IJAAR PUBLISHING®

West African Journal of Interdisciplinary Research | ISSN: 3027-1878
Volume 3, Issue 4 (2025) | www.ijaar.org

# ANALYSIS OF DYNAMIC INTERACTION AMONG CLIMATE CHANGE, HUMAN HEALTH AND ECONOMIC GROWTH IN NIGERIA

[1]ONI SUNDAY GBENGA, [2]Dr. Owonbo Paul and [3]Akinrinade S. A.
[1]Department of Technical Education
School of Vocational and Technical,
E-mail: sgooni@ossceila.edu.ng
[2]Department of Agricultural Economics, University of Science and Technology Okitipupa, Ondo State
[3]Department of Mathematics, Osun State College of Education Ila-Orangun

## ABSTRACT

*The study was undertaken to determine the dynamic relationship among climate change, human health and economic growth in Nigeria. The study made use of secondary data was sourced from different publications and data centres. Data on real gross Domestic Product, life expectancy, local carbon dioxide emissions, urbanization and food production were sourced from the World Development Indicators of the World Bank. Data were analysed using descriptive statistics and Vector Autoregressive (VAR) model. The study concluded that a dynamic relationship existed among climate change, human health and economic growth. The study recommends that for human health to improve economic growth in Nigeria, government should adopt measures to augment life expectancy in order to improve the health status of the Nigerian populace.*

**Keywords**: Analysis, interaction, climate change, human health and Economic growth

## ACKNOWLEDGEMENT

We are grateful to TETFUND for funding this research



Gbenga, O. S., Owonbo, P. & Akinrinade, S. A. (2025). Analysis of Dynamic Interaction Among Climate Change, Human Health and Economic Growth in Nigeria. *West African Journal of Interdisciplinary Research. 3*(4), 30-44. DOI: https://doi.org/10.5281/zenodo.17768774

## INTRODUCTION

There is no doubt that Nigeria is a reflection of the sub-optimal economy with poor portable water, poor health care delivery and unhygienic environment (Okonjo-Iweala, 2004) is susceptible to the consequences of climate change which impede meaningful growth. Moreover, studies have shown that no meaningful developmental goals can be achieved as long as anthropogenic climate change is not controlled (McMichael, 2009 and Mawle, 2010). For instance, a country with high incidence and prevalence of disease has a Gross Domestic Product (GDP) that is five times lower than that of a country that does not have these negative incidences (Gallop and Sachs, 2001). According to Ajayi (2013), agriculture employs 70 per cent of Nigerian population, besides contributing about 41 per cent to Gross Domestic Product, in addition to accounting for 5 percent total export and 88 percent of non oil earnings. In spite of this huge contribution of agriculture to the economy, sustainability of and improvement on agricultural sector productivity have been difficult, as unpredictable weather patterns induce farm abandonment for non-farm activities, causing monumental reduction in food production which is vital for human health sustainability (Apata *et al.*, 2009). This suggests that unpredictable weather condition can also be inimical to vocational engagements and cause unproductive resource allocation across sectors in the economy. Consequently, all these upshots and resultant health challenges might even lead to deaths; thereby reducing the labour force and untimely lowering the general productivity of an economy. Therefore, to achieve any meaningful development goals in Nigeria, reducing the impact of climate change on human health is a crucial issue that the economy cannot afford to overlook. Accordingly, this study will examine the long-run effect of climate change on human health. In essence, if economic growth and development are to be stimulated, human health is a requisite condition (Haines *et al.*, 2016 and Dube and Chimbari, 2014). Prior medical and meteorological studies have explored the relationship between climate change and human health status; as well as made use of mostly descriptive statistics method of analysis (see Darwin and Tol, 2001; Kovats *et al.*, 2003; Van Liesshout *et al.*, 2004; Haines *et al* ., 2016; Eriksson, 2008; Nwoke *et al.*,2009; Hutton, 2011). Also, there are studies on human health and economic growth (see Bloom *et al.*, 2004); Bloom and Canning, 2008; Peykarjou *et al.*, 2011; Ogungbennle *et al.*, 2013. Researchers have also investigated the relationship between climate change and economic growth (see Fankhauser and Tol, 2005; Dell *et al.*, 2008; Mendelsohn, 2009; Rahman *et al.*, 2009; Roson and Van der Mensbrugghe, 2010). However, extent studies that have looked into the dynamic relationship among these tripartite – variables-climate change, human health and economic growth are not only sparse and inconclusive, but are also mostly cross-country analysis which might not account for their country specific peculiarities, especially for a country like Nigeria.

For instance, studies on Europe revealed that the old are more vulnerable to health hazard of climate change, contrariwise, in India, the impact of climate change was more extensive on children between the age of zero and fourteen years (Haines *et al.*, 2016; Mandal, 2008). Equally, some studies have it that the global effect of climate change is little while other studies argue otherwise (Mendelsohn, 2009; Eboli *et al.*, 2009; Roson and Van der Mensbrugghe, 2010; Woodward *et al.*, 1998; Hardee and Mutunga, 2009). Thus, it becomes apropos to carry out a critical survey of the relationship among climate change, human health and economic growth in Nigeria. This is with a view to examining the link among the trio, besides assessing the consequences of the prevalent climate change on human health, including how the emissions of carbon dioxide vary climate conditions in Nigeria, and subsequently reduce the impact of climate change on human health in Nigeria, cum economic growth via improved economic policies.

Meanwhile, this study clearly departs from studies that adopted descriptive statistics or Computable General Equilibrium (CGE) economic model to predict changes in climate and its values, as Ackerman *et al.* (2001) made it clear that CGE models do not empirically achieve the expected result in environmental reviews, as they generate incorrect forecast. Moreover, the economic theory underlying CGE models is controversial and their techniques are defective for dynamic analysis. Hence, this study will add to knowledge by employing both descriptive and inferential statistics analyses; precisely, graphs and Vector Autoregressive (VAR) econometric technique which are most appropriate for dynamic analysis (Lutkepohl, 2005).

**Research Questions**

This study intends to answer the following pertinent questions:

i. What is the profile of climate change, human health and economic growth in Nigeria?
ii. What is the dynamic interaction among climate change, human health and economic growth in Nigeria?

**Research Objectives**

The main objective of this study is to empirically analyse the dynamic relationship among climate change, human health and economic growth in Nigeria.

**Empirical Models**

As earlier stated, this research study will specify its models by adopting the relevant variables expounded in the conceptual framework. It follows that anthropogenic carbon dioxide emissions can cause climate change; climate change impairs human health both directly and indirectly and impaired human health in turn results in low productivity of labour and ultimately decline in economic growth. Poor health (poor physical and mental capabilities) reduces workers' productivity, as they both physically and mentally destabilised.

The health damage of climate change induced by air pollution causes economic loss (market impact) and also reduces people's happiness (non-market impact). The importance of the link from $CO_2$ to climate change; from climate change to human health and from human health to labour productivity and economic growth cannot overemphasised. Hence, we specify the different models below according to the conceptual framework specified.

**Carbondioxide and Climate Change Variation**

Carbondioxide is the primary greenhouse gas emitted through human activities and has been identified from the background to this study as the major cause of global warming which changes climate patterns, while variation in climate change is the deviation in long-term continuous changes in average condition of the climate. According to Hansen *et al.* (2011) the standard deviation of local surface temperature measures the typical magnitude of year-to-year variations of mean surface temperature. Hence, the study would have employed the standard deviation of the mean temperature in addressing this objective. However, Engle (2001) posited a preference for GARCH variance to correct for the deficiencies of least squares like assumption of homoscedasticity. Therefore, the data on variation in temperature will be generated from the mean surface temperature data using the standard tools of autoregressive conditional heteroscedasticity (ARCH) and generalized autoregressive conditional heteroscedasticity (GARCH).

The conceptual framework shows among others, two main variables of interest for this particular analysis: Carbondioxide and climate change variables, as literature has it that

$CO_2$ is a major compound that influences climate change because of its prevalence over other GHG and the decomposition of other GHG into $CO_2$ (McMichael, 2009 and Odjugo, 2010a). Thus, we will measure $CO_2$ and climate change variation with $CO_2$ emissions in kilo tonnes and GARCH variance temperature series, respectively.

Therefore, Equation 3.1.4 below is the empirical model for the second objective that accounts for the extent at which $CO_2$ emissions explain variation in climate change in Nigeria. This model makes use of both the global and the local $CO_2$ in explaining variation in climate change in Nigeria.

Drawing from the conceptual framework, the implicit form of the model is specified as;

$$LMTEMPV = f\,(LCO_2, GCO_2) \qquad (3.1.1)$$

This equation states that *LMTEMPV* is a function of $LCO_2$, and $GCO_2$, which means the value of *LMTEMPV* is determined by the values of $LCO_2$, $GCO_2$.

Grossman and Krueger (1991) posited that growth leads to more air pollution at the initial stage which implies more $CO_2$ and more warming of the earth's surface temperature. Hence, we add RGDP to the equation above for the measurement of growth. Therefore, we assume that the economy is at the initial stage of growth. Hence, we have the model extended below:

$$LMTEMPV = f(LCO_2, GCO_2, RGDP) \qquad (3.1.2)$$

Further empirical literature also establishes that there are negative correlations between rainfall and temperature (Cong and Brady, 2012); therefore, we add rainfall variable to our model and we have:

$$IMTEMPV = f\,(LCO_2, GCO_2, RGDP, LMRFALL) \qquad (3.1.3)$$

The econometric representation of Equation 3.1.3 which is the main implicit model for the second objective of this study is specified thus:

$$LMTEMPV = \beta_0 + \beta_1\, LCO2 + \beta_2\, \mathrm{GCO2} + \beta_3\, RGDP + \beta_4\, LMRFALL + u \qquad (3.1.4)$$

Where;

*LMTEPTV* = Variation in local mean temperature
*LCO2* = Local carbondioxide emissions
*GCO2* = Global carbondioxide emissions.
*RGDP* = Real gross domestic product
*LMRFALL* = Local mean rainfall
*u* = Error term

A priori expectations: $\beta_1 > 0,\ \beta_2 > 0,\ \beta_3 > 0,\ \beta_4 < 0$

## RESULTS AND DISCUSSION

This research study has attempted to conceptualise the probable link among climate change, human health and economic growth in chapter three of this study. Therefore, given the unit root properties of RGDP, LEXP and GMTEMP/LMTEMP, we proceeded to determine whether there is a long-run co integration relationship among the series. Therefore, we equally used the Johansen full information maximum likelihood for this last objective.

The choice of Johansen multivariate cointegration technique as stated earlier is based on the fact that the variables for analysis are I(1) series and the model itself is multivariate.

**Table 1**

**Johansen Cointegration Test for RGDP, LEXP and GMTEMP/LMTEMP**

| RGDP LEXP GMTEMP | | | | | |
|---|---|---|---|---|---|
| **Trace** | | | **Maximum Eigen value** | | |
| Trace Statistic | 5% Critical Value | *p* Values | Max-Eigen Statistic | 5% Critical Value | *p* Values |
| 60.00452 | 29.79707 | 0.0000** | 54. 22361 | 21.13162 | 0.0000** |
| 5.780913 | 15.49471 | 0.7212 | 5.671835 | 14.26460 | 0.6556 |
| 0.109011 | 3.841466 | 0.7412 | 0.109077 | 3.841466 | 0.7412 |
| RGDP LEXP LMTEMP | | | | | |
| **Trace** | | | **Maximum Eigen value** | | |
| Trace Statistic | 5% Critical Value | *p* Values | Max-Eigen Statistic | 5% Critical Value | *p* Values |
| 37.73253 | 29.79707 | 0.0050** | 31.40164 | 21.13162 | 0.0013** |
| 6.330896 | 15.49471 | 0.6564 | 6.181658 | 14.26460 | 0.5900 |
| 0.149238 | 3.841466 | 0.6993 | 0.142938 | 3.841466 | 0.6993 |
| 1 co integrating eqn detected | | | 1 co integrating eqn detected | | |

Significance level: **=5%

The co integration result in the Table 5.11 showed that there is a co integrating long-run relationship between the RGDP, LEXP and GMTEMP/LMTEMP despite the non-stationery properties of variables employed. The presence of co integration between variables is consistent with the results found in other studies (McMichael, 2009; Ikefuji et al., 2012 and Ogungbennle et al., 2013). Thus, there is a probable dynamic relationship between climate change, human health and economic growth in Nigeria. Hence, we present the co integration equation from the Johansen co integration results reported in Tables 2

**Table 2**

**Johansen Cointegration Equations for GMTEMP/LMTEMP, LEXP and RGDP**

| **Equation for GMTEMP** | | | **Equation for LMTEMP** | | |
|---|---|---|---|---|---|
| RGDP | LEXP | GMTEMP | RGDP | LEXP | LMTEMP |
| 1.000000 | -15.75352 | 33.32145 | 1.000000 | -5.253195 | 5.632949 |
| | (1.26587) | (3.56921) | | (0.38813) | (0.83716) |
| | [-12.4448] | [9.33580] | | [-13.53463] | [6.77233] |

( ) standard error; [ ] *t* statistic

These equations can be re-written as:

*RGDP = 15.753520*LEXP - 33.32145*GMTEMP + 38.32328

*RGDP = 5.2593195*LEXP – 5.632949*LMTEMP + 8.706888

As shown by the co integration equations above, which normalised the coefficients of RGDP both for the global and the local models, climate change and human health are significant in influencing changes in economic growth given the significant *t* statistics and the conforming signs to a priori explanation. The global climate change showed a greater negative impact on economic growth than the local climate change.

**Vector Error Correction for Climate Change, Human Health and Economic Growth**

The implication of co integration in I(1) series implies that VAR is not equally appropriate in tying the short-run disequilibrium of this models to their long-run values. Therefore, having tested for co integration and discovered a strong evidence of the same, we employed vector error correction mechanism (VECM) to capture both the long-run and short-run information on the dynamic relationship between the climate change, human health and economic growth. We determined the lag length from the values of AIC, BIC, and HQC selection criteria, bearing in mind that BIC is the most relevant for all sample sizes and annual time-series data.

**Table 3**

**Lag Selection for Equations 3.3.7 and 3.3.8**

| **Model with Global Mean Temperature (Eqn 3.3.7)** | | | |
|---|---|---|---|
| Lags | AIC | SIC | HQC |
| 0 | -11.04549 | -10.91487 | -10.99944 |
| 1 | -17.52683 | -17.00437 | -17.34264 |
| 2 | -21.03828 | -20.12397 | -20.71594 |
| 3 | -23.38540 | -22.07925 | -22.92492 |
| 4 | -24.10102 | -22.40303 | -23.50240 |
| 5 | -24.13997 | -22.05013 | -23.40320 |
| **Model with Local Mean Temperature (Eqn 3.3.8)** | | | |
| Lags | AIC | SIC | HQC |
| 0 | -9.761638 | -9.631023 | -9.715590 |
| 1 | -16.02091 | -15.49845 | -15.83672 |
| 2 | -18.73306 | -17.81876 | -18.41073 |
| 3 | -21.79862 | -20.49247 | -21.33814 |
| 4 | -22.76970 | -21.07179 | -22.17117 |
| 5 | -22.72474 | -20.63490 | -21.98797 |

Following Ivanov and Kilian (2005), we based our lag selection order on the result of SIC, as they posited that it is more accurate for all sample sizes. Having determined the lag order, we fitted a VEC regression analysis for both global and local climate change. Therefore, our original VAR model was converted into a VEC model, for both GMTEMP and LMTEMP. We bore in mind that we now have only one cointegrating equation. Hence, it takes the form below.

Where Θ is the parameter of the ECT and it measures the error correction mechanism that drives Y, back to its long-run equilibrium and Λ is the difference operator. Our variables are Y, X and T for RGDP, LEXP and GMTEMP/LMTEMP, respectively.

## REFERENCES

Adom. P.K., Bekoe W., Amuakwa-Mensah F., Mensah, J. T. and Botchway, E. (2012), 'Carbon Dioxide Emissions, Economic Growth, Industrial Structure, and Technical Efficiency: Empirical, Evidence from Ghana, Senegal, and Morocco on the Casual Dynamics, Energy, 47:314-325.

African Development Forum 7, (2010), ''Acting on Climate Change for Sustainable Development in Africa''. In "Climate Change, Economic Growth, and Poverty Reduction in Africa.", rrADF VII 10-15 October 2010, United Nations Conference Centre Addis Ababa, Ethiopia.

Apata, T.G. Samuel, K.D. and Adeola, A. O. (2009) "Analysis of Climate Change Perception and Adaptation among Arable Food Crop Farmers in South Western Nigeria." Contributed Paper prepared for presentation at the International Association of Agricultural Economists" 2009 Conference, Beijing, China, August 16-22,2009.

Artikov I. and Lynne G.D. (2005), "Climate and Farm Use Weather Information." *American Journal of Agricultural Economics* 71:774-784

AUC, (2010), African Union Commission: Fifth meeting of the Committee of Experts Distr.. General E/ECA/COE/29/5, AU/CAMEF/EXP/5/(V)

Awake (2014) "Are we running out of water?" *Awake!* January 2009, 3-7.

Bambaige, A.J. Cuamba, B. and Hauengue, M. (2014) "Climate Change and Health in Mozambique" Capacity Strengthening in the Least Developed Countries (LDCs) for Adaptation to Climate Change (CLACC) working Paper 6; International Institute for environment and Development: The Ring Alliance of Policy Research Organisation.

Bardsen, G. (1989) 'Estimation of long-run coefficients in error correction models', *Oxford Bulletin of Economics and Statistics*, 51, 345-50

Bertinelli, L. and Strobl, E. (2005) "The Environmental Kuznets Curve Semi-Parametrically Revisited," Economics and Management Memorandum, Elsevier, Economics Letters 88 (2005) 350-357, www.elsevier.com/locate/econbase

Bloom, D.E. and Canning, D. (2008) "Population Health and Economic Growth" The International Bank for Reconstruction and Development/ The World Bank on behalf of the Commission on Growth and Development 1818 H Street NW Washington, DC 20433.

Bock, B. R and Sikora, F. J. (1990) "Modified Quadratic Plateau Model for Describing Plant Responses for Fertilizer." *Soil Science Soc. Am.Journal* 54:1784-1789

Bosello F. Roberto, R. and Tol, R. S. J. (2006) "Economy Wide Estimates of the Implications of Climate Change: Human Health." Ecological Economics, 58:579-591.

Bryant, L. Carver, L. Butler, C. D. And Anage, A. (2009) "Climate Change and Family Planning: Least Developed Countries Define the Agenda." Bull World Health Organ 87:852-7.

Department for International Development (DFID) (2006) "How Climate Change Threatens the World's Poor." *Development Issues*, 25:8-9.

Deschenes, O. and Greenstone, M. (2006) "The Economic Impacts of Climate Change: Evidence from Agricultural Output and Random Fluctuations Weather." American economic review 97:354:385.

DeWeerdt, S (2014) "Climate Change Coming Home: Global Warming Effect on Populations." *World Watch*, 2(3):6-13.

Dhiman, R. C., Pahwa, S., Dhilion, G.P. S. and Dash, A.P. (2010) "Climate Change and Threat of Vector-Borne Disease in India: Are We Prepared?" *Parasital Res*, 106:763-773.

Eke, P. O and Onafalujo, A. K. (2012) "Effects of Climate Change on Health Risks in Nigeria." Society for Business Research Promotion, Asian Journal of Business and Management Sciences: Vol. 1 No. 1[204-215] ISSN: 2047-2528; www.ajbms.org

Engle, R. (2001) "GARCH 101: The Use of ARCH/GARCH Models in Applied Econometrics" *Journal of Economic Perspectives* 15(4), 157-168

Engle, R. F. and C. W. J. Granger (1987) "Co integration and Error Correction: Representation, Estimation and Testing", *Econometrica*, 55, 251-76.

EPA (2013) United States Environmental Protection Agency, "Climate Change: Basic Information" http://www.epa.gov/climatechange/basics/june

Fisher, R. A. (1920) "Studies in Crop Variation: An Examination of the Yield of Dressed Grain from Broadbalk," *Journal of Agricultural Science* 2(2) London.

Frumkin, H. Hess, J. Luber, G. Malilay, J. and McGeehin, M. (2008), "Climate change: the public health response." *Am J Public Health*. 98:435-445

Gallup, J. L. Sachs, J. D., and Mellinger, A. D. (1999) "Geography and Economic Development", CID Working Paper 1. Harvard Center for International Development, Cambridge.

Hajat, S. Armstrong, B. Gouveia, N. And Wilkinson, P. (2005) "Mortality displacement of heat-related deaths: a comparison of Delhi, Sao Paulo, and London." *Epidemiology* 16:613-620.

Halicioglu, F. (2010) 'Modelling Life Expectancy in Turkey', Munich Personal PePEc Archive Paper No 30840, http://mpra.ub.uni-muenchen.de/30840/

Hansen, J.; Sato, M.; Kharecha, P.; Beerling, D.; Masson-Delmote, V.; Pagani, M.; Raymo.; Royer, D. L. and Zachos, J. C. (2018), "Target CO2: Where Should Humanity Aim?" http://www.columbia.edu/~jeh 1/2018/Target $CO_2$_20080407pdf

Harbaugh, W. Levinson, A. Wilson, D.M., (2002) "Re-examining the Empirical Evidence for an Environmental Kuznets Curve." *Review of Economics and Statistics 84, 541- 551.*

Hardee, K. and Mutunga, C. (2009) "Strengthening the Link between Climate Change

Adaptation and National Development Plans: Lessons from the Case of Population in National Adaptation Programmes of Action (NAPAs)" Mitig Adapt Strateg Glob Change DOI 10.1007/s11027-009-9208-3; Springer Science+ Business Media

INVS (2003) "Impact Sanitaire de la Vague de Chaleur d"aout 2003 en France. Bilan et Perspectives [Health Impact of the Heatwave in August 2003 in France]." Institute Veille Sanitaire, Saint-Maurice, 120pp.

IPCC (2001) "Survey for Policymakers." The Report of Working Group 1 of the Intergovernmental Panel on Climate Change.

IPCC (2007) "Climate Change 2007: The Physical Science Basis", Contribution of Work Group 1 to the Fourth Assessment Report of the Intergovernmental panel on Climate, Cambridge University Press, Cambridge, United Kingdom.

IPCC (2014) "Climate Change 2014: Impacts, adaptation, and Vulnerability: Global, Sectoral and Regional aspects, working Group II Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

Jagtap, S. (2007) "Managing Vulnerability to Extreme Weather and Climate Events: Implications for Agriculture and Food Security in Africa." Proceedings of the International Conference on Climate Change and Economic Sustainability held at Nnamdi Azikiwe University, Enugu, Nigeria. 12-14 June 2007.

Jetten, T. H., Martens, W. J. M. And Takken, W. (1996) "Model simulations to estimate Malaria Risk under Climate Change," *Journal of Medica Entomology* 33 (3), 36.

Johanses, S. (1988) 'Statistical Analysis of Cointegration Vectors' *Journal of Economics Dynamics and Control,* 12: 231-254.

Johanses, S. and Juselius (1990) 'Maximum Likelihood Estimation and Inference on Conintegration-with Applications to the Demand for Money' *Oxford Bulletin of Economics and Statistics* 52(2), 169-210.

Mandal, K. (2008) "Drinking Water supply vis-a-vis Technological Interventions for Social Empowerment of Rural India." Available: http://www.nistads.res.in/indiasnt2008/t6rurral/tt6rur7.htm_[accessed 23 May 2010]

Mankiw, G., Romer, D and Weil, D. (1992) 'A Contribution to the Empirics of Economic Growth.' *Quarterly Journal of Economics* 107 (2): 407-437

Masih A. M. and Masih R. (1996) 'Empirical tests to discern the dynamic causal chain in macroeconomic activity: new evidence from Thailand and Malaysia based on a multivariate cointegration/vector error-correction modelling approach' *Journal of Policy Modelling* 18(5):531-560.

Mawle, A. (2010) "Climate Change, Human Health, and Unsustainable Development" *Journal of Public Health Policy* (2010) 31, 272-277. doi:10.1057/jphp.2010.12.

McCarthy, J. J. Canziani, O. F. Leary, N. A. Dokken, D. J. and White, K. S. (2001) "Climate Change: Impacts, Adaptation, and Vulnerability" Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.

McMichael, A. J. Woodruff, R. E. and Hales, S. (2006) "Climate Change and Human Health: Present and Future Risks." Lancet, 367, 9513, 859-69.

Mojtahed, A. and Javadipour, S. (2006) "Studying the Impact of Health Expenditures on Economic Growth." Allameh Tabatabaee University, Department of Economics, National Bureau of Economic Research, 8587.

Molua, E. L. and Lmbi, C.M. (2007) "The impact of climate change on agriculture in Cameroon." Policy Research Working Paper 4364. World Bank.

Naeem Akram N., UI Haq Padda, I. and Khan, M. (2008) "The Long Term Impact of Health on Economic Growth in Pakistan" The Pakistan Development Review, 47: 4(2) 487-500.

Nakicenovic, N. And Swart, R. Eds., (2000) "Special Report on Emissions Scenarios: A Special Report on Working Group III of the Intergovernmental Panel on Climate Change." Cambridge University Press, Cambridge, 599pp.

NEST (2003) "Nigerian Environmental Study/action Team"

Ngene, U. (2012) "Climate change: Any impact on Nigeria?- Vanguard Newspaper on October 29, in Viewpoint, 12:00 am, www.vanguardngr.com/2012/10/climate-change-anyimpact-on-nigeria/

Nguyen,N. V. (2006) "Global Climate Changes and Rice Food Security" FAO, Rome. http://wwwfao.org/climatechange/15526-03ebc62366f779dled45287e698a442e.pdf

Nkomo, J. C. Nyong, A. O and Kulindwa, K. (2006) "The Impacts of Climate Change in Africa." Report prepared for the Stern Review on the Economics of Climate Change, 51 pp. http://www.hm-treasury.gov.uk/media/8AD/9E/

Noji, E. K., (1997) "The Public Health Consequences of Disasters". New York: Oxford University Press; 1997.

Nordhaus, W. D. (1994) "Managing the Global Commons: The Economics of Climate Change" The MIT Press, Cambridge.

Nordhaus, W. D. (2008) "A Question of Balance: Weighing the Options on Global Warming Policies", Yale University Press, New Haven, CT.

Nwafor, J. C. (2006) "Environmental Impact Assessment for Sustainable Development: The Nigerian perspective." Enugu: EL "DEMAK pubs. Pp. 359-394.

Nwafor, J. C. (2007) "Global Climate Change: The Driver of Multiple Causes of Flood Intensity in Sub-Saharan Africa." Paper presented at the International Conference on Climate Change and Economic Sustainability held at Nnamdi Azikwe University, Enugu, Nigeria, 12-14 June 2007.

Nwoke, B. E. B. *Nwoke*, E. A. and Ukpai, O. (2009) "Effect of Climate Change on Human Health and Some Adaptive Strategies –A Review." *Bayero Journal of Pure and Applied Sciences*. 2(1): 168-172.

Odjugo, P. A. O. (1999) "Climatological Implications of Environmental Degradation on Sustainable Human Development." *Georesearch*, 3: 52-60.

Odjugo, P. A. O. (2000) "Global Warming and Human Health: Current and Projected Effects." *Environmental Analar*, 4(2): 49-60.

Odjugo, P. A. O. (2001) "Global Warming and Food Production: A Global and Regional Analysis." *African Journal of Environmental Studies,* 2(2): 85-91

Odjugo, P. A. O. (2007) "The Impact of Climate Change on Water Resources; Global and Regional Analysis." *The Indonesian Journal of Geography,* 39: 23-41.

Odjugo. P. A. O. (2009), "Quantifying the Cost of Climate Change Impact in Nigeria: Emphasis on Wind and Rainstorm" *J. Human Ecol.*, 28(2): 93-101.

Odjugo, P. A. O. (2010a), "General Overview of Climate Change Impacts in Nigeria" Kamla-Raj 2010 J. Hum Ecol, 29(1): 47-55 (2010)

Patz, J. A. Gibbs, H. K. Foley, J. A. Rogers, J.V. and Smith, K. R. (2007) "Climate Change and Global Health: Quantifying a Growing Ethical Crisis." *EcoHealth* 4:397-405.

Paxson, H. (1992), "Using Weather Variability to Estimate the Response of Savings to Transitory Income in Thailand" *American Economic Review* 2(82): 15-33

Pearce, D. W. Cline, W. R. Achanta, A. N. Fankhauser,S. Pachauri, R. K. Tol, R. S.J and Vellinga, P. (1996) "The Social Costs of Climate Change: Greenhouse damage and benefits of control", in Bruce J, Lee H & Haites E (eds), Climate Change 1995: Economic and Social Dimensions of Climate Change, Cambridge: Cambridge University Press, pp.179-224

Pesaran M. H. And Pesaran B. (1997) 'Working with Microfit 4.0: Interactive Econometric Analysis' Oxford University Press, pp 303-304

Pesaran, M. H., Shin, Y. And Smith, R. (2001) 'Bounds Testing Approaches to the Analysis of Level Relationships, Journal of Applied Econometrics. 16(3): 289-326.

Peyharjou, K.; Gollu R.B. Gashti, H. P. and Shahrivar, R. B. (2011) "Studying the relationship between health and economic growth in OIC" *Interdisciplinary Journal of Contemporary Research in Business*, 3(8): 1041-1054

Postnote, (2006) "Adapting to Climate Change in Developing Countries" Parliamentary Office of Science and Technology, No. 269, October, 2006

Rahman, A. Alam, M. Mainuddin, K. Ali, L. Alauddin, S. M. Rabbani, G. Miah, M. U. Uzzaman R. and Ashraful Amin, S. M. (2015) "The Probable Impacts of Climate Change on Poverty and Economic Growth and the Options of Coping with Adverse Effect of Climate Change in Bangladesh." General Economics Division, Planning Commission, Government of the People's Republic of Bangladesh & UNDP Bangladesh

Raisanen, J. (2006) "How reliable are climate models?" The Author Journal compilation, Blackwell Munksgaard, Tellus (2007), 59A, 2-29 C

Reisinger, A. and Dogra, N. K. (2008) "Climate Change and Human Health: Protecting Human Health from Climate Change." Some Key Findings from the Fourth Assessment Report of Intergovernmental Panel of Climate Change, Regional Health Forum-12(1): 1-10

Rettner, R. (2011), '5 Ways Climate Change Will Affect Your Health; Livescience', April 22, 09:30 am

Richardson, K., Steffen, W. and Liverman, D. (2009) "Climate Change, Global Risk, Challenges and Decisions." Copenhagen 2009, 10-12, March, International Alliance of Research University; www.climatecongress.ku.dk

Rivera, B and Currais M. (2004) 'Public Health Capital and Productivity in the Spanish Regions: A Dynamic Panel Data Model' World Development 32 (5): 871-885

Robine, J. M. Cheung, S. L. Le Roy, S. Van H., Griffiths C., Michel J. P. and Herrmann F. R. (2008), "Death Toll Exceeded 70,000 in Europe during the Summer of 2003." Les Comptes Rendus/Serie Biologies, 2008, 331: 171-78

Romer, P. M. (1990) "Endogenous technological change" *Journal of Political Economy* 98, S71-S102.

Rosenberg, E. Alves, D. Timmins, C. and Evenson, R. (2014), "Health, Climate and Development in Brazil: A Cross-Section Analysis" Inter-American Development Bank Banco Interamericano de Desarrollo Latin American Research Network Red de Centros de Investigacion Research Network Working Paper #R-386

Roson, R. and van der ,Mensbrugghe, D. (2010) "Climate Change and Economic growth: Impacts and Interactions" *Journal of Economic Literature* CODES: C68, D58, F43, F47, Q54, Q56

Saunders, M. K. Gadhi, R. and Connor, C. (2004) "Investments in Health Contribute to Economic Development." Partners for Health Reformplus (PHRPlus) E-Version: http://www.phrplus.org

Sen, A. (1980), "Poverty and Famines: An Essay on Entitlement and Deprivation." Clarendon Press, Oxford

Schnellnhuber, H. J. Cramer, W. Nakicenovic, N. Wigley, T. and Yohe, G. Eds (2016) "Avoiding Dangerous Climate Change." Cambridge University Press, 2006

Shahbaz, M, Jalil A. and Dube, S. (2010) "Environmental Kuznets Curve (EKC): Time series Evidence from Portugal.

Simon, F. Lopez-Abente, G. Ballester, E. and Martinez, F. (2005) "Mortality in Spain during the Heat Waves of Summer 2003. Euro Surveill 2005; 10:156-60

Soukiazis, E. and Cravo, T. (2007) "The Interaction between Health, Human Capital and Economic Growth. Empirical Evidence." Discussion Paper No. 42; JEL: I, $I_{10}$, $I_{20}$, $I_{30}$

Stern, D. I. (2004) "The Environmental Kuznets Curve" In: Cleveland, C. J. (Ed), Encyclopaedia of Energy. Academic Press, San Diego, CA.

TFN, (2012), "Transparency for Nigeria; Environmental Issues", Published on Saturday, 30 June 2012 06:42

Tunde, A. M., Usman, B. A. and Olawepo, V. O. (2014) "Effects of Climatic Variables on Crop Production in Patigi L. G. A., Kwara State, Nigeria. *Journal of Geography and Regional Planning* 4(14):695-700, 18 Available online at http://www.academicjournals.org/JGRP ISSN 2070-1845 (C) 2014 Academic Journals.

United Nations Development Programme: Human Development Report 2007/2008. "Fighting Climate Change: Human Solidarity in a Divided World." New York: UNDP, 2008

United Nations Development Program: Nigeria Human Development Report, Abuja: UNDP, 2009a

United Nations Development Program: Nigeria and Climate Change: Road to Cop. 15, Achieving the Best Outcome for Nigeria. UNDP, 2009b

United Nations Development Program: China and Climate Change http://www.undp.org.vn/undpLive/System/Newsroom/Feature-Details?contentId=2492

UNICEF (2000) "Global Water Supply and Sanitation Assessment: 2000 Report." World Health Organization, Geneva, 87 pp. http://www.who.int/entity/water_sanitation_health/monitoring/jmp2000.pdf

United Nations Millennium Ecosystem Assessment Conference, Iceland, August 2007.

USAID (2008) "Integrating Climate Change into Development." U.S Agency for International Development 1300 Pennsylvania Avenue, NW Washington, DC 20523. www.usaid.gov-keyword: climate change

Von Storch, H. (2008) "Assessment of Climate Change for the Baltic Sea Basin" Book Chapter in Regional Climate Studies: The BACC Author Team, The International BALTEX Secretariat GKSS-Foreschungszentrum, Geesthacht GmbH, Max-Plank-Str. ID-21502 Geesthacht Germany