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Poverty and Environment Degradation on Life Expectancy in Nigeria

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Abstract
The correlation between poverty and environment degradation on life expectancy in Nigeria was investigated. This was done to gauge the effect of increasing poverty and environmental pollution and predict future trends in life expectancy. The research adopted the ex-post facto (After-the-fact) research method and relied on secondary data sourced from the Central Bank of Nigeria, Bureau of Statistics and World Bank Data Bank and other sources. Econometrics analyses were performed using different models after inquest into the stationarity conditions of the series through a Unit Root Test using the Augmented Dickey-Fuller (ADF) tool. This was aided by the E-View® version 10.0 Statistics Software. Result of the investigation reveals the following: (a) There is no significant relationship between CO_2 and NO_2 and life expectancy in Nigeria. (b) There is a significant relationship between oil spills and life expectancy in Nigeria. (c) There is no significant relationship between poverty and life expectancy in Nigeria. Based on the findings of this research, it can be concluded that oil spill is the single most important determinant of life expectancy in Nigeria contrary to theoretical expectations. Therefore, poverty alleviation, air quality control and the prevention of oil spills and the remediation of the environment are of utmost importance as negligence of these portends grave danger to life expectancy in Nigeria.

Keywords: Poverty, Environment, Degradation, Life Expectancy, Nigeria

1. Introduction

Poverty is a global problem in both developed and developing nations. However, its effect is more pronounced in developing nations particularly in sub-Saharan Africa (Addae-Korankye, 2014) [1]. In Nigeria, poverty has become endemic and pervasive in the last four decades despite the economic boom experienced in the 1970s (Anyanwu, 1997 [3]; Mohammed-Hashim, 2008; Obi, 2007) [7]. Available records reveal that about 60% of Nigerians live in poverty despite the country's enormous oil wealth (Sadiq, 2007) [9]. It can be argued that poverty varies from one subgroup to another such that poverty is seen in all its manifestations and its magnifications as antithetic to economic growth (Rodrigues, 2009) [8].

Globally, poverty has been recognized as a major blemish in developing economies ever since economists began to take interest in the third world (Killic, 1981) [4]. On the whole, the Nigerian economy depends so much on the exportation of oil that nearly all its budgetary revenues come from oil earnings sold in the international market. In 1973, most economic indicators such as real per capita income, real wages, and private consumption were positively impacted by the first oil shock, which caused a dramatic increase and sharp rise in them. Similarly, income inequalities between urban and rural areas increased sharply, primarily because of the oil boom and its spin-offs (Anusionwu and Diejomoah, 1981) [2]. However, the international price of oil decreased or fell constantly between 1980 and 1985 and brought about worsening economic conditions; there was a sharp fall in the standard of living and the biting hand of poverty was ushered in as a leading problem in Nigeria. Worse still, the increased mining of crude oil and the increase in industrial activities have further compounded environmental issues such as oil spills, air pollution and contamination of ground and open waters. This has resulted to health issues and reduced life expectancy.

To this end, WHO (2019) [10], opined that Anthropogenic air pollution is one of the biggest public health hazards worldwide, given that it accounts for about 9 million deaths per year. Also, Manisalidis (2020) [5] is of the view that environmental pollution in the form of air pollution has short-term and long-term effects on human health. The Short-term effect is closely related to COPD (Chronic Obstructive Pulmonary Disease), cough, shortness of breath, wheezing, asthma, respiratory disease,

and high rates of hospitalization (a measurement of morbidity). The long-term effects include chronic asthma, pulmonary insufficiency, cardiovascular diseases, and cardiovascular mortality. This shows a direct correlation between poverty, environment and life expectancy.

The motivation behind this study therefore, is built on the increasing poverty rate in Nigeria that has escalated the unsustainable utilization of environmental resources, resulting in severe environmental degradation amidst growing uncertainty in Nigeria's health outcomes and death rates. This is the issue.

2. Research Methodology

2.1 Research Design

This study adopted the ex-post facto (after-the-fact) research design which is a variant of the non-experimental research design. This is because it is a research that involves the collection of information that is already available. The collected data/information was analyzed according to the research questions or hypotheses.

2.2 Model Specification

2.2.1 Model One: Life Expectancy Model:

$$LER = f(POV, LIT, CO2, SLD, WTD) \quad (1)$$

The econometric form of this equation will be given as:

$$LER = \beta 0 + \beta 1 POV + \beta 2 LIT + \beta 3 CO2 + \beta 4 SLD + \beta 5 WTD + \mu\varepsilon \quad (2)$$

Where:

LER=Life expectancy. POV=Poverty index ($1.25) LIT=Adult literacy rate (a measure of education attainment). APL =Air pollution to be proxied by Carbon dioxide emissions

SLD= Soil degradation to be proxied by oil spill. WTD= Water Degradation to be proxied industrial waste. β's= unknown parameters. a priori expectation β1, β2,β3,β4,β5<0

2.2.2 Model Two: Interaction Model for Life Expectance Rate

$$LER = f(POV*LIT, POV*APL, POV*SLD, POV*WTD) \quad (3)$$

The econometric form of this equation will be given as:

$$LER = \beta 0 + \beta 1 POV*LIT + \beta 2\ POV*APL + \beta 3\ POV*SLD, + \beta 4 POV*WTD + \mu\varepsilon \quad (4)$$

Where:

LER = Life Expectance Rate

POV*LIT = Interaction between Poverty*Adult literacy rate

POV*APL = Interaction between Poverty *Air Pollution

POV*SLD = Interaction between Poverty *Soil Degradation

POV*WTD = Interaction between Poverty *Water Degradation

β's= unknown parameters. a priori expectation β1,β2,β3,β4<0

2.3 Description of variables in the model

2.3.1 Dependent variable:

2.3.1.1 Life expectancy: Life expectancy is a statistical measure of the average time an organism is expected to live, based on the year of its birth, its current age, and other demographic factors including sex.

2.3.2 Independent Variables:

The independent variables include poverty rate, carbon dioxide emission, oil spill, and industrial waste while literacy rate will enter the equation as a control variable.

2.3.2.1 Poverty: Poverty is a state or condition in which a person or community is deficient in financial resources and essentials for a minimum standard of living. Poverty-stricken people and families might go without proper housing, clean water, healthy food, and medical attention. Each nation may have its threshold that determines how many of its people are living in poverty. In this study, the percentage of the population living on less than $1.25 a day will constitute the poor. The apriori expectation is that poverty will have a positive effect on life expectancy. POV<0

2.3.2.2 Literacy rate: Literacy is the ability to read and write in at least one method of writing. The literacy rate as will be used in this work represents the total number of people that can read, write and use numerical in Nigeria. The a priori expectation is that an increase in literacy will reduce life expectancy.

2.4 Source of Data

Secondary data were sourced from the Central Bank of Nigeria, National Bureau of Statistics, CBN annual release bulletin, World Bank data bank, Ministry of Finance annual and other sources include journal articles, test books, and the internet.

2.5 Method of Data Analysis.

A descriptive and analytical approach was adopted in the examination of the relationship between poverty, environmental degradation and life expectancy in Nigeria. The descriptive tool employed was graphic exposition of the trends. Econometric analysis was employed after an inquest into the stationarity condition of the series through a unit root test and Augmented Dickey-Fuller (ADF).

2.6 Research Hypothesis

1. There is no significant relationship between poverty and life expectancy in Nigeria.
2. There is no significant relationship between environmental degradation and life expectancy in Nigeria.
3. There is no significant relationship between the joint interaction of poverty and environmental degradation on life expectancy in Nigeria.

3. Result

The result obtained from primary data of the dependent and independent variables are represented in figures 1 to 5.

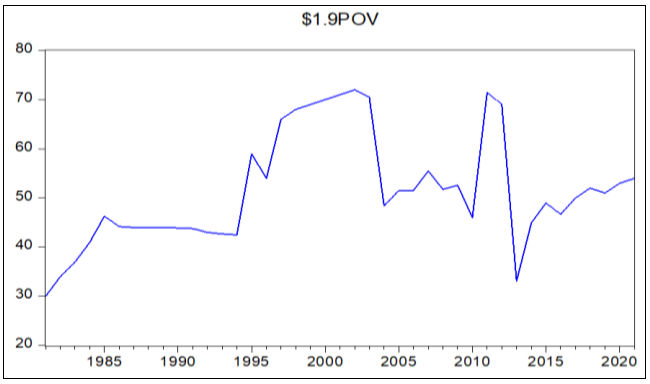
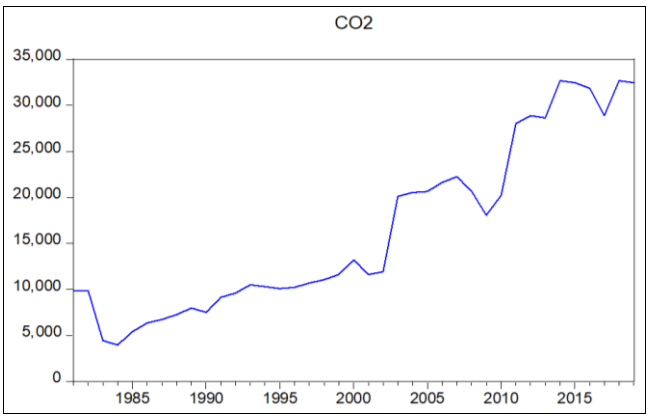
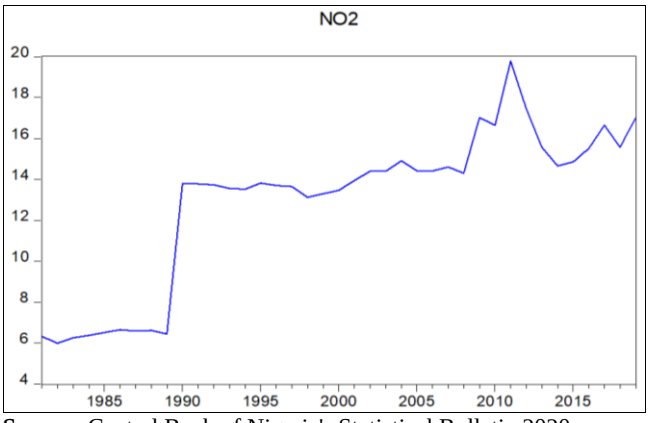


Fig 1: Trend analysis of poverty in Nigeria for the period of 1980 to 2020



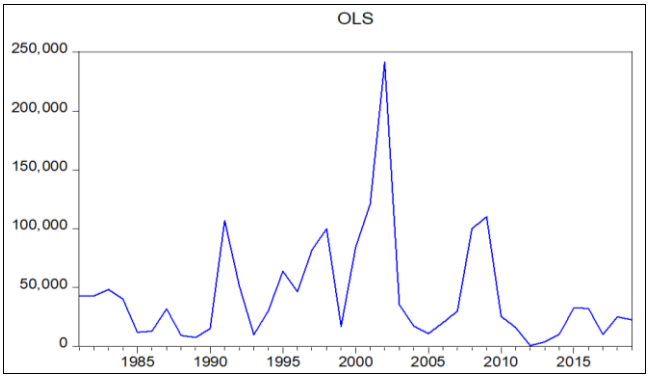
Source: Central Bank of Nigeria's Statistical Bulletin 2020

Fig 2: Carbon dioxide emission in Nigeria for the period of 1980 to 2020



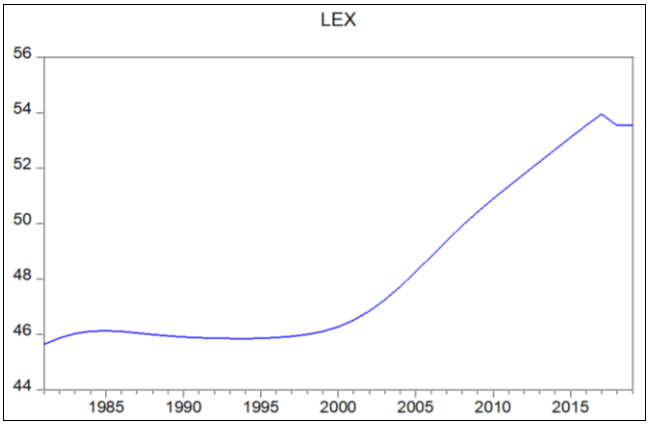
Source: Central Bank of Nigeria's Statistical Bulletin 2020

Fig 3: Trend of nitrogen dioxide in Nigeria for the period of 1980 to 2020



Source: Central Bank of Nigeria's Statistical Bulletin 2020

Fig 4: Trend of oil spill in Nigeria for the period of 1980 to 2020



Source: Central Bank of Nigeria's Statistical Bulletin 2020

Fig 5: Trend of life expectancy rate in Nigeria for the period of 1980 to 2020

3.2 Analyses of Data

Table 1: Descriptive Statistic

	LEX	MMR	POV	CO_2	NO_2	OLS
Mean	48.22746	48.27713	51.40632	16404.56	12.90400	44038.76
Median	46.26700	46.26700	48.70000	11617.06	13.81638	30282.67
Maximum	53.95000	54.68700	72.00000	32702.31	19.77919	241617.6
Minimum	45.63700	45.63700	30.00000	3942.025	5.996883	665.0300
Std. Dev.	2.925861	3.025038	11.87521	9396.248	3.841063	46269.91
Skewness	0.822095	0.883657	0.431581	0.538023	-0.797048	2.311197
Kurtosis	2.053852	2.232247	2.187531	1.868615	2.461453	9.650235
Jarque-Bera	5.847651	6.033376	2.224830	3.961600	4.600658	106.5872
Probability	0.053728	0.048963	0.328764	0.137959	0.100226	0.000000
Sum	1880.871	1882.808	1953.440	639777.9	503.2561	1717511.
Sum Sq. Dev.	325.3051	347.7325	5217.762	3.36E+09	560.6430	8.14E+10
Observations	39	39	38	39	39	39

3.2.1 Stationarity Test for Model One

Table 2: Summary Compilation of Stationarity Test (ADF)

Statistics / variable	Level			First Diffirence			Order of Integration
	T.Statistic	5% Level	Prob	T.Statistic	5% Level	Prob	
POV	-2.897319	-3.536601	0.1749	-6.274991	-3.544284	0.0000	I(1)
LOG(CO_2)	-4.549406	-3.533083	0.0043	-	-	-	I(0)
LEX	1.023982	-1.950117	0.9165	-3.682584	-1.950687	0.0470	I(1)
LOG(NO_2)	-1.705751	-2.941145	0.4204	-6.533216	-2.943427	0.0000	I(1)
LOG(OLS)	-3.517377	-2.941145	0.0128	-	-	-	

ADF - Augmented Dickey Fuller**. Prob –** Probability Level

Using the Augmented Dickey-Fuller test as compared with the Test Critical Value of 5%, it is observed that all variables in the model became stationary after they were subjected to first differencing except the log of carbon dioxide and the log of oil spill. These variables became stationary at that level or revert to their mean values. By implication, both oil spill and carbon dioxide components of environmental degradation do not have a unit root problem. Thus, the hypothesis is rejected. On the other hand, other variables in the model became stationary after they were subjected to their first difference. This shows the presence of a unit root in the trend and unless they are differenced, the variable behaves inconsistently and will be unreliable when used in estimation. Hence, the variable was subjected to a differencing procedure that is in line with Box and Jenkins' 1970 procedure. When variables fail to attain stationarity, the differencing of variables helps smooth the trend of the variables. This is superior to the logarithm, which cannot manipulate negative values. The study, therefore, presents the cointegration test as follows.

3.2.2 Co-integration Test

Table 3: Co-integration Test for Model One ((Bound Test)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Significance	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	4.722	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
Actual Sample Size	36		Finite Sample: n=40	
		10%	2.427	3.395
		5%	2.893	4
		1%	3.967	5.455
			Finite Sample: n=35	
		10%	2.46	3.46
		5%	2.947	4.088
		1%	4.093	5.532

The co-integration tests (Table 3), shows that the f-statistical value of 4.72 is greater than the upper bound of the critical value of 3.49 at 5 per cent level. Therefore, we reject the null hypothesis of no long-run relationship and accept the alternative hypotheses of the existence of a long-run relationship. By implication, there is a long-run cointegration among the series in the hypotheses, and in the long run, there will be convergence. Since there is a long-run association, we then proceed to ascertain their long-run and error correction regressions.

3.2.3 Long Run (ARDL) Estimate

Table 4: Long Run (ARDL) Estimate for model one

Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
POV	0.070253	0.044090	1.593397	0.1242
LOG(CO_2)	0.546702	1.468416	0.372307	0.7129
LOG(NO_2)	1.825428	1.651487	1.105324	0.2800
LOG(OLS)	-1.549153	0.571036	-2.712881	0.0121
C	49.24981	13.64781	3.608624	0.0014

Table 4 depicts the long-run impact of poverty and environmental degradation on Nigerian life expectancy from 1980 to 2020.The test statistics show that poverty has a positive effect on life expectancy but is not statistically significant. By implication, poverty is not a driver or determinant of life expectancy in Nigeria in the long run. The coefficient of carbon dioxide emission has a positive effect on life expectancy in Nigeria, but its value of 5 percent is not statistically significant. In the same vein, the coefficient of nitrogen dioxide affected life expectancy positively, although it was not statistically significant at 5 percent. This implies that both carbon dioxide and nitrogen dioxide are not significant determinants of life expectancy in Nigeria.

The coefficient of an oil spill has a negative effect on life expectancy and is statistically significant at 5 percent. Therefore, an increase in oil spills will, all things being equal, amount to a -1.54 unit reduction in life expectancy in Nigeria. This causality is consistent with economic theory and explains the situation in Nigeria, especially in oil-producing areas of the state. The continued exploration or drilling of crude oil in the Niger Delta area of Nigeria has led to an increase in oil spills into the river and on land. According to the above findings, the negative effects of these spills have had a significant long-term impact on Nigeria's life expectancy.

3.2.4 Error Correction regression and Short Run causality

Table 5: Error Correction regression and Short Run causality

ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEX(-1))	0.117075	0.156326	0.748913	0.4612
D(LEX(-2))	1.251692	0.209605	5.971667	0.0000
D(POV)	0.000454	0.002162	0.209831	0.8356
DLOG(OLS)	-0.052341	0.017529	-2.985981	0.0064
DLOG(OLS(-1))	0.096016	0.020604	4.660073	0.0001
DLOG(OLS(-2))	0.066795	0.021201	3.150531	0.0043
CointEq(-1)*	-0.086031	0.014703	-5.851266	0.0000
R-squared	0.852149	Mean dependent var		0.208833
Adjusted R-squared	0.821559	S.D. dependent var		0.253104
S.E. of regression	0.106917	Akaike info criterion		-1.460863
Sum squared resid	0.331506	Schwarz criterion		-1.152956
Log likelihood	33.29553	Hannan-Quinn criter.		-1.353395
Durbin-Watson stat	2.196210			
* p-value incompatible with t-Bounds distribution.				

Table 5 illustrates the error correction regression. Statistically, the R-Square is 0.852, while the adjusted R-Square value is 0.821. This means that the coefficient of determination is 0.821559, or that 82 percent of the variation in life expectancy is accounted for by poverty and environmental degradation in Nigeria while the remaining 28 percent is captured in the error term. The Durbin-Watson statistic value of 2.196210 shows the absence of first-order autocorrelation in the residual. The error correction term appeared with a normal sign (-). Therefore, the past disequilibrium will herald a long-run equilibrium at a speed of 8 percent.

Econometrically, the past realization of life expectancy in the first year is positive but not statistically significant at 5 percent, while the second year's past value affected life expectancy significantly by 1.251692. The implication of the above causation is that life expectancy has a feedback effect on itself in the short run. The coefficient of poverty has a positive effect on life expectancy, but it is not statistically significant at 5 percent, whereas the coefficient of oil spill is a significant determinant of life expectancy in the short run. A one-unit increase in oil spills will, all things being equal, amount to a -0.052341 unit decrease in life expectancy in the short term. This causality supports the theoretical underpinnings of this research work. Theoretically, an increase in oil exploration will lead to oil spills, which will reduce the quality of the soil and reduce the biodiversity of the oil and aquatic life. This menace will amount to a reduction in agriculture and the quality of its products, and if that occurs, the nutrient value of agricultural output will not be sufficient to improve life expectancy rather than reduce it. In addition to the above, the past values of oil spills are positive determinants of life expectancy by 0.096016 and 0.066795.

3.3 Poverty, environment, and life expectancy in Nigeria

In estimating the link between poverty, environmental degradation, and life expectancy in Nigeria for the period of 1980 to 2020 using ARDL, it was glaring that oil spills have a negative effect on life expectancy in both the long and short run, while other variables like carbon dioxide emissions and nitrogen dioxide are insignificant. By implication, the oil spill has had a permanent reduction in influence on life expectancy in Nigeria, and this causality is consistent with the current happenings. Recall that when crude oil spills on the soil, it reduces the quality of the soil, and when it spills into the water, it kills all aquatic animals. These will lead to a reduction in agricultural production and reduce the nutritional quality of the available food intake of Nigerians, which will reduce their life expectancy. Oil spills have been a regular occurrence in the Niger Delta region of the country over time, and this may have been the reason behind the low life expectancy in the region.

The estimated vector error correction mechanism (VECM) shows that poverty and oil spills' interaction has a positive effect on life expectancy, contrary to theoretical expectation. These, to a great extent, show the endemic influence of poverty on Nigerians and explain the traumatizing influence of oil spills in Nigeria. By implication, Nigeria has seen oil

spills triggered by poverty, like the activities of the oil thieves and artisanal refineries, as sources of income and means of bettering their economy. This could also imply that an increase in oil spills will boost the economy of the informal system, which the majority of people rely on due to the land's agonizing poverty.

4. Summary and Conclusion

4.1 Summary

The study of the impact of poverty and environmental degradation on life expectancy in Nigeria from 1980 to 2020.The motivation behind this study is built on the increasing poverty rate in Nigeria that has escalated the unsustainable utilization of environmental resources, resulting in severe environmental degradation amidst growing uncertainty in Nigeria's health status. This study is an empirical elucidation that followed a three-step procedure in research writing. These procedures include pre-estimation, estimation, and post-estimation. The pre-estimation test was conducted with an augmented Dickey-Fuller test and a KPSS test. The pre-estimation test indicates that there is a mixed order of integration of the time series data, which was sourced from the central bank of Nigeria's statistical bulletin 2020. The dependent variable is life expectancy, while the independent variables include poverty rate, carbon dioxide emission, nitrogen dioxide emission, and oil spills. To capture the study's specific objectives, two structural equations were estimated using the underlying assumptions of classical linear regression. One of the models is a normal estimation, while the other one is an interaction model. Hence, the results of the estimation can be summarized as follows:

1. An increase in oil spills will reduce life expectancy in Nigeria in the long and short term.
2. In the short run, the historical values of oil spills will increase life expectancy.
3. Nigeria suffers from poverty as a result of the oil spill.
4. The interaction of poverty and carbon dioxide emissions ($POVCO_2$) increases life expectancy in Nigeria.

4.2 Conclusion

This study concludes that oil spills are the main channel through which environmental degradation affects health outcomes and life expectancy in Nigeria and that such a negative effect has been consistent over a long period of time. Also, it was resolved that poverty is not a determinant of life expectancy in Nigeria. Hence, the perception that reduction in life expectancy are caused by the extreme poverty in Nigeria has been put to rest. Other than poverty alone, the interaction of poverty and carbon dioxide emissions increases life expectancy in Nigeria. Hence, the augmented model performed better than the baseline model. In Nigeria, poverty has triggered carbon dioxide emissions life expectancy.

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