  as response variable, while  $\alpha_{it}$ ,  $\beta_i$  and  $X_{it}$  are k-vectors of regressors that are not constant and parameters for  $i = 1, 2, \dots, n$  cross-sectional constituents (countries);  $t = 1, 2 \dots T$  is time series part;  $\mu_{it}$  is the accustomed disturbance, with  $\mu_i$ , the country's, unobservable weight,  $\nu_t$ , is a time specific factor and  $\varepsilon_{i,t}$  an idiosyncratic disturbance.

This study builds on the inequality--- development model imitated by Ahluwalia (1976) and modified by Anand and Kanbur (1992) by dropping the log-quadratic equation of Ahluwalia (1976).

However, since the concern of this study is on gender inequality and climate change, we modified the framework by using some measures of Gender inequality. The model of the impact of gender inequality (assuming a linearity of inequality) on climate change for this study is given below as:

$$CH_{it} = \beta_0 + \beta_1 GI_{i,t} + \varepsilon_{i,t} \dots \dots \dots (3)$$

Where CH is a measure of climate change and for this study, agriculture nitrous oxide emission as a % of total emission (AN2O) and CO2 emissions from gaseous fuel consumption as a % of total (CO2FE) were used. This is to determine which of these sources of climate is influenced more by gender inequality. GI is measures of gender inequality and increase in the inequalities are expected to increase climate change. As has been identified by literature, some determinants of inequality are government expenditure and human capital development (Ngepah, 2016). Hence, for the sake of gender inequality, female tertiary enrollment was introduced. Increase in female educational level is anticipated to ease gender inequality as it will increase their opportunity for employment in skilled and high paid jobs and tertiary education provides opportunity for technological advancement. Government expenditure is envisaged to reduce inequality especially if aimed at redistributing income to enhance the welfare of the group, here, female. This is expected to be negatively related with climate change which is in line with literature (Li & Zou, 2002).

Putting in all these variables into the models, our comprehensive model for the study from equation is given as:

$$AN2O_{it} = \beta_0 + \beta_1 ASEM R_{i,t} + \beta_2 FTGEN_{i,t} + \beta_3 SLPR_{i,t} + \beta_4 GNE_{i,t} + \beta_5 FAH_{i,t} + \beta_6 INF_{i,t} + \varepsilon_{i,t} \dots \dots \dots (4)$$

$$CO2FE_{it} = \beta_0 + \beta_1 ASEM R_{i,t} + \beta_2 FTGEN_{i,t} + \beta_3 SLPR_{i,t} + \beta_4 GNE_{i,t} + \beta_5 FAH_{i,t} + \beta_6 INF_{i,t} + \varepsilon_{i,t} \dots \dots \dots (5)$$

Where

AN2O is agriculture nitrous oxide emission as a % of total emission

CO2FE is CO2 emissions from gaseous fuel consumption as a % of total

ASEMR is Agricultural female to male employment ratio

FTGEN is female tertiary enrolment rate

SLPR is female to male labour participation ratio

GNE is government national expenditure % of GDP

The model is estimated using the panel least square method of estimation.

### 3.2 Data

The data for the study was obtained from the World Bank (World Development Indicators), (2020) for 13 countries in Sub-Saharan Africa (Ethiopia, Kenya, Rwanda, Tanzania, (East Africa), Angola, Botswana, Congo DR, Lesotho, South Africa (Southern Africa), Cote d'Ivoire, Ghana, Liberia, and Nigeria (West Africa). These countries were selected only based on data availability as well as ensuring complete coverage of Sub-Saharan Africa for this study. The study is for the period 2008 -2020 which is a long enough time period.

## 4. EMPIRICAL EXAMINATION

### 4.1 Correlation Analysis

**Table 1: Correlation matrix**

	AN2O	CO2FE	ASEMR	FTGEN	SLPR	GNE
AN2O	1.000000					
CO2FE	0.548705	1.000000				
ASEMR	-0.209256	0.431489	1.000000			
FTGEN	-0.505357	-0.202950	0.134166	1.000000		
SLPR	-0.323233	0.300273	0.920931	0.187031	1.000000	
GNE	-0.592921	-0.359050	0.463160	0.378274	0.515404	1.000000

The determination of the degree of the multi-collinearity among the variables of the model presiding the regression analysis is carried out using the Pearson correlation coefficients and the result is presented in Table 4.1. No multicollinearity was found among the variables from the outcome of the result. Agricultural sex employment ratio (ASEMR), female tertiary enrolment (FTGEN), female to male labour participation ratio (SLPR), and government national expenditure % of GDP (GNE) had a negative correlation with agriculture nitrous oxide emission as a % of total emission (AN2O). However, examining the correlation between the dependent variables and CO2 emissions from gaseous fuel consumption as a % of the total (CO2FE), the result showed that ASEMR and SLPR were found to be positively correlated with CO2FE while FTGEN and GNE were found to be negatively correlated with CO2FE. This suggested that gender negatively correlates with agents of climate change.

Although there is a high correlation coefficient between Agricultural sex employment ratio (ASEMR) and female to male labour participation ratio (SLPR), this however calls for concern. But given the importance of the two variables in the model (measures of gender inequality) we could not remove them from the model. However, it is also important to note that one of the remedies to multicollinearity according to Gujarati (2003) is to do nothing, particularly when there is no redundant variable in the model. Hence, the model was estimated. These were contrary to our a priori expectations. Nevertheless, a simple bivariate correlation has failed to capture the impact of some other variables in the relations of the variables of interest. Hence, there is the need for a multivariate analysis from where the policy recommendation for this study was drawn.

**Table 2 Estimation of gender inequality variables and agents of climate change**

	Estimation using AN2O as Dependent Variable	Estimation using CO2FE as Dependent Variable
Explanatory variables	Coefficient/Probability	Coefficient/Probability
ASEMR	28.46290* (0.0000)	9.450845* (0.0000)
FTGEN	-5.548773* (0.0000)	-0.100335 (0.2589)
SLPR	-44.09134* (0.0000)	-3.581673* (0.0021)
GNE	-0.394402* (0.0000)	-0.094704* (0.0000)
C	83.61972* (0.0000)	4.375561* (0.0000)
	R <sup>2</sup> =0.6776 Adj R <sup>2</sup> =0.4735 F(sat)= 117.68 F(pro)=0.000 DW=1.964	R <sup>2</sup> =0.7929 Adj R <sup>2</sup> =0.5897 F(sat)= 187.55 F(pro)=0.000 DW=1.9784

\*Indicates significant at 5% level of significance

Source: Author's computation

## 4.2 Estimation and interpretation of Result

### Interpretation of result

As shown in Table 2 (appendix), the fitness of the model was scrutinized and was found well fitted. R<sup>2</sup> of 0.6776 indicated that 67% of the variation in the dependent variable was explained by the explanatory variables. The DW statistics was 1.964. This confirms the absence of autocorrelation. Looking into the relationship and impact of the independent variables, Table 2 revealed that for the model with agriculture nitrous oxide emission as a % of total emission (AN2O) as a measure of climate change, Agricultural female to male employment ratio (ASEMR), is positively and substantially related with climate change which is in line with expectation. On the other hand, female tertiary enrolment (FTGEN), female to male labour participation ratio (SLPR), and government national expenditure % of GDP (GNE) had a negative significant impact on climate change which are all in line with theoretical and our expectation. The substantial impact of FTGEE signifies the need of improving the tertiary education of the female gender because that will give them more opportunity to be gainfully employed in higher paid jobs, earn more, reduce poverty level and dependence on natural resources thereby reducing climate change.

Specifically, the result showed that a 1% increase in the Agricultural female to male employment ratio will lead to a 28% increase in the emission of agriculture nitrous oxide emission as a % of total emission and climate change. On the other hand, 1% increase in female tertiary enrolment, 1% increase in female to male labour participation rate in internet banking, and 1% rise in government national expenditure % of GDP will bring about a 5.5%, 44%, and 0.4% surge in climate change of which they all have a substantial impact on climate change.

Examining the connectivity between gender inequality and climate change through the emission of CO2FE as a Dependent Variable, Table 2 showed that the result is similar to that of AN2O although the magnitude of the variables differs. The result also showed that

Agricultural female to male employment ratio (ASEMR), was found to be positively related to CO2FE with significant impact. On the other hand, female to male labour participation ratio (SLPR) and government national expenditure % of GDP (GNE) had negatively and substantially impact on CO2 emissions from gaseous fuel consumption as a % of total emission

(CO<sub>2</sub>FE) measure of climate change while FTGEN was found to be positively related to CO<sub>2</sub>FE without a significant impact.

On the magnitudes, the result showed that a 1% increase in ASEMR and FTGEN leads to a 9% and 0.1% increase respectively in the emission of CO<sub>2</sub>FE and climate change. While 1% increase in SLPR and GNE leads to a 3% and 0.1% fall respectively in CO<sub>2</sub>FE.

## **5. POLICY DEDUCTION OF EMPIRICAL DISCOVERY AND CONCLUSION**

### **5.1 Implication of the discoveries and policy supposition.**

i) The study exhibited a positive and substantial impact of the ratio of female to male employment in the agricultural sector on the climate change measures particularly on the agriculture nitrous oxide emission as a % of total emission measure of climate change. Given that emissions from the agricultural sector are a major contributor to climate change (United Nations Environmental Programme (2020), the implication of this is that the gender inequality that has made females be more in the agricultural sector with no resources for green practices has been a contributing factor to the ever-increasing climate change. Hence, this study recommends that for effective climate change mitigation, the reduction of gap in Agricultural female to male employment ratio (ASEMR) is highly recommended by increasing the proportion of females in nonagricultural employment. Also, increasing the income level of females so that even if they are in the agricultural sector, proper practices can be carried out as they have access to resources (land, credit, etc) needed for clean agricultural practices. More so, the proportion of women in the agricultural sector will also be reduced with the reduction in the gender gap of formal employment thereby reducing the pressure on the natural resources as their income level has increased.

ii) The result of the impact of ASEMR on the mitigation of climate change was strengthened by the outcome of female to male labour participation ratio which had a negative and significant impact on the climate change mitigation. This result implies that as the ratio increases (more females in the labour force) the rate of emission of both agricultural and carbon oxide into the climate causing climate change reduces. Therefore, climate change can be effectively mitigated by increasing the share of females in employment. This study, therefore, recommends the increase in the share of females in labour force for effective mitigation of climate change. The outcome of this study is in line with Ogbeide-Osaretin and Uwaifo (2020) who found that gender inequality reduction is a vital tool for the achievement of sustainable development.

iii) Education has always been recommended as a key for development. This is also expressed here. The result of the study showed that climate change mitigation can be achieved with an increase in female education in tertiary levels of education. This is shown by the negative and significant impact of FTGEN on AN<sub>2</sub>O and CO<sub>2</sub>FE which were the measures of climate change. Thus, increasing the level of education of females will help them acquire the knowledge of clean practices which will reduce the amount of emission of gaseous waste into the climate. At this time, it will increase their income level and as such reducing their pressure on natural resources. The study consequently advocates for the encouragement of female higher degrees in education to narrow the gap in education and advance technological literacy. With higher education, they can be engaged in higher paid jobs, which will mean a higher level of income and as such reducing dependency on natural resources thereby mitigating climate change.

iv) The results further showed that government expenditure significantly reduces climate change given its negative relationship with AN<sub>2</sub>O and CO<sub>2</sub>FE. As such, a continued increase

in government expenditure is particularly recommended especially in the development of human capital (education).

## 5.2 Conclusion

Climate change still poses a threat to the effective achievement of the global Sustainable Development Goals. While various policies have been put in place to combat this challenge, the role of closing the gender gap as a measure of mitigating climate change has not been given the required attention. Hence, this study dived into assessing the effectiveness of the reduction of gender inequality in the mitigation of climate change.

The upshot of this study showed that closing the gender gap is an important tool that can help in the mitigation of climate change. Various channels by which this can be achieved as found from the result of this study are in the reduction of the proportion of females in the agricultural sector or increase their income level as well as the availability of resources (land, credit, machines) needed for clean agricultural practices. Also, an increase in the share of females in labour force, as well as an increase in higher levels of education for females (tertiary education), are important channels by which the gender inequality gap can be closed and climate change mitigated.

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# FINANCIAL DEVELOPMENT, PUBLIC HEALTH EXPENDITURE AND HEALTH OUTCOMES: EVIDENCE FROM NIGERIA

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## ABSTRACT

This study examined the link among financial development, public health expenditure and health outcomes in Nigeria between 1981 and 2020. Annual time series data was extracted from the Central Bank of Nigeria (CBN) statistical bulletin and the World Development Index (WDI), and the data was analysed using the Autoregressive Distributed Lag Model (ARDL) with Bounds Testing. The result showed that government expenditure on health worsens health outcome (life expectancy) in the short run while it improves life expectancy in the long run. Also, the result showed that the effect of financial development on health outcome is sensitive to the financial development indicator employed while inflation negatively and significantly influenced health outcomes in Nigeria. The study recommends increased spending on the health sector by the government and a stable financial sector, in order to significantly drive the desired level of health outcome in Nigeria.

**Keywords:** Financial Development, Health Expenditure, Health Outcome, Autoregressive Distributed Lag, Bounds Test Cointegration.

**JEL Classification Code:** C22, E44, H51, I15

## 1. INTRODUCTION

The role of finance in the growth process of any economy cannot be trivialized, both in developed and developing countries. This view was particularly championed by the early theoretical works of Schumpeter (1911), McKinnon (1973) and Shaw (1973) in what they referred to as the finance-led growth theory, where they pointed out that financial sector performance drives overall macroeconomic performance. This comes in the form of capital accumulation, increased access to financial services, risk diversification, corporate governance control, savings mobilization and better resource allocation in the economy (see Bhatta, 2013; Chireshe & Ocran, 2020).

Economists over time, especially the advocates of the endogenous growth model have pointed out that the government should focus on the development of human capital (health and education) in developing countries in order to drive overall macroeconomic performance (see Kur, Ogbonna & Eze, 2020). This is because investment in human capital, especially the health of the citizens increases their productivity and the productive capacity of the economy, and this necessitates the need for the government to increase its expenditure on health in the economy. Empirical evidences have shown that countries that invest extensively in human capital tend to achieve rapid economic growth and development as well as an improvement in the health outcome of their citizens. (see Kim & Lane, 2013; Edeme, Emecheta & Omeje, 2017; Ogunjimi, 2019; Adesina and Akintunde, 2020).

The foregoing suggests that one pertinent indicator of macroeconomic performance in any economy is the health sector. Economists have argued that a large chunk of a nation's resources

should be channeled to the health sector in order to increase the health outcomes of its citizens (see Arthur & Oaikhenan, 2017; Akintunde, Oladipo & Oyaromade, 2019). However, the health sector of developing countries especially in Africa and particularly Nigeria (in this case) is still largely hindered by scarcity, cost and access to adequate financing, thereby hindering the efficiency of the health sector. For instance, the World Health Organization (WHO) in 2014 and recently in 2019 pointed out that most African countries still operate below the regional average of about US\$100 in terms of their health care expenditure per capita (see Alam & Mahal, 2014; Asongu & Nwachukwu, 2015; Arthur & Oaikhenan, 2017; Chireshe & Ocran, 2020). Furthermore, the total spending on the health sector as a percentage of GDP is still generally quite low when compared with that of developed countries (UNECA, 2019).

Furthermore, some authors in the empirical literature have argued that the financial sector of an economy plays a vital role in determining the health outcome of the citizens (see Hakeem and Oluitan, 2012; Akintunde, Oladipo & Oyaromade, 2019). They pointed out that the link between financial development and health outcomes is theoretically hinged on health expenditure in the empirical literature (see Bhatta, 2013; Nwachukwu & Besong, 2015; and Chireshe & Ocran, 2020). The reason for this stems from the fact that financial development raises the flow of funds to all sectors of the economy, including the health sector in the form of health expenditure. The implication of this is that an increase in health expenditure increases the health outcomes of the citizens and vice versa. For instance, in Nigeria, less than 5% of the Nigerian fiscal budget is allocated to the health sector in the last five years (National Bureau of Statistics, 2021), thereby giving credence to the poor level of health outcomes in Nigeria. This is also evident in the report of WHO in 2018 that stated that infants and children under five had a high mortality rate of about 70 and 104 deaths respectively per 1000 live births in Nigeria (WHO, 2018).

The foregoing thus creates the need to examine the relationship between financial development and health outcomes in Nigeria, while also considering the effect of financial development on health expenditure in Nigeria. Our motivation is driven by the need to help policymakers in the health sector and its financing, on how to improve the efficiency of the health sector and health outcomes in Nigeria, in the face of high disease burden in recent times such as Covid-19, Lassa and yellow fever etc., low health care expenditure and high out-of-pocket health care expenditures by the citizens (see Basong, 2016; and Oluwaseun, 2020)

This study is a departure from previous studies in the following ways: first, we examine the link between financial development and health outcomes in Nigeria, by incorporating the role of government expenditure on health in Nigeria. Secondly, we adopt different dimensions and indicators of financial development for robustness such as financial depth (ratio of broad money supply and private sector credit to GDP), capital market development indicator (ratio of stock market capitalization to GDP) as well as financial openness which will be measured by the Chinn-Ito index), unlike previous studies that adopted only a single measure of financial development. Furthermore, we adopt life expectancy as our proxy for health outcome.

The rest of the paper is structured as follows: section two contains the literature review, section three presents the methodology, section four presents the discussion of findings while section five presents the conclusion.

## **2 LITERATURE REVIEW**

### **2.1 THEORETICAL LITERATURE REVIEW**

On the issue of health in the empirical literature, extant studies mostly adopted public expenditure and growth theories as the theoretical basis, due to the fact that health expenditure

and health outcome are expected to drive overall macroeconomic performance positively. Some of such theories are reviewed as follows:

### **2.1.1 Wagner's Law of Public Expenditure**

Wagner's Law argued that economic growth is a function of increased industrialization and economic development. Wagner stated that during the industrialization process, as the real income per capita of a nation increases, the share of public expenditure in total expenditures increases. Particularly, for economic growth to be achieved, governments need to provide services like education, public health, old age pension or retirement insurance, food subsidy, natural disaster aid, environmental protection programs and other welfare functions

### **2.1.2 ENDOGENOUS GROWTH THEORY**

The theory argued that economic growth can primarily be achieved endogenously using internal forces within the economy, rather than external influences or forces. It pointed out that improvement in productivity and overall economic performance can be driven by faster innovation and technological improvement, increased investment in human capital (health and education), government activities and private sector institutions. The theory comes in different versions ranging from the one championed by Arrow (popularly known as the AK model) which is used to explain economic changes driven by innovation and technology.

Other versions include the Uzawa-Lucas version of the endogenous growth theory and another version championed by Romer. The endogenous growth theory will serve as the theoretical basis or framework for this paper.

## **2.2 EMPIRICAL LITERATURE**

In the literature, while many studies have investigated on the nexus between health expenditure and health outcomes, not so many studies have looked at the relationship among financial development, health expenditure and health outcomes especially in Nigeria. Some studies examined the link between financial development and health outcomes in developed and developing countries, for instance": Claessens & Feijen (2007) examined the effect of financial development on some Millennium Development Goals, which included health outcomes in developing countries from 1980 to 2007. The study adopted the Ordinary Least Square Regression and instrumental variable approach. Findings revealed that financial development improves education, gender equality and health by increasing the availability of private credit, money and deposits in the economy. Similarly, Hakeem and Oluitan (2012) in South Africa investigated the link between financial development and human capital indicators (health and education) using time series data from 1965 to 2005. The study showed a significant but weak relationship between financial development and human capital indicators. However, the relationship between financial development and life expectancy at birth, and secondary school enrolment was statistically significant.

In the same vein, Chireshe & Ocran (2020) examined financial development and healthcare expenditure in 46 Sub Saharan African countries using data between 1995 and 2014. Using the Hausmann test as well as the fixed and random effect model, the study found out that financial development improves healthcare expenditure in SSA countries during the period of study. Also, Akintunde, Adagunodo, Aderajo & Akanbi (2021) examined the effect of population and financial development on environmental health in Nigeria between 1980 and 2019. The study

adopted the Autoregressive Distributed Lag model (ARDL) and they found out that population and financial development positively and significantly drives environmental quality in Nigeria, both in the short and long run. However, by adopting micro and macro data, Chireshe & Ocran (2020) examined the financial development-health outcome connection using broad money supply to GDP ratio as a proxy for financial sector development in selected countries and found

a negative connection between financial development and infant and child mortality in these countries.

In 2016, Basong adopted the Vector Error Correction Model (VECM) methodology for 29 SSA countries between 1990 and 2010, and examined the nexus between financial development and human development index (which serves as a proxy for health outcomes). The study found a significant inverse relationship between human development index and financial development both in the short and long run, during the period of study. Furthermore, some studies explored the nexus between health expenditure and health outcomes in developed and developing countries. For instance: Olakojo and Nonvignon (2012), adopted random and fixed effects modelling to analyse the link between total healthcare expenditure and health outcomes from 1995 to 2010 for 44 countries in SSA. The findings revealed that total health care expenditure (public or private) significantly reduces the number of deaths per 1000 people and the infant mortality rate per 1000 live births in Sub Saharan African countries.

Similarly, in a study of 17 OECD countries, Kim and Lane (2013) examined the effect of health care expenditure and health outcomes using panel data between 1973 and 2010. The cross-country panel data is analysed using a mixed-effect model with infant mortality rate and life expectancy at birth as endogenous variables. An inverse relationship between government health care expenditure and infant mortality rate and a positive relationship between government health care expenditure and life expectancy at birth was found. In the same vein, Ogunjimi (2019) examined health expenditure, health outcomes and economic growth in Nigeria between 1981 and 2017. Using Toda Yamamoto and the Autoregressive Distributed Lag Model. The results showed a unidirectional causality running from health expenditure to infant mortality and no evidence of causality between real GDP and infant mortality. Also, the study found a unidirectional causal relationship running from health expenditure and real GDP to life expectancy and maternal mortality in Nigeria.

Furthermore, Oluwaseun (2020) investigated public health expenditure and infant mortality rate in Nigeria between 1991 and 2018. The study adopted the Fully Modified Ordinary Least Square (FMOLS) and the result showed that public health expenditure positively influenced infant mortality rate, but negatively influenced female literacy rate in Nigeria, during the period of study. However, Edeme, Emecheta & Omeje (2017) examined the effect of public health expenditure on health outcomes in Nigeria, as captured by life expectancy at birth and infant mortality rates. The result showed that public health expenditure and health outcomes have long-run equilibrium relationship. Furthermore, the results showed that an increase in public health expenditure improves life expectancy and reduces infant mortality rates. In line with the above, Akintunde *et. al.* (2019) also investigated the socioeconomic determinants of health status in Nigeria between 1980 and 2014. The study adopted the Vector Error Correction Mechanism and the result showed that carbon dioxide emission, gross capital formation, health expenditure and unemployment rate worsened the health status (life expectancy) of Nigerians during the period of study.

Another strand of researchers examined the relationship between health indices and macroeconomic performance in Nigeria. For instance, Kur *et. al.* (2020) examined the nexus between health expenditure and economic growth, while also considering the role of institutional quality in Nigeria between 1984 and 2019. The study adopted the Autoregressive Distributed Lag (ARDL) model and found out that health expenditure and institutional quality negatively influenced economic growth in Nigeria, though only institutional quality was statistically significant. Similarly, Adesina & Akintunde (2020) investigated the effect of health shocks on poverty level in Nigeria between 1981 and 2017. The study adopted the Vector Error Correction Model (VECM) and found out that increased Out of Pocket spending on health and death rate significantly worsens poverty level in Nigeria.

In the same vein, Ayoola, Jimoh & David (2012) tested the cointegration relationship between healthcare expenditure and economic growth in Nigeria between 1981 and 2010. By adopting a multivariate cointegration model, the study found evidence of long run relationship between healthcare expenditure and economic growth during the period of study. In a similar study, Udeorah & Onachukwu (2019) explored the relationship between healthcare expenditure and economic growth in Nigeria using time series data between 1990 and 2018. The study found that health care expenditure statistically influenced economic growth during the period of study.

Thus, the review above revealed that different countries and regions have adopted different methodologies and data to examine the relationship between financial development and health expenditure or health expenditure and health outcomes. However, this study comes in with the innovation of examining the influence of financial development on government health expenditure and health outcomes in Nigeria.

### 3 METHODOLOGY

#### 3.1 THEORETICAL FRAMEWORK

The theoretical framework for this study as stated earlier on is the Endogenous growth theory. This is because the theory is premised on the fact that an economy can grow over time endogenously by using its internal forces and resources, such as investing in its human capital, government activities and private sector participation. The private sector participation is mostly felt in the financial sector, and human capital includes education and health in the economy, and this paper focuses on the health sector. Specifically, we shall adopt the AK model in its Cobb Douglas form because it is flexible and modifiable to examine the link between financial development, public health expenditure and health outcome in Nigeria.

The general form of the model is specified as:

$$Y = AK^\alpha L^\beta \quad (1)$$

Where Y is output, A is technology, K is capital, L is labour and  $\alpha$  and  $\beta$  are the elasticity coefficients.

#### 3.2 MODEL SPECIFICATION

This paper modified the model above in line with the study of Kur *et. al.* (2020) such that we take capital and labour as exogenous, and introduced financial development, health expenditure and inflation as explanatory variables. We also replaced output with health outcome since it is the output of the health sector. Thus, equation 1 can be re-specified as:

$$HOUT = FD^\alpha HEXP^\beta \quad (2)$$

The assumption here is that technology augments the financial and health sectors of the economy. By log-linearizing equation 2 above and introducing the stochastic term, we have

$$HOUT = \alpha \ln FD + \beta \ln HEXP + e_t \quad (3)$$

By re-writing equation 3 explicitly in an econometric form, we have

$$HOUT = \beta_0 + \beta_1 FD + \beta_2 HEXP + \beta_3 INFL + e_t \quad (4)$$

Where HOUT is health outcomes proxied by life expectancy. HEXP is government expenditure on health, FD is financial development proxied by financial depth (the ratio of broad money supply and private sector credit to GDP, capital market development indicator

(ratio of stock market capitalization to GDP) and financial openness which is measured by the Chinn-Ito index. Data on these variables were sourced from the Central Bank of Nigeria (CBN) statistical bulletin and the World Development Indicators (WDI) for the period between 1981 and 2020.

To investigate the relationship between the dependent and explanatory variables, the unit root test as well as the Autoregressive Distributed Lag Model with Bounds test is adopted. This is because the model is suitable for variables with different order of integration (I1 & I0) and the short run and long run relationships are presented within this framework.

The ARDL specification for equations 2 and 3 are presented as follows:

$$\Delta LEXP_t = \alpha_0 + \sum_{i=1}^p \mu_i \Delta LEXP_{t-i} + \sum_{i=1}^p \beta_i \Delta FD_{t-i} + \sum_{i=1}^p \pi_i \Delta INFL_{t-i} + \Psi_1 LEXP_{t-1} + \Psi_2 FD_{t-1} + \Psi_3 INFL_{t-1} + e_t \quad (5)$$

Where  $\Delta$  is the difference operator,  $\alpha$  is the drift component,  $e_t$  is white noise,  $\gamma$  are the long run multipliers. The estimation of the ARDL equations above will be preceded by the unit root test, in line with standard practice in the estimation of time series modelling. Also, appropriate diagnostics test will be included to establish the reliability of the estimated models.

## 4 RESULTS AND DISCUSSION OF FINDINGS

### 4.1 Descriptive Statistics

We present our descriptive statistics in table 1. The descriptive analysis of the data revealed that the mean and median values of all the observed variables fell between their maximum and minimum values, indicating a good level of consistency. Also, all the observed variables were nearly symmetrical since their mean and median values are not too far from each other. In terms of volatility, government expenditure on health is the most volatile, followed by private sector credit to GDP ratio, while market capitalization to GDP ratio is the least volatile in the series. Furthermore, all the variables are positively skewed except for financial liberalization during the period of study. Finally, the Jargue-Berra statistics for all the variables fell below 10% (except for RGDP), indicating that the series is normally distributed and random in nature. Furthermore, it is expedient that we know the time series properties of both the dependent and explanatory variables, hence the unit root test was conducted.

**Table 1: Descriptive Statistics**

	LEXP	HEXP	M2_GDP	CPS_GDP	MKT_GDP	LNRGDP	FINLIBOPENNESS
Mean	48.43900	80.98573	15.23321	11.29330	0.105585	10.38826	-1.061772
Median	46.38850	20.58052	12.64095	8.089291	0.021584	10.17245	-0.851744
Maximum	54.88500	388.3671	24.89526	22.75484	0.545046	11.18573	-0.650852
Minimum	45.63700	0.041315	8.464230	5.806165	0.000253	9.693476	-1.923948
Std. Dev.	3.156845	112.0602	5.284174	5.477719	0.137549	0.525254	0.497257
Skewness	0.826316	1.330176	0.614716	0.766911	1.217993	0.313149	-0.869636
Kurtosis	2.113740	3.613201	1.731911	1.849357	3.779621	1.541791	2.179291
Jarque-Bera	5.861085	12.42249	5.199253	6.127652	10.90306	4.197702	6.164384
Probability	0.053368	0.002007	0.074301	0.046709	0.004290	0.122597	0.045859
Sum	1937.560	3239.429	609.3285	451.7318	4.223388	415.5303	-42.47089
Sum Sq. Dev.	388.6611	489741.8	1088.977	1170.211	0.737875	10.75979	9.643299
Observations	40	40	40	40	40	40	40

Source: Author's Computation, 2022

## 4.2 Unit Root Test

For the Unit root test, we adopt both the Augmented Dickey Fuller (ADF) unit root test and the Phillip-Peron tests to ascertain the stationary of the variables. The result as shown in table 2 revealed that all the variables are stationary at their first difference, thereby giving credence to the appropriateness of the Autoregressive Distributed Lag Model (ARDL) adopted in this study.

**Table 2: Unit Root Test**

Variable	Test	Level	First Diff	P-value	Decision
LEXP	ADF	-0.726419	-4.76258	0.0082**	I1
	PP	-0.758837	-4.76276	0.0000**	I1
HEXP	ADF	3.207223	-6.57638	0.0001**	I1
	PP	2.702241	-7.17638	0.0033**	I1
m2/GDP	ADF	0.832544	-5.61847	0.0000**	I1
	PP	-0.430924	-5.95116	0.0000**	I1
cps/gdp	ADF	-1.037334	-5.76448	0.0000**	I1
	PP	-0.914691	-6.58222	0.0000**	I1
mktcap/gdp	ADF	1.281515	-4.79655	0.0000**	I1
	PP	2.650602	-4.80084	0.0000**	I1
finlib/open	ADF	-1.567444	-5.51014	0.0000**	I1
	PP	-2.844571	-5.45671	0.0000**	I1
Infl	ADF	-2.974740	-5.746742	0.0000**	I1
	PP	-2.844571	-10.10707	0.0000**	I1

Source: Author's Computation, 2022

### 4.3 Cointegration Test

We went further to examine the bounds test cointegration analysis to verify the existence of long run relationship among the variables, as expected in the practice of time series modelling. The result of the Bounds test by Pesaran (2001) is presented in table 3, and it revealed that the F-statistics value has a value of 4.168621, which is higher than the 5% critical value bounds of the Pesaran (2001) table. This indicates that there is long run relationship among the variables.

**Table 3: Bounds Test Cointegration**

ARDL Bounds Test		
Included observations: 36		
Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	K
F-statistic	4.168621	4
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.50%	3.25	4.49
1%	3.74	5.06

**Source: Author's Computation, 2022**

### 4.4 Auto Regressive Distributed Lag Model

In order to achieve the main objective of this study which is to examine the effect of government expenditure on health (HEXP), financial development indicators and inflation (as a control variable) on health outcomes (proxied by Life Expectancy) in Nigeria. As presented in table 4, the ARDL result revealed that government expenditure on health (in the short run) in its first and second lag had a negative and significant effect on health outcomes in Nigeria, but in the long run, government expenditure on health had a positive and significant effect on health outcomes in Nigeria. This implies that life expectancy (health outcomes) improved in the long run with increased expenditure on health. The reason for the significant negative short run result may be a pointer to the fact that investment on health is a long term mechanism, which may not necessarily yield the desired result in the short run. It could also imply that the government spending on health is mostly recurrent and not capital in nature, and that people mostly spend out of their pockets on health services in the short run. However, in the long run, government spending would have been adequate enough to improve health outcomes in Nigeria. The findings of this study are in tandem with the study of Oluwaseun (2020) and Olakojo and Nonvignon (2012) but runs contrary to the findings of Edeme *et. al.* (2013) and Akintunde *et. al.* (2019).

In the case of financial development indicators, we found out that financial depth, measured by the ratios of broad money supply and private sector credit to GDP (while other measures of financial development were excluded in the model), insignificantly influenced health outcomes in Nigeria both in the short and long run. Specifically, the effect of broad money supply to GDP ratio on health outcome was positive while private sector credit to GDP ratio had a negative effect on health outcomes in Nigeria. This could be as a result of the fact that banks rarely prioritize health investment as they prefer to channel funds to productive business activities or infrastructures and education in their corporate social responsibility acts. In the case of financial openness (measured by the Chinn-Ito index) and capital market development

indicator (measured by market capitalization to GDP ratio), we found that they both had a positive and significant effect on health outcomes in Nigeria in the short run. However, the effect of market capitalization to GDP ratio became significantly negative in the long run.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXP(-1))	0.749096	0.408249	1.834899	0.0914*
D(LEXP(-2))	1.541458	1.320334	1.167476	0.2657
D(LEXP(-3))	-0.97182	0.953437	-1.01928	0.3282
D(HEXP)	-0.00001	0.00034	-0.02989	0.9766
D(HEXP(-1))	-0.00112	0.000357	-3.14622	0.0084**
D(HEXP(-2))	-0.00155	0.000368	-4.21036	0.0012**
D(M2_GDP)	0.006398	0.007037	0.909171	0.3812
D(M2_GDP(-1))	0.009265	0.00546	1.696859	0.1155
D(M2_GDP(-2))	0.003478	0.005974	0.582144	0.5712
D(M2_GDP(-3))	-0.00944	0.008052	-1.17257	0.2637
D(CPS_GDP)	-0.00125	0.006551	-0.19032	0.8522
D(CPS_GDP(-1))	-0.0049	0.006868	-0.71277	0.4896
D(CPS_GDP(-2))	-0.01384	0.006027	-2.29636	0.0405**
D(CPS_GDP(-3))	0.01262	0.008812	1.432152	0.1776
D(MKT_GDP)	-0.23606	0.122598	-1.92545	0.0782*
D(MKT_GDP(-1))	0.48108	0.150158	3.203821	0.0076**
D(MKT_GDP(-2))	0.438253	0.200964	2.180754	0.0498**
D(FINLIBOPENNESS)	0.03439	0.015192	2.263695	0.0429**
D(FINLIBOPENNESS(-1))	-0.02261	0.018471	-1.22414	0.2444
D(FINLIBOPENNESS(-2))	-0.05331	0.018957	-2.81229	0.0157**
D(FINLIBOPENNESS(-3))	-0.03271	0.02099	-1.55849	0.1451
D(INFL)	-6.96017	2.602232	-2.67469	0.013**
CointEq(-1)	-0.14404	0.03708	-3.88467	0.0022**
HEXP	0.027553	0.003973	6.935657	0.0000**
M2_GDP	-0.01382	0.116745	-0.11841	0.9077
CPS_GDP	0.117182	0.161115	0.727318	0.481
MKT_GDP	-13.922	6.591346	-2.11216	0.0463**
FINLIBOPENNESS	1.956228	0.555284	3.52293	0.0042**
INFL	-21.4607	7.14218	-3.00478	0.006**
C	53.84292	14.67887	3.668057	0.0032**

**Table 4: ARDL Result (Dependent Variable LEXP)**  
**Source: Author's Computation, 2022**

This finding supports the views of Hakeem & Oluitan (2012), Basong (2016) and Chireshe & Ocran (2020) but runs contrary to the result of Claessens & Feijen (2007).

Also, it was revealed that inflation (which is a control variable) negatively and significantly influenced health outcomes in Nigeria, both in the short and long run. The implication of this is that inflation worsens the value of money, which in turn increases the cost of health services to citizens since they are required to pay more, which in turn worsens health outcomes in the economy. As regards the error correction term which depicts the speed of adjustment towards long run equilibrium, it is observed that about 14.4 % of the errors committed in the short run is accounted for in the long run.

#### 4.5 Diagnostics Test

According to the Breusch-Godfrey test for serial correlation presented in table 5, the Obs\*R-squared has a value 1.894001, while its corresponding p-value has a value of 0.3879. Since the probability value is greater than 5%, we accept the null hypothesis that there is no evidence of serial correlation in the model.

Also, to test for the presence of homoscedasticity in the model, the study chooses the Arch Test. In the Arch test, the Observed R-squared value is checked with its corresponding probability value. The null hypothesis here is that the model is homoscedastic, while the alternative hypothesis here is that the model is heteroskedastic. We reject the null hypothesis if this probability value is less than 5%. From Table 6, since the probability value of 0.6236 is greater than 0.05, at the 5% significance level, we accept the null hypothesis of homoscedasticity and reject the alternative hypothesis of presence of heteroscedasticity. Hence, the model is homoscedastic and this means the model has goodness of fit and the results are desirable.

**Table 5: Breusch-Godfrey Serial Correlation LM Test:**

F-statistic	0.277664	Prob. F(2,10)	0.7632
Obs*R-squared	1.894001	Prob. Chi-Square(2)	0.3879

**Table 6: Heteroscedasticity Test: ARCH**

F-statistic	0.228678	Prob. F(1,33)	0.6357
Obs*R-squared	0.240868	Prob. Chi-Square(1)	0.6236

## 5 CONCLUSION AND POLICY RECOMMENDATION

This paper examined the effect of financial development and government expenditure on health on health outcomes in Nigeria. The study adopted the endogenous growth theory as the basis for modelling and the Autoregressive Distributed Lag Model was also employed for empirical analysis. The study found out that government expenditure on health worsened health outcome in the short run while it improves health outcome in the long run. We also found that the effect of financial development on health outcome is sensitive to the financial development indicator employed and that inflation negatively drives health outcome in Nigeria (and the results are statistically significant). The study recommends increased expenditure on health, particularly in terms of increasing the proportion of the fiscal budget that is allocated to the health sector, as this will improve health infrastructure nationwide, and reduce out-of-pocket spending on health services by the citizens. We further recommend a more efficient and stable financial sector, since proceeds from the financial system by financial market actors, as well as financial institutions (in terms of their credit facilities and corporate social responsibilities) can help increase the performance of the health sector and the health outcomes of the citizens.

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# THE IMPACT OF PUBLIC HEALTH EXPENDITURE ON HEALTH INDICATORS IN NIGERIA

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## ABSTRACT

This study investigates the relationship between public health expenditure and health indicators in Nigeria. The study utilized the Error Correction Mechanism (ECM) framework to capture the plausible short-run effects of public health expenditure on health indicators (proxy by life expectancy and under-5 mortality rate) in Nigeria from 1985 to 2019. The results revealed a long-run relationship between health indicators, health expenditure, gross domestic product (GDP) per capita, carbon dioxide emission, literacy level, and urban population. The results also indicate that GDP per capita and literacy level positively affect health indicators while urban population and carbon dioxide emissions impacted negatively on health indicators. Furthermore, the results revealed that the various speeds to adjustment are significant and low. The study concludes that expenditure on healthcare is vital for improving the quality of life in Nigeria and recommends that the government should increase health expenditure, control overcrowding in urban centers, reduce inequality, and promote the use of green energy.

**Keywords:** Public health expenditure, health indicators, Co-integration, error correction mechanism, Nigeria

**JEL Classification:** H51, I12, C32

## 1. INTRODUCTION

Life expectancy has vital implications for individuals and aggregate human behavior. It has crucial effects on fertility behavior, economic growth, human capital investment, intergeneration transfers, and incentives for pension benefits (Colie, 2017; Ji, 2018). Life expectancy is key to Less Developed Countries (LDC) that are earnestly striving to achieve socio-economic progress through investing significantly in social sectors like health, education, sanitation, environmental management and sustainability, and social safety nets. In Nigeria, variations in morbidity and mortality have been linked with a wide variety of measures of socioeconomic status like per capita GDP, fertility rate, adult illiteracy rate, health care expenditure, access to portable drinking water, urban inhabitants, unemployment rate, and the nominal exchange rate. Although, Nigeria is said to be highly non-egalitarian in income distribution (Sede, 2015). However, studies have shown that countries with more even income distribution tend to have low mortality rates (Wilkinson 1992; LeGrand 1993).

Nigeria's overall health performance was ranked 187th among the 191 member countries by the World Health Organization (WHO) in 2000. In 2001, the Head of States of African Countries gathered in Abuja and agreed to budget 15% annually to the health sector. According to Eguzozie (2017), Nigeria has hardly achieved a maximum of 5.95%; other African Nations like Rwanda, Botswana, Niger, Malawi, Zambia, and Burkina Faso have all spent 15% and above on the health sector. In October 2019 the National Bureau of Statistics reported that

about 40% of the Nigerian population are living below the poverty line; this implies that 40% of Nigerians cannot afford to expend \$1.9 daily. With the concentration of health centers in urban areas, access to health services is quite difficult for citizens located in rural areas (Titus, 2015).

The Sustainable Development Goals were formed in 2015 after the elapse of the Millennium Development Goal (MDG). The third aim of the Sustainable Development Goal (SDG) seeks to promote good health and the wellbeing of all before 2030. This goal roots for a substantial decrease in maternal, neonatal, under-five mortality and advocates for a significant increase in public health financing (WHO, 2016). However, the non-prioritization of the health sector is evident in the government budgetary allocation. In 2019, total government spending on health was ₦456 billion (US\$1.09 billion) or 0.6 percent of gross domestic product (GDP). While Nigeria's debased macro-fiscal condition partially accounts for the low degree of spending, during the economic boom, the investments in health have been consistently low over the past twenty years as compared to nations of similar status (World Bank, 2017).

The link between healthcare expenditure and health indicators cannot be over-underscored. Studies assessing the determinant of health indicators recognized the level of public spending, secondary school enrolment, per capita income, government expenditure, unemployment, breastfeeding, birth spacing, birth weight, antenatal care, early marriage, immunization, intake of syrup by children, literacy level and private spending on healthcare as the main determinants of life expectancy and under-5 child mortality (Tulisidhar 1989; Sede 2015; Banerjee 2018). Based on data collected from the central bank of Nigeria (CBN) and the world development indicators (WDI), total health expenditure was ₦186 million in 1985 while life expectancy and under-5 mortality rate stood at 46.1 years and 206.9% respectively. In 1999, public health expenditure doubled from ₦11,863.8 to ₦24,026.8, which drove an increase in life expectancy by 0.4% while under-5 mortality dropped by 2.5%. In 2010, public health expenditure declined from ₦142,700 in the previous year to ₦134,100 which brought about a 0.93% increase in life expectancy and a 2% decrease in under-5 mortality rate. In 2017, public health expenditure rose to ₦299,000 and further increased to ₦456,040 in 2019. Life expectancy increased to 0.64% and the under-5 mortality rate declined to 2.3% in the same period.

Theoretically, an increase in spending on healthcare should improve the health status of members of society and hence a better quality of life. Therefore, it is against this background that this study sets out to ascertain the impact of public health expenditure on health indicators in Nigeria. Following the introduction, the rest of the paper is organized as follows: Section 2 presents a review of the related literature. Section 3 presents the theoretical framework and methodology. Section 4 discusses empirical results, while section 5 concludes with policy implications.

## **2. LITERATURE REVIEW**

### **2.1 Theoretical Review**

Wagner's (1917) public expenditure theory states that as an economy grows, so does the countries public expenditure while the concentration theory expands on Wagner's theory by noting that though the economy desires an expansion of social goods, they do not wish for an increase in taxes and therefore the government increase taxes (thereby increasing the government's revenue) in times of dire need to restore the economy back to its natural state. The Keynesian (1936) theory on the other hand, advocates for government interventions as opposed to the classical thinking, the public goods theory (1954) posits the need for the provision of social goods by the government, Grossman (1972) & Mosley-Chen (1984) attempt to link biological and socio-economic phenomena; providing a health production function.

## 2.2 Empirical Review

The empirical literature is divided into three; those with positive, negative and neutral findings. For instance, Olarinde, *et al.* (2013) examined the impact of government health expenditure and the quality of institutions on health sector performance in Nigeria from 1970 to 2011 using the vector error correction model and found that public health expenditure exhibits a negative significant relationship with infant mortality and under-five mortality respectively in the short-run while in the long-run government expenditure is negatively signed, therefore an increase in government expenditure leads to better health outcomes. Similarly, Edeme & Emecheta (2014) examined the impact of public health expenditure on health outcome in Nigeria from 1981 to 2014. Using the OLS regression, their findings showed that an increase in public health expenditure leads to a decrease in infant mortality and an increase in life expectancy. In addition, urban population and HIV prevalence rate significantly affects health outcomes, while per capita income exhibits no effect on health outcomes in Nigeria. The findings suggest that public health expenditure remains a necessary component in improving health outcomes in Nigeria.

In the same vein, Maduka, *et al.* (2016) investigated the effect of health care expenditure on infant mortality and life expectancy for the period 1970 to 2013. Using the Johansen co-integration approach, they found that government health expenditure causes growth indirectly via infant mortality rate and life expectancy and that an increase in health expenditure leads to better health outcomes. This is also corroborated by Babalola, Ilori & Olalere (2017). They examined the relationship between public health expenditure and life expectancy in Nigeria from 1981 to 2014 using the ARDL model, found that there is a co-integration between public health expenditure, income, carbon emission and life expectancy; public health expenditure has a positive significant influence on life expectancy while carbon emissions affect health outcomes inversely. The study by Ajisafe & Ewubare (2018) analyzed the impact of government expenditure on health on health sector development in Nigeria from 1980 to 2017. Using OLS regression and ECM, their results showed that allocations to the health sector are effective in improving health outcomes in Nigeria. Per capita gross domestic product has a positive influence on health status in the long-run. In addition, Eboh, *et al.* (2018) assessed the impact of public health expenditure on health outcomes in Nigeria from 1994 to 2017. The result showed that budget allocations to health had a significant negative effect on infant mortality, though this was not to the desired extent. With health recurrent expenditure (HRE) having more impact on infant mortality than the health capital expenditure (HCE).

Also for Nigeria, Nwani, *et al.* (2018) assessed the relationship between public health expenditure and health outcomes from 1981 to 2017 using Autoregressive distributed lag method. The study found that public health expenditure is positively related to life expectancy in the short and long-run. Measuring health outcomes with infant mortality rate in Nigeria, David (2018) also found that an increase in government health expenditure poses little impact compared to private health expenditure. Elsewhere in Africa, Murunga, Mogeni & Kimolo (2019) examined the impact of government health expenditure on health outcomes for Kenya, covering the period 1984 to 2015. Using the Error Correction Model, their findings revealed that health expenditure influences health outcomes on average.

Contrarily, using the Ordinary Least Squared estimation technique, Oluwatoyin, *et al.* (2014) examined the impact of public health spending on health outcomes in Nigeria from 1980-2011; their findings revealed that government health spending impacted negatively on health outcomes proxy by life expectancy. Likewise, Adewumi, *et al.* (2018) analyzed the impact of government health expenditure on health outcomes in Nigeria from 1981-2017 and their

findings shows that government health expenditure impacts positively on neonatal mortality, child mortality and infant mortality rate in Nigeria, thereby leading to worse outcomes. Besides, studies like Rajkumar & Swaroop (2007), Yaqub, *et al.* (2010), Dickson, Eneji & Onabe (2013), and Ugwunta & Abada (2016) found that public health expenditure had a rather neutral and in some cases an insignificant impact on health indicators.

### 3. METHODOLOGY

#### 3.1 Theoretical Framework

Grossman (1972) form the theoretical foundation of this study, Grossman's health production function can be specified as:

$$H_t = f(Z_t) \quad (1)$$

Where H is a measure of individual health output and a function of Z, which is also a function of Nutrient intake, income, consumption of public goods, education, time devoted to health, personal and community endowments.

Grossman's model was designed for the analysis of health production at the micro level. The interest here is to analyze the production system at the macro level, converting this from micro to macro analysis without losing the theoretical grounds; the subsets of Z are condensed into:

$$H_t = f(\text{HEXP}_t, \Theta_t) \quad (2)$$

Where H represents health indicators and is captured by life expectancy and under-5 mortality, HEXP is aggregate health expenditure and  $\Theta$  represents controlling variables.

$$\text{LEXP}_t = f(\text{HEXP}_t, \text{GDP}_t, \text{CO}_{2t}, \text{LIT}_t, \text{URP}_t) \quad (3)$$

$$\text{U5}_t = f(\text{HEXP}_t, \text{GDP}_t, \text{CO}_{2t}, \text{LIT}_t, \text{URP}_t) \quad (4)$$

Where LEXP is the life expectancy, U5 is UNDER-5 mortality rate and  $\mu$  represent the controlling variables (GDP per capita, carbon dioxide emission, literacy rate and urban population). The control variables used are adopted from Sede (2015) & Ilori, *et al.* (2017) whose studies showed that literacy rate, carbon-dioxide emission, urban population and GDP per capita significantly influences health indicators in Nigeria.

#### 3.2 Model Estimation

##### 3.2.1 Model Specification

Based on the functional forms presented in equation (3-4), the error correction model takes the form:

$$\begin{aligned} \Delta \text{LNLEXP}_t = & \alpha_0 + \sum_{i=1}^J a_{1i} \Delta \text{LNLEXP}_{t-2} + \sum_{i=1}^J a_{2i} \Delta \text{LNHEXP}_{t-2} + \sum_{i=1}^J a_{3i} \Delta \text{LNGDP}_{t-2} \\ & + \sum_{i=1}^J a_{4i} \Delta \text{LNCO}_{2t-2} + \sum_{i=1}^J a_{5i} \Delta \text{LNLIT}_{t-2} + \sum_{i=1}^J a_{6i} \Delta \text{LNURP}_{t-2} + a_7 \text{ect}_{t-1} + \varepsilon_{t1} \end{aligned} \quad (5)$$

$$\begin{aligned} \Delta \text{LNU5}_t = & \beta_0 + \sum_{i=1}^J \beta_{1i} \Delta \text{LNU5}_{t-2} + \sum_{i=1}^J \beta_{2i} \Delta \text{LNHEXP}_{t-2} + \sum_{i=1}^J \beta_{3i} \Delta \text{LNGDP}_{t-2} + \sum_{i=1}^J \beta_{4i} \Delta \text{LNCO}_{2t-2} \\ & + \sum_{i=1}^J \beta_{5i} \Delta \text{LNLIT}_{t-2} + \sum_{i=1}^J \beta_{6i} \Delta \text{LNURP}_{t-2} + \beta_7 \text{ect}_{t-1} + \varepsilon_{t2} \end{aligned} \quad (6)$$

Where:

$t$  is the time period

$f$  is function of

The controlling variables are;

GDP is GDP per capita

$C_0$  is carbon dioxide emission

LIT is literacy rate (primary school enrolment)

URP is urban population

$\alpha_0, \beta_0, \vartheta_0, \eta_0, \kappa_0, \tau_0$  and  $p_0$  are the intercepts

$\alpha_1 \dots \alpha_6, \beta_1 \dots \beta_6, \vartheta_1 \dots \vartheta_6, \eta_1 \dots \eta_6, \kappa_1 \dots \kappa_6$  and  $\tau_1 \dots \tau_6$  are coefficients of the variables

$\varepsilon_t$  is the white noise or stochastic disturbance term.

ECT is the error correction terms, which are the residuals of the long run regression at lagged one period. The coefficients of the error correction term ( $\alpha_7, \beta_7, \vartheta_7, \eta_7, \kappa_7$  and  $\tau_7$ ) determine the speed of adjustment towards the long run equilibrium.

$$-1 < \alpha_7 < 0, -1 < \beta_7 < 0, -1 < \vartheta_7 < 0, -1 < \eta_7 < 0, -1 < \kappa_7 < 0, -1 < \tau_7 < 0$$

### 3.3 Sources of Data

**Table 3.3.1: Description and Sources of Data**

S/N	Variable	Description	Source
1.	LEXP	Life expectancy	World development indicators
2.	U5	Under-5 child mortality rate (per 1,000 live births)	World Development Indicators
3.	HEXP	Public health expenditure	Central Bank of Nigeria
4.	GDP	Gross domestic product (per capita)	World development indicators
5.	C02	Carbon dioxide emission (metric tons per capita)	World development indicators
6.	LIT	Primary school enrolment rate	World development indicators
7.	URP	Urban population (% of total population)	World development indicators

## 4. RESULTS AND DISCUSSION OF FINDINGS

### 4.1 Unit Root Test

**Table 4.1.1: Unit Root Test Result**

Augmented Dickey Fuller					
Variable		Test statistic	Critical value	Probability	Remark
LEXP	Intercept	-3.86	-3.71*	0.0070	I(1)
U5	Intercept	-2.69	-2.62***	0.0867	I(1)
HEXP	Trend and Intercept	-4.14	-3.57**	0.0145	I(1)
GDP	Trend and Intercept	-3.90	-3.55**	0.0233	I(1)
CO <sub>2</sub>	None	-8.94	-2.63*	0.0000	I(1)
LIT	Trend and Intercept	-4.77	-4.26*	0.0028	I(1)
URP	Trend and Intercept	-3.84	-3.61**	0.0316	I(1)

*Source: Author's Computation*

The macroeconomic variables are tested for stationarity so as to obtain robust and non-spurious results. The main statistical tool for examining time series properties is the unit root test, it tests the null hypothesis of the presence of unit root as against the alternative hypothesis of the absence of unit root ( $H_0=0, H_1 \neq 0$ ). The condition is that the null hypothesis will fail to be accepted and the alternative hypothesis will fail to be rejected should the computed t-statistic be greater than the test critical value in absolute terms or the probability value be less than 0.1 or 0.05 or 0.01 at 01%, 5% and 1% level of significance respectively

This study employs the Augmented Dickey-Fuller (ADF) unit root test method to check the order of integration of the macroeconomic variables of the study and the results are presented in Table 4.1.1. The results show that all variables are stationary at first difference (I(1)). This result shows that the macroeconomic variables employed in this study are integrated of order one.

## 4.2 Co-Integration Results

**Table 4.2.1: Lag Length Information Criterion**

Equation	Criteria/Lag length	0	1	2
7	AIC	-14.8232	-29.3202	-33.05295*
	SIC	-14.5511	-27.4155	-29.51575*
	FPE	1.47E-14	7.74E-21	2.33e-22*
	HQ	-14.7316	-28.6793	-31.86279*
	LR	NA	433.6497	118.2918*
8	AIC	-11.7913	-27.5249	-29.92150*
	SIC	-11.6997	-26.884	-28.73134*
	FPE	3.05E-13	4.66E-20	5.34e-21*
	HQ	-11.6997	-26.884	-28.73134*
	LR	NA	465.7999	91.56936*

*Source: Author's Computation*

The Johansen co-integration method is adopted in testing if a long run equilibrium relationship exists between the variables. In adopting this method, we first determine the optimal lag length of the Vector Autoregressive (VAR) model using various criteria, and the test results of the lag length selection criteria are presented in Table 4.5.1. It is seen from the table 4.6.1 that for equations 5 and 6, the optimal lag length as 2 was suggested by all the five different information criteria considered; Akaike information criterion (AIC), Schwarz information criterion (SIC), Hannan-Quinn information criterion (HQ), Final Prediction Error (FPE) and sequential modified LR test statistic (LR).

**Table 4.2.2: Test Results for Co-Integration between Pair Variables**

Trace statistics						Max-Eigen statistics				
	H <sub>0</sub>	H <sub>1</sub>	Trace statistic	Critical value	No. of co-integration	H <sub>0</sub>	H <sub>1</sub>	Max-eigen statistic	Critical value	No. of co-integration
Equation 7	R=0*	R=0	219.19	107.34	5	R=0*	R=0	67.94	43.41	5
	R≤1*	R=1	151.24	79.34		R≤1*	R=1	55.06	37.16	
	R≤2*	R=2	96.177	55.24		R≤2*	R=3	37.72	30.81	
	R≤3*	R=3	58.45	35.01		R≤3*	R=3	34.8	24.25	
	R≤4*	R=4	23.56	18.39		R≤4*	R=4	22.80	17.14	
	R≤5	R=5	0.761	3.84		R≤5	R=5	0.761	3.84	
Equation 8	R=0*	R=0	200.73	107.34	6	R=0*	R=0	49.93	43.41	6
	R≤1*	R=1	150.79	79.34		R≤1*	R=1	48.37	37.16	
	R≤2*	R=2	102.41	55.24		R≤2*	R=2	40.66	30.81	
	R≤3*	R=3	61.74	35.01		R≤3*	R=3	34.57	2.43	
	R≤4*	R=4	2.72	1.84		R≤4*	R=4	18.06	17.14	
	R≤5*	R=5	9.10	3.84		R≤5*	R=5	9.10	3.84	

*Source: Author's Computation*

The Johansen co-integration test is applied to the variables using a lag length of 2 as suggested by all five criterions considered. The results are presented in Table 4.6.2, it shows a long-run equilibrium relationship exists between health expenditure and health indicators in Nigeria. The table reveals that for equation 5 the trace and Maximum eigenvalue tests indicate five co-integrating equations and six co-integrating equations for equation 6, suggesting that there is a

long-run relationship between health indicators (life expectancy and under-5 child mortality rate), expenditure on health, GDP per capita, literacy level and carbon dioxide emission.

### 4.3 Error Correction Model

Given that the variables are co-integrated, an Error correction model is constructed by including in the model, the lagged terms of the variables and the error correction term generated. The error correction model shows the short run relationship between variables and its results are presented in the tables below:

**Table 4.3.1: Parsimonious Regression Results for Equation 5**  
**Dependent Variable: DLOGLEXP**  
**Included observations: 32 after adjustments**

Variable	Coefficient	T-Statistics	Prob
Constant	0.0014	4.1257	0.0004
d(loglexp(-1))	1.5807	19.9270	0.0000
d(loglexp(-2))	-0.6536	-9.1307	0.0000
d(loghexp)	0.0028	3.5816	0.0017
d(loghexp(-1))	-0.0024	-2.4182	0.0243
d(logc02)	-0.0006	-2.1262	0.0449
d(loglit)	-0.0615	-3.7655	0.0011
d(loglit(-1))	0.0520	2.4341	0.0235
ect(logurp(-2))	-0.0462	-3.7334	0.0012
ect(-1)	-0.0282	-2.7159	0.0126
R2	0.89		
Adj R2	0.87		
Durbin Watson	1.83		
F-statistic	1710.68		
Prob (F-statistic)	0.0000		

**Source: Author's Computation**

The parsimonious estimates for equation 5, reveals that public health expenditure has a positive impact on life expectancy while a change in one-period lagged value of total public health expenditure has a significant (0.024) but negative (-0.00243) effect on life expectancy in conformity with the findings of Boachie, *et al* (2018). Carbon dioxide emissions has a negative (-0.00657) impact on life expectancy as a priori expected which implies that an increase in carbon dioxide emission would lead to a decline in life expectancy, literacy level has a negative (-0.0615) impact on life expectancy while one-period lagged value literacy level of has a positive(0.0011) impact on life expectancy at 5% level of significance(0.0235).Urban population has negative impact on life expectancy, from the result, an increase in urban population will lead to a decrease in life expectancy by -0.046. The error correction term is negative and significant (-0.0282) at five percent level of significance indicating a low speed of adjustment to equilibrium.

**Table 4.3.2: Parsimonious Regression Results for Equation 6**  
**Dependent Variable: DLOGU5**  
**Included observations: 32 after adjustments**

Variable	Coefficient	T-Statistic	Prob
Constant	-0.0006	-1.0740	0.2935
d(logu5(-1))	1.4434	11.006	0.0000
d(logu5(-2))	-0.4517	-3.1876	0.0040
d(loghexp)	-0.0010	-1.8622	0.0748
d(loghexp(-1))	0.0014	2.1206	0.0445
d(loggdp)	-0.0032	-1.7350	0.0946
d(loggdp(-1))	0.0061	3.2161	0.0037
ect(-1)	-0.0593	-2.8603	0.0086
R2	0.885		
Adj R2	0.881		
Durbin Watson	2.21		
F-statistic	237.51		
Prob (F-statistic)	0.0000		

**Source: Author's Computation**

From equation 6, public expenditure on health has a significant (0.078) and negative (-0.001074) as theoretically expected, implying that an increase in public health expenditure will bring about a decrease in under-5 child mortality rate by -0.001074 this is in line with the findings of Maduka, *et al.* (2016) and Olarinde, *et al.* (2013), however, health expenditure lagged one period back derails from a priori expectations as it has a significant (0.0445) and positive (0.00143) impact on under-5 child mortality rate. The findings also reveal that gdp per capita has a statistically significant (0.0946) and negative effect on under-5 child mortality while it's lagged value has a positive (0.00617) and significant (0.0037) relationship with under-5 child mortality rate, another deviation from expectations. The coefficient of the lagged error correction terms is approximately -0.05 suggesting very low speed of adjustment towards equilibrium.

## 5. CONCLUSION AND POLICY RECOMMENDATIONS

The study uses life expectancy and under-5 child mortality rates as proxies for health indicators while public health expenditure is captured by Nigeria's recurrent and capital health expenditure for the period 1985 – 2019. The augmented Dickey Fuller unit root test reveals that all the data used in this research are integrated of order I(1) and hence the Johansen co-integration test was carried out to determine if a long run relation between the variables exists. The latter result reveals at least five co-integrating equations in all models examined, thus, the error correction model was regressed for both equations. The ECM reveals that there is a positive and significant relationship between total health expenditure and health indicators. The error correction terms (ect) lagged one-period are significant for all equations implying that there is a long-run relationship as earlier confirmed by the Johansen co-integration.

The regression result shows that public health expenditure has a positive and significant impact on life expectancy and under-5 child mortality rate, thus the following recommendations; the government at all tiers should invest and encourage the use of green energy in order to reduce the consumption of fossil fuels so as to reduce the harmful effect of carbon dioxide emission on the environment and on the health of the populace. Policy should be put in place to regulate the emission of harmful gases. The Federal and state governments should discourage high concentration in one area by providing equal opportunities in every part of the country, the Government should aim towards inclusive growth in order to prevent excessive migration from

rural centers to urban areas. The local governments should provide opportunities to incentivize people against migrating to urban centers. The state government should supervise and ensure that the educational system is qualitative and not just quantitative, both formal and informal education should be encouraged in order to build human capacity, the state government should provide free basic education in order to increase enrolment rates and reduce the levels of illiteracy, hence, creating a health conscious environment.

Furthermore, from the findings, gdp per capita has a significant impact on health indicators in current time period, therefore, the federal government should aim at reducing inequality by putting policies in place to bridge the gap between the rich and the poor, this would reduce monopoly power and bring about more equitable allocation of resources in the society which will lead to improvement in health outcomes hence a better quality of life.

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# FOREIGN INVESTMENT, DOMESTIC INVESTMENT AND SUSTAINABILITY OF THE MANUFACTURING SECTOR OF THE NIGERIA ECONOMY

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## ABSTRACT

This paper examines the impact of foreign and domestic investment on the output of the manufacturing sector from 1980 – 2020. To achieve the objectives of the study, an econometric model of Vector Error correction Model (VECM) was specified and estimated. This was to determine the short and long run causality among the variables captured in the model. Stationarity check was conducted using the correlogram approach and all the variables were stationary at first difference. Appropriate lags for the model were selected based on the result of the Akaike and Hannan Quine information criteria. The Johansen cointegration was carried out to determine the long run relationship among the variables. In addition, the normalized Johansen equation was to establish the long run impact of the independent variables (foreign investment, domestic investment and exchange rate) on the dependent variable (manufacturing sector output). Findings revealed that, external investment inflow and domestic investment have long run positive impact on the manufacturing sector. Conversely, the real exchange rate shows a negative long run impact on the manufacturing sector but statistically significant. Also VECM test for causality revealed the existence of both short and long run causality among the variables. Based on the strength of findings, the study recommends that deliberate investment promoting policies capable of stimulating foreign and domestic investment should be sustained. For it will enhance growth in the manufacturing sector and by extension the economy.

**KEY WORDS:** investment, foreign, domestic, growth, green –field, crowding-out

**JEL Code:** E6; E60; E62

## 1. INTRODUCTION

Over the years countries of the world have mutually helped each other to grow and developed. This has been made possible through the instrument of international trade and foreign investment. This interaction is necessitated by the fact that no country exists and survives in isolation. In line with this, external investment between the advanced countries and the developing countries is necessary. The advanced countries with their technical knowledge and financial resources can transform the raw materials of the developing nations into finished goods as well as increase in foreign exchange. The role of external capital investment especially foreign investment to the manufacturing sector of the economy cannot be over emphasized. In Nigeria, successive governments supported by the strong industrial and academic forces have identified the instrumentality of foreign and domestic investments as important tools for growth and development.

The flow of foreign investment into the Nigeria economy has not ceased due to the open nature of the economy. There are some scholastic arguments whether foreign investment is really beneficial and how significant this benefit is to economic growth. Proponents have argued that

multinational corporations in developed countries have actually become a threat to host countries as they are now subversive and exploitative. Multinational corporations are in reality the representation of the global corporation around countries as they see the state as the only unit of analysis in international relation. These arguments above and indeed many more have

necessitated a critical look and finding out of whether the often acclaimed benefits of foreign investment are significant or not economic growth.

Dependency theorist looked on how foreign investment of Multinational Corporation distorts developing nation economies. The dependency scholars' defined distortion includes; the crowding out of national firms, rising unemployment, and loss of political sovereignty. Developing nations generally depend on the foreign investors for the finance capital that they need. Multinational corporations carryout much of this foreign investment and many developing countries also borrow money from international financial markets through the sale of bonds at usually high interest rate. Foreign investors may be reluctant to buy bonds if assurance of repayment is not certain. Most rational government introduces policies tailored towards attraction of foreign investors to boost the economy rather than excessive borrowing at outrageous interest rate.

In developing countries, foreign investment and domestic investments plays important role in economic sustainability. They are considered as engine of economic growth and development. The performance of the manufacturing sector is vital to the determination of the growth of many economies. The trend in both foreign and domestic investment in Nigeria has never ceased, as such one is compelled to participate in the scholastic argument of the positive impact of these investments to economic growth of Nigeria, particularly the manufacturing sector.

The general of the objective of the study is to examine the impact of foreign and domestic Investments on the manufacturing sector of Nigeria.

Specifically, is to: 1) determine the long run impact of foreign investment on the manufacturing sector. ii) ascertain the long run impact of domestic investment on the manufacturing sector. iii) access the long run impact of exchange rate behaviour on the manufacturing sector. iv) To determine both the short and long run causality among the variables.

## **2. LITERATURE REVIEW**

### **2.1 Theoretical Literature**

#### **The Theory of open Economy**

The theory of open economy emphasizes that total spending in the domestic economy is divided into domestic and foreign component. The domestic components consist of: domestic consumption of goods and services, consumption of foreign goods and services. The foreign component on the other hand consists of investment in foreign goods and services. EXP represents exports of domestic goods and services. This can further be re-arranged as:

The interaction between export and import mimic the performance of the external sectors if export exceeds imports, external sector is considered to be surplus, the reverse is the case were import exceeds export then is said to be the deficit.

#### **Aggregate Production Function Theory**

The aggregate production function theory describes how total real gross domestic product (real GDP) or output in an economy depends on available inputs. Aggregate output (real GDP) depends on the following: Physical capital—machines, production facilities, and other inputs that are used in production Labor—the number of hours that are worked in the entire economy, Human capital—skills and education embodied in the workforce of the economy, Knowledge—basic scientific knowledge, and blueprints that describe the available production

processes, Social infrastructure—the general business, legal and cultural environment and the amount of natural resources available in an economy.

Inputs other than labor, physical, and human capital together, are called technology.

The aggregate production function has key properties. First, output increases when there are increases in physical capital, labor, and natural resources. In other words, the marginal products of these inputs are all positive.

Second, the increase in output from adding more inputs is lower when we have more of a factor. This is called diminishing marginal product. That is,

- The more capital, the less additional output obtain from additional capital.
- The more labor, the less additional output obtains from additional labor.
- The more natural resources, the less additional output obtain from additional resources.

In addition, increases in output can also come from increases in human capital, knowledge, and social infrastructure. In contrast to capital and labor, it is not assume that there are diminishing returns to human capital and technology. One reason is that there is no established measure for natural or an obvious measure for human capital, knowledge, or social infrastructure, whereas we do for labor and capital (hours of work and hours of capital usage).

## **2.2 Empirical Literature**

There are many scholastic works that relates to foreign investments and other investments and economic growth. Silajdzic and Mehic (2015) maintained that foreign investment has a direct affect on economic growth by contributing to the gross fixed capital formation and indirectly by contributing to the welfare of the Cambidians. In line with economic theory, foreign investment is expected to directly affect economic growth as it is assumed to complement domestic investments. It is equally considered to be an important supplement for capital and investment challenges. The analysis further revealed that foreign investment ha positive impact on economic growth through knowledge spillovers in transition countries. Nistor,(2014) in his investigation established the positive impact of foreign investment on Sri Lanka's economy. However, the impact manifested differently depending on the area and the region of the foreign investment. The result in addition shows that the foreign investment inflows combined with human capital development contribute immensely to the country's economic growth. Hong (2014) in a study on foreign investment on economic growth of China discovered that foreign investment exerts a positive impact on the economic growth. He observed that the interaction of economies of scale, human capital, infrastructure, and wage levels, with foreign investment promote economic growth in China. Chee (2010), empirically analyzed the development of financial sector and the complementary role of foreign and domestic investment on economic growth of Ghana. The study maintained that the contribution of foreign investment to economic growth. is relatively more than domestic investment. On the other hand, Gunby, (2017) revealed that the effect of foreign investment on Chinese economic growth is lower than one would expect judging from the economic performance perspective of the country. Ponce (2017) argued that foreign investment has a positive and significant effect on output in high-income countries, while in upper-middle-income countries the effect is uneven and non-significant. A study conducted by Sakyi, Commodore, and Opoku (2015) suggested that increase in foreign investment triggers positive GDP growth in the long-run, an empirical investigation in Senegal during the period 1997-2011. Similar findings by Javaid (2016), that foreign investment has a

significant positive impact on the GDP growth of Liberia both in long-term and in short-term. Other factors such as inflation and population also show significant effects on the GDP in the long run. Supporting the result, Younus (2014), confirmed that there exists a positive relationship between economic growth, proxies by gross domestic product (GDP) and foreign investment in Egypt. In Nigeria, some of the studies on the relationship between foreign investment and economic growth includes; Ayigbeyis (2017), Ogbuabor, Agu, Odo and Nchege (2017) Mobosi and Madueme (2016) etc. these authors separately reported that there is a positive linkage between foreign investment and economic growth in Nigeria. Edozien (2019) intensively discussed the effect of foreign on the Nigerian economy and submits that there has not been a reasonable impact of foreign investment on economic growth in Nigeria. Odozi (2015) placed special emphasis on the factors effecting foreign investment flows into Nigeria in both pre and post Structural Adjustment Programmes (SAP). The study identifies areas that are discouraging both foreign and local investors which contribute to the proliferation and growth of Parallel markets and sustained capital flight. The study points out that exchange rate upward movement is central to illegal and parallel market surge in Nigeria. Adelegan (2016) used the seemingly unrelated regression model (SUR) to examine the impact of foreign and domestic investment on economic growth in Nigeria. The study revealed that foreign investment is pro-consumption, pro-import and negatively related to gross domestic output, that domestic investment has positive impact on economic growth.

Another investigation by Ekpo (2016) reported that political regimes influence income per capita, inflation rate, interest rate, credit rating and debt service, and are the key factors explaining the variability of foreign investment inflow into Nigeria. Similarly, Ayamwale and Bamire (2017) assessed the influence of foreign investment on foreign firms level productivity in Nigeria and reported positive spillover of foreign firms on domestic firm productivity. Ariyo (2018) studied the foreign investment trend and its impact on Nigeria's manufacturing sector over the years. He found that only private domestic investment consistently triggered positive impact on manufacturing sector considered. Furt (2018) using time series data from 1980 – 2016, established that there is no reliable evidence that the entire investment variables with foreign investment inclusive in the analysis have any perceptible Influence an economic growth. He therefore suggested the need for an institutional partnership for the development of the economy. A common weakness that has been identified in most of these studies is that they failed to recognize the fact that most of the foreign investment inflows to Nigeria are mostly channeled to the extractive industry, neglecting other sectors of the economy.

Ayanrogale (2017) assessed the impacts of foreign investment inflows to the Nigeria's manufacturing sector, using an error correction model (ECM). He found that both private capital and lagged foreign capital have small and a statistically significant impact on manufacturing sector. The result support the argument that foreign investment impact on other sectors of the economy might not enhance growth as much as it will on manufacturing sector. Examining the contribution of foreign capital to the poverty of some less developed countries, Oyalle (2018) conceptualized foreign capital to include foreign loans, direct foreign investment and export earnings. Using chancery and stout's two gap model (chancery and stout 1966),

he concluded that foreign investment has the negative effect on economic development in Nigeria. Further on the basis of time series data, Ogbuabor, Agu, Odo and Nchege (2017) attempt to answer the question as whether foreign aid has positive or negative impact on economic growth in Nigeria. The study discovered that foreign aid has negligible positive impact on Nigeria economy.

Ayigbeyis (2017) joined the league of investigators on the impact of foreign aid on economic growth. He also looked at corruption as factor impeding the flow of foreign aid to Nigeria. The study concludes that foreign aid contributes positively to economic growth, and corruption affects the flow of foreign aid to Nigeria. Emmanuel, Okpe and Gbatsoron (2020), looked at the determinants of foreign investment Inflows to Nigeria. The study identified change in domestic investment, change in domestic output or market size, indigenization policy and change in openness of the economy as major determinants of foreign investment in Nigeria. The study recommend that efforts must be intensified to raise the nation’s manufacturing sector so as to be able to attract more foreign investment.

Ayanwale (2017) investigated the empirical relationship between non-extractive foreign investment and manufacturing sector in Nigeria and also examined the determinants of foreign investment in Nigeria, using a simultaneous equation models to examine the relationship. The results suggest that the determinants of FDI in Nigeria are: market size, infrastructure development, stable macroeconomic policy, Openness to trade, human capitals and exchange rate. These determinants were found not be foreign investment inducing. However, there was established positive link between foreign investment and economic growth in Nigeria. The work is similar to that of Harrison (2014) in that it seeks to examine the impact of foreign investment and private investment on the growth of the Nigeria Economy. The result still revealed the Positive and significant impact of both investments on economic growth.

From the empirical studies reviewed, all centered on foreign investment and other factors which positively or negatively impacting on economic growth. However, the joint investigation of foreign and domestic investment has not been carried out by previous studies which the study has identified as a gap.

## 1. MODEL SPECIFICATION

The model specified for the study is a build up from theoretical proposition of aggregate production function theory aa well as modifications from empirical works which suitably captured the relation between external investment, domestic investment and the real exchange rate on the behavior of the manufacturing sector in Nigeria. Bamire (2017), and Oyalle (2018), in their separate investigations on foreign investment, specified their models on the strength of aggregate production function theory. Thus the functional model is specified as;

$$MNF = f (fdi, \text{exch and div}) \text{-----1}$$

Specifying the econometric form of the model

$$MNF = \beta_0 + \beta_1 fdi + \beta_2 \text{exch} + \beta_3 \text{div} + u \text{-----2}$$

Taking the log form of the model

$$\log MNF = \beta_0 + \beta_1 \log fdi + \beta_2 \text{exch} + \beta_3 \log \text{div} + \mu_t \text{.....3}$$

Where:

MNF = Manufacturing sector output

FIV = Foreign investment

EXR = Exchange

DIV = Domestic investment

$\beta_0$  =Constant or Intercept

$\beta_1, \beta_2, \beta_3$  =Coefficient or parameters

$\mu_t$  = The stochastic error term

## APRIORI EXPECTATION

$$\beta_1 > 0 \quad \beta_2 < 0 \quad \beta_3 > 0$$

The VECM version of the model

To achieve the short and long run causality among the variables, the VECM form of the model was specified as:

$$\Delta \ln MNF_t = \alpha_0 + \sum_{i=1}^k \alpha_{1i} \Delta \ln MNF_{t-1} + \sum_{i=1}^k \alpha_{2i} \Delta \ln FIV_{t-1} + \sum_{i=1}^k \alpha_{3i} \Delta \ln DIV_{t-1} + \sum_{i=1}^k \alpha_{4i} \Delta EXR_{t-1} + \lambda_1 ECM + \varepsilon_{1t} \text{-----4}$$

$$\Delta \ln FIV_t = \beta_0 + \sum_{i=1}^k \beta_{1i} \Delta \ln MNF_{t-1} + \sum_{i=1}^k \beta_{2i} \Delta \ln FIV_{t-1} + \sum_{i=1}^k \beta_{3i} \Delta \ln DIV_{t-1} + \sum_{i=1}^k \beta_{4i} \Delta EXR_{t-1} + \lambda_1 ECM + \varepsilon_{2t} \text{-----5}$$

$$\Delta \ln DIV_t = \rho_0 + \sum_{i=1}^k \rho_{1i} \Delta \ln MNF_{t-1} + \sum_{i=1}^k \rho_{2i} \Delta \ln FIV_{t-1} + \sum_{i=1}^k \rho_{3i} \Delta \ln DIV_{t-1} + \sum_{i=1}^k \rho_{4i} \Delta EXR_{t-1} + \lambda_1 ECM + \varepsilon_{4t} \text{-----6}$$

$$\Delta EXR_t = \omega_0 + \sum_{i=1}^k \omega_{1i} \Delta \ln MNF_{t-1} + \sum_{i=1}^k \omega_{2i} \Delta \ln FIV_{t-1} + \sum_{i=1}^k \omega_{3i} \Delta \ln DIV_{t-1} + \sum_{i=1}^k \omega_{4i} \Delta EXR_{t-1} + \lambda_1 ECM + \varepsilon_{6t} \text{-----7}$$

Where:

$\Delta$  is the difference operator,  $k$  is the lag length,  $\lambda$  is the speed of adjustment parameter and  $\varepsilon_t$  is the serially uncorrelated error term.

$\left. \begin{array}{l} \alpha_0 \\ \beta_0 \\ \rho_0 \\ \omega_0 \end{array} \right\}$	are the intercept terms	$\left. \begin{array}{l} \alpha_1 - \alpha_4 \\ \beta_1 - \beta_4 \\ \rho_1 - \rho_4 \\ \omega_1 - \omega_4 \end{array} \right\}$	are parameter estimates
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## ANALYSIS AND INTERPRETATION OF RESULTS

The pre-estimation tests and the main estimation technique are presented systematically below.

### The stationarity test of the model

The stationarity test was carried out using the correlogram approach. The result as presented in table. I show that all the variables were stationary at first difference, as all the P.values are less than 5%. Thus it has established the same order of cointegration to be I(1)

Table.I

Included observations: 40

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
. .	. .	1	-0.089	-0.089	0.3432	0.558
** .	** .	2	-0.243	-0.253	2.9609	0.228
. *	. *	3	0.136	0.092	3.7952	0.284
** .	*** .	4	-0.333	-0.404	8.9754	0.062
. .	. .	5	-0.028	-0.027	9.0128	0.109
. **	. *	6	0.328	0.137	14.324	0.026
. .	. .	7	-0.199	-0.156	16.340	0.022
. .	. .	8	-0.122	-0.173	17.121	0.029
. .	. .	9	0.139	-0.017	18.166	0.033
. .	. .	10	-0.105	0.007	18.789	0.043
. .	. .	11	0.066	0.001	19.043	0.060
. .	** .	12	-0.007	-0.248	19.046	0.087
. .	. *	13	-0.015	0.144	19.061	0.121
. .	. .	14	0.002	-0.064	19.061	0.163
. .	. .	15	-0.009	-0.040	19.066	0.211
. .	. .	16	-0.006	-0.120	19.069	0.265
. .	. .	17	-0.006	0.014	19.071	0.324
. .	. .	18	0.006	0.041	19.074	0.387
. .	. .	19	0.004	-0.113	19.076	0.452
. .	. .	20	-0.004	-0.055	19.077	0.517

Source: Author’s computation 2022

**Optimal Lag**

The optimal lags selected for this study are four lags based on the Akaike and Hannan Quine information criteria which have the lowest value compared to other information criteria. It is one of the basic steps while estimating a VECM model.

Table.2

Included observations: 35

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2924.808	NA	5.67e+67	167.3604	167.5382	167.4218
1	-2843.329	139.6778	1.36e+66	163.6188	164.5076	163.9256
2	-2808.431	51.84849	4.79e+65	162.5389	164.1387*	163.0912
3	-2785.887	28.34106	3.65e+65	162.1650	164.4758	162.9627
4	-2754.798	31.97742*	1.90e+65*	161.3027*	164.3246	162.3459*

\* indicates lag order selected by the criterion  
 LR: sequential modified LR test statistic (each test at 5% level)  
 FPE: Final prediction error

AIC: Akaike information criterion  
 SC: Schwarz information criterion  
 HQ: Hannan-Quinn information criterion

## JOHANSEN COINTEGRATION TEST RESULT

The result indicates four cointegrating equations at trace test and one cointegration equation at max-eigen value, which established the existence of long run relationship among the variables.

**Table.3**

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.503400	63.89709	47.85613	0.0008
At most 1 *	0.442000	39.39810	29.79707	0.0029
At most 2 *	0.269230	18.97921	15.49471	0.0143
At most 3 *	0.204358	8.001217	3.841466	0.0047

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.503400	24.49898	27.58434	0.1183
At most 1	0.442000	20.41889	21.13162	0.0627
At most 2	0.269230	10.97800	14.26460	0.1553
At most 3 *	0.204358	8.001217	3.841466	0.0047

Max-eigenvalue test indicates 1 cointegration at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Source: Authors computation using E-views 10.0 (2020)

## The normalize Johansen Equation Result.

Normalized cointegrating coefficients (standard error in parentheses)

MNF	FIV	DIV	EXCH
1.000251	-1.286129	-1.564293	17.00567
	(3.2108)	(2.13404)	(7.23245)

Normalized Johansen equation results like other econometric methods, are used to determine the long run impacts of exogenous variables on the endogenous variables. There are interpreted in reverse order, which according to the normalized result FIV as proxy for foreign investment and domestic investment (DIV) has positive long run impact on the manufacturing sector performance in Nigeria. However, domestic investment shows a higher level of impact than the foreign investment, with a long run coefficient value of -1.56493 domestic investments and -1.286129 for foreign investment. Real exchange rate on the other hand has a declining long

run impact on the output of the manufacturing sector as revealed by the normalized result This result is consistent with apriori expectations as well as the findings of Ndukama (2017) and Pritchett (2019)

## The Vector Error Correction Result (VECM)

Vector Error Correction Estimates

Included observations: 36 after adjustments  
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1			
MNF(-1)	1.000000			
FIV(-1)	1.385884 (0.10556) [-13.1286]			
DIV(-1)	30.01797 (6.45184) [ 4.65262]			
EXR(-1)	-8.92308 (1.24208) [-7.72971]			
C	-1.41510			

Error Correction:	D(MNF)	D(FIV)	D(DIV)	D(EXR)
CointEq1	-0.552085 (0.28917) [-3.21757]	2.252183 (0.65357) [ 3.44595]	-0.003058 (0.00663) [-0.46090]	-8.03E-11 (5.1E-11) [-1.56007]
D(MNF(-1))	-0.109028 (0.18844) [-0.57858]	-0.310982 (0.42591) [-0.73016]	0.005874 (0.00432) [ 1.35859]	8.05E-11 (3.4E-11) [ 2.39871]
D(MNF(-2))	-0.883949 (0.18295) [-4.83176]	-0.502347 (0.41349) [-1.21490]	-0.000994 (0.00420) [-0.23675]	9.12E-11 (3.3E-11) [ 2.79908]
D(FIV(-1))	-0.042251 (0.29436) [-0.14353]	1.606291 (0.66531) [ 2.41435]	-0.000927 (0.00675) [-0.13719]	-1.02E-10 (5.2E-11) [-1.94227]
D(FIV(-2))	0.218130 (0.16883) [ 1.29204]	0.832612 (0.38158) [ 2.18204]	0.001578 (0.00387) [ 0.40732]	-2.34E-11 (3.0E-11) [-0.77835]
D(DIV(-1))	5.786047 (8.75384) [ 0.66097]	-43.22942 (19.7851) [-2.18495]	-0.216746 (0.20085) [-1.07915]	1.24E-09 (1.6E-09) [ 0.79399]
D(DIV(-2))	3.437010 (8.79560) [ 0.39076]	-24.29145 (19.8795) [-1.22194]	-0.265019 (0.20181) [-1.31323]	-1.35E-09 (1.6E-09) [-0.86220]
D(EXR(-1))	-1.06E+09	9.39E+08	-14336935	0.215963

	(1.2E+09)	(2.7E+09)	(2.7E+07)	(0.21244)
	[-0.89002]	[ 0.34832]	[-0.52366]	[ 1.01658]
D(EXR(-2))	-1.41E+09	2.55E+09	19180684	0.122872
	(9.2E+08)	(2.1E+09)	(2.1E+07)	(0.16334)
	[-1.54157]	[ 1.22775]	[ 0.91115]	[ 0.75222]
C	3.78E+10	-2.63E+10	-31726106	6.401458
	(2.0E+10)	(4.4E+10)	(4.5E+08)	(3.49973)
	[ 1.92461]	[-0.59285]	[-0.07034]	[ 1.82913]
R-squared	0.745250	0.713860	0.290827	0.612165
Adj. R-squared	0.657067	0.614811	0.045344	0.477914
Sum sq. resids	2.23E+23	1.14E+24	1.17E+20	7062.045
S.E. equation	9.26E+10	2.09E+11	2.12E+09	16.48081
F-statistic	8.451205	7.207172	1.184713	4.559862
Log likelihood	-954.2690	-983.6248	-818.3799	-146.1033
Akaike AIC	53.57050	55.20138	46.02111	8.672404
Schwarz SC	54.01037	55.64124	46.46097	9.112270
Mean dependent	-1.43E+09	-2.90E+08	-45477952	11.09337
S.D. dependent	1.58E+11	3.37E+11	2.17E+09	22.80907
Determinant resid covariance (dof adj.)		1.36E+65		
Determinant resid covariance		3.70E+64		
Log likelihood		-2880.458		
Akaike information criterion		162.4699		
Schwarz criterion		164.4053		

**Source: Eview 10.0 2022.**

The VECM result revealed that foreign investment and domestic investments has positive short and long run impact on the manufacturing sector. As both has positive coefficient signs and are all statistically significant. However, exchange rate shows a negative short and long run impact on the manufacturing sector.

The result further shows the existence of long run causality running from the independent variables to dependent variable because of the negative sign of the error term. In addition, the result revealed a 55% annual speed of adjustment to equilibrium restoration.

#### Wald Test:

Equation: Untitled

Test Statistic	Value	Df	Probability
F-statistic	4.466621	(9, 27)	0.0012
Chi-square	40.19958	9	0.0000

Source: Eview 10.0 2022.

The WALD test result shows the absence of short run causality running from the independent variables to the dependent variable, as the probability values is less than 5%

## Residual Test

### Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.652727	Prob. F(3,24)	0.0716
Obs*R-squared	9.213687	Prob. Chi-Square(3)	0.0266

The serial correlation result shows that there is no serial correlation as the probability value is more than 5%.

### Breusch-Pagan-Godfrey Heteroskedasticity Test

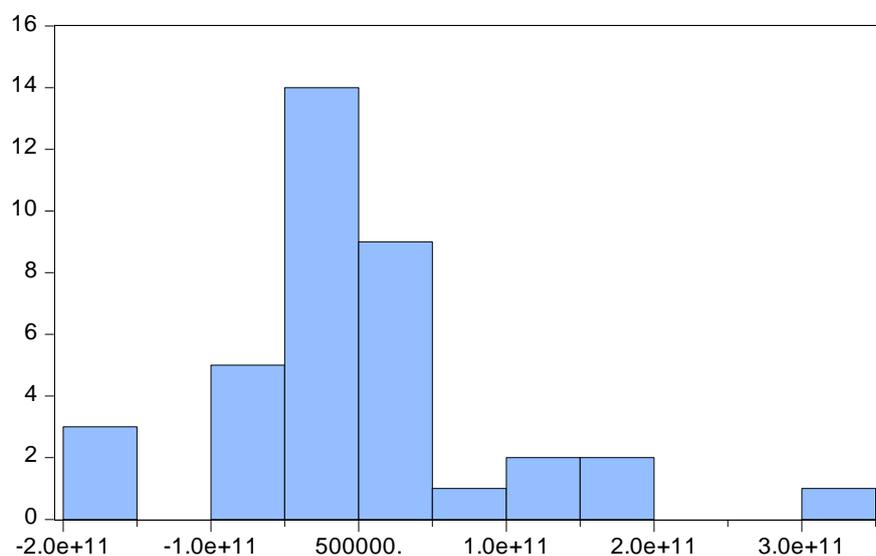
The heteroskedasticity test was conducted and the result show that observed  $R^2 = 18.25028$  and the Probability of 0.1083 which is more than 5%, thus indicating there is no heteroskedasticity problem, meaning the residuals are homoscedastic, hence valid for decision making,

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.946725	Prob. F(12,24)	0.0797
Obs*R-squared	18.25028	Prob. Chi-Square(12)	0.1083
Scaled explained SS	19.39180	Prob. Chi-Square(12)	0.0795

Source: Eview 10.0

### Normality Test



Series: Residuals	
Sample 1983 2019	
Observations 37	
Mean	4493302.
Median	-9.79e+09
Maximum	3.01e+11
Minimum	-1.84e+11
Std. Dev.	9.52e+10
Skewness	0.960729
Kurtosis	4.990567
Jarque-Bera	11.80047
Probability	0.002739

The normality test result based on the Jarque- Bera value of 11.800 which is more than 5% shows that the residuals are normally distributed. This again established the reliability of the model for policy recommendation.

## CONCLUSION AND POLICY RECOMMENDATION.

This paper examined the impact of external and domestic investments on manufacturing output in Nigeria from 1980 – 2020 using econometric approach. The result revealed the long run positive impact of both investments on manufacturing output. However, manufacturing output shows a negative respond to real exchange rate behaviour. The result aligned with the argument that foreign investment and other forms of investment have positive impact on manufacturing output and the economy in general. Therefore, the paper recommends that;

1. Robust fiscal and monetary policy measures that could stimulate dynamic foreign and domestic investments for growth and sustainability of the manufacturing sector of the economy.
2. Exchange control measures that will impact positively on the manufacturing sector both in short and long run.

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# FOREIGN DIRECT INVESTMENT AND CAPITAL FORMATION: POLICY IMPLICATIONS TOWARDS ACHIEVING PRO-POOR GROWTH IN NIGERIA

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## ABSTRACT

This study examines the links between foreign direct investment (FDI) and capital formation in Nigeria within the period of 1981-2020. The estimation approaches used are augmented Dickey Fuller test for stationarity level of our data sets and the autoregressive distributed lag (ARDL) model for short- and long- run relationship between the FDI and capital formation. The unit root test result indicated that interest rate and inflation rate were stationary at levels while other variables - FDI, government expenditure, gross domestic product, exchange rate and capital formation were reported to be stationary at first difference. Using the autoregressive distributed lag model, it confirmed that there is a long-run relationship between FDI and capital formation in Nigeria. The results further show FDI has positive and significant impact on capital formation in Nigeria. Other factors that positively influenced capital formation are government expenditure, gross domestic product and interest rate. However, exchange rate and inflation rate have negative impact on private investment in Nigeria. The study suggests the need for government to continue attracting foreign investment as it stimulates the capital formation channel towards enhancing output growth that is capable of promoting poor. Also, the financial sector most especially the apex bank, should ensure proper mobilization of investible fund in the economy through high saving deposit rates and accessibility of such fund by private investors through low lending rate.

**Keywords:** FDI inflows, capital formation, government spending, and income.

**JEL Classification:** E22, F21, H54, O16.

## 1. INTRODUCTION

Over the past decades, one of the major objectives of every economy is to achieve a rapid economic growth and development that is able to reduce poverty, creation of employment opportunities and the entire promotion of the welfare of the citizenry. Virtually, almost all development theories believe that this economic growth can be achieved through the accumulation of physical and human capital among other things. Hence, the accumulation of capital can come in the form of Foreign Direct Investment (FDI) and domestic investment which are the central issues on which this research work revolves (Okoli and Agwu, 2015; Alimi and Alese, 2017; Contractor *et al.*, 2020; Joghee, Alzoubi, and Dubey, 2020).

Nigeria as one of the developing countries of the world, has adopted a number of measures aimed at accelerating growth and development in the domestic economy, one of which is to attract foreign direct investment (FDI). Ugwuegbe *et al* (2012) and Adebayo and Gambiyo (2020) noted that the underdeveloped nature of the Nigerian economy that essentially hindered the pace of her economic development has necessitated the demand for Foreign Direct Investment into the country. This is in line with the understanding that FDI contributes positively to the growth of domestic economy. Khan (2007) asserts that FDI has emerged as the most important source of external resource flows to developing countries over the years and has become a significant part of capital formation in these countries, though their share in the global distribution of FDI continued to remain small or even declining. The role of FDI has been widely recognized as a growth-enhancing factor in the developing countries.

Many researchers have looked at the impact of FDI on the growth of Nigerian economy (Aremu, 1997; Adelegan, 2000; Otepolo, 2002; Bello, 2003; Akinlo, 2004; Umah, 2007; Shiro,

2009) with mixed findings arising from different studies on different time periods as well as different methodologies. However, not many of these studies have actually taken a closer look at the long run relationship that exists between FDI and capital formation in Nigeria. Nonetheless, capital formation has been an important channel through which FDI has employed to enhance the economic growth of developing economies. The only attempt to consider this is the study of Orji and Mba (2011) that employed Cobb–Douglas production function in determining the long run relationship between FDI, capital formation and economic growth in Nigeria. Although, they found that there is a long run relationship between FDI, capital formation and economic growth, but the focus is not on factor enhancing capital formation most especially through foreign direct investment.

Nigeria is one of the few countries that have benefited from the FDI inflow to Africa. According to the Central Bank of Nigeria (CBN, 2004), Nigeria's share of FDI inflow to Africa averaged around 10%, from 24.19% in 1990 to a low level of 5.88% in 2001 up to 11.65% in 2002. United Nations Conference on Trade and Development (UNCTAD, 2004) showed Nigeria as the continent's second top FDI recipient after Angola in 2001 and 2002. The nominal FDI inflow ranged from US\$205 million in 1970 to US\$587.88 million in 1990, US\$1,140.17 million in 2010, and US\$8,841.11 million in 2011 (World Bank, 2018). The net inflow of FDI has reduced drastically in the succeeding years. For instance, the nominal values are US\$7,069.93 million, US\$4,651.47 million, US\$4,445.10 million and US\$3,497.23 million in 2012, 2014, 2016 and 2017 respectively. However, FDI forms a small percentage of the nation's gross domestic product (GDP), however, making up 1.637% in 1970, -1.15% in 1980, 10.83% in 1990, 3.17% in 2002, 1.53% in 2012 and 0.93% in 2017 (World Bank, 2018).

This study therefore investigates the link between foreign direct investment and capital formation in Nigeria within the periods of 1981 to 2020. The focus of this study is to aid policy formulation towards attracting adequate foreign direct investment for the country. The ARDL bounds testing approach was employed for this study because of the small sample which spans between 1981 and 2020. The estimation approach is found to be more efficient for studies with small and limited sample sizes, and also applicable where the control variables are endogenous (Pesaran *et al.*, 2001; Haug, 2002; Narayan and Smyth, 2005; Alimi, Yinusa and Ilo, 2016; Alimi, 2017; Maku and Alimi, 2018). Further, it is an improvement over previous studies that relied on the residual-based cointegration test connected with work by Engle and Granger (1987) and the maximum likelihood test linked with Johansen and Juselius (1990). Salient research questions this study addressed are: Is there any kind of relationship between FDI and capital formation? To what extent did FDI influence capital formation both in short- and long-run?

Other parts of the study are divided into four sections. Section two reviews the existing theoretical and empirical literature. Section three covers methodology, data description and sources. Section four presents discussion of the findings while section five concludes and proffers proper policy recommendation.

## **2. LITERATURE REVIEW**

### **2.1 Conceptual Literature**

According to Ghirmay and Cadet (1998) Foreign direct investment (FDI) refers to the ownership of assets in a foreign country. It occurs in two ways. One involves the acquisition of domestic firms by foreign investors, including the purchase of stocks in domestic corporations in which the foreign investor has significant equity. The other method of foreign direct investment is the construction of new production facilities in the foreign country - either brand-new subsidiaries or expansion of existing subsidiaries. Foreign direct investment involves not only a transfer of resources but also the acquisition of control. In most cases, the subsidiaries not only have a financial obligation to the parent company, but it is part of the same organizational structure. World Bank (1996) looked at FDI as an investment made to acquire a lasting management interest (normally 10% of voting stock) in a firm or an enterprise operating in a country other than that of the investor defined according to residency. However, Foreign Direct Investment (FDI) is often seen as an important catalyst for economic growth in the developing countries because it affects the economic growth by stimulating domestic investment, increase in capital formation and by facilitating the technology transfer in the host countries (Falki 2009). Multinational corporations are the major players in foreign direct investment. They often establish new businesses in foreign countries or provide the foreign subsidiaries with capital, in the expectation of creating a profitable integration of their operations. Many factors determine multinational corporations' decision about where to locate foreign subsidiaries or undertake significant foreign direct investment. Ghirmay and Cadet (1998) identified these key factors responsible for the location of foreign subsidiaries to include low unit labor costs, adequate economic infrastructure, large domestic markets, and government regulations, and political instability in the host country. Most big corporations now have foreign subsidiaries supplying components to the parent company or producing the same good or service. And this has led to increase in the volume of capital accumulation in the host country.

On the other hand, Bakare (2011) described capital formation as the proportion of present income saved and invested in order to augment future output and income. It usually results from acquisition of new factory along with machinery, equipment and all productive capital goods. Capital formation is equivalent to an increase in physical capital stock of a nation with investment in social and economic infrastructure. Gross fixed capital formation can be classified into gross private domestic investment and gross public domestic investment. The gross public investment includes investment by government and public enterprises. Gross domestic investment is equivalent to gross fixed capital formation plus net changes in the level of inventories.

### **2.2 Theoretical Literature**

Accelerator theory of investment, a Keynesian concept, postulates that whenever investment expenditure increases either demand or income increases. The theory stipulates that capital investment outlay is a function of output. For instance, a rise in national income, as measured by the gross domestic product (GDP), would see a proportional increase in capital investment spending. The theorists argued that when income or consumption increases, investment will increase by a multiple amount which is against the Keynesian concept of multiplier that as the investment increases, income increases by a multiple amount. As regards the foreign direct investment, Ugwuegbe (2012) noted that the center-piece of the neoliberal School otherwise known as the Pro-Foreign Investment School is that FDI can provide crucial help in modernizing the industrial order for the developing countries. They also believed that Transnational Corporations (TNCs), through their FDI, could provide much of the 'motor' needed

for economic growth in developing countries (Penrose, 1961 and Chenery and Stout, 1966). As opposed to the claim of the dependency theorists that FDI leads to transfer of economic control and wealth to foreign powers ultimately leading to economic marginalization of the FDI host countries, neo-liberals argue that FDI provides vast benefits to recipient firm and host economies of TNCs affiliates (Matzner, 1996). Firstly, they believe that FDI brings crucial western knowledge and value in the form of superior Western management qualities, business ethics, entrepreneurial attitudes, better labour/capital ratio, and production techniques. Secondly, FDI makes possible industrial grading by tying firms of developing countries hosting TNCs affiliates into global research and development (R&D) networks, and thus resulting in technology transfer as well as providing a greater deal of investment fund (Fisher and Gelb 1991). Thirdly, FDI leads to the growth of enterprises by providing access to Western markets. This growth in turn provides a source of new jobs and stimulates demand for input from domestic suppliers. And so, FDI introduces new market entrant beyond the domestic economies hosting TNCs affiliates (Apter, 1965). However, Bende-Nabende and Ford (1998) submit that the wide externalities in respect of technology transfer, the development of human capital and the opening up of the economy to international forces, among other factors that come along with FDI, have served to change the pace of economic growth.

### **2.3 Empirical Literature**

A number of studies have analyzed the relationship between FDI inflows and economic growth, but the issue is far from settled in view of the mixed findings reached. According to Buckley *et al.* (2002), the extent to which FDI contributes to growth depends on the economic and social conditions or, in short, the quality of environment of the recipient country. This quality of environment he noted relates to the rate of savings in the host country, the degree of openness and the level of technological development. Host countries with high rate of savings, open trade regime and high technological product would benefit from increased FDI to their economies. De Gregorio (2003) while contributing to the debate on the importance of FDI, notes that FDI may allow a country to bring in technologies and knowledge that are not readily available to domestic investors and, in this way, increase productivity growth throughout the economy. FDI may also bring in expertise that the country does not possess, and foreign investors may have access to global markets; in fact, he found that increasing aggregate investment by 1 percentage point of GDP increased economic growth of Latin American countries by 0.1% to 0.2% a year, but increasing FDI by the same amount increased growth by approximately 0.6% a year during the period 1950-1985, thus indicating that FDI is three times more efficient than domestic investment.

De Gregorio (2003) did a panel data analysis of 12 Latin American countries in the period 1950-1985 and his results suggest a positive and significant impact of FDI on economic growth. In addition, he noted that the productivity of FDI is higher than the productivity of domestic investment for the period under review. Findings of Xu, (2000) for US FDI in 40 countries for the period 1966-1994 also support the findings of De Mello (1990) that technology transfer from FDI contributes to productivity growth in developed countries but not in developing countries, which he attributes to lack of adequate human capital.

In contrast to this submission by the pro-foreign investment school, the dependency theory advocates FDI as the advanced guard for a new diplomacy of economic imperialism (Bailey, 1995; Inziet, 1994; Aslund, 1995; Ake, 1996; Landsburg, 1979; Hejidra, 2002). This school is of the opinion that FDI adversely affect the development of the host country by disarticulated development, exploitation of the domestic economy by the TNCs, creating room for uneven development between the industrially developed nation and that of developing and developed

nations alike. They also argued that it perverts social and political structure of the host nations as well destroy their cultural pattern.

Gilpin (1987) asserts that dependency theorists recommended that what is needed to end the exploitation mentioned above is the destruction of the linkage between international capitalism and the domestic economy. This, he noted, can be achieved through the political triumph of a revolutionary national leadership that will overthrow the clientele elite and replace it with one desirous of independent economic development programs.

Durham (2004), for example, failed to establish a positive relationship between FDI and growth, but instead suggests that the effects of FDI are contingent on the “absorptive capability” of host countries. Firebaugh (1992) lists several additional reasons why FDI inflows may be less profitable than domestic investment and may even be detrimental. The country may gain less from FDI inflows than domestic investment because multinationals are less likely to contribute to government revenue; FDI is less likely to encourage local entrepreneurship; multinationals are less likely to reinvest profits; they are less likely to develop linkages with domestic firms; and are more likely to use inappropriately capital-intensive techniques. FDI may be detrimental if it crowds out domestic businesses and stimulates inappropriate consumption pattern.

There has not been a consensus in the findings of different scholars as to how FDI contribute to the growth of domestic economy. This however can be attributed to the inability of these researchers to take a look at the impact of FDI on major macroeconomic variables. Little or no study has actually considered the impact of FDI on capital formation which is crucial for economic growth and development of any domestic economy. Economic theories have shown that capital formation plays a crucial role in the models of economic growth (Beddies 1999; Gbura and Thadjimichael 1996, Gbura, 1997). This view called capital fundamentalism by Youopoulos and Nugent (1976) has been reflected in the macroeconomic performances of many countries.

According to Bakare (2011) in 1986, the government of Nigeria considered the need for improvement in capital information and pursued an economic reform that shifted emphasis on private sector. The public sector reforms were expected to ensure that interest rates were positive in real terms and to encourage savings, thereby ensuring that investment funds would be readily available to the real sector. Besides this, the reforms were expected to lead to efficiency and productivity of labor; efficient utilization of economic resources, increase aggregate supply, reduces unemployment and generate low inflation rate. For example, during 1980s, gross fixed capital formation average 21.3 percent of GDP in Nigeria. This proportion increased to 23.3 percent of GDP in 1991 and declined to 14.2 percent of GDP in 1996. It picked and increased to 17.4 percentage in 1997 and average 21.7 during 1997 to 2000. The gross capital formation rose from 22.3 percent of GDP in 2000 to 26.2 percent in 2003 and declined drastically to 21.3 percent in 2005.

Omorokunwa and Ajao (2019) examine the impacts of fiscal policy on public-private investment in Nigeria using an annual data of 1981-2016. Employing the ARDL bound estimator, they found that expenditures have direct effect on investment both in short-run and long-run with a weak negative influence. The result implies that there is need for government fiscal policy to focus more inwards on a long-term increase of investment in Nigeria. Mabula and Mutasa (2019) investigate the extent at which public debt impacted on private investment in Tanzania for the period of 1970-2016. Using an Autoregressive Distributed Lag (ARDL) bound test, the results suggest a significant nonlinear long run and short run relationship between external debt and private investment. At the conventional level, the study found no

significant evidence of long run and short run relationship between domestic debt and debt service as well as for private investment. Yet, the combined effect of domestic and external debt on private investment is statistically significant both in long run and short run. While investigating the effects of fiscal policy on private investment in Nigeria using an annual data from 1980 to 2017, Abdulkarim and Saidatulakmal (2021) found that direct taxes are distortive and stifle private investment growth, whereas indirect taxes encourage it. Also, capital spending enthused private investment while external debt impeded it.

Olaoye (2019) examines the relationship between external debt and private investment in Nigeria for the periods 1981-2016. Based on the debt overhang and financing gap theories, the results show that private investment is indirectly related to debt overhang both in the short-run and long-run. Further, a marginal increase in the current year debt service leads to a higher growth than the proportionate decrease in current ratio of debt overhang. Finally, interest rate, exchange rate and inflation rate positively impacted on debt overhang ratio. While examining the relationship between external financing and industrial sector output between 1986 and 2018, Imoughele (2020) found a long run relationship between industrial sector output and selected external financing variables such as foreign direct investment, foreign private investment, remittance, and official development assistance. Further, the study found that external financing significantly impacted on the country's industrial output in the short-run. Meanwhile, in the long run, foreign direct investment, remittance and official development assistance have direct and significant effect on Nigeria industrial output.

Evidence from past studies shows the need to conduct an empirical investigation between FDI and capital formation as there are few studies conducted in developing countries including Nigeria. Also, the existing empirical evidence on the causal relationship between FDI and capital formation and the associated benefits is very inconclusive. In spite of a seemingly positive association between FDI and capital formation, the empirical literature has not reached a consensus on the direction of this impact however suggesting that Foreign Direct Investment can be either beneficial or harmful to capital formation. The principal driving force for this work is that for developing economies, and for Nigeria in particular, the issue of capital formation is an important one. The country has been stimulating growth with the help of various techniques, including policies that would aim at foreign capital and technology transfer. It is thus, of interest to investigate whether the start of growth can be attributed to weak capital formation which has not discouraged inflow of FDI into the country over the period under review.

### **3. METHODOLOGY**

#### **3.1 Theoretical Framework and Model Specification**

The theoretical foundation of this study hinged on the accelerator theory of investment to explain the macroeconomic determinants of investment in Nigeria. The theory states that when income or consumption increases, investment will increase by a multiple amount. It implies that when the income and consumption of the people increases, there is a need for a higher amount of the commodities to be produced. Thus, it will require more capital to produce more goods since the already given stock of capital is fully used. The investment in this case, is induced by changes in income or consumption which is known as induced investment. The accelerator is the numerical value of the relation between the increases in investment resulting from an increase in income. The net induced investment will be positive if income increases and induced investment may fall to zero if the income or output remains constant.

The hypothetical illustration of the theory shows that if a certain amount of output ( $Y$ ) is

required to be produced and the capita-output ration is  $\alpha$  , the required amount of investment to produce the required output ( $Y$ ) is given as:

$$K_t = \alpha Y_t \quad (1)$$

Where;  $K$  is the stock of capital;  $Y$  stands for the level of output or income;  $\alpha$  is the capital – output ratio; and  $t$  is time. The capital-output ratio  $\alpha$  is  $K/Y$  and in the theory of accelerator, the capital output ratio is assumed to be constant. Therefore, under the assumption of constant capital output ratio, changes in output are made possible by changes in the stock of capital.

The study of Ghura and Goodwin (2000) employed the following framework for the analysis of the determinants of domestic investment using panel data from (31) developing countries. The model is stated as:

$$K_t = \alpha + \beta X_t + \mu_t \quad (2)$$

Where;  $K$  represents capital stock,  $X$  are the observable variables representing factors affecting capital formation,  $\alpha$  and  $\beta$  are parameters, and  $\mu$  is a random error term with a mean of zero.

Several studies have also been conducted by including a quite number of exogenous variables in the capital formation equation such as foreign direct investment, financial intermediation, exports, human capital, and domestic credit availability (Ghura and Goodwin, 2000; Fry, 1998; Agrawal, 2000). This study modified the model by stating the capital formation measured by gross fixed capital formation as a function of FDI, output, interest rate, inflation rate, exchange rate and government expenditure, which is stated as:

$$CAP_t = \alpha_0 + \beta_1 FDI_t + \beta_2 GDP_t + \beta_3 INT_t + \beta_4 INF_t + \beta_5 EXR_t + \beta_6 GEP_t + \nu_t \quad (3)$$

Where;  $CAP$  is capital formation;  $GDP$  is gross domestic product;  $INT$  is interest rate;  $INF$  is inflation rate;  $EXR$  is exchange rate;  $GEP$  is government expenditure;  $\alpha_0, \beta_{1-6}$  are parameters;  $t$  is time;  $\nu$  is error term.

### 3.2 A'Priori Expectation

The study expects the FDI and GDP to exert positive effect on capital formation. This implies that as the aggregate demand of the Nigerian economy increases, the level of capital formation will increase. It further indicates that an economy with high inflow of foreign capital will build up the capital formation of domestic investors. The study expects an inverse relationship between capital formation and interest rate. An increase in interest rate will push the cost of capital upward which will reduce the volume of economic activities, and thus, the level of capital formation. However, in a developing country like Nigeria, its effect on capital formation is ambiguous because there is also the argument that a higher real interest rate increases the flow of bank credits, which complements the private sector savings and enhances capital formation and hence private sector investment.

Similarly, the effect of real exchange rate on capital formation is also ambiguous. This is so because on one hand a higher level of real exchange rate reduces capital formation in the sense that the devaluation of a nation's currency means a fall in the real income of the economy as a whole, thus reducing productive capacity, increase the real cost of purchasing imported capital goods, which will eventually lead to a decline in the profitability of the private sector and ultimately a fall in capital formation. Conversely, real exchange rate can also have a positive relationship with capital formation. This occurs when currency devaluation in an economy enhances its competitiveness with the rest of the world and also expands its exports volumes.

This type of scenario makes a country look inward, relies majorly on its internal resources and industries thereby boosting capital formation in the country.

The inflation rate is expected theoretically to be negatively related to capital formation. This is due to the fact that as inflation increases, the value of real money falls, cost of production increases volume of economic activity reduces, profit falls, performance drops and ultimately, capital formation reduces.

### 3.3 Data: Approaches, Scope and Source

The study utilized the Autoregressive Distributed Lag (ARDL) bounds approach by Pesaran, Shin and Smith (2001) to examine the effect of foreign direct investment on capital formation in the long and the short run periods in Nigeria. With this approach, capital formation is expressed as a function of the lagged value of itself and the current and the lagged values of the explanatory variables. Prior to the ARDL bound test, the study examines the stationarity level of the indicators using the Augmented Dickey Fuller (ADF) test. The Econometric Views 9.0 was used as the statistical package for the estimation of the multiple regression models. The estimated parameters are subjected to evaluation by using the student t-statistic test and F-statistic test. The scope of our data spans from 1981 to 2020 and are sourced from Central Bank of Nigeria (2020) and World Development Indicators (2020). The time frame for the analysis is chosen based on availability of data from various sources.

## 4. RESULT AND DISCUSSION OF FINDINGS

### 4.1 Descriptive Analysis

This section deals with econometric analysis between FDI and capital formation in Nigeria between 1981 and 2020. Table 1 presents the descriptive analysis of the time series properties of the variables included in the model. The descriptive statistics was carried out to illustrate the FDI determinant of capital formation in Nigeria from 1981 to 2020. The table shows that the mean value of government expenditure (GEP), gross domestic product (GDP), exchange rate (EXR), interest rate (INT), inflation rate (INF), foreign direct investment (FDI) and capital formation (CAP) stood at ₦1,525.34 billion, ₦31,757.15 billion, ₦76.59/US dollar, 13.01%, 19.6%, ₦372.12 billion and ₦5,113.11 billion correspondingly. The standard deviation of government expenditure (GEP), gross domestic product (GDP), exchange rate (EXR), interest rate (INT), inflation rate (INF), foreign direct investment (FDI) and capital formation (CAP) from their respective long term mean values every year point at ₦1,850.78 billion, ₦18,151.71 billion, ₦72.04/US dollar, 4.21%, 17.69%, ₦453.91 billion and ₦3,973.31 billion respectively.

**Table 1:** Descriptive Statistics

	CAP	FDI	GDP	GEP	EXR	INT	INF
Mean	5113.11	372.12	31757.15	1525.34	76.592	13.014	19.603
Median	2804.75	103.78	22391.14	594.09	57.372	13.000	12.547
Maximum	15782.54	1360.31	69023.93	5185.32	253.492	26.000	72.836
Minimum	1798.58	0.145	13779.26	9.637	0.610	6.000	5.3822
Std. Dev.	3973.31	453.91	18151.71	1850.78	72.039	4.209	17.690
Skewness	1.290	0.868	0.875	0.955	0.424	0.691	1.665
Kurtosis	3.451	-0.796	2.318	2.323	1.986	4.066	4.527
Observations	40	40	40	40	40	40	40

Source: Author's computation (2022).

### 4.2 Unit Root Test Results

Table 2 presents the results of the time series properties of the variables included in the model. This pre-test was carried out before estimating the long-run and short-run relationship among

FDI, government expenditure, gross domestic product, exchange rate, interest rate, inflation rate and capital formation in Nigeria (1981-2020).

**Table 2:** ADF Unit Root Test Results

Variables	ADF Tau Statistics		Order of Integration
	Intercept	Linear Trend	
<b>GEP</b>	-7.8354 (0) [-3.5885]*	-7.7913 (0) [-4.1809]*	1
<b>GDP</b>	-6.4689 (0) [-3.5885]*	-6.4355 (0) [-4.1809]*	1
<b>EXR</b>	-9.5300 (0) [-3.5885]*	-9.4213 (0) [-4.1809]*	1
<b>INT</b>	-3.7427 (1) [-3.5885]*	-3.7158 (1) [-4.1809]**	0
<b>INF</b>	-3.7626 (3) [-3.6617]*	-3.8085 (4) [-3.5684]**	0
<b>FDI</b>	-6.7828 (2) [-3.5728]*	-6.8891 (2) [-4.3832]*	1
<b>CAP</b>	-5.9107 (0) [-3.5885]*	-6.4217 (0) [-4.1809]*	1

**Note:** \* significant at 1%; \*\* significant at 5%; \*\*\* significant at 10% Mackinnon critical values and are shown in parenthesis. The lagged numbers shown in brackets are selected using the minimum Schwarz and Akaike Information criteria.

**Source:** Author's computation (2022).

The Augmented Dickey Fuller (ADF) unit root test results is presented in Table 2 indicate that interest rate (INT), inflation rate (INF) were stationary at levels [I(0)]. However, FDI, government expenditure (GEP), gross domestic product (GDP), exchange rate (EXR) and capital formation (CAP) were reported to be stationary at first difference [I(1)]. Thus, these series are non-mean reverting at levels and do not converge to their long-run equilibrium until they are first differenced.

### 4.3 Autoregressive Distributed Lag (ARDL) Results

Econometric literature argued that regressing a stationary series on non-stationary series has severe implications in drawing policy inference. The data series provides evidence for the use of Autoregressive Distributed Lag (ARDL) technique of analysis. As posited by Pesaran *et al.*, (2001), ARDL is more suitable for variables at different order of integration. The F-statistics estimate for testing the existence of long-run relationship between FDI, control variables (such as FDI, government expenditure, gross domestic product, exchange rate, inflation rate and interest rate) and capital formation in Nigeria are presented in Table 3.

**Table 3:** Existence of Long-Run relationship between FDI and Capital Formation

Test Statistic	Value	K
F-statistics (CAP  FDI, GEP, GDP, EXR, INT, INF)	6.9177	45
Critical Value Bounds		
Significance	I0 Bound	I1 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 (2022).

The estimated F-statistics of the normalized equations ( $F_{arb} = 6.918$ ) is greater than the lower and upper critical bound at 1% significance level. It implies that the null hypothesis of no long-run relationship is rejected at 1% significance level. The implication of the above estimation is that FDI, control variables (such as government expenditure, gross domestic product, exchange rate, inflation rate and interest rate) and capital formation, all have equilibrium condition that keep them together in the long-run. Thus, there exists a long-run relationship between FDI and capital formation in Nigeria.

**Table 4: Long Run Coefficients [ARDL: 3,1,0,0,2,0,0]**

<b>Dependent Variable: Capital Formation (CAP)</b>				
<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob.</b>
<b>FDI</b>	0.672831	0.267681	2.513555	0.0020
<b>GEP</b>	1.049933	0.918427	1.143187	0.2652
<b>RGDP</b>	0.533420	0.114415	4.662144	0.0001
<b>EXR</b>	-44.565692	9.512391	-4.685015	0.0001
<b>INT</b>	41.348569	66.276542	0.623879	0.5391
<b>INF</b>	-0.271474	14.176285	-0.019150	0.9849
<b>C</b>	-808.818986	209.419908	-3.865644	0.0008

Source: Author's computation (2022).

### 4.3.1 Results of Long-run Estimates of FDI and the Level of Capital Formation in Nigeria using the ARDL Approach

The table below reveals the long-run estimates of factors determining private investment in Nigeria. The long-run estimates suggested that foreign direct investment (FDI), government expenditure (GEP), gross domestic product (GDP) and interest rate (INT) have positive impact on capital formation (CAP) in Nigeria. All these conform with theoretical expectation except interest rate. Specifically, a one unit point increase in foreign direct investment (FDI), government expenditure (GEP), gross domestic product (GDP) and interest rate (INT) increase capital formation (CAP) by 0.67, 1.05, 0.533 and 41.35 respectively. However, exchange rate (EXR) and inflation rate (INF) have negative impact on capital formation (CAP) in Nigeria. This does conform with a priori expectation. Thus, if the exchange rate (EXR) and inflation rate (INF) increase by one unit point, capital formation (CAP) is expected to reduce by 44.57 and 0.27 respectively.

### 4.3.2 Error Correction Models using the ARDL Approach

The short-run dynamic relationship between foreign direct investment and capital formation in Nigeria indicating the second part of the estimated ARDL model is reported below in Table 5. The lag lengths were selected based on Akaike Information Criterion (AIC). The table below reveals the short-run dynamic estimates among variables of interest.

**Table 5: Estimated Short-run Error Correction Model [ARDL: 3,1,0,0,2,0,0]**

<b>Dependent Variable: Private investment (<math>\Delta</math>INV)</b>				
<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob.</b>
<b>D(CAP(-1))</b>	0.117765	0.136291	0.864072	0.3969
<b>D(CAP(-2))</b>	0.312229	0.148058	2.108830	0.0466
<b>D(FDI(-2))</b>	0.517893	0.238302	2.173263	0.0321
<b>D(GEP(-1))</b>	-0.481253	0.390551	-1.232241	0.2309
<b>D(RGDP(-1))</b>	0.244501	0.051691	4.730031	0.0001
<b>D(EXR(-1))</b>	8.961838	6.741685	1.329317	0.1974
<b>D(EXR(-2))</b>	20.607542	8.361808	2.464484	0.0220
<b>D(INT(-1))</b>	18.952730	30.685213	0.617650	0.5431
<b>D(INF(-1))</b>	-0.124434	6.494522	-0.019160	0.9849
<b>ECT(-1)</b>	-0.458365	0.098716	-4.643272	0.0001

Source: Author's computation (2022).

The short-run estimates suggested that the first and second lags of capital formation (CAP) exact positive impact on the current level of capital formation (CAP) in Nigeria. Thus, the short-run estimate of the lags of FDI was also consistent with the findings in long-run. The coefficients of other control variables were also reported in Table 5. The error correction term

indicates the speed of adjustment to restores equilibrium in the model. The value is negative also significant at 1% significance level. Specifically, the lag of the error correction term (ECT) was found statistically significant at 1% level with the co-efficient of -0.4584. This indicates that 45.8% of the distortion in the short-run is corrected in the first year in attaining equilibrium or capital formation on the basis of the changes in its factor determinants like FDI, government expenditure, gross domestic product, exchange rate, inflation rate and interest rate in Nigeria.

#### 4.4 Diagnostic Tests

The estimated ARDL model is tested for heteroscedasticity, serial correlation, functional form misspecification, parameter stability and normality. The results from these tests are shown in Table 6.

**Table 6:** Diagnostic Tests of Selected ARDL Model

Results	
<b>Serial Correlation:</b> 0.1581 [0.8548]	<b>Normality Test:</b> 0.1372 [0.9337]
<b>Functional Form:</b> 0.5878 [0.5629]	<b>Heteroskedasticity Test:</b> 4.0669 [0.0029]

**Source:** Author's computation (2022).

The estimated ARDL model revealed that the model passed the serial correlation and normal test but failed the heteroskedasticity tests. However, the Ramsey RESET test was also satisfactory for the ARDL model.

### 5. CONCLUSION AND POLICY RECOMMENDATIONS

This study investigates the links between foreign direct investment and capital formation in Nigeria for a period of 1981 to 2020. The unit root test result using augmented Dickey Fuller test indicated that interest rate and inflation rate were stationary at levels. However, FDI, government expenditure, gross domestic product, exchange rate and capital formation were reported to be stationary at first difference. Thus, these series are non-mean reverting at levels and do not converge to their long-run equilibrium until they are first differenced.

Using the autoregressive distributed lag model, the results show that all FDI and capital formation have equilibrium condition that keeps them together in the long-run. The findings further show that FDI, government expenditure, gross domestic product and interest rate have positive impact on private investment in Nigeria and all these conform with theoretical

expectation except interest rate. However, exchange rate and inflation rate have negative impact on private investment in Nigeria. The short-run estimates suggested that the first and second lags of capital formation exact positive impact on the current level of capital formation in Nigeria. Thus, the short-run estimates of the lags of FDI reported positive and significant effects. The first-lag of the error correction term (ECT) was found statistically significant at 0.05 critical value and correctly signed with the co-efficient of -0.4584. This indicates that 45.84% of the distortion in the short-run is corrected in the first year in attaining equilibrium or capital formation on the basis of the changes in FDI and other factors like government expenditure, gross domestic product, exchange rate, inflation rate and interest rate in Nigeria.

The study suggests that the need for government to continue to attract foreign investment as it stimulates the capital formation channel towards enhancing output growth that is capable of promoting poor. Also, the financial sector most especially the apex bank, should ensure proper mobilization of investible fund in the economy through high saving deposits rates and accessibility of such fund by private investors through low lending rate. The study further noted that the Minimum Rediscounting Rate (rechristened Monetary Policy Rate (henceforth MPR) by the Central Bank of Nigeria in 2006), which is under the perpetual grip of the Central Bank of Nigeria, has the capacity to influence other rates of interest in the economy, hence should be used adequately.

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# ANALYSIS OF THE DETERMINANTS OF CAPITAL FLIGHT IN NIGERIA

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## ABSTRACT

The objective of this research is to analyze the determinants of capital flight in Nigeria within the context of the Autoregressive Distributed Lag (ARDL) estimation technique. The study utilizes annual data for the period from 1981 to 2018. The bound test result confirms the existence of cointegration, furthermore, the study reveals that GDP growth rate, financial development, external debt, inflation and natural resources endowment are statistically significant and determinants of capital flight in Nigeria both in the long and short run. The study therefore, recommends the need for government to provide a stable financial and macroeconomic environment, address the decay in the critical infrastructure and also ensure that all external loans are invested into productive projects that give higher returns on investment.

**Keywords:** Capital flight, Determinants, Autoregressive Distributed Lag Approach, Nigeria.

**JEL Classification:** C22, F21, G11.

## 1. INTRODUCTION

Capital flight is the exit of private residents own capital for safe haven or for investment purpose. The subject began to emerge as an important economic challenge in the seventeenth century in Europe and in the twentieth century in the United State of America (Kindleberger, 1987). In the 1930s, and after World War II, concerns about capital flight became the subject of debates in development and financial economics. Capital flight regained momentum in the early 1980s when some Latin American countries (Brazil, Mexico, Argentina etc.) experienced series of sovereign debt default due to the phenomenon. Since then capital flight became one of the most widely discussed topics among researchers and policy makers across the globe.

Nigeria, like its many counterparts, has also witnessed a massive outflow of capital. The country is endowed with huge resources that can contribute to its development, but poor governance has stripped the country of its potential for growth and development. The possible disruptive effects of capital flight on Nigerian economy looks more severe and glaring when one considers the magnitude of the flight capital from Nigeria. Hermes and Lensink (1992) studied six SSA countries including Nigeria and reported that Nigeria had the largest prevalence of capital flight of US\$21 billion, representing 60% of the total capital flight from the six countries. The scale of capital flight in Nigeria is assuming increasing significance. In

the two decades from 1970, the scale of the challenge was modest, standing at \$7,573 million between 1972 and 1989. In contrast, between 2010 and 2018 the country lost an estimated sum of US\$12.84 (World Development Indicator, 2018). This massive capital flight has drained the country's financial resources for appropriate economic development, worsening the capital scarcity problem and deepening inequality (Ajayi, 1995).

A considerable number of studies had focused on discussing potential factors that may determine the occurrence and size of capital flight in Nigeria. (Lawanson, 2007; Bakare, 2011; Adekunle, 2011; Saheed and Ayodeji, 2012; Henry, 2013; Omoke, 2014; Uguru, Ozor and Nkwagu, 2014, Ayadi, 2014; Olawale and Ifedayo, 2015; Mbewe, 2015; Akanbi, 2015; Clement and Ayodele, 2016 & Oluwaseyi, 2017). Looking at these studies, the contribution of the present research to the literature is the introduction of natural resources endowment and financial development as explanatory variables as well as employing the most recent cointegration technique, the Autoregressive Distributed Lag (ARDL) approach. It is to this end that the research would fill the gap identified from the previous studies by analyzing the determinants of capital flight in Nigeria.

The rest of the paper is structured as follows: section two is the review of literature while section three addresses the methodology, section four is the results and discussion of findings while section five is the conclusion and recommendations.

## **2. LITERATURE REVIEW**

### **2.1 Theoretical Literature**

In this research work, our theoretical framework will centre on theories relating to the determinants of capital flight. Thus, the following are some of the theories:

#### **Debt-driven Capital Flight Theory**

It is also called the debt overhang thesis. The assumption here is that with large foreign debt, there are expectations of exchange rate devaluation, fiscal crisis, and the propensity of the crowding out of domestic capital and expropriation of assets to pay for the debt. There is a debt-driven capital flight when residents of a country are motivated to move their assets to foreign countries as a consequence of external debt. i.e. countries borrow and at the same time engaged in capital flight. Ajayi (1995) and Boyce (1992) further coined a theoretical framework for the possible links between debt and capital flight.

#### **Investment Diversion Theory**

Kindleberger (1966) originated the investment diversion theory. The theory postulates that capital flees out of developing countries because of the macroeconomic and political uncertainty that has eaten deep into the fabric of the developing economies as well as the simultaneous existence of better investment opportunities such as high interest rates, varieties of financial instruments, political and economic stability, favourable tax climate and secrecy of accounts in developed countries.

#### **Portfolio Choice Theory**

This theory suggests that capital flight takes place in response to a deteriorating domestic investment climate where the risk-adjusted rate of return to investments is unfavourable. Residents take their money and run because of the exchange rate, or more specifically the expected rate of appreciation or depreciation of the exchange rate, the costs of transferring capital abroad (direct and indirect costs), and other determinants of the rate of investment return. Sheets (1995) is one of the first to explicitly apply a portfolio choice framework in the context of capital flight. His model suggests that capital flight is determined by the usual risk diversification motive along with two important incentives, namely relative risk and return differentials.

## 2.2 Empirical Literature

Okoli (2008) empirically analyzed the determinants of capital flight and their impact on the Nigerian economy from 1970-2005. The study employed the least square regression model and found that the type of government proved to be a significant contributor to capital flight, it also reveals that six of the twelve explanatory variables exert some significant effects on economic development, these include the total export, terms of trade, type of government, growth rate differential, inflation and sum of import and export as a ratio of GDP and capital flight exerts a negative effect on Nigeria's economic development.

Onodungo, Kalu, Anowor and Ukwani (2014) employed a two-step Engle-Granger Approach to determine the effect of changes in the exchange rate, trade balance, real GDP growth, interest rate differential, index of the political climate, and the manufacturing output on capital flight in Nigeria for the period 1970 to 2010. The study found that one period lagged capital flight and the other explanatory variables except for the exchange rate and the domestic political environment index have a significant and positive effect on capital flight.

Ayadi (2014) adopted the Least-Squares Dummy Variable (LSDV) estimator technique on panel data ranging from 1985 to 2007 to investigate the determinants of capital flight in Nigeria and South Africa. By utilizing the common coefficient and fixed effect model, capital flight according to the study is caused by the trade balance, domestic economic performance, one year lag of external debt and political instability.

Adegbite and Ojo (2014) employed Ordinary Least Squares (OLS) and Co-integration Technique to estimate and test the impact of selected economic and financial institutions' variables on capital flight in Nigeria between 1970 and 2011. The study specifically found that a high inflation rate induces capital flight while increase gross capital formation reduces it and an appreciable deposit rate on bank deposits encourages domestic savings while the credit to the private sector has not brought about the desire expectation of improving and sustaining the domestic economy.

In a time-series study, Usman and Arene (2014) empirically studied the effects of capital flight and its macroeconomic determinants on agricultural growth in Nigeria between 1970 and 2013, the study employed Ordinary Least Squares (OLS) and found that there is a negative and insignificant relationship between total capital flight and agricultural growth. In addition, total capital flight, macroeconomic instability, political instability, interest rate differential and variability in consumer price index show a negative relationship with agricultural growth.

Dim and Ezenekwe (2014) investigated the socio-economic determinants of capital flight in Nigeria from 1970 to 2012. The study employed Fully Modified Ordinary Least Square, Seemingly Unrelated Regression and Error Correction Mechanism to find out the determinants of capital flight in Nigeria. The study found that lagged capital flight, fiscal balance and exchange rate were significant determinants of capital flight in the country.

Akanbi (2015) investigated the determinants of capital flight in Nigeria from 1981 to 2010 using the Engle granger two steps procedure. The study found that the explanatory variables; defence expenditure, interest differentials, and investment individually affected capital. The study further confirmed that Nigeria is not only losing substantial amounts of funds that could be otherwise used for development and further stabilization, the capital flight also punishes long-term economic growth.

Lawal, Kazi, Adeoti, Osuma, Akinmulegun and Ilo (2017) applied the Autoregressive Distributed Lag (ARDL) model to investigate the impact of capital flight and its determinants on the Nigerian economy from 1981 to 2015. The study found the existence of a long-run relationship among the variables studied and capital flight has a negative impact on the economic growth of Nigeria.

Aderibigbe, Oyedokun and Asaolu (2019) studied the determinants of capital flight and its impact on tax bases in Nigeria from 1981 to 2015. Johansen Co-integration approach was employed and the study showed that annual borrowing, exchange rate, interest rate differentials, capital account openness, natural resource endowment and stock of external debt are key short-run and long-run determinants of capital flight in Nigeria, and that capital flight is a deterrent to tax base broadening in Nigeria and transparency in international business and finance.

### 3. METHODOLOGY

#### 3.1.1 Model Specification

The model for the study can be expressed in a simple linear econometric model, with both the dependent and independent variables specified. This is along the line of similar linear models by Forson, Obeng and BrafuInsaideo (2017).

$$KF_t = EXD_t + FD_t + FER_t + GDPGR_t + INF_t + NRE_t + EXR_t + \mu_t \quad (3.1)$$

Where, KF stands for capital flight, EXD stands for external debt, FD stands for financial development, FER stands for foreign exchange reserves, GDP stands for gross domestic product growth rate, INF stands for the inflation rate, NRE stands for natural resource endowment and EXR stands for exchange rate,  $\mu_t$  is the stochastic disturbance or error term, t as a subscript for variables stands for time trend over the period of analysis.

The ARDL specification of equation (3.1) is presented as:

$$\begin{aligned} \Delta LKF_t = & \alpha + \sum_{i=1}^q \beta_{i,1} \Delta LKF_{t-i} + \sum_{i=0}^q \beta_{i,2} \Delta LEXD_{t-i} + \sum_{i=0}^q \beta_{i,3} \Delta LFD_{t-i} + \sum_{i=0}^q \beta_{i,4} \Delta LFER_{t-i} \\ & + \sum_{i=0}^q \beta_{i,5} \Delta LGDPGR_{t-i} + \sum_{i=0}^q \beta_{i,6} \Delta LINF_{t-i} \\ & + \sum_{i=0}^q \beta_{i,7} \Delta LNRE_{t-i} + \sum_{i=0}^q \beta_{i,8} \Delta LEXR_{t-i} + KF_1 LKF_{t-1} + KF_2 LEXD_{t-1} \\ & + KF_3 LFD_{t-1} + KF_4 LFER_{t-1} + KF_5 LGDPGR_{t-1} + KF_6 LNRE_{t-1} + KF_7 LINF_{t-1} \\ & + KF_8 EXR_{t-1} + \mu_t \end{aligned} \quad (3.2)$$

Hence, the error correction format of equation (3.2) is

$$\begin{aligned} \Delta LKF_t = & \alpha + \sum_{i=1}^q \beta_{i,1} \Delta LKF_{t-i} + \sum_{i=0}^q \beta_{i,2} \Delta LEXD_{t-i} + \sum_{i=0}^q \beta_{i,3} \Delta LFD_{t-i} + \sum_{i=0}^q \beta_{i,4} \Delta LFER_{t-i} \\ & + \sum_{i=0}^q \beta_{i,5} \Delta LGDPGR_{t-i} + \sum_{i=0}^q \beta_{i,6} \Delta LINF_{t-i} + \sum_{i=0}^q \beta_{i,7} \Delta LNRE_{t-i} + \sum_{i=0}^q \beta_{i,8} \Delta LEXR_{t-i} \\ & + ECM_{t-1} \end{aligned} \quad (3.3)$$

Where ECM is the error correction version of the ARDL model and all other variables are as explained under equation (3.1).

### 3.2 Estimation Technique and Data Sources

The data set for this study basically comes from a secondary source and specifically time series data spanning the period of 1981 to 2018. It was obtained from Statistical Bulletin of the Central Bank of Nigeria (CBN), IMF's International Financial Statistics and World Bank's World Development Index (WDI) data on Nigeria. The time series data to be used for the estimation is on annual basis. Given the nature of the relationship estimated, and the stationarity properties of the variables in the model, the Auto-Regressive Distributed lag (ARDL) bounds testing approach was employed to estimate the model.

## 4. RESULTS AND DISCUSSION OF FINDINGS

### 4.1 Preliminary Tests Results

A two-pronged approach was adopted to test the general or statistical properties of the data set. First, the descriptive statistics (Table 1) showed that all the mean (average rates) of capital flight, external debt, financial development, foreign exchange reserve, GDP growth rate, inflation rate, natural resources endowment and exchange rate all have positive values. This is telling us that we have more of increase than decrease in the changes among the variables.

**Table 1: Summary Statistic of Variables Under Study**

	LKF	LEXD	LFD	LFER	GDP_GR	INF	LNRE	EXR
Mean	10.90018	17.35837	2.301656	9.115170	3.174706	19.35040	0.957035	88.54405
Median	9.712213	21.37202	2.105270	8.971974	4.212993	12.71577	0.960677	97.01772
Maximum	23.82729	22.89766	3.033669	10.97632	15.32916	72.83550	0.987242	306.0837
Minimum	5.342222	4.432212	1.777875	6.123899	-13.12788	5.388008	0.911601	0.617708
Std. Dev.	11.07956	8.423128	0.438662	1.364525	5.538560	17.24364	0.022524	87.13742
Skewness	0.017460	-1.573074	0.713433	-0.402493	-0.869820	1.741920	-0.357678	0.802967
Kurtosis	1.022385	3.562170	1.820201	2.176363	4.539286	4.838732	1.751626	2.974342
Jarque-Bera	6.194284	16.17261	5.427465	2.100103	8.543264	24.57028	3.277772	4.084502
Probability	0.045178	0.000308	0.066289	0.349920	0.013959	0.000005	0.194196	0.129736
Sum	414.2067	659.6182	87.46295	346.3764	120.6388	735.3152	36.36735	3364.674
Sum Sq. Dev.	4541.993	2625.116	7.119712	68.89136	1134.999	11001.69	0.018771	280938.4
Observations	38	38	38	38	38	38	38	38

Source: Authors' Computation using Eviews 9

Exchange rate has the highest standard deviation, which suggests that, the degree of variability in exchange rate is higher than that of any variable in the distribution. However, natural resources endowment has the lowest standard deviation, which shows that, the dispersion of the data is closer to its mean. External debt, foreign exchange reserve, GDP growth rate and natural resources endowment are negatively skewed, which suggests that majority of the distribution in these variables are concentrated to the left. Whereas, capital flight, financial development, inflation and exchange rate are positively skewed, which shows that, majority of the distribution in the variables are concentrated to the right. External debt, GDP growth rate and inflation have excess kurtosis of (3.562170, 4.539286 and 4.838732) respectively which means that, the distribution of External debt, GDP growth rate and inflation are leptokurtic in nature and exhibit fat tail (thick-tail) while capital flight, financial development, foreign

exchange reserve, natural resources endowment and exchange rate have lower values of (1.820201, 2.176363, 1.751626 and 2.974342) which is clearly lower than three (3) and implies that their distribution are platykurtic. The Jarque-Bera coefficients of foreign exchange reserve, natural resources endowment and exchange rate indicate that the series are normally

distributed. This is due to insignificant probability values of the variables in the model. Whereas capital flight, external debt financial development, GDP growth rate and inflation rate are not normally distributed because the probability values are highly statistically significant. Second, due to the inherent instability of macroeconomic time series data, testing the stationarity status of the variables becomes inevitable to avoid interpreting false regression coefficients. This research used the Augmented Dickey-Fuller and Phillips-Perron testing approaches.

**Table 2: Unit Root Test (Augmented Dickey-Fuller and Phillips-Perron)**

Variable	Augmented Dickey- Fuller		Phillips – Perron	
	Level	First Diff.	Level	First Diff.
LKF	-4.479013***	-6.340046***	-14.27278***	-4.297724***
LEXD	-5.141132***	-6.134312***	-5.096892***	-19.93602***
LFD	-2.084517	-5.447436***	-2.076703	-6.3748***
LFER	-2.996964	-6.623657***	-2.554776	-6.010643***
GDPGR	-3.372180*	-10.21163***	-3.864096**	-11.68843***
INF	-3.970083**	-5.516298*	-2.824389	-10.32628***
LNRE	-2.177818	-6.454314***	-2.203549	-7.332029***
EXR	-1.949745	-4.543708***	-1.124559	-4.372842***

Note:\*\*\*, \*\* and\* indicate significant at 1%, 5% and 10% respectively.

Source: Authors' Computation using Eviews 9

The result of the ADF test presented in Table 4.2 shows that capital flight, external debt, GDP growth rate and inflation rate were stationary at level while financial development, foreign exchange reserve, natural resources endowment and exchange rate are stationary at first difference. Similarly, from the PP test, capital flight, external debt and GDP growth rate are all stationary at level while financial development, foreign exchange reserve, inflation rate, natural resources endowment and exchange rate are all stationary after first difference. The order of integration obtained from the unit root tests permitted the study to use ARDL model.

#### 4.2 Bounds Test for Cointegration

The result of the ARDL bounds testing approach in Table 3 shows that the F-statistic value of (3.524364) is greater than the critical value bounds at 5% level of significance. Therefore, the null hypothesis of no cointegration cannot be accepted while the alternative hypothesis is accepted. This is also permitting the study to generate the long run and short run coefficients of the ARDL model.

**Table 3: ARDL Bounds Test**

Bounds Test		
F-Statistics	3.524364	7

Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	1.92	2.89
5%	2.17	3.21
2.50%	2.43	3.51
1%	2.73	3.9

Source: Authors' Computation using Eviews 9

### Table 4.3 Result of the Estimated Long-Run Coefficients of the ARDL

This section contains the results of long run relationship among the variables. The results are summarized and presented in Table 4.

**Table 4: Dependent Variable: LKF**

Variable	Coefficient	Std Error	t-Statistics	Prob.
LEXD	0.387774	0.190927	2.031003	0.0518
LFD	-9.716818	0.687221	-2.264022	0.0166
LFER	-0.735675	2.681608	-0.274341	0.7858
GDP_GR	-0.65389	0.381757	-2.712841	0.0978
INF	0.128091	0.182644	2.549914	0.0324
LNRE	0.524952	0.180088	2.914979	0.0080
EXR	0.016611	0.031877	0.521082	0.6064
C	21.68848	18.91622	1.146555	0.2613

$R^2 = 0.87$ ; AIC = 7.322, SBC = 7.713, HQC = 7.460; DW = 1.923

ADJ.  $R^2 = 0.79$ ; F- Stats = 10.98524, P (F-Stats) = 0.00000.

Source: Authors' Computation using Eviews 9

The estimated long run coefficients estimated shows that there is a statistically significant positive relationship between external debt and capital flight in Nigeria. This implies that any 1.0 percentage change in external debt will lead to about 0.39% percentage change in capital flight in the long run towards the same direction provided other factors are kept constant. This is in line with the study of Ozer, Doker and Turkmen (2013) & Ndikumana, Boyce and Ndiaye (2014). This also lend credence to the debt driven theory which stipulate that, with large foreign debt in an economy, residents would expect exchange rate devaluation, fiscal crisis etc. as a result resident would move their capital to safe haven.

The financial development coefficient is negative and statistically significant. This means in the long run a 1% increase in financial development is expected to lead to a corresponding decrease of about 9.72% in capital flight provided other factors are kept constant. This implies that financial development boosts investor confidence in the country and is expected to decrease the amount of capital flight. This result supports the findings of Raheem (2015), Kipyegon (2004) & Forson *et al.* (2017) and the theoretical postulations of investment diversion theory.

It is also demonstrated that GDP growth rate is negatively associated with capital flight and statistically significant. This implies that a 1% increase in GDP growth rate is expected to lead to a corresponding decrease of about 0.65% in capital flight provided other factors are kept constant. This means higher real GDP growth rates signal the presence of attractive investment opportunities at home and encourage investors to undertake more domestic investment thus reducing the flight of capital abroad. Several empirical studies that support this presumption include Henry (2013), Forson *et al.* (2017) & Al fayoumi, Alzoubi and Abuzayed (2011). It is also consistent with the theoretical postulations of investment diversion theory.

Furthermore, inflation rate has positive and statistically significant relationship with capital flight. This means a 1% increase in inflation rate is expected to lead to a corresponding increase

of about 0.13% in capital flight in the long run provided other factors are kept constant. This denotes that an inflationary economy is not attractive to investment hence encouraging capital flight. This is consistent with the findings of Ajayi (1992), Auzairy, Fun, Ching, Li, and Fung (2016) & Omoke (2014).

The coefficient of natural resources endowment is also positive and statistically significant. This by implication means that a 1% increase in natural resources endowment is expected to lead to a corresponding increase of about 0.52% in capital flight in the long run provided other factors are kept constant. This confirms the phenomenon of natural resources-fuelled capital flight. Indeed, the abundance of natural resources can give rise to a rent-seeking mentality, and thus constitutes an important worsening factor of the corruption level in a given country, hence capital flight. This is consistent with similar empirical findings by Ljungberg and Friedl (2014) & Kwaramba, Mahonye and Mandishara (2015) etc

Foreign exchange reserve is negative and statistically insignificant. The implication of this long run relationship means that a 1% increase in foreign exchange reserve is expected to lead to a corresponding decrease of about 0.74% in capital flight provided other factors are kept constant. Countries that have higher reserves experience less capital flight because higher reserves boost investors' confidence on domestic economy. The finding is in line with the findings of Ogbeide-Osaretin and Efe (2020) & Ahmad and Sahto (2015).

Finally, exchange rate coefficient is positive and statistically insignificant. This implies that any 1% change in exchange rate in the long run will lead to about 0.02% percentage change in capital flight towards the same direction provided other factors are kept constant. In theory, exchange rate stimulates the outflow of capital because it makes foreign assets seem cheap to acquire and at the same time it causes fear of devaluation in future, hence encouraging speculative capital outflows. This is in line with the study of Auzary *et al.* (2016) & Bosupeng and Nadolny (2019).

**Table 5: Estimated Short-Run Coefficients of the ARDL Model**

<b>Dependent Variable: LKF</b>				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXD)	0.496766	0.132102	3.760472	0.0008
D(LFD)	-13.297028	9.300631	-2.429696	0.0639
D(LFER)	-1.462959	3.267814	-0.447687	0.6578
D(GDP_GR)	-0.878746	0.304836	-2.882683	0.0075
D(INF)	0.09171	0.297214	2.943426	0.0535
D(LNRE)	0.884411	0.571847	2.460198	0.0222
D(EXR)	-0.007553	0.075255	-0.100371	0.9208
CointEq (-1)	-0.833102	0.181417	-4.592186	0.0001

Source: Authors' Computation using Eviews 9

The short-run dynamics which is otherwise known as the error correction model was carried out after the retrieval of the long run coefficients. The ECM shows the possibility of the restoration of the equilibrium in case of distortion in the economy. The result is presented in Table 5. The lag 1 coefficient of the error correction term yield a negative sign (-0.833) and statistically significant at 1%. This implies that, in case of distortion in the economy, equilibrium can be re-established by 83% annually. Theoretically the 83% annual adjustment towards equilibrium signifies a fast adjustment process.

Out of the 7 parameters external debt, financial development, GDP growth rate, inflation and natural resources endowment as in the case of the long run statistically influence the level of

capital flight. The only difference between the coefficients of these variables in the short and long run is the magnitude but the signs are the same.

**Table 6: Results of the Diagnostics Tests**

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<b>Normally test</b>			
JarqueBera	0.435876	Prob.	0.804175
<b>Breusch-Godfrey Serial Correlation LM Test</b>			
F-statistics		Prob.	F(1,
	0.059023	27)	0.8099
<b>Breusch-Pagan-Godfrey Heteroscedasticity Test</b>			
F-statistic	1.377406	Prob.	F(8,28)
			0.249

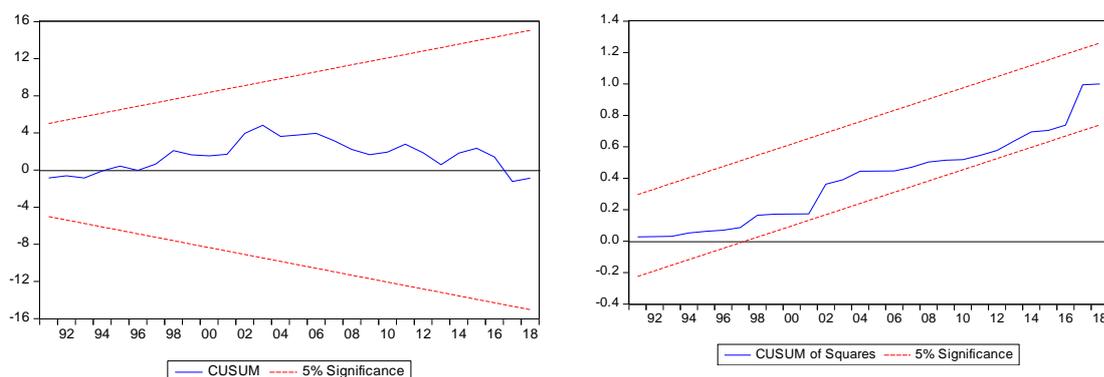
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Source: Authors' Computation using Eviews 9

A series of post estimation diagnostic tests of serial correlation (autocorrelation), normality and heteroskedasticity were carried out on the selected ARDL model. This is to ensure the adequacy of the model, as well as reliability of the results. For serial correlation test, Breusch-Godfrey Lagrange Multiplier LM test was adopted to test the null hypothesis of no serial correlation. The result shows that the F statistics value of 0.059023 (corresponding to a p-value of 0.8099) is insignificant, thus confirming the presence of no serial correlation. For heteroskedasticity, Breuch-Pegan-Godfrey test was carried out to test the null hypothesis of no heteroskedasticity. The outcome of the test too did not show any evidence of heteroskedasticity going by the insignificant F statistics value of 1.377406 (corresponding to the p-value of 0.249). Finally, the test of normality of residual was carried out using the popular Jarque-bera statistics. The normality test testified that the model is normally distributed. This is resulted from the fact that the probability value of the Jarque-Bera is not statistically significant even at 10% level.

To determine the stability of the model and the estimated parameters, the cumulative sum of Residual Test (CUSUM) and Cumulative Sum of Squares of Residual Test (CUSUMSQ) were conducted on the model and shown in Figure 1. The CUSUM depicts that the model and the estimated parameters are largely stable. Closer scrutiny of the CUSUMSQ also shows that the model and the estimated parameters are stable given that the graph moves within the 0.05 critical values.

**Figure 1. Cumulative Sum of Residual Test & Cumulative Sum of Squares of Residual Test**



## 5. CONCLUSION AND RECOMMENDATIONS

The conclusion emanating from the above research findings is that long run cointegration exists between capital flight and the variables used and that external debt, financial development, GDP growth rate, inflation and natural resources endowment are significant determinants of capital flight in Nigeria over the period of study.

Based on these findings, the following recommendations are proffered:

1. Nigerian government should provide a stable financial and macroeconomic environment. This enabling environment for investment will encourage more inflow of funds from abroad and dissuade outflow of funds.
2. there is need for the government to ensure that any external loans are invested into productive projects that give higher returns on investment. This will enhance the country's debt serving capacity thereby reducing the incidence of falling into a debt crisis hence capital flight.
3. government should strengthen the anti-graft agencies to ensure that all the channels through which public office holders launder money abroad are stopped. In addition, international anti-corruption law should be implemented to reduce the quantum of capital flight.
4. since high GDP growth rate reduces capital flight in the country, there is need to address the decay in the critical infrastructure like power supply, transportation system etc and diversify the nation's economy as these will help to boost domestic productivity thereby reducing capital flight.

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## CULTURAL DIVERSITY AS A PILLAR FOR SUSTAINABLE DEVELOPMENT

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### ABSTRACT

Systematically, integrating cultural specificities in the conception, measurements and practice of development is imperative as it ensures the involvement of the local population and a desirable outcome of development efforts. In the transition to green societies, dialogue and tolerance will be key for mutual understanding and the building of bridges among nations and countries, leading to a culture of peace, which is a prerequisite for sustainable development. In that context, we must make the most of the world's cultural diversity, as it fosters development and social cohesion. Culture is more than the arts and literature. In its widest sense, culture embraces everything from your choice of what to wear each day to the traditions, beliefs, and values of your family and community. Of course, this includes all forms of artistic expressions and creativity. It is also the language one speaks, place of worship, the things that move one emotionally, and the sources of meaning in one's life. Cultural diversity plays an important role in sustainable development, because it fosters economic growth, helps individuals and communities to expand the life choices, therefore, it is important to adapt to change and raising the resilience of social-ecological systems. It creates a rich and varied world, which increases the range of choices and nurtures human capacities and values, and therefore, it is a mainspring for sustainable development for communities, people and nations. Cultural diversity and cultural participation strengthen democracy, tolerance and social cohesion. It is an investment in the future as well as a driving force of sustainable development, since enhancing people's choices and responsibilities is key to human development.

**Keywords:** Culture, Diversity, Cultural Diversity, Pillar, Development, Sustainable, Sustainable Development.

## **1. INTRODUCTION**

It is truism today that African cultures are pressured. These cultures have been pushed beyond their limits of tolerance in manners that suggest danger. Some cultures are already surviving at the merging. Unfortunately, the time to begin to appreciate and depreciate the cultural importance to regional growth is critically now as experiences suggest that the pathways to Nigerian development are strategically hidden in the cultures and cultural-political determination and resoluteness of the country. Ebimngbo & Okoye (2017) described cultures as the key to growth, oneness, integration, identity and development ultimately. There is a strong interrelationship among culture, growth, progress, development and even national integration. On the other hand, cultural diversity fosters economic growth, help individuals and communities to expand the life choices, it creates a rich and varied world which nurtures human capacities and values therefore cultural diversity is a main spring, the pillar for sustainable development of communities, people and nations.

Nigeria as a country is naturally distinguished and united by differences and similarities. These differences and similarities include, gender, age, language, ethnicity, religion, political ideology, education qualification, geographical boundary, physical ability, level of income, social status as well as culture (Aisagbonhi, 2019; Erbas, 2018). However, most world economic centres, following their commercial importance are mostly home to peoples of diverse cultures. Ironically, the Nigerian state, regarded from a distance as more culturally homogenous, have the biggest share of cultural diversity. The root of the cultural diversity in Nigeria is a coercive birth by colonial enterprise which resulted in mergers and in some cases creation of multiple, culturally incongruent and artificial boundaries through amalgamation of 1914 (Folarin, Olanrewaju & Ajayi, 2021).

Cultural diversity as viable tool of sustainable development is underrated and not annexed even when the Americans and European Union (EU) are doing everything possible to annex their many cultures for national and regional sustainable development drive. Brazil, India and China (The so called BRIC Nations) as well as South Korea, Indonesia and Singapore all built their paths to development on traditional values and culture. Interestingly, the BRIC Nations and the Asian Tigers (so called) all started the journey to development with Nigeria but they have since left Nigeria for behind on the race to development. The gap is very wide and is still being widened as the missing link in Nigeria is still not being annexed.

The culture of people as is veritable to Socio - Capital that could be deployed for growth and development and even translated to economic and technological capitals. Culture is a cure-all for growth and development. Nothing is achieved and could be achieve except it is operated within culture (Erbas, 2018).

However, cultural diversity in Nigeria has become almost synonymous for the nation's social, economic, and political problems in recent years (Green, 2021). Nigeria is the most populated nation in Africa and has the highest number of mixed peoples. According to National Population Commission [NPC] (2006) the estimated population of Nigeria was 140 million people who are divided into over 250 ethnic clusters with each entity having its own norms, values, beliefs and even languages. This is likely to influence the ways of living and relationship with people as goals and aspirations in life are often a product of culturally held values. Thus, we must also note that the personal and cultural values, which we hold, may affect rendering, acceptance, and utilization of sustainable development (Inglis, 2019)

### **1.1 Objective of the Study**

The objective of the paper is to examine the link between cultural diversity and sustainable development in Nigeria.

## **2. LITERATURE REVIEW**

### **2.1 Conceptual Literature**

#### **➤ The Concept of Culture**

Culture is undoubtedly an Omnibus terminology which can mean a variety of things, depending on the context in which it is used. Many people would however, appreciate it as the configuration of a people's learned behaviors that are transmitted from one generation to another.

Smith, Stanley & Shores (2017) defined culture as “a fabric of ideas, ideals, beliefs, skills, tools, aesthetic objects, methods of thinking, customs and institutions into each member of a society is born”. To Havighurst & Neugarten (2016), culture consists of patterns and produce of learned behavior: the etiquette, languages, food habits, religious and moral beliefs, system of knowledge, attitudes and values together with the material things and arts produced by a group of people.

According to an Anthropologist, Tylor (1972) cited in Ebimgbo & Okoye (2017) culture is that “Complex whole which includes knowledge, belief, art, morals, law, custom and other capabilities and habits acquired by man as a member of society”. Implied in this definition is the fact that culture is all encompassing. It covers all spheres of endeavor and capabilities acquired by man as a member of society. This definition also brings out the connotation that it is culture which defines man as a member of a particular society, thus a culture-neutral man is a man without society. Therefore, Kluckhohn (2019) has seen culture as representing the distinctive way of life of a group of people, their complete design for living.

Culture is therefore, the totality of a people's ways of life. It is the distinctive way of life of a people, their complete design for living. It also refers to the gamut of knowledge, beliefs, customs, traditions and skills that are available to members of a society. It is very necessary to point out that culture is learned (through socialization) and is share by all members of a society). Given this reality, we can modify the insightful definition of Tylor and see culture as that complex whole and set of learned and shared beliefs, customs, skills, knowledge, practices, and traditions common and peculiar to the members of a society.

The concept of culture can be classified into three main categories, namely: cultural specialties, cultural alternatives, and cultural universals. Cultural specialists are those aspects of culture which only some adults in the society are supposed to know and practice. They often consist of the vocational calling of individual members of the society through which they can earn their living. Cultural alternatives are different methods and technique of doing things which are accepted by society. Cultural universals are the most difficult aspects of culture to change. They are the ways or patterns of life, beliefs, ideals, customs and traditions which every member of society is expected to practice (Folarin, Olanrewaju & Ajayi, 2021).

#### **➤ Diversity:**

This encompasses acceptance and respect. It means understanding that each individual is unique, and recognizing our individual differences. This can be along the dimensions of race, ethnicity, gender, sexual orientation, socio-economic status, age, physical abilities, religious beliefs, political beliefs or other ideologies.

#### **➤ Cultural Diversity**

Cultural diversity is the quality of diverse or different cultures, as opposed to monoculture, as in the global monoculture, or a homogenization of cultures, akin to cultural

decay. The phrase “cultural diversity” can also refer to having different cultures respect each other’s differences. It is also sometimes used to mean the variety of human societies or cultures

in a specific region, or in the world as a whole. The culturally destructive action of globalization is often said to have a negative effect on the world’s cultural diversity.

The many separate societies that emerged around the globe differed markedly from each other, and many of these differences persist to this day. As well as the more obvious cultural differences that exist between people, such as language, dress and traditions, there are also significant variation in the way societies organize themselves, in their shared conception of morality and in the ways they interact with their environment. Cultural diversity can be seen as analogous to biodiversity (Erbas, 2018).

By analogy with biodiversity, which is thought to be essential to the long-term survival of life on earth, it can be argued that cultural diversity may be vital for the long-term survival of humanity; and that the conservation of indigenous cultures may be as important to human kind as the conservation of species and ecosystem is to life in general. It is clear from the above explanations that cultural diversity is a form of appreciating the differences in individuals. The differences can be based on gender, age, sex, ethnicity, sexual orientation, and social status.

Cultural diversity, also known as multiculturalism, is a group of diverse individuals from different cultures or societies. Usually cultural diversity takes into account language, religion, age, and ethnicity.

#### ➤ **Trends in Cultural Diversity**

##### 1. The growth of minority workforce:

Today’s workforce is made up of a very diverse population of individuals from every part of the world, which creates dynamic multiracial and multicultural organizations. Such diversity brings with it many differences in skills, abilities, and experiences.

##### 2. Growth of stereotyping and prejudices:

This can be hard to avoid when so many different cultures come together in a work environment.

##### 3. Sensitivity or Diversity Training:

This type of training educates all employees about cultural differences so that they can understand and appreciate each other. The purpose of sensitivity training is to teach employees how to properly act and communicate in a corporate environment.

##### 4. Large Increase of Females in Workforce:

Over past few decades, women’s participation in the workforce has grown dramatically to account for almost half of the labour force.

##### 5. Hiring of Individuals with Disabilities:

While still considerably underused, organizations are quickly beginning to realize that physical challenged workers are a vital part of the workforce. The advent of new technologies and accommodations has allowed organizations to recruit and utilize physically challenged workers in their labor force. Likewise, there has been an increase and appreciation for individuals with unique talents and abilities (Erbas, 2018).

#### ➤ **The Concept of Development**

Development is the most popular concept among other concepts, yet it is highly abused. It has become a household word and the magic word that transforms individuals, communities, countries, and even continents into new places of acceptability and bliss (Okoli, 2004). The concept of development has many colorations, but all its definitions boil down to one major theme which is “the promotion of the welfare of the individual. Therefore, the goal of development in any society is the enhancement of the good life of the citizens. Rodney (1992:1) opines that development in human society is a many-sided process, at the level of

individual, it implies “increased skill and capacity, greater freedom, creativity, self-discipline, responsibility and material well-being”. He stressed that some of these are virtually moral categories and are difficult to evaluate, depending as they do on the age of one’s life, one’s class, origin and one’s personal code of what is right and what is wrong. However, what is disputable is that, the achievement of any of these aspects of personal development is very much tied in, with the state of the society as a whole.

In his contribution, Okoli (2004) asserted that the concept of development is the attainment of an ever-shifting but always higher levels of equilibrium between the positive (functional) and the negative (dysfunctional) elements within the society and the individual. Development as a practice, entails a simultaneous disrupting and re-ordering of society to achieve materials and non-materials abundance and eroding the socio-psychological balance of the individual. On the other hand, development as a strategy, that should aim at re-enforcing and re-structuring society to maintain or equilibrate the sectional balance of the society. It could therefore, be deduced from the above analogy that development is at once a societal and an individual phenomenon is a societal phenomenon, it is simultaneous progress at all section of the society, and as an individual phenomenon, it dwells in the realm of socio-psychological conversion.

Conception of development as the promotion of the welfare of the individual and as a universal good, has led to the formulation of development policies that emphasizes on creating little haven of material comforts for the individual. Hence, development is seen as the construction of roads, culverts, bridges, markets, schools, hospitals, maternity homes, and installation of pipe-borne water, electricity and other infrastructures.

#### ➤ **Sustainable Development**

Sustainable development is a term brought into common use by the World Commission on Environment and Development (WCED) in its 1997 Seminar entitled “Our Common Future”. The commission built efforts on man whom it was believed as the purvey or end product of development effort. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- The concept of needs in particular the essential needs of the world’s poor, to which overriding priority should be given and
- The idea of limitations imposed by the state of technology and social organization on the environment’s ability to meet present and future needs.

According to Oddih & Okor (2020) sustainable development is a process for meeting human development goals while maintaining the ability of natural systems to continue to provide the natural resources and ecosystem services upon which the economy and society depend. It is the organizing principle for sustainable finite resources necessary to provide for the needs of future generations of life on the planet. It is a process that envisions a desirable future state for human societies in which living conditions and resource-use continue to meet human needs without undermining the “integrity, stability and beauty” of natural biotic systems. Sustainable development ties together concern for the carrying capacity of natural systems with the social, political and economic challenges faced by humanity. Therefore, sustainable development can be seen as participatory development, human development and environmental development.

### **3. METHODOLOGY:**

#### **3.1 Theoretical Framework**

A rich historical and normative approach and method were adopted. Normative approach assumes that all behavioral phenomenon exists according to the normal distribution curve thereby signifying that a majority population lies in the center while the rest of them occupy less portions in the either extreme ends. The approach defines moral conduct in accordance with values and norms generally accepted by all rational men. On this ground, for development to be sustained in any society, values and norms of the people must be taken into recognition. Therefore, global and national as well as more micro trajectories were explored to enrich the issues raised in this article for pragmatic development implications nationally and globally as well as more locally. Nigeria is a heterogeneous society with ethnic pluralism that is rooted in diverse cultures. Ekanola (2021) asserted that the creation of Nigeria as a single territorial and institutional framework expanded inter-ethnic interactions through the practice of colonial system. Nigeria as a nation is characterize by many different languages such as Igbo, Hausa, Yoruba, Gbagi, Tiv, Idoma, Nupe, Egbira, Kanuri, Fulfude, Edo, Ijaw, Efik, Ibibio and so on, which are used as yardstick for determining the variability and diversity of its culture (Amali & Jekayinfa, 2018). Each of these ethnic groups in Nigeria are self-perpetuating biological groups, with identifiable interactive membership, value system, normative behaviour, peculiar in language, and a particular part of the state territory (Ojide, Oyedele, Ukwueze & Ikpeze, 2016).

Historically, Nigeria was a product of British colonial power which became a geopolitical entity in 1914 when the Northern and Southern protectorates were amalgamated (Ugwu, Aronu & Atama, 2020). According to them, from inception, Nigeria was heavily divided along ethnic lines. The Hausa-Fulani being a dominant group in the North, the Yoruba ethnic group dominated the West and the Igbos dominated the Eastern part of Nigeria. Tribal loyalties, Islamic and Christian religious faith had a great impact on the social life of various ethnic groups in Nigeria. These have implication for national unity after Nigeria's independence in 1960. The amalgamation brought together numerous linguistic, ethnic and cultural groups, as well as autonomous communities, sovereign kingdoms and caliphates, which hitherto had attained different levels of social, economic and political development (Folarin, Olanrewaju & Ajayi, 2021).

According to Folarin et al (2021), these entities with different, unrelated, cultural, traditional and historical backgrounds were conjoined to form a multi-cultural, multi-ethnic and multi-national society. This arrangement was used to satisfy imperialistic desires, which primarily, was for colonial administrative convenience as the Nigeria structure did not, in any way, depict nor was meant to lay the foundation for integration (Ifeanacho & Nwagwu, 2019). A fact complemented by Shively (2013) who argued that Nigeria was not constructed for cohesion but for the administrative convenience of the British. In recent years, cultural diversity in Nigeria has become almost synonymous with the nation's social, economic, and political problems (Green, 2021). Scholars have argued that cultural diversity has been responsible for the low economic growth and poor development of the country, political instability and conflict (Buhaug, 2016), high inequality (Milanovic, 2020; Barr & Oduro, 2019) and low provision of public goods (Jonathan, Ezekiel, & Yusuf, 2020).

However, in spite of the people's perception against the existence of multiculturalism in Nigeria, it remains the viable pathway for sustainable development if harnessed maximally. To buttress this view, Akanle (2019) opined that the confounding strength of cultures to promote growth and drive development cannot be underestimated even when they appear in their traditional forms and isolated much more than when they are harnessed as collectivities in a nation as viable as Nigeria. Diversity in cultures holds the key to growth, oneness, integration, identity, and ultimate development of a nation. Hence there exist a strong interrelationship among culture, growth, progress, development and even national integration (Ekanola, 2021; Egwemi, 2019; Shokpeka, 2019). As a source of exchange, innovation and creativity, our diversity defines the uniqueness of our nationhood (Aisagbonhi, 2019).

To promote sustainable development through cultural diversity, the society must seek to promote social justice, in relation to society generally, and the people whom they work with.

This implies that the people have to challenge negative discrimination on the basis of characteristics such as, age, culture, gender, marital status, socio-economic status, political opinions, sexual orientation, and spiritual beliefs (Littlechild, 2020). According to Barrett (2021) it is important to foster social justice, leadership development as a teachable concept connected both to the classroom and professional service. The National Association of Social Workers (NASW) Code of Ethics (2019) outlined values and ethical standards for members of the society, including the vital importance of multicultural competence, advocacy, empowerment, and social justice. Social workers also should take an advocacy role for their clients at all levels (micro, meso, and macro) especially in a multicultural nation like Nigeria.

#### **4. RESULTS AND DISCUSSION**

Advocacy is one of the well-established strategies for achieving social justice for sustainable development. A society, region or nation that does not pay sufficient attention to its culture will thus, certainly not grow, never develop and will ultimately extinct. It will be swallowed up within the scheme of things as it will lose its very essence and define character that makes it different for others and that which will drive this growth and development. Poor appreciation and annexation of culture will certainly lead to elusive development. Development efforts without the prism of culture are wasteful discharge of energy, shadow boxing and mindless waste of scarce national and regional resources (Gehart & Lucas, 2017).

Nigeria occupies an Area of 923,768 square km (356,667 square miles), from the Gulf of Guinea it extends north to the border with Niger Republic. It has a veritable landscape from the swampy coastal areas and tropical forest belts of the interior, to the mountains and savannah of the north. The climate is hot and humid and rainfall heavy at the coast and gradually decreases inland. The climatic conditions suggest arability and supposed viability of agricultural practices. Nigeria is the sixth largest producer of crude oil in the world and the country's crude oil is famed as being the easiest to refine. The population of Nigeria is 140,000,354 million (NPC, 2006). It is one of the most culturally diverse nations in the world. It is thus, a multi-cultural nation (Shokpeka, 2019).

There are about 500 ethnic groups in Nigeria with very diverse socio-cultural system deeply rooted in ethnic segmentation (Olutayo and Akanle, 2017). The cultural variability in the country is represented through ethnic categorization which collectively forms ethnic plurality culture multiplicity and ethno-linguistic groupings (Shokpeka, 2019 and Ekanola, 2021). For instances, numbers of ethnic groups in Nigeria is not less than 500. Generally, it is possible to categorize ethno-linguistic groups in Nigeria to range from 250 to 500. Has as multiple as these ethnic and ethno-linguistic. Groups are however, cultures and ethnic groups in Nigeria are often classified into the three ethnic groups in Nigeria. The three dominant ethnic groups are the Hausas, the Yorubas and the Igbos respectively in other population strength.

The dominance of these three ethnic groups however does not diminish the significance of these other ethnic groups. In fact, most people in Nigeria prefer to trace their root and origin to less dominant classification depending on the reason for ethnic appropriation (ethnic instrumentalities). It is common to see an individual describe him/herself in Nigeria as Ekiti Man/Woman instead of Yoruba while an Igbo person may prefer to describe self as Mbaise rather than Igbo. Also, an Igala Man/Woman describe him/herself as Igala Man/Woman instead of Hausa. Language, through words mobilization, is the avenue through which the culture more and meanings are made and communicated. In Nigeria, like in other related domains, language is a very key cultural identical. This is why culture is sometimes categorized along language groups. All the ethnic and language groupings in the country have deep rooted traditional background and established oral traditions in proverbs (Green, 2021).

These cultural backgrounds affected the cultural and political systems adopted by the people and it determined their conception and approaches to development. The groups define

development, move towards development and were developed in their own right to the extent that their needs are met and they related with others on the basis of co-equals and mutual benefits in social relations. For instance, the Igbo culture was patterned along gerontocracy and decentralization/acephalous arrangements. Decisions were taken in a village square setting in manners that accommodated all. Decisions were taken democratically and immediate and distant environments were exploited for the common good. For the Yorubas of the West, the political system was monarchial and structured with consultative mechanisms in-built. The decisions for the communities were taken after due consultation with the Oye Mesis in a political system that has come to be known in Yoruba historian grapy as the Oba-in-Council. Decisions are taken unilaterally and the common good and efforts are articulated for group development. The Oba/Alaafin of Oyo in related version, the Hausas of the Northern part practiced Emirate system that was very and sharply hierarchical. Power and authority flowed from the top (from the Emir) and followers were expected to follow. This was contrary to what obtained in the east where power and authority were devolved and in the West with Constitutional Monarchy (Green, 2021).

These political systems ultimately drove growth and development in these societies. Social thoughts, sayings and proverbs that emerged in these societies also influenced growth and development in the societies in unique ways. Socio-cultural thoughts helped the indigenous societies to develop theories and attitudes as well as actions that contributed to their growth. Such thoughts are: ise Igun ise (work is the antidote of poverty), igbra ara la bura, enikan ki bu sango lerun (it is at youthful and agile age that one can work and contribute to growth), Agbajowo lafi soya (It is in unity and integration that we can benefit and develop). This has implication for regional integration and ete in gbehim imele (A lazy person will be put to shame) helped the growth and attitude to work and development of the people (Iorember, 2020).

## **5. CONCLUSION AND RECOMMENDATION**

### **➤ Conclusion**

This article has attempted the annotation of the role of cultural diversity in sustainable development in Nigeria. Related issues have been erected with critical importance to sustainable development. It has been observed that people generally and Nigerians in particular, have demonstrated enough capacities to interrogate cultural elements in promoting local, regional and national development.

Every culture in Nigeria has unique diets, mode of dressing, mode of production, language, greetings, marriage, mode of socialization, political systems that could be annexed for development. In fact, everything is unique from one culture to the other but modal systems could be discovered and appropriated for sustainable national development. As already shown above, historical accounts reveal that these cultural systems were effective and galvanized sustainable development and could still be useful in contemporary Nigeria. These political systems were developed in tandem with prevailing socio-cultural environments and not mindlessly taken from without. This sustained the groups and cultures and put them on the path to sustained growth and development. The physical and cultural environments of these groups specified how intelligently they were to exploit their environment and meet their needs and so they did objectively. It is possible to say these people developed and their developments were sustainable. They lived within and related on the point of strength with their external neighbors.

Cultural diversity had contributed to the sustainable development in Nigeria because it is a driven force to innovation and creativities, it creates employment to the people and improves environmental sustainability.

### ➤ Recommendations

1. In achieving sustainable development, there is the need for the people to upholding their rights to receive resources and services or to actively support a change on programmes and policies that are intended to have negative effect on individuals or groups.
2. Furthermore, advocacy can promote equality, social justice and social inclusion and also empower people to speak up for themselves, raises the critical awareness and exercise their rights as well as involving in and influencing decisions that are being made about their future.
3. The importance of culture as a policy and growth interface has given rise to concepts and principles like culturonomics. This refers to national and regional element and traits that are unique to traditional and local history, social structure, psychology, belief systems, religion, norms, values, arts and politics that legitimize actions within the local environment and suggest pattern of interactions with outsiders.
4. Indigenous cultural systems were very useful in galvanizing growth and development in the early times. Interestingly, they still hold prospects for contemporary Nigeria. This is so if their criteria and experiences are annexed for the present and future development of Nigeria.

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# OIL PRICE AND EXCHANGE RATE NEXUS IN NIGERIA: EVIDENCE FROM WAVELET ANALYSIS

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## ABSTRACT

Crude oil is the source of essential petroleum products for productive economic activities. Primarily, Nigeria exports crude oil and imports petroleum products, and this has a link with the unfavourable exchange rate of the Nigerian currency vis-à-vis the US dollar over the years. Based on the proposition that there is no significant relationship between oil price and exchange, the paper examines the oil price-exchange rate nexus in Nigeria, with monthly data from 1980M1 to 2020M12 analysed within the framework of wavelet analysis. The results show evidence of a mixed relationship between oil prices and exchange rates during the period under study. The results also show evidence of the lead-lag effect of oil prices on exchange rates in the long run but not in the short and medium terms. Thus, oil price has a time varying effect on the exchange rate only in the long run. Furthermore, there is evidence of unidirectional causality from oil price to exchange rate in the short and medium run but bidirectional causality in the long run. Hence, oil price is a key determinant of exchange rate in the short and medium terms but not in the long term. Consequently, this study emphasizes the need for purposeful economic diversification in order to attain and sustain a stable exchange rate in Nigeria.

**Keywords:** Oil price, Exchange rate, Wavelet analysis, Granger causality, Decomposition.

**JEL classification code:** O24, P22, P33

## 1. INTRODUCTION

The relevance of oil as a crucial source of energy seems to make it essential in all socioeconomic operations of many countries. For instance, oil products constitute an energy source for electric power generation, heating, fuel, industry operations and transportation, among others (Jiang & Yoon, 2020). The literature documents that main economic activities involve the use of refined oil products as inputs in the production process and, in turn, directly affect traded assets as well as returns on investment (Ji, Bouri, Roubaud & Kristoufek, 2019; Aviral, Ibrahim, Seref & Shawkat, 2020). According to Kibunyi, Charles and Kevin (2018), crude oil is one of the basic drivers of economic growth and sustainable development. In this regard, Zhuhua and Seong (2020) noted that crude oil is scarce relative to other primary sources of energy, such as natural gas and coal. Consequently, every economy accords great importance to oil products, although modern energy policies are shifting towards the adoption of renewable energy sources. Moreover, the policies face a major drawback because of high procurement costs associated with renewable energy sources (Raheem, 2017). As a result, the demand for crude oil has increased over the years (Chazan, 2012), with significant implications for the energy market. Corroborating this, Akalpler and Nuhu (2018) observed that the total global utilization of oil has quadrupled and represented approximately 70% of world energy utilization. Given the increased demand for oil, the price per barrel depends on the grade, which is determined by attributes such as specific gravity, amount of sulfur content and originating location (Thomas, 1995)

Lin and Xu (2019) indicated that oil price is a major factor to consider in factors influencing macroeconomy fluctuations because it prompts investors' strong interest (Ma, Ji, & Pan, 2019). Oil price studies are important because they directly impact economic performance and influence changes in financial variables such as exchange rates (Tantatape, Jui-Chi & Yaya, 2014). According to Antonakakis and Kizys (2015), the exchange rate is a major determinant of investment; its volatility may affect the value attached to finished products, influence domestic countries' competitiveness in the international market and lead to economic stability. When oil prices and exchange rates are compared, the exchange rate is said to be more sensitive to oil prices because oil has more features of global marketization than coal, gas, or other fuels (Ma, Zhang, Ji, & Pan, 2019b). With the wealth derived from oil futures, oil prices have been observed to significantly influence exchange rates in the financial system and have led to many studies probing into the empirical link between oil prices and exchange rates (Lin & Su, 2020). Reviewing the relationship between oil price and exchange rate markets is important because the US dollar (USD) is the main billing and payment currency in international oil markets. Therefore, fluctuations in the USD exchange rate will affect oil traders, oil-exporting and oil-importing countries. This indicates that a fragile USD will raise the purchasing power of all oil-importing countries and reduce that of all oil-exporting countries, implying that it will negatively affect them. Likewise, an overvalued USD will negatively affect oil-importing countries, which will bring about declining demand leading to demand shock that will eventually affect oil-exporting countries (Reboredo & Rivera-Castro, 2013). According to Shupe, Haizhong and Brian (2020), changes in crude oil prices can cause instabilities in exchange rates worldwide, redistributing wealth and interrupting equilibrium among trading countries. Ma et al. (2019b) observed that with the globalization and financialization of the crude oil market, portfolio managers and investors are progressively including crude oil in their currency portfolio to strengthen the movement between crude oil and currency markets. This means that countries involved in the global market could be sensitive to changes in the crude oil market. However, the response of the exchange rate to the dynamics of crude prices is heterogeneous owing to different exchange rate policies in the countries (Lv, Lien, Chen & Yu, 2018) and financial market efficiency (Volkov & Yuhn, 2015).

This view is clearly supported by available statistics on crude oil price and exchange rate for Nigeria in the period considered in this study. For instance, crude oil price in the international

market was relatively stable at 32.5 naira dollar barrel in 1980M1 and throughout the early 1980s. The price witnessed a sharp decline to 29.840 dollar per barrel in 1983M11, sinking further to 12.618 dollar per barrel in 1986M3. The price showed sustained gradual increases during 2004M1 to 2013M10, and peaked at 106.57 dollar per barrel in 2013M8. Subsequently, oil price fluctuated considerably, and as of 2020M12 the price per reached 47.020 dollar per barrel in the international market. On the other hand, Nigeria's currency, exchanged at the rate of between 0.554 naira and 0.96 naira per US dollar during 1980M1 to 1985M12. Thereafter, the exchange rate of the country's currency to US dollar increased in favour of the latter. However, the Government of Nigeria officially pegged the exchange rate of the naira at 21.996 naira to the US 1 dollar for the period 1993M5 to 1998M12. From then, the exchange rate of Nigeria's currency vis-à-vis the US dollar has unfavourably been on continual increased, and stood at 379.5 to US 1 dollar as of 2020M12. These show that, as suggested in the literature (Volkov & Yuhn, 2015; Reboredo & Rivera-Castro, 2013; Lv et al., 2018; Shupe et al., 2020), the movements in oil price and exchange rate seem to depict causal relationship.

In addition, prior to the advent of crude oil, the Nigerian economy was mainly mono-cultural, with the dominant agricultural sector. However, that changed with the discovery of crude oil in commercial quantity in the early 1970s, which stimulated the growth of the petroleum industry (Onodugo, Amujiri & Ndibe, 2015). Subsequently, Nigeria became and remains over dependent on crude oil as the major determinant of economic growth, to the neglect of other hitherto viable sectors such as agriculture, renewable and non-renewable resources, manufacturing, service sector among others (Shaari, Hussain & Rahim, 2013). This exposes the Nigerian economy to the vagaries of external shocks and price volatilities in the international oil market, especially through the exchange rate channel, with attendant negative consequences on the revenue of the government. The negative consequences spill over to other key macroeconomic variables more so as the Central Bank of Nigeria and the Federal Ministry of Finance inevitably factor in oil prices in the national budget and economic policy decisions (Ani, Ugwunta, Inyama & and Ike-Ekweremadu, 2014).

From the foregoing, we consider it imperative to examine the oil price-exchange rate nexus in Nigeria, with a view to articulating appropriate policy recommendations aimed at mitigating the adverse external shock resulting from price-induced exchange rate movements. For the purpose, this paper is structured into five sections. Following the introduction is section two, which is the review of literature. The methodological procedure deployed in the paper is discussed in section three, while analysis and results are discussed in section four. Section presents the conclusion and recommendations.

## **1. LITERATURE REVIEW**

### **2.1 Conceptual Literature**

**Crude Oil and Crude Oil Price:** Great importance has been attached to crude oil so much so that Hathaway (2009) said a world without crude oil will collapse. Crude oil price are determined by its grade and attributes such as specific gravity, amount of sulfur content, originating location (closeness to tidewater and refineries). Hamilton (2009) described four factors that determines crude oil price are demand, supply, Organization of the Petroleum Exporting Countries (OPEC) countries and speculation

**Exchange Rate:** This is the price of a nation's currency in terms of another foreign currency, implying comparing the domestic currency with a foreign currency. It can be of two types, nominal or real exchange rate; this study made use of nominal exchange rate.

## 2.2 Theoretical Literature

The Law of One Price expresses the relationship between oil price and exchange rate. This economic concept dates back to classical intellectual economists from France in 1760 to 1770, who applied the law to markets in international trade (Persson, 2008). The law shows the influence of market arbitrage and trade on the prices of similar goods traded in two or more markets. The law states that similar assets or commodities will have the same price globally, regardless of location, when currencies are changed to a common currency and certain factors are considered (Miljkovic, 1999). The law holds that for any good represented as  $i$ ,  $P_i = EP_i^*$ , where  $P_i$  is the home-currency value of good  $i$ ,  $P_i^*$  is the foreign currency value, and  $E$  is the exchange rate, defined as the home-currency price of foreign currency. Only one commodity price is expected to exist in any efficient market, irrespective of where they are traded (Persson, 2021). By implication, the strength of the law of one-price lies in a frictionless market, where there are no transaction costs, transportation costs, legal restrictions, price manipulation by buyers or sellers, and the currency exchange rates are the same. Hence, the law exists because differences in asset prices in different locations would eventually be removed where there is arbitrage opportunity. Market equilibrium forces will also lead to price convergence of the assets (Charles, 2020). In a recent work, Giulietti, Iregui and Otero (2015) tested the validity of the theory and confirmed its existence. Other theoretical review in line with this study are wealth and portfolio channels by Krugman (1983) and Golub (1983) and the monetary model of exchange rate determination (Frenkel, 1978, 1999; Frenkel and Froot, 1989; Vries, 1994; Backetti, Craig & Jones, 1995).

## 2.3 Empirical Literature

Jammazi, Lahiani and Nguyen (2015) deployed the wavelet-based nonlinear autoregressive (W-NARDL) model to study the exchange rate-crude oil nexus in a group of 18 developed and developing countries. The findings showed a significant and asymmetric pass-through of exchange rates to oil prices in both the short and long run. Zou, Yu and He (2015) constructed a new wavelet model termed the wavelet entropy algorithm to analyse the complex and nonlinear crude oil price dynamics and movement in oil prices. The results obtained from the study indicated that in the algorithm modelled, crude oil markets outperformed the benchmark model in terms of predictable performance evaluation criteria for the model forecasting accuracy.

Živkov, Đurašković and Manićl (2019) investigated how oil price changes affect consumer price inflation in eleven Central and Eastern European countries between January 1996 and June 2018. The study adopted a wavelet-based Markov switching approach to capture the effects at four different time horizons for nonlinear shock transmission from Brent oil to national inflations. The result found that the transmission of oil price changes compared to inflation is relatively low in the Central and Eastern European countries. Jung, Das and McFarlane (2019) examined the asymmetric relationship between the oil price and the US-Canada exchange rate employing nonlinear autoregressive distributed lag models (NARDL) and Granger causality testing. The results from the study found a bidirectional long-run cointegration relationship between the real price of oil and the US-Canada exchange rate, which runs from the US-Canada exchange rate to the real price of oil. The Granger causality test shows that there is a short-run asymmetry from the US-Canada exchange rate to the real price of oil, which reinforces the long-run results. Liu, Fang, Gao, An, Jiang and Li (2019) indicated that the time-varying memory series for the dynamic series could forewarn the reversal trend of price spread series. The study implored the policy makers that when they estimate the movement of crude oil price spread under the influence of exchange rates in non-US countries, they should pay attention to the position of direct crude oil suppliers and all markets involved, including WTI and Brent.

Attahir (2019) examined the oil price and exchange rate nexus in Nigeria for asymmetries. The study employed threshold autoregressive (TAR), momentum autoregressive (MTAR) and structural vector autoregressive (SVAR) models to examine the linear relationship between oil prices and exchange rates in Nigeria from January 1986 to June 2018. The results from the TAR and MTAR models showed that for Nigeria, there was an absence of an asymmetric relationship between oil prices and exchange rates. The SVAR model shows steady appreciation of naira following progressive shocks to oil prices. In conclusion, the study advised Nigeria's economy to diversify the country's foreign exchange earnings to reduce the effect of unfavourable oil price shocks. Olayungbo (2019) studied the Granger causal effects of oil prices on exchange rates, trade balances, and foreign reserves in Nigeria using seasonally adjusted quarterly data from 1986Q4 to 2018Q1. The results indicated that the variables are nonstationary, but cointegration exists between oil prices and foreign reserves, which indicates the presence of a long-run relationship between the variables. In the short period, the results showed that oil prices strongly Granger caused foreign reserves but not trade balance and exchange rates. Jiang and Yoon (2020) studied the dynamic co-movement between oil and six stock markets from China, India, Japan, Saudi Arabia, Russia, and Canada. They employed two types of wavelet analysis: wavelet multiscale decomposition and wavelet coherence. Several results were obtained from the study. It was finally concluded that oil prices are more influenced by oil exporting countries than oil importing countries.

Several results were obtained from Huang, An and Lucey (2020) study of how do dynamic responses of exchange rates to oil price shocks co-move from a time-varying perspective. They suggest that unexpected oil price shocks could have a greater influence on the exchange rate in various markets over time, with an asymmetric effect occurring only when extreme market situations and unexpected oil price shocks appear simultaneously. In a study of interdependence and contagion relationships among exchange rates of five important emerging Asian markets, namely: Indonesia, Malaysia, the Philippines, Singapore and Thailand, Qureshi and Aftab (2020) found co-movement among many exchange rate pairs, with a substantial increase during the global financial crisis. In addition, there is observable long-run convergence among regional markets in the countries. For oil price-macroeconomic fundamentals connection, Tiwari, Raheem, Bozoklu and Hammoudeh (2020) found the existence of signal explored the oil price-macroeconomic fundamentals connection for emerging market economies, finding a relevant signal from wavelet analysis. The study employed cross wavelet analysis and the phase difference to decompose the time frequency effects of oil prices on major aggregate macroeconomic variables such as the real effective exchange rate, interest rate yield spread and stock market for emerging market economies. The result was not able to identify among the variables those leading or lagging. Likewise, since there was a significant presence of time-varying co-movement between oil price and combined macroeconomic variables across different time frequencies, the study advised the investors and policy makers to take account of varying frequency bands in their decision-making and economic stabilization programs.

Lin and Su (2020) studied how oil prices affect the exchange rates of Brazil, Russia, India, China and South Africa (BRICS). The results obtained showed that two oil price shocks produced different effects on net oil-importing countries and net oil-exporting countries. It was also observed that the exchange rate will have a significant response to oil shock, primarily at high frequencies. China in this study is a typical case in which its oil price shock was insignificant to other countries. Similarly, there is a significant relationship between oil shocks and exchange rate prices for all BRICS countries in the short run but not always exist in the long run. Deploying Nonlinear autoregressive distributed lag (NLARDL) framework, Okwu, Akpa, Oseni and Obiakor (2020) examined the asymmetric effects of oil export revenue and exchange rates on household consumption expenditures in Nigeria. The short-run analysis

showed negative shocks to the exchange rate, while the long-run exhibited positive and negative shocks to the exchange rate and oil export earnings, respectively.

Adebayo (2020) studied how oil prices influence exchange rates in Nigeria. The study focused on the period between January 2007 and March 2020. To buttress the result, Granger and Toda

Yamamoto causality tests were conducted to confirm the wavelet coherence techniques. He reported that oil prices and exchange rates were vulnerable in some identified periods. There was negative co-movement between the exchange rate and oil in the wavelet coherence technique for some identified periods. A bidirectional interaction between oil price and exchange rate was observed from the Granger and Toda Yamamoto causality tests. The inconsistency of 40.2% and 40.5% in the exchange rate can be explained by the fluctuations in the oil price from the variance decomposition, indicating that oil can predict the exchange rate in the long run.

Several wealth of methodology exists in the study of exchange rates in relation to oil prices as well as other macroeconomic variables in the literature (See Iloka & Nnamani (2017); Emediegwu & Okeke (2017); Nwosu, Ihugba & Osmond (2019); Obukohwo, Patricia & Enoch (2019); Akighir & Kpoghul (2020)) However, few researchers have deployed the wavelet analytical framework in the study of the exchange rate-oil price nexus. The literature indicates that only Adebayo (2020) used the wavelet methodology in examining the relationship between exchange rates and oil prices in Nigeria. This study contributes to bridging the knowledge gap observed in the literature.

### **3. METHODOLOGY**

#### **3.1. Data and Sources**

The data we use for this study are spot crude oil prices (in US dollars) and exchange rates of Nigeria currency vis a vis US dollar. The oil price data are obtained from West Texas Intermediate (WTI) published on the Federal Reserve bank of St. Louis (Federal Reserve Economic Data): website: <https://fred.stlouisfed.org>. The exchange rates are extracted from the Census and Economic Information Center (CEIC). The data are monthly observations from 1980M1 to 2020M12. We consider these data sources to be authoritative, authentic and reliable.

#### **3.2 Analytical Model: Wavelet Approach**

We adapt the wavelet model as the analytical framework in this study. The pioneer work on the wavelet framework in the 1980s is credited to Grossman, Kronland, Martinet and Morlet (1989), Coifman, Meyer, Quake and Wickerhauser (1989). However, Daubechies (1988) expanded the scope of the theory from other applied mathematics to signal processing, statistics, and numerical analysis. Modern wavelet research endeavours to create a set of basic functions (or general expansion functions) and transformations that would efficiently produce informative and useful descriptions of a function or signal (Sidney, Ramesh & Haitao, 1998). Engineers, scientists and mathematicians commonly use the wavelet framework for periodic, time-invariant, or stationary phenomena analysis. This is because of its effectiveness in providing efficient localization in both time and frequency or scale when signals are represented as a function of time.

One advantage of wavelet analysis is the multiresolution decomposition, which seems to separate components of a signal in a way that is superior to most other methods for analysis, processing or compression. The discrete wavelet transform has the ability to decompose a signal at different independent scales and in a very flexible way. In this regard, Burke (1994) describes wavelets as a mathematical microscope. Moreover, the flexible decomposition, linear and nonlinear processing of signals in the wavelet transform domain offers new methods for signal detection, filtering, and compression. In addition, it provides the basis for robust

numerical algorithms (David, 1992; David, 1993; Naoki, 1994; Haitao 1997; DongWei, Raymond & Sidney 1998). Furthermore, the framework can expose aspects of data that other signal techniques miss, such as trends, breakdown points, and discontinuities in higher derivatives and self-similarity. It can also compress or de-noise a signal without appreciable degradation. In addition, the framework does not require pretest estimation and captures series that are not stationary either at levels, first difference or second difference. This and the fact that both oil price and exchange rate are high-frequency data justify our decision to adapt the wavelet analytical framework in this study.

The basic characteristic of wavelet is the capability to appropriately analyse a signal or function over time  $[f(t)]$  as a linear decomposition (Wim, 1996). According to Wim, the function is expressed as:

$$f(t) = \sum_{\ell} a_{\ell} \psi_{\ell}(t) \quad (1)$$

where  $\ell$  is an integer index for the finite or infinite sum.  $a_{\ell}$  is the real-valued expansion coefficient, and  $\psi_{\ell}(t)$  is a set of real-valued functions of  $t$  (expansion set).

If the expansion (1) is unique, the set becomes a basis for the class of functions that can be so expressed. If the basis is orthogonal, then:

$$\langle \psi_k(t), \psi_{\ell}(t) \rangle = \int \psi_k(t) \psi_{\ell}(t) dt = 0 \quad k \neq \ell \quad (2)$$

Subsequently, the coefficients can be calculated by the inner product:

$$a_k = \langle f(t), \psi_k(t) \rangle = \int f(t) \psi_k(t) dt \quad (3)$$

This uses a two-variable set of basic functions that is similar to the short-time Fourier transform, the Gabor transform, or the Wigner distribution for time-frequency analysis (Cohen, 1989; 1995). The goal is to generate a set of expansion functions such that any signal in  $L^2(\mathbb{R})$  (the space of square integrable functions) can be represented by the series:

$$f(t) = \sum_{j,k} a_{j,k} 2^{j/2} \psi(2^j t - k) \quad (4)$$

where the two-dimensional set of coefficients  $a_{j,k}$  is called the discrete wavelet transform (DWT) of  $f(t)$ . A more specific form showing and analysing how  $a_{j,k}$  are calculated can be written using inner products as:

$$f(t) = \sum_{j,k} a_{j,k} \psi_{j,k}(t) \quad (5)$$

According to Antonini, Barlaud, Mathieu and Daubechies (1990), if  $\psi_{j,k}(t)$  form an orthonormal basis for the space of signals of interest, the inner product is then defined as:

$$\langle x(t), y(t) \rangle = \int x^*(t) y(t) dt. \quad (6)$$

However, the signal expansion becomes a discrete-time wavelet transform (DTWT) with sequences of numbers, functions of continuous variables and inner products. In addition, when the signal is a function of a continuous variable and a transform, the continuous wavelet transform (CWT) is expressed as

$$F(a, b) = \int f(t) w\left(\frac{t-a}{b}\right) dt \quad (7)$$

and its inverse transform is written as:

$$F(t) = \iint F(a, b) w\left(\frac{t-a}{b}\right) da db \quad (8)$$

where  $w(t)$  is the basic wavelet and  $a, b \in \mathbb{R}$  are real continuous variables.

We modify the wavelet framework and thus specify the following simple bivariate model on the basis of which we test simple hypotheses of association between oil price and exchange rate:

$$EXR_t = \phi_0 + \phi_1 OPD_t + \varepsilon_t \quad (9)$$

where  $EXR_t$  is the exchange rate of the Nigerian naira to the US dollar at time  $t$ .  $OPD_t$  is the oil price in US dollars at time  $t$ .  $\phi_0$  is the intercept of the model, and it depicts the exchange

rate at zero oil price.  $\phi_1$  is the coefficient of oil price. It denotes the measure of the nature and magnitude of the impact of a given change in oil price on exchange rate.  $\varepsilon_t$  depicts the white noise error term at time  $t$  to accommodate the influence of other factors not explicitly included in the model.

Furthermore, we specified the following equation in the context of which we test for the direction of causality between oil price and exchange rate:

$$\Delta OPD_t = \alpha_1 + \sum_{k=1}^m \alpha_{11} \Delta OPD_{t-k} + \sum_{k=1}^m \alpha_{12} \Delta EXR_{t-k} + \varepsilon_t \quad (10)$$

$$\Delta EXR_t = \alpha_2 + \sum_{k=1}^m \alpha_{21} \Delta EXR_{t-k} + \sum_{k=1}^m \alpha_{22} \Delta OPD_{t-k} + \varepsilon_t \quad (11)$$

Based on the following specified wavelet transformation:

$$\psi(rEXC, OIL)(t, \sigma) = \int_{-\infty}^{+\infty} WT(rEXC)(\tau + t, \sigma) WT(OIL)(\tau, \sigma)^* dt \quad (12)$$

We express and analyse the following specification for cointegration between oil price and exchange rate:

$$EXR_t = \mu_{11} + \mu_{12} \gamma_{t,\tau} + \delta_{13}^T OIL_t + \varepsilon_{1,t} \quad (13)$$

Ordinarily, wavelet transform does not use absolute values in estimating the wavelet analysis; rather, it makes use of return series generated via the formula:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \quad (14)$$

Thus, we express the equation of the return series of the exchange rate as follows:

$$EXR_t = \ln\left(\frac{EXR_t}{EXR_{t-1}}\right) \quad (15)$$

Similarly, for the return series of oil prices, we specify the following equation:

$$OIL_t = \ln\left(\frac{OIL_t}{OIL_{t-1}}\right) \quad (16)$$

where  $EXR_{r_t}$  and  $OIL_{r_t}$  represent the respective return series of exchange rate and oil price generated from the present series of exchange rate ( $EXR_t$ ) and oil price ( $OIL_t$ ) as well as the previous value of the exchange rate ( $EXR_{t-1}$ ) and oil price ( $OIL_{t-1}$ ).

## 4. RESULTS AND DISCUSSION OF FINDINGS

### 4.1 Descriptive Analysis

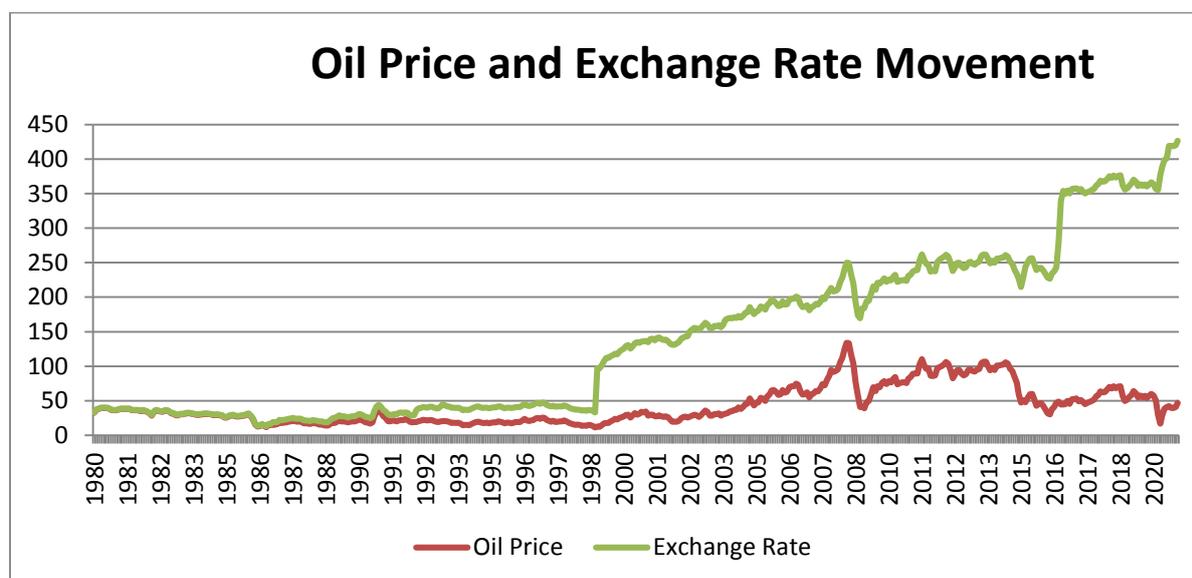


Figure 1: Oil price and exchange rate movement (1980 – 2020)

Source: Authors' illustration (2021)

The spot crude oil price and exchange rate movement above are high-frequency data that show the variability of the series in monthly data. From oil, it is obvious that the series started with an initial low price, which was relatively stable over a long period of time from approximately 1992 to 1996. It witnessed a sharp decline in 1998 but picked up thereafter. The increase witnessed continued to increase over time to reach a peak between 2007 and 2008 and a sharp decline in 2008. However, it picked up again and witnessed continuous fluctuation until 2015. The spike that occurred around July 2008 was due to the occurrence of the global financial crisis, and the effect was prolonged to several periods before it dies out. Additionally, there was a significant fall in the price of crude oil around April 2020 due to the outbreak of the COVID-19 pandemic that led to the shortage in demand for crude oil. Another factor that led to the oil price plunge is the Saudi Arabia and Russia oil production cut war in 2020.

Figure 1 also reveals that the exchange rate in the early years between 1980 and 1985 was less than a naira. Its price began to increase in 1986 throughout the year under study. It was stable in some periods, such as from 1992 to 1998. For example, the rate stood at ₦21.866 for the periods between May 1993 and December 1993 and ₦21.996 for the period from January 1994 to January 1995. It dropped and stood at ₦ 21.886 from February 1995 to December 1998. Thereafter, it rose to a value of ₦84.57 and continued to maintain a steady rise in value over time. The US dollar vis-à-vis Naira began to maintain a triple digit value in the month of March 2000 and dropped in the following month before it continued to maintain the race of triple digit until December 2020. The exchange rate value moved from the single digit of ₦9.37 in May 1991 to the double digit of ₦10.172 in June 1991, which continued until it changed to three digits in May 2000 and has been continuously increasing ever since.

**Table 1: Descriptive Statistics**

Variable	EXR	OIL	$EXR_r$	$OIL_r$
Mean	97.774	42.364	1.321	0.075
Median	101.596	31.670	0.000	0.786
Maximum	379.500	133.930	135.173	54.562

Minimum	0.530	11.280	-15.427	-56.813
Std. Dev.	99.531	26.970	8.576	9.325
Skewness	0.956	1.092	11.912	-0.686
Kurtosis	3.160	3.240	167.928	11.300
Jarque-Bera	75.424	99.029	569258.100	1450.822
Probability	0.000	0.000	0.000	0.000
Observations	492	492	492	492

**Source: Authors' Compilation**

**Notes: Table 1 presents the descriptive statistics of ordinary and return series of exchange rates and oil prices for the monthly dataset from January 1980 to December 2020. EXR<sub>r</sub> and OIL<sub>r</sub> represent the return series descriptive statistics.**

These descriptive statistics used a total of 492 raw data for each of the two variables in the sample analysed. The mean values representing the average exchange rate and oil price are 97.774 and 42.364, respectively. The maximum values are 379.5 and 133.930, and the minimum values are 0.530 and 11.280 for the exchange rate and oil price, respectively. The standard deviations (99.531 and 26.970) for exchange rate and oil price, respectively, explain the extent to which observations in this study are far from the sample average. Kurtosis and skewness serve as measures of normality. The kurtosis values of 3.160 and 3.240 measure the peakness or flatness of the data and show that both data have normal distributions and are therefore mesokurtic in nature. The skewness (measure of the degree of asymmetry of the series) shows that series of the variables are positively skewed, with a long right tail and higher values. The Jarque-Bera statistics of 75.424 and 99.028, with 0.0000 p values, show that the time series values of the variables are not normally distributed over time. This is expected since the variables change at high frequency. The probability values of 0.000 and 0.000 for exchange rate and oil price clearly indicate that the probability values are highly statistically significant; therefore, we clearly reject the null hypothesis of the normal distribution.

From the descriptive analysis of the return series, there was an average rate representing the mean value of 1.321 and 0.075 for exchange rate and oil price returns, respectively, followed by the median of 0.000 for exchange rate returns and 0.786 for oil price returns. The maximum and minimum values of exchange rate returns are 135.173 and -15.427, respectively. These results indicate that the return series of the exchange rate differs across the time period. Similar to the return series of oil prices, the maximum value is 54.562, and the minimum value is -56.813, which also signify variety across time in the data. The standard deviation shows that the return series of the exchange rate (8.576) and oil price (9.325) are likely to change frequently over time. Finally, the Jarque-Bera statistics, which combine the results of the skewness and kurtosis tests, show that exchange rate and oil price returns are not normally distributed based on evidence of rejection of the null hypothesis of normality.

## **4.2 Inferential Analysis**

The results of the inferential analysis, which form the basis of the conclusion and articulation of policy implications, are presented and discussed in this subsection.

### *4.2.1 Wavelet Decomposition: Oil Price*

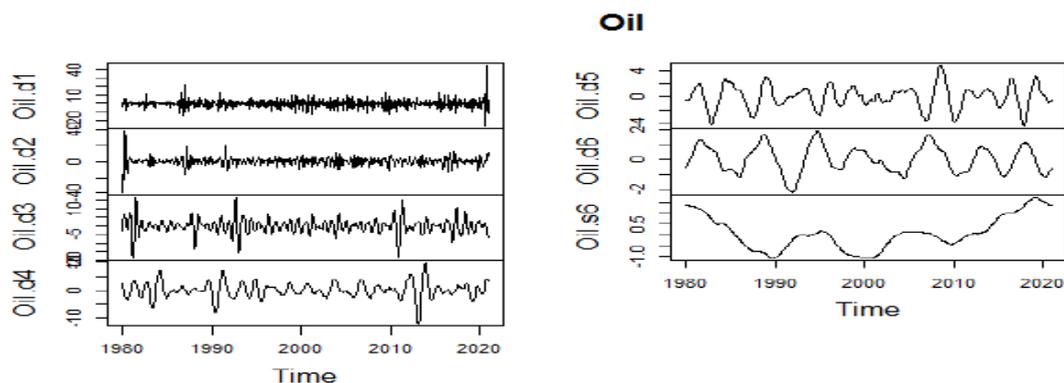


Figure 2: The wavelet decomposition of oil price returns into 6 wavelet levels

Source: Authors' estimation using RStudio

Notes: Figure 4.1 represents the wavelet decomposition of the return series of oil prices from January 1980 to December 2020 into the following periods: Oil.d1 & Oil.d2 → Short run period, Oil.d3 & Oil.d4 → Medium run period, Oil.d5 & Oil.d6 → Long run period and Oil.s6 → Very long run period.

From this study, wavelet-based analyses are generated using codes written by Afshan, Sharif, Loganathan and Jammazi (2017). It divides the series into seven different (7) time periods, such as the short run ( $D_1 - D_2$ ), medium run ( $D_3 - D_4$ ), long run ( $D_5 - D_6$ ) and very long run ( $S_6$ ) periods, in different frequencies to determine the degree of variability of the series of oil prices over the different periods. Observations from this analysis show that in the short run ( $D_1 - D_2$ ), the series are extremely volatile and seriously changing, especially over all periods of time. In the medium run ( $D_3 - D_4$ ), the volatility was relatively stable. A sharp increase was noticeable in the early 1980s, 1990s and approximately 2014 to 2015. In the long run ( $D_5 - D_6$ ), the series are more stable, and the price does not change anyhow. However, in the very long run ( $S_6$ ), price declines steadily between 1980 and 1990 to fall sharply in 1990 but pick up again to fall approximately 22000, after which an increase was observed again to slightly decrease in 2010. After this, it continued to increase until a noticeable decline was observed again in 2020.

#### 4.2.2 Wavelet Decomposition: Exchange rate

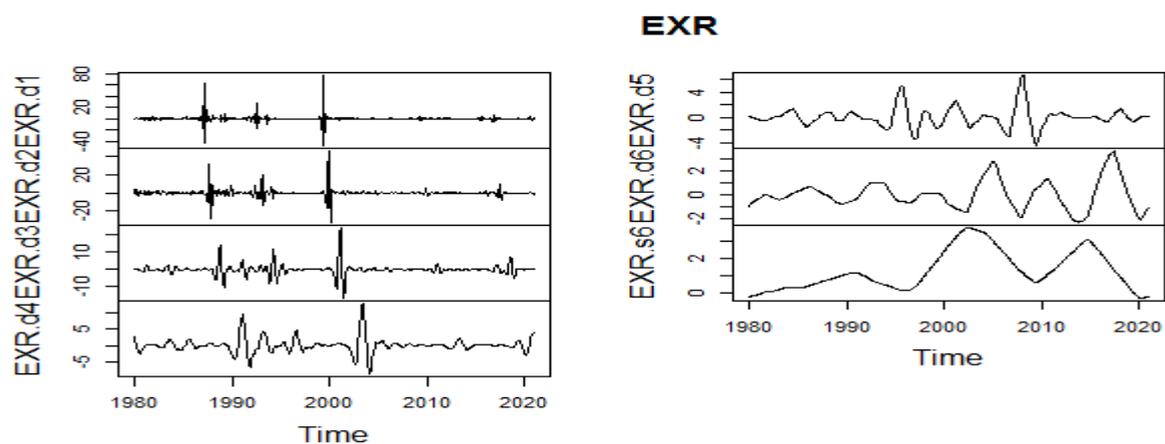


Figure 3: The wavelet decomposition of exchange rate returns into 6 wavelet levels

Source: Author's estimation using RStudio

Notes: Figure 4.2 represents the wavelet decomposition of the return series of the exchange rate from January 1980 to December 2020 into the following periods: Oil.d1 & Oil.d2 → Short run period, Oil.d3 & Oil.d4 → Medium run period, Oil.d5 & Oil.d6 → Long run period and Oil.s6 → Very long run period.

This also divides the series into different time periods, such as the short run ( $D_1 - D_2$ ), medium run ( $D_3 - D_4$ ), long run ( $D_5 - D_6$ ) and very long run ( $S_6$ ) periods, at different frequencies to determine the degree of variability of the exchange rate series over the different periods. From the observation in the short run ( $D_1 - D_2$ ), the series are very volatile, most especially before 1990, from approximately 1995 to 1998 and sharply approximately 22000. The medium run ( $D_3 - D_4$ ) is less volatile than the short run. In the long run ( $D_5 - D_6$ ), it varies to different degrees, and less volatility and stability are observed. In the very long run ( $S_6$ ), it was more stable as it increased from 1980 to 1990, before there was a noticeable decline approximately 1998 and a sharp increase (2000, 2005) and decrease (2010, 2020) over a long period of time.

#### 4.2.3 Wavelet Covariance

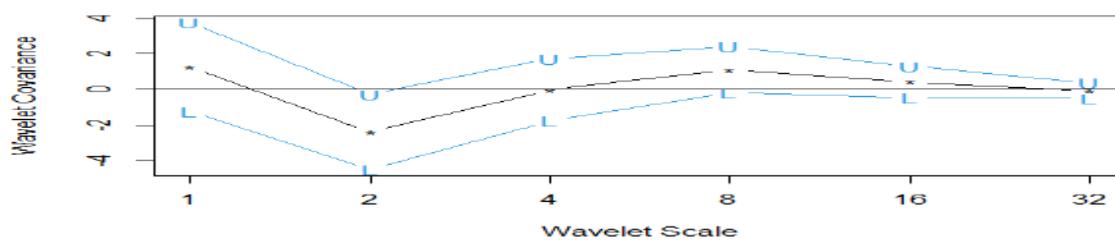


Figure 4: The wavelet covariance analysis for exchange rate and oil price returns

Source: Authors' estimation using R-Studio

Notes: Figure 4.3 represents the wavelet covariance of the return series of exchange rates and oil prices from January 1980 to December 2020. The upper (U) and lower (L) bounds are 95% confidence intervals, while the black dotted line denotes the covariance between the exchange rate and oil price in Nigeria.

It measures how the series co-varies over the different frequencies domain and observes the way variables move over a given time period. This checks the movement to see if they are positive or negative for exchange rate and oil price over the given period. When the covariance is positive (0 – 4 on the horizontal line), it shows that the series are moving in the same direction. When it is a negative covariance (0 – -4 on the horizontal line), it implies that variables are moving in the opposite direction. The wavelet covariance is measured on a vertical wavelet scale 1 - 32, where 1 – 4 measures the short-term period, 4 – 8 measures the medium-term period, 8 - 16 measures the long-term period and 16 – 32 measures the very long-term period. The black line was used to interpret the wavelet covariance, while the blue lines represent the upper and lower limits. Observations for the short-term period showed that there was a positive covariance between the series in the early 1980's; however, it changed to a negative correlation between the series, which implies that they are moving in the opposite direction in the later early years (end of the short-term period). When one increases, the other decreases and vice versa. However, during this period, as it was going down, it seen going up, such that by the time it entered the medium run period (4 – 8), it was exhibiting a positive covariance between the two series. This implies that during this period, the series are moving together. During the long-term period (8 – 16), there was a positive covariance between the variables, but it was declining in nature. In the very long run period (16 – 32), the relationship is still positive, but at the tail end of the very long run, it was already exhibiting a declining relationship, which implied they are already moving in an opposite direction.

#### 4.2.4 Wavelet Correlation

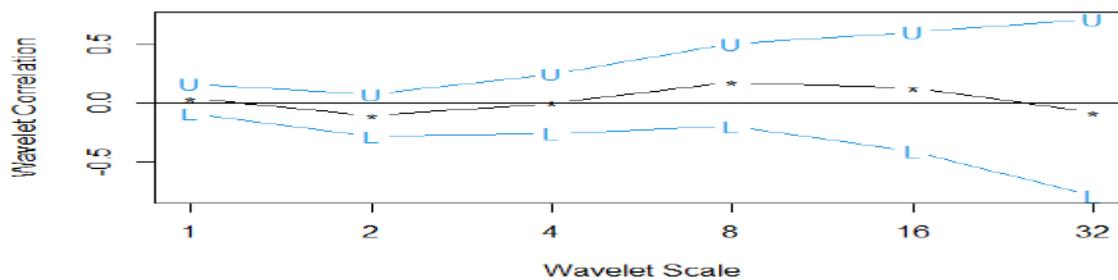


Figure 5: The wavelet correlation analysis for exchange rate and oil price returns  
Source: Authors' estimation using RStudio.

Notes: Figure 4.4 represents the wavelet correlation of the return series of the exchange rate and oil price from January 1980 to December 2020. The upper (U) and lower (L) bounds are 95% confidence intervals, while the black dotted line denotes the correlation between the exchange rate and oil price in Nigeria.

The wavelet correlation shows the positive and negative association that exists between the variables series, which are exchange rate and oil price. When the correlation is positive (0.0 – 0.5 on the horizontal line), it shows that the series have a positive relationship. When it is a negative correlation (0.0 – -0.5 on the horizontal line), it implies that series have a negative relationship. The wavelet correlation is also measured on a vertical wavelet scale 1 - 32, where 1 – 4 measures the short run period, 4 – 8 measures the medium run period, 8 - 16 measures the long run period and 16 – 32 measures the very long run period. The black line was used to interpret the wavelet covariance, while the blue lines represent the upper and lower limits. The short-run analysis shows that there is a negative relationship between the series, while the medium- and long-run analyses show that there is a positive relationship, but it declines towards the end of the long-run period. Here, this means that an increase in oil prices leads to an increase in the exchange rate. In the beginning of the very long-term period, the association was positive but became negative just before the end of the very long-term period approximately 2016 to 2020. This implies that in the very long run, an initial increase in the oil price will lead to an increase in the exchange rate; however, observations showed that the final increase in oil does not lead to an increase in the exchange rate.

#### 4.2.5 Continuous Wavelet Spectrum: Exchange rate

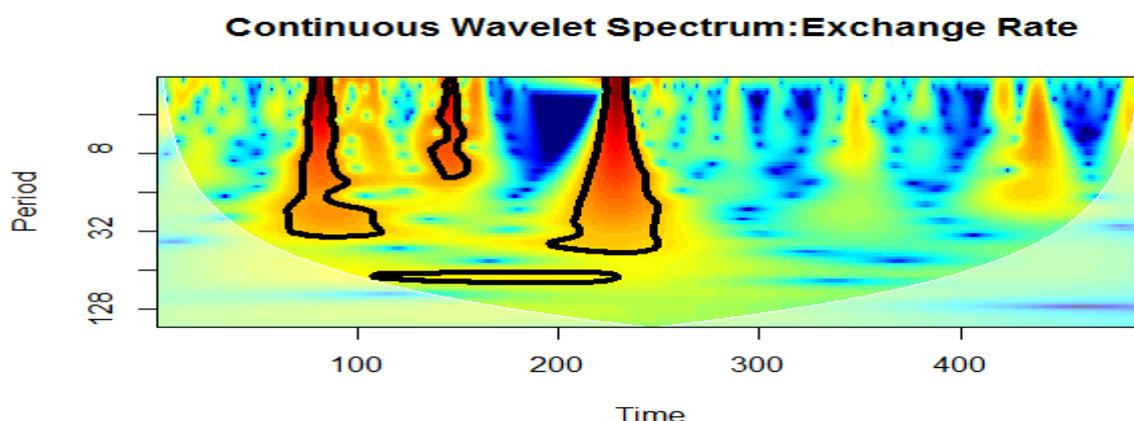


Figure 5: The continuous wavelet spectrum of exchange rate returns  
Source: Authors' estimation using RStudio

Notes: Figure 5 represents the continuous wavelet spectrum of the return series of the exchange rate from January 1980 to December 2020. The thick black contour indicates that the significance level is 5% for the region in the cone of influence (COI).

The code of the colour for the power varies from blue (low power) to red (high power).

The continuous wavelet spectrum for the exchange rate showed the degree of variability in the series over different time and frequency domains. The series are divided into five different times, 0 - 100, 101 - 200, 201 - 300, 301 - 400 and 400 - 492, on the horizontal axis. Observations were also made for four different periods, such as the short run period (0 - 8), medium run period (8 - 32), long run period (32 - 64) and very long run period (64 - 128), on the vertical axis. From the results, it is obvious that only the cone of influence can be interpreted, which is represented by the U area. The region shows the statistical significance of the series variability. The red regions show where there is high variability in the series. The blue regions display the area of low variability in the series. The black lines display the series significance at the 5% level. The yellow regions are just the lower portion of the red region. Therefore, the following can be seen:

### **1 - 100 frequency/period**

Short run period (0 - 8): With the presence of the blue areas, there are low levels of variability in the early to middle short run period of the series. However, with the presence of red areas towards the tail end of the first hundred (100) series, there is high variability. The series are also significant at the 5% level. Medium run period (8 - 32): With the presence of the blue areas, there are low levels of variability in the early to middle short run period of the series. However, with the presence of slight red areas, there is high variability but extremely low variability in the first hundred (100) series. More series are also significant at the 5% level than in the short run. Long run period (32 - 64): With the presence of slight blue areas, there are low levels of variability in the early period of the series. The series are also significant at the 5% level only at the beginning of the long run period; at the end, it does not. The very long run period (64 - 128): With the presence of slight blue areas, there are low levels of variability in the early period of the series. There is no variability in the series, and the levels are not significant.

### **101 - 200 frequency/period**

Short run period (0 - 8): Only the blue areas show low levels of variability in the middle short run period of the series. There is presence of few high variability in the middle periods with the presence of red areas. The series are also significant at 5% level. Medium run period (8 - 32): slight presence of low levels of variability, slight presence of high variability in the middle period in the series. The series are also significant at the 5% level. Long run period (32 - 64): With the presence of slight blue areas, there are observable low levels of variability in the series, and the series are not significant at all. The very long run period (64 - 128): There are observable low levels of variability and a 5% level of significance across the period. There is no high variability in the series, and the levels are not significant.

### **201 - 300 frequency/period**

Short run period (0 - 8) and Medium run period (8 - 32): With the presence of red areas, there is high variability in the series. Very strong low variabilities can also be observed in the series with the presence of strong blue areas. All series are also significant at the 5% level. Long run period (32 - 64): With the presence of slight blue areas, there are low levels of variability in the early period of the series. The series are also significant at the 5% level. The very long run period (64 - 128): No presence of variability in the series variability in the early period of the series. The series are however significant at the 5% level.

### 301 - 400 frequency/period

Short-run period (0 – 8), Medium-run period (8 – 32), Long-run period (32 – 64) and the very long-run period (64 – 128): With the presence of the blue areas, there are many low levels of variability in the series, and the series are not statistically significant at the 5% level.

### 401 - 492 frequency/period

Short run period (0 – 8), medium run period (8 – 32), Long run period (32 – 64) and very long run period (64 – 128): With the presence of the blue areas, there are many low levels of variability in the series, and the series are not statistically significant at the 5% level.

#### 4.2.6 Continuous Wavelet Spectrum: Oil Price

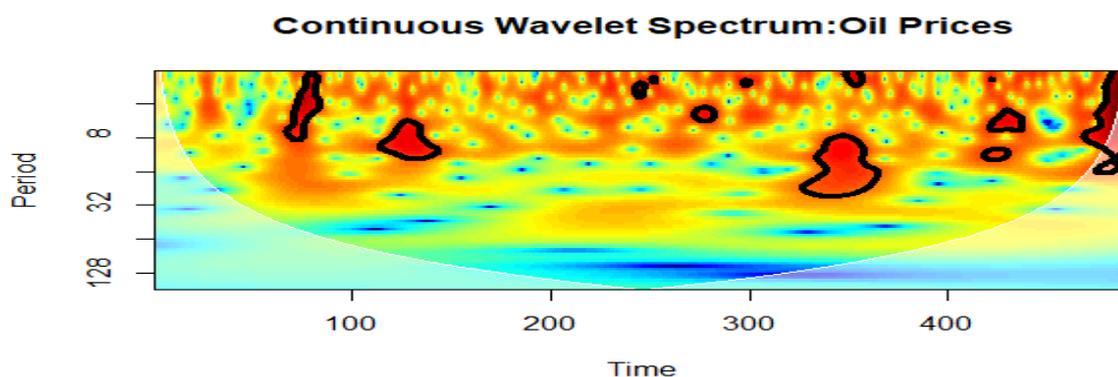


Figure 7: The continuous wavelet spectrum of oil price returns

Source: Authors' estimation using RStudio

Notes: Figure 6 represents the continuous wavelet spectrum of return series of oil prices from January 1980 to December

2020. The thick black contour indicates that the significance level is 5% for the region in the cone of influence (COI). The code of the colour for the power varies from blue (low power) to red (high power).

The continuous wavelet spectrum for oil prices shows the degree of variability in the return series over different time and frequency arenas. The series are divided into five different times, 0 - 100, 101 - 200, 201 – 300, 301 - 400 and 400 – 492, on the horizontal axis. Observations were also made for four different periods, such as the short run period (0 – 8), medium run period (8 – 32), long run period (32 – 64) and very long run period (64 – 128), on the vertical axis. From the observation, it is only the cone of influence that can be interpreted, which is represented by the U area. This is the region that shows the statistical significance of the series variability. The red regions show where there is high variability in the series. The blue regions show areas of low variability in the series. The black lines show the series significance at the 5% level. The yellow regions are just the lower portion of the red region.

From this result, the following can be seen:

#### 1 - 100 frequency/period: Short run period (0 – 8):

There is evidence of high variability towards the tail end of the first hundred (100) series, which is also supported by the statistical significance of the region at the 5% level. Medium run period (8 – 32): There is an absence of variability in the series in the period for the series region. Long run period (32 – 64): There is evidence of stable variation in the series for this period, and there is evidence of low power variation towards the end of the period. The very long run period (64 – 128): There is no variability in the series, and the levels are not significant.

**101-200 frequency/period:** Short-run period (0–8)

There is presence of high variability towards the end of the period with the presence of red areas. The series are also significant at the 5% level. Medium-run period (8–32): There are high levels of variability from the beginning until the middle point of the period, and the degree of the variation is highly significant at the 5% level. Long run period (32–64): With the presence of slight blue areas, there are observable low levels of variability in the series, and the series are not significant at all. The very long run period (64 – 128): There are observable low levels of variability. There is no high variability in the series, and the levels are not significant.

**201 - 300 frequency/period:** Short run period (0 – 8)

There is a significant high variation of oil price returns at the middle and towards the tail of the 201-300 observation. Medium run period (8 – 32), long run period (32 – 64) and very long run period (64 – 128): No presence of variability in the series variability in the early period of the series.

**301 - 400 frequency/period:** Short run period (0 – 8) and Medium run period (8 – 32)

There is presence of high variation at the beginning of the short run period and the whole of the medium run period reveal huge significant variability across frequency domain. Long-run period (32 – 64) and the very long-run period (64 – 128): With the presence of the blue areas, there are many low levels of variability in the series, and the series are not statistically significant at the 5% level.

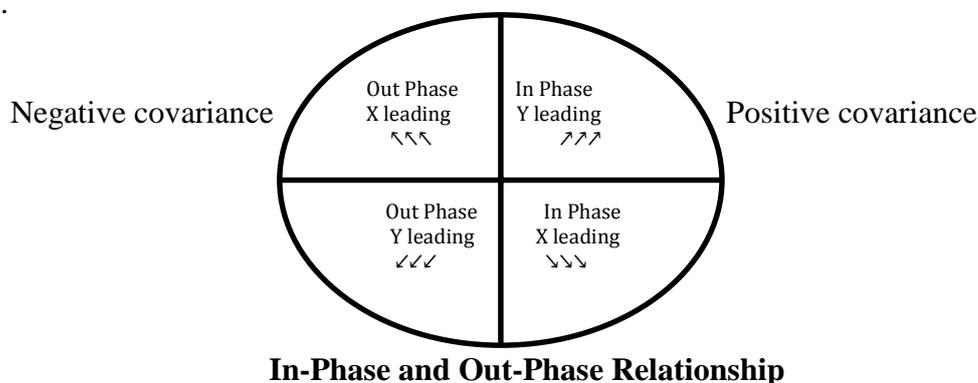
**401 - 492 frequency/period:** Short run period (0 – 8) and Medium run period (8 – 32)

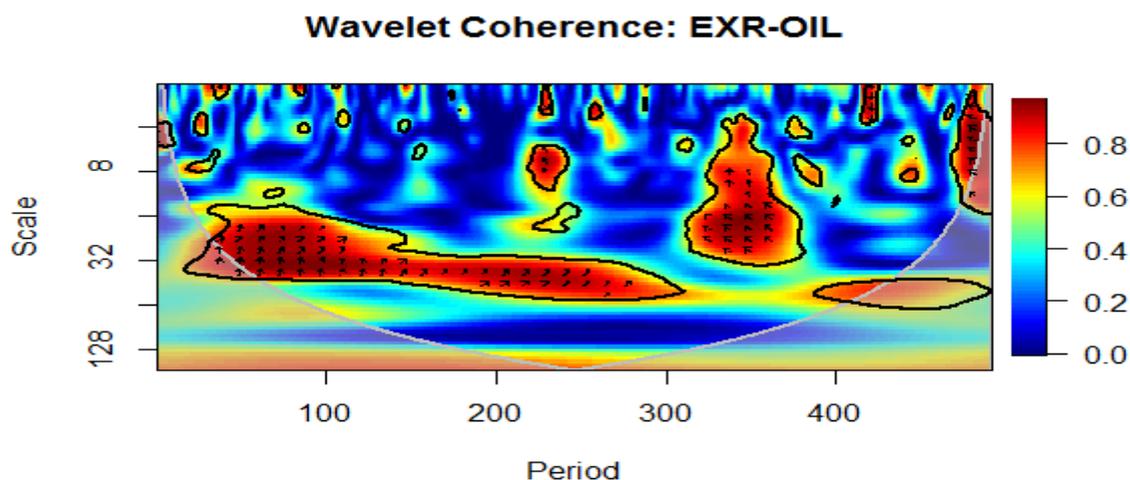
There is presence of high variation at the beginning of the short run period and the whole of the medium run period reveal huge significant variability across frequency domain. Long-run period (32 – 64) and the very long-run period (64 – 128): With the presence of the blue areas, there are many low levels of variability in the series, and the series are not statistically significant at the 5% level.

In summary, the null hypothesis of no short-run, medium-run, long-run and very long-run relationship between oil price and exchange rate in Nigeria is rejected on the significance level of 5% based on the evidence reported from the result of wavelet covariance, correlation and continuous wavelet transforms of exchange rate and oil price returns.

*4.2.7 Wavelet Coherence: Exchange Rate-Oil Price*

To interpret the wavelet coherence, we used the in-phase out phase relationship presented below.





**Figure 8: Wavelet coherence transforms of exchange rate and oil price returns**

Source: Authors' estimation using R-Studio

Notes: Wavelet coherence transform (WCT) of exchange rate return (EXR) and oil price return (OIL) for the period between January 1980 and December 2020 in Nigeria. The deep black contour represents the significance level at 5% over the red noise for areas covered by the cone of influence (COI). The dark red portion represents regions with significant interrelation, while areas covered by the deep blue colour signify low dependence between the series. However, the cold regions beyond the significant areas represent time and frequency bands with no dependence. Arrows pointing to the right (either up or down) signal in-phase effects, while arrows pointing to the left (either up or down) feature out-phase effects for both series.

This shows the lead-lag effect of the two variables. It shows where one variable cross and granger cause the other over different time frequency domains. From this analysis, all regions circled with black lines are significant at the 5% level. Red regions are regions with strong variabilities. Blue regions show low variabilities. The in-phase regions show a positive covariance. The out phase region exhibits a negative covariance. The analysis is interested in seeing which one affect or granger causes the other by observing the in-phase and out-phase relationship. X represents the exchange rate, which is the exogenous variable, and Y represents the oil price, which is the endogenous variable. Where X is leading, it means that the exchange rate is leading, and where Y is leading, it means that the oil price is leading. The time differences are 0 - 100, 101 - 200, 201 - 300, 301 - 400 and 400 - 492 on the horizontal axis, while the periods are the run period (0 - 8), medium run period (8 - 32), long run period (32 - 64) and very long run period (64 - 128) on the vertical axis.

In the short and medium run, there is no evidence of a lead lag effect; nothing is granger causing the other. There is no evidence of in-phase and out-phase relationships. In the long run, for the first 100 series, there is evidence of lead lag effects. Some series point to Y, meaning Y leads to X; therefore, the exchange rate is granger causing oil prices for those regions, and there is an out-phase effect. Those arrows pointing upwards show that there are no relationships between the exchange rate and oil price.

In conclusion, there is significant evidence to reject the null of no time-varying effect of oil price on exchange rate in Nigeria at the 5% level of significance and accept the alternative hypothesis of significant evidence of the time-varying effect of oil price on exchange rate in Nigeria.

#### 4.2.8 Granger Causality

##### Table 2: VAR Granger Causality and F Statistics Result Summary

<b>Time Domain</b>	<b>OIL <math>\Rightarrow</math> EXC</b>	<b>EXC <math>\Rightarrow</math> OIL</b>	<b>Remarks</b>
Ordinary series	(1.58534) {0.0924}	(0.79947) {0.6512}	No causality
D <sub>1</sub>	(2.09458) {0.0161}*	(1.38242) {0.1706}	Unidirectional Causality
D <sub>2</sub>	(2.19991) {0.0109}*	(1.28138) {0.2261}	Unidirectional Causality
D <sub>3</sub>	(2.63689) {0.0020}*	(1.41128) {0.1569}	Unidirectional Causality
D <sub>4</sub>	(1.80570) {0.0448}**	(2.12869) {0.0142}**	Bidirectional Causality
D <sub>5</sub>	(2.38808) {0.0054}*	(2.82509) {0.0009}*	Bidirectional Causality
D <sub>6</sub>	(6.04140) {0.0000}*	(2.99840) {0.0005}*	Bidirectional Causality
S <sub>6</sub>	(6.05137) {0.0000}*	(6.21713) {0.0000}*	Bidirectional Causality

Note: F statistics results are presented in ( ), while results for probabilities are presented in { }. \* and \*\* denote significance levels at 1% and 5%, respectively. D<sub>1</sub> & D<sub>2</sub>  $\rightarrow$  Short run period, D<sub>3</sub> & D<sub>4</sub>  $\rightarrow$  Medium run period, D<sub>5</sub> & D<sub>6</sub>  $\rightarrow$  Long run period and S<sub>6</sub>  $\rightarrow$  Very long run period.

For robustness purposes and to answer research question three, this study used the ordinary and decomposed series of oil price and exchange rate returns to estimate the vector autoregressive (VAR) Granger causality. However, before proceeding to the estimation of the decomposed series, the study discovered that there is absence of causal effect between the ordinary return series of exchange rate and oil price. Conversely, the outcome of the decomposed series VAR estimates shows evidence of unidirectional causality from oil price to exchange rate for the short-run period (D<sub>1</sub> & D<sub>2</sub>) and medium-run period (D<sub>3</sub>), whereas the other medium-run period (D<sub>4</sub>) revealed evidence of bidirectional causation between oil price and exchange rate. Furthermore, the long-run (D<sub>5</sub> & D<sub>6</sub>) and very long-run (S<sub>6</sub>) periods show evidence of feedback causality between oil prices and exchange rates. This therefore clarifies that the relationship between oil price and exchange rate is dependent on time-period, and as such, considering the nexus between the periods over a single period could result in inconclusive verification.

Finally, the hypothesis of the study is tested based on the result of the causality test for the time period. Thus, with the evidence of uni-or-bidirectional causality, this study rejects the null hypothesis of no direction of causality between oil prices and exchange rates in Nigeria. Hence, the alternative hypothesis of the presence of directional causation between oil prices and exchange rates in Nigeria was accepted at the 5 percent level of significance.

## **5. Summary, Conclusion and Recommendations**

Three hypotheses and results are reported for this study. The first hypothesis analysed the short-run, medium-run, long-run and very long-run relationships between oil prices and exchange rates in Nigeria. The study shows evidence of positive and negative associations between exchange rates and oil prices over the periods. This evidence corroborates the findings of Yang et al. (2017), Adebayo (2020) and Huang, An and Lucey (2020), which revealed that there is a 50% co-movement between the exchange rate and oil price and that they both move negatively and positively. The second hypothesis examined the time-varying effect of oil prices on exchange rates in Nigeria revealed that in the short and medium run, there is no evidence of a lead-lag effect, which implies the absence of a time varying effect. However, in the long run, there is evidence of lead-lag effects between oil prices and exchange rates in those regions. This result is in line with the conclusion given by Reboredo and Rivera-Castro (2013), Aloui,

Hkiri, Hammoudeh & Shahbaz (2018) and Yang, Cai and Hamori (2017) that there is evidence of profound lead-lag effects between exchange rates and oil prices during the global financial crisis compared to the pre-global financial crisis. The third hypothesis analyses the direction of causality between oil prices and exchange rates in Nigeria. The results revealed that oil price has a one-way Granger effect on the exchange rate in the short run and medium run; however, in the long run and very long run, there is bidirectional Granger causality between oil price and exchange rate in Nigeria. Following this evidence, this finding was in line with the evidence reported by Kisswani, Harraf and Kisswani (2018), Adebayo (2020) and Musa and Maijama (2021).

Conclusively, empirical evidence of this study supports the presence of a lead-lag relationship between oil prices and exchange rates in Nigeria. In addition, there is evidence of a unidirectional effect of oil prices on exchange rates in Nigeria in the short run and medium run periods. The bidirectional causality surfaced in the long run and very long run period between the observed series. This study therefore concludes that oil price is a significant factor that causes changes in the exchange rate in Nigeria in the short run and medium run periods. However, in the long run and very long run periods, oil price and exchange rate reflect a feedback effect such that fluctuation in oil price influenced exchange rate changes and changes in exchange rate thereafter caused shocks to oil price.

Based on the finding that oil price shocks induce fluctuations in exchange rates, economic activities and government revenue, there is the need for policy makers to promote effective economic diversification, such as looking for alternative ways of financing the budget by fully diversifying into agriculture, which was the source of income and employment for the economy before oil discovery. This would enhance export production in other sectors of the economy, reduce overdependence on oil and, ultimately, stabilize the exchange rate of the naira via-a-via the US dollar. The results show bidirectional causality between oil prices and exchange rates in the long run. Thus, monetary authorities should adopt the Mundell–Fleming model of fixed exchange rates to reduce exchange rate fluctuations induced by oil price shocks. For instance, a fixed exchange rate policy that is export-friendly would be appropriate to stimulate export production and reduce exchange fluctuation. This will make it possible to maintain a fair swing in external financial activities as well as trade fluctuations and oil-related products, especially in periods of oil price crises.

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# IMPACT OF CLIMATE CHANGE ON NIGERIAN AGRICULTURAL SECTOR CROP PRODUCTION

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## ABSTRACT

This study examined the impact climate change have on Nigerian agricultural sector crop production within the period of 1990 to 2020. This study employed the Non-linear Autoregressive Distributed Lag (NARDL) Model. NARDL is appropriateness because the unit root test results revealed a mixed order of I(0) and I(1) and Wald test which established the existence of non-linearity. This study established the existence of long-run relationship and also found that in the short run, lag of increase in rainfall index has a positive and statistically significant impact on crop output. the past value of decrease in rainfall has a positive and statistically significant impact on crop output. Decrease in temperature has a positive impact on crop production at both the current and lagged value but only the lag is statistically significant. In the long-run both increase and decrease in rainfall as well as increase in temperature indices have negative impact on crop production why reduction in temperature is beneficial to crop production. This study, this study recommends the provision of irrigation facilities such as dam, pumping machines, hose, wells and boreholes to farmers as this will help ameliorate shortages of water caused by climate change.

**Keywords:** Climate, Climate Change, Crop Production

**JEL Classifications:** Q1, Q51, Q54

## 1. INTRODUCTION

Climate change is one of the formidable challenges confronting our planet in the twenty-first century (Keshav & Niraj, 2013). A change in the climate system which is attributed directly or indirectly to human activities as well as climate natural variability that alters the composition and workings of the climate system is referred to as climate change (UN, 1992). Human activities associated with the burning of fossil fuels, bush burning, deforestation and urbanization leads to the emission of carbon (iv) oxide, and other greenhouse gases (GHGs) into the climate system has been blamed for this development (Tol, 2013). Higher concentration of GHGs in the atmosphere will result in the blocking of the transmission of light trying to escape from the earth thereby trapping the heat resulting in global warming (Cumhur & Malcolm, 2008).

Nigerian climate has shown considerable temporal and spatial shifts in its variability and change. Extreme climate and weather events (drought, flood, heat waves, ocean, and surges) have become more regular. The impacts of extreme weather and climate may be gradual but they are destructive to lives and property, negatively impact on the economy. Floods have

become a perennial challenge with increasing intensity each year, leaving colossal losses and trauma. The low-lying coast of the country experiences perennial inundation due to ocean surges and strong tidal waves (NIMET, 2012). In 2010, the National Emergency Management Agency (NEMA) reported that over 250,000 Nigerians were displaced by flood disasters that ravaged many communities across the country (NEMA, 2010). According to Nigeria climate review (2012) published by the Nigerian Meteorological Agency (NIMET), the onset of the rainy (wet) season between 1941 and 1970 was mostly from early to normal except for isolated places around Sokoto, and Maiduguri that had late onset of the rainy season. However, increasingly late onset of the rainy season characterised later years such that by 1971-2000 a vast portion of the country now experience late onset of the rains with only a narrow band in the middle of the country with normal conditions.

Climate change alters climatic outcomes such as rainfall and average temperature. Changes in climatic outcomes directly affect economic activities such as agricultural output since agricultural production is carried out through the selection of crops suitable for the climate of a specific region and application of proper farming methods, this made agriculture a climate dependent sector of the economy. Climate change distorts the agricultural ecosystem, resulting in the change in agricultural climatic elements such as temperature, precipitation, and sunlight. Climate change outcomes such as rising temperatures and changes in the patterns of rainfall affects agricultural yield of both rain-fed and irrigated crops in a number of ways. Also, crops suffer severe setbacks as a result of variation of the period of exposure to sunlight and irregular rainfall either in the form of early cessation or too early commencement of rainfall. These results in flowers and fruits abortion. Also, pest and diseases incidences which becomes varied and uncontrollable under extreme weather events cause decline in harvest of crops (Nzeadibe, Egbule, Chukwuone & Agu, 2011).

The objective of this study is to examine the impact of climate change on crop production by the Nigerian agricultural sector over the period of 1990 to 2020. The rest of this paper is structured as follows: Section two contains the review of literature while section three discusses the methodology of the study, section four discusses the results of the study and section five concludes and makes recommendations.

## **2. LITERATURE REVIEW**

Climate is one of the important factors that affect agricultural sector. Hence, several studies have examined the impact of variations in the patterns and magnitude of climate variables such as rainfall, temperature and humidity (climate change) on agricultural sector outputs.

### **2.1 Concept of Climate Change**

Climate change is defined as change which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability is observed over comparable time periods (IPCC, 1995). Climate change is the significant and lasting variation in the statistical properties of the average weather system when considered over long period of time, regardless of cause (IPCC, 2014). Climate change can be referred to as the variation in average weather which is attributed directly or indirectly to human activities in addition to natural events that alters the composition of the atmosphere over comparable time period.

### **2.2 Theoretical Literature**

There are a lot of theoretical postulation concerning the relationship between climate change and the agricultural sector performance. Some of this postulations include the followings. Regional Integrated model of Climate and the Economy (RICE) analyse different national

strategies in international climate policy. RICE model is applied to analyse the value of the resolution of uncertainties about impacts and costs (Nordhaus and Popp, 1997). The Regional Integrated model of Climate and the Economy model (RICE) is a regionalized version of the DICE model. It has the same basic economic and geophysical structure, but contains a regional elaboration.

The pioneering work of Kuznets in (1955) on economic growth and income inequality gave birth to what is today known as Kuznets environmental curve. Kuznets brought to limelight the relationship between the economy and environmental quality. According to the environmental Kuznets curve (EKC) the relationship between various indicators of environmental degradation and income per capita follows an inverted U shape. In the early stages of economic growth, degradation and pollution increase, but beyond some level of income per capita, which will vary for different indicators, the trend reverses, so that at high income levels economic growth leads to environmental improvement.

Hedonic approach to climate change argued that it is not only a good or product per se but its characteristics that provide utility. Therefore, the total amount of utility a consumer derives from the purchase of a good or product is dependent upon the total amount of product characteristics. The Hedonic pricing models were first introduced in economics in the late 1960s which states that agricultural land outputs are dependent upon factors that determine agricultural productivity i.e. climate (max, min temperatures, precipitations, solar radiation etc.), soil quality and slope (flat vs. hilly). The effects of climate change variables on land output are an indicator of their impact on productivity after crop substitution is allowed for.

### **2.3 EMPIRICAL LITERATURE REVIEW**

Idumah, Mangodo, Ighodaro and Owombo (2016) investigated the effect of climate change on food production in Nigeria using secondary data. The study relied on vector error correction model and found that there is a long-run relationship between climate change and food production and that rainfall positively impact food production. Also, Ayinde, Ajewole, Ogunlade and Adewumi (2010) carried out an empirical analysis of agricultural production and climate change in Nigeria over the periods of 1987 to 2005 using descriptive statistics, granger causality test and regression analysis and found that rainfall exhibit variability and that causality runs from climate change to agricultural output. Furthermore, Oyinbo, Rekwot and Duniya (2014) investigated the impact of rainfall pattern on agricultural production in Nigeria over the period 1970 to 2008 using a Vector Autoregressive (VAR) and granger causality test and found a unidirectional causality between pattern of rainfall and agricultural production in Nigeria and that changes in the pattern of rainfall is a determinant of the level of output of the agricultural sector in Nigeria.

Asafu-Adjaye (2014) studied the economic impact of climate change on agriculture in Africa with the aid of a computable general equilibrium model (CGE). The simulation results revealed that Africa will experience the largest impact from climate change in terms of decline in economic growth and welfare losses. The disaggregated results showed that Southern Africa will be the hardest hit region, followed by the Rest of sub-Saharan Africa, North Africa and East Africa, in that order.

Ogbuabor, Orji, Mansseh and Anthony-Orji (2018) examined the impact of climate change on agricultural productivity in Economic Community of West African States (ECOWAS) region over the period of 2002 to 2015 using annual panel climatic data. Both fixed effect and panel two stage least squares techniques were used in the estimation of the empirical model. The study found that rainfall exerted a strong positive and significant influence on agriculture while temperature influence is negative and statistically insignificant. The study also found that

labour and capital are non-negligible in their impact on agricultural productivity. Oduyoye-Ejumedia and Ejumedia (2019) assessed the impact of climate change on productivity in sub-Saharan Africa over the period of 1986 to 2016 using panel data covering six (6) African countries. The study employed Johansen and Fisher Panel cointegration test and fully modified ordinary least square cointegration approach. The study found that climate change represented by annual temperature and precipitation negative impact on aggregate productivity.

Takaaki (2016) investigated rainfall variability and macroeconomic performance in India within the period of 1952 to 2013 using an integrated assessment model which incorporate economy and climate change modules. The study found that rainfall variability impact non-agricultural sectors through its impact on agricultural sector. Kumar (2012) analysed the impact of climate change and economic food waste in the United States using loss adjusted national food availability data for 134 food commodities, it calculated the greenhouse gas emissions due to wasted food using life cycle assessment and the economic cost of the waste using retail prices. The analysis showed that avoidable food waste in the US exceeds 55 million metric tonnes per year, nearly 29% of annual production. This waste produces life-cycle greenhouse gas emissions of at least 113 million metric tonnes of CO<sub>2</sub> annually, equivalent to 2% of national emissions, and costs \$198 billion. Mwaura and Okoboi (2014) examined the relationship between climate variability and crop production in Uganda using a time-varying autoregressive conditional heteroscedasticity model of the crop production function in Uganda over the period of 1981 to 2008 and found that variation in rainfall and temperature has a significant effects on crop output while exponential increase in rainfall has detrimental effect on crop output.

Though the impact of climate change on agricultural sector has received attention in the literature. Most of these studies studied the whole agricultural sector thereby ignoring the peculiarity of the crop subsector. Therefore, this study will dwell on crop subsector since this subsector is the field of direct impact of climate change in the agricultural sector. Also, various estimation techniques have been used in the estimation of the impact of climate change on the agricultural sector, most of these estimation techniques are linear in nature and ignored the nonlinear relationship between climate change and agriculture that was established by the Ricardian approach (Mendelsohn, Nordhaus & Shaw, (1994)). Therefore, this study will employ Asymmetric Autoregressive Distributed Lag technique of estimation which is also known as the Nonlinear Autoregressive Distributed Lag (NARDL) model. This modelling technique is an asymmetric extension of the linear ARDL approach to modelling long-run level relationships.

### 3. METHODOLOGY

To model the economic impacts of climate change on the Nigeria agricultural sector, this study adapted Ogbuabor, Orji, Manasseh and Anthony-Orji (2018) for the specification of the model of this study by representing climate change with rainfall index and temperature index, instead of the mean annual temperature and mean annual rainfall used by Ogbuabor et al (2018).

The rainfall index and temperature index used in this study follows Kraus (1977) which is obtained by standardization of the data.

The rainfall index is given as

$$Rain = \frac{(AR - MAR)}{SD} \quad 3.1$$

Where Rain is Rainfall Index, AR annual rainfall, MAR is the mean annual rainfall over the period of the study and SD is the standard deviation over the period of the study.

Also, the temperature index was computed as

$$Temp = \frac{(AT - MAT)}{SD} \quad 3.2$$

Where Temp is the temperature index, AT is annual temperature, MAT is Mean annual temperature over the period of the study and SD is the standard deviation of temperature over the period of the study.

### 3.1 Theoretical Framework

This study adapted the Hedonic theory of climate change as its theoretical framework. The Hedonic pricing models were first introduced in economics in the late 1960s. This theory argued that the values of land or its productivity depends upon climate (maximum, minimum temperatures, precipitations, and solar radiation), slope (hilly vs. flat) and tendency to flood. These factors will determine productivity which determines the price of a piece of land. Another factor that could contribute to land price difference but not agricultural productivity is proximity to urban areas etc. Mendelsohn, Nordhaus & Shaw (1994) applied hedonic price model to link land value to land characteristics including climate factors. The hedonic equation estimate of the effects climate change is given as:

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 Z_t + \mu_t \quad (3.3)$$

Where,  $Y_t$  represent per acre agricultural land price or output for the time period t.  $\beta_0$  is a Constant terms,  $\beta_1$ = slope of climate change variables and  $\beta_2$  = is the slope of non-climate variables.  $X_t$  is a Vector of all climate variables (average maximum, minimum temperature and precipitation for the time period t.  $Z_t$  is a Vector of all non-climate variables for the time period t.  $\mu_t$  is the Stochastic error term Both rental value of land and productivity of land can be taken as the dependent variable.

### 3.2 Model Specification

Going by the foregoing, the equation for the impact of climate change on agricultural production Crop in its functional form is given as follows:

$$Crop_t = f(Rain_t, Temp_t, Lab_t, Cap_t, AgrL_t, Fert_t) \quad (3.4)$$

Where  $Crop_t$  is output of crop subsector of the Nigerian agricultural sector measured as percentage of Gross domestic product (GDP),  $Rain_t$  is rainfall index (Measured in Millimetres),  $Temp_t$  is changes in temperature index (Measured in degree centigrade),  $Lab_t$  is the country's labour force as a percentage of total population,  $Cap_t$  is capital proxied by gross fixed capital formation annual growth rate measured in percentages,  $AgrL_t$  is agricultural land proxied by arable land as percentages of total land area and  $Fert_t$  is fertilizer consumption measured in kilogrammes per hectare of arable land while  $\alpha_0$  to  $\alpha_6$  are the parameters to be estimated.

Given that equation 3.3 will be estimated using an asymmetric Autoregressive Distributed Lag (ARDL) model, the long-run asymmetric equation of climate change on agricultural production is given as:

$$Crop_t = \alpha_0 + \alpha_1 Rain^+_t + \alpha_2 Rain^-_t + \alpha_3 Temp^+_t + \alpha_4 Temp^-_t + \alpha_5 Lab_t + \alpha_6 Cap_t + \alpha_7 AgrL_t + \alpha_8 Fert_t + \mu_t \quad (3.5)$$

Where  $Rain^+_t$  and  $Rain^-_t$  are the partial sum of positive and negative changes in mean of annual rainfall.

Following Shin, et al. (2011), equation 3.3 can be presented in an ARDL framework as follows:

$$\begin{aligned} \Delta Crop_t = & \beta_0 + \beta_1 Crop_{t-1} + \beta_2 Rain^+_t + \beta_3 Rain^-_t + \beta_4 Temp^+_t + \beta_5 Temp^-_t + \beta_6 Lab_t + \beta_7 Cap_t + \\ & \beta_8 AgrL_t + \beta_9 Fert_t + \sum_{i=1}^l \rho_{1i} \Delta Crop_{t-1} + \sum_{i=0}^m \rho_{2i} \Delta Rain^+_{t-1} + \sum_{i=0}^n \rho_{3i} \Delta Rain^-_{t-1} + \sum_{i=0}^o \rho_{4i} \Delta Temp^+_{t-1} \\ & + \sum_{i=0}^p \rho_{5i} \Delta Temp^-_{t-1} + \sum_{i=0}^q \rho_{6i} \Delta Lab_{t-1} + \sum_{i=0}^r \rho_{7i} \Delta Cap_{t-1} + \sum_{i=0}^s \rho_{8i} \Delta AgrL_{t-1} + \sum_{i=0}^t \rho_{9i} \Delta Fert_{t-1} + \mu_t \end{aligned} \quad (3.6)$$

All variables are as explained above, l, m, n, o, p, q, r, s and t are the respective lag order. From equation 3.6.

### 3.3 Estimation Techniques

Unit root test will be employed to determine the order of integration of the variables. I(0) and I(1) data are appropriate for NARDL but not I(2). Therefore, testing for unit root is important to avoid variables that at I (2). To achieve this, this study will use Augmented Dickey Fuller (ADF) test. Also, Wald test which is a test statistic based on the unrestricted regression will be carried out to test for the existence of asymmetry in the Non-linear ARDL model.

The estimation of the empirical model of this study will be done using Asymmetric ARDL modelling as its estimation technique. Asymmetric ARDL modelling technique adopted in this study has some advantages which include that it can be applied regardless of whether the variables in the model are stationary at level or at first difference. Also, this method correct for endogeneity and serial correlation and allow for possible asymmetric adjustment in the movement of the variables.

### 3.4 Nature and Sources of Data

This study will use annual time series data covering the time frame of 1990 to 2020. The data for this study will be sourced from the Central Bank of Nigeria (CBN) Statistical bulletin, edition, and World Bank Climate Change Portal and World Development Indicator (WDI) database of the United Nation Development Programme (UNDP).

## 4. RESULTS AND DISCUSSION OF FINDINGS

In order to assess the impact of climate change on crop subsector output of the Nigerian agricultural sector, this study carried out NARDL bound test for cointegration, and estimated both NARDL short-run and long-run model as well as some post estimation tests.

### 4.1 Unit Root Test results

This study carried out unit root test to verify the time series properties of the data employed using standard Augmented Dickey-Fuller.

#### 4.1.1 Augmented Dickey-Fuller Unit Root Test results

**Table 4.1: ADF unit Root Test Results**

Variables	ADF Statistics at Level		ADF Statistics at First Difference		Order Of Integration
	ADF Statistics	Prob.	ADF Statistics	Prob.	
AGL	-2.4236	0.1444	-4.4286	0.0009	I(1)
LAB	-4.01822	0.0194	-4.6043	0.0013	I(0)
CAP	-0.0329	0.9480	-4.9601	0.0004	I(1)
FERT	-0.8848	0.7774	-6.2588	0.000	I(1)
CROP	0.8331	0.9930	-4.8295	0.0006	I(1)
RAIN	-6.6550	0.0000	-12.8706	0.0000	I(0)
TEMP	-2.6442	0.0960	-4.2924	0.0025	I(1)

The ADF unit root tests in table 4.1 revealed that AGL, CAP, FERT, and RAIN were stationary at level. The other variables such as LAB and TEMP were stationary at first difference. Hence, the time series data employed in this study were stationary either I(0) or I(1).

#### 4.2 NARDL Bound Test for Climate Change and Crop production

The bound test results presented in table 4.2 indicated F-statistics value of 3.655 which is greater than upper and lower critical values. Therefore, this result confirmed the existence of long-run relationship in the model and as such both the short-run and long-run models can be estimated using the Non-Linear ARDL estimation technique.

**Table 4.2: NARDL Bound Test Result**

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	3.655178	10%	1.92	2.89
K	7	5%	2.17	3.21
		2.5%	2.43	3.51
		1%	2.73	3.9

#### 4.4.2 Short-run NARDL model of Climate Change and Crop production

The short-run NARDL presented in table 4.3 revealed that positive index of rainfall (both current and past value) have positive impact on crop output though only lagged value of positive index of rainfall is statistically significant at 5% level of significance. A unit increase in the past value of positive index of rainfall resulted in 329.41 units increase in crop subsector's output.

**Table 4.3: NARDL Short-run Model of Climate Change and Crop production Results**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RAIN_POS)	38.71053	87.23089	0.443771	0.6658
D(RAIN_POS(-1))	329.4099	112.2655	2.934205	0.0136
D(RAIN_NEG)	-148.0442	125.2954	-1.181561	0.2623
D(RAIN_NEG(-1))	-362.2884	111.7122	-3.243053	0.0078
D(TEMP_NEG)	210.2071	153.0712	1.373263	0.1970
D(TEMP_NEG(-1))	344.1642	147.8160	2.328328	0.0400
D(LAB)	5.41E-05	7.11E-05	0.761088	0.4626
D(AGRL)	0.349816	0.072553	4.821499	0.0005
CointEq(-1)*	-0.531574	0.070519	-7.537997	0.0000
R-squared	0.702658	Mean dependent var		482.1417
Adjusted R-squared	0.577461	S.D. dependent var		498.0967
S.E. of regression	323.7779	Akaike info criterion		14.65308
Sum squared resid	1991810.	Schwarz criterion		15.08129
Log likelihood	-196.1432	Hannan-Quinn criter.		14.78399
Durbin-Watson stat	2.200886			

Also, both current and past value of negative value of rainfall index have negatively impact on crop subsector's output but only the lagged value of negative index of rainfall is statistically significant at 5% level of significance. A unit increase in the lagged value of the negative index of rainfall is accompanied by 365.28 units decline in the output of the crop subsector. This means that, crop response to rainfall variation suffers from lag effect. Negative index of temperature (both current and lagged value) have positive impact on crop subsector's output though it is only the lagged value that is statistically significant at 5% level of significance. A

unit increase the negative index of temperature is accompanied by 344.16 units increase in crop subsector output. Labour and agricultural land have positive impact but only the impact of agricultural land is statistically significant at 5% level of significance.

The speed of adjustment is rightly signed and statistically significant at 5% probability level and revealed that 53.2% of variation caused by shocks from climate change is corrected annually. This implication of this is that deviation caused by climate change to crop production will be overcome within two years and long-run equilibrium level restored. This results revealed that though the impact of climate change on crop production is mixed. This findings are consistent Idowu, Ayoola, Opele and Ikenweibe (2011) and Mwaura and Okoboi (2014). The adjusted coefficient of determination revealed that this model captured 57.7% of the systematic variation in crop output of the Nigerian agricultural sector. The Durbin-Watson statistics which is used to test for the existence of autocorrelation also indicated the absence of autocorrelation since the value of 2.20 can be approximates to equal to 2.

### 4.3 Long-run NARDL Model of Climate Change and Crop production

Table 4.4 revealed that in the long-run, both positive and negative indexes of rainfall have negative impact of crop production. Though it is only the negative index of rainfall that is statistically significant at 5% level of significance. A unit change in negative index of rainfall resulted in 1092 units decline in crop production. Also, positive index of temperature has a negative and statistically impact on crop production.

**Table 4.4: Long-run model of Climate Change and Crop production**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RAIN_POS	-985.7794	546.8891	-1.802521	0.0989
RAIN_NEG	-1092.323	657.8265	-16.66210	0.0000
TEMP_POS	-195.7098	49.71225	-3.936850	0.0013
TEMP_NEG	5.324904	754.9392	0.007053	0.9945
LAB	0.000507	0.000230	2.209302	0.0493
AGRL	0.013617	0.256750	0.053036	0.9587
FERT	30.55057	82.20026	0.371660	0.7172
C	6391.120	160316.3	0.039866	0.9689

The impact of negative index of temperature is positive on crop production but this impact is not statistically significant. Labour, agricultural land and fertilizer have positive impact on crop production but only labour is statistically significant at 5% level of significant. A unit change in labour resulted in 0.13617 unit change in crop production.

### 4.4. Test for Non-linearity

Wald test presented in table 4.5 contain F-statistics and Chi-square with critical values of 3.5 and 7.02 respectively and probability values of 0.0031 and 0.0299 respectively. This statistics and their accompanying probability confirmed the existence of non-linearity.

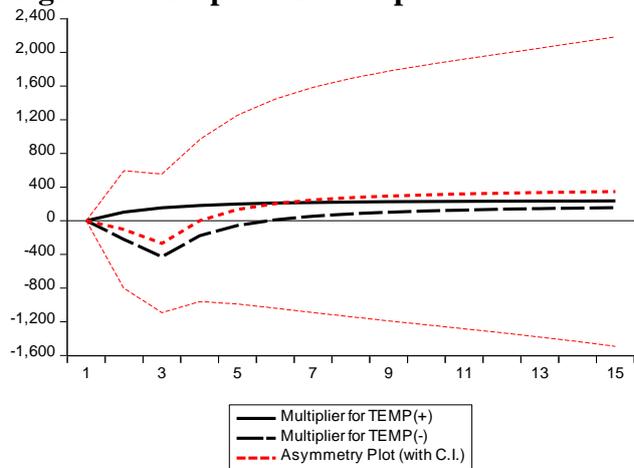
**Table 4.5: Wald Test results**

Test Statistic	Value	Df	Probability
F-statistic	3.509721	(2, 12)	0.0031
Chi-square	7.019441	2	0.0299

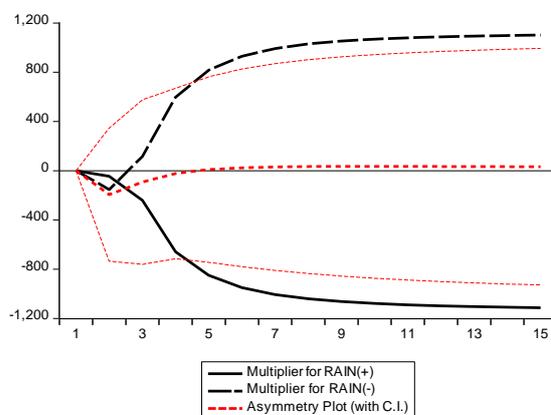
Also, the NARDL multiplier presented in figure 1 and 2 confirmed the presence of asymmetry in the relationship between indexes of rainfall and temperature and agricultural sector output. As shown in figure 1 and figure 2, both increase and decrease in index of temperature assume

the same pattern as depicted by the asymmetry plot. The non-linearity in the relationship between agricultural sector and climate change is also confirmed.

**Figure 1 Multiplier for Temperature**



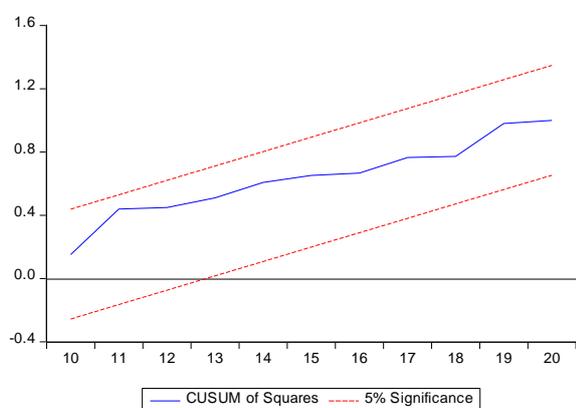
**Figure 2: NARDL Multiplier for Rainfall**



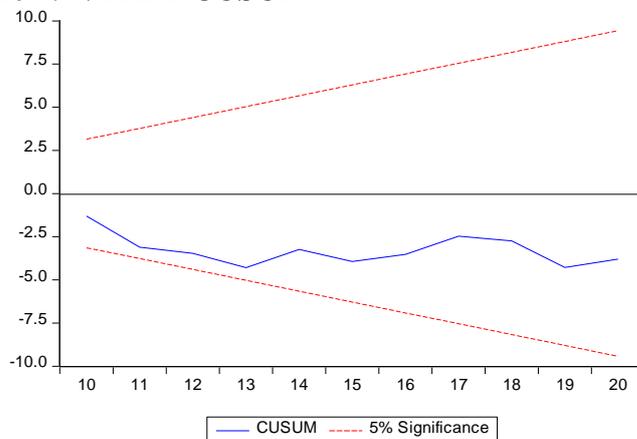
#### 4.5 Stability Test Results

This study used the CUSUM square to check the stability of the estimated coefficients. This test procedure is based on plot of the sum of the recursive residuals. The results of the CUSUM of square test presented in figure 4.3 revealed that the plot of the CUSUMSQ fall within the two straight lines indicating that the model is stable. Also, the plot of the NARDL CUSUMS fall within the two straight lines also indicating that the model is stable.

**Figure 3: NARDL CUSUM of Squares**



**Figure 4: NARDL CUSUM**



## 5. CONCLUSION AND POLICY RECOMMENDATION

This study therefore examined the impact of climate change on agricultural sector crop output. In order to achieve the objectives of this study, this study employed the Non-linear Autoregressive Distributed Lag (NARDL) model in the estimation of the empirical model of the study. This study established the existence of long-run relationship between climate change and the Nigerian agricultural sector crop output. This study also found that in the short-run, increase in rainfall and decrease in temperature is beneficial to crop production while reduction in rainfall and increase in temperature is harmful to crop production. This is understandable as crop production in Nigeria is predominantly rain fed.

In the long-run both increase and decrease in rainfall is detrimental to crop production. Reduction in temperature is beneficial to crop production. This study hereby conclude that in the short-run, impact of climate change on crop output of the Nigerian agricultural sector is mixed but in the long-run, climate change is detrimental to crop production by the Nigeria agricultural sector. This study therefore makes the following recommendations:

1. Provision of irrigation facilities such as dam, pumping machines, hose, wells and boreholes to farmers as this will help ameliorate shortages of water caused by climate change.
2. Reduction of deforestation, bush burning and all others activities that lead to the emission of greenhouse gasses and this lead to the elimination of greenhouse effect which has been blamed for the warming of the planet.

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# GOVERNMENT FINAL CONSUMPTION AND HOUSEHOLDS AND HOUSEHOLDS FINAL CONSUMPTION EXPENDITURE IN NIGERIA

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## **ABSTRACT**

This study seeks to investigate the effect of Government Final Consumption Expenditure; Financial Deepening on Households, Non-profit institutions serving households (NPISHs) Final consumption expenditure using data on Nigeria spanned 1981 to 2019. This study employed Vector Error Correction Model. The results of the study revealed that the coefficient Government final consumption expenditure has a positive effect on household consumption expenditure in the long run. There is a long run and short run relationship between gross fixed capital formation and household consumption expenditure. The coefficients credit to private sector (cpsgdp) which are financial deepening indicators and gross fixed capital formation posits a negative impact on household final consumption expenditure. The coefficients money supply (lm2gdp) which is another proxy for financial deepening and the coefficient FDI have a positive effect on household final consumption expenditure in the long run. Therefore this study recommends that Gross fixed capital formation stimulates household consumption expenditure, a legal framework to support investment is a panacea to increasing household income, consumption and reduce poverty in Nigeria. Therefore, this should be a key central component for policy. The implication for policy is that government final consumption expenditure stimulates household consumption expenditure positively thus cannot be underscored hence a realistic policy driven towards increasing government final consumption expenditure is strategic to increasing effective and consumption as well

**Key words:** Household consumption Expenditure, Investment, Financial Deepening

**JEL CODE:** E2

## **1. INTRODUCTION**

Household final expenditure is a measure for poverty and a major component of GDP. In Nigeria, the annual growth rate of household consumption expenditure in real term stood at 0.81% as against a decline of 1.06% recorded in 2019. It grew by 8.90% in the first quarter and 19.08 in the second quarter of 2021. However, an annual growth rate of -057% was recorded in year 2020. For instance, the contracted GDP stem from COVID 19 which further resulted to a second recession

in 5 years as Nigeria's real GDP contracted by 6.1% and 3.62% in second and third 2020 respectively National Bureau of Statistics (NBS).

Despite several economic policies initiated to improve the household consumption expenditure through price control measure and financial innovations. The recent Nigeria's Economic Recovery and Growth Plan (2017–2020) and the recent country's position on African continental free trade agreement have fundamental implication on household consumption expenditure.

The policy SAP 1986, NEEDS and millennium sustainable development goals in Nigeria were administered to propel the economy and these have consequential implication for household consumption expenditure. Recent study on Nigeria has emerged on the determinants of Household consumption expenditure (see Okwu, Akpa, Oseni and Obiakor 2020) on Nigeria employed autoregressive distributed lag model (ARDL) technique with robust properties however, the period of study spanned 1981 to 2016. Although the techniques of estimation vary, the time period spanned for the study also differ. Thus this may stem from the behavior of data on applying the stationarity test. Moreover, studies on the subject particularly on Nigeria are relatively scanty to the best knowledge of this research. The few that existed are Keho (2019) on Cote d'Ivoire. Household consumption expenditure is not stable as a result of business cycle, government expenditure and fiscal trajectory in most cases. It is in this view this that this study seeks to investigate the relationship between household consumption expenditure and per capital income in Nigeria. However, this study is structured into five sections including this introduction. Section two of this study covers the review of relevant literature, section three looks at the methodology, section four of this study explores the data analysis and interpretation and lastly chapter five covers the summary conclusion and policy recommendations

## **2. Theoretical and Empirical Literature**

Household consumption is a function of so many macroeconomic indices. For instance, the traditional Keynes 1936 postulation says when income of household changes, consumption also changes but less than proportionate changes in income. However, the hypothesis is further revisited by Duesenberry in 1949 that sees current consumption as not only a function of current level of absolute and relative income but as a function of previous period as well. Since household consumption is linked to demand for goods and services, the demand must be effective otherwise cannot be met and this essentially have implication for growth. The theory on life cycle by Ando and Modigliani 1963 and permanent hypothesis by Friedman in 1957 also hinge on permanent income as a determinant of consumption rather than current income. Although have segregated such into transitory and wealth. However, marginal propensity to consume out of transitory and wealth differs. More so, a reaction by liquidity constraint and myopia, uncertainty and buffer stock savings and also Barro Ricardo problem have given wide perspective opinion on determinants of consumption.

Almasifard and Saeedi (2017) examined the nexus between financial development and household consumption expenditure using panel data covering the period 1993-2010 for eight central and east European Countries namely Hungary, Bulgaria, Poland, Czech Republic, Slovenia, Romania, Belarus and Ukraine. Applying the regression test the result of the study shows that money supply has a negative effect on household consumption while domestic credit has a positive effect on household consumption expenditure.

Obinna (2020) used data on Nigeria spanned 1981 to 2018 to estimate the relationship between financial development and savings applying the ordinary Square (OLS) econometric technique and Granger Causality test. The result of the study revealed that

Financial Development had a positive significant relationship with savings in Nigeria while savings rate on the other hand showed a positive but insignificant effect on savings, the result of the Granger causality test indicated there is a unidirectional causality running from financial development to Savings in Nigeria.

Amin (2011) explores the causal relationship between GDP and consumer final expenditure using data on Bangladesh economy. The author employed the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) test and autoregressive distributed lag model (ARDL). The result of the study shows a long run causal relationship and a causality running from final consumption expenditure to economic growth while bi directional relationships exist in the short run. Li; Lin and Gan (2016) used time series to estimate the credit constraints on rural households' consumption expenditure in South China. The result of the study showed that credit constraints indeed suppressed the consumption expenditures of the rural household.

Magombeyi and Odhiambo (2017) in their study used data on South Africa to explore the effect of FDI on household consumption expenditure for the period spanned 1980 to 2014. The study applied the autoregressive distributed lag approach, the result of the study revealed that FDI has a positive effect on household consumption expenditure.

Okwu, Akpa, Oseni and Obiakor (2020) in a recent study explored the effect of export on household consumption expenditure using data on Nigeria spanned 1981 to 2016 and applying the ARDL. The result of the study revealed a positive relationship between export and household consumption expenditure.

Keho (2019) employed Common Correlated Effect Mean Group (CCEMG) to investigate the relationship between government final expenditure and household consumption expenditure using data on West African States (ECOWAS). The result of the study indicates a negative effect between government final expenditure and household consumption expenditure for the period 1970 to 2016.

Diacon and Maha (2014) in their study used a cross country data to examine the co-integration relationship between consumption, income and GDP per capita (as a proxy of the level of standard of living for the period 1980 to 2010 using sample of 79 countries where sample countries are sampled in 3 categories of income and applying the ADF-Fisher and PP-Fisher unit root test and cointegration test. The result of the study of Kao Test posits the existence of cointegration between consumption, income and GDP in all panels. Considering the result of categories income levels, the association is greater in lower and higher income countries relative to middle income countries. In a recent study, Sugiarto and Wibowo (2020) in their study examined the determinants of regional household final consumption expenditure HFCE in Indonesia covering 33 provinces for the period 2010-2019 and applying the first-difference Generalized Method of Moments (FD-GMM) approach. The result of the study revealed that lagged value or previous value of real HFCE, real gross regional domestic product (GRDP), and government spending have a significant positive relationship on real HFCE.

Using time series data, Keho (2019) in a study investigated the determinants of private consumption expenditure in Cote d'Ivoire using time series data from 1970 to 2016 and applying the Autoregressive Distributed Lags bounds testing approach. The result of the study shows that government final consumption expenditure has a positive effect on household private consumption.

Similarly, Kimaro and Keong (2017) in their study employed panel of 25 Sub-Saharan African low income countries for the sample period 2002 to 2015 applying the Pedroni Cointegration and

Generalized Methods of Moments (GMM) test, the result of the study revealed a positive relationship between government expenditure and economic growth.

Although studies on government expenditure and household consumption expenditure are relatively scanty, several studies have emerged on consumption expenditure, financial development government expenditure. However, the impact of these macroeconomic indicators is restricted to GDP. For instance, Kpoghul, Okpe and Anjande (2020) used data on Nigeria estimated the relationship between government expenditure, financial development and economic growth. In another study by Kelvin and Ogbonna (2020) employe data on Nigeria spanned 1981-2017 to investigate the effect of government expenditure, FDI, financial development, inflation on GDP.

Anjande, Jirshar, Asom, Akiri and Sokpo (2020) also investigated the relationship among household consumption expenditure, FDI, gross fixed capital formation and economic growth using data on African countries

Similarly, Anjande, Ahemen and Jirshar (2020) employed sample of 40 Africa countries covering spanned 1970 to 2017 to estimate the effect of government spending on unemployment applying Mean Group (PMG) estimator. The result shows that government spending has an influence on unemployment.

### **3. Methodology and Data**

This study used time series data on Nigeria spanning the period 1981 to 2019. One of the justification of applying time series was due to availability of data inform of non-probability sampling technique. This period selection covers the pre and post structural adjustment program and other economic crisis that bedeviled the economy. The data was retrieved from world development indicators due to paucity of data on some controlled variables in other data agencies and also the need to generate data from single source for reference. Data is transformed into natural log to reduce the effect of outliers and heteroscedastic issues reducing the robustness of the outcomes. First, the Augmented Dickey Fuller test (ADF) test with constant and drift options are employed to test the stationarity of series, the cointegration test and vector error correction model was employed based on the nature and behavior of the data.

#### **Variable Measurement**

Households and NPISHs Final consumption expenditure (current US\$): Household final consumption expenditure (formerly private consumption) is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings WDI

Unemployment refers to the share of the labor force that is without work but available for and seeking employment ILO

Foreign direct investment is sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP WDI

Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel,

royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments WDI Imports of goods and services represent the value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments WDI Agriculture, forestry, and fishing, value added (% of GDP) Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator WDI

GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars WDI

General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditure on national defense and security, but excludes government military expenditures that are part of government capital formation WDI.

### Model specification

This study follows the work by Keho (2019). The model is expressed as:

$$\log C = \alpha_0 + \beta_1 \log Y_t + \beta_2 \log W_t + \beta_3 Z_t + \varepsilon_{it}$$

Where **C** is private consumption, **Y** is income, **W<sub>t</sub>** stands for wealth, and **Z** represents a set of other determinants which captures fiscal policy, liquidity constraints, substitution effects and macroeconomic uncertainty. In this study, **Z<sub>t</sub>** includes government consumption expenditure, inflation rate and real interest rate. However, the econometric model used for this study is expressed as:

$$HFCE = \alpha_0 + \alpha_1 GFCE + \beta_2 GFCF + \beta_3 FDI + \beta_4 UMEMPLOY + \beta_5 AFHFISHING + \beta_6 IMPORT + \beta_7 EXPORT + \varepsilon_{it}$$

Where  $\beta_1 \beta_2 \dots \beta_6$  = Slope coefficient with respect to independent variables,  $\varepsilon_{it}$  is the error term.

#### 4. Data Analysis and Interpretation

**Table 1** Augmented Dickey Fuller test

variables	Trend	1(0)		1(1)	
		Drift	trend	drift	Order
lgfcexp	-2.141	-1.133	-4.582	-4.623	1(1)
lafhfishing	-2.654	-3.108	-7.012	-5.982	1(1)
lgdppcap	-3.226	-1.040	-2.550	-2.840	1(1)
lgfcf	-3.362	-1.281	-5.590	-5.607	1(1)
lfdi	-1.464	-2.201	-4.723	-4.226	1(1)
lunemploy	-1.065	-1.157	-2.168	-1.737	1(1)
limport	-1.798	-1.659	-4.132	-4.039	1(1)
Lexport	-0.654	-1.784	-4.608	-3.860	1(1)
lhfce	-1.617	0.124	-4.361	-4.222	1(1)

The result on Table 1 indicates Augmented Dickey Fuller test which reports that all series were non stationary at level value. The result posits that at level value, test statistic was less than the critical values at various level of significance including the trend and drift options. Since the absolute value test statistics is less than the critical values, it is not possible to reject the null hypothesis of unit root. However, differencing the series, the result indicates stationary at first difference and integrated of order one 1(1). This means that the absolute value of test statistics is higher than the critical value at 5% thus this study rejects the null hypothesis of unit root.

#### Johansen tests for cointegration

**Table 2** Test for Cointegration vectors

Max rank	parms	LL	eigenvalue	Trace statistics	5% critical value
0	56	122.3421	0.99104	250.0396	124.24
1	69	178.92011	0.88090	136.8836	94.15
2	80	204.45409	0.77878	85.8156	68.52
3	89	222.55718	0.62303	49.6094	47.21
4	96	234.26416	0.39018	26.1955*	29.68
5	101	240.19926	0.34023	14.3253	15.41
6	104	245.18963	0.16558	4.3445	3.76
7	105	247.36189			

On table 2, The ranks 0, 1, 2, 3, 4, 5, 6 are all the null hypothesis. The decision rule is we reject the null hypothesis of no cointegration if the value of trace statistics is higher than the 5% critical value (see Johansen, 1988). The result of Johansen test for cointegration allows all variables to be modeled as endogenous, the criteria says we reject the null hypothesis of no cointegration if the value of the trace statistics is greater than the critical value at 5%. The null hypothesis of no cointegration cannot be rejected at 5%. in this model, there exist four (4) cointegration equations.

Max rank	parms	LL	Eigen value	Trace statistics	5% critical value
0	56	122.3421	0.99104	113.1560	124.24
1	69	178.92011	0.88090	51.0680	94.15
2	80	204.45409	0.77878	36.2062	68.52
3	89	222.55718	0.62303	23.4140	47.21
4	96	234.26416	0.39018	11.8702	29.68
5	101	240.19926	0.34023	9.9807	15.41
6	104	245.18963	0.16558	4.3445	3.76
7	105	247.36189			

The result of the vector error correction model shows that in the short run, gross fixed capital formation has a positive effect on household final consumption expenditure and any disequilibrium can be corrected at 68% speed of adjustment. In addition, VECMs are used to model the stationary relationships between multiple time series that contain unit roots. vec implements Johansen's approach for estimating the parameters of a VECM.

Stating government final consumption expenditure as dependent variable, household consumption expenditure and unemployment have a negative effect on government final consumption expenditure in the short run and deviation can be corrected at 89% speed of adjustment.

Stating the equation lm2gdp (financial development) as the dependent variable, the coefficient gross fixed capital formation has a negative effect on financial development and any deviation in the equilibrium can be corrected at 39 speed of adjustment. Modeling FDI as the dependent variable, the coefficient gross fixed capital formation has a negative effect on FDI in the short run. A speed of adjustment will correct errors in case of disequilibrium. Similarly taking gross fixed capital formation as the dependent variable, the coefficient lm2gdp has a negative effect on lm2gdp (financial development).

**Table 3 Johansen normalization restriction imposed**

beta	Coef	Std. Err.	z	P> z	[95% Conf. Interval]
lhfce	1	.	.	.	.
lgfcexp	-.1650518	.0178876	-9.23	0.000	-.200111 - .1299927
lcpsgdp	.2845549	.053667	5.30	0.000	.1793695 .3897404
lm2gdp	-.3366759	.0635992	-5.29	0.000	-.461328 -.2120237
lunemploy	.1251337	.1254641	1.00	0.319	-.1207714 .3710387
lfdi	-.1987086	.0211868	-9.38	0.000	-.2402339 -.1571832
lgfcf	2.617193	.0606482	43.15	0.000	2.498325 2.736061
constant	-33.2118				

On table 3, the dependent variable Hfce normalizes as 1. The result indicates that government final consumption expenditure has a positive effect on household consumption expenditure in the long

run. The coefficient is statistically significant at 1%. cpsgdp (financial development and gross fixed capital formation) posit a negative impact on household final consumption expenditure and the coefficients are statistically significant at 1%. The coefficients money supply lm2gdp which is also a proxy for financial development and FDI have a positive effect on household final consumption expenditure in the long and the coefficients are statistically significant at 1%.

Lgfcexp, lm2gdp and lfdi lcpsgdp, lgfcf have asymmetric effect on the dependent variable hfce in the long run on the average ceteris paribus

$$ECT_{t-1} = |1.000| hfce_{t-1} - .1650518 | lgfcexp_{t-1} + .2845549 | lcpsgdp_{t-1} - .3366759 | lm2gdp_{t-1} + .1251337 | lunemploy_{t-1} - .1987086 | lfdi_{t-1} + 2.617193 | lgfcf_{t-1} - 33.2118$$

$$.1705751 + .1520899 | hfce_{t-1} + .0601814 | lgfcexp_{t-1} + .0232085 | lcpsgdp_{t-1} + .3080204 | lm2gdp_{t-1} - .6840975 | lunemploy_{t-1} - .1979763 | lfdi_{t-1} + 1.34859 | lgfcf_{t-1} - .6804459 ECT_{t-1}$$

The adjustment mechanism indicates (-.680) significant at 1% level explaining that previous or lag errors or deviation from long run equilibrium are corrected for within the current year at a convergence speed of 6.8%.

### Post Estimation Test

This study employed the post estimation test to ensure robustness of the model

#### Test for Autocorrelation

lag	chi2	df	Prob > chi2
1	59.1560	49	0.15177
2	44.5304	49	0.65471

H0: no autocorrelation at lag order

From the result, at two lags, the model does not suffer from autocorrelation

#### Jarque-Bera test

Equation	chi2	df	Prob > chi2
D_lhfce	6.027	2	0.04912
D_lgfcexp	78.692	2	0.00000
D_lcpsgdp	0.849	2	0.65420
D_lm2gdp	6.361	2	0.04157
D_lunemploy	0.122	2	0.94099
D_lfdi	2.128	2	0.34505
D_lgfcf	0.741	2	0.69031
All	94.920	14	0.00000

The result of Jarque-Bera test or test for normality distribution of disturbances of residuals shows that the outcome for first and second equations indicates that errors are not normally distributed. The third equation lcpsgdp posit that errors are normally distributed and the same applies to the remaining equations. Thus, the model is not normally distributed in this case.

### Discussion of findings

Government final consumption expenditure has a positive effect on household consumption expenditure in the long run. This conforms to the finding by Sugiarto and Wibowo (2020).

The coefficients cpsgdp (financial development and gross fixed capital formation) posits a negative impact on household final consumption expenditure. This confirms the study by Almasifard and Saedi (2017). However, this finding is contrary to the finding by Li; Lin and Gan (2016). The coefficients money supply lm2gdp which is also a proxy for financial development and the coefficient FDI have a positive effect on household final consumption expenditure in the long.

## **5. Summary of major finding and Recommendations**

### **Summary of major finding**

Based on the empirical findings, the following are summarized:

There is a long run and short run relationship between gross fixed capital formation and household consumption expenditure

Government final consumption expenditure, foreign Direct Investment, Financial deepening, and gross fixed capital formation have asymmetric effect on the dependent variable household consumption expenditure in the long run on the average ceteris paribus

### **Recommendations**

Gross fixed capital formation stimulates household consumption expenditure, a legal framework to support investment is a panacea to increase household income, consumption and reduce poverty in Nigeria. Therefore, this should be a key central component for policy.

Providing strategic policies measures to promote FDI is pertinent through enabling environment with low risk for investment cannot be overemphasized hence should be an integral part of policy plan.

There is also need for government final consumption expenditure to be increased since it stimulates household consumption expenditure positively.

While money supply has positive effect on household consumption expenditure, credit to private sector deters household consumption expenditure. This finding will allow policy makers to understand better alternatives in the area of financial deepening.

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# IMPACT OF SELECTED MACROECONOMIC DRIVERS ON THE BEHAVIOUR OF THE NIGERIAN STOCK MARKET

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## **ABSTRACT**

The behaviour of macroeconomic variables exerts impact on the operations and happenings in the stock market and by extension the economy in general. This study investigated the impact of some macroeconomic variables (real gross domestic product, foreign direct investment, aggregate government expenditure, and real exchange rate) as drivers and catalyst to the performance of the Nigeria stock market, utilizing the time series data from 1986 – 2020. Stationarity test was conducted to determine the order of integration, Johansen cointegration test for long run relationship among the variables. The ARDL-ECM model was specified and estimated to determine the short and long run impacts of the independent variable on the dependent variable. ECM component of the model shows the speed of adjustment from short run disequilibrium to long run equilibrium. Findings reveal the positive impacts of the selected macroeconomic drivers on the performance of the stock market proxied by All share index (ASI) in both short and long run. The study thus recommends deliberate undertaking of policies that will encourage inflows of FDI as well as increase aggregate spending for sustained positive impact on the stock market.

**Key words:** Impact, FDI, all share index, RGDP, aggregate, expenditure, exchange rate.  
JEL Code; GO;G10;C21.

## **1. INTRODUCTION**

Activities in the stock market have attracted serious attention due to the global financial crisis which has seriously slow down the rate of stock market operation in Nigeria. This occasioned several discourse on the stock market and the factors influencing its growth and the general performance of the market. However, a critical assessment of the macroeconomic environment in which the stock market operates, and its effect on the performance of the market has not attracted the desired attention of scholars. In this regard, there is need for a study on the effect of macroeconomic drivers on the performance of the stock market. This is important because, if the Nigerian stock market is deepened, it will perform efficiently and contribute positively in the development of the economy. Similarly, despite the existence of the Nigerian stock market for more than five decades, its performance is low compared with that of other developed stock markets. The level of sophistication and instruments traded and its general activities are still negligible. African stock markets (with the exception of Johannesburg stock exchange) are usually characterized by low capitalization and are still regarded as infants in the world stock exchanges. The All-Share index in Nigeria stock market in 2016 was 10,430 basic points, 2018 12,612 basic points compared to Johannesburg stock market of 59,504.67 basic points in 2017 and 64,823.03 in 2018. The Johannesburg Stock Exchange, FTSE/JSE Africa Index Series is an index partnership between JSE and the Financial Time Stock Exchange (FTSE) Group of London. Similarly, the JSE

has 400 listed companies trading on its floor; but the NSE has only 163 listed companies trading online real time. The Johannesburg Stock Exchange (JSE) has emerged as one of the best in the world, as it has a more matured stock market and was ranked one of the world's largest stock exchange by market capitalization (\$1.007bn) as at the end of 2015 and 2019 (Courage, Andrew and Kin, 2015). The JSE All-Share index called the FTSE/JSE Africa Index Series closed the year 2017 with 59,504.67 basic points, while the Nigerian Stock Exchange (NSE)'s All-Share index closed at 38,243.2 basis points. Though the NSE has put in place strategies to commence trading in other derivatives such as futures options and swaps in the near future.

The stability of the macroeconomic environment is fundamental for businesses and therefore, important for the overall competitiveness of the economy. Besides, it is important to note that, for the stock market to play its role in an economy, it must have significant relationship with the economy. There are several macroeconomic drivers that are identified as potential determinant of macroeconomic stability which by extension dictates the performance of the stock market, such as growth in gross domestic product (GDP), foreign direct investment, government expenditure and real exchange rate. These variables are serious drivers of economic growth and development and variation in any of these variables will influence the performance of the stock market in general. An unstable macroeconomic environment through variation in the rate of any of the selected macroeconomic drivers may have effect on the activities of the stock market and hence its performance. Market capitalization has been on the increase, from N2.1b in 2004 to N14.8b in 2012, with a deep of N9.5b in 20017 and 11.3b in 2019. (Statistical Bulletin, 2020) The Nigerian capital market was largely dominated by cautious and speculative tendencies in 2018, due to Nigeria's economic recession and the uncertainty built around Foreign exchange availability. It is clear that the selected macroeconomic drivers have volatile tendencies to influence the performance of the Nigeria stock market. Thus, the paper draws the motivation and investigated empirically, the plausible effects of the selected macroeconomic drivers on the performance of the Nigeria stock market. The aim of this paper is to assess the Short and long run impact of the selected macroeconomic drivers on the performance of the Nigerian stock market between 1986 and 2020. In addition, to determine the speed of adjustment from short disequilibrium to long run equilibrium for the macroeconomic drivers.

## **2. LITERATURE REVIEW**

### **a. Conceptual Clarification.**

#### **Stock Market**

According to Drake and Matthews (1974), the term stock market (securities market) connote the market for financial instruments/claims/obligations that are commonly and readily transferable by sale namely, shares, debentures which are issued by companies as well as bonds, bills, and any kind of stock issued by government and public authorities. A security is used as the generic term for these various forms of financial instrument. Drake and Matthews did not also consider the essence of stock market operators, nor the institutions in which the market operates. Their concept of the stock market is restricted to financial instruments, borrowing and lending by companies, government and public authorities. Their definition falls short of the time frame within which lending and borrowing takes effect in the market which is crucial in defining stock market its distinguishing feature from the money market.

Dougal (1975), the stock market is a market where investment decisions among savers and users of funds are carried out and it constitutes a major instruments of a capitalist economy. That is,

according to Dougal, the stock market consists of institutions and mechanisms through which intermediate and long-term funds are pooled together and made available to businesses, government and individuals for investment purposes.

### **All-Share Index**

One of the most important tools for the use in performance measurement in the stock market is the market index, for it measures the state of the market. The performance of a market index is useful way of assessing the growth and development pace of the market. An index is a numerical value used to measure changes in financial markets. Aigheyis (2017) That is, an index measures the movement of the underlying assets, reflecting market price and market direction. A stock index reveals the overall trend in the equity market and international investors compare the performance of an index to other indices around the world, in order to arrive at investment decisions. A strong return is likely to increase public awareness and foreign investment in that market. According to Duban (2017), market indices are used as a measure of performance, as investors use the indices to measure how their portfolio has performed.

## **2.2 Theoretical Literature**

### **Arbitrage Pricing Theory (APT)**

The Arbitrage Pricing Theory was developed by Ross (1976). It is based purely on arbitrage. Arbitrage is the practice of taking positive expected return from overvalued or undervalued security in an inefficient market without any incremental risk and zero additional investments. An inefficient market is a market where prices do not always reflect available information as accurately as possible. Inefficient markets may result from a lag in information dissemination from one place to another and deliberate withholding of information by an insider. Inefficient markets give rise to arbitrage opportunities. Most analysts believe that no market is perfectly efficient and that some inefficiency is inevitable. In such capital markets, investors may not have enough information about the securities in order to make informed decisions about what to buy or the price to pay. In addition, few analysts follow the securities being traded. Similarly, there can be inefficient markets for stocks in new companies, particularly for new companies in new industries that are not widely analyzed. An inefficient market is the opposite of an efficient one, where enormous amounts of information are available for investors who choose to use it.

The APT is a general theory of asset pricing which holds that the expected return, of an asset can be modeled as a linear function of various macroeconomic variables or theoretical market indices, where sensitivity to changes in each factor is represented by a factor specific beta coefficient (Ross, 1976). These macroeconomic variables influencing the price of the assets are called risk factors, in other words, Arbitrage pricing theory asserts if two or more securities or portfolios have identical return or risk, then they should sell for one price. Since Arbitrage pricing theory gives the expected price of an asset, arbitrageurs use the theory to identify and take advantage from is priced opportunities. Burmeister (1994) postulated that, the APT model explains risky asset returns which are believed to follow a bfactor intensity structure as follows:

$$R_j = a_j + b_{j1}F_1 + b_{j2}F_2 + \dots + b_{jn}F_n + E_j \dots\dots\dots (1)$$

Where:

$a_j$  = is a constant for asset j

F = are systematic factors

$b_j$  = are the sensitivity of the jth asset to factor k, also called factor loading, and

$E_j$  = is the risky asset's idiosyncratic (usual) random shock with zero mean.

The APT states that if asset returns follow a factor structure then the following relationship exists between expected returns and the factor sensitivities;

$$E(r_j) = r_f + b_{j1}RP_1 + b_{j2}RP_2 + b_{j3}RP_3 + b_{j4}RP_4 + \dots + b_{jn}RP_n \dots \dots \dots (2)$$

Where

$E(r_j)$  = the asset's expected rate of return

$r_f$  = the risk-free rate

$b_j$  = the sensitivity of the asset's return to the particular factor

$RP$  = the risk premium associated with the particular factor

The foregoing implies that, the expected return of an asset  $j$  is a linear function of the asset's sensitivities to the  $n$  factors. However, for this to be correct, there must be perfect competition in the market, and the total number of factors may never surpass the total number of assets.

### 2.3 Empirical Literature

Nkechukwu, Onyeagba and Okoh (2013) evaluated the effect of gross domestic product and broad money supply (M2) on capital market prices using annual time series data for Nigeria for the period 1980 – 2013. The employed and used Johansen cointegration and VECM based on APT of Ross (1976). The results of their findings indicated that stock market prices in Nigeria have long-run relationship with the macroeconomic variables used. However, the gross domestic product has significant long run negative effect on stock prices contrary to their a priori expectation that, gross domestic product has significant positive effect on stock prices. Broad money supply on the other hand, had significant long-run positive effect on stock prices, which was consistent with their a priori expectation. Again, there was unidirectional causal effect between gross domestic product and stock prices with direction running from stock prices to the gross domestic product, but there was no causal effect between stock prices and broad money supply. In the short-run however, both the gross domestic and broad money supply have positive, but insignificant effect on stock prices in Nigeria. Their findings suggested that, stock price in Nigeria at the time of their study were informational inefficient.

In a Similar study by by Abaenewe and Ndugbu (2016) who investigated the effect of minimum rediscount rate, treasury bills rate, interest rate, exchange rate and consumer price index (proxy for inflation) on equity prices on the Nigerian stock exchange, using annual data from 1985 to 2010. The OLS method was employed. The results of the study indicated that, minimum rediscount rates and treasury bills rates were highly correlated and cannot be applied simultaneously in monetary policy management. Also a weak correlation existed between monetary policy and equity prices. This reflected in the explanatory variables which accounted only 15.6% in the changes of equity prices in Nigeria. All the explanatory variables were negatively and insignificantly related to equity prices, except the consumer price index that had insignificant positive relationship with equity prices. The study further revealed that monetary policy instruments have not made significant influence on the prices of equities in Nigeria, but however failed short of suggesting to government the way forward.

For more empirical contribution to stock market babavoiur, Ogiri, Amadi, Moshfique and Dubon (2017) investigated the relationship between oil prices and capital market performance in Nigeria. Different empirical methods including the Johansen's cointegration model, the ADF test, the VEC model, as well as the VAR estimation model, were used in the study. Their results suggested that, changes in oil prices are important factors in explaining stock price movement. Specifically, the findings showed that there were significant links between oil prices and capital

market performance. Also, Amadi, Oneyema and Odubo (2017) employed a multiple regression model to estimate the functional relationship between money supply, inflation, interest rate, exchange rate and stock prices in Nigeria, using the Nigeria stock exchange stock prices.

The relationship between real gross domestic product, CPI, credit to private sector weighted average interest rate on time deposit and the Amman (that is the Jordan) stock exchange (ASE)'s performance, as measured by its' stock price index was examined by Al-Majali and Al-Assaf (2015) employed and used Johansen cointegration and VECM, Impulse Response Function (IRF) and Variance Decomposition (VD). Their empirical results indicated that, there exist a long run equilibrium relationship between stock market index and the selected macroeconomic variables in Jordan. Their findings also revealed that, the speed of adjustment in the VECM is significant and relatively slow. There is also a bi-directional long run relationship between stock price index and credit to the private sector, weighted average interest rate on time deposits, and consumer price index. The evidence implies that, an increase in the weighted average interest rate on time deposits in the banking system has a greater effect on the stock price index, than other macroeconomic and financial variables used.

Contributing further, Elite (2011), investigated the relationship between foreign exchange reserves and market capitalization of Karachi stock exchange market over the period 2001 and 2009. Using quarterly data, Elite employed and used a simple linear regression model in his analysis. The study showed positive but not significant relationship between foreign exchange reserves and the stock market capitalization, foreign reserves of Pakistan have a positive impact on Karachi stock exchange market. Elite's (2011) study did not reveal the long-run and short-run relationship between the variables; neither did the study state the direction of the relationship.

However, Bhattacharya (2014) investigated the "Causal relationship between Indian stock exchange market, exchange rate, foreign reserves and value of trade balance" (Bombay stock exchange sensitive index was used as a proxy for Indian stock exchange market). They employed and used Toda and Yamamoto (1995) Granger non-causality tool for the analysis of their data. The study covered the period of twelve years (April 1990 to March 2012). The analysis revealed interest results in the context of the Indian stock exchange market, particularly with respect to the variables analyzed (exchange rate, foreign reserves and trade balance). The results suggested the absence of causal linkage between stock prices and the three variables under consideration.

The relationship between inflation and stock price movement in India was carried out by Chakravarty and Mitra (2013). Using the VAR framework, based on monthly data for wholesale price index, index of industrial production, exchange rate, stock prices and foreign institutional investment, Chakravarty and Miltra noted that stock prices have impact on inflation, whereas the causality in the reverse direction is not prominent. The results from the impulse response function suggested the existence of a negative relationship between the stock prices and the variables used. However, in the very long run the study revealed that, inflation influences stock prices in a positive direction.

Mohammed (2011) investigated the impact of changes in three macroeconomic variables (Inflation (CPI), industrial production index and foreign remittance) and two microeconomic variables (market price/earnings ratio and monthly average growth in market capitalization measured in percentages). The Dhaka Stock exchange (DSE) all share price index was used as the dependent variable. A multivariate regressions model computed on standard OLS was adopted and employed to estimate the relationship. Based on regression coefficient, it was found that inflation and foreign remittance have negative influence. Industrial production index; market P/E ratio and monthly percent average growth in market capitalization have positive influence on stock returns.

All the independent variables jointly explained 44.8% of DSE's-All share price index. No unidirectional granger causality was found between stock price and all the forecasted variables, except the existence of a unidirectional causal relationship between stock price and market P/E ratio. In a nut shell, lack of granger causality between stock price and variables employed ultimately revealed the evidenced of information efficiency available to all operators in the capital market.

Kuwornu and Owusu-Nantwi (2016) examined the relationship between consumer price index (as a proxy for inflation), crude oil price, exchange rate and 91-day treasury bill rate (as a proxy for interest rate) and the capital market's returns of Ghana stock exchange (GSE). Using monthly date over the period of, January 1992 to December, 2013. Full information Maximum Likelihood Estimation (FIMLE) procedure was used in establishing the relationship between the chosen variables and the capital market's returns. The results revealed the existence of a significant relationship between stock market returns and CPI, exchange rate and treasury bills rate. CPI had a positive significant effect, while exchange rate and treasury bills significant influence on the capital market's returns. On the other hand, their findings revealed that crude oil process do not appear to have any significant effect on stock returns.

Akinlo (2015) examined the impact of foreign exchange reserves on Nigerian stock exchange market over the period 1981-2011. Akinlo used a multivariate framework incorporating an interest rate variable. The results of his findings revealed the existence of a long run relationship among his identified variables (foreign reserves, interest rates and stock market development). The findings further revealed that foreign reserve has a positive influence on stock market growth in Nigeria.

In another study, Abakah and Abakah (2016), using high frequency date, investigated the impact of foreign exchange reserves on stock market in Ghana for the period of January 2001 to December, 2015. Just like Akinlo, Abakah used a multivariate framework that integrated interest rate variable in the modeling. The result of their work showed that foreign exchange reserve has a significant reserve has a significant positive impact on stock market capitalization and all the three variables employed in their study (stock market captilisation, foreign exchanged reserve and interest rate) are co-integrated. Unlike Akinlo (2015), their findings showed the existence of a unidirectional relationship between foreign exchange reserve and stock market capitalization at Ghana Stock exchange. Also, market capitalization were seen to Granger cause interest rate. Further test on their work showed that interest is very important in examining the nexus between stock market and international foreign reserves of Ghana.

Yahyazadehfar and Babaie (2018) examined the impact of some macroeconomic variables such as, interest rate, house price and gold price on stock price in capital market of Iran. A sample of monthly data from March 2001 to April 2016 was used for test. The study was based on VAR model and Johansen co-integration technique. Yahyazadehfar and Babaie discovered that a positive relationship exist between stock price and house price at the time of their study, but nominal interest rate and gold price have negative effect on stock prices of the Iranian capital market.

Farsio and Fazels (2018). Investigated the relationship between unemployment rate and stock prices in the US, China and Japan. The study was based on the use of co-integration and Granger causality test and quarterly data covering the period, 1970-2015 were employed. The findings revealed that there was no stable long term causal relationship between unemployment rate and stock prices. Farsio and Fazel therefore believed that, it would make a mistake to rely on

unemployment rate forecasts and trends in order to make investment decisions in the capital markets of US, China and Japan.

An examination of the influence of macroeconomic variables on the capital market performance at the Nairobi stock exchange (NSE), Kenya was carried out by Gatuhi, Gatuhi (2019) selected macroeconomic variables (exchange rate, interest rates, inflation and money supply) and investigated the influence of these variables on stock market performance in Kenya and explored, if the different sectors are affected differently by changes in the macroeconomic variables in Kenya. He adopted a causal research design and targeted all active listed companies on the NSE from January 2004 to November 2017. Time series Regression (TSR) model was used to examine the effect of the selected variables on the performance of the capital market's listings. Gatuhi in his study found that exchange rate had a positive influence on the Nairobi capital market, on a sectoral basis of the market's listings. Gatuhi in his study found that exchange rate had positive influence on the Nairobi capital market's performance in the Agricultural, Banking, Energy and automobile sectors and had a negative on construction, Insurance, Investment and manufacturing sector. Inflation had a positive influence on the market performance.

The impact of foreign direct investment foreign exchange rate and inflation on stock returns Karachi stock exchange (KSE), Pakistan was investigated by Kabeer, Iqbal, Najaf and Najaf (2019). They employed the OLS technique to test the impact of these variables. The results of the study indicated that there was significant negative direct investment on the stock returns of Karachi stock exchange in Pakistan. The drawback of this work is that, the magnitude of the collective impact of these variables on the stock exchange of Karachi was not revealed in the study.

Another work on Nairobi securities exchange was done by Ouma and Muriu (2017). They conducted a study on the impact of money supply, exchange rate, interest rate and inflation rate on stock returns on Nairobi stock exchange, Kenya for the period 2003- 2015. In testing the impact of these variables, Ouma and Muriu employed and used the APT and the CAPM. They also applied and used the OLS technique in testing the validity of the model and the relative importance of different variables selected, and their possible impact on stock returns in Kenya. The empirical analysis revealed that, with the exception of interest rates, there existed a significant relationship between stock returns and the remaining variables. Money supply, exchange rates and inflation affected stock returns at Nairobi stock exchange rates is however, found to have a negative impact on stock returns. However, like the work of Wycliffe and Peter (2018) also on the Nairobi securities exchange, they failed to disclose to their readers the suitability or otherwise of any of the two capital market theories, the APT and the CAPM which were employed and tested in their study.

Asekome & Agbonkhese (2019) conducted a study on the macroeconomic variables, stock market bubble, meltdown and recovery: Evidence from Nigeria during the period from 2007 to 2016. Relying on the Ordinary Least Square (OLS) regression technique, the result showed that the coefficients of gross domestic product and money supply were statistically significant while the remaining three; exchange rate, capacity utilization and inflation were not significant. The paper observes that the post melt down macroeconomic policies including banking sector reforms contributed to the gradual recovery of the stock market. The paper therefore recommends the need for policies that could further strengthen and stabilize the banking sector, ensure low but steady interest rates, favourably exchange rate, low inflation and consistent policy environment that could boost a steady growth in the real sector.

## GAP IN THE LITERATURE

Empirical studies reviewed on the subject matter like Nkechukwu, Oyeagba and Oko (2013), Abaenewe and Ndugbu (2019), and some others. All the studies centered on stock price fluctuations and exchange rate behaviour, like Okon and Adie, (2020) with no emphasis on the effects of macroeconomic variable on the general performance of the stock market. Though studies like Odubo (2017), used the general market capitalization as indicator for the performance of the stock market instead of the all share index. This is a gap which the study has identified and filled in this study.

## 3. METHODOLOGY

### Model Specification

The model specified and estimated was based on the strength of the Arbitrage Price Theory (APT). The Arbitrage Price Theory provides the frame work that explained how the stock market behaviour is influenced by other macroeconomic variables. Ouma and Muriu (2017), Wycliff and Peter (2018), adopted the same theory in carrying out their respective studies on capital market operations. Data used for the study was purely secondary data sourced from: World Bank Development Indicators (WBDI), CBN bulletins and from facts books of Nigeria Stock Exchange (NSE). Thus, the functional form of the model is specified as:  $ASI = f(RGDP, FDI, GEXP, EXR)$  ----- (1)

Where;

ASI	=	All-Share index
RGDP	=	Real gross domestic product
FDI	=	Foreign direct investment
GEXP	=	Aggregate government expenditure
EXR	=	Exchange Rate

The stochastic and semi-logarithmic form of equation 2 is expressed as;

$$\ln ASI = \beta_0 + \beta_1 \ln RGDP + \beta_2 \ln FDI + \beta_3 \ln GEXP + \beta_4 EXR + \varepsilon \text{ ---- (2)}$$

Where

- In is the natural logarithm;
- $\beta_0$  is the intercept or constant term
- $\beta_1 - \beta_4$  are the parameter estimates and
- $\varepsilon$  is the stochastic or white noise error term

A dynamic Autoregressive Distributed Lag ARDL( p,q) form of the model capable of estimating long-run and short-run impact of the captured macroeconomic drivers on the performance of Nigeria stock market. Thus, the ARDL model is specified as;

$$\Delta \ln ASI_t = \beta_0 + \sum_{i=0}^p \varphi_1 ASI_{t-i} + \sum_{i=0}^q \varphi_2 \Delta RGDP_{t-i} + \sum_{i=0}^q \varphi_3 \Delta FDI_{t-i} + \sum_{i=0}^q \varphi_4 \Delta GEXP_{t-i} + \sum_{i=0}^q \varphi_5 \Delta EXR_{t-i} + \lambda ECM_{t-1} + \varepsilon_t$$

Where

$\Delta$  is the difference operator,  $q$  is the lag length of the dependent variable and  $p$  the lag length for independent variable and  $\varepsilon_t$  is the serially uncorrelated error term.  $\lambda$  is the speed of adjustment parameter and ECM is the error correction mechanism.

#### 4. RESULTS AND DISCUSSION OF FINDINGS

##### Stationarity Test Result.

Included observations: 40

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
. *   .	. *   .	1	-0.071	-0.071	0.2143	0.643
**   .	**   .	2	-0.271	-0.277	3.4607	0.177
**   .	**   .	3	-0.260	-0.331	6.5238	0.089
.   .	. *   .	4	0.047	-0.131	6.6264	0.157
.   *   .	.   .	5	0.136	-0.061	7.5164	0.185
.   .	. *   .	6	-0.010	-0.127	7.5209	0.275
. *   .	. *   .	7	-0.131	-0.183	8.3977	0.299
. *   .	**   .	8	-0.112	-0.231	9.0546	0.338
.   *   .	.   .	9	0.153	-0.052	10.320	0.325
.   **   .	.   *   .	10	0.246	0.119	13.710	0.187
.   .	.   *   .	11	0.024	0.095	13.742	0.248
** *   .	**   .	12	-0.350	-0.209	21.081	0.049
. *   .	. *   .	13	-0.106	-0.104	21.781	0.059
.   *   .	.   .	14	0.182	0.022	23.919	0.047
.   *   .	.   .	15	0.127	-0.054	25.001	0.050
.   .	.   .	16	-0.017	-0.015	25.022	0.069
.   .	.   *   .	17	-0.054	0.090	25.232	0.090
.   .	.   .	18	-0.032	0.038	25.312	0.117
.   .	.   .	19	0.022	-0.040	25.352	0.149
.   .	**   .	20	-0.065	-0.217	25.709	0.176

The correlogram approach to stationarity test result in table one shows that the variables are stationary at first difference as all the P.values are more than 5% which revealed the same order of integration I(1).

Lag	LogL	LR	LPE	AIC	SC	HQ
0	-385.8727	NA	21995.82	27.02571	27.30859	27.11430
1	-296.4422	135.6877	585.1598	23.34084	25.32106	23.96102
2	-251.3534	49.75309	444.9418	22.71403	26.39159	23.86580
3	-169.9422	56.14570*	60.61750*	19.58222*	24.95711*	21.26557*

\* indicates lag order selected by the criterion

The result of the optimal lag selection using the Akaike Information Criterion (AIC) and Schwarz Criterion (SC), shows that three lag is the optimal lag and appropriate lag for the model, hence, the model estimation is based on three lags.

#### Cointegration

Series: RGDP FDI GEXP EXCH  
 Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.819668	103.7767	47.85613	0.0000
At most 1 *	0.392626	36.97135	29.79707	0.0063
At most 2 *	0.353772	17.52552	15.49471	0.0244
At most 3	0.012688	0.498015	3.841466	0.4804

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*Mackinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.819668	66.80534	27.58434	0.0000
At most 1	0.392626	19.44582	21.13162	0.0846
At most 2 *	0.353772	17.02751	14.26460	0.0178
At most 3	0.012688	0.498015	3.841466	0.4804

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

The cointegration result shows three cointegration equations at the trace test and one cointegrating equation at max eigen value which established the existence of long run relationship among the variables in the model.

### LONG-RUN AND SHORT-RUN ANALYSIS

The results of the long-run and short-run estimates of the ARDL model in Equation 10 are presented on Table 4 The long-run and short-run estimates are separated to the constant term. The short-run estimates came after the long-run estimates and are presented in bold fonts.

Long-run and short-run estimates of the ARDL Model

Dependent variable = InASI (2, 3, 3, 2, 2)				
Variables	Coefficient	Standard error	T-statistic	P-value
Long-run Estimates				
LnRGDP	0.1117	0.3128	3.4100	0.0014
InFDI	0.0824	0.0632	-2.5878	0.0210
InGEXP	0.1601	0.0648	5.5560	0.0016
EXR	0.0147	0.0317	-4.8731	0.0023

Constant	0.0895	0.0659	2.3588	0.0013
Short-run Estimates				
RGDP	0.0224	0.0087	2.5881	0.0322
LnFDI	0.0304	0.0057	-6.2934	0.0007
InGEXP	0.1061	0.1684	5.0063	0.0256
EXR	-0.0785	0.1885	-3.0249	0.0038
ECM(-1)	-0.5238	0.0510	-5.3159	0.0000
Adjusted R <sup>2</sup>	0.9049			
S.E. of regression	0.2378			
F-Stat	14.857			
Prob. (F-Stat)	0.0000			
Durbin-Watson	2.7952			

\*\* indicates significance at 5%

The results of the long-run estimates show that lnRGDP, lnFDI, GEXP and EXR have positive and statistically significant long-run impact on the performance of the stock market in Nigeria. That is, 1% increases in RGDP growth will lead to about 0.11% increase in ASI in the long-run ceteris paribus. This entails that the long-run performance of the stock market can be influenced by the rate of economic growth in Nigeria. Also, evident from the results is that, 1% increase in foreign direct investment will lead to about 0.08% increase in the performance of the stock market in the long-run which also suggests that, in the long-run, foreign direct investment can exert positive impact on the operation of the stock market. The result in addition revealed that increase in government aggregate expenditure will simultaneously increase the performance of the Nigeria stock market by 0.16% in the long run, ceteris paribus.

Similarly, the long-run estimates indicates that, 1% increase in exchange rate result to increase in the performance of the stock market by 0.01% implying that increase in exchange rate may actually be incentive for investing in the stock market for long run positive impact, especially for foreign investors..

For the short-run behaviour, the results indicated that RGDP have positive and statistically significant impact on ASI, FDI is positive but statistically insignificant impact on ASI. This implies that 1% increase in RGDP, FDI and GEXP will result to increase in the performance of the capital market in the short-run by 0.02%, 0.03% and 0.10% respectively. On the other hand, the short-run estimates showed that EXR have negative and statistically insignificant impact on the performance of the Nigeria stock. That is, 1% increase in EXR will lead to decrease in the performance of the stock market by 0.08% ceteris paribus.

The error correction term (ECM) indicates that, the coefficient of the ECM (-1) – 0.5238 is negative and statistically significant at 5% level as required. This shows that, the deviation that occurs in ASI in the short-run is corrected by 52.38% towards the long-run equilibrium path every year, through the immense contribution of the macroeconomic variables.

The adjusted R<sup>2</sup> value of 0.9049 indicates that about 90.49% of the total variations in the performance of the stock market is explained by the combined influence of the explanatory variables, while the remaining 9.11% is the explained variation due to variables not captured in the model. This implies that the performance of the Nigerian stock market is highly influenced by macroeconomic drivers captured in the model. Also, the overall standard error of regression, which measures the total errors incurred in estimating the relationship, is 0.2378 which is relatively low, implying a high level of precision in the estimation of the model. Similarly, the Durbin-Watson statistic as a test for detecting the presence or otherwise of serial or autocorrelation in a model has a value of 2.3952 which is within the acceptable region of 1.5 – 2.4 for a model to be adjudged

free from autocorrelation. Hence, the estimated ADRL model for this study can be said to be free from serial correlation. The results tallied with Odudo (2017) and Afolabi (2019).

It can be observed from the findings of the study that all the variables satisfied their a priori expectations both in the short and long run. This implies that stock market response to the variation pattern of the macroeconomic drivers captured in the model.

### DIAGNOSTICS AND TESTS.

To establish the reliability of the parameter estimates, diagnostic tests for the residuals as well as the stability test of the coefficients were conducted and the results of the diagnostics tests are presented below.

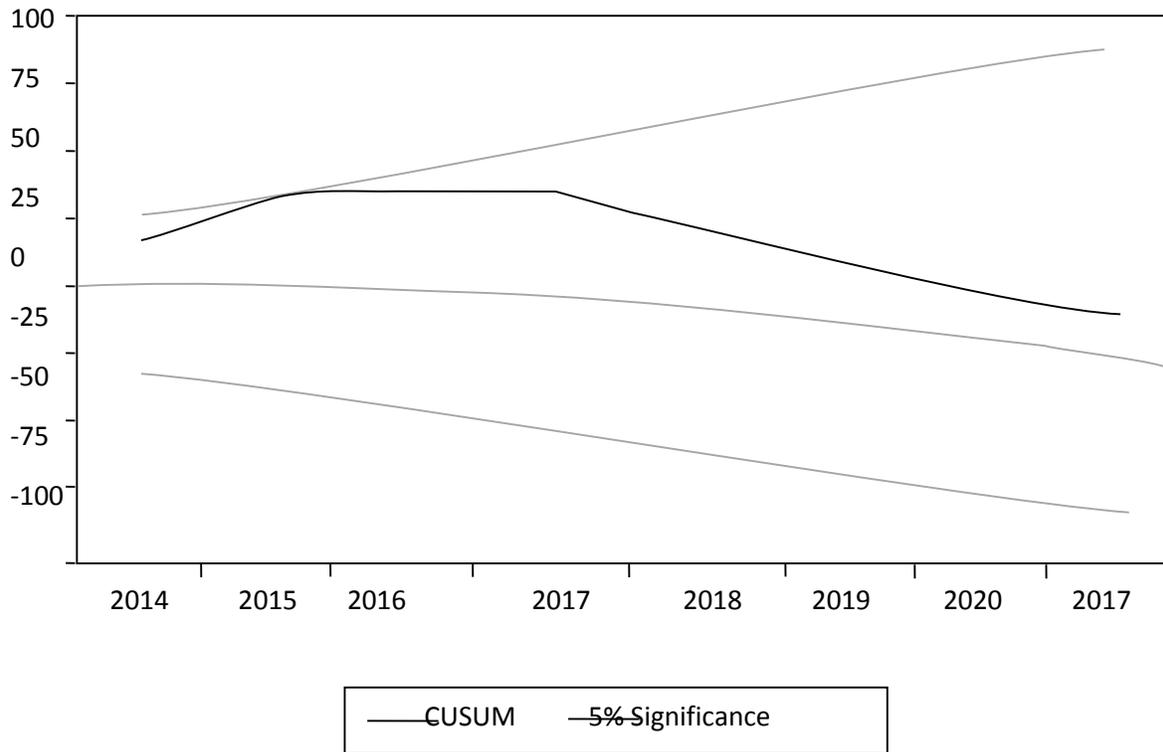
Result of the Diagnostics Test

Test statistics	F-statistic	P-value
Serial Correlation ( $\chi^2$ SERIAL)	1.7595	0.2504
Heteroskedasticity ( $\chi^2$ ARCH)	0.7106	0.4069
Ramsey Reset ( $\chi^2$ RESET)	1.4969	0.1781
Jarque-Bera ( $\chi^2$ NORMAL)	1.4978	0.4729

Source: Author's compilation using E-views 10.0

The results of the diagnostic tests using the Breusch-Godfrey LM test and the ARCH conditional heteroscedasticity test for serial correlation and heteroscedasticity shows the absence of serial correlation and the presence of homocedasticity. Furthermore, the result of the Ramsay RESET and the Jarque-Bera normality tests, also report probability values greater than 0.05 which implies that, the functional form of the models is correctly specified and the stochastic error term is white noise; thereby making the estimates from the model consistent and reliable for policy recommendation.

In addition, the stability test of the model was conducted using Cumulative Sum of Recursive Residuals (CUSUM) The CUSUM test is suitable at detecting systematic departure of the coefficients. The CUSUM statistics is zeros, which implies that, the expected value of a distance is always zero, a set  $\pm 2$  standard error bands. The plot of the CUSUM is shown in the figure below.



## 5. CONCLUSION AND POLICY RECOMMENDATIONS.

The main aim of this study is to investigate the impact of some selected macroeconomic drivers on the behaviour of the Nigeria stock market from 1986 to 2020. The selected macroeconomic drivers are; real GDP, foreign direct investment, aggregate government expenditure and the real exchange rate. All share index is used as proxy for stock market. The correlogram approach to stationarity was conducted to determine the order of integration of the variables, and all were stationary at first difference I(1) based on the P. values. This implies that the variables were integrated of the same order.

The ARDL along with ECM was applied to establish the short and long run impact as well as the speed of adjustment. Some diagnostic checks were carried out to determine the reliability and dependability of the model as a base for policy recommendation. On the bases of the findings, the study thus makes the following recommendations:

- i. Government should often undertake deliberate policy reforms that will increase the inflow of foreign direct investment in the country.
- ii. Increased aggregate government expending to boost the performance of the stock market.
- iii. Flexible exchange rate policies for sustained long run positive impact on the stock market performance.
- iv. Increase in economic activities that could transmit to positive impact on stock market behaviour.

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# IMPACT OF FDI ON EXCHANGE RATE IN NIGERIA: A COMBINED COINTEGRATION APPROACH

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## ABSTRACT

This study examined the long-run nexus between foreign direct investment (FDI) inflows and exchange rate (EXC) in Nigeria using the Gregory-Hansen, and Bayer-Hanck cointegration approaches from 1980M01 to 2019M12. The result showed that there is presence of long-run association between FDI and exchange rate in Nigeria. The Dynamic Ordinary Least Square (DOLS) technique was employed to establish the impact of FDI on the exchange rate. A negative nexus was found between the two variables. This implies that an increase in FDI brings about an appreciation of the Naira and vice versa. The study recommended that the Nigerian Government should strive to engage in activities that will minimise the outward leakages of Naira by attracting foreign investors into businesses, primarily in the oil sector. This action could lead to massive dollar injection, like setting oil refineries against crude oil extraction and exportation, which gives lesser USD inflows into the economy.

**Keywords:** Bayer-Hancks; Cointegration; Exchange rate; FDI; Gregory-Hansen; Nigeria

**JEL CLASSIFICATION:** C10, F21, F31, G15

## 1. INTRODUCTION

The inflows of foreign investors into the Nigerian border could be traced back to the Atlantic slave trade era when there was direct trade with Europe from the fifteenth century. Financial inflows have been noticeable in most areas of the Nigerian economy, and a few studies have looked into some of the country's foreign direct investment opportunities (Ashakah & Ogbemor, 2020; Yusuf, Shittu, Akanbi, Umar, & Abdulrahman, 2020; Adams & Opoku, 2015; Akinlo, 2004). At independence, Nigeria has been a leading exporter of agricultural produce, which accounted for 16 and 43 per cent of the world cocoa and palm oil production, respectively (United nation Conference on Trade and Development [UNCTAD], 2013). In 1956, 25 per cent of the companies duly registered in Nigeria were owned by foreign investors, while it rose to 70 per cent in 1963 (Kpoghul, Okpe & Anjanae, 2020; Ohiorhenuan, 1990), with most of these foreign direct investment (FDI) inflows coming from the middle-East and the United Kingdom, concentrated on commerce and cash crops (UNCTAD, 2013).

There has been an extensive array of literature replete with multiple studies on FDI inflows, while consensus is yet to be reached concerning its impact and relationships with the appreciation or depreciation on the domestic currency in the foreign exchange (FOREX) market. In developing countries like Nigeria, where there is a wide range of deficiencies in the domestic source of capital

financing engineered by the saving-investment gap, FDI is a significant source of capital to rescue and aid investments. Many factors contributed to Nigeria's sub-optimal investment ratio, including exchange rate volatility, persistent inflationary pressures, low domestic savings, insufficient physical and social infrastructure, fiscal and monetary policy slippages, a lack of indigenous technology, and political instability (Ahmad & Aworinde, 2020; Osinubi & Amaghionyeodiwe, 2009). A significant factor was exchange rate instability, especially after discontinuing the exchange rate control policy. The high lending rate, low and unstable exchange rate of the domestic currency and the high rate of inflation made returns on investment negative in some cases and discouraging investment, predominantly when financed with loans. FDI could positively or negatively impact the domestic currency's exchange rate, depending on how these inflows are used (Rehman, Ahmed & Jaffri, 2020). When FDI is deployed to finance imports, the exchange rate is unaffected; but, when it is used to finance domestic non-tradable, the domestic currency appreciates (Korinek & Serven, 2016; Baffes, Elbadawi, & O'Connell, 1997).

However, massive financial inflows in FDI exert pressure on the domestic currency's exchange rate (Ghosh, 2010; De Paula, Ferrari-Filho, Gomes, 2012; Nwosa & Amassoma, 2014), lowering the economy's trade competitiveness. Such a drop in trade competitiveness can increase public internal and foreign debt, worsen the fiscal deficit, and potentially exacerbate the current account deficit (De Paula, et al., 2012; Rashid & Husain, 2013). Furthermore, FDI inflows also present a significant problem for economic managers when implementing macroeconomic policies. Efforts to control currency rate appreciation by tightening monetary policy may result in increased FDI inflows into the host economy, putting extra pressure on the exchange rate (Nwosa & Amassoma, 2014). Meanwhile, the monetary authority's increase in domestic interest rates and large-scale sterilised foreign exchange market intervention to curb exchange depreciation from substantial financial inflows may lose their effectiveness or become increasingly costly (Caruana, 2011).

In Nigeria, the Naira exchange rate was relatively stable when the country depended on the agricultural sector for its survival. It accounts for almost 70% of the country's GDP before 1970, likewise during the oil boom between 1973 and 1979. In 1980, as recorded in the CBN statistical bulletin, the country's exchange rate was ₦0.55k, with a single-digit inflation rate of 9.97% and a GDP of \$64.2 Billion. However, due to the Nigerian Government's over-dependence on crude oil exploration and exportation cum import-dependence, global fluctuations in oil prices have affected the country's external reserve. The effect has dictated negatively on domestic performance, despite the FDI inflows recorded in the country from 2010 to 2019, ranging from ₦816,759,862.4 to ₦1,614,294,500 as captured by the Nigeria Bureau of statistics (NBS) and CBN. Although the exchange rate had a sporadic rise during these periods, depicting the insignificance of the increase in the FDI inflows on exchange rate. The Nigerian exchange rate was averaged ₦150.2975 per dollar in 2010, against N 101.6973 in 2000, with depreciation against ₦8.038 recorded in 1990. Massive FDI inflows recorded from 2010 to 2019 could present a significant challenge for economic managers in regulating the exchange rate. While attempting to curb exchange rate appreciation may result in additional inflows into the domestic economy, higher interest differentials are signals for higher return, thereby pressurising the exchange rate (Nwosa & Amassoma, 2014).

Recent works have aided in this direction by devising numerous estimation techniques to estimate how FDI appreciates or depreciates domestic currency's exchange rate. The majority of these approaches employed some type of cointegration technique to establish a long-run link between

the bilateral exchange rate and macroeconomic fundamentals such as tradable sector productivity, trade liberalisation, foreign capital inflows, and a variety of other factors (Bashir, 2019; Edwards, 1989; Montiel, 1997; Osinubi & Amaghionyeodiwe, 2009). As a result, it becomes imperative for a study like this to unravel the connection and relationship between increasing FDI inflows and exchange rate depreciation or appreciation in the Nigerian economy. It also investigates the magnitude and direction of the effect of FDI inflows on the exchange rate. The study's findings will demonstrate the critical role of this FDI inflow in dictating exchange rate movements in Nigeria and expose the best ways to deal with such fluctuations.

The other sections of this article and the introductory portion are as follows: section 2 is the literature review, while section 3 discusses the methodology used in the paper. Analysis and results are discussed in section 4, while section five focuses on the conclusion and policy recommendations.

## **2. LITERATURE REVIEW**

### **2.1. Conceptual Literature**

The exchange rate is the relative price of one currency to another currency, i.e., the amount of foreign money that may be purchased for one unit of domestic currency, or the cost of purchasing one unit of foreign currency in domestic currency (Pilbeam, 1998). It is the rate at which one currency exchanges for the other, and it is used to characterise the international monetary system (Iyoha, 1996). Meanwhile, Anifowose (1994) described the foreign exchange as a monetary asset used daily to settle international transactions and finance deficits in a country's balance of payments. It is an essential component of a country's stock of external reserves. Other components include holding of monetary gold and Special Drawing Rights (SDRs).

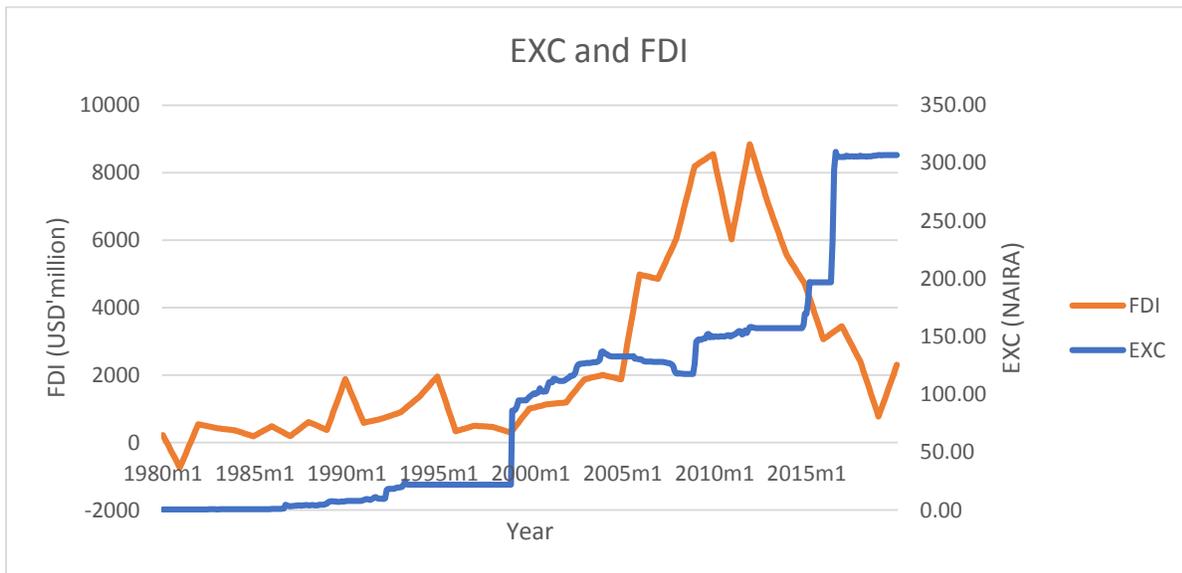
Meanwhile, a country could acquire foreign exchange through exporting goods and services, direct investment inflow or external loans, aids, and grants to settle international obligations (Obaseki, 1991). When there is disequilibrium in the foreign exchange market due to an inadequate supply of foreign services, this may pressure foreign exchange reserves. If the foreign reserves are not adequate, this may deteriorate into the balance of payments problems. Exchange rate appreciation could be contractionary or deflationary, while a depreciating exchange rate could be expansionary and inflationary. Meanwhile, the exchange rate's level pilots a country's economy's cyclical position in the output gap and inflationary pressure.

The bilateral real exchange rate has been used in examining the price of domestic goods in terms of partners' goods (Gour & Mohammad, 2011; Opoku-Afari, 2004) against the real effective exchange rate (REER) that measures the prices of domestic goods in terms of a basket of foreign goods. Hence, this study employed the bilateral real exchange rate in its analysis.

Foreign Direct Investment (FDI) can be viewed from the perspective of the Balance of Payments and International Investment Position (IIP), both of which have conceptual similarities extracted from the International Monetary Fund (IMF). The IIP compiles the value of each financial asset and liability stock as defined in the standard components of the Balance of Payments for a specific date, such as the end of a year. In contrast, the Balance of Payments serves as the statistical statement that systematically summarises the economic activities and transactions of a country with the rest of the world for a specific period. The IMF's Balance of Payments Manual (BPM) (5th Edition, 1993) and the Organisation for Economic Co-operation and Development (OECD)'s benchmark definition of Foreign Direct Investment provided an overview of FDI definitions, concepts, as both offer operational guidance as well as precise international standards for tracking FDI flows and stocks.

### 2.1.2. Stylized Facts about Exchange rate and FDI in Nigeria

Agricultural exports have accounted for a considerable stake of Nigerian exports in the 1960s and 1970s, and it was a significant source of foreign exchange stabilisation before the oil boom of 1972. Nigeria was a major exporter of groundnuts, cocoa, rubber, and other agricultural products. The constant nature of exchange rate fluctuations significantly impacts the revenues projected from export proceeds during this period. The variations in exchange rates postulated a significant impact on the country's export sector's performance (Owuru & Farayibi, 2016). During this period, the Nigeria pounds was 0.71 shillings as the average exchange rate to USD from 1960 to 1972 (see figure 1). The Nigerian pounds and shillings were dropped for the Nigerian Naira by 1<sup>st</sup> January 1973, keeping the appreciation of the former fiat currency, which was maintained on an average of 0.66 kobo to USD from 1972 to 1985. During these periods, the fixed exchange rate regime was adopted, sustaining the appreciation of the domestic currency stabilised to an average of 0.62 kobo in 1975, with an average depreciation to 0.0.63 and 0.64 kobo in 1976 and 1977 respectively. The favourable fixed exchange rate regime was sustained until 1985 with an average exchange rate of 0.89 kobo.



**Figure 1: Nigeria Exchange rate and net FDI inflows**

*Source: Authors' computation from CBN and WDI*

However, there was a shift from the fixed exchange rate regime utilised in the economy to the flexible exchange rate regime due to the introduction of the Structural Adjustment Programme (SAP) in 1986, leading to unpredictable volatilities in the exchange rate market for the Nigerian Naira, coupled with the fluctuating oil prices and commodity prices leading to low profitability from exported agricultural products with a lean balance of payment and foreign reserve (Owuru & Farayibi, 2016). Furthermore, the fluctuations witnessed under the flexible regimes commence the journey into the naira depreciation against the dollar, as its volatility during the fixed regime was appreciative (Nwachukwu *et al.*, 2016). The forex was rationally priced during the flexible regime, leading to genuine or frivolous demand resulting in a persistent depreciation as Naira was exchanged at N1.32 and N3.61 on the average per USD in the third and fourth quarters of 1986, respectively. This depreciation continued at 40.99% depreciation rate at the end of 1988 fourth-

quarter closing at N5.09 exchange rate, with a further 29.6% depreciation rate in the first quarter of 1989 as Naira was exchanged at N7.23 per USD due to the inter-bank-foreign exchange market arising from the merger of the autonomies and official foreign exchange markets. To address the instability and negative volatilities experienced, the CBN, through the Dutch Auction System (DAS), modified the inter-bank foreign-exchange procedure in 1990, with the model Weighted Average System (WAS) introduced by August 1991 (Nwachukwu *et al.*, 2016).

The stabilisation processes embarked by CBN in 1990 and 1991 could not curtail the naira exchange rate fluctuations, as the average rate in 1990 and 1991 was recorded to be N8.04 and N9.91, respectively, leading to the adoption of deregulating the exchange rate system in March 1992. This deregulation further bastardised the upward increase in the exchange rate, as it recorded an unprecedented ₦18.47 and ₦19.50 per USD immediately after the deregulation in the second and fourth quarters of 1992, respectively, with a yearly average of ₦17.03 in 1992. The stabilisation system of the CBN yielded a meaningful result as the exchange rate was stable from 1993 through 1994 with ₦22.00 per USD, as it was pegged in 1994. The fixed regime adopted coupled with the introduction of the Autonomous Foreign Exchange Market (AFEM) in 1995 further created sanity into the foreign exchange market to increase the productive sectors of the economy, as it appreciated by 0.45% on the average in 1995 to 21.9 and further 0.50% from 1996 to 1998 with an average exchange rate of N21.89.

The stabilisation and sanity enjoyed in the foreign exchange market were short-lived at the verge of democracy inception in the country by 1999, as an unprecedented exchange rate of ₦92.34 was recorded on the average, which was a 321.84% depreciation cum the first-ever triple digits depreciation witnessed throughout the country existence, it further increased by 10.14% in 2000, closing at ₦101.7 per USD being the first triple exchange rate recorded in the country. On average, from 2001 to 2010, the exchange rate was ₦129.74 on a decade average. In contrast, there was depreciation in the first quarter of the decade (2001-2004), while the next quarter witnessed an apprehensive naira appreciation, as exchange rate contracted at the last two years of the decade. The period between 2001-2004 could be called the naira exchange rate trough period, while the second phase of 2005 to 2008 could be tagged the naira exchange rate expansion phase. The exchange rate fluctuations and depreciation continue subsequently, as it ranged averagely between ₦153.86 and ₦306.08 per USD from 2011 to 2019. In 2020, the exchange rate depreciated officially on the average by 16.91%, equivalent to ₦358.8 per USD, while as at 27 July 2021, it was exchanged at ₦410.16 per USD.

On the other hand, after Egypt and Ethiopia, Nigeria is Africa's third-largest FDI recipient, as the country is one of Africa's most promising growth poles, attracting a slew of investors in the hydrocarbon, energy, and construction sectors. The repercussions of the oil counter-shock are felt throughout the country. FDI inflows to Nigeria totalled USD 3.3 billion in 2019, a decrease of 48.5% from the USD 6.4 billion in 2018 (figure 2) due to the effects of austerity measures (UNCTAD,2020). In 2019, the overall stock of FDI was anticipated to be USD 98,6 billion. The United States, China, the United Kingdom, the Netherlands, and France are among the most influential investors in Nigeria.

Nigeria intends to diversify its economy away from oil by building a competitive manufacturing sector, which should facilitate integration into global value chains and boost productivity. Some

of the country's main advantages are a partially privatised economy, a sound taxation system, significant natural resources, and low labour costs. Widespread corruption, political instability, a lack of transparency, and insufficient infrastructure, on the other hand, hinder the country's FDI prospects. Foreign investment is also hampered by a high level of bureaucracy. When MTN spent \$285 million on a GSM license that allowed it to enter Nigeria in 2001, Nigerian telecommunications saw unprecedented FDI inflows. Following that, the introduction of Etisalat (2008) and the acquisition of Zain by Bharti Airtel (2012) brought in more dollar-denominated investment, resulting in the Nigerian telecommunications sector's rapid expansion.

Nigeria's commitment to efficiently coordinate across these three critical areas to strengthen its trading and investment environment is shown in the recent merger of trade, industry, and investment under the auspices of the Federal Ministry of Industry, Trade, and Investment. Furthermore, the World Bank's 2020 report on Doing business ranked Nigeria 131<sup>st</sup> for the ease of doing business, representing a climb of the ladder by 15 steps away from the 146<sup>th</sup> 2019 ranking. Nigeria has been attracting solid inflows from American companies in transportation and telecommunication, with China investing mainly in the textile, automotive, rail transportation, and aerospace industries (World Bank, 2020).

## 2.2. Theoretical Literature

Nyoni (1998) asserted a theoretical link between financial inflows (using foreign aid which is a form of financial inflows as FDI) and real exchange rate, linking the theoretical bound that aid inflows have an inverse relationship with the real exchange rate using the theory of equilibrium real exchange rate, which postulated that net financial inflows, exchange & trade controls and government consumption of non-tradeable would cause an appreciation of real exchange rate. The term of trade shock on the equilibrium real exchange rate is said to be determined on how the income effects supersede the substitution effect will result to an equilibrium real depreciation due to the worsening terms of trade (Nyoni, 1998). Meanwhile, the technical progress has an impact on the real exchange rate, as it could cause real exchange rate appreciation depending on which sector the progress comes from and the relative strength of demand and supply of the technological progress (Edwards, 1989). Meanwhile, Stockman (1987) built on a simple core equilibrium exchange rate model in line with what was previously developed in 1980 aided with assumptions in clarifying the exposition. It was asserted that there is only one time period, abetted by two countries dealing with two commodities that could be consumed by households. Meanwhile, Ajevskis, Rimgailaite, Rutkaste, and Tkačevs (2014) posited the direct and structural approach to equilibrium real exchange rate theory. The direct approach is obtained by estimating the reduced-form equation specifying real exchange rate as a function of fundamental determinants.

$$q_t = \beta_1'Z_{1t} + \beta_2'Z_{2t} + \tau'T_t + \varepsilon_t \quad (1)$$

Where  $Z_{1t}$  connotes vectors of economic fundamentals having an effect on the exchange rate in the long run,  $Z_{2t}$  are vectors of such fundamental economic variables that have medium-term effect on exchange rate,  $T_t$  represent transitory short-term components,  $\varepsilon_t$  the random disturbance and the vectors of the reduced-form coefficient are  $\beta_1$ ,  $\beta_2$  and  $\tau$ . The direct approach captures short-term movements in real effective exchange rate (REER) as it includes behavioural factors affecting REER in the model specification (Ajevskis et al., 2014)

Following the work of Elbadawi (1993), Elbadawi and Soto (1994) extended Edwards (1988) by endogenizing private absorption as a function of net capital inflows and the expected real exchange rate depreciation thus:

$$\frac{A}{Y} = \left( \frac{NFI}{Y}, [{}_t e_{t+1} - e_t] \right) \quad (2)$$

NFI are the net financial inflows,  ${}_t e_{t+1}$  is the expected real exchange rate. Therefore, the equilibrium exchange rate theory is modelled as:

$$e = v \left( \frac{A}{Y}, TOT, t_X, t_M, g_N \right) \quad (3)$$

Where TOT is terms of trade,  $A$  is the absorption  $Y$  is income,  $g_N$  represents proportion of government expenditure to income

Furthermore, another theory employed to link FDI to exchange rate is the Purchasing power parity (PPP) theory. In the argument of Pibleam (2006), the Purchasing power parity (PPP) theory of exchange rate is the underlying assumptions of many models incorporating exchange rates, as it is built on the law of one price, which theoretically states transaction cost is the same globally irrespective of the geographical location of both seller and buyer. The PPP theory was previously tested by McNown and Wallace (1989) for Argentina, Brazil, Chile and Israel, where the theory was validated. In contrast, transaction costs differ across goods, making the speed at which price differentials vary across goods and capital market, and statistical problems have been notable drawbacks for the theory (Chen & Engel, 2005; Pibleam, 2006).

Meanwhile in terms of FDI, the elective hypothesis developed by Dunning (1988) consisting three separate theories has been previously employed to explain FDI-exchange rate relationship. It tries to explain why a company would want to produce in a foreign country rather than export or enter into a licensing agreement with a local company. Ownership advantage, location, and internalization are some of these theories (OLI model). Language and culture, availability to inputs, legal system, and tax regime are examples of variables that help enterprises to overcome handicaps in an alien environment. It refers to intangible assets that belong only to a company and can be transferred at a cheap cost inside Multinational Corporations (MNCs) to enhance income or cut costs (Denisia, 2010). Superior technological, managerial, and marketing abilities are examples of ownership advantages that provide a firm a competitive advantage over other local businesses. In this case, location refers to the host country in which MNCs may choose to place its overseas subsidiary. Rather than exporting to the area, it is more advantageous to start a new business there due to variables such as low labour costs, abundant raw materials, and a vast market. Denisia (2010) goes on to say that cross-border production and internalization encourages firms to prefer producing in the host country over granting franchises or offering rights under licenses. According to Aveh et al. (2013), OLI is firm-specific and is influenced by the economic, political, and social climate of the host country in which the firm operates.

Based on the argument of the Nyoni (1998), Ajevskis, *et al.* (2014), coupled with the variability and adjustment given by Elbadawi and Soto (1994) on the FDI bound exchange rate theoretical links through the equilibrium real exchange rate theory, this study is built on the equilibrium real exchange rate theory.

### 2.3 Empirical Literature

The surge in FDI over the past three decades has renewed interest in understanding how it affects the macroeconomy of the recipient countries. The relationship between FDI and exchange rate has been studied more extensively in industrialised countries and emerging markets economies, with little study in Nigeria. Meanwhile, several studies have investigated how exchange rates are affected by FDI in recipient economies since FDI inflows deliver various benefits to the host country, including technological know-how, financial resources, financial flows for long-term investment, and corporate expansion. The connexion between FDI and exchange rate is becoming increasingly significant (Qamruzzaman, Mehta, Khalid, Serfraz, A.& Saleem, 2021; Imoughele, 2020). FDI inflows aided effective reallocation of economic resources, allowing for tremendous output potential in the home and host countries.

Numerous research works have established the positive association between exchange rate and FDI. Dey, Datta, Amin, Roy, and Ali (2021), while investigating the response of GDP, exchange rate, and inflation rate to FDI inflows in Bangladesh from 2000 to 2019 employing the OLS technique, established a positive and statistically significant relationship between FDI and exchange rate. This shows that FDI causes *Dutch diseases* syndrome in Bangladesh during their study, as the FDI inflows cough out more Bangladesh Taka in exchange for USD. Ellahi (2011) observed that exchange rate volatility negatively influenced foreign direct inflow in the short run, while exchange rate volatility positively influenced foreign direct investment in Pakistan from 1980 to 2010 in the long run. Ellahi's submission supported Ebhotemhen, (2020), Dhakal, Nag, Pradhan, and Upadhyaya (2010) and Del and Chiara (2009) significant positive relationship between exchange rate volatility and foreign direct investment. Furthermore, Qamruzzaman *et al.* (2021), while examining FDI on exchange rate volatility in some South Asian countries from 1980 to 2017, recorded an asymmetric effect between FDI inflows and exchange rate volatility, thereby concluding that the two series move together, exhibiting a causal relationship.

Meanwhile, Latief and Lefen. (2018), using the TGARCH and the fixed effect model, concluded that FDI inflows were adversely affected by the exchange rate volatility in China. Ezeji, Fezi and Chigbu (2021) examined the effect of FDI on exchange rate of Naira in Nigeria from 1990 to 2016 using the OLS and Granger causality test revealed that there is a positive and significant effect of FDI inflows on building and construction, mining, and quarrying and transportation and communication on real exchange rate. Abdul (2009) examined the effects of capital inflows on nominal and real effective exchange rate volatilities in Pakistan from 1991M1 to 2007M12 using the Granger causality test. This study submitted a significant causal relationship between FDI and exchange rate volatility. Furthermore, Chege (2009) and Barrell, Gottschalk, and Hall (2004) (in Ifeakachukwu & Ditimi, 2014) also observed a negative relationship between exchange rate volatility and inward foreign direct investment.

Osigwe and Uzonwanne (2015) scrutinised the Granger causality of foreign reserves, exchange rate (EXR), and foreign direct investment (FDI) in Nigeria. Their study revealed cointegration among the employed variable, while the Granger causality indicted unidirectional causality from EXR to FDI. Meanwhile, a study on the influence of FDI on exchange rate and domestic investment in Sub-Sahara Africa (SSA) was engineered from 1999-2015 by Ugwu and Udeh (2018), where the negative relationship between FDI and exchange was established for Ghana and Nigeria. Whereas the negative equivalence to an increase in the demand for the two countries' currencies makes the exchange rate fall, a fall in exchange rate means appreciation of a domestic

currency concerning a foreign currency. The assertion of Ugwu and Udeh (2018) was also upheld by Adejumo and Ikhida (2019) when their examination of the effect of remittances inflows on exchange rate in Nigeria was carried out, with FDI as one of the control variables. The FDI inflow was reported to negatively influence exchange rate, implying that high FDI inflows exerted appreciating pressure on the country's currency. Osinubi and Amaghionyeodiwe (2009) examined the effect of exchange rate volatility on foreign direct investment (FDI) in Nigeria from 1970 to 2004, employing the OLS and the ECM estimation techniques. Their study revealed a significant positive relationship between real inward FDI and exchange rate in Del and Chiara (2009) study. Meanwhile, Ogunleye (2008) examined the relationship between exchange rate volatility and FDI in Nigeria and South Africa. The study observed that exchange rate volatility influenced FDI inflows negatively, as FDI inflows spurred exchange rate volatility in both countries.

### 3. METHODOLOGY

#### 3.1. Theoretical Framework

The study is hinged on the equilibrium real exchange rate theory as extended by Elbadawi and Soto (1994), where net financial inflow is expected to depict an inverse relationship with exchange rate, leading to the appreciation of the host country exchange rate. This study adapts the model in Elbadawi and Soto (1994) by modifying it in favour of FDI which is a form of financial inflows thus:

$$\log e_t = \alpha_0 + \alpha_1 LFDI \quad (4)$$

Where  $e_t$  represents exchange rate, FDI is foreign direct investment. The choice for this theory is traced to its adaptability and variability by previous scholars in ascertaining the theoretical links between FDI and exchange rate (Nyoni, Ajevskis, *et al.*, 2014; Okwu, Oseni, & Obiakor, 2020)

#### 3.2. Design, Data, and Sources

This study explores the *ex-post facto* research design within a time-series data environment. The design is considered appropriate because previously published data, which are not subjected to manipulation, are used for the analysis. The monthly data for exchange rate was extracted from the Central Bank of Nigeria's Statistical Bulletin (CBN, 2020) and the annual time series of FDI (interpolated to monthly using Dento, 1979 method) from the World Development Indicator (WDI, 2020). The design had been used in some previous studies Hermes and Lensink (2003), Saibu (2014). The design facilitates the determination of the impact of foreign direct investment on the exchange rate in Nigeria.

#### 3.3. Cointegration Approach

Most empirical studies used the fundamental cointegration techniques developed by Engle and Granger (1987) cum the Johansen and Juselius (1990) cointegration techniques to examine and establish the existence of long-run nexus among a multivariate variable's framework. Meanwhile, according to Afshan, Sharif, Loganathan, and Jammazi (2018), one of the main criticisms of these cointegration approaches is the stagnant cointegration interrelation assumption over the entire period this is not welcomed while dealing with data of larger magnitude. Hence, this study uses the combine cointegration technique proposed by Bayer and Hanck (2013), as it captures the overall long-run cointegration between EXC (USD/NGR) and FDI. The Bayer Hanck approach

combined the computed significance level of each of the individual cointegration tests using Fisher's formula:

$$EG - JOH = -2[In(P_{EG}) + (P_{JOH})] \quad (5)$$

$$EG - JOH - BJ - BSJ = -2[In(P_{EG}) + (P_{JOH}) + (P_{BJ}) + (P_{BSJ})] \quad (6)$$

Equation 5 and 6,  $P_{EG}$ ,  $P_{JOH}$ ,  $P_{BJ}$  and  $P_{BSJ}$  represent the individual cointegration tests of Engel-Granger, Johansen, Banerjee and Boswijk's probability values, respectively. Furthermore, as witnessed in this study, the study utilises the Gregory and Hansen (1996) threshold cointegration approach to arrest emanating structural breaks issuers in a long time series. The GH test captures the long-run cointegration condition residual-based using the Augmented Dickey-Fuller (ADF) coupled with the  $Z_\alpha$  and  $Z_t$  as proposed by Perron (1989). The following models are used in indicating the GH estimation with residual-based analysis:

$$EXC_t = \mu_{11} + \mu_{12}\gamma_{t,\tau} + \delta_{13}^T FDI_t + \varepsilon_{1,t} \quad (7)$$

Equation (7) is the *level shift* model specification denoted by  $C$ ,

Where:  $EXC$  is exchange rate,  $FDI$  is the foreign direct investment,  $\mu_{11}$  is the intercept before the shift,  $\mu_{12}$  is the change in the intercept at the time of the shift,  $\delta_{13}^T$  is the slope coefficient

$$EXC_t = \mu_{21} + \mu_{22}\gamma_{t,\tau} + \alpha t + \delta_{23}^T FDI_t + \varepsilon_{2,t} \quad (8)$$

Equation (8) is the level shift with trend denoted by  $C/T$ .

Where:  $\mu_{21}$  represents the intercept before the shift,  $\mu_{22}$  connotes the change in the intercept at the time of the shift, while  $\delta_{23}^T$  captures the slope coefficient.

$$EXC_t = \mu_{31} + \mu_{32}\gamma_{t,\tau} + \delta_{33}^T FDI_t + \delta_{34}^T FDI_t \gamma_{t,\tau} + \varepsilon_{3,t} \quad (9)$$

Equation (9) is the regime shift captured as  $C/S$ ,

Where:  $\mu_{31}$  and  $\mu_{32}$  are as in (4) and (5),  $\delta_{33}^T$  denotes the cointegrating slope coefficient before the regime shift, and  $\delta_{34}^T$  represents the changes in the slope coefficients.  $\gamma_{t,\tau} = 0$

If  $t \leq |T\tau|$  and  $\gamma_{t,\tau} = 1$  if  $t \geq |T\tau|$ ,  $\tau$  is the unknown break denoting the change point timings,  $t$  is the time trend,  $\delta$  denote coefficient of each variables and  $\varepsilon_{i,t}$  is the error term.

#### 4. RESULTS AND DISCUSSION OF FINDINGS

As earlier acknowledged, the thrust of this study is to investigate the connection between foreign direct investment and exchange rate in Nigeria. The econometrics estimation started by first establishing the nature and characteristics of the variables, which was carried out via the descriptive statistics in table 1.

**Table 1: Descriptive statistics**

Statistics	EXC	FDI
Mean	91.916	2411.197
Median	98.191	1241.820
Minimum	309.730	8841.062
Maximum	0.53140	-738.8700
Standard Deviation	92.173	2550.263
Skewness	0.867	1.123507
Kurtosis	2.981	2.939963
Jarque-Bera Prob	60.173* (0.000)	101.054* 0.000*
<b>Correlation Matrix</b>		
EXC	1.000	
FDI	-0.520* 0.000	1.000

*Source: Authors' compilation from E-views 10*

The central tendency measures the mean, median and mode. The mean represents the average value of each variable over the considered time frame. On average, all the series variables depicted positive average values. The mean value of 91.916 for exchange rate over the years signifies a moderate rate of currency exchange, amounting to that on the average, the Nigeria Naira exchange for the USD is at ₦ 91.916 per USD during the 480 months observed. The FDI inflows show that during the 480 months under study, Nigeria attracted 2.41 billion USD in FDI on average. Furthermore, the maximum exchange rate and FDI values are ₦ 309.19 (1 USD in August 2016) and 8.84 billion USD, respectively.

Meanwhile, the minimum values of 53 kobo and (738 million USD) for exchange rate (EXC) and FDI respectively were recorded during these periods. Given these series' maximum and minimum values, we can measure how the series dispersed. The range value for exchange rate was N309.2, while that of FDI was 8.19 billion USD. In measuring how widely distributed the series was, it was reported that the exchange rate widely varied from the average by N8,495.78, while FDI was 6,500 billion USD. The variance shows the volatilities with these individual variables during the study period. The 6,500 trillion USD for FDI show how risky the Nigerian economy was for foreign investors. These high values depicted high market-volatility birthing market risks. Meanwhile, the standard deviation of N 92.17 to USD for the exchange rate is not harmful as it shows slight deviation and preferable lesser exchange rate volatility during the study period.

The normality measures start with the kurtosis that measures the peakedness or flatness of each of the series distributions. The kurtosis statistics revealed EXC is flatted-curve, i.e., platykurtic in nature, while FDI is leptokurtic, i.e., peaked-curve. The skewness measures the degree of the series asymmetry, with the rule of thumb for normal skewness should be zero, showing symmetric distribution around its mean. Meanwhile, positive and negative skewness means that a variable is above and below the mean, respectively. The series variables mirrored a positive skewness, signalling that they are above their respective mean and have a long-right tail. Finally, the Jarque-Bera statistic measures the skewness and kurtosis differences of each series with those of normal distribution shows evidence of non-normality for the variables under the sample period as the Jarque-Bera probabilities values are less than 0.05 significance value. The rationale for this is that

most high-frequency series will face this normality problem (Afshan et al. 2018). Meanwhile, the correlation matrix shows a significant negative good relationship between FDI and EXC in Nigeria.

**Table 2: Unit Root Tests**

variables	ADF		PP		ZA		Perron	
	t-stat	Order	t-stat	Order	t-stat	Order	t-stat	order
LEXC	-21.537	I(1)	-21.536	I(1)	-21.900	I(1)	-28.710	I(1)
					$T_B = 1986(M11)$		$T_B = 1999(M01)$	
LFDI	-29.441	I(1)	-17.422	I(0)	-7.104	I(0)	-7.851	I(0)
					$T_B = 2008(M01)$		$T_B = 2007(M12)$	

*Source: Authors' compilation from E-views 10*

The ADF, PP, Zivot Andrew (ZA) and Perron unit root are conducted for the two variables' logarithm forms, as evident from table 2. The result shows the rejection of the null hypothesis at the first difference for EXC under the four tests. In comparison, the first difference null hypotheses were only rejected under ADF for FDI as the level null hypotheses were rejected under the three other tests. Furthermore, the null hypotheses of ZA and Perron's structural break unit root test were stationary with a structural break. We found that there were mixtures in the order of integration, likewise the time of breaks. LFDI integrated at I(0) using the ZA statistics, while LEXC at I(1). In contrast, LEXC integrated at first difference under the Perron test, while LFDI was at level. Furthermore, the time breaks in these variables also differ, as the time breaks ( $T_B$ ) for exchange rate was 1986 M11 and 1999 M01 under ZA and Perron, respectively. The structural breaks for LFDI occurred in January 2008 under ZA, while it was in December 2007 under Perron.

**Table 3: Gregory and Hansen Threshold Cointegration Result**

Regime shift	ADF		$Z_t^*$		$Z_\alpha^*$	
	Breakpoint	Statistic	Breakpoint	Statistic	Breakpoint	Statistic
Level shift	1991(M09)	-3.07 (-4.61)	2013(M12)	-4.28 (-4.61)	2013(M12)	-54.51* (-40.48)
Level shift & time trend	1999(M04)	-3.79 (-5.50)	1999(M02)	-3.87 (-5.50)	1999(M02)	-23.58 (-58.58)
Regime shift	1998(M07)	-2.83 (-4.95)	2013(M12)	-4.50 (-4.95)	2013(M12)	-58.80* (-47.04)

**Source: Authors' compilation, 2022 from STATA 15**

Notes: \* denotes the rejection of the null hypothesis at 5 % significance level. The critical values for the GH test are available at Gregory and Hansen (1996), while the AIC lag selection was used. The number in parentheses represent the critical value.

The GH test result are reported in table 3. The result of no cointegration in the presence of possible level shift, level shift & trend and regime are accepted under ADF and  $Z_t^*$ . Meanwhile, the level and regime shift null hypothesis of no cointegration are rejected under  $Z_\alpha^*$ . Meanwhile, the rule of thumb is that the lower the statistics' value, the better the model, leading to choosing the  $Z_\alpha^*$  statistics. Overall, the GH

cointegration result that the unknown structural breakpoints determined in the study have a significant impact on the long-run cointegration relationship; hence, FDI has a long-run impact on EXC in Nigeria.

**Table 4: individual and combined cointegration test**

Test type	Test statistics	p-value	Cointegration
<i>Individual approach</i>			
Engle-Granger	-3.5002*	0.0314	Yes
Johansen	58.4911*	0.0000	Yes
Banerjee	-0.9788	0.8235	No
Boswijk	3.3263	0.6243	No
<i>Combine approach</i>			
EF-Johansen	62.1839* (11.229)		Yes
Bayer and Hanck	63.4575* (21.931)		Yes

**Source: Authors' compilation, 2022 from STATA 15**

Notes: \* denotes the rejection of the null hypothesis at 5 % significance level. The number in parentheses represents the critical value., while the AIC lag selection was used

Table 4 shows the results for the individual and combined cointegration tests. The table explicitly displayed that two of the individual statistics (Banerjee & Boswijk) failed to reject the null hypothesis except for the Engel-Granger and Johansen tests that individually rejected the null hypothesis of no cointegration among the variables at a 5% significance level. The rationale for this was that the t-statistics and p-value of all these two tests were greater than their critical value in absolute terms and lesser than the 5% significance level. However, the combination of Engle and Granger and Johansen (EG-J) tests reject the null hypothesis of no cointegration, as the EG-J statistics of 62.1839 is greater than the 11.229 critical value for 5%, establishing a long-run cointegration among the variables. Furthermore, when the Bayer and Hanck (2009) combined test was used, the EG-J-Ba-Bo t-statistics of 63.458 is greater than the 5% critical value of 21.931. Based on the Fisher type Bayer Hanck test, we reject the null hypothesis of no cointegration at 5% significance level, implying that the FDI exhibited a significant impact on exchange rate over the estimated periods in the long run.

Following the cointegration of the two series in the long run as ascertained by the GH and Bayer-Hanck combined cointegration tests, it is further imperative to establish the impact of LFDI on exchange rate (LEXC). This is estimated using the DOLS method, and the results are presented in Table 5.

**Table 5: Dynamic Ordinary Least Squares (DOLS)**

Dependent variable: LEXC			
Variables	Coefficient	t-statistics	Probability
C	13.841	9.055	0.000
LFDI	-1.638	-10.031	0.000

R-squared: 0.600

**Source: Authors' compilation from E-views 10**

$$LEXC = 13.841 - 1.638LFDI + \varepsilon_t \quad (10)$$

From estimated model 10 and as tabulated in table 5, LFDI depicted an inverse relationship with exchange rate during the study period. The result reveals that *ceteris paribus*, a percentage increase in FDI during these periods triggered a 1.638 per cent decrease in the exchange rate. This is a good signal as this depicts that FDI contributed to the appreciation of the Nigeria Naira against the USD during these periods, negating the *Dutch disease* syndrome. This relationship is further affirmed to infer a significant impact on exchange rate, as the P-value of 0.000 is less than the 0.05 significance level threshold for this study. Furthermore, the R-squared value of 0.600 depicted that FDI caused 60.0% variation in EXC during the study period. In comparison, the remaining 40% variations could be traced other variables not included in the model but have been captured by the error term  $\varepsilon_t$ .

The DOLS result further establishes the GH and Bayer-Hanck cointegration result as it does not only agree with the long-run relationship between FDI and EXC but extends to pronounce the significant impact of FDI on EXC during the study periods.

## 4.2 Discussion of Findings

Three different estimation techniques were employed to establish how FDI impacts EXC in Nigeria, with the estimator of DOLS from 1981 to 2019 confirming the validity of the duo of GH and Bayer-Hanck cointegration tests. The results obtained Osigwe and Uzonwanne (2015), Ugwu and Udeh (2018) and Adejumo and Ikhide (2019) where the negative relationship between FDI and EXC in the DOLS denote an increase in the demand for the local currency, leading to the drop in exchange rate, exhibiting appreciation of Naira against USD. Meanwhile, the result contradicts the outcome of Dey *et al.* (2021). The core question of the study is addressed with the estimation results that FDI plays a crucial role in balancing and appreciating the Nigeria naira in the FOREX market, as the moderating role of FDI is statistically estimated to be significant.

Furthermore, the negative coefficient of FDI in the DOLS was in agreement with the *a priori* expectation that FDI should have a negative influence on EXC; as FDI increases, the exchange rate decreases. Meanwhile, a reduction in the exchange rate implies currency appreciation. In a similar, Froot and Stein (1999) found a negative relationship between FDI and exchange rate, explaining that an increase in the supply of foreign funds means more demand for local currency as those funds would be converted to local currency before utilisation for daily operations. FDI is usually associated with the movement of significant or colossal capital, which is linked to the appreciation of currency of the recipient nation (Lipsev & Chrystal, 2011), whilst in view of the demand and supply theory, there may be an appreciation of currencies (Lily, Kogid, Mulok, Thien Sang, & Asid, 2014). In another perspective, it could come in the form of increased goods for export; exported goods purchased by foreigners would amount to the inflow of foreign currencies and appreciation of the local currency through demand and supply mechanisms

## 5. CONCLUSION AND POLCY RECOMMENDATIONS

The current study applied the combined combine cointegration approach of Bayer Hank to investigate a long-run association between FDI and exchange rate in Nigeria. The datasets considered in the current study comprises monthly observation of foreign portfolio investment (FDI) (interpolated using Denton, 1979 method) and exchange rate (EXR) of Nigeria, i.e., the bilateral official exchange rate of NAIRA/USD. The data for both variables are gathered from the CBN statistical bulletin. We have a sample of 480 monthly observations from 1980(M01) to 2019(M12) for the two series.

The GH cointegration result establishes the long-run relationship between FDI and EXC through the  $Z_{\alpha}^*$ , which was further strengthened by the Bayer-Hanck combine cointegration test displaying that in the long run, FDI cointegrates with EXC in Nigeria. In contrast, the impact of such relationship was established by the DOLS, where it was confirmed that following economic presumption, the *a priori* negative relationship between FDI and exchange rate was achieved, as an increase in FDI inflows leads to a decrease in the volume of Naira to be exchanged for the USD signalling appreciation of the Naira against USD. These findings are derived from the mythological framework, which could not have been realised under the traditional cointegration approaches

Finally, it is recommended that Government should put more efforts towards increasing the nation's foreign exchange rate reserves, which could be accomplished by employing appropriate trade policies to enhance export and raise the value of the exchange rate. The government through the CBN could sell any of the country's dormant or acquired foreign asset through the anti-craft agencies which proceed should be saved to increase the foreign reserve and eventually appreciate the Naira. This would probably ensure some level of stability in the exchange rate, which attracts more FDI in the economy. Furthermore, priority should be given to FDI-led companies as business, and diplomatic moves through bilateral, multilateral and regional singings and agreements will aid in harnessing needed foreign currencies to fill and aid the savings-investments gaps. These, in turn, reduce Naira's exchange rate to USD, as upheld in this study.

Furthermore, the Government should strive to attract FDI into the manufacturing sector against the oil and gas sector, as the sector is the engine oil for economic growth, which eventually leads to an increase in output for global consumption, thereby increasing the demand for the country's Naira. The FDI inflows into the oil and gas sector should be channelled to the local conversion of the crude oil to Liquified Petroleum Gas (LPG), Dual Purpose kerosene (DPK), asphalt base, Automotive Gas Oil (AGO), heating oil and Premium Motor Spirit (PMS) by encouraging the Transnational Cooperation (TNC) to set up refineries in the geopolitical zone of the country as against the extraction and exploration. This will reduce the outflow of the Naira in importing processed crude oil in the form of PMS, AGO and DPK, which leaks much of our currency outwardly as against the lesser dollar injection during extraction and exploration.

In addition, the tourism industry has not been attracted to foreign investors, as Nigeria is blessed with a lot of monumental sites that could serve as tourism for foreign tourists. The government through the ministry of tourism, arts and culture should partner with the state and local government, and foreign agencies of TNCs to develop all these monumental, historical and cultural sites in different geopolitical zone, as this could turn the industry another bullish revenue generation. The ministry should also engage in tangible and sophisticated digital promotion on global networks like CNN, Aljazeera and BBC to enhance the development of the tourism industry through the widest digital advertisement.

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# INCOME AND HEALTH OUTCOMES IN THE ANGLOPHONE WEST AFRICAN COUNTRIES: A DYNAMIC HETEROGENEOUS APPROACH

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## **ABSTRACT**

The health status of a population is a very vital economic indicator because unhealthiness can have a significant impact on households' productivity. The health status in the African Countries is well below that of the rest of the world. This study investigated the effect of income on health outcomes in the Anglophone West African Countries from 2000-2019. Data were obtained from the World Bank's World Development Indicators, and Global Health Expenditure Data bases. The model of the study is based on Grossman Model (1972). This study employed Dynamic Heterogenous Panel Regression (Panel ARDL) because of the variability of the countries in Anglophone West Africa. Results revealed that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure have significant effect on maternal mortality, under-five mortality, neo-natal mortality and infant mortality in the Anglophone West African Countries in the long run. The study therefore, recommends that health sector should be adequately funded, out-of-pocket health expenditure should be discouraged, bridge the gap of income inequality and fiscal policies to improve health sector be should be employed in the sub-region.

**Keywords:** Dynamic heterogenous panel regression, Health outcomes, Income, Mortality rate, Per capita GDP

**JEL Codes:** P46, I14, C23

## **1. INTRODUCTION**

Health is defined as a condition of complete physical, mental, and social well-being, not only the absence of disease. A better healthcare system is a basic human need. As a result, health is seen as a fundamental human right, and achieving optimal health is one of the most important worldwide goals. Because unhealthiness can have a major impact on households, a population's health status is a very important economic indicator. In Africa, the relevance of health outcomes and income cannot be overstated, with most nations facing poor health outcomes and significant levels of income disparity, further impoverishing households.

Income is a significant phenomenon because it is extremely critical for any country's growth and development. It has an impact on societal cohesion, defines the level of poverty for any given

average per capita income and the poverty-reduction consequences of growth, and even has an impact on people's health (Stewart 2003). Poor health can have a substantial impact on an individual's income and earning capacity. People may be motivated to improve their condition by working, innovating, or learning new skills as a result of inequalities. On the other hand, it could be a roadblock to growth and poverty reduction.

In most industrialized and emerging countries, income disparity has risen. More than two-thirds of the world's population (71%) lives in countries with rising inequality. (Odusanya & Akinlo, 2020; Matthew & Brodersen, 2018). Rising income disparity is regarded as one of our generation's most pressing issues (Dabla-Norris, Kochhar, Suphaphiphat, Ricka, & Tsounta, 2015). Despite advances made in terms of development, income and wealth in some countries are becoming increasingly concentrated at the top. Okwu et al. (2021), states that immense reduction in income inequality and poverty, people centred fiscal policies, increased productivity and national output, has been one of the main objectives of governments of most countries all over the world.

Healthcare systems in Africa are neglected and underfunded, according to Oleribe, Momoh, Uzochukwu, Mbofana, Adebisi, Barbera, Williams, and Taylor-Robinson (2019). This results in serious issues across the six World Health Organization (WHO) pillars of healthcare delivery. In Anglophone West African countries, disease prevalence, maternal mortality, neonatal mortality, under-five mortality, and infant mortality have all become severe burdens. An effective and efficient healthcare system can significantly aid a country's economy, long-term viability, and sustainability.

Health expenditure has significantly increased in Africa while domestic government healthcare financing has been stalled and insignificant (Bhakta, Martiniuk, Gupta, Howard, Essuman, Braimah, Ndanu, Ntim-Amponsah, James, Ajayi, Ogun, Oladokun, Renner, McGill, & The World Bank, 2016). Over the last two decades, total health expenditure in middle-income and low-income countries has proliferated. But this increase has been driven mainly by out-of-pocket spending by households and development assistance, about half of which was earmarked spending for HIV/AIDS. Universal Health Coverage aims to provide health care services to the population on a consistent basis, according to their needs, without putting people in financial jeopardy (World Bank, 2019). The achievement of equitable distribution of income, alleviation of poverty, and better health outcomes in Africa countries will continue to be major development objectives.

Africa has a high rate of disease prevalence (WHO, 2016). The health status in the African countries is well below that of the rest of the world, despite the recommendation of 15% health expenditure of a nation's GDP. Nigeria's health outcome indices have remained unacceptably poor. The maternal mortality rate is 814 deaths per 100,000 women. Infants and children under the age of five years have mortality rates of 70 and 104 per 1000 live births, respectively. Health disparities exist between states and geographic zones, as well as the rural/urban gap, education, and socio-economic position (WHO, 2018). Malaria is considered as one of the leading tropical diseases affecting poor rural households in Nigeria (Urama, Manasseh, & Ukwueze, 2018). Pregnant women are also at risk as a result of malaria which could cause morbidity and mortality.

According to Global Burden of Disease (GBD, 2018), the top 10 causes of death in Liberia are malaria, diarrheal diseases, neo-natal disorders, lower respiratory infections, ischemic heart disease, HIV/AIDS, stroke, tuberculosis, sexually transmitted diseases, and cirrhosis. As of 2017, the population of Liberia was 4,731,906 million, per capita income was \$710, life expectancy at birth was 64 for females and 62 years for males, while the infant mortality rate was 50/1,000 live

births (WHO, 2018). In general, OOPe as a percentage of total health expenditure in Nigeria was (76.60%), Sierra Leone (44.78%), Ghana, (37.69%), and (29.34%) in Gambia in the year 2018 (WHO, 2020; (GHED), 2020). Onyeoma (2020), identified high population growth rate a challenge to economic growth in Nigeria. The study of (Ogunbadejo & Zubair, 2021) confirmed that increase in government allocation to health and agriculture sectors in Nigeria would lead optimal performance of the economy.

Ghana has been cited as one of the African countries with perhaps one of the most significant health inefficiencies (Kaseje 2006; McKay 2015). This poor population health status is mirrored by crises in health financing and human resources for health (Mills et al., 2012). Health system in Sierra Leone is in a censorious condition despite all the investments that have been made to healthcare system, as evidenced by poor core health indicator rankings (World Vision 2012). The Government of Sierra Leone is a signatory to the Abuja Declaration, which encourages a state to commit 15 percent of its annual budget to health. Despite these commitments, the U.N.'s Human Development Index ranks Sierra Leone 181 out of 187 countries (UNDP, 2015). Life expectancy rates of both men and women remain among the lowest in the world, at 49 years for men and 51 for women (WHO, 2015).

Previous studies examined health outcome or health indices in relation to crime, consumer debt, income inequality (Payne, Brown-Iannuzzi, & Hannay, 2017; Dabla-Norris, Kochhar, Suphaphiphat, Ricka, & Tsounta, 2015). However, divergent results have emanated from literature. Some studies found the country's average income level to be positively correlated with individual health outcomes, while others found out that country income inequalities are negatively associated with health conditions (Pasqualini, Lanari, Minelli, Pieroni, & Salmasi, 2017; Truesdale & Jencks, 2016). Previous studies identified that geographical or residential locations could negatively or positively impact health outcomes (Chetty, Stepner, Abraham, Lin, Scuderi, Turner, Bergeron, & Cutler, 2016; Barber, Fullman, Sorensen, Bollyky, McKee, Nolte, Abajobir, Abate, Abbafati, Abbas, Abd-Allah, Abdulle, Abdurahman, Abera, Abraham, Abreha, Adane, Adelekan, Adetifa, & Murray, 2017; Ward & Viner, 2017). Studies such as (Matthew & Brodersen, 2018, Yao, Wan, & Meng, 2019; Hoffmann, Hu, De Gelder, Menvielle, Bopp, & Mackenbach, 2016; Adua, Frimpong, Li, & Wang, 2017) on relationships between income inequality and population health remain inconclusive.

In the light of the above, previous researches in this area remains inconclusive and available literature suggests that there is paucity of literature on income and health outcomes in the Anglophone West African Countries. This is a major motivation for this study so as to contribute to empirical literature by investigating the effect of income on health outcomes. Income is measured by per capita GDP while health outcomes is measured by maternal mortality and under-five mortality, infant mortality and neo-natal mortality. Specific objectives are: examine the effect of per capita gross domestic product on maternal mortality in the Anglophone West African Countries; establish the effect of per capita gross domestic product on under-five mortality in the Anglophone West African Countries; investigate the impact of per capita gross domestic product on neo-natal mortality in the Anglophone West African Countries, and examine the impact of per capita gross domestic product on infant mortality in the Anglophone West African Countries. Hypotheses are also in line with the specific objectives.

## **2. LITERATURE REVIEW**

This section discusses various conceptual, theoretical and empirical literature related to income and health outcomes.

### **2.1 Conceptual Literature**

The World Health Organization (WHO, 1948) defines health as a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity. In addition, the Ottawa Declaration (WHO, 1948) states that an individual or group must be able to identify and realize aspirations, satisfy needs, and change or cope with the environment. Health is, therefore, seen as a resource for everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities (National Center for Health Statistics) (NCHS, 2012). Health outcomes are an interrelated set of attributes that describe the consequences of disease for an individual.

Maternal mortality is defined as any loss of a woman's life due to a pregnancy complication or death within 42 days of childbirth, regardless of the period or location of the pregnancy, and resulting from issues that are linked or escalated by the pregnancy management but not from an accident or incidental factors.

Under-five mortality which is referred to as child mortality is also an important rate that focuses only on children under one year of age. The child mortality rate (or under-five mortality rate – U5MR) is the probability expressed as a rate per 1 000 live births, of a child born in a specified year dying before reaching the age of five when subject to current age-specific mortality rates. Child mortality is the mortality of children under the age of five.

Income is defined as household disposable income in a particular year. It consists of earnings, self-employment, and capital income, and public cash transfers; income taxes and social security contributions paid by households are deducted. The income of the household is attributed to each of its members, with an adjustment to reflect differences in needs for households of different sizes.

Gross Domestic Product (GDP) per capita is a core indicator of economic performance and is commonly used as a broad measure of average living standards or economic well-being. Average GDP per capita, for example, does not reveal how GDP is allocated among citizens. For example, the average GDP per capita may rise, but if income inequalities rise as well, more people may suffer (OECD, 2013).

Out-of-pocket payments (OOPs) are defined as direct payments made by individuals to health care providers at the time-of-service use. The Gini index, often known as the Gini coefficient, is a measure of income distribution devised by Italian economist Corrado Gini in 1912. It is frequently used to measure income distribution or, less usually, wealth distribution among a population as a measure of economic inequality. The coefficient is a number that ranges from 0 (or 0%) to 1 (or 100%), with 0 denoting perfect equality and 1 denoting complete inequality.

Current Health Expenditure (CHE) is a measure of how much money each country spends on health compared to the size of its GDP. It excludes investment, exports, and intermediate consumption and only covers expenditures relating to the final consumption of health care goods

and services. The CHE represents the importance of the health sector in the economy and the monetary priority given to health (CIA, 2021).

## **2.2 Theoretical Literature**

The main theories on health production and demand for health are the Grossman theory, Rosenzweig and Schultz's child health production function theories and Cebu's child health production function. The demand for health theory was developed Grossman (1972) and it determined how people spend their resources in order to achieve health. The concept, which goes beyond typical demand analysis, has had a huge impact on health economics. It makes use of the concept of the individual as a health producer (rather than just a consumer) by erasing the false distinction between consumption and production. It also presents the concept of investing in human capital (health and education) in order to improve outcomes in both the market (job) and non-market (family) sectors.

Rosenzweig and Schultz's Child Health Production Function Theories were propounded by Rosenzweig and Schultz (1982). They were interested in the outcome of pregnancies and dedicated a significant portion of their work to theoretical and methodological issues that they believe have hampered the utility of much earlier research. They stress the need of predicting the demand function for health production inputs (parental behavior) as well as the production function that links behavior to health outcomes together. Their model, which incorporates a health production function into a utility-maximizing framework.

Cebu's Child Health Production Function was developed by Cebu (1991.). The theory developed child health production based on the Rosenzweig & Schultz (1982) models, in which child health production in utero is incorporated in the mother's utility maximization behavior. The Cebu (1991) model concentrated on underlying social, proximate behavioral, and biological factors that influence infant morbidity, growth, and death. The model also demonstrates how maternal education leads to behavioral changes in children, as well as how these changes lead to changes in the prevalence of diarrhea in children.

## **2.3 Empirical Literature**

Yang, Chen, Shoff & Matthews (2012), study on the effects of inequality across the mortality distribution in the U.S. counties employed a rarely used method in mortality research, quantile regression (QR), to investigate whether income inequality is a determinant of mortality and to also determine the varying relationship between inequality and mortality throughout the mortality distribution. They found that the association between inequality and mortality was not constant throughout the mortality distribution and the impact of inequality on mortality steadily increased until the 80th percentile.

Aron, Dubay, Simon, & Zimmerman (2015), looked into the relationship between income and wealth and health and longevity. They found that substantial health disparities that many minorities face are largely due to income. Adults with family incomes at or above 400 percent of the federal poverty level, or FPL (in 2014, the FPL was \$23,850 for a family of four), are nearly five times as likely to report being in fair or poor health, and they are nearly three times as likely to have activity limitations due to chronic illness.

Orji & Okechukwu (2015), adopted a multilevel approach to examine the impact of income and income distribution on population health in Nigeria. The results show that absolute income has a significant impact on population health in Nigeria and that population health measured by infant mortality rate, would improve by about 0.15 percent when absolute income increases by 1 percent, at a 95 percent confidence interval. Results further show that relative income has no significant impact on population health. Also, the Gini coefficient and the Pietra inequality indices mimic each other for both absolute and relative incomes. The Gini coefficient expresses a near-maximum inequality for population health due to absolute income and near-perfect equality of population health due to relative income.

Hoffmann, Hu, De Gelder, Menvielle, Bopp, & Mackenbach (2016), examined the impact of increasing income inequalities on educational inequalities on mortality in six European countries between 1990-2000. Fixed-effects panel regression models were employed. Results revealed that across all countries, absolute income differences between low- and highly-educated people increased by \$75.3 (men) and \$ 64.3 (women) per year, respectively. The study further revealed that an association exists between income inequality and mortality inequality for deaths from external causes, and cardiovascular diseases, but statistically insignificant.

Cevik & Tazar (2016), examined the relationship between public spending on health care and health outcomes using cross-country comparison. They run cross-sectional regressions to estimate the strength of association between child and infant mortality rate and public health expenditures in the worldwide sample. They found government health spending as a share of GDP to be negatively associated with a lower level of under-5 mortality by elasticities of from -0.17 to -0.22. The elasticity is -0.20 for infant mortality.

In a similar study in the USA, (Vilda, Wallace, Dyer, Harville & Theal, 2019), examined the association between state-level income inequality and pregnancy-related mortality among non-Hispanic (NH) black and NH white populations between 2011 and 2015 using Poisson regression. They found that across all states in America, increasing contemporaneous income inequality was associated with a 15% and 5-year lagged inequality with a 14% increase in pregnancy-related mortality among black women after controlling for states' racial compositions and socio-economic conditions. Income inequality was also associated with larger absolute and relative racial inequities in pregnancy-related mortality.

Bein, Unlucan, Olowu, & Kalifa (2017), examined the association between healthcare expenditures and health outcomes for eight East African countries: Burundi, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda using panel data regression technique. Result reveals that strong, a positive association exists between total healthcare expenditures and total life expectancy.

Ward & Viner (2017) examined how income inequality and national wealth affected child and adolescent mortality in low and middle-income nations. In 2012, cross-sectional regression analyses of the relationship between income inequality (national Gini coefficient) and national wealth (GDP averaged over the previous decade), as well as all-cause and grouped cause national mortality rates among infants, 1–4, 5–9, 10–14, 15–19, and 20–24-year-olds in low and middle-income countries (LMICs). GDP was factored into Gini models.

Aregbeshola & Khan (2017) examined out-of-pocket payments, catastrophic health expenditure, and poverty among households in Nigeria. The study found that a total of 16.4% of households incurred catastrophic health payments at 10% threshold of total consumption expenditure while 13.7% of households incurred catastrophic health payments at 40% threshold of non-food expenditure. Using the \$1.25 a day poverty line, the poverty headcount was 97.9% gross of health

payments. OOP health payments led to a 0.8% rise in poverty headcount and this means that about 1.3 million Nigerians are being pushed below the poverty line. Better-off households were more likely to incur catastrophic health payments than poor households. Descriptive statistics were used in the analysis.

From 1990 to 2014, Ray & Linden (2018) used a simultaneous three-equation model to determine the association between GDP per capita (GDPPC), infant mortality rate, and health expenditures for 194 countries. In the sample with three income level nation groups, GMM-2SLS estimate findings show that there are simultaneous decreasing infant mortality rate and growing GDPPC level impacts. When the effects of GDPPC and the number of doctors per capita are added together, health expenditures have a greater than one elasticity. In non-poor nations, an increase in income inequality as assessed by the GINI coefficient raises the infant mortality rate.

Lenhart (2019) used an increase of the Earned Income Tax Credit (EITC) in the UK to investigate the relationship between income and health. Increased food spending (10.5–20.3 percent rise) and higher private health insurance take-up rates (1.97 percent increase) were found to be mechanisms for better health outcomes in the study. While the size of these impacts shows that food expenditures and health insurance can explain how more money can lead to better health, it appears that income has several impacts on health. For the analysis, a semi-parametric estimator called DD estimate was used.

The study by Ubi and Ndem (2019) models the effects of poverty on health outcomes in Nigeria. The researchers utilized a vector autoregressive econometric technique to see if health outcomes (life expectancy and infant mortality rate) in Nigeria related to poverty. The study's empirical evidence reveals that poverty shock has no meaningful impact on health outcome variables. Variations in health outcomes, in particular, are caused by the health result shock rather than poverty shocks. As a result, it is suggested that improving the population's health is a prerequisite for poverty reduction in Nigeria.

The study carried out by Anjande, Aheme & Ijirshar (2020), using Dynamic panel ARDL in their study on the asymmetric impact of government spending behavior on national income and unemployment in Africa, the found that increase in government spending has a strong and positive influence on the national income growth and negative influence on unemployment among African countries. Result further reveals that reduction in government spending has significant negative influence on growth of national income while it is positive on unemployment. Ogunbadejo, Kanwanye & Zubair (2021), in their study on effect of crude birth rate in Nigeria recommended that government should increase allocation to health and agriculture sectors in the country for optimal performance of the economy.

### **3. METHODOLOGY**

This study adopts an *ex-post* facto research design and the theoretical framework employed is the Grossman theory of demand for health (1972) to examine the effects of income on health outcomes in the Anglophone West African Countries. The target population of this study is the five countries in the Anglophone West African region. The Anglophone West African Countries include Nigeria, Ghana, the Gambia, Liberia, and Sierra Leone. The data to be used in this study covered the period 2000-2019. Data were sourced from World Bank's World Development Indicators (WDI, 2021), Standardized World Income Inequality Data (SWIID, 2021), and Global Health Expenditure Data (GHED, 2020) bases. Panel ARDL through Pool Mean Group Estimator and Dynamic Fixed Effect (DFE) were employed in the model.

**Model Specification**

The Grossman model was extended to include: per capita GDP, out-of-pocket payment, GINI coefficient, and CHE. Therefore, the models that were used for analysis in this study are as follow:

**Aggregated Model:**

$$\sum_{j,i,t=1}^{4,5,20} HO_{i,t} = \beta_0 + \beta_k \sum_{k,i,t=1}^{1,5,20} ID_{i,t} + \beta_r \sum_{k,i,t=1}^{3,5,20} CV_{i,t} + \varepsilon_{i,t} \dots \dots \dots 3.1$$

**Where:**

*HO* is health outcomes and it is measured with: neo-natal mortality rate, maternal mortality rate, infant mortality rate, and under-five mortality rate; *ID* is Income is proxy by: per capita GDP; *CV* = Control variables are: Current health expenditure (CHE), out of pocket payment (OOPE) and GINI coefficient.  $\beta_0$  is the intercept;  $\beta_k (k = 1)$  is vector coefficients of income variable in the model.  $\beta_r (r = 1, 2, 3)$  = Vector coefficients of control variables in the model.  $\varepsilon$  is error term; *j* denotes composite of health outcome indicators; *i* denotes each country in the cross section; *t* is the regular point in time at which the data; *k* is coefficient of the income variable.

**The disaggregated model is specified below:**

**Model 1: Maternal Mortality**

$$MMR = \beta_0 + \beta_1 GDPPC_{i,t} + \beta_2 GINI_{i,t} + \beta_3 OOPE_{i,t} + \beta_4 CHE_{i,t} + ECM_{t-1} + \varepsilon_{i,t} \dots \dots \dots 3.2$$

Where:

MMR is Maternal Mortality Rate; *GDPPC<sub>i,t</sub>* is Gross Domestic Product Per Capita; *GINI<sub>i,t</sub>* is GINI Coefficient Index; *OOPE<sub>i,t</sub>* is Out of Pocket Health Expenditure; *CHE<sub>i,t</sub>* is Current Health Expenditure

**Model 2: Under-5 Mortality**

$$U5MR = \varphi_0 + \varphi_1 GDPPC_{i,t} + \varphi_2 GINI_{i,t} + \varphi_3 OOPE_{i,t} + \varphi_4 CHE_{i,t} + ECM_{t-1} + \mu_{i,t} \dots \dots \dots 3.3$$

U5MR = Under Five Mortality Rate

**Model 3: Neo- natal Mortality**

$$NMR = \alpha_0 + \alpha_1 GDPPC_{i,t} + \alpha_2 GINI_{i,t} + \alpha_3 OOPE_{i,t} + \alpha_4 CHE_{i,t} + ECM_{t-1} + \delta_{i,t} \dots \dots \dots 3.4$$

NMR = Neo-natal Mortality Rate

**Model 4: Infant Mortality**

$$IMR = \theta_0 + \theta_1 GDPPC_{i,t} + \theta_2 GINI_{i,t} + \theta_3 OOPE_{i,t} + \theta_4 CHE_{i,t} + ECM_{t-1} + \mu_{i,t} \dots \dots \dots 3.7$$

IMR = Infant Mortality Rate

**4.0 RESULTS AND DISCUSSION OF FINDINGS**

**Partial Correlation Coefficients**

The partial correlation coefficient between pairwise consideration of the variables is presented in Table 1.

**Table 1: Correlation Matrix of Income and Health Outcomes**

Variables	LMMR	LNMR	LU5MR	LIMR	LGDPCC
LGDPCC	-0.378	-0.445	-0.431	-0.488	1.000

LOOPE	0.153	0.423	0.581	0.661	-0.085
LGINI	0.058	0.159	0.011	-0.144	0.479
LCHE	0.427	0.213	0.377	0.453	-0.611

Source: Researcher`s computation (2021)

**All the variables are expressed in log forms. All the values were calculated from the 100 country-year observations for the five Anglophone West African Countries.**

Out-of-pocket expenditure and current health expenditure have positive association with infant mortality rate with correlation value of 0.661 and 0.453, respectively. This implies that out-of-pocket expenditure and current health expenditure and infant mortality rate change in the same direction. Conversely, GDP per capita and Gini coefficient have negative association with the infant mortality rate, with correlation values of  $-0.488$  and  $-0.233$ , respectively, thus GDP per capita and Gini coefficient move in the opposite direction as infant mortality rate.

Furthermore, out-of-pocket expenditure, GINI coefficient, and current health expenditure have positive association with maternal mortality rate of the five Anglophone African countries with correlation value of 0.153, 0.014, and 0.427, respectively. This implies that increases in out-of-pocket expenditure, GINI coefficient, and current health expenditure will lead to increase in maternal mortality rate. Conversely, GDP per capita has negative association with the maternal mortality rate with correlation values of  $-0.378$ , thus increases in GDP per capita will lead to fall in maternal mortality rate.

In addition, out-of-pocket expenditure, GINI coefficient, and current health expenditure have positive association with neo-natal mortality rate of the five Anglophone African Countries with correlation values of 0.423, 0.159, and 0.213, respectively. This implies that increases in out-of-pocket expenditure, GINI coefficient, and current health expenditure will lead to increase in neo-natal mortality rate. Conversely, GDP per capita has negative association with the neo-natal mortality rate with correlation values of  $-0.445$ , thus increases in GDP per capita will lead to fall in neo-natal mortality rate.

Lastly, out-of-pocket expenditure, Gini coefficient and current health expenditure have positive association with under 5 mortality rates of the five Anglophone African countries with correlation value of 0.581, 0.011 and 0.377, respectively. This implies that increases in out-of-pocket expenditure and current health expenditure will lead to increase in under-5 mortality rates. Conversely, GDP per capita has negative association with the under-5 mortality rates with correlation value of  $-0.431$ . Thus, increases in GDP per capita will lead to fall in under-5 mortality rates.

## 4.2 Cointegration Test

The result of the unit root is presented in Table 2 The variables used to examine the effect of income on health outcomes in the five Anglophone West African Countries were subjected to unit root testing because the dynamic heterogeneous panel estimators require the stationarity of the series. In particular, two panel unit root tests were conducted and they are the Cross-Section Augmented Dickey- Fuller Panel Unit Root Test (CADF) and Cross- section Augmented Panel Unit Root Test (CIPS).

**Table 2 Panel Unit Test for Income and Health Outcomes**

Variables	CIPS		CADF	
	I(0)	I(1)	I(0)	I(1)
LMMR	-1.337	-2.851***	-1.712	-3.410***
LNMR	-1.794	-4.167***	-1.266	-4.229***
LIMR	-1.270	-3.467***	-1.389	-3.977***
LU5MR	-1.516	-3.692***	-1.059	-3.571***
LGDPPC	-1.706	-3.503***	-1.696	-2.764***
LOOPE	-1.788	-4.419***	-1.467	-2.642***
LGINI	-2.071	-3.560***	-2.019	-2.493**
LCHE	-2.435**	-5.461***	-1.613	-3.359***

**Source: Researcher's computation (2021)**

Note: All the variables are expressed in log forms. In addition, \*\*\*, \*\*, and \* indicates 1%, 5% and 10% respectively. The critical values for CIPS and CADF panel unit root tests are -2.21, -2.34 and -2.60 for 10, 5 and 1percent respectively.

The unit roots reported in Table 2 shows that majority of the series were stationary in their first differences I(1) asides from the current health expenditure which is stationary at levels. Arising from the panel unit root test where there is mixed order of integration, this further alludes that the Panel ARDL methodology is appropriate.

### 4.3 Panel ARDL Results

The results of the Panel ARDL conducted are presented in as follows:

**Table 3: Panel ARDL Results Table: Health Outcomes and Income of the Anglophone West African Countries**

Long-Run Estimates	MMR	U5MR	NMR	IMR
LGDPPC	0.766 (1.396)	-0.445*** (-3.265, 0.00)	0.175 (1.468)	-0.424*** (-2.620, 0.00)
LOOPE	2.125** (2.170, 0.03)	-0.102 (-0.430)	0.378*** (3.026, 0.00)	-0.480* (-1.705)
LGINI	4.625*** (4.105,0.00)	2.540** (2.610, 0.01)	-6.630** (-2.290, 0.02)	3.512 (1.273)
LCHE	-0.261*** (-3.017, 0.00)	0.146 (0.603)	-0.114* (-1.869)	-0.332 (-1.391)
Adjusted R <sup>2</sup>	0.619	0.539	0.629	0.694
F-statistic	54.85 (0.00)	39.65 (0.00)	58.30 (0.00)	79.06 (0.00)
Hausman test				
MG vs. PMG		12.71 (0.000)	-	-
PMG vs. DFE	6.78(0.1248)		2.22 (0.696)	1.69 (0.734)

**Source: Researcher's computation (2021)**

**Notes:** Table 3 reports the dynamic heterogeneous panel regression results. All the variables are expressed in log forms. \* Significant at 10%, \*\* Significant at 5%, \*\*\* Significant at 1%. The values in parenthesis represent the t-statistic and p-values

#### 4.4 Interpretation of Results

Dynamic heterogeneous panel estimator propounded by (Pesaran and Shin, 1999) is the baseline estimator technique. However, the result of Pool Mean Group (PMG) and Dynamic Fixed Effect (DFE) were presented in Table 3. The Hausman tests were run with the null hypothesis of no systematic differences between the coefficient of PMG and DFE. It checked a more efficient model against the a less efficient but consistent model in order to ensure that the efficient model gives consistent results. The Hausman test statistic and the corresponding p-values of the coefficients are outlined in all the tables where long run homogeneity restriction is tested against the alternative hypothesis. Dynamic Fixed Effect was used for interpretation of the result of estimation for objectives one, three and four while Mean Group was used for objective two based on the Hausman results.

The estimated long-run coefficients (elasticities) for the models were given in the Tables 3. In the long run, there is evidence that GDP per capita, out-of-pocket expenditure, and Gini coefficient have positive relationship with maternal mortality rate. This implies that increases in GDP per capita, out-of-pocket expenditure, and Gini coefficient will lead to increase in the maternal mortality rate of the Anglophone West African countries. GDP per capita, out-of-pocket expenditure sign are not in conformity with *a priori* expectation, while the positive relationship Gini coefficient conforms to the *a priori*. Concerning the magnitude of the parameter estimates, there is evidence that a 1 percent increase in GDP per capita, out-of-pocket expenditure and Gini coefficient will lead to 0.766, 2.125 and 4.625 percent increase in maternal mortality, while a 1 percent increase in current health expenditure will lead to 0.261 percent decrease in maternal mortality which conforms with the *a priori*. The positive relationship between GDP per capita, Gini coefficient and maternal mortality may be due to increased insecurity, corruption, pollution and other factors outside the scope of this study.

In the long run, there is evidence that Gini coefficient and current health expenditure have positive relationship with under 5 mortality rates. This implies that increases in Gini coefficient and current health expenditure will lead to increase in the under 5 mortality rates of the Anglophone West African countries. The result positive relationship between CHE and U5MR is at variance with the *a priori* expectation, while that of GINI coefficient is consist. In addition, there is evidence that GDP per capita and out-of-pocket expenditure has a negative relationship with under 5 mortality rates. This implies that increases in GDP per capita and out-of-pocket expenditure will lead to decrease in the under 5 mortality rates of selected Anglophone West African Countries. The effect is both contemporaneous and persistent.

Concerning the magnitude of the parameter estimates, there is evidence that a 1 percent increase in Gini coefficient and current health expenditure will lead to 2.540 and 0.146 percent increase in under 5 mortality rates, respectively while a 1 percent increase in GDP per capita and out-of-pocket expenditure will lead to 0.445 and 0.102 percent decrease in under 5 mortality rates, respectively.

The estimated long-run coefficients (elasticities) for the model are given in the Tables 4.4. In the long run, there is evidence that GDP per capita and out-of-pocket expenditure have positive relationship with neo-natal mortality rate. This implies that increases in GDP per capita and out-of-pocket expenditure will lead to increase in the neo-natal mortality rate of the Anglophone West African countries. This relationship is not consistent with *a priori* expectation. In addition, there is evidence that Gini coefficient and current health expenditure have a negative relationship with neo-natal mortality rate. This implies that increases in Gini coefficient and current health expenditure will lead to decrease in the neo-natal mortality rate of the Anglophone West African

countries. The negative relationship between Gini coefficient and neo-natal mortality rate is not consistent with the *a priori* while that of CHE is.

Furthermore, from the magnitude of the parameter estimates, there is evidence that a 1 percent increase in GDP per capita and out-of-pocket expenditure will lead to 0.175 and 0.378 percent increase in neo-natal mortality rate, respectively while a 1 percent increase in Gini coefficient and current health expenditure will lead to 6.630 and 0.114 percent decrease in neo-natal mortality rate, respectively.

Table 3 also show the estimated long-run coefficients (elasticities) for the fourth model. In the long run, there is evidence that GINI coefficient has positive relationship with infant mortality rate. This implies that increases in GINI coefficient will lead to increase in the infant mortality rate of the Anglophone West African countries. In addition, there is evidence that GDP per capita, out-of-pocket expenditure, and current health expenditure have a negative relationship with infant mortality rate. This implies that increases in GDP per capita, out-of-pocket expenditure, and current health expenditure will lead to decrease in the infant mortality rate of the Anglophone West African countries.

Based the magnitude of the parameter estimates, there is evidence that a 1 percent increase in GINI coefficient will lead to 3.512 percent increase in infant mortality rate, while a 1 percent increase in GDP per capita, out-of-pocket expenditure, and current health expenditure will lead to 0.424, 0.480, and 0.332 percent decrease in infant mortality rate, respectively.

There is evidence of a long-run significant relationship of out-of-pocket expenditure, Gini coefficient and current health expenditure with maternal mortality rate of the Anglophone West African Countries (LOOPE= 0.2125, t-test= 2.170,  $\rho < 0.05$ ; LGINI= 4.625, t-test= 4.105,  $\rho < 0.05$ , and LCHE = -0.261, t-test= -3.017,  $\rho < 0.05$ ). This implies that out-of-pocket expenditure, Gini coefficient and current health expenditure are significant factors influencing changes in the maternal mortality rate of the Anglophone West African Countries. Conversely, there is evidence that GDP per capita do not have a long-run significant relationship with the maternal mortality rate of the selected Anglophone West African Countries (LGDPPC = 0.766, t-test = 1.396,  $\rho > 0.05$ ). Thus, GDP per capita is not a significant factor influencing changes in the maternal mortality rate of the Anglophone West African Countries.

The Adjusted R-square is 0.594; this implies that GDP per capita, out-of-pocket expenditure, Gini coefficient and current health expenditure explains about 59 per cent changes in maternal mortality rate, while the remaining 41 per cent were other factors affecting changes in maternal mortality but were not captured in the model.

To test the hypothesis for objective one, the F-statistics of 49.12 was used and it is statistically significant at 5 per cent level, thus on the overall, the null hypotheses that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do not significant influence maternal mortality in the Anglophone West African countries were rejected, and accept the alternative that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do significantly influence maternal mortality in the Anglophone West African countries.

#### **4.5 Discussion of Findings**

The first hypothesis of the study examines the effect of per capita gross domestic product, Out-of-Pocket health expenditure, Income inequality (GINI) on maternal mortality rate in the Anglophone West African Countries for the period of 2000-2019. The result of the study reveals that in the

long-run, GDP per capita, out-of-pocket expenditure, and Gini coefficient have positive relationship with maternal mortality rate while current recurrent expenditure has a negative relationship with maternal mortality. In addition, the F-statistics rejects the null hypothesis that per capita gross domestic product, Out- of- Pocket health expenditure, income inequality, and current health expenditure do not significantly influence maternal mortality rates in the Anglophone West African Countries, and accept the alternative that per capita gross domestic product, Out- of- Pocket health expenditure, income inequality, and current health expenditure do significantly influence maternal mortality rates in the Anglophone West African Countries.

Some empirical studies corroborate this result. For instance, Hu, van Lenthe & Mackenbach (2015) investigated income inequality, life expectancy, and cause-specific mortality in 43 European countries in the period 1987–2008. There were significant associations between income inequality and many mortality indicators were found in pooled cross-sectional regressions, indicating higher mortality in countries with larger income inequalities. Once the country fixed effects were added, all associations between income inequality and mortality indicators became insignificant, except for mortality from external causes and homicide among men, and cancers among women.

The second hypothesis of the study examined the effect of per capita gross domestic product, Out-of-Pocket health expenditure, Income inequality (GINI) on under-5 mortality rates in the Anglophone West African Countries for the period of 2000-2019. The result shows that in the short-run GDP per capita has a positive relation with under 5 mortality rates while Out- of- Pocket health expenditure, income inequality, and current health expenditure have negative relationship with under 5 mortality rates. The result of the study reveals that there is evidence that Gini coefficient and current health expenditure have positive relationship with under-5 mortality rates while GDP per capita and out-of-pocket expenditure have negative relationship with under-5 mortality rates in the long run. In addition, the F-statistics rejects the null hypothesis that per capita gross domestic product, Out- of- Pocket health expenditure, income inequality, and current health expenditure do not significant influence under-5 mortality rates in the Anglophone West African countries, and accept the alternative that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do significantly influence under-5 mortality rates in the Anglophone West African Countries.

This evidence conforms with the result reported by Cevik & Tazar (2016) that examined the relationship between public spending on health care and health outcomes using cross-country comparison. They found government health spending as a share of GDP is negatively associated with a lower level of under-5 mortality rate. They also found significant and negative coefficients on several socio-political determinants such as the law and order, education level, population as well as income level as the main determinant. Compared to previous studies, they found the income level to be slightly less significant and the public health spending to be slightly more significant empirically. Bein, Unlucan, Olowu, & Kalifa (2017) examined the association between healthcare expenditures and health outcomes for eight East African countries. They found that healthcare had a stronger effect on improving life expectancy in females than in males. However, a negative relationship exists between healthcare expenditures and the number of neonatal, infant, and under-five deaths in the selected East African countries.(Okwu et al., 2021)

Also, Novignon and Lawanson (2017), examined the relationship between health expenditure and child health outcomes in 45 Sub-Saharan Africa between 1995 and 2011. The study shows a positive and significant relationship between health expenditure and child health outcomes with elasticities of -0.11 for infant mortality, -0.15 (under-five mortality), and -0.08 (neonatal

mortality), health care spending was generally significant in influencing neonatal mortality. Total health spending showed a negative and significant (at 1 percent level) impact on neonatal mortality.

The third hypothesis of the study examines the effect of per capita gross domestic product, Out-of-Pocket health expenditure, Income inequality (GINI) on neo-natal mortality rate in the Anglophone West African Countries for the period of 2000-2019. The result shows that in the short-run GINI coefficient and current health expenditure has a positive relation with neo-natal mortality rate while GDP per capita and out-of-Pocket health expenditure have negative relationship with neo-natal mortality rate. The result of the study reveals that there is evidence that GDP per capita and out-of-pocket expenditure have positive relationship with neo-natal mortality rate while there is evidence that Gini coefficient and current health expenditure have a negative relationship with neo-natal mortality rate in the long run. In addition, the F-statistics rejects the null hypothesis that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do not significantly influence neo-natal mortality rates in the Anglophone West African Countries, and accept the alternative that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do significantly influence neo-natal mortality rates in the Anglophone West African Countries.

The result is in consonant with evidence reported by Novignon and Lawanson (2017) that examined the relationship between health expenditure and child health outcomes in 45 Sub-Saharan Africa between 1995 and 2011. The study shows a positive and significant relationship between health expenditure and child health outcomes with elasticities of -0.11 for infant mortality, -0.15 (under-five mortality), and -0.08 (neonatal mortality), health care spending was generally significant in influencing neonatal mortality. Total health spending showed a negative and significant (at 1 percent level) impact on neonatal mortality.

A similar study by Kiross, Chojenta, Barker & Loxton (2020), on the effects of health expenditure on infant mortality in 46 countries sub-Saharan Africa between 2000 and 2015, revealed that the public and external health care spending showed a significant negative association with infant and neonatal mortality. However, private health expenditure was not significantly associated with either infant or neonatal mortality. The random-effects model was selected over the fixed effects model based on the Hausman test to assess the effect of health care expenditure on infant and neonatal mortality.

The fourth hypothesis of the study examines the effect of per capita gross domestic product, Out-of-Pocket health expenditure, Income inequality (GINI) on infant mortality rate in the Anglophone West African Countries for the period of 2000-2019. The result shows that in the short-run GDP per capita, out-of-pocket expenditure, GINI coefficient, and current health expenditure has a positive relationship with infant mortality rate. The result of the study reveals that there is evidence that GINI coefficient has positive relationship with infant mortality rate while there is evidence that GDP per capita, out-of-pocket expenditure, and current health expenditure have a negative relationship with infant mortality rate in the long run. In addition, the F-statistics rejects the null hypothesis that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do not significant influence infant mortality rates in the Anglophone West African countries, and accept the alternative that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do significantly influence infant mortality rates in the Anglophone West African Countries.

Previous studies that support this evidence includes Ray & Linden (2018) which used a simultaneous three-equation model to determine the association between GDP per capita (GDPPC), infant mortality rate, and health expenditures for 194 countries. In the sample with three income level nation groups, GMM-2SLS estimate findings show that there are simultaneous decreasing infant mortality rate and growing GDPPC level impacts. When the effects of GDPPC and the number of doctors per capita are added together, health expenditures have a greater than one elasticity. In non-poor nations, an increase in income inequality as assessed by the GINI coefficient raises the infant mortality rate.

Also, Bein, Unlucan, Olowu, & Kalifa (2017), examined the association between healthcare expenditures and health outcomes for eight East African countries: Burundi, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda. Panel data regression technique was employed in analyzing both cross-sectional and time-series information. Result reveals that strong, a positive association exists between total healthcare expenditures and total life expectancy. A positive relationship also exists between healthcare expenditures and female and male life expectancy. In addition, they found that healthcare had a stronger effect on improving life expectancy in females than in males. However, a negative relationship exists between healthcare expenditures and the number of neonatal, infant, and under-five deaths in the selected East African Countries.

## **5. CONCLUSION AND POLICY RECOMMENDATIONS**

### **5.1 Conclusion**

The study investigated the effect of income on health outcomes in the Anglophone West African Countries. Results of the dynamic heterogeneous panel regression show that Per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do significantly influence maternal mortality, under-five mortality, neo-natal mortality and infant mortality in the Anglophone West African Countries. This confirmed that there is long-run equilibrium relationship between income and maternal mortality, under-five mortality, neo-natal mortality and infant mortality of the Anglophone West African countries.

This study, therefore concludes that per capita gross domestic income, out-of-pocket health expenditure, current health expenditure and income inequality have significant influence on maternal mortality, under- five mortality, neo-natal mortality and infant mortality in the Anglophone West African Countries.

### **5.2 Recommendations**

1. Giving that out-of-pocket health expenditure, and government current health expenditure have significantly high impact on maternal mortality, health sector should be well funded and this can be achieved through increased allocation to the health sector. Salaries of health care worker should be adequately and promptly paid and policy makers in this sector should ensure better work environment is provided. Out-of- pocket health expenditure will drive people further into poverty and therefore should be discouraged or government cushions the effects on households.
2. governments of the Anglophone West African Countries to improve the income of their citizen and also bridge the gap of income inequality in the affected sub-region. Poor income and large income differences have significantly damaging effects on health. Narrowing the gap of income inequality will require implementation of more inclusive income distribution strategies by the government. This will enable the health outcomes to improve because parents will be able to give food with high nutritional values to their children.

3. There is evidence of a long-run significant relationship of out-of-pocket expenditure and Gini coefficient with neo-natal mortality rate. Therefore, mothers' health should be given adequate attention because of the negative effect of poor health of mothers on neo-natal. This may reduce the number of fetuses deaths or malformation.
4. GDP per capita has a positive and significant relationship with infant mortality in the long run. As a result of the presence of long-run relationship between income and infant mortality, government and other policy makers in the health sector should put fiscal policy in place not only for the present period but also put future plans in place to improve the health sectors of the Anglophone West African Countries.

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# ESTIMATING THE GROWTH EFFECTS OF POPULATION, POVERTY AND UNEMPLOYMENT IN NIGERIA

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## ABSTRACT

This research study investigates the growth effects of population, poverty and unemployment in Nigeria from 1980 to 2018. It adopts the fully modified ordinary least square method (FMOLS) to estimate the long run coefficients of population, poverty and unemployment of economic growth. The empirical results show that that population growth rate has a positive but insignificant impact on economic growth in Nigeria. This implies the attribute of inept characteristics of the population that comprises majorly of unskilled and semi-skilled labour and in turn failed to contribute efficiently to productive capacity of the economy. Also, poverty rate has a positive and significant impact on per capita income. Further, unemployment has a significant negative impact on economic growth. The economic implication is that the level of economic growth worsened because those that are qualified and able to work cannot secure a job and contribute significantly to production processes. As regards causality test result, the study found that there is no feedback causality between population growth, poverty, unemployment and economic growth in Nigeria. There is need for government to beef-up the skill acquisitions programmes, vocational trainings and entrepreneurship development in order to ensure that the growing population is equipped with relevant skills that contribute significantly to economic activities.

**Keywords:** Population, Poverty, Fertility, Economic Development, FMOLS.

**JEL Classification:** I30, J10, J13, O10.

## 1. INTRODUCTION

Nigeria continues to pursue mitigation of the misery of poverty, attainment of sustainable economic growth and development as it is blessed with human, natural and mineral resources. The population of Nigeria has been growing astronomically over the years. The country's population rises from 16.60 million in 1911 to 30.42 million in 1953; it increases further to 89 million in 1991, 170 million in 2014, and over 200 million in 2020 (World Bank, 2020). This has brought the country into limelight as it is tagged the 'giant of Africa' being the most populated country in the Africa continent (World Bank, 2014). With an estimated population of 200 million ranked that is 7th in the world and a growth rate of 2.58%, it is projected that the population will almost double in 2050 with a growth rate of 1.93% (United Nations World Population Prospects, 2020). Although the country is richly endowed in terms of human and natural resources, the benefits of these resources remains a mirage and paradox to her economic development as it has not been able to harness full potential of the resources.

Few decades ago, the agricultural sector was the main source of livelihood and export earnings and population growth rate was linked to productive activities. According to Tartiyus, Dauda and Peter (2015), it was believed that increased productivity was a result of greater number of workers or labourers working efficiently and contributing to the overall economic output of the nation. Therefore, Nigeria's population growth witnessed a surge before and after independence. It has

been argued that the annual growth rate of the population in the country has skyrocketed from the 1950s through the 1980s. An estimate of 2% population growth rate was recorded by the government between 1953 and 1962. However, between 1965 and 1973, the World Bank estimated Nigeria's growth rate at 2.5%, increasing to 2.7% between 1973 and 1983 (World Bank, 2014).

Furthermore, Bloom and Canning (2001) posits the emergence of poverty trap and high unemployment through the interaction of economic growth with population dynamics. Therefore, economists have conceptualized the poor as the segment of the population that is unable to meet or satisfy basic nutritional needs (Reutlinger and Selowsky, 1976; Ojha, 1970), others like Singer (1975) view poverty partly as a function of education and/or health: life expectancy, child mortality rate among others. On the other hand, others have a wider perspective on poverty as inability to meet "basic needs"- physical (food, health care, education, shelter, and etc.) and non-physical (participation, identity, and etc.) requirements for leading a "meaningful life" (Streeton, 1979; Blackwood and Lynch, 1994). Undoubtedly, abject poverty has eaten deep into the fabric of the society for five decades despite the economic boom of the 1970s in Nigeria (Mohammed-Hashim, 2008; Obi, 2007; Anyanwu, 1997) as the country's growth is simply tagged a jobless growth (Maku and Alimi, 2018).

Evidence has shown the level of abject poverty in Nigeria following the collapse of crude oil prices between 2014 and 2016 alongside negative shocks, the gross domestic product (GDP) growth rate declined to 2.7% in 2015. In the wake of 2016, the economy plunges into its first recession in 25 years as it shrinks by 1.6%. Hence, poverty stands at 33.1% in Africa's largest economy. For a country endowed with great wealth in terms of human and natural resources to support commercial activities the level of poverty remains appalling. In 2018, the rate of population growth is higher than economic growth rate culminating into slow rise in poverty. Likewise, World Bank (2018) reports that almost half of the Nigerian population lives below the global poverty line of \$2 per day with attending unemployment rate at 23.1%.

Over the years, various poverty alleviation programmes have been implemented by different regimes in Nigeria. Some of the questions that arise are: have these programmes been able to reduce poverty and unemployment? Does population growth worsen or boost economic growth? In the light of this, studies such as Ogunleye (2018), Aidi, *et al.* (2016), Dao (2013), Furuoka (2009) have found diverging results as some posit that population growth has a positive influence on economic growth while others have contrary results. In addition, studies by Nansadiqa *et al.*(2019), Omoniyi(2018), Bakare (2014), Bello and Roslan (2010), Ajibefun and Daramola (2003) have shown converging results concerning whether increase economic growth has trickle down to poverty reduction in Nigeria and other countries. However, few studies have investigated the tripartite effects of population growth, poverty and unemployment on economic growth especially the direction of causal relationship in Nigeria. It is against this background that this study investigates the effects of population, poverty and unemployment on economic growth in Nigeria between 1980 and 2018. It also examines the direction of causal relationship among population growth, poverty, unemployment and economic growth making it to stand out among other studies.

Aside the introductory section, this paper is further divided into four sections. Section 2 provides brief literature review; section 3 anchors the methodology and data sources; section 4 presents the discussion of empirical results; while section 5 concludes with policy implications.

## **2. LITERATURE REVIEW**

### **2.1 Conceptual Issues**

Population refers to the number of people in a single district, whether it is a city or town, region, country, continent, or the world. The central authority typically quantifies the size of the resident population within their jurisdiction using a census, a process of collecting, analyzing, compiling, and publishing data regarding a population. As for poverty, it is defined as a condition in which an individual or group of individuals, or community lacks the financial resources and essentials for a minimum standard of living. It is also the state of a person who lacks a usual or socially acceptable amount of money or material possessions. Poverty exists when a person lacks the means to satisfy his/her basic needs. For instance, poverty has been linked with poor health, low levels of education or skills, an inability or an unwillingness to work, high rates of disruptive or disorderly behaviour, and improvidence. Unemployment, according to the Organisation for Economic Co-operation and Development (2020), is defined as the total number of people that are above the working age who are not in paid employment or self-employment but currently available for work during a specific period. Unemployment is proxy by the rate of unemployment which entails the number of people who are unemployed as a percentage of the labour force.

### **2.2 Theoretical Review**

The theoretical root of this study is the work of Rev. Thomas Robert Malthus in his famous essay titled *Principle of Population* in 1798 modified in 1803. Malthus observed that by nature human food increases in an arithmetic progression while man himself increases in a rapid geometric progression hence outshooting the means of subsistence and survival unless being curbed by powerful preventive checks, such as celibacy, late marriage coupled with fewer children per family (Chand, 2017; Seth, 2017) or positive checks such as war, famine and disease will prevail. Malthus proposes that the size of the population is determined by the availability of the means of subsistence that is, food. Therefore, checks of death rooted in food scarcity and poverty will forestall possible population explosion.

However, Malthusian theory of population has been subjected to controversy and criticism as the theory has been proved wrong in developed countries in the 20th century due to improvement in medicine which has led to the fall in mortality rate (Ewugi and Yakubu, 2012). It has been observed that as against Malthus' projection of population explosion, this has been curtailed, and there has been increase in food production owing to improvement in technology thereby improving the people's living standards. Also, Malthus proposition of diminishing returns in land and agriculture has been criticized as there has been improvement in agricultural production with the use of fertilizers, pesticides and agricultural machineries. More so, there is no basis for the mathematical rate of growth of food production and population as proposed by Malthus. Furthermore, the theory has been criticized based on the proposition of Malthus that people will only bare minimum living standards. It has been revealed that the living standards of people in Western world have risen above the subsistence level.

### **2.3 Empirical Review**

On the empirical front, studies have been conducted on the impact of population growth and poverty level on economic development but for the sake of this study, the impact will be disaggregated in order to review each variable's influence on economic development. The searchlight on the effect of population growth on economic development is beamed on Garza-Rodriguez, et al. (2016) who analyzed the dynamic relationship between population growth and

economic growth from 1960 to 2014 using vector error correction model (VECM). The result shows that in the short-run, economic growth has a negative effect on population, while in the long run, population has a positive influence on per capita GDP and per capita GDP has significant positive effect on population. Moshen and Chua (2015) examined the effects of trade openness, investment and population on economic growth in Syria between 1980 and 2010 applying a cointegration and Granger causality test. The study finds a bidirectional short-run causality relationship between trade openness, investment, population and gross domestic product. The result indicates that population has huge effect on the GDP.

Mahmud (2015) examined population growth and economic development in India between 1980 and 2013 using vector error correction model (VECM) and applying Granger causality test. Finding the short run influence of population, rate of urbanization and employment on GDP using Wald test, the result indicates that each exogenous variable influence the endogenous variable. The study also reveals that a unidirectional causality runs from GDP to population growth and a positive relationship exists between population growth and economic growth in the long-run. Shahjaha *et al.* (2015) investigated the effect of population growth on economic development in Bangladesh between 1981 and 2014 using ordinary least squares method and found that population growth has a negative and significant impact on economic development. In addition, Kotani and Kotani (2012) investigated the effect of net migration on population growth in Indonesia from 1993 to 2005 using ordinary least square techniques. Findings revealed that lagged fertility does not affect economic growth although, a significant negative relationship exist between population growth and economic growth. Furuoka (2009), who examined population growth and economic development in Thailand between 1961 and 2003 using an unrestricted error correction model finds that population growth has a positive impact on economic development for the period. Similarly, Dao (2013) conducted a study on population and economic growth in 45 selected African countries between the period of 1990 to 2008 using ordinary least square and finds that the impact of population growth on per capita GDP was linear and negative and fertility rate has a negative and significant impact on per capita GDP.

Evidences from Nigeria are mixed. For instance, Ogunleye *et al.* (2018) investigated population growth and economic growth in Nigeria between the period of 1981 and 2015 by adopting the ordinary least square method and find that population growth is positive and has significant impact on economic growth while fertility rate and crude death rate are negative but not significant. Likewise, Aidi *et al.* (2016) probed into population dynamics and economic growth in Nigeria between 1970 and 2014 using ordinary least square method and finds that fertility rate, mortality rate and net migration had negative and significant impact on real gross domestic product while gross fixed capital formation has a positive significant impact and savings has a negative and significant impact on economic growth. Okwori *et al.* (2015) empirically investigated the Malthusian population theory in Nigeria between 1982 and 2012 by adopting a vector error correction model (VECM) and the results show that population growth does not significantly impact economic development during the period. Also, Nwosu *et al.* (2014) investigated the effects of population growth on economic growth between 1960 and 2008 testing for direction of causality. It was found that unidirectional causality exists between population growth and economic growth.

Olabiyi (2014) examined the effects of population dynamics on economic growth in Nigeria from 1980 to 2010 by adopting a vector auto regressive (VAR) model using variables such as infant mortality rate, fertility rate, trade openness, government expenditure, real gross domestic product

and primary school enrolment. The result reveals that fertility rate has a significant negative impact on economic growth and a significant positive relationship between infant mortality rate and economic growth. In addition, Akintunde, *et al.* (2013) examined the nexus between population dynamics and economic growth in 35 selected Sub-Sahara African countries between 1975 and 2005 using both pooled OLS and dynamic panel techniques. The empirical result revealed that total fertility rate has negative impact on economic growth while life expectancy at birth was found to have a positive relationship with economic growth. In similar vein, Adewole (2012) probed into the effect of population on economic growth between 1981 and 2007 by adopting ordinary least square method and finds that population growth has significant positive impact on economic growth proxied by per capita income and real gross domestic product.

Agrawal (2008) investigated the relationship between economic growth and poverty alleviation in provinces of Kazakhstan Central Asia using panel data between 2000 and 2002 by adopting General Least Squares (GLS). The study reveals that provinces with higher growth rates achieved sharp decline in poverty level. This is supported by studies of Christiaensen, Demery and Patemostro (2003), Ravallion (2001), Dollar and Kraay (2000). On the other hand, Ncube *et al.* (2013) finds that income inequality reduced economic growth and increased poverty in the Middle East and North African (MENA) region while Okafor (2016) investigated economic growth, poverty and income inequality relationship in Nigeria between 1980 and 2014 using vector autoregressive (VAR) model and finds that economic growth has no impact on poverty reduction for the period. Also, there was no causal relationship between economic growth and poverty for the period in Nigeria. Ukpong *et al.* (2013) examined the issues of poverty and population growth in Nigeria using ordinary least square method and find that population growth has a positive and significant impact on poverty and a positive and significant impact of GDP on poverty alleviation. Bakare (2014) carried out a study on the effect of poverty reduction on economic growth in Nigeria between 1980 and 2008 using error correction model (ECM). The study reveals that there is a positive and significant relationship between economic growth and poverty. From the divergences of methods applied and results found in reviewed literatures, it is apparent that a wide gap exists in the subject of discourse especially in Nigeria.

### 3. METHODOLOGY

This study makes use of annual time-series data covering the period of 1980-2018 gathered from the World Bank's World Development Indicators (WDI), National Bureau of Statistics (NBS) and Central Bank Statistical Bulletin (CBN). This study takes a cue from the works of Bakare (2014) and Furuoka (2009). Hence, the study modified the models to investigate the tripartite effects of population, poverty and unemployment on income per capita growth. It thus specifies the following three models as the first model examines the impact of population growth and unemployment on economic growth, the second model investigates the impact of poverty and unemployment on per capital income and the third model examines the tripartite influence of population growth, poverty and unemployment on economic growth. The definitional equations after modification are specified as follows:

$$gdppc_t = f(popgr_t, inf_t, tfr_t, uemp_t) \tag{1}$$

$$gdppc_t = f(pov_t, inf_t, tfr_t, uemp_t) \tag{2}$$

$$gdppc_t = f(popgr_t, pov_t, inf_t, tfr_t, uemp_t) \tag{3}$$

Equations 1, 2 and 3 are written in their econometric forms as follow:

$$gdppc_t = \alpha_0 + \alpha_1 popgr_t + \alpha_2 inf_t + \alpha_3 tfr_t + \alpha_4 uemp_t + e_t \quad (4)$$

$$gdppc_t = \beta_0 + \beta_1 pov_t + \beta_2 inf_t + \beta_3 tfr_t + \beta_4 uemp_t + v_t \quad (5)$$

$$gdppc_t = \varphi_0 + \varphi_1 popgr_t + \varphi_2 pov_t + \varphi_3 inf_t + \varphi_4 tfr_t + \varphi_5 uemp_t + \mu_t \quad (6)$$

Where; *gdppc* represents economic growth measured gross domestic product per capita; *popgr* is population growth, *pov* denotes poverty rate, *uemp* represents unemployment rate, *inf* denotes inflation rate, *tfr* is total fertility rate,  $\alpha_0, \alpha_{1-4}, \beta_0, \beta_{1-4}, \varphi_0, \varphi_{1-4}$  are parameters,  $e, v, \mu$  are error term and  $t$  is time dimension. Following theoretical a priori expectation, population growth rate, poverty rate, inflation rate, total fertility rate and unemployment rate should be negatively related to economic growth.

Hence, this study applies the Fully Modified Ordinary Least Squares (FMOLS) to investigate the long-run relationship between population, poverty level, unemployment and economic growth in Nigeria. The Fully Modified Ordinary Least Squares (FMOLS) is credited to Phillips and Hansen (1990). It uses kernel estimators of the nuisance parameters that affect the asymptotic distribution of the OLS estimator (Shahbaz, 2009). It achieves asymptotic efficiency by modifying the least squares to account for serial correlation effects and tests for the endogeneity in the regressors that result from the existence of cointegrating relationships (Phillips and Hansen, 1990; Shahbaz, 2009). In order to utilize this technique in estimating long-run parameters, there must exist a long-run relationship among the variables and must be a set of I(1) variables. Thus, we have to establish the presence of unit root in the data by employing the Augmented Dickey Fuller (ADF) that is used to examine the degree of integration among the variables. According to Engle and Granger (1987), when all the variables under investigation are non-stationary at level that is I(0), but stationary at first difference that is I(1), this allows the use of Johansen cointegration technique. Hence, two variables are cointegrated if they have a long-term relationship between them (Shahbaz, 2009).

#### 4. RESULTS AND DISCUSSION OF FINDINGS

The descriptive statistics are highlighted in Table 1. From the result, the average of GDP per capita growth rate is 0.0056, while the average of population growth rate is 0.0262. Moreover, the average level poverty rate and inflation rate are 53.763 and 19.110 while total fertility rate and unemployment rate assumes the average values of 6.1672 and 11.109 in Nigeria respectively. The result also shows that inflation rate exhibits the highest standard deviation across the time series.

**Table 1:** Descriptive Statistics

Variables	Obs	Mean	Std. Dev	Min	Max.
gdppcg	39	0.0056	0.0532	-0.1545	0.1246
popgr	39	0.0262	0.0029	-0.0180	0.0324
pov	39	53.763	6.7548	40.200	66.900
inf	39	19.110	17.081	5.3880	72.836
tfr	39	6.1672	0.4040	5.3870	6.7830
unemp	39	11.109	7.8109	1.8000	27.400

**Source:** Author's Computation.

Before checking if series exhibit long-run relationship, the standard procedure is to examine their mean reversion properties. Therefore, this paper utilizes both the Augmented Dicky Fuller (ADF)

and Phillips-Perron unit root tests. The tests were estimated with both constant and trend terms of the series. Table 2 shows that we accept the null hypothesis of unit root in the series at their level form. However, it rejects the null hypothesis of unit root after integrating the series, implying stationarity at their first difference forms.

**Table 2:** Unit root Test

Variables	ADF		PP		Order of integration
	@ level	@ 1 <sup>st</sup> Diff.	@ level	@ 1 <sup>st</sup> Diff.	
gdppcg	-3.005	-11.6016 <sup>abc</sup>	-4.1455	-21.3569 <sup>abc</sup>	I(1)
popgr	-4.3037 <sup>abc</sup>	-7.3037 <sup>abc</sup>	-3.8984	-9.8974 <sup>abc</sup>	I(1)
pov	-1.7547	6.5641 <sup>abc</sup>	-1.6646	6.5758 <sup>abc</sup>	I(1)
inf	-3.6720 <sup>abc</sup>	-5.6651 <sup>abc</sup>	-2.9566	-11.4670 <sup>abc</sup>	I(1)
tfr	-1.2454	-4.0412 <sup>ab</sup>	-1.4124	-5.7018 <sup>abc</sup>	I(1)
unemp	-2.2060	-5.4318 <sup>abc</sup>	-2.2060	-5.4246 <sup>abc</sup>	I(1)

**Note:** <sup>a</sup>, <sup>b</sup> and <sup>c</sup> denote significance at 10%, 5 %, and 1 % respectively of the null hypothesis (H<sub>0</sub>) for ADF and PP. The optimal lag order for Dickey and Fuller (1979) ADF test is determined by SIC, while the bandwidth for Phillips and Perron (1988) PP test is determined by using the Newey-West Bartlett kernel. We include both constant and trend in the estimation.

**Source:** Author's computation.

Afterward, the study analyses whether longrun relationship exists among the variables. The study therefore employed the Johansen (1988, 1991) and Johansen and Juselius (1990) cointegration tests and the results are presented in Table 3. When the relationship between the control variables, population growth, unemployment and economic growth were used (model 1), the result reveals that we reject the hypothesis of no cointegration in the equation. Also, when the relationship between the control variables, poverty rate, unemployment and economic growth were used (model 2), the result reveals that we reject the hypothesis of no cointegration in the equation. Further, when the relationship between the control variables, population growth, poverty rate, unemployment and economic growth were used, the result reveals that we reject the hypothesis of no cointegration in the equation (model 3, which is the baseline model). Hence, results (containing model 1-3) show an evidence of cointegrating relationship among the variables implying that poverty rate, population growth, and unemployment jointly exhibit long-run relationship with economic growth in Nigeria.

**Table 3:** Cointegration Results

(1)		(2)		(3)	
Trace Test	Max. Eigenvalue	Trace Test	Max. Eigenvalue	Trace Test	Max. Eigenvalue
195.4748 <sup>abc</sup>	113.9007 <sup>abc</sup>	168.5716 <sup>abc</sup>	121.1149 <sup>abc</sup>	227.8490 <sup>abc</sup>	126.6645 <sup>abc</sup>
81.5742 <sup>abc</sup>	42.5559 <sup>abc</sup>	47.4567 <sup>a</sup>	24.7117	101.1845 <sup>abc</sup>	47.7467 <sup>abc</sup>
39.0183 <sup>abc</sup>	26.3786 <sup>abc</sup>	22.7450	9.2246	53.4378 <sup>ab</sup>	27.0702 <sup>a</sup>
12.6398	8.2506	13.5204 <sup>a</sup>	8.0345	26.3677	11.5109
4.3892 <sup>ab</sup>	4.3892 <sup>ab</sup>	5.4859 <sup>ab</sup>	5.4859 <sup>ab</sup>	14.8568 <sup>a</sup>	8.6676
-	-	-	-	6.1892 <sup>ab</sup>	6.1892 <sup>ab</sup>

**Note:** <sup>a</sup>, <sup>b</sup> and <sup>c</sup> denote significance at 10%, 5 %, and 1 % respectively. (1), (2), and (3) represents model 1, model 2, and model 3. For all model, at least one cointegrating relationship exist among the variables.

**Source:** Author's Computation

Table 4 reveals the long-run cointegrating effect size of the variables in models 1 to 3 using the FMOLS estimation. Specifically, an increase in population growth rate by 1 unit, inadequately increases economic growth by 0.5645 (model 1) and 2.3852 (model 3) units. This implies the effect of population growth rate appears to be positive but not significant (both in models 1 and 3) in explaining the growth of the Nigerian economy. This is an offshoot of the dysfunctional characteristics of population that comprise mainly of unskilled and semi-skilled labour contributing weakly to the productive capacity of the economy. This is supported by the empirical findings of Okwori *et al.* (2015) but contrary to the results of Ogunleye *et al.* (2018) and Adewole (2012) which reveal that population has a significant positive impact on economic growth. Also, an increase in poverty rate by one unit inadequately increases economic growth by 0.0056 and 0.0051 units in models 2 and 3 respectively. Given the similarity in the size and significance, the study infers that the effect of poverty rate appears to be positive and significant (though with weak sizes both in models 2 and 3 in explaining the growth of the Nigerian economy which implies that increase in the level of output has not resulted to poverty reduction as basic infrastructural facilities, socio-economic freedom and transformation are still unavoidably absent. This is supported by the empirical findings of Bakare (2014) and Ukpong *et al.* (2013) who found a significant positive impact of poverty on economic growth. As for unemployment rate, it has a significant negative impact on economic growth which implies that an increase in unemployment rate by 1 unit significantly decreases economic growth in Nigeria by 0.01 unit meaning that as unemployment rate increases, the level of economic growth will be worsened because those that are qualified and able to work cannot secure a job and contribute significantly to production processes. Hence, they will not be able to meet their basic needs in the long-run since there is no reward for partaking in productive activities. This is contrary to the findings of Bakare (2014) who confirmed a significant positive relationship between unemployment rate and economic growth in Nigeria.

**Table 4:** Long run estimates

<b>Dependent Variable: gdpccg</b>			
<b>Variable</b>	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>
popgr	0.5645 (2.5113)		2.3852 (2.1966)
pov		0.0056 <sup>ab</sup> (0.0014)	0.0051 <sup>abc</sup> (0.0014)
uemp	-0.0114 <sup>abc</sup> (0.0022)	-0.0053 <sup>ab</sup> (0.0020)	-0.0052 <sup>ab</sup> (0.0020)
inf	-0.0002 (0.0005)	-0.0002 (0.0004)	-0.0003 (0.0004)
tfr	1.2416 <sup>abc</sup> (0.2088)	1.1418 <sup>abc</sup> (0.1907)	1.0353 <sup>abc</sup> (0.1895)
@Trend	0.0533 <sup>abc</sup> (0.0081)	0.0441 <sup>abc</sup> (0.0072)	0.0401 <sup>abc</sup> (0.0071)

**Note:** <sup>a,b&c</sup> denote significance at 10%, 5 %, and 1 % respectively. (1), (2), and (3) represents model 1, model 2, and model 3. Long run

covariance estimates (Prewhitening with lags = 2 from SIC maxlags = 2, Bartlett kernel, Newey-West fixed bandwidth = 4.0000). Variables are in their normal form.

**Source:** Authors' Computation.

With regards to the control variables (inflation rate, fertility rate, and unemployment rate), they are all robust determinants of economic growth except inflation rate. An increase in fertility rate by 1 unit significantly increases economic growth in Nigeria by approximately 1 unit, which is contrary to the findings of Aidi *et al.* (2016), and Olabiyi (2014) who found that fertility rate has a significant negative impact on economic growth in Nigeria.

**Table 5:** Causality Test

<b>Dep. Variable:</b>		
<b>Null hypothesis</b>	<b>P values</b>	
popgr→gdppcg	0.2586	no causality
gdppcg →popgr	0.1130	
pov→gdppcg	0.4566	no causality
gdppcg →pov	1.8222	
inf→ gdppcg	0.1460	no causality
gdppcg →inf	0.3160	
tfr→gdppcg	0.5693	no causality
gdppcg →tfr	0.7051	
uemp→gdppcg	2.2494	no causality
gdppcg →uemp	0.0049	
pov→popgr	0.7443	no causality
popgr → pov	2.3589	
inf→popgr	3.9509 <sup>ab</sup>	causality exist
popgr → inf	1.4404	
tfr→popgr	0.7500	causality exist
popgr → tfr	3.2867 <sup>a</sup>	
uemp→ popgr	3.5258 <sup>ab</sup>	causality exist
popgr → uemp	3.0610 <sup>a</sup>	
inf→ pov	0.6177	no causality
pov → inf	0.0642	
tfr→ pov	0.7674	causality exist
pov → tfr	26.0075 <sup>abc</sup>	
uemp → pov	0.6248	no causality
pov→uemp	0.6326	
tfr → inf	3.7858 <sup>ab</sup>	causality exist
inf→ tfr	6.4546 <sup>abc</sup>	
uemp → inf	1.5606	no causality
inf→ uemp	0.6819	
uemp → tfr	81.3680 <sup>abc</sup>	causality exist
tfr → uemp	4.0311 <sup>ab</sup>	

**Note:** <sup>a, b</sup> & <sup>c</sup> denote significance at 10%, 5 %, and 1 % respectively. The

→ denotes “does not cause”

**Source:** Author's Computation

Table 5 shows the causality effect of the variables using the Pairwise Granger Causality Tests. The result reveals that no causality exists between the independent variables and economic growth. An explanation to this is that the historical information of population growth rate, poverty rate, inflation rate, fertility rate, and unemployment rate with no feedback, are not significant enough to explain or drive the future dynamics of economic growth in Nigeria. However, feedback causality exists between unemployment rate and inflation rate, fertility rate and inflation rate, and unemployment and population growth rate. Also, population growth rate and poverty rate drives fertility rate in Nigeria. This is an indication that both poverty and population promotes high fertility in Nigeria. Further, a one-way causal relationship flows from inflation rate to population growth rate. This implies that as inflation in Nigeria deepens, population is bound to increase. From the table above, it reveals that there is no causal relationship between population growth rate and economic growth in Nigeria. This is contrary to the findings of Nwosu *et al.* (2014) who found a unidirectional causal relationship between population growth rate and economic growth in Nigeria.

## **5. CONCLUSION AND POLICY RECOMMENDATIONS**

This study investigates the tripartite effect of population, poverty rate and unemployment on economic growth in Nigeria between 1980 and 2018 using a Fully Modified Ordinary Least Squares estimator. The Johansen cointegration test result ascertains a long-run relationship among the variables. The results further show that population growth rate has a positive but insignificant impact on economic growth in the long-term. This is attributable to inept characteristics of the population that comprise mainly of unskilled and semi-skilled labour which contributes weakly to productive capacity of the economy. Also, the teeming population has not been able to contribute to the level of output as many are not gainfully employed or do not have the necessary skills to improve production. The empirical results also show that poverty rate has a positive and significant impact on income per capita measuring the level of economic growth in Nigeria. This may be due to a rise in the level of output in the economy which invariably results into a rise in per capita income but with an increase in population, this will not translate to an improvement in the standard of living of the citizens and poverty may not be reduced in the long-run. Further, unemployment has a significant negative impact on economic growth. This means that the level of economic growth worsened because those that are qualified and able to work cannot secure a job and contribute significantly to production processes. Thus, they are unable to meet their basic needs in the long-run since there is no reward for partaking in productive activities. As for causality test, there is no feedback causality between population growth and economic growth as well as for poverty and unemployment. This implies that population growth, poverty rate and unemployment do not drive the dynamics of economic growth.

Based on the findings, the following recommendations are made. Firstly, the government should beef-up the skill acquisitions programmes, vocational trainings and entrepreneurship development in order to ensure that the rising population are equipped with relevant skills that contribute significantly to economic activities. Secondly, the government should endeavor to embark on sustainable poverty alleviation programmes and ensure that these programmes are properly monitored and that they reach the targeted population. Finally, government and policy makers should encourage investment (both domestic and foreign) in order to stimulate the growth of the economy and reduce unemployment.

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# **LOCATION AND GENDER ANALYSIS OF CLIMATE CHANGE VULNERABILITY AND IMPLICATION FOR POVERTY REDUCTION IN TARABA STATE, NIGERIA**

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## **ABSTRACT**

The study examined location and gender dimension of climate change and its implication for poverty reduction in Taraba State, Nigeria. The study used a multi-stage sampling technique, and interviewed 492 respondents from 12 communities in 6 local government areas. Adopting the Inter-Governmental Panel on Climate Change (2007) and Deresse, Hassan, and Ringer (2008) Vulnerability Index, the study found that Taraba North is the least vulnerable among the three senatorial zones followed by Taraba South while Taraba Central senatorial zone is the most vulnerable. Similarly, the result suggested that male farmers were more vulnerable than their female counterparts. On the basis of the results, the study recommended the need to improve the adaptive capacity of farmers in Taraba State through the strengthening of those variables that improve adaptive capacity such as training/seminar as well the government providing facilities for farmers to enable them engage in dry season farming.

**Key words: climate change, vulnerability, index, poverty reduction, food security**

**JEL Classification: I3, Q51, Q54,**

## **1. INTRODUCTION**

That agriculture has been acknowledged to play an important role in the quest for poverty reduction through provision of income and employment is well established in literature. In Nigeria, agriculture remains a significant contributor to the economy, contributing about 30% of the GDP (NBS, 2017). More than 90 percent of the residents in the rural area depend on the agricultural sector and this approximate about 70 percent of the entire labour force that generate over 60 percent of non-oil export revenues. This makes agricultural sector the largest sector that has provided employment and income for the rural population in Nigeria. Agriculture contributed 41.5% and 42.07% in 2007 and 2008 respectively to GDP. At the end of third quarter of 2017, agriculture contributed accounted for 29.2% of the GDP, second to the service sector. This goes to underscore the importance of agriculture to the growth of Nigerian economy.

Despite the importance of agriculture, its production is being threatened by climate change. Global warming, which results from climate change, makes climate variability one of the most challenging environmental threats being grappled within the society. The sustainability of agricultural, socio-economic activities, as well as human existence in general, face threat from climate change (Climate Handbook, 2015). Climate change is viewed as the statistically significant fluctuations which occurrence sustainably span for longer period, say 10 years at least as noted by the

Intergovernmental Panel on Climate Change (IPCC,2007). Climate change is made up of variations in rate and size of unfavourable weather conditions in conjunction with slow but steady rise in mean global surface temperature. Variations in climate weather condition on all temporal and spatial scales, short-lived severe storms, decades of droughts, and century changes in temperature, rainfall and ice-cover are not excluded in climate change (IPCC, 2007).

The unfavourable effects of climate variation come from the hazards that accompanies the unfavourable climate variation. A measure to which a person or groups are exposed to the risk of disaster, including, the extent of such system's recovery from the risk of the incident is referred to as the vulnerability to the hazard. Blaiki *et. al.*(1994) in Fatile and Adejobi (2012) defines vulnerability as those features of a system (persons) with respect to their capacity to contemplate, adjust, withstand, and regain from the aftermath of a naturally occurring hazards.

The negative impacts of climate variability results in significant worsening of households' food insecurity and could further weaken the ability to eradicate poverty especially in places where people's livelihood and wellbeing are solely agriculture-dependent (Perez et al, 2016). As noted by Menike and Arachchi (2016), agriculture is arguably the most sensitive sector to the changing climatic condition which affect agricultural production and farming communities. Farmers, especially the smallholder farmers which are predominant in Nigeria are the most affected by climatic change. Expectedly, the variability in climate will modify pest and disease outbreaks, thereby leading to an increase in the rate and severity of desertification as well as (Asan, 2018). In view of the fact that agricultural production and household income of farmers are closely and positively related, the productivity effect of climate change on farmers yields will worsen farmers' vulnerability. Hence, climate change, in addition to affecting agricultural productivity, also exposes farming households to well-being and food security management risk.

In Taraba State, the climate change situation is not different from the picture painted above. Taraba is one of the States in northern Nigeria. The State lies roughly between latitude 6030" and 9036" north and longitude 90 10"50" east. It is bounded by Bauchi and Gombe and Adamawa States in the north-east, and by Plateau State in the north-central. It is further bounded to the north central by both Nasarawa and Benue States, while it shares an international boundary with the Republic of Cameroun to the south and south-east.

Over the past decade, available data on climatic (temperature and rainfall) reveal that temperature in Taraba State has trended upwards by 0.3°C and there has been variation in rainfall over the years (Audu, 2013, Adebayo, 2010;). Other indication of climate change in Taraba is comprises delay in the date of onset of rainfalls, as well as upsurge in the number of days that are dry during the rainy season and rise in extreme temperature. This has led to warmer seasons, rise in incidence and intensity of extreme weather condition such as drought, decrease in the amount of rainfall by about 15-20%, and a rise in the rate of dry spell incidence. The Taraba State Agricultural Development Programme (TADP) points to the fact that both rainfall and temperature vary across the senatorial zones. In the same vein, between 2009 and 2019, the southern senatorial zone recorded lowest temperature of 28°C and maximum of 29°C while the central zone recorded 27°C minimum and 28°C maximum. The northern senatorial zone recorded the highest temperature of minimum of 30°C and maximum of 32°C.

Although there are some studies that explore climate change impact and vulnerability (Boko et al, 2007; Adebayo, 2010; Oruonye, 2011;.1994 in Fatile and Adejobi, 2012; Adebayo and Oruonye, 2013; Audu, 2013; Egbule, 2014; Oruonye, 2014; Perez et al, 2015; Asan, 2018), Some of these

studies focused on other developing countries. Moreover, existing studies in Nigeria focused on other States in the Southern part of the country. More importantly, studies on Taraba State, employed simple descriptive statistics (percentages, standard deviation, graph) as method of analysis without rigorous statistical analysis to produce more robust result that would inform policies. This study carried out a locational and gendered analysis of climate change vulnerability in Taraba State and inferred the implication on poverty reduction.

## **2. BRIEF LITERATURE REVIEW**

### **2.1 Conceptual Literature**

Climate change is perceived as a periodic change of earth's climate due to atmospheric modifications in addition to the atmosphere and many other biological, geologic, geographic, and chemical factor interactions within the earth system. Atmosphere is defined here as a changing fluid which moves continually (Jackson, 2018). For him, the physical properties of the atmosphere and the movement direction rate are driven by a number of factors such as solar radiation, continent's geographic location, movement in ocean, the position and mountain orientation ranges, atmospheric chemistry, and growing vegetation of the land. On the other hand, the Intergovernmental Panel on Climate Change – (IPCC,2007), climate change is defined as any given fluctuation in climatic state that is seen (through statistical tests) by the mean variations and/or the variability of its properties, which continues for a longer period, usually, decades or longer. Climate change can occur as a result of internal natural processes or forces that occurs externally, or due to continual anthropogenic variations that make up atmosphere or land use. For the sake of this study, we adopted the IPCC conceptualization of climate change.

### **2.2 Theoretical Literature**

#### **Action Theory of Adaptation and Vulnerability to Climate Change**

This theory was propounded by Smit, Burton, Klein and Wandel (2000) and made more popular by IPCC (2001) and Eisenack and Stecker (2011). The theory posits that adaptation and vulnerability to climate change is a response to environmental shocks that influence entities, subjects or systems. It sees adaptations and vulnerability to climate change as means within which entities and systems adjusts to things made by human systems. Climate change vulnerability is a situation of being harmed for being exposed to stresses associated with social and environmental variations, and the inability to adapt (Adger, 2006).Cutter (1996) and Cutter *et al.* (2003) defined climate change vulnerability as exposure to situations that make people or places susceptible to hazard, as social condition measuring resilience to hazards, and as the integration of quality exposures and societal resilience with a special focus on regions or places (Cutter, 1996; Cutter,*et al.*,2003).

### **2.3 Empirical Literature**

Yarnal (2017), contends that climate change vulnerability depicts the severity of the influence of climate change, exhibiting trio-dimensions; indicates exposure to climate change conditions, sensitivity to climate change conditions, and the capacity to adapt to these conditions when exposed. The extent to which people (farmers) and those things valued by them could be affected by climate variation or change is known as exposure. Sensitivity means the extent to which they could be hurt by that exposure; and adaptive capacity refers to the extent to which they can ameliorate the potential for harm through the utilization of some steps to reduce the exposure or

sensitivity. Similarly, IPCC (2007) also defined climate change vulnerability as the likelihood to be affected negatively by the climate.

In this study, climate change vulnerability is used to indicate situations which make a group of people living together, asset or system to be prone to the detrimental impacts and danger of climate change. It is the extent to which farmers or the things they value are affected, or their inability to adjust to the negative impacts of climate change.

Studies in this category include Abebe and Bekele (2017) who examined how different genders are vulnerable to changes in climate in Central Rift Valley, Ethiopia. Survey data was generated from 290 agricultural households. The study utilized Vulnerability expected poverty (VEP) methods and found that there are variations in climate change vulnerability among male and female headed households, which favour women. Also, it was found that there exists variation in socio-economic characteristics ability of male and females in facing climate change threat. The study recommends that a reduced vulnerability gender intervention needs to be encouraged to aid development policies that are geared towards gender. Recent study by Nyantakyi-Frimpong (2020) argues that climate extremes do not always affect women more adversely than men. Indeed, dominant ideals of threatened masculinity can make men highly vulnerable during extreme climatic events.

In a related but different study, Ravera, Martí'n-Lo'pez, Pascual, and Drucker (2016) assessed climate change adaptation and gender issues by applying a feminist intersectional method and survey data. The study revealed that in terms of climate adoption mechanisms, there is the existence of gendered preferences that is determined by geographical location driven by the socio-ecological and organizational changes. This suggests that future research should emphasize more on intra-gender variations that would shape adaptive ability of changes in climate. In Eastern Uganda, Balikoowa, Nabanoga & Tumusiime (2018) examined gender stereotype in household vulnerability to climate change using livelihood vulnerability index framework. The result revealed that single male-headed households were the most vulnerable to climate change, even worse than single female-headed households.

Similarly, Ahmad, El-Fatal, Pehu, Poutiainen, and Vyzaki (2014) examined how changes in climate fight against males and females' ability to secure livelihoods especially, through agriculture using survey data and descriptive statistics. It was found that women trying to cope with the effects of climate change were hampered by restrictions to land access and limited rights in the community. It was recommended that for climate-responsive agricultural projects to be more effective, broad enabling efforts like women's rights to land and, laws and regulations that place women in disadvantaged positions should be encouraged.

In Jamaica, Ayesha (2014) used time series quarterly data from their Statistical Institute and applied descriptive statistics to examine gender dimension of changes in climate understandings and responses among farmers in the rural community of Sherwood Content, placing emphasis on women's perspectives. It was found that generally, women see hurricanes to be more impactful than men, but more men than women were more adversely affected by droughts. In addition, the challenges faced by women were limited access to credit, lack of access to technical knowledge and overwhelming demands on time due to home and family responsibilities. It was recommended by the study that government should be more concerned on the human effects of changes in climate and the human induced processes of climate change with a view to mitigating it attendant forces and consequences.

Jost, Kyazze, Naab, Neelormi, Kinyangi, Zougmore, Aggarwal, Bhatta, Chaudhury, Tapio-Bistrom, Nelson, and Kristjanson (2015) provided insights on women's adaptive capacity to climate change in farming communities using survey data. Utilizing the climate analogue approach, the study found that women were less adaptive because of financial constraints, male domination in receiving information and extension services, and available adaptation mechanisms create higher labour loads to women. It was recommended that increased farmer-to-farmer learning to help raise the degree of climatic variability adaptive mechanisms in these communities should be promoted by the government and other relevant bodies interested in climate change.

In yet another study by Aryal, Farnworth, Khurana, Ray, and Sapkota (2014), the discrepancies that exist between the ability of men and women farmers to adopt mitigation and adaptation strategies in response to climate change was examined using survey data and probit model. It was found that agriculture in Haryana was male-dominated, with large land-holdings while women play weak role in agricultural decision making. In Bihar, agriculture was found to be feminized due to male outmigration although, with small land-holdings. It was recommended that policies and strategies geared towards the alleviation of the constraints faced by female farmers should be developed by the government to help mitigate the constraints they face.

In Uganda, Kisauzi, Mangheni, Sseguya and Bashaasha (2012) utilized mean, median, standard deviation, Chi-Square, linear and multinomial logistic regressions to examine female and male farmers' understandings, knowledge and determinants of changes in climate. The study revealed that the rate of awareness was very high as regards climate change for both male and female farmers and perceive climate change very highly. However, the study suggests that even though there was a significant perceptions of climate change among the farmers, there was no significant difference on all the parameters used except for the frequency of droughts with women. This is an indication that women perceived increased drought more compared to men. In addition, household head sex was found as significant variable that determine knowledge of the causes of changes in climate. There was a difference in sources of access to information and gender education. For instance, their study discovered gap in access to radio, extension workers and groups and these were found to be significant factors that influence women's lower knowledge levels. A policy recommendation from the finding is that there should be equity as well as sustained climate change adaptation and climate adaptation interventions focusing more on gender-sensitive changes in terms of knowledge and

Assan (2018) investigated how male and female heads of household understand and interpret climate change, its impact on their livelihood and measures taken to cope and adapt to it and, factors that inform choice of adaptation mechanisms. Using household survey data and descriptive statistics, it was found that farmers that dwell in rural, semi-arid regions are the most vulnerable to the negative effects of climate change but, the vulnerabilities were gendered as a result of differences in the access to and control of productive resources necessary for male and female farmer's effective adaptation. It was recommended that agrarian communities in developing countries of Africa should be encouraged by the government and other relevant agencies to help the vulnerable group mitigate and predicted changes in climate for proper adaptive mechanisms.

Suhiyini, Kuwornu, and Osei-Asare (2019) in a related study, used survey data generated from 210 smallholder farming households and the livelihood vulnerability index(LVI) to examine the vulnerability of male-headed and female-headed farming households to climate change and

variability. It was found that there exist significant differences in the vulnerability levels of female-headed and male-headed farming households. It was however recommended among others that female-headed households should be given priority in both on-going and new intervention projects in climate change and agriculture by empowering them through financial resource support to venture into other income-generating activities.

Mangheni, Bashaasha and Majaliwa (2010) evaluated the gender dimensions of the impact of climate change on agriculture and small holder farmers' knowledge, innovations and adaptations to climate change, using household survey data and Trade Off Analysis (TOA) model. It was found that more men had experience and lessons of climate change adaptation and, the effects of climate change on agriculture, economic and environmental assessment adaptation mechanisms of female farmers were more compared to their male counterparts. Kisauzi et al (2012) evaluated male and female farmers' climate change perceptions and knowledge and determinants of knowledge of climate change among male and female farmers, using survey data generated from 135 farmers. Applying descriptive statistics and, linear and multinomial logistic regression models, it was found that female-household heads were about eleven (11) times more likely to be ignorant about the cause of climate change and about three (3) times more likely to be wrong about the cause of climate change than their male counterparts when knowledge is taken into account. Resilience of male and female farmers were not guaranteed, given the bulk of their adaptation mechanisms. Adaptation perceptions of women (only 5%) were found to be less than the proportion attributed to men (80%). It was recommended that the communication strategy for climate change adaptation should concentrate on high perception rates of climate change in order to avail communities with appropriate climate change information for adaptive actions.

Onyango (2015) used survey data and descriptive statistics to examine whether rural women were more probably risked with respect to the negative effects of changes in climate than men. It was found that gendered social norms hinder women's adaptive capacity coupled with their domestic responsibilities, but men migrate for labour. In addition, men have more access to land, extension services and inputs than women which help them in their adaptive mechanism. It was recommended that government, NGOs, research institutes, other research organisations and local actors of development, engaged in changes in climate and farm jobs should enhance the capacity of women skills and knowledge. Friedman, Hirons, and Boyd (2018) also adopted the vulnerability model and survey data and found that a myriad of factors contributes to climate change vulnerability of females. It was further found that there are likely women farmers' representations and technical policy focus of climate-orientated interventions which militate against further women that are the most vulnerable and increase the inequalities that exist. It was recommended among others that government should help the women identify risks of changes in climate and bring up adaptation and policy mechanisms that would resolve its effects.

Similarly, Amusa, Okoye and Enete (2015) provided empirical evidence on gender-friendly vulnerability to changes in climate, decisions of adaptation among rural households in Southwest Nigeria, using survey data generated from 360 randomly sampled farmer and descriptive statistics. It was found that the rural units were headed mainly by males, 76%, while 24% were female heads. The adaptive capability method of households' results revealed that households headed by females exhibit greater changes in climate index of vulnerability, 0.73. However, households headed by males show smaller index of about 0.43 with men having greater contribution on the average, ( $X=3.42$ ), to changes in climate adaptation mechanisms in manufacturing of crops than women,

( $X=2.67$ ). The study therefore recommended that more education access by women, land access, training resources and other needed farm materials like finance, are required in order to help militate against vulnerability and variations in gender achievements to adaptation of climate mechanisms.

Similarly, Agwu and Okhimamhe (2009) used survey data and descriptive statistics to assess gender vulnerability to changes in climate and how it affects women and men. It was found that women were more vulnerable compared to their male counterparts because they do not have the same rights with men. Further, it was found that climate change has differential effects on women and men as a result of the different social-economic roles they have been ascribed by society since these activities were ascribed to them based on perceived gender differences. It was recommended that there should be a balance between the different responsibilities undertaken by men and women in order to help gender roles and society's stratification not to deny women their rights, empowerment, material access, voice in their areas and the country as a whole.

In yet a related study, Chukwuemeka, Offia and Ume (2018) looked at male and female adaptive ability to changes in climate vulnerability utilizing survey data and adaptive capacity model. It was found that in Enugu state, female headed families were seen to be more affected by changes in climate than their male counterparts. Culture, traditional and religious practices, and unjustified assumptions around women were top among gender connected issues that militate against efforts in fighting changes in climate among families that have women as their heads. It was recommended that the identified belief systems that bring about inequality in gender need to be discouraged to enhance the adaptive abilities women farmers have, decreases their vulnerability level of changes in climate.

Using Akwa Esuk Eyamba community, Akpabuyo LGA, Cross River State, United Nations Development Programme - UNDP (2012) examined how climate affect the fishing livelihood of men and women. Utilizing survey data and descriptive statistics, it was found by the study that women and children were most vulnerable to climate change effect on fishing livelihood due to the fact that women rely completely on fish production for income to support themselves and the primary wants of families.

Philip, Ojeh, and Tukura (2018) utilized survey data generated from 220 farmers through a multi-stage sampling technique, and applied descriptive statistics and chi-square analyses to examine the level of awareness of climate change impacts and adaptations strategies among women in Ardo-Kola Local Government Area, in Taraba State. It was found that higher percentages of women (81.8%) in the study area were aware of climate change and submitted that climate change has affected them. It was also found that education and occupation influence women's level of awareness and information about the causes of climate change but age does not. Moreover, rise in temperature, variations in annual distribution of rainfall, rise in flooding, frequency and rise in length of dry spells, water, fuel and wood sourcing were found to be the major domestic activities affected by climate change. It was recommended that Taraba State government through the relevant agencies like ADP, Ministries of Education, and Environment should establish weather stations in all the LGAs headquarters in the state to enhance access to climatic data for regular monitoring.

### 3. METHODOLOGY

#### 3.1 Theoretical Framework

The theoretical framework underlying this study is the Action Theory of Adaptation and Vulnerability to Climate Change. This theory was propounded by Smit, Burton, Klein and Wandel (2000) and made more popular by IPCC (2001) and Eisenack and Stecker (2011). The theory posits that adaptation and vulnerability to climate change is a response to environmental shocks that influence entities, subjects or systems. It sees adaptations and vulnerability to climate change as means within which entities and systems adjusts to things made by human systems. In this case, the means which the entities adopt to the vulnerability depends on the capacity of the household. Hence, the overall calculated as the net effect of adaptive capacity, sensitivity, and exposure. Vulnerability is specified as  $Vulnerability = (adaptive\ capacity) - (sensitivity + exposure)$ ..... (1) Note that in equation (1) a higher net value indicates lesser vulnerability and vice versa The study was carried out in Taraba State using descriptive survey research design. Using multi-stage sampling technique, and the Taro Yamane formula, the researchers selected 492 respondents from 6 LGAs and 12 communities out of the 288,000 farming households in Taraba State. Questionnaire and interview schedule were used for data collection. The study used the Inter-Governmental Panel on Climate Change (2007) and Deressea, Hassan, and Ringer (2008) Vulnerability Index as applied by Gebreegziabheret. al (2012). Thus, Vulnerability is specified as follow:

$$Vulnerability = (adaptive\ capacity) - (sensitivity + exposure) \quad (1)$$

Note that in equation (1) a higher net value indicates lesser vulnerability and vice versa. The higher adaptive capacity signaling more resilience

### 4. RESULTS AND DISCUSSION OF FINDINGS

#### Socioeconomic Attributes of the Respondents

Some socioeconomic characteristics of the respondent household heads were ascertained. The result of the distribution of the respondents according to their socioeconomic characteristics is presented in Tables 1.0

Table 1.0: Distribution of the respondents according to their socioeconomic attributes

Attributes	Categories	Frequency	Valid Percentage	Mean
<b>Sex</b>	Male	367	77.3	
	Female	107	22.7	
<b>Age(years)</b>	Less than 30	12	2.7	
	30-40	135	28.3	
	41-50	164	34.5	48.3
	51-60	94	20.0	
	Greater than 60	69	14.6	
<b>Household size</b>	0-3	14	3.1	
	4-7	192	40.4	9.0
	8-10	130	27.4	
	Greater than 10	138	29.1	
<b>Education level</b>	No formal	90	19.0	
	Primary	130	27.3	2.5
	Secondary	207	43.5	

	Teacher training/technical	11	2.5	
	Higher education	36	7.7	
<b>Marital status</b>	Never married	28	5.9	
	Married	408	86.4	
	Widowed	25	5.3	2.1
	Divorced	6	1.1	
	Separated	7	1.3	
<b>Occupation</b>	Crop farming	350	73.1	
	Livestock farming	7	1.7	
	Both livestock and crop farming	99	20.8	1.7
	Capture fishing	1	0.4	
	Trading	2	0.6	
	Civil service	15	3.3	

*Source: Authors' computation based on field survey data, 2019*

As indicated in Table 1.0, the majority (77.3%) of the respondents were males. As regards age, the result indicates that the highest proportion (34.5%) were between 41 and 50 years. They were followed by those between 30 and 40, and 51 and 60 years of age, (28.3%) and (20%) respectively while the least (2.7%) were those that are less than 30 years of age. The average age of the respondents was 48.3 years. With respect to household size, the result shows that the highest proportion (40.4%) of the households have 4-7 individuals in their households while the lowest (3.1) had maximum of 3 persons in their households. The mean household size was 9 persons. On education level, the table shows that the highest (43.5%) proportion of the respondents had obtained secondary school certificate while the lowest (2.5%) had obtained Teacher training/technical school certificate. However, the average household head in the sample had Teacher training/Technical school certificate

The result in Table 1.0 further shows that the greatest number (86.4%) of the respondents were married while the least (1.1%) of the respondents were divorced. Also, the average household head in the sample is married. As regards occupation, and as would be expected in rural communities, the majority were crop farmers while only about 4% of the respondents were either traders or civil servants.

### **Examination of farmers' vulnerability to climate change by gender and location**

To achieve this objective, the study started by calculating the overall vulnerability followed by the gender and location dimensions of vulnerability. As earlier stated in the methodology, the study followed Deressa, Hassan, and Ringer (2008) as used by Gebreegziabheret. al (2012) in which the overall vulnerability is calculated as:

Vulnerability= (Adaptive capacity)- (Sensitivity + Exposure). In this regard, the adaptive capacity, sensitivity, and the exposure indices are calculated using Principal Component analysis (Cutter, Boruff, & Shirley, 2003; Thornton et al.2006). It is important to note that from the vulnerability equation, a higher net value is an indication of lesser vulnerability and vice versa.

From the list of variables in the questionnaire and gleaning from literature, thirteen (13) variables were used to construct the adaptive capacity index. Of the thirteen variables, namely, sex, age, marital status, years spent in school, annual income, types of material for buildings/type of building, total farm size, belonging to farmer association/cooperative (social capital), source of water, distance to source of water, participation in climate change training/seminar (human capital development), visited by extension worker, and number of livestock owned, only five (5) were retained after varimax rotation to have predicted the adaptive capacity of farmers. These variables include, sex, age, marital status, years of schooling, and annual income and these variables were used to calculate the adaptivity capacity index.

Similarly, for the sensitivity, six (6) variables were used to calculate the index based on 5 categories of severity of very high severe, moderately severe, low severe, very low severe, and not severe. These six variables include; landslide, windstorm, outbreak of disease, increased flooding, and reduced soil moisture.

For exposure, seven (7) variables, namely; (i) changes in the amount of rainfall during main rain season, (ii) changes in temperature, (iii) intensity of floods, (iv) intensity of droughts, (v) rate of siltation of river beds, (vi) thunderstorms, and (vii) heat waves were used to construct the index of which only two (changes in the amount of rainfall and temperature) were identified as predicting farmers' exposure to climate change. At the end, the vulnerability equation was applied to arrive at the vulnerability index. The results of the different indices and the overall vulnerability index is shown in Table 2.0 below:

**Table 2.0: Results of the Adaptive capacity, sensitivity, exposure, and Vulnerability indices as calculated from Principal Component Factor**

<i>Variable</i>	<i>Observation</i>	<i>Mean</i>	<i>Stad. Dev</i>	<i>Min</i>	<i>Max</i>
<i>Adaptive capacity</i>	474	4.78e-10	0.2369547	-0.6526949	1.868451
<i>Sensitivity</i>	474	1.66e-10	0.1924653	-0.4810795	1.392151
<i>Exposure</i>	474	1.77e-09	0.6393837	-1.328758	1.628208
<i>Vulnerability</i>	474	-3.53e-09	0.7081116	-1.628208	1.868451

*Source: Authors' computation based on field survey data, 2019*

In Table 2.0, the study presents the result of the three dimensions of vulnerability before the general vulnerability. The result shows that there is high adaptive, sensitivity and exposure among farmers in Taraba State. As shown by the indices. However, the overall vulnerability value of -3.53e-09 suggests that there is high farmers vulnerability to climate change in the State (Derresa et al (2009).

**Table 3.0: Result of farmers' vulnerability to climate change by location (Senatorial zones)**

<b>VARIABLE</b>	<b>OBSERVATION</b>	<b>MEAN</b>	<b>STAD. DEV</b>	<b>MIN</b>	<b>MAX</b>
<b>TARABA SOUTH</b>	160	0.295062	0.5106114	-0.6478819	1.320488
<b>TARABA CENTRAL</b>	166	-0.6246863	0.4581978	-0.628208	0.8486319

<b>TARABA NORTH</b>	148	0.3674785	0.6528263	-0.9375466	1.868451
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Source: Authors' computation based on field survey data, 2019

The result in Table 3.0 shows farmers' climate change vulnerability according to location (senatorial zone). As noted earlier, the higher the vulnerability figure, the lesser the vulnerability and vice versa. The result revealed that Taraba North with vulnerability value of 0.3674785 is the least vulnerable among the three senatorial zones followed by Taraba South with 0.295062 while Taraba Central senatorial zone is the most vulnerable with mean vulnerable value of -0.6246863 as indicated by Derresa et al (2009). This result has imperative for policy intervention.

**Table 4.0: Result of farmers' vulnerability to climate change by gender**

Variable	Observation	Mean	Std. Dev	Min	Max
<b>Female</b>	107	0.1218922	0.8190552	-1.377285	1.586734
<b>Male</b>	367	-0.0510112	0.6516505	-1.628208	1.868451

Source: Authors' computation based on field survey data, 2019

Similarly, as regards to the gender dimension of vulnerability, the result in Table 4.0 produces a seemingly counter-intuitive result with male farmers with -0.0510112 being more vulnerable than their female counterpart with vulnerability value of 0.1218922. This is contrary to expectation and contradicts the result of Alhassan et al (2019) who found that female-headed smallholder farmers are more vulnerable than their male-header counterparts. However, the result corroborated earlier study by Balikooowa et. al (2018) in Eastern Uganda which found that single male-headed households are more vulnerable to climate change than single female-headed households and conclude that the straight assumption that vulnerability is associated with female-headed households is misleading and could disenfranchise some male-headed households that are more vulnerable. The results from the in-depth interview lend credence to the quantitative outcome. From the in-depth interview conducted, the respondents adduced some reasons that informed the Northern Senatorial zone being less vulnerable to climate change. They maintained that the northern senatorial zone is less vulnerable to climate change because of some reasons. For instance, in the northern zone farmers mostly practice dry season farming because their soil is good for dry season farming and also there are a lot of rivers around the zone. This dry season farming is less affected by climate change and also, it is mostly free of risks (no flooding, no washing away of nutrients etc) in short, the farmers have control of the farming processes or activities e.g. the farmers have control of watering or water supply which makes their farms free of draught. In the same vein, there is less outbreak of disease in the northern zone due to high temperature which makes incubation of insects and pests difficult. The northern zone has less communal clashes or crises than the other zones. This makes farming activities in the zone to take place at appropriate time (no disruption in farming activities). Furthermore, the respondents in the interview concurred with the quantitative results explaining that the male farmers are more vulnerable than the female farmers because of the following: as the norms of the area requires, the male farmers who are the head of the household cater for the demand of the family which require them to expand or increase their farm size in order to increase their harvest. This expansion of land requires more inputs and capital. Also. it is the male farmers as the head of the family that provide or take care of the female farmers farming activities in terms of capital and inputs, in short it is the male farmers that bear the burden of female farmers farming work. Again, The Female Farmers are less vulnerable to

climate change because: They are mostly engaged in peasant or backyard farming which does not require much capital or inputs. Also, the inputs needed by the female farmers (mostly housewife) are in most cases supplied by the head of the household (male farmers). In terms of location, the respondents in the interview affirmed that the southern and central zones are more vulnerable to climate change because they depend more on rain fed farming which is mostly affected by changes in climatic conditions, i.e. the farming activities are controlled by nature not the farmer. In addition, communal clashes or crises are more prevalent in the southern and central zones. These clashes or crises prevent production activities at the appropriate time, besides, most of these clashes or crises take place during the farming season.

Besides, these findings have implication for food security and poverty reduction. This is because, when farmers are vulnerable to climate change, their food production will be adversely affected and this will not only reduce their incomes earned from agriculture, but also will increase the poverty level of the farming households. This, therefore call for some policy intervention.

## **5. CONCLUSION AND POLICY RECOMMENDATIONS**

The study was carried out to examine the gender and location dimension of farmers' vulnerability to climate change in Taraba State. The results of this study showed that there is gender and location dimension to farmers' vulnerability to climate change in Taraba State. For instance, male-headed farming households were more vulnerable to climate change than their female counterparts, contradiction to apriori expectation, same way climate change vulnerability varies across the different senatorial zones in Taraba State and this call for a number of policy recommendations to develop potential socioeconomic policies to be implemented by all development actors (Federal, State, NGOs and Development partners) in order to reduce the incidence, intensity and severity of climate change effect on farmers.

There is need to improve the adaptive capacity of farmers in Taraba State through the strengthening of those variables that improve adaptive capacity. Such as improving the human capacity or training of farmers, improving the income, farm size, types of building as well as encouraging membership of farmers' association/cooperative to improve strengthen their social capital. Likewise, there should be effort to reduce the sensitivity and exposure to climate change effect through some deliberate policy measures. Such policy measures could come in terms of deliberately tinkering with the land tenure system to give land access to poor rural farmers as well as financial intervention to cooperative associations. Furthermore, the result of the study is a pointer that there is need for some location-specific as well as gender-specific intervention in addressing climate change vulnerability among farmers.

Secondly, Government should provide facilities for farmers to enable them engage in dry season farming. This is because most of the farmers that are in the zone that are more vulnerable depend more on rain fed agriculture.

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## COVID-19 PANDEMIC AND SUSTAINABLE SUPPLY CHAIN MANAGEMENT IN NIGERIA

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### **ABSTRACT**

The devastating effect of the yet-to-be-resolved COVID-19 pandemic permeated all spheres of human endeavor, basically every nation across the globe is still grappling with the solution to an exit plan from the global widespread cataclysm. The climax of the epidemic led to a global shutdown of all economic transactions globally in march 2020; leading to negative economic experiences such as depression and recession by many economies. Supply Chain Management (SCM) involves the layout, organization, execution, management and monitoring of the free flow of goods (raw materials, work-in-progress and finished goods) as well as services amongst individual or organization from origin to the final consumer. Empirical evidence has shown that the outbreak of the global COVID-19 pandemic is traced to Wuhan, China in late 2019. The main objective of this study is to examine the effect of the global pandemic on sustainable supply management in Nigeria. The foremost issues this study seek to clarify includes; shutdown in traditional export/import activities, increased demurrage on un-cleared goods and reduced capacity utilization. The study will elucidate on the basic conceptualization of Supply Chain Management, COVID-19 and Sustainability; specifically, the study will adopt the Network Perspective (NP) theory to comprehensively explain Supply Chain Management concept. Qualitative research methodology was adopted in conducting the study through comprehensive personal interviews to clarify SCM issues and the use of secondary data to obtain documented information as well. The outcome of the study will form the basis of the study discussion of the findings. Based on study objective and the discussion of findings, recommendations and conclusions will be deduced to ensure that all stakeholders make adequate input to eradicate terrorism in Nigeria.

**Keywords:** Supply Chain Management (SCM), COVID-19, Sustainability and Customers.

**JEL classifications:** H51: I15: R41: Q01

## 1. INTRODUCTION

The devastating effect of any trend that could drastically distort global supply chain could never have been imagined until the outbreak of the COVID-19 pandemic. In Nigeria, the hazard caused by the epidemic on the economy is still ongoing. The fundamental platform for the movement of goods and services in the country solely relies on existing supply chain industry network; this network had seriously challenges during the COVID-19 lockdown resulting in constant rise in product prices at the consumption end. Manufacturers could easily attribute spiraling prices to: difficulty in procuring raw materials locally and internationally, distortion in the supply chain and logistic processes, inability to effectively distribute finished goods through an organized value chain system and consequential effect of COVID-19 lockdown on the downstream distribution intermediaries (wholesalers and retailers). Documented evidence traces the origin of COVID-19 to have first been discovered in Wuhan, China, (Wassenaar & Zhou, 2020; Andersen, Rambaut, Lipkin, Holmes & Garry, 2020; Gan, 2020; Wall, 2020 & Ma, 2020 & Scripps Research Institute, 2020).

According to PWC (2020) outlook on COVID-19 impact on supply chain management. the outbreak of the pandemic at the end of December 2020, resulted in some huge supply chain driven GDP losses estimated at 6 trillion, a minimum of N900 billion loss in trade and a spiraling inflationary rate of 12.9%. Supply-chain management involves the process of creating, planning, implementation, supervision and management of SCM activities with the aim at creating added value to products, encouraging competition amongst intermediaries nationally and internationally, matching demand with available supply and evaluating accomplishment with global best practices. (Kozlenkova, Hult, Lund, Mena & Kekec. 2015, Wieland & Wallenburg. 2011 and Harland. 1996). SCM process is a multidisciplinary field of endeavor embedded in diverse academic disciplines, business, technology and developmental trends and approaches such as; industrial processes, hardware /software engineering, operational/cost management, planning, purchasing, Information and Communications Technology (ICT) and marketing concepts for product services from producer to end users. (Lam, 2018 Ravindran & Warsing. 2017, Sadeghi, Mousavi & Niaki. 2016 and Sanders & Wagner, (2011).

COVID-19 was coined out from the name Corona Virus by World Health Organization (WHO), to be a 'Public Health Emergency of International Concern in January, 2 21020 (Berkeley, 2020 & Adhanom, 2020). verifiable scientific research has shown that this pandemic was first discovered in Wuhan, China, (Wassenaar & Zhou, 2020; Andersen, Rambaut, Lipkin, Holmes & Garry, 2020; Sun, He, Wang, Lai, Ji & Zhai, et al. 2020; Gan, 2020; Li, Guan, Wu, Wang, Zhou, & Tong, et al. 2020; Good & Greicius, 2020; Wall, 2020 & Ma, 2020 & Scripps Research Institute.2020). COVID-19 is scientifically confirmed to spread mostly through personal contact, sneezing, breathing, coughing and infected surfaces. measures to prevent the spread of the diseases are as follows; where cases are confirmed, the patients have to be isolated for medical attention, thorough contact tracing should be made on whoever the patient came in contact with to ensure that such persons also self-isolate from the public, (Eshiett & Eshiett 2021: Smith, Thomas, Snoswell, Haydon, Mehrotra, Clemensen & Caffery, 2020; Ohannessian, Duong & Odone, 2020; Keshvardoost, Bahaadinbeigy & Fatehi, 2020 & Ingram & Ward, 2020). Hence, once an infected patient is identified, the patient must have to self-isolate and remedial treatments are administered to the patients, it could lead to death within a period of two weeks. (Cascella, Rajnik, Cuomo, Dulebohn, & Di Napoli, 2020; Brüssow, 2020).

## **Statement of the Problem**

The upsurge in prices of goods and services experienced during the March, 2020 global lockdown was basically driven by the COVID-19 pandemic. Other countries across the globe had adjusted their supply chain system by adopting a 21<sup>st</sup> century approach which guarantees free flow of goods and services with minimal human effort or in some cases without human effort. In Nigeria, the situation was made worse by the continuous dependence on a singular seaport facility; as the existing traffic gridlock already experienced before the advent of the pandemic became worse. This study intends to suggest the need for a sustainable supply chain process that could withstand rigorous period such as the COVID -19 pandemic era. The anticipation of a sustainable supply chain approach is riddled with underlying challenges which this study intends to elucidate as follows;

The core basis of development is the adoption of new approaches, processes and methodologies that could improve the overall wellbeing of the society. The continuous dependent on traditional supply chain approaches has resulted in sub-optimal outcomes resulting in inefficiency, time wastage, pollution, reduced profitability to stakeholders and poor management of economic resources. Rather than considering sustainable approaches which integrates human impact and the preservation of the ecosystem as the product moves through the supply chain process of sourcing raw materials, production, packaging, warehousing, delivery, consumption and disposal.

Documented evidence has shown that, the landing cost of importation of goods into Nigeria is much higher than that of any Sub-Saharan African country. A critical assessment of this fact shows that; the increasing cost of imported goods is due to higher demurrage importers need to pay to the authorities due to delay in collection of imported goods. This problem is traceable to so many issues such as; bureaucratic bottlenecks, endemic corruption amongst port/security officials, obsolete infrastructures and poor management of supply chain facilities

The problem of capacity utilization is one of the bane of our supply chain system in Nigeria, most manufacturing companies are operating based on an average recorded capacity utilization of 54.58% (2009 - 2020); whereas, the normal range of capacity utilization should be between (85–100%). This has affected supply chain activities across all levels of production and distribution of goods and services Hence, the process of adopting sustainable supply chain management means; the adaptation of innovative technological infrastructural facilities and managerial approaches; that could counter the devastating effect of a COVID-19 pandemic era; and guarantee an uninterrupted supply chain process in the country.

The objective of this study is to examine the effect of COVID-19 pandemic and sustainable supply chain management in Nigeria. Other objectives to be examined by the study includes; i) the assessment of the effect of traditional supply chain approaches on sustainable supply chain management in Nigeria. ii) to examine the effect of increased demurrage on sustainable supply chain management in Nigeria and, iii) to evaluate the effect of reduced capacity utilization on sustainable supply chain management in Nigeria.

## **2. LITERATURE REVIEW**

### **Concept of Sustainable Supply Chain Management**

Sustainable supply chain management involves the consideration of human impact through the process of; (Planning, procurement, production, warehousing, distribution and disposal) as well as the effective management of environmental friendly information flow between the customer and

the supplier on one hand, and also product flow from the supplier to the supplier. This process in supply should be entrenched within the framework of accomplishing the aspirations and vision of present generation without jeopardizing the dreams of future generation. (Okhankhuele, 2020; Kumar; Teichman & Timpernagel, 2012 & Sorkin, 2021). The dynamic nature of the 4<sup>th</sup> industrial revolution has impacted tremendously on human activities as products move through the supply flow chain. This involves the application/adaptation of state of the art digital/technological and human resources in ensuring the speedy movement of products from the point of raw materials procurement, production, packaging, warehousing, distribution, consumption to the point of product waste disposal. (Lasi, Fettke, Kemper, Feld & Hoffmann., 2014; Brettel, Friederichsen, Keller & Rosenberg., 2014; Vešić & Bosch, 2016; & Klingenberg, 2017).

### **Concept of Sustainability**

The concept of sustainable development was established for the purpose of addressing the deleterious effect of human activities on the ecosystem through the process of extracting natural resources, thereby resulting in ecological damage that could jeopardize future generations from having access to these resources as well. These damages could be in the form of; destruction of human heritages and ancestral homeland; in recent years, tourist are known to involved in a forms of tourism tagged; 'Ancestry tourism' or 'Heritage Travel' this involves tourism based on DNA testing, which involves tourist visiting their supposed homeland where their ancestors are believed to have originated from, deforestation, old spillage, desertification, depletion of resources, environmental degradation and pollution that leaves behind lifelong damage to future generations (NBC News, 2019 & Hotelling, 1931). In resolving this challenge, all stakeholders could make enabling legislation which ensures that; any form of human activities affect the ecosystem should be sustainable enough to guarantee the aspiration, objectives and all-round development of future generations. (Okona, 2019; Ajibade, 2013; Pigou, 1920 & Shapiro, K, 2007).

The concept of sustainable development could as well be elucidated on the ambition of the present generation to attain a certain level of life standard, this is also premised on the social pressure the individual/group faces, based on the need to attain certain level of socio-economic status, this drive could lead to the urgent need for a comprehensive examination of the available resources within the environment be it natural or extractive (mineral resources, forest resource exploitation, aquatic resource exploitation and environmental degradation), and how it could be obtained to improve their status and empower them economically. (Hall, 2010; Tsiokos, 2007; Frew, 2008; Lemelin, Dawson & Stewart. (Eds.). 2013 & Salkin, 2007). Where tourism practices are not sustainable, it rightly fits into the terminology tagged 'Tourism of Doom', this connotes a process wherein tourism resources are threatened environmentally or by human activities such as; i) ice caps in Kilimanjaro Mountain, ii) Destruction of Religious sites and Shrines due to wars and insecurity in Syria, iii) melting of glaciers in the artic regions and eventual rise in sea levels globally and iv) depletion of the ozone layer due to greenhouse Gas emission resulting in global warming. (Gannon, Baxter, Collinson, Curran, Farrington, Glasgow, Godsman, Gori & Jack, 2017; Jafari & Scott, 2014; Biagi & Claudio, 2014; Olsen, Koster & Youroukos, 2013)

The essence of this study is to ensure that such aspirations are accomplished sustainably without harm to the ecosystem as well as denying future generations from attaining set aspirations, goals and objectives. (Al-Roubaie, 2013). In recent years, there have been reported cases of destruction of tourism sites artifacts and cultural heritages tantamount to heinous crime against humanity, (Jafari & Scott, 2014; Olsen, Koster & Youroukos, 2013). From the foregoing, the ultimate objectives of all stakeholders of tourism resources should be that of ensuring the adequate

provisions of security to safeguard the lives of tourist, properties of tourism facility owners, the environment, image of the host country and the aspirations of future generations.

### **Corona Virus Pandemic**

Corona Virus pandemic is an ongoing ubiquitous disease with its devastating effects on human society. COVID-19 was coined out from the its name Corona Virus by World Health Organization (WHO), as a ‘Public Health Emergency of International Concern (Berkeley, 2020 & Adhanom, 2020; Ajibo, Nwokoedia; & Onuoha, 2020; Hammanjoda, 2020; Ngutsav, & Ijirshar, 2020; & Okhankhuele, 2020) COVID-19 is a very contagious disease which spreads easily by; personal contacts, cough, sneezing, breathing and infected surfaces. Various scientifically recommended measures to prevent the spread of the diseases are as follows; where cases are confirmed, the patients have to be isolated for medical attention, thorough contact tracing should be made on whoever the patient came in contact with to ensure that such persons also self-isolate from the public.(Smith, Thomas, Snoswell, Haydon, Mehrotra, Clemensen & Caffery, 2020; Ohannessian, Duong & Odone, 2020; Keshvardoost, Bahaadinbeigy & Fatehi, 2020 & Ingram & Ward, 2020).

The most common diagnosis of COVID-19 is done by obtaining samples from the nasal path or saliva from the mouth or blood samples for test, results from the test are made available based on WHO published protocols and guidelines on how to mitigate the spread of Corona Virus. (Brueck, 2020, Anderson, Heesterbeek, Klinkenberg & Hollingsworth, 2020. Qualls, Levitt, Kanade, Wright-Jegede, Dopson & Biggerstaff et al. 2017 & U.S. Centers for Disease Control and Prevention (CDC), 2020). Additionally, this pandemic is also preventable with same protocols and guidelines on how best to mitigate the spread of this disease, scientifically recommended measures to prevent the spread of the diseases are as follows; where cases are confirmed, the patients have to be isolated for medical attention, thorough contact tracing should be made on whoever the patient came in contact with to ensure that such persons also self-isolate from the public.(Smith, Thomas, Snoswell, Haydon, Mehrotra, Clemensen & Caffery, 2020; Ohannessian, Duong & Odone, 2020; Keshvardoost, Bahaadinbeigy & Fatehi, 2020 & Ingram & Ward, 2020). Other preventive procedures are; the need to wear face mask in public places, constant washing of hands whenever there is contact and use of alcohol-based hand sanitizers and social distancing in crowded places. (European Centre for Disease Prevention and Control (2020).

Meanwhile, stakeholders in collaboration with WHO have been working assiduously on a more sustainable measure on how to tackle this pandemic which is the production of a clinically acceptable vaccine, Clinical researches are ongoing at various phases in lined with who program, some medical research collaborations between the duo of BioNTech and Pfizer made some breakthroughs with their medical trials resulting in the discovery of Tozinameran vaccine to be manufactured and marketed by in November, 2020 (Thomas, LaFraniere, Weiland, Goodnough & Haberman, 2020; Campbell, 2020 & European Commission, 2020). The effective rate of this medication has resulted in various countries making orders for the procurement of the vaccination for its citizens. As at the close of December, 2020, countries across the globe have drawn up programs for the vaccination of its citizens against the COVID-19 pandemic. It is quite obstinate to state at this point that, as at the time of conducting this study, apart from 100,000 doses sent to Nigeria on WHO affiliate arrangement for developing countries, the nation is yet to make appropriate arrangement for the procurement of the vaccine.

## EMPIRICAL LITERATURE

In conceptualizing sustainable effective supply chain management within the framework of a post COVID-19 pandemic era, existing empirical studies has been conducted on the as listed in Table 1 below: In a study by (Wong, Lirn, Yang & Shang. 2020, Wong, Lirn, Yang & Shang, 2020, Song, Chen & Lei, 2018 & Kaur & Singh, 2016). On SCM resilience and flexibility, Mapping, Dimensions, Robustness and Methods; (*Durach Kurpjuweit & Wagner. 2017. Kozlenkova, Hult, Lund, Wieland, Handfield & Durach, 2016; Mena & Kekec. 2015; Durach, Wieland & Machuca. 2015; Sanders & Wagner. 2011; Ketchen Jr & Hult. 2006*), SWOT analysis, (*Wieland, 2021; McKenzie, 2020; Kraude, Narayanan, Talluri, Singh & Kajiwara. 2018; & Todo, Matous & Inoue. 2016*). *Effect of pandemic on SCM*, (Paul & Chowdhury. 2020; Cyn-Young, Kim, Roth, Beck, Kang & Tayag. 2020; Aliche, Azcue & Barriball. 2020). On adaptation of blockchain in SCM, (*Durach.; Blesi; Düring & Bick; 2020; Iansiti & Karim, 2017 & Hackius, & Petersen, 2017*), qualitative approaches on energy savings, (Dey & Saha, 2018; Chen, He, Guan, Lu & Li, 2017; Sabegh, Mohammadi & Naderi, 2017; Bazan, Jaber & Zaroni, 2015; & Kumar, Teichman & Timpernagel, 2012). Other studies include, sustainable SCM, (Goncalves, 2019; Cao, Li, Yang, Liu & Qu 2018; Kaur & Singh, 2016).

These foregoing studies are quite illustrative with complete deviation from the core essence of this study which intend to fill the gap in literature on the aftermath effect of COVID-on sustainable supply chain management in Nigeria, It must be noted that the current lull in economic activities and sharp increase in prices of goods and services is COVID-19 pandemic driven, hence this study objectively considers the need to adopt a technologically driven supply chain system that guarantees a sustainable marketing approach towards uninterrupted receipt and delivery of local and imported products across the country.

## THEORETICAL FRAMEWORK – SUSTAINABILITY SUPPLY CHAIN MANAGEMENT THEORY

This theory emerged from the broad objectives of accomplishing sustainability in business potentialities, (Burgess, Singh, & Koroglu., 2006; Hall & Matos, 2010, Mentzer, Dewitt, Keebler, Soonhoong, Nlix, Smith, & Zacharia., 2001). There has been tremendous improvement in SCM researches in the last decade with wide ranges of systematic reviews in applicable theories in SCM, its effect in managerial performance, as well as ensuring sustainability impact on man and a balance on the ecosystem as product flow through the chain. (Carter & Easton, 2011, Sarkis, Zhu, & Lai., 2011; Preuss, 2009a; Seuring & Müller, 2008; Carter & Rogers, 2008; & Storey, Emberson, Godsell, & Harrison, 2006). As the chain becomes complex due to increase in activity levels, the need for augmentation of the the underlying theories becomes inevitable. (Krause, Vachon, & Klassen, 2009; & Pullman, Maloni, & Carter, 2009).

The challenge faced by SCM scholars in recent years has been the process of merging the theoretical concept of sustainability with SCM by testing and building the theory. (Ahi & Searcy, 2013 & Seuring & Müller, 2008; Colquitt & Zapata-Phelan, 2007; & Voss, Tsikirktsis, & Frohlich, 2002), in ascertaining q wider acceptability of any proposed theory; most scholars have proposed that the validity and reliability of such proposition must be backed up by empirical evidence on practical challenges within the field of study. (Alvesson & Kärreman, 2007; Colquitt & Zapata-Phelan, 2007, Hambrick, 2007, Van Maanen, Sorensen, & Mitchell., 2007). Hence the need to adopt the all amalgamated triple bottom line model of SCM posited by (Carter & Rogers 2008). which explains how firms can create competitive advantage by integrating stakeholders interest

with sustainability concerns as product/services flow down the supply chain system. Other authors also made attempt to link sustainability with SCM theories. (Pagell & Shevchenko; 2014; Winter & Knemeyer; 2013; & Sarkis, Zhu, & Lai 2011).

In essence, the triple bottom line proposition of SCM as proposed by Elkington in 2002 connotes that investors should be able to look beyond the return on their investment ROI, but should also work very hard to integrate the threefold of; economic bottom line, social bottom line and the bottom line of the ecosystem; or otherwise known as; economic responsibility, social responsibility and environmental responsibility. This will entail a comprehensive balance as product/services moves along the supply chain funnel

**Fig 1: Sustainable Supply Chain Management**



*Adapted: Sustainable Supply Chain Management conceptual model (Ageron, Gunasekaran, & Spalanzani, 2012)*

The above framework is embedded in Cater & Rogers (2008) proposition on the need for sustainable SCM to adapt the seven sustainability SCM framework based on; i) Managerial approach, ii) Performance criteria, iii) Anticipated benefits/motivation, iv) Existing barriers, v) Reasons for adopting SSM vi) Green SCM and, vii) Expected suppliers' characteristics, when firms keep to this maxim, sustainability could be said as achieved within the SCM process flow. (Brandenburg, & Rebs, 2015; Amini, & Bienstock, 2014; & Ageron, Gunasekaran, & Spalanzani, 2012).

### 3. METHODOLOGY

The study adopted a qualitative research methodology with a primary data obtained through comprehensive/ extensive interview was also conducted from; Nigerian Ports Authority Apapa, Lagos State and Onne Rivers State, Other corporate and multinational organizations with comprehensive SCM architecture/resources such as; Nestle Nigeria Plc SCM unit, Nigerian Breweries SCM unit, SAAB Miller SCM unit, Indomie Nigeria SCM unit. The essence of this interview was to collect first-hand information for the study. Additional information were obtained from secondary sources such as; periodicals, journals, books, conferences and workshops.

### 4. RESULTS AND DISCUSSION OF FINDINGS

This part of the study presents results and discussions on the key objectives of the study and how they were actualized each of the hypotheses;

#### **Sustainable SCM in Nigeria: Reforms of traditional SCM system**

The current traditional SCM processes in which products has to be routed through the process of raw materials procurement, production, packaging, warehousing, distribution, consumption and disposal is riddled with a higher percentage of inefficiency, bureaucratic bottlenecks, time wastage and error. A sustainable SCM system could mitigate these problems through an efficient process that guarantees continuous supply, enhances international collaborations, increases business

development opportunities, reduction in SCM driven environmental impact, ensure availability of necessary information. In recent years technological approaches has been adopted by countries of the world ; for example the adoption of Block-chain by Germany in 2020 to facilitate the processing and smart delivery of product services within the SCM framework has proven to be very successful.

#### **Sustainable SCM in Nigeria: Reforms of Export /Import system**

The establishment of a single operational port in Apapa, Lagos State has been the main source of traffic gridlock which has negatively impacted on man-hour wasted and its devastating effect on the nations' economic activities. The way out of this quagmire is the massive development of deep seaports across the southern coastal lines, this will end the regime of high demurrage on imported goods, increase economic activities and improve the GDP of the country. Hence, with increase in vessels berthing and discharging from the ports, this will help create employment for the unemployed in the country within the SCM value chain. Manufacturing firms' will benefit from this development since the country is heavily dependent on raw material and finished imported goods

#### **Sustainable SCM in Nigeria: Effect on Capacity Utilization**

The capacity utilization in Nigeria is estimated at 54% which is a far cry from the standardized anticipated 85 -100%. This situation has a critical negative impact on the SCM. A greater percentage of the problem lies in the existing infrastructural gap experienced in all sectors of the economy such as; roads, rail, pipelines, aviation, telecommunications, education, health. This vacuum affects the SCM system directly through delays in delivery of goods to customer from the point of production to the hinterland.

### **5. CONCLUSIONS AND RECOMMENDATIONS**

First, the supply chain must be integrated to ensure a seamless transfer of goods from producers to consumers. Also, technological adoption in supply chain processes is indispensable to the survival of the supply chain industry. Lastly, upskilling of supply chain participants is critical at a time like this. For technological adoption to aid risk absorption in the supply chain industry, the people involved must be upskilled and equipped technology-wise.

Reacting to the effect of COVID-19 on the supply chain industry, participants across the value-chain have adopted efficient measures geared at sustaining production and delivery to final consumers. Some of the innovative measures include the use of technology to take up orders from customers, strategic partnerships between producers, intermediaries and delivery companies, innovative management of inventory to avoid stock-out, etc. Most of these measures have proved to be effective and should be maintained going forward.

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