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Environment Quality in Nigeria: Implications for Poverty Reduction

Owolabi O.A., Aderounmu B., Ogunbiyi T.

Department of Economics and Development Studies, Covenant University, Ota, Ogun State, Nigeria.

oluwarotimi.owolabi@covenantuniversity.edu.ng

Abstract: Poverty in Nigeria is at extremely high levels and represents one of the many economic hardships faced by the Nigeria population. One of the factors potentially contributing to present high poverty levels is poor environment quality which is prevalent in Nigeria and which may result in increased poverty levels as efforts are undertaken to address adverse environment quality. This paper explored the effect of environment quality on poverty reduction in Nigeria using data from the World Bank World Development indicators over the period of 1990 to 2015. The study employed Augmented Dickey Fuller unit root test, and Autoregressive Distributed Lag (ARDL) estimation in analyzing data and the findings of the study revealed that improved environment quality as measured by improved access to sanitation and access to electricity positively and significantly increase poverty level in Nigeria, possibly on account of the increased financial and social costs of gaining access to sanitation and electricity. It is recommended that policy makers ensure that policies aimed at improving environment quality in Nigeria take into account the adverse implications of improving environment quality for poverty so as to ensure that a balance is achieved between improved environment quality and reduced poverty so that a cleaner environment is achieved at lower financial and welfare cost to citizens.

Keywords: Environment Quality, Carbon dioxide, Access to Sanitation, Access to Electricity, Poverty, Welfare

1   Introduction

The Quality of the environment is central to the existence of life, be it that of humans, animals or, plants [1]. Where the environment in a country is of high quality, human beings as well as plants and animals will live longer, enjoy a life of improved quality, and hence sustainable development may be achieved. However over the past couple of years, the quality of environment in many countries of the world have been gradually receiving increasing attention on account of the awareness of the adverse implications of a degenerate environment that may result if the environment in countries of the world continues to be neglected by society [2]. In developed and

developing countries alike, poor environment quality is evident, however it is the case that the pace of the factors that give rise to environment quality tends to be far ahead of that of the developed countries [3].

While there are several adverse implications of poor quality environment for a country, major ones include that for health and education which affect individual well being. Through poor health which could be on account of a poor quality environment, the individual's capability to make a livelihood is affected negatively [4]. Further through poor environment quality, an unconducive environment for teaching and learning is created and hence human capital development is adversely affected [5]. In addition, a poor quality environment in affecting animals and plants, food for human consumption is affected and as food is an essential of life, humans suffer hunger and lack of nutrition which is another channel through which health of individuals are affected. Consequently, through health and education amongst other channels, poor environment quality will give rise to poverty.

Poverty is at present high in Nigeria as highlighted by the World Poverty Clock of the Brookings Institute, USA [6]. Infact as at May 2018, Nigeria had the highest number of citizens in poverty with about 86.9 million Nigerians in poverty [6]. Thus despite the efforts of the Nigeria government over the years to curb high and rising poverty, it is evident that past government efforts have yielded little result.

Environment quality may be one of the factors militating against the Nigeria government's efforts at curbing high and rising poverty in Nigeria. This is because, through health and education amongst other channels, the quality of the environment will adversely affect the capacity and capability of Nigerian's to be productive and contribute positively to the Nigerian economy. This could be related to the Environmental Kuznet's curve hypothesis that argues that environment quality is related to GDP per capita in the form of an inverted-U. Consequently, education, health and poverty amongst a variety of economic indicators are related to GDP per capita.

Poor environment quality is not peculiar to Nigeria alone, as it is more entrenched in developing countries in general. However if challenges as poverty are to be an occurrence of the past in Nigeria amongst other developing countries, then tackling environment quality must remain a priority of the government. This is more so as the achievement of zero poverty and sustainable cities and communities are two of the United Nation Sustainable development goals which Nigeria as well as other countries of the world must strive towards by the year 2030.

Poor environment quality results on account of various factors including fossil fuels combustion, carbon emissions from factories and vehicle exhausts, oil spills, deforestation, green house gas emissions, Soil degradation and so on [7, 8, 9]. These represent the adverse consequences of the actions of private and public agents on the society welfare. Further, contributing to poor environment quality in addition to the aforementioned, are poor access to clean water, poor access to sanitation, poor access to electricity as clean water, sanitation, electricity are basic utilities which in the present age, the average citizen must have access to in order to meet a minimum acceptable living standard. Carbon emissions, Poor access to clean water, poor access to sanitation, poor access to electricity amongst others are characteristic of the

Nigeria economy and therefore are argued to be a contributor to poverty in Nigeria. However addressing poor environment quality may cause Nigerian's already in poverty to slide further into poverty on account of the cost of improving the quality of the environment. In other words, a poor (unclean or polluted) environment while a contributor to poverty, may pose a dilemma for the Nigeria government as to how the environment may be transformed into a habitable or good quality environment, as costs will be required to be incurred by citizens, which exacerbates the poverty situation of the Nigeria society. These costs which may be financial may also be quantified in terms of the impact on welfare of measures to improve environment quality. This is because access to amenities that may improve quality of living such as clean water, sanitation, electricity, are not equal, especially with those in the rural areas often disadvantaged. The argument of this present study contrasts to that of most other studies arguing that poverty affects environment quality (10, 11)

This present study in light of the aforementioned, explores the implications for poverty reduction in Nigeria of efforts of the government to improve environment quality in Nigeria. This study is founded on the theory of Environmental Kuznet's curve and in contrast to most studies on environment quality employ access to sanitation, and access to electricity in addition to traditional measures of environment quality as, carbon dioxide emissions.

2.   Environmental Hazards and Poverty: A Review

The health and livelihood of the poor (men, women and children) are affected by changes in the environment thus making them vulnerable to environmental hazards. The importance of quality environment in attaining development was central to the Millennium Development Goals [12]. However the inability to achieve the Millennium Development Goals led to the creation of the Sustainable Development Goals where poverty and environment occupies the 1st and 11th goals- "End poverty in all its forms and Sustainable Cities and Communities" respectively.

The effect of growth on environmental quality in Nigeria over the period of 1970 to 2011 was examined using fractional cointegration technique [13]. The study found that there is high level of degradation in the environment at the early stage of development. It was established that due to dumping made in the environment as a result of poor quality institutions and unregulated trade openness, the quality of the environment has been on a continuous decline. Also, greater population density increases the consciousness for cleaner environment. Thus, the study found a positive relationship between trade openness, foreign direct investment and CO_2 emissions within the country. Although the study incorporated institutional quality, trade openness and population density in the analysis, which distinguished it from previous studies, the study was unable to attain a reasonable turning point in the establishment of environmental Kuznets curve.

The empirical study of the relationship between economic development and environmental quality in Nigeria by [14] showed the existence of N-shaped relationship indicating a weak existence of standard Kuznets curve while there is a strong existence of the nested Kuznets curve. The finding supported the fact that improvements in the environment is linked with economic development in Nigeria

Electricity as a factor for economic development in Nigeria was analyzed by [15] and it was observed that between electricity consumption and economic development, a cointegration relationship was present. Further, causality in one direction only running from economic development to electricity consumption was observed. The measure of economic development using per capita income highlights a weakness of the study as economic development is a broad concept that can't be captured sufficiently with only one indicator, and also the study did not control for other measures of energy consumption aside electricity. In relation to the aforementioned study, [16] analyzed the role played by electricity consumption and human capital development in contributing to the economic growth of Nigeria over the period of 1981 to 2016, using the fully modified ordinary least squares model estimation technique. Evidence obtained suggested that while human capital development is not significant for economic growth in Nigeria, electricity consumption positively and significantly contributes to improving economic growth in Nigeria. The study however in studying the effect of only electricity consumption as an energy source in addition to other control variables such as human capital indicators of health and education, like to earlier study also excludes other sources of energy such as fossil fuels, which could contribute to economic growth.

In the study by [17] they analyzed the determinants of environmental quality on financial development in Nigeria from 1981-2016 using ARDL bound approach. The result showed that income, financial development, energy consumption and trade affect environmental quality while energy consumption and environmental degradation are related to each other with causality running from either direction. The study also indicated that the Environmental Kuznets Curve was present for Nigeria. However, the study employed principal component analysis in generating the index measuring the quality of the environment from particulate emissions damage and emissions of carbondioxide.

[18] examined the factors contributing to the bidirectional relationship between poverty and the decline in the quality of the environment in Africa. The study showed that the poor are affected not only by the local environmental issues but also by national environment. However, the study failed to carry out any empirical analysis to back up theoretical findings. In the same vein, [19] carried a review on environmental problems in Nigeria. The study categorized the causes of environmental as urbanization, overpopulation, deforestation, desertification and pollution which resulted from poor management and corruption.

[20] examined the relationship between poverty and the environment using systematic review. The study concluded that a causal interlink or bidirectional relationship exist between poverty and the environment. The study established that poverty worsen environmental degradation and at the same time environmental degradation worsened poverty by weakening the poor's living condition, income and health. However, despite that the study reviewed enormous wealth of literature, they failed to apply this empirically.

The quality of life in terms of the environment is related to sustainable development and it may be assessed by a system of indicators as argued by [1]. The indicators may be categorized into three related groups and the groups are: quality of the environment, acts that take into account concern for the environment, and utilization of environmental services. The group of

indicators that take into account the quality of the environment included urban population encounter with air pollution through particulate matter, urban population encounter with air pollution by ozone, and Biochemical Oxygen demand in river. The indicators measuring acts that take into account the concern for the environment are: resource productivity, energy productivity, The share of renewable in final energy, Sewage sludge production and disposal, and Recycling rates for packaging waste. The utilization of environmental services indicators included: adequacy of appropriate sites based on the directive of the European Union regarding habitats, terrestrial areas set aside to be protected, and the land area occupied by forests and other wooded land per capita. Further the authors highlight that the environmental quality indicators identified encompass some environmental mediums (such as soil, water, air and waste), however various constraints informed their focus on air pollution indicators related to the quality of the environment only. Investigation of excluded mediums may therefore give rise to more robust results by the study.

3.   Theoretical Foundation and Research Method

A number of theories exist that explain the existence of poverty, however of all the theories the Environmental Kuznets Curve theory put forward by Simon Kuznets is the most appropriate for this study. Therefore this present study is built on the Environmental Kuznets Curve theory.

The Environmental Kuznets Curve theory argues an inverted-U relationship between environmental degradation and GDP per capita. Thus relating the Environmental Kuznets Curve theory to poverty as argued in this present study, as environment quality deteriorates due to factors as carbon dioxide emissions, unclean water, poor sanitation, fossil fuels use and so on, poverty results on account of both the effect of the environmental quality factors on health as well as the costs involved in improving environment quality, and GDP per capita is consequently low. Therefore poverty may be viewed as a channel of transmission of poor environment quality to low GDP per capita in line with the arguments of the Environmental Kuznets Curve theory.

Data employed in this study is secondary data sourced from World Bank World Development Indicators (WDI). Data is annual data covering the period of 1990 to 2015. Poverty (POV) is obtained by using GDP per capita as a proxy in the absence of traditional poverty indicators as the multidimensional poverty index, total poverty gap or head count index for which data for Nigeria is unavailable. Higher values of GDP per capita reflect lower poverty and vice verse. However in order for easy interpretation of results, the GDP per capita variable is multiplied by "-1" to obtain the poverty indicator so that higher values of the poverty indicator reflect high poverty and vice versa. Data on carbon dioxide emission is in metric tons per capita I.e, carbon dioxide emissions in metric tonnes divided by population. Fossil fuels consumption (FOSF) is measured as a percentage of total energy consumption. Oil, products of natural gas, coal and petroleum together constitute fossil fuel. Access to Electricity (ATE) is the percentage of the total population with access to electricity. Access to Sanitation (ATS) is the percentage of the total population using basic sanitation services. Primary School Enrollment (PSE) refers to the number of individuals that have been registered to undertake education at primary school level, as a percentage of the population of individuals in the age category of those that are officially recognized as primary school students.

The general form of the model specified for this study is as in Equation (1), and the model is estimated using Autoregressive distributed Lag (ARDL) model estimation, after ADF unit root testing and co integration test.

$$POV = f(CO2, FOSF, ATE, ATS, PSE) \tag{1}$$

The above Equation specified as an Autoregressive distributed Lag (ARDL) model is as in Equation (2).

$$POV_t = \beta_0 + \sum_{i=1}^{p} \beta_1 POV_{t-1} + \sum_{I=1}^{q} \beta_2 CO_{2t-1} + \sum_{i=1}^{q} \beta_3 FOSF_{t-1} + \sum_{i=1}^{q} \beta_4 ATE_{t-1} + \sum_{i=1}^{q} \beta_5 ATS_{t-1}$$

$$+ \sum_{i=1}^{q} \beta_6 PSE_{t-i} + \varepsilon_t \tag{2}$$

Where,
POV =Poverty
CO_2 = Carbon dioxide Emissions
FOSF = Fossil Fuels Consumption
ATE = Access to Electricity
PSE = Primary School Enrollment
ε = Error term

From the above model, the parameters are the marginal effects of changes in respective explanatory variables on poverty. The Subscripts t represent the time period of observations which is 1990 – 2015. Note that the above ARDL model representation is an ARDL (P, q_1, q_2, q_3,q_4, q_5) where P indicates the number of lags of the explained variable, and q_1…q_5 indicates the number of lags of each of the respective explanatory variables in the model from the first explanatory variable, Carbon dioxide emissions (CO_2) to the last explanatory variable Primary School Enrolment (PSE). Note that the inclusion of primary school enrollment in the above model is based on primary school enrollment being an important contributor to poverty reduction according to theory and hence in the context of this study a relevant control variable for the model.

4.   Results and Discussion

In analyzing data to achieve the research objective of this study, an Augmented Dickey Fuller Unit root test was performed on the data to examine the stationarity of the data as one of the important time series properties of times series data. Further bounds test for co-integration performed revealed that there exists no cointegration between variables in the estimated model and hence only a short run model estimation may be performed

4.1.   Stationarity Test

The Augmented Dickey Fuller Unit root test is one of a number of unit root tests that may be applied to time series in econometrics. It is ideal that data is stationary for regression to give credible results, however non-stationarity of time series data gives rise to the use of other novel model estimation techniques which may give appealing and valuable estimation results.

The Augmented Dickey Fuller (ADF) unit root test results for variables used in the specified model for this study as presented in Table 1 reveal that all the variables except for Access to Electricity (ATE), are integrated of order 1 denoted I(1). In other words, all variables employed in the estimated model of this study except ATE must be differenced once to become stationary and valid for use in the specified model for this study. Access to Electricity (ATE) on the other hand, is stationary without the need for differencing and hence is integrated of order Zero, denoted I(0). Access to Electricity (ATE) is therefore the only variable valid for use in the specified model for this study without need for differencing.

Table 1. Augmented Dickey Fuller Unit Root Test Results

	Series at Levels			**Series at First Difference**			
Variable	**ADF Statistic**	**Critical Value at 5%**	**Remarks**	**ADF Statistic**	**Critical Value at 5%**	**Remarks**	**Order of Integration**
Poverty	3.528	-3.658	Non-Stationary	-5.174	-3.612	Stationary	I(1)
CO_2	-1.197	-3.603	Non-Stationary	-3.933	-3.612	Stationary	I(1)
FOSF	-2.355	-3.603	Non-Stationary	-4.814	-3.612	Stationary	I(1)
ATE	-5.493	-3.603	Stationary	-5.187	-3.633	Stationary	I(0)
ATS	-0.631	-3.612	Non-Stationary	-9.669	-3.612	Stationary	I(1)
PSE	-2.664	-3.612	Non-Stationary	-3.770	-3.612	Stationary	I(1)

Augmented Dickey Fuller (ADF) unit root test results were performed for other measures of environment quality in addition to the above such as Access to clean water and other potential controls for poverty as Fertility rate, however the measures and controls were not stationary at either levels or first difference and were consequently discarded from the analysis

4.2   *Auto Regressive Distributed Lag (ARDL) Model Estimation Results*

The Results of Auto Regressive Distributed Lag (ARDL) Model Estimation of equation (2) above are presented in Table 2. The estimated model is an ARDL (1,1,1,2,1,0) which reflects the lag order of the ARDL model according to the number of lags of each variable in the model in line with their position in the specified model. The number of lags of each variable selected for inclusion in the model was chosen automatically based on Akaike Information Criterion. The choice of ARDL estimation over other competing methods was based on the presence of variables of different others of integration in the specified model, and the appeal of ARDL which may be used to estimate both short run and long rum model estimations of a given estimated model.

The results presented in Table 2 are the short run ARDL estimates as bounds test for cointegration performed on variables following ADF unit root test did not reveal cointegration among variables in the model. The results show that one-period lagged poverty is positive and significant for current poverty level in Nigeria. In particular one period lagged poverty (POV(-1)) increases present period poverty by 0.8527 units and this impact is of importance for present period poverty in Nigeria. Further Fossil Fuels reduces poverty in Nigeria and is significant in doing so as the significant coefficient of Fossil fuel of -1.6037 indicates . This may be explained by the popular use of firewood especially in the rural areas for cooking and other household uses. Fossil fuels may be viewed as a cheaper alternative for cooking relative to the more costly fuels

used for cooking which may be unaffordable in light of existing level of poverty in the rural areas in Nigeria. Access to electricity (ATE) and improved sanitation (ATS)are positive and significant for poverty in Nigeria. This is evidenced by the positive and statistically significant coefficients of the variables in the below table of 1.2382 and 5.4938 respectively. Thus access to electricity and improved sanitation contribute significantly to increasing poverty in Nigeria. This may be explained by the cost incurred in accessing both electricity and improved sanitation. Access to electricity is a luxury that few Nigerians can afford on account of high costs of purchasing electricity meters that give individuals control of the electricity that they use, and the high level of extortion that results where outrageous electricity bills arise for homes without pre-paid meters. Access to electricity therefore results in high costs to society which puts society further in poverty as they are either forced to pay the outrageous electricity bills, or have their electricity disconnected and are forced to use unclean energy sources. Electricity in particular represents cleaner energy relative to other traditional energy sources which are unclean, and is therefore important in promoting improved health and therefore reduced poverty. However, where such energy is not accessible, individuals are forced to use unclean energy which may be cheaper financially, but at the cost to their health and in consequence will be increasingly exposed to poverty.

Table 2. Autoregressive Distributed Lag Regression Estimates

Dependent Variable: POV				
Variable	**Coefficient**	**Standard Error**	**T-Statistic**	**P-Value**
POV(-1)	0.8527	0.1098	7.7626	0.0000***
CO_2	1.7005	1.0480	1.6227	0.1230
FOSF	-1.6037	0.6346	-2.5272	0.0217**
FOSF (-1)	10.0339	4.2078	2.3846	0.0290**
ATE	1.2382	0.3058	4.0485	0.0008***
ATS	5.4938	1.2870	4.2688	0.0005***
PSE	-1.2207	1.1732	-1.0405	0.3127
C	-2.2912.	4.7305	-4.8436	0.0002***

R-Squared = 0.986470	**F-Statistic** = 177.0673
Adj. R-Squared = 0.980899	**Prob(F-statistic)** = 0.000000
Durbin Watson Stat. = 1.714921	
** and *** denote significance at 5% and 1% respectively	

Improved sanitation is also another luxury in Nigeria for the rich and wealthy as the poor are unable to afford modern sanitation and must resort to traditional measures of sanitation as pit latrines, bucket toilets and even open defecation which will increase health risks for society and contribute to increasing poverty.

CO_2 Emissions is another measure of environment quality which while positive is insignificant for poverty in Nigeria. On the other hand, primary school enrolment (PSE) is negative but insignificant for poverty in Nigeria.

4.2.1 Implication of Findings

The findings from this study highlights that environment quality does contribute to poverty and in that regard is consistent with the predictions of the Environmental Kuznet's curve theory. This is because, according to the Environmental Kuznet's curve theory, poor environment quality occurs with a country at a low level of development represented by low GDP per capita, and since low level of development is consistent with high poverty, poor environment quality will therefore occur with high poverty. This consequently implies that efforts by the Nigeria government to improve environment quality prevalent in Nigeria as is also the case in developing countries, must take into account the financial and welfare costs that will be incurred by citizens, so as not to place citizens in further poverty than they are presently. There is the need for a balance to be found between improving environment quality in Nigeria as well as devising low cost measures to achieve it. The findings of this study may equally provide lessons to governments of other developing countries, especially those in sub-sahara Africa who also face both poor environment quality as well as high poverty.

5.   Conclusion

This present study explored the possibility of promoting improved environmental quality in Nigeria and its implications for poverty reduction. The findings highlighted that while improved access to sanitation and electricity should reduce poverty, it may exacerbate poverty on account of the costs involved in gaining access to improved sanitation and electricity. Thus, in conclusion improved environment quality in Nigeria may be achieved at greater cost to society of increased poverty. This reflects a consideration for the Nigeria government in seeking to achieve improved environmental quality in Nigeria.

Acknowledgements

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