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Economic Development, Technological Change, and Growth

Effects of Environmental Quality on Human Health Status in Nigeria

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Abstract: Environmental quality is fundamental to the existence life; when the environmental quality of a nation is high, humans, plants and animals will enjoy a longer and improved quality life which in turn will lead to the achievement of sustainable development. Studies have shown that deterioration in the quality of the environment is associated to severe human health issues and it is against this backdrop that the link between the quality of the environment and human health is being examined by policy makers and researchers. This study therefore investigated the effects of environmental quality on human health status in Nigeria using the Ordinary Least Square estimation techniques. The findings indicate the existence of a long-run relationship between health as measured by life expectancy and the explanatory variables included. The outcome also demonstrates that CO_2 emissions, an indicator for environmental quality significantly reduce life expectancy. More so, income and the linear combination of access to improved water source and access to improve sanitary facility significantly improves life expectancy. In the light of foregoing, consequently, this research recommends that it is important for the Nigerian government to strengthen environmental regulations meant to improve people's access to a better water supply and sanitary facilities along improved income aimed at bettering health status.

Keywords: Environmental quality; co_2 emissions; health status; life expectancy; access to improved water source

JEL Classification: O13

1. Introduction

Environmental quality relates to the extent to which air, land, and water are freed from contaminations and dreadful conditions caused by human activity (Rapoport, 1990). Environmental quality is critical to the survival of humans, plants, and animals. When a country's environmental quality is high, humans, plants, and animals live longer and better lives, which lead to economic growth and achievement

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of sustainable development. In recent times, environmental quality in many nations of the world have been receiving increasing attention, creating awareness on the adverse consequence of a deteriorated environment that may occur if the environment in nations of the world continues to be uncared for by society.

Poor quality of the environment has several unpleasant consequences for a country. The chief among them include in terms of health and education which affect individual wellbeing. Poor environmental quality affects the individual's health which in turn impacts negatively on the individual's ability to make a livelihood. Further, a poor quality environment makes the environment unconducive for teaching and learning. The implication of this is that human capital development is severely affected. More so, food for human consumption is affected through the effect of poor quality environment on plants and animals and as a result, humans suffer hunger and poor nutrition which is another channel through human health is affected. The overall consequence of the adverse effects of poor environmental quality through health and education among other channels is that it gives rise to poverty.

Following the scenario above, it may be correct for one to say, that environmental quality is part of the reasons the Nigerian government have not been able to curb the prevalence of high and rising poverty in the country mostly rampant in Niger-Delta region where oil spillage due to oil exploration have negatively impacted on the livelihood of the rural poor communities. Further, as stated earlier, through health and education amongst other channels, the quality of the environment will negatively affect the ability and capability of people to contribute meaningfully, economically and positively to the Nigerian economy.

Poor environmental quality is a common feature of developing countries and if the challenges of poverty and other adverse consequence of poor quality environment are to be an occurrence of the past in Nigeria amongst other developing countries, then government must make strengthening environmental quality a priority. There is also the need for an all inclusive regulations and policies aimed at checkmating the activities of industrial companies most especially oil exploration companies. The use of pollution tax may also be considered. This will help in the achievement of zero poverty and sustainable cities and communities by the year 2030 possible.

2. Literature Review

There is much insight on the relationship between health and the social environment without a broader consideration of the natural environment and as such the literature on the health-natural environment nexus is scant most especially in Africa. In this section we will attempt to review some economic theories of health that are related to our study in an attempt to plausibly guide this study.

The health-environmental connection was first studied by Anderson in 1960. His model covered the influencing variables influencing the use of health care with a cursory discussion of health outcomes. This approach placed more focus on social variables than it did on the influence of the physical environment on health. Andersen (1995) openly accepted physical, political, and economic elements (external environment) as inputs of the utilization of health care and health outcomes in a developing model. This model cleverly connected the health outcomes to his findings indicating that the external environment has a direct effect on health and health services utilisation and can also indirectly affect health outcomes and services use through influencing characteristics, enabling resources, health practices and services utilisation. Insightfully, this model was able to link the health outcomes to the external environment which are of paramount importance in preventing and promoting health policy.

According to Baker's (1963) ecological model of health, both the physical, mental and social environments have a substantial impact on both health and illness. This model's key feature is the interactive, complicated, nested reciprocal chain in which humans influence the environment and the environment influences humans in turn. Further, health was viewed as a durable capital asset developed by an individual using their own time and market inputs in Grossman's (1972) model. This model of health production links a variety of elements, such as physical activity, healthcare, diet, housing, and leisure. The Grossman health production model, in particular, offers the theoretical groundwork for the consideration of numerous social, economic, and environmental aspects when determining health status.

In consideration of rising pollution, shrinking forests, and decreasing water and sanitation access due to climate change and variability, studies have tried to establish or re-establish the significance of the physical environment in explaining health outcomes. In a two fixed effects regression study, Denovan et al. (2013) discovered that an increase in the number of trees lost to the emerald ash borer causes more deaths from cardiovascular and lower respiratory tract illnesses. Sanglimsuwan (2011) found that particulate matter, population density, access to improved water sources, as well as improved sanitary facilities were significant in explaining infant mortality. Particulate matter causes an 8.6% increase in neonatal mortality. Infant mortality was discovered to be adversely correlated with access to access to improved water sources, as well as sanitary facilities. Education, hygienic conditions, and economic factors were discovered to have a favorable impact on mother health in the study by Alvarez et al. The findings also revealed a link between maternal mortality and unfavorable factors such access to improved water sources, adult literacy rates, female enrollment rates, education indices, per capita spending, and gross income. Fogden (2009) discovered an inverse relationship between the mortality rate for children under the age of five, as well as access to safe drinking

water using statistical methods of correlation analysis. The outcome also showed a favorable correlation between clean water access and life expectancy.

The theories and empirical literature reviewed indicates the relevance of physical environment in explaining health outcomes. However empirical results on the environment-health nexus have remained inconclusive. While some suggests a positive relationship, others indicate a negative or no significant relationship. There is therefore the need for more vigorous research, using more sophisticated techniques and in different population settings.

3. Theoretical Framework and Research Methods

In order to conduct this investigation, we used the Grossman enhanced model of health production (Grossman, 1972). In addition, social, economic, and environmental factors were present. Nigeria is the sole focus of the study, which spanned 26 years (1990 – 2015). The World Development Indicators were used to gather the study's data because most of the indicators from 2016 to 2020 lacked environmental quality data during the time that was chosen (World Databank, 2020).

3.1. Model Specification and Estimation

In order to estimate the effects of environmental quality on human health, we formulate a model in which the quality of life proxied by Life Expectancy at birth (LEXP) is specified as a function of the other environmental and economic variables selected from a varied literature:

$$LNLEXP) = \lambda_0 + \lambda_1 LNCO_2 + \lambda_2 LNAIWS + \lambda_3 LNAISF + \lambda_3 LNAIWSISF + \lambda_4 \ln(PGDP) + \lambda_5 \ln(POP\_GRT) \quad (3.1)$$

Where: LEXP = Life Expectancy at Birth

CO_2= Carbon dioxide emissions

AIWS= Access to Improved Water Source

AISF= Access to Improved Sanitary Facility

AIWSISF= Access to Improved Water Source and Improved

Sanitary Facility

PGDP= Per capital Gross Domestic Product

POP_GRT= Population Growth

LN= Natural Log

The model was estimated using the Ordinary Least Square (OLS) estimation method. This model will calculate the percentage of variance in health outcomes that can be accounted for by environmental factors.

3.2. Nature and Description of Data

LEXP: Life expectancy is used as a proxy for life satisfaction. It is an estimate of a person's life span derived from averaging the ages of all people who died in a given year (Chen & Ching 2000).

CO2: A stand-in for the effect of the environment on the climate is the emission of carbon dioxide. It is expressed as metric tons per person. Increased carbon dioxide emissions are associated with poor environmental conditions and air pollution. In consequence, this has a negative impact on life expectancy and makes it worse.

AIWS: This is the proportion of the population with access to improved drinking water sources. Examples of improved drinking water sources include the piped water on premises (piped household water connection inside the user's home, plot, or yard) and other improved drinking water sources (public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, and rainwater collection). Human health is expected to improve as the prevalence of water-borne diseases decreases as more people gain access to better water sources. According to this study, increased access to water sources will increase life expectancy on these grounds.

AISF: The percentage of the population using better sanitation facilities is referred to as access to improved sanitation facilities. Improved restrooms are likely to guarantee the hygienic separation of human excreta from human contact. They consist of flush/pour toilets (to pipes in septic tanks, pit latrines, and sewer systems), vented improved pit latrines (VIP latrines), pit latrines with slabs, and composting toilets.

AIWSISF: The acronym AIWSISF—Access to Improved Water Source and Sanitary Facilities—was created to assess how access to an improved environment affects people's health. It is the average of having access to better water sources and sanitary facilities. As long as people have access to both better water sources and better sanitary facilities, it is anticipated that this will reduce the health risks associated with poor water quality and unclean sanitary facilities, increasing life expectancy. In the model, AIWSISF is anticipated to have greater explanatory power than the individual variables.

PGDP: Income level was approximated using GDP per capita. GDP divided by midyear population is how it is calculated. GDP is calculated as the total gross value added by all producers who are residents of the economy, plus any applicable product taxes, less any subsidies that are not reflected in the prices of the goods. It

is calculated without taking into account natural resource degradation or the depreciation of manufactured assets. Health is said to be affected favorably and remedially by income. Better meals, better education, greater housing, better access to medical care, and a more hospitable environment are all benefits of more money. Therefore, it is reasonable to assume that increased income and human health are positively correlated. However, some people may adopt unhealthy lifestyles and stressful lives after a specific income level, as claimed by some researchers, which may lead to a negative association between money and human health status.

POP_GRT: Rapid population growth has resulted in urban health issues brought on by a lack of sanitation and clean water, as well as shortages of land, water, and fire wood in rural areas (UNPF, 1991). As the population increases, so does the demand for products and services. If population growth remains constant, this could result in more environmental degradation (WDR, 1992). It is obvious that growing population density has contributed to severe and accelerating degradation of the exact resources that these expanding people depend on for existence in many of the world's poorest regions. The earth's ability to absorb resources is negatively impacted by population growth, which also puts more people in need of jobs. Additionally, there is a detrimental association between local health problems and population growth.

4. Presentation and Discussion of Results

The results of the ordinary least square (OLS) estimation and other statistics are examined in this section. The regression generally covers the period of 1990 – 2015.

4.1. Unit Root Result:

The standard economic theory requires series to be stationary i.e., are either *I(0) or I(1)* prior to estimating their relationship to avoid generating spurious results. In view of this, the conventional Augmented Dickey Fuller (ADF) test was employed.

The results are displayed in Table 1. The test statistics indicate that all the variables except carbon dioxide (CO_2) emission were stationary at level while CO2 became stationary at first difference. This implies that the null hypothesis of non-stationarity for LEXP, AIWS, AISF, PGDP and POP_GRT is thus rejected while the null hypothesis of non-stationarity for CO_2 cannot be rejected.

Table 1. Unit Root Test Results Summary

Variables	I(0) t-statistics	I(I) t-statistics	Conclusion
LEXP	2.684902(3)***	-	*I(0)*
CO_2	-0.01479(0)	-4.078267(0)***	*I(1)*
AIWS	-3.871855(0)***	-	*I(0)*
AISF	2.923907(4)*	-	*I(0)*
PGDP	4.029368(0)***	-	*I(0)*
POP_GRT	-3.421850(0)**	-	*I(0)*

Source: Author's Computation (using Eviews)

*Note:. ***,**,* denotes significance at 1%, 5%, and 10% levels respectively. The values in bracket for the ADF test indicate the optimal lag selected by the SIC within a maximum lag of 5.*

4.2. Johansen Cointegration Test Result

Having established the stationarity of the variables, the Johansen and Juselius (1990) cointegration technique was then applied.

The results of the Johansen test for cointegration are presented in Table 2a and Table 2b below.

Table 2a. Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	5% Critical Value	Prob. **
None *	0.975107	211.3930	95.75366	0.0000
At most 1 *	0.889121	122.7566	69.81889	0.0000
At most 2 *	0.735259	69.97306	47.85613	0.0001
At most 3 *	0.508290	38.07696	29.79707	0.0045
At most 4 *	0.391827	21.04017	15.49471	0.0066
At most 5 *	0.315713	9.105077	3.841465	0.0025

Source: Author's computation (using Eviews)

Table 2b. Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5% Critical Value	Prob. **
None *	0.975107	88.63637	40.07757	0.0000
At most 1 *	0.889121	52.78356	33.87687	0.0001
At most 2 *	0.735259	31.89610	27.58434	0.0131
At most 3	0.508290	17.03679	21.13162	0.1703
At most 4	0.391827	11.93509	14.26460	0.1131
At most 5 *	0.315713	9.105077	3.841465	0.0025

Source: Author's computation (using Eviews)

The result of the Johansen cointegration test indicates that a longrun relationship exists, among LEXP CO2 AIWIS AISF PGDP and POP_GRT. Therefore, the null hypothesis of no cointegration is rejected.

4.3. Presentation of Regression Result

Table shows the estimated long-run relationship between LIFE EXP and its determinants. All the long-run co-efficient are statistically significant in explaining the variation in LEXP at their individual level except POP_GRT. The results however revealed that there is a negative relationship between Life expectancy (LEXP) and Carbon dioxide emission (CO_2).This is consistent with the findings of Feyza Balan (2016) and the findings by Greenidge and Stanford (2007) who found a negative relationship between CO_2 emission and health status. The result further implies that a 1% increase in CO_2 emission in Nigeria will reduce life expectancy by 0.0092%. This finding is in accordance with the a priori expectation

Although coefficient of access to improved water source and access to improved sanitary facilities are statistically significant at 1% level of significance, they are however, not correctly signed according to economic literature. The study therefore opines that the negative relationship between access to improved water source (AIWS), access to improved sanitary facilities (AISF) and life expectancy (LEXP) could indicate that the current level of AIWS and AISF are not sufficient enough to impact positively on human health at their individual level. This is so much so, as gain from access to improved water source (public water scheme by the government), may be eroded by lack of access to improved sanitary facility and vice versa.

The linear combination of access to improved water source and access to improved sanitary facility has a positive effect on life expectancy with a high explanatory power. A 1% increase in this variable will improve life expectancy by 3.14%. This is indicative that investing in improved water source and sanitary facility will yield

This finding of this result is in agreement with the findings of Sanglimsuwan (2011). Therefore, if environmental quality is viewed as access of the population to improved water and sanitary facilities, human health status will improve significantly and as the quality of the environmental declines the health of the population worsens.

Per capita PGDP was found to have a positive effect on health status as expected from theory and also statistically significant at 1% level. A 1% increase in income level of an individual would lead to 0.083% increase in life expectancy. This is in line with the study of Or (2000) that found that income significantly improves health outcomes. We therefore conclude that human health status will improve proportionately with continuous improvements in income.

The result indicates that population growth was not statistically significant in explaining human health status in Nigeria within the study period.

Our coefficient of determination (*R*-square) of 0.9973 shows that the model provides a good fit as 99.73% variations in life expectancy is attributed to the included variables. The result also has an *F*-statistics of 1210.922 which indicates that the explanatory variables are jointly significant in explaining LEXP in Nigeria. The Durbin-Watson statistics of 1.88and the Breusch-Godfrey Serial Correlation LM Test reported in table 4below shows the absence of serial correlation.

Table 3. Estimated Long-Run Coefficients for the Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCO2	-0.009257	0.003317	-2.790666	0.0117
LNAIWS	-0.845205	0.167894	-5.034170	0.0001
LNAISF	-0.727756	0.118443	-6.144381	0.0000
LNAIWSISF	3.149383	0.575380	5.473565	0.0000
LNPGDP	0.083608	0.021841	3.828000	0.0011
LNPOP_GRT	0.108341	0.110903	0.976902	0.3409
C	2.006517	0.144344	13.90090	0.0000
R-squared	0.997392	Mean dependent var		3.872940
F-statistic	1210.922	Durbin-Watson stat		1.889785

Source: Author's computation (using Eviews)

Table 4. LM Test for Breusch-Godfrey Serial Correlation

F-statistic	0.058823	Prob. F(2,17)		0.9431
Obs*R-squared	0.178692	Prob. Chi-Square(2)		0.9145
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCO2	-0.000502	0.003831	-0.130917	0.8974
LNAIWS	0.005574	0.177630	0.031378	0.9753
LNAISF	0.002826	0.125084	0.022589	0.9822
LNAIWSISF	-0.015958	0.607994	-0.026247	0.9794
LNPGDP	0.000500	0.023181	0.021561	0.9830
LNPOP_GRT	-0.001983	0.117433	-0.016890	0.9867
C	-0.000161	0.152091	-0.001062	0.9992
RESID(-1)	-0.021653	0.264364	-0.081907	0.9357
RESID(-2)	-0.092907	0.272151	-0.341379	0.7370

Source: Author's computation (using Eviews)

5. Conclusion and Recommendations

The aim of this study was to investigate the impact of environmental quality on health status in Nigeria between 1990 and 2015. Environmental quality was measured using Carbon emissions per capita, access to a better water supply and improved sanitary facilities. Human health status was proxied by birth life expectancy. The augmented health production model was used in the analysis.

Results indicated that carbon emissions significantly and negatively affect health results in Nigeria. Access to a better water supply and improved sanitary facilities had a negative relationship with life expectancy at 1% level of significant individually but was statistically noteworthy in improving life expectancy when linearly combined. Interpreting our model gives the impression that environmental, economic and social factors account for about 99.73% percent of expected lifespan in Nigeria within the sample period.

The paper also concludes that income, access to a better water supply and improved sanitary facility are important variables that explained health outcomes in Nigeria and therefore, it is important for Nigeria to strengthen environmental legislation designed to increase people's access to sanitary facilities and high-quality water, together with increased income aimed at improving health status.

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