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The Impact of Climate Change on the Nigerian Economy

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ABSTRACT

This paper examined the impact of climate change on the overall growth of the Nigerian economy. The ordinary least squares (OLS) estimation technique and data for the period 1981-2014 were used. Changes in annual rainfall, carbon emission and forest depletion were used to capture climate change, while changes in government expenditure, domestic private investment and exchange rate were used as control variables. The results indicate that both in the long-run and short-run, carbon emissions affect growth adversely. In addition, forest depletion impacts negatively on growth in the short-run. These results imply that Nigerian government should evolve and implement policies to curb carbon emissions and forest depletion. In particular, a National Climate Change Commission is required in Nigeria to deal with all climate change issues. Furthermore, the finding that domestic private investment and naira-to-dollar exchange rate impede growth in Nigeria means that policymakers and governments at all levels in Nigeria should evolve and implement policies to reverse these undesirable outcomes.

Keywords: Climate Change, Economic Growth, Ordinary Least Squares, Nigeria
JEL Classifications: Q25, O40, C22, N17

1. INTRODUCTION

Climate change has been described as a statistical variation that persists for an extended period, typically for a decade or longer. It includes shift in the frequency and magnitude of sporadic weather events as well as the slow but continuous rise in global average surface temperature (Intergovernmental Panel on Climate Change [IPCC, 2001]). The German advisory council on climate change noted that climate change is a threat already having substantial impact on human beings and the natural eco-system both in developed and developing countries but at varying degrees (German Advisory Council on Global Change [WBGU, 2003]). For the developed countries, the impact of climate change has been perceived to be less severe due to natural advantage, high adaptation techniques, high technology, mechanized agricultural system and wealth status. These factors have enabled the developed economies to curtail the adverse effects of climate change. For developing countries like Nigeria, the impact of climate change is of great importance given the high temperature level, poor adaptation capacity, and lack of early warning system.

Apart from the above, climate change affects economies whose economic activities are natural resource sensitive such as agricultural activities. Unfortunately, some aspects of the existing literature show that climate change may lead to significant reductions in agricultural productivity in developing countries (McGuigan et al., 2002). Indeed, the effect of climate change on agricultural activities can be viewed from various aspects. Climate change affects the distribution of rainfall and temperature during a year and this determines crop yields especially those crops cultivated under rain-fed conditions (Thurlow et al., 2009). Excessive rainfall leads to destruction of arable land, impairment of cultivated crops, increased growth of weeds and greater post-harvest loss while a significant reduction in rainfall may culminate in drier land, reduction in water level in streams and rivers, increase in farmers' search for water for irrigation and consequently resulting in invaluable man hour losses and reductions in crop yield (Ozor, 2009). Climate change also affects livestock production due to reduction in the available pasture land, reduction in surface water resources for animals, increase in salinity of water resources for animals, increase in salinity at watering points due to increased temperature and evaporation in the face of reduced rainfall. This implies that there would be a decline in the production of livestock, resulting in a reduction in the supply and availability of animal protein including meat, egg, milk and other animal produce such as hides and skins (Ozor, 2009).

In Nigeria, climate change also affects forestry due to erosion and excessive wind thereby resulting in decline in forest produce such as wood and cane. Consequently, it leads to reduction in forestry produce and low income, as well as an increase in the costs of building and furniture materials. Onuoha (2009) estimated the cost of deforestation and losses in non-timber forest products in the last 5 years in Nigeria at N120 billion per year, which is equivalent of 1.7% of gross domestic product (GDP) in 2003. Obviously, climate change portrays a potential threat to the composition of agricultural output in particular and to aggregate national output in general.

In 2012, Nigeria adopted its Climate Change Policy Response and Strategy (CCPRS) to ensure an effective national response to the multi-facetted impacts of climate change. The main goals of the CCPRS include: Implementation of mitigation measures that will promote low carbon as well as sustainable and high economic growth; enhancement of national capacity to adapt to climate change; raising climate change related science, technology and research and development to a new level that will enable the country to better participate in international scientific and technological cooperation on climate change; significantly increase public awareness and involve private sector participation in addressing the challenges of climate change; strengthen national institutions and mechanisms (policy, legislative and economic) to establish a suitable and functional framework for climate change governance. The National Adaptation Strategy and Plan of Action for Climate Change Nigeria (NASPA-CCN) describes the adaptation priorities, bringing together existing initiatives and priorities for future action. The NASPA-CCN vision is a Nigeria in which climate change adaptation is an integrated component of sustainable development, reducing the vulnerability and enhancing the resilience and adaptive capacity of all economic sectors and of all people to the adverse impacts of climate change, while also capturing the opportunities that arise as a result of climate change.

It is the goal of this study to examine the impact of climate change on economic growth in Nigeria. To achieve this goal, the paper used ordinary least squares (OLS) estimation technique and data for the period 1981-2014. Changes in annual rainfall, carbon emission and forest depletion were used to capture climate change, while changes in government expenditure, domestic private investment and exchange rate were used as control variables in order to obtain robust estimation. The results indicate that both in the long-run and short-run, carbon emissions affect output growth in Nigeria adversely. In addition, forest depletion impacts negatively on national output growth in Nigeria in the short-run. These results imply that Nigerian government should evolve and implement policies to curb carbon emissions and forest depletion. In particular, a National Climate Change Commission (NCCC) is required in Nigeria to deal with all climate change issues. Furthermore, the finding that domestic private investment and naira-to-dollar exchange rate impede output growth in Nigeria means that policymakers and governments at all levels in Nigeria should evolve and implement policies to reverse these undesirable outcomes.

2. AN OVERVIEW OF THE LITERATURE

Two theoretical perspectives are particularly relevant towards our understanding of the phenomenon of climate change, namely the Anthropogenic Global Warming (AGW) hypothesis and the standard theory of externalities. The UK Met Office (1998) describes the AGW hypothesis as the first theory of climate change, which contends that human emissions of greenhouse gases, principally carbon dioxide (CO_2), methane, and nitrous ox-ide, are causing a catastrophic rise in global temperatures. The mechanism whereby this happens is called the enhanced greenhouse effect. Energy from the sun travels through space and reaches the earth. The earth's atmosphere is mostly transparent to the incoming sunlight, allowing it to reach the planet's surface where some of it is absorbed and some is reflected back as heat into the atmosphere. Certain gases in the atmosphere, called "green-house gases," absorb the outgoing reflected or internal thermal radiation, resulting in earth's atmosphere becoming warmer than it otherwise might be. Water vapor is the major greenhouse gas, responsible for about 36-90% of the greenhouse effect, followed by CO_2, methane, and ozone. During the past century, human activities such as burning of wood and fossil fuels as well as burning of forests are thought to have increased the concentration of CO_2 in the atmosphere by approximately 50%. Proponents of the AGW theory believe that man-made CO_2 emission is responsible for floods, droughts, severe weather, crop failures, species extinctions, spread of diseases, ocean coral bleaching, famines, and literally hundreds of other catastrophes. According to them, all these disasters will become more frequent and more severe as temperatures continue to rise so that only large and rapid reductions in human emissions will save the planet from these catastrophic events.

Like other environmental problems, climate change involves externality, for instance, the emission of greenhouse gases causes damages to other economic agents for which they are not compensated by the agent responsible for the emission. The standard theory of externalities points to one of taxation of the emitter equivalent to marginal social cost of the externalities generated by it. But where there is weak representation of those most affected, coupled with long-term horizons, a global scale major uncertainties, and important interactions with other market failures, then resolving the externality problem can be quite complex. Hence, while the standard theory can provide useful initial insights, there is a much deeper and more complex economic policy problem. There is a problem of intertemporal international collective action with major uncertainty and linked market failures.

Empirical studies have also confirmed that climatic change can have substantial impacts on the overall economy. In Ethiopia, Gebreegziabher et al. (2011) examined the economic effect of climate change on agriculture productivity using a countrywide computable general equilibrium (CGE) model. The study observed that the impact of overall climate change will be relatively benign until approximately 2030, and thereafter worsen considerably. Further, the simulation results showed that, over a 50-year period, the projected reduction in agricultural productivity may lead to about 30% less average income, compared with the possible outcome in the absence of climate change. Using descriptive analysis, Ozor (2009) demonstrated the processes that lead to climate change so as to enable a better understanding of the concept. The study described in details the impacts of climate change on various issues of national development such as low agricultural productivity, food insecurity, resource conflicts, unemployment, environmentally-induced migration, livelihood problems and health issues. The study also noted that these impacts are as a result of devastating effects of flooding, drought, erosion, desertification, sea level rise, heat stress, pests and diseases, and erratic rainfall patterns, arising from climate change. The study further suggested the need for climate policy in Nigeria, the establishment of NCCC, the development of a national framework for climate change adaptation, and the embracing of emerging technologies.

Onuoha (2009) examined the threats posed by climate change across the globe with particular reference to developing countries, where agriculture is a dominant sector and in turn depends on weather and climate. The study utilized the sustainable development model in the form of the Green Wall Sahara Nigeria Program as a strategy for greening the drought-prone and desert infested areas of Northern Nigeria. The study concluded that the challenges of climate change to economic growth and sustainable development in Nigeria require creative thinking, holistic ideas, innovative solutions and the involvement of all stakeholders. Agwu and Okhimamhe (2009) conducted two studies on the gender dimensions of climate change in North-Central and South-Eastern Nigeria. The North-Central study assessed the impact of climate change on the Zumba and Augie Communities in Niger and Kebbi states respectively. It highlighted the challenges and adaptation strategies of the selected communities. The study observed that communities had noticed climate change but failed to identify its causes. Some of the women in these communities attributed the climate change such as environmental degradation to the construction of the Shiroro dam and the resulting massive deforestation. Less scientifically, Augie women believed that the flood waters from Bakolori and Goronyo dams which destroyed their farms and affected the health of their people were calamities inflicted by the gods. Again, the women accepted that they had contributed to deforestation in their search of fire wood which led to the disappearance of many plant and animal species. Although these resilient communities have put various adaptation measures in place, they were not primarily targeted at reducing the impact of climate change. The study finds that Augie community is already practicing a number of coping strategies and requesting for assistance to strengthen them. Specifically, the stakeholders of the community requested for funding, awareness campaigns and capacity building. In Zumba, awareness campaigns are also needed to address traditional beliefs. The second aspect of the study focused on two South-eastern communities, namely: Enugwu Nanka in Anambra State and Akama Amankwo Ngwo in Enugu State. The study revealed that the impacts of climate change in South-Eastern Nigeria include the destruction of shelter (both human and animal), arable farmlands, access roads and economic trees by landslides and tornadoes. Climate change is also responsible for excessive heat, heightened insect activity and the drying up of streams. The study concluded that while ingenious adaptive and mitigation strategies developed by women were found in the sample states, better policy making to combat climate change is urgently needed.

Zhai et al. (2009) examined the long-term potential effect of global climate change on agricultural production and trade in the People’s Republic of China. Utilizing an economy-wide, global CGE model as well as simulation scenarios of how global agricultural productivity may be affected by climate change up to 2080, the study suggested that with a declining share of agriculture in GDP, the impact of climate change on the overall macro economy may be moderate. In Sri Lankan, Seo et al. (2009) analyzed the effect of climate change on agriculture productivity using the Ricardian method. The model analyze the net revenue per hectare for four most important crops (namely rice, coconut, rubber, and tea) in the country. The study focused more on the precipitation effect on crop production due to the greater range of precipitation across the country although the limited range of temperature variation allowed only a simple test of temperature impacts in the study. The study finds that the effects of increase in precipitation are predicted to be beneficial to all crops tested and the benefit ranged from 11% to 122% of the current net revenue of the crops in the model. On the other hand, the impacts of increase in temperature were predicted to be injurious to the economy and the loss ranged from −18% to −50% of the current agricultural productivity.

Barrios et al. (2004) examined the impact of climatic change on the level of total agricultural production of Sub-Sahara Africa (SSA) and non-SSA (NSSA) developing countries. The study utilized a new cross-country panel climatic dataset in an agricultural production framework. The findings of the study revealed that climate change, measured as change in country-wide rainfall and temperature has been a major factor influencing agricultural production in SSA while in NSSA countries agricultural production seems not to be affected by climate change. In addition, simulations using the estimates suggest that the detrimental changes in climate since the 1960s can account for a substantial portion of the gap in agricultural production between SSA and the rest of the developing world. Umar (2008) noted that the effects of global warming and climate change in Nigeria are currently of concern to governments, institutions, environmentalists and firms. They noted that the effects of climate change in the country generally manifests as shifting weather variations or patterns involving unprecedented and overall changes in weather patterns, excessively heavy precipitation, unusual high temperature, propelling significant changes in different parts of the country, rising sea levels, disappearance of the coastal strips and noticeable increases in the frequency of some extreme weather events in the country. The study concluded by recommending that governments have a big role in disseminating information on the potential and actual impacts of climate change as well as on forecast impacts on agriculture, water resources and diseases.

Efe (2009) studied the threat of climate change to food security and livelihoods in selected states in Nigeria, while Ubachukwu (2005) examined the effects of climate change on food productivity in the Niger delta. They find that climate change impacts significantly on all aspects of crop yields, availability of seeds, and access and utilization of foods. They noted that there were decreases in crop yields due to decreases in temperatures in the study areas and that most of the farmers had low level of awareness on the dangers of climate change. Efe (2008) highlighted the implications of climate change-induced variability's on food security and livelihoods and recommended that management issues raised by the study be translated into decision and policy making by stakeholders in order to ensure food security in northern Nigeria. Njoku (2006) discovered a downward trend in rainy days per annum in Sokoto and Kano, with Kaduna having only a slight reduction in its rain day per annum. This observed climate change induced variability was found to have a negative effect on annual crop yields. The study also found that a decrease in food crops availability occurred as rainfall and temperatures decreased in the study areas. Okoli (2008) finds that most of the environmental consequences of climate change manifest as physical changes such as sea level rises, higher local temperature and changes in rainfall pattern. Odjugo (2005) also studied the effects of climate change on the socio-economic development of Nigeria, and finds that climate change and existing climatic variability will have harsh effects on the low-income and marginalized poor people in Nigeria and will, in addition, make the process of eradicating poverty more difficult because of the negative effects of climate change on economic growth, poor people's livelihoods and assets and the level of risks to which the people are exposed.

Nwafor (2007) notes that a common theme in the climate change vulnerability literature is the idea that countries, regions, economic sectors and social groups differ in their degree of vulnerability to climate change. This is partly due to the fact that changes in temperature and precipitation occur unevenly and that climate change effects on resources and wealth are distributed unevenly across the globe. Onuoha (2008) extended these observations by adding that unless appropriate mitigation measures are adopted to reduce vulnerability in Nigerian and other developing countries of sub Saharan Africa, climate change portends grave danger not only to the people but also to the biotic and abiotic environments. The study expressed concern that all developmental advances witnessed in sub Saharan Africa may be destroyed or reversed over a short period of time unless the effects of climate change are urgently tackled.

3. METHODOLOGY AND DATA

This study adopted the OLS method, which gives consistent estimates when the regressors are exogenous, and optimal in the class of linear unbiased estimation methods when the stochastic disturbances are homoscedastic and serially uncorrelated. The baseline model for the study is stated as follows:

$$GDP_t=\beta_0+\beta_1 ARF_t+\beta_2 FDL_t+\beta_3 CEM_t+\beta_4 GEXP_t+\beta_5 PINV_t+\beta_6 REXR_t+\varepsilon_t \quad (1)$$

Where,

GDP = gross domestic product, measured in millions of naira (measure of overall economic activities in the Nigerian economy), ARF = average total annual rainfall (millimetres per year), FDL = forest depletion (% of GNI), CEM = carbon emission (kt), GEXP = government expenditure (measured in millions of naira), PINV = domestic private investment (proxied by real gross fixed capital formation), measured in millions of naira, REXR = average official exchange rate (naira to dollar), β_0 = intercept, β_1-β_6 are the partial slope coefficients, and ε_t = stochastic error term. This study captured climate change using climatic factor such as rainfall, forest depletion, and carbon emission. In order to obtain robust estimation, government expenditure, private investment and exchange rate are introduced as control variables. The data for GDP, annual rainfall, government expenditure, and exchange rate were obtained from the 2014 Central Bank of Nigeria Statistical Bulletin; the data for forest depletion and carbon emission were obtained from the World Bank; while the data for domestic private investment was obtained from index mundi. The data were logged and examined for their time series properties, while the model was also examined to ensure that the underlying assumptions are adequately satisfied.

4. RESULTS AND DISCUSSION

The empirical analysis began with the examination of the data for its time series properties. The results of the unit root tests are shown in Table 1. The results indicate that all the series are I(1), except annual rainfall. This suggests that the variables may be cointegrated, since the dependent variable (GDP) has the same order of integration with majority of the regressors. Indeed, we conducted the cointegration test using the residual approach. The result, which is shown in Table 2, indicates that the residual is stationary at level, thereby confirming the existence of an equilibrium relationship between the variables. As a robustness

Table 1: Unit root test results

Variable	ADF	Phillips-Perron	Result
GDP	I (1)	I (1)	I (1)
ARF	I (0)	I (0)	I (0)
CEM	I (1)	I (1)	I (1)
FDL	I (1)	I (1)	I (1)
GEXP	I (1)	I (1)	I (1)
PINV	I (1)	I (1)	I (1)
REXR	I (1)	I (1)	I (1)

I (0) and I (1) denote stationary at level and after first difference, respectively. The unit root tests were performed at 5% level controlling for trend and intercept for GDP, GEXP and REXR and controlling for only intercept in other cases. All variables are in their natural log transformation, GDP: Gross domestic product, ADF: Augmented Dickey-Fuller check, we also conducted the Johansen cointegration test and the results are shown in Table 3. While the Trace test indicates the existence of at least 4 cointegrating equations, the Max-Eigen test shows the existence of at least 3 cointegrating equations. All told, both tests confirm the existence of cointegrating relationship between the variables.

Following the establishment of an equilibrium relationship between the variables, we estimated the long-run relationship of equation 1. The results are shown in Table 4. We summarize the main findings as follows. First, out of the three climate change variables in this study, only carbon emission impacts negatively on the overall output growth of the Nigerian economy. This suggests that Nigerian government must evolve and implement policies that will reduce the amount of carbon emission in the country, especially those coming from the consumption of fossil fuels and gas flaring. Second, the impacts of rainfall and carbon emission are statistically significant at the 5% level. This shows that these climate change variables are important in Nigeria. Third, contrary to expectation, the impact of forest depletion is positive, though it is not statistically significant. This may be due to inadequacies in documenting forest depletion activities in Nigeria. Consequently, this study will favor the continuation of efforts towards forest conservation in Nigeria. Fourth, all the control variables conformed to theoretical expectations, except for domestic private investment. While government expenditure impacts positively and significantly on output growth at the 1% level, both private investment and exchange rate impact negatively and significantly on output growth at the 5% level. This suggests that the existing levels of private investment in the economy may not be adequate to drive growth.

The diagnostic checks indicate that the underlying assumptions of the model have been substantially satisfied. The adjusted R^2 shows that the regressors have adequately accounted for the variations in the dependent variable. The F-statistics, which is strongly significant at the 1% level, shows that the model as a whole is meaningful. The Durbin-Watson Statistic which is approximately 2 is in line with theoretical expectation. Even though the Breusch-Godfrey Test indicates the presence of residual serial correlation problem at the 5% level, we corrected this problem using the Newey-West HAC method such that the validity of all the reported standard errors is fully restored. The Breusch-Pagan-Godfrey test shows that there is no problem of Heteroscedasticity in the results. The Jarque-Bera statistic shows that the residual is normally distributed, in line with theoretical expectations. Overall, the model assumptions are adequately fulfilled.

To account for the short-run relationships, we estimated an error correction model and the results are shown in Table 5. We find that unlike the long-run results, the coefficient of forest depletion is negative, even though it is still not statistically significant even at the 10% level. We find that the impact of rainfall decreased from 17% in the long-run to 10% in the short-run, though it remained positive and statistically significant in both cases, at least at the 10% level. We find that the impact of carbon emission remained largely stable both in the long-run and short-run. Again, the impacts of the control variables remain qualitatively the same as in the long-run. The diagnostic checks also indicate the model has adequately satisfied its underlying assumptions. In particular, the error correction term has a negatively sign and statistically significant at the 1% level in line with theoretical postulations.

Table 2: Testing the residual for unit root

Variable	Augmented Dickey-Fuller Test Statistic	1% Critical value	5% Critical value	Probability value
Residual	−6.339649	−3.646342	−2.954021	0.0000

The residual is stationary at 1% level of significance

Table 3: Johansen cointegration test results

Hypothesized number of CE (s)	Trace statistic	5% critical value	P value	Hypothesized number of CE (s)	Max-Eigen statistic	5% critical value	P value
None*	218.0508	150.5585	0.0000	None *	56.8722	50.5999	0.0099
At most 1*	161.1786	117.7082	0.0000	At most 1 *	51.3355	44.4972	0.0078
At most 2*	109.8431	88.8038	0.0007	At most 2 *	43.1871	38.3310	0.0128
At most 3*	66.6560	63.8761	0.0286	At most 3	30.1416	32.1183	0.0855
At most 4	36.5144	42.9153	0.1881	At most 4	18.4764	25.8232	0.3418
At most 5	18.0380	25.8721	0.3414	At most 5	11.7789	19.3870	0.4360
At most 6	6.2592	12.5180	0.4281	At most 6	6.2592	12.5180	0.4281

Note: The * indicates that the Trace statistic or the Max-Eigen statistic is greater than the corresponding 5% critical value.

Table 4: Robust long-run estimation results (dependent variable=GDP)

Variable	Coefficient	Diagnostic checks	
Constant	−3.71***	Adjusted R^2	0.99
ARF	0.17**	F-statistic	842.44***
CEM	−0.22***	Wald F-statistics	4191.52***
FDL	0.01	Durbin-Watson Statistic	2.22
GEXP	0.84***	Breusch-Godfrey Test [observed Chi-square]	8.62**
PINV	−0.35***	Breusch-Pagan-Godfrey Test [observed Chi-square]	6.89
REXR	−0.14**	Jarque-Bera statistic	0.21

The reported standard errors are Newey-West corrected standard errors. *** denotes significance at 1% level, ** denotes significance at 5% level, while * denotes significance at 10% level, respectively. Breusch-Godfrey test and Breusch-Pagan-Godfrey test are the standard tests for autocorrelation and Heteroscedasticity, respectively, GDP: Gross domestic product

Table 5: ECM estimation results (dependent variable=D[GDP])

Variable	Coefficient	Diagnostic checks	
Constant	0.05	R^2	0.59
D (ARF)	0.10*	Adjusted R^2	0.48
D (CEM)	−0.21*	F-statistic	5.29***
D (FDL)	−0.05	Durbin-Watson Stat	1.75
D (GEXP)	0.76***	Breusch-Godfrey test [observed Chi-square]	1.91
D (PINV)	−0.30***	Breusch-Pagan-Godfrey test [observed Chi-square]	10.56
D (REXR)	−0.29***	Jarque-Bera statistic	1.62
ECM(−1)	−1.09***		

***,** and * denote significance at 1%, 5% and 10% levels; respectively. ECM is residual from long-run model estimation. Breusch-Godfrey test and Breusch-Pagan-Godfrey test are the standard tests for autocorrelation and Heteroscedasticity, respectively, GDP: Gross domestic product

5. CONCLUSION AND POLICY IMPLICATIONS

This paper examined the impact of climate change on economic growth in Nigeria. The paper used OLS estimation technique and data for the period 1981-2014. Changes in annual rainfall, carbon emission and forest depletion were used to capture climate change, while government expenditure, domestic private investment and exchange rate were used as control variables in order to obtain robust estimation. The paper estimated an error correction model in order to account for both long-run and short-run relationships. The results indicate that both in the long-run and short-run, carbon emissions affect output growth in Nigeria adversely. In addition, forest depletion impacts negatively on national output growth in Nigeria in the short-run. These results imply that Nigerian government should evolve and implement policies to curb carbon emissions and forest depletion. In other words, government intervention is required to reduce carbon emissions, especially those emanating from gas flaring, bush burning, deforestation, and fossil fuels consumption. Government should evolve policies to encourage the use of environmental-friendly equipment, machines, infrastructure, and technologies that generate minimal greenhouse gases, such as improved road and rail transport as well as use of bio-fuels and energy saving devices. A NCCC is obviously required in Nigeria to deal with all climate change issues. Furthermore, the finding that domestic private investment and naira-to-dollar exchange rate impede output growth in Nigeria implies that policymakers and governments at all levels in Nigeria should evolve and implement policies to reverse these undesirable outcomes.

REFERENCES

Agwu, J., Okhimamhe, A. (2009), Climate Change, Its Impacts and Adaptation: Gender Perspective from the Northern and Eastern Nigerian. Available from: http://www.ng.boell.org/downloads/Gender_Climate_Change_in_Nigeria.pdf. [Last accessed on 2017 Jan 03].

Barrios, S., Ouattara, B., Strobl, E. (2004), The Impact of Climatic Change on Agricultural Production: Is It different for Africa? MPRA Paper No. 6240.

Efe, S.I. (2008), Climate Change: A Challenge to my Generation. Being a Paper Presented at a Conference Organized by the Nigerian International Secondary Schools Model United Nation (Nissmun) Club of Infant Jesus Academy, Held on July 5th, 2008, at Infant Jesus Academy, Asaba. p2-13.

Efe, S.I. (2009), Climate change and food security in African: Delta state Nigeria experience. In: Anyadike, R.N.C., Madu, L.A., Ajaero, C.K., editors. Conference Proceeding on Climate Change and the Nigerian Environment, Nsukka, 29 June-2 July; 2009. p105-126.

Gebreegziabher, Z., Stage, J., Mekonnen, A., Alemu, A. (2011), Climate Change and the Ethiopian Economy: A Computable General Equilibrium Analysis. Environment for Development, Discussion Paper Series, EfD DP 11-09.

German Advisory Council on Global Change (WBGU). (2003), Climate Protection Strategies for the 21st Century: Kyoto and Beyond. Special Report. Berlin, Germany: WBGU. p1.

IPCC. (2001), Impact, Adaptation and Vulnerability. Contribution of Working Group II of the Intergovernmental Panel on Climate Change to the Third Assessment Report of IPCC. London: Cambridge University Press.

Mcguigan, C., Reynolds, R., Wiedmer, D. (2002), Poverty and Climate Change: Assessing Impacts in Developing Countries and the Initiatives of the International Community. London: School of Economics Consultancy Project for the Overseas Development Institute.

Njoku, J.D. (2006), Analysis of the Effect of Global Warming on Forests of Southeastern Nigeria Using Remotely-sensed Data. Unpublished PhD Dissertation, Department of Geography and Environmental Management. Owerri: Imo State University.

Nwafor, J.C. (2007), Global Climate Change: The Driver of Multiple Causes of Food Insecurity in Sub Saharan Africa. Paper Presented at the International Conference on Climate Change and Economic Sustainability. Awka: Nnamdi Azikiwe University, 12-14 June, 2007.

Obeta, M.C. (2014), Review of studies on clobal warming and climate change in Nigeria. IOSR Journal of Engineering, 4(10): 19-27.

Odjugo, P.A.O. (2005), An analysis of rainfall pattern in Nigeria. Global Journal of Environmental Science, 4(2), 139-145.

Onuoha, C.M. (2008), Understanding climate change in Africa economies. The Green Economist-International Journal of the Green Economics, Institute, UK, 3(2) Autumn. Available from: http://www.greeneconomics.org.uk.

Onuoha, C.M. (2009), Climate Change and Sustainable Development in Nigeria: The Mitigating Role of Green Wall Sahara Nigeria Programme. African Institute for Applied Economics (AIAE), Enugu Forum Policy Paper 10.

Ozor, N. (2009), Implications of Climate Change for National Development - The Way Forward, African Institute for Applied Economics (AIAE), Enugu Forum Policy Paper 10.

Seo, S.N., Mendelsohn, R., Dinar, A., Hassan, R., Kurukulasuriya, P. (2009), A Ricardian analysis of the distribution of climate change impacts on agriculture across agro-ecological zones in Africa. Environmental and Resource Economics, 43, 313-332.

Thurlow, J., Zhu, T., Diao, X. (2009), The Impact of Climate Variability and Change on Economic Growth and Poverty in Zambia. IFPRI Discussion Paper 00890. Washington, DC: International Food Policy

Research Institute, Development Strategy and Governance Division, and Environment and Production Technology Division.

Ubachukwu, N.N. (2005), Climate and Agriculture in Northwestern Nigeria. Unpublished B.Sc. Project. Nsukka: University of Nigeria.

UK Met Office. (1998), Easter 1998 Floods. Available from: http://www.metoffice.gov.uk/climate/uk/interesting/easter1998. [Last accessed on 2017 Jan 03].

Umar, A.T. (2008), Global Warming and the Millennium Development Goals (MDGS) in Nigeria: A Way Forward. Paper Delivered at the 5th Annual Conference of the Association of Nigerian Geographers (ANG) at the University of Calabar, 25th-28th August. p47-55.

Zhai, F., Lin, T., Byambdorj, E. (2009), A general equilibrium analysis of the impact of climate change on agriculture in the people's Republic of China. Asian Development Review, 26(1), 206-225.