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ECONOMIC GROWTH, AIR POLLUTION AND HEALTH OUTCOMES IN NIGERIA

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Abstract

The study examined air pollution, health outcomes and economic growth in Nigeria spanning from 1990 to 2020. Three hypotheses guided the study. OLS and Co-integration analysis technique were employed in obtaining the numerical estimates and the long-run relationship between the variables. The findings revealed that the long run relationship between air pollution, health outcomes and economic growth in Nigeria was found to be negative. In other words, there is an indirect and negative relationship between air pollution, health outcomes and economic growth in Nigeria. For a number of reasons, the government should prioritize building up the healthcare system and providing high-quality medical care. First, social welfare is adversely impacted by the poor health infrastructure. Second, spending on public health and human capital boosts labour productivity, which in turn leads to higher economic growth and revenue. Effective energy management policies are a crucial precondition for reducing air pollution emissions without negatively impacting economic activity. Similarly, even while achieving economic development is the primary goal, it is crucial to examine methods that enhance the value of the atmosphere.

Keywords: Air Pollution, Health Outcomes, Economic Growth

1. Introduction

A stable economy is what every respectable country aspires to. The progressive increase or rise in the market value of the commodities and services generated by an economy, after accounting for inflation, is known as economic growth. Real GDP growth as a percentage of GDP is often used to measure economic growth. Stated differently, economic growth is the rise in output of products and services from one historical period to the next. The year 2020 was the worst year for economic loss since 1983, with a 1.8% decline in the Nigerian GDP. The COVID-19 problem was the main cause of the

economic crisis; other external conditions included capital outflows, rising risk aversion, low oil prices, and declining foreign remittances (Lawal *et al*, 2020). Even though the future is somewhat unpredictable, analysts predict that Nigeria's GDP would expand by 1.8% by the end of 2021. Furthermore, macroeconomic risks are worsened by excessive unemployment and inflation, and tertiary sector activity will not return to normal until COVID-19 is managed. There are pros and cons to economic expansion. The advantages include a greater quality of life, better access to healthcare, more years of life expectancy, and a better probability of completing

postsecondary education. Economic progress is not without its expenses. Economic development entails greater production and consumption, which may worsen health conditions, widen economic gaps, deplete natural resources, and pollute the environment more heavily, especially the air. Families' ability to save money and create income is also indirectly impacted by air pollution. Governments have additional budgetary burdens as a result (Afolabi, Urhie, Ogunbiyi, Ogundiran & Afolabi, 2019).

The literature has shown a multitude of elements that drove the economic growth of both industrialized and developing nations. The environment has recently gained prominence among contemporary issues for both developed and developing countries, as concerns about the degradation of environmental quality raises concerns about global warming and climate change, which are primarily caused by greenhouse gas (GHG) emissions (Alam & Gow, 2017). Concerns over energy shortages, rising energy use, and climate change have intensified. The growing threat of climate change and global warming, along with pressure from a more populated nation and a more energy-intensive economy, have all contributed to a rise in Nigeria's greenhouse gas (GHG) emissions (Akpan & Akpan, 2019). Because of the current worry about global warming, the relationship between air pollution from carbon emissions and economic development has continued to be discussed by many scholars and economies worldwide. The majority of individuals agree that CO₂ emissions are one of the primary drivers of global warming (Akpan & Akpan, 2019). Specifically, rising energy use-related carbon dioxide emissions are responsible for over 72% of the total emitted greenhouse gases that contribute to global warming (Karnjana, 2019). Growing worries about environmental problems, including air pollution from energy use, have resulted in increased health care costs, decreased savings, and ultimately decreased investment, all of which may have an effect on future growth and development. Nigeria's economy is impacted by air pollution in a number of areas, chief among them being the petroleum and agricultural industries. Nigeria's economic growth is impacted by every economic sector. Nigeria's agriculture industry

has suffered greatly as a result of air pollution, which has slowed economic growth. Although reducing pollution has aided in economic development, it is very difficult to regulate pollution after it has occurred and restore a region to its pre-polluted form (Araoye, Ajayi, Olatunji & Aruwaji, 2018).

The population's health has a big impact on productivity since only a healthy labor force can significantly contribute to the expansion and growth of the nation's output. Depending on the production scale and returns to scale, the amount and level of inputs have a proportionate impact on the quantity and level of output, much like a conventional production function (Ogunjimi & Adebayo, 2020). Because it has a beneficial effect on economic development, which is one of any government's macroeconomic aims, the health of its population is thus vital, and as such, providing appropriate healthcare should be one of the main objectives of government. In a similar vein, the resources available to the population as well as the nature of the health system impact health outcomes. The connection between results and resources makes it easier to evaluate how well a nation's health system is working. If a nation produces better health outcomes with the same amount of resources as another nation, or if it produces the same results with less resources, then its health system performs better than that of the other nation. Either taxes, in the case of state-owned healthcare services (national health services), or income-related social contributions (social security systems) are used to fund health systems. In nations with high per capita incomes, social security plays a huge role in maintaining the finances of the health system. A primary responsibility of every government is to provide funding for social welfare programs, of which health care is a crucial component. Therefore, in an effort to improve citizens' health and allow them to significantly contribute to the nation's economic growth and development, the government allocates public funds to health care services.

In Nigeria, service delivery is not improving despite the widespread belief that more spending for social services would make a positive difference. Budget fraud and/or mismanagement are major contributors to

wasteful public spending in many developing countries (World Bank, 2018). For example, despite increased funding allocated to the health sector, several health indices indicate that Nigeria performs poorly in terms of health outcomes. According to UNAIDS' 2016 report, Nigeria has the second-highest rate of HIV/AIDS prevalence worldwide. Nigeria was listed as having the eighth-highest infant death rate (69.8 per 1000 live births) in the world by the Central Intelligence Agency (CIA) in 2017.

Rich people and those in positions of political power import medical services into Nigeria or travel abroad for medical examinations and/or treatments, benefiting foreign nations at the expense of the domestic economy. Nigeria's economy is largely dependent on imports of both goods and services. For example, Muhammadu Buhari, the current president of Nigeria, took a medical leave of absence in early 2017 that lasted more than 50 days. In May of the same year, he took another medical leave of absence that lasted an incredible 103 days. Since the majority of Nigeria's machinery and equipment are antiquated and fall short of what is available in developed nations, the president, other politicians, and the wealthy all exhibit a lack of faith in the services provided by resident medical practitioners. As a result, there's a rise in brain-drain as skilled medical professionals relocate to industrialized nations with access to advanced medical technology in order to maximize productivity and stay up to date with the field's rapid advancements. As a result, the health sector's labor force declines, which lowers the sector's contribution to GDP and the overall national production. Over time, a number of institutional frameworks and policies have been put in place to enhance the functioning of the Nigerian health system. These policies include the National Population Policy of 1988, the National Population Policy for Sustainable Development of 2004, and the National Population Policy of 2006. The National Primary Health Care Development Agency (NPHCDA), the National Health Insurance Scheme (NHIS), the Nigerian Institute of Medical Research (NIMR), and the National Agency for Food and Drug Administration and Control (NAFDAC) are the four agencies that make up the Federal Ministry of Health

and whose operations have an impact on Nigeria's demographic structure. The Federal Ministry of Health, the National Planning Commission, and the National Population Commission (NPC) are examples of the institutional structures. However, considering the illnesses plaguing Nigeria's healthcare system, these government initiatives have not produced the expected results, which have an influence on health outcomes.

Thus, it is certain that Nigeria's present emission profile is a serious obstacle to the nation's economic development. In addition to contributing to global warming and thinning the ozone layer in the sky, air pollution is a major cause of cancer and respiratory illnesses. There are many ways and causes of air pollution, both natural and man-made. For example, air pollution serves as a warning that unsustainable economic expansion has resulted in environmental deterioration as well as a danger to individuals' health. Particulate matter is a characteristic that is common to causes of air pollution, such as carbon monoxide, sulfur nitrate, nitrogen, etc. Unfortunately, breathing difficulties, coughing, shortness of breath, chest tightness, and eye discomfort are all common short-term symptoms of particle pollution exposure. Nonetheless, this research makes an effort to investigate how Nigeria's economic development is impacted by air pollution and health effect. The study therefore examined the effect of air pollution on the health outcomes and economic growth in Nigeria.

There hypothesis were formulated

HO₁: There is no significant impact of air pollution on economic growth in Nigeria.

HO₂: There is no significant impact of health outcomes on economic growth in Nigeria.

HO₃: There is no significant long run relationship between air pollution, health outcomes and economic growth in Nigeria.

2. Literature Review

2.1 Theoretical Literature

Eco-Efficiency Theory

The natural environment, rather than human activity, is the primary determinant of an ecosystem. Man and the natural environment are in a dynamic connection. In its 1998 contribution to the discussion of environmental sustainability, Environmental Right Action (ERA) emphasized that it is imperative that humans confront the problem of environmental depletion. Eco-efficiency proposes that businesses may consume fewer resources, have a smaller carbon footprint, and generate more valuable goods all at the same time. Additionally, eco-efficiency argues that the emphasis should be on addressing the causes of harmful environmental impact rather than the effects themselves. According to Aert, Cornier, and Magnum (2006), this idea conveys at least three key ideas. The first is that enhancing ecological and economic performance should be seen as complementary. Second, it is important to consider enhancing environmental performance from a competitive standpoint rather than as an act of charity or compassion. This is in contrast to the opinion expressed by Deegan (1998), who said that social costs—that is, environmental costs—that do not equal associated income are borne for the benefit of society as a whole rather than the particular business. A third proposal is that eco-efficiency need to be seen as beneficial to sustainable development.

2.2 Empirical Review

Akinbode, Dipeolu, Bolarinwa, and Olukowi (2021) investigated the connection between economic development and health outcomes in sub-Saharan Africa (SSA). The findings demonstrated that a number of variables significantly influenced economic development, including capital formation, labor force participation (LF), health expenditures (HE), trade openness (TOP), health outcome (as determined by life expectancy), and lagged GDP per capita. These results demonstrate the vital significance that health plays in the region's economic development process.

Orji, Ogbuabor, Mba, and Anthony-Orji (2021) examined the relationship between public health expenditure and health outcomes in Nigeria. The under-5 mortality rate is significantly reduced and life expectancy is increased when government health expenditure is increased, according to empirical results from the Classical Regression Analysis. Furthermore, studies have shown that although HIV prevalence shortens life expectancy, measles immunization reduces the mortality rate among children under five. In order to ascertain the contribution of health to growth and poverty reduction as well as the threshold of health required to buffer the detrimental effects of poverty on economic growth in Nigeria, Lawanson and Umar (2021) looked at the relationship between life expectancy growth and the role of poverty reduction. The entirely modified ordinary least square technique was used to assess the relationship between life expectancy, the rate of poverty, and economic development based on the endogenous growth theoretical approach. The results demonstrated that although poverty hinders Nigeria's economic progress, health also has a favorable role.

Alhassan, Adedoyin, Bekun, and Agabo (2020) looked studied the relationship between public health spending, mortality rate, and life expectancy and Nigeria's economic development under COVID-19. Throughout the research period, the empirical data for the limits test monitors the long-term correlation between public health spending and economic growth. Additionally, the study's findings showed that a 1% increase in the life expectancy and death rate, respectively, causes 3.85 and 1.84% rises and falls in economic growth. Between 1981 and 2017, Ogunjimi and Adebayo (2019) looked at the connection between health outcomes, health spending, and economic development in Nigeria. The Toda-Yamamoto causality paradigm was used in this work to investigate these linkages. The highest order of integration of the variables used in the study was indicated by the value of one obtained from the Augmented Dickey Fuller unit root test. Using the Autoregressive Distributed Lag (ARDL) Bounds test approach to cointegration, the long-run relationship between the macroeconomic variables used in the

study was examined, and the outcome was good. A unidirectional relationship between health expenditure and infant mortality, a bidirectional relationship between real GDP and infant mortality, and a unidirectional relationship between health expenditure and real GDP and life expectancy and maternal mortality were the three patterns of causal relationships identified by the Toda-Yamamoto tests.

Alege and Ogundipe (2013) investigated the connection between Nigeria's economic development and environmental quality. According to the study, Nigeria's early development emphasizes how critical environmental deterioration is. Moreover, it concludes that the degree of environmental damage brought about by environmental dumping is amplified by weak institutions and unbridled commercial openness. Ultimately, the research demonstrates that higher population density raises environmental consciousness and accelerates environmental mitigation initiatives. Afolabi, Urhie, Ogunbiyi, Ogundiran, and Afolabi (2019) evaluated the relationship between economic development and health outcomes in Nigeria with regard to air pollution. Using process software, the study calculated the overall, direct, and indirect effects of economic development on Nigeria's health performance. The study found a clear and positive correlation between life expectancy and GDP, which are indicators of economic growth and health outcomes in Nigeria. It also found that the use of a transmission mechanism (air pollution, in this case) can have an indirect effect on the connection, indicating that better health outcomes may not always follow economic growth. Araoye, Ajayi, Olatunji, and Aruwaji (2018) investigated how Nigeria's economic development was impacted by environmental pollution. For the years 2000 to 2014, it primarily looked at the trajectory of economic growth and the impact of environmental costs of pollution on that growth. Secondary time series data from the Central Bank of Nigeria's statistics bulletin were used in this investigation. The study's conclusions demonstrated that Nigeria's economic growth was not significantly impacted by the cost of pollution. According to the report, fines and penalties for gas flaring and oil spills

should be raised to the point that doing so outright dissuades oil firms from doing so.

3. Methodology

Secondary data from 1990 to 2020 gotten from Central Bank of Nigeria (CBN) and IndexMundi were used for this paper. The Quality of Life Theory (QOL) assumptions about the connection between air pollution and economic development, as well as the Maduka, Madichie, and Ekesiobi (2016) model about the relationship between health outcomes and economic growth, are represented mathematically as follows:

$$RGDP = f(HEXP, LEXP) \quad (1)$$

Explicitly, equation 1 is transformed into equation 2

$$RGDP = a + b HEXP + LEXP + e \quad (2)$$

Where:

LEXP = Health outcomes measured by life expectancy

HEXP = Health expenditure

RGDP = Economic growth and e is the error term

However, the Maduka et al model was altered in order to meet the study's aims, and this alteration included the addition of an air pollution variable. The modifications are as follows:

$$RGDP = a + b LEXP + c AIRP + u \quad (3)$$

Where:

RGDP = Economic growth (proxied by growth rate)

LEXP = Health outcomes (proxied by life expectancy)

AIRP = Air pollution

a , b and c = Parameters to be estimated;

u = Stochastic term

The econometric process was used in the study's estimate technique. The above-mentioned model's coefficient numerical estimates were obtained by using the OLS analysis approach. The following statistical and economic methods are employed as assessment techniques: Durbin Watson statistics, R-square, F-test, standard error, and t-test. To determine if the parameter estimations are statistically significant when compared to zero, the standard error was used. Standard error was governed by the heuristic that the

standard error of the parameter estimate had to be less than half of the parameter estimate ($SE\ b_0 < \frac{1}{2} b_0$) in order to be considered statistically significant. When this occurs, we are expected to reject the null hypothesis and accept the alternative hypothesis, and vice versa. Additionally, the calculated parameter's individual statistical significance was tested using the t-test at a predetermined significance threshold, typically 5%. According to the t-test's thumb rule, the computed t-test must be larger than the tabulated t-test or the theoretical value at the 5% level of significance in order for statistical significance to be established. We are to accept the alternative hypothesis and reject the null hypothesis when the t-statistic is more than the critical value. Similarly, we are to accept the null hypothesis when the critical value is greater than the t-statistic. Additionally, R-squared was used to evaluate

the model's goodness of fit. A model has a poor fit if R-squared is less than 50%, and vice versa. Additionally, the combined statistical significance of the explanatory factors and the dependent variable was tested using F-statistics. There is a joint significant association when F-calculated is bigger than F-critical, and vice versa. Lastly, the existence or lack of positive association was examined using econometric criteria. Durbin Watson Statistics is the economic metric that was used in this case. If the Durbin Watson statistic is not around 2, but rather is between 0 and 2. This suggests that positive serial correlation is present, but negative serial correlation is present if the correlation is close to or greater than 2. There is proof of negative serial correlation if the value is higher than 2.

4. Results and Discussion

Table 1: OLS results on the impact of air pollution and health outcomes on economic growth in Nigeria

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXP	-0.216286	0.195659	-1.105424	0.2784
AIRP	-0.224320	0.083993	-2.670702	0.0125
C	29.83841	11.64116	2.563181	0.0160
R-squared	0.217863	Mean	dependent	4.418710
Adjusted squared	R- 0.161996	S.D. dependent var		3.982184
S.E. of regression	3.645393	Akaike criterion	info	5.516571
Sum squared resid	372.0890	Schwarz criterion		5.655344
Log likelihood	-82.50685	Hannan-Quinn criter.		5.561808
F-statistic	3.899677	Durbin-Watson stat		1.266835
Prob(F-statistic)	0.032060			

Source: Authors' Computation (2024)

4.1 Interpretation of the Result

The regression result above showed that the estimate parameter for health outcomes (LEXP) had a coefficient of -0.216286. This demonstrated that there is an indirect link between Nigeria's economic growth and health results. This further suggested that the linear combination of health outcome explained around 0.216286 of the decline in economic growth. For air pollution (AIRP), the coefficient of the estimation parameter is -0.224320. This suggested that

air pollution and Nigeria's economic growth have a negative relationship.

Half of the variable's coefficient is ($\frac{1}{2} \times -0.216286 = -0.108143$), and the standard error of health outcomes (LEXP) is 0.195659. According to a general rule of thumb, health outcomes are one of the major elements influencing economic growth in Nigeria as the half of the coefficient of health outcomes is smaller than the standard error of the coefficient of the variable. The t-statistics from the table (critical t-test) are (1.007) at

the 5% level of significance, but the t-statistics computed for health outcomes are 1.105424. The null hypothesis was rejected since the variable's t-calculated value is larger than the t-table value of 1.007. Consequently, the variable is statistically significant. This suggests that health results have a major influence on Nigeria's economic growth. The air pollution standard error is 0.083993, while the variable's half-coefficient is $(1/2 \times -0.224320 = -0.11216)$. According to a general rule of thumb, air pollution is statistically significant if its half of the coefficient of the variable (air pollution) is smaller than its standard error. At the 5% level of significance, the crucial t-test t-statistic from the table is (1.007), however the t-statistic for air pollution estimated is 2.670702. Given that the variable's t-calculated value is less than the t-table value of 1.007, the null hypothesis is rejected and the variable is statistically significant. This further indicates that air pollution has a major influence on Nigeria's economic growth.

With a coefficient of determination (R^2) of 0.217863, or around 22%, there is a weakly positive correlation. This suggested that the regression lines did

have a fair measure of fit and that only around 22% of the variability in economic growth can be explained by the explanatory variables, which are air pollution and health outcomes. The remaining 78%, however, cannot be explained by air pollution or health outcomes; instead, the variables in the model did not account for other factors that may have an impact on Nigeria's economic growth.

The combined variance between the independent and dependent variables is measured by the f-statistics. The f-statistic from the table is 1.986 at 5% degree of freedom, while the f-statistic computed is 3.899677. The null hypothesis is rejected since the estimated f-statistics ($3.899677 > 1.986$) are larger than the f-statistics from the table, indicating that the model is statistically significant. The researchers came to the conclusion that air pollution and health outcomes have a substantial combined impact on Nigeria's economic growth. Furthermore, the Durbin Watson statistics computed are 1.266835, or about equivalent to 1. This suggests that the developed model has positive serial correlation.

Table 2: Long run relationship between air pollution, health outcomes and economic growth in Nigeria

AIRP(-1)	1.000000	
LEXP(-1)	14.58874	
	(4.53020)	
	[3.22033]	
C	-782.8940	
Error Correction:	D(AIRP)	D(LEXP)
CointEq1	0.068386	0.007155
	(0.04579)	(0.00253)
	[1.49351]	[2.83129]
D(AIRP(-1))	-0.389325	-0.003132
	(0.21812)	(0.01204)
	[-1.78490]	[-0.26021]
D(AIRP(-2))	-0.388293	-0.010442
	(0.20535)	(0.01133)
	[-1.89087]	[-0.92136]
D(LEXP(-1))	-4.411153	-0.431820
	(4.22627)	(0.23325)
	[-1.04375]	[-1.85135]
D(LEXP(-2))	-0.868436	0.101188
	(6.28633)	(0.34694)

	[-0.13815]	[0.29166]
C	2.961606	0.350417
	(2.46699)	(0.13615)
	[1.20049]	[2.57371]
RGDP	-0.208890	0.035557
	(0.37953)	(0.02095)
	[-0.55039]	[1.69756]
R-squared	0.256770	0.446751
Adj. R-squared	0.044419	0.288680
Sum sq. resids	702.8384	2.140765
S.E. equation	5.785196	0.319282
F-statistic	1.209175	2.826266
Log likelihood	-84.85119	-3.735702
Akaike AIC	6.560800	0.766836
Schwarz SC	6.893851	1.099887
Mean dependent	0.169643	0.376429
S.D. dependent	5.918126	0.378567
Determinant resid covariance (dof adj.)		3.411763
Determinant resid covariance		1.919117
Log likelihood		-88.58667
Akaike information criterion		7.470476
Schwarz criterion		8.231736

Source: *Authors' Computation (2024)*

It was shown that there was a negative long-term correlation between air pollution, health outcomes, and economic development in Nigeria. Stated differently, there exists a circumstantial and adverse connection among air pollution, health consequences, and economic expansion in Nigeria.

The results showed that there was a negative long-term correlation between air pollution, health outcomes, and economic development in Nigeria. Stated differently, there exists a circumstantial and adverse correlation among air pollution, health consequences, and economic expansion in Nigeria. Air pollution has a major impact on Nigeria's economic growth. These results are consistent with those of Akinbode, Dipeolu, Bolarinwa, and Olukowi (2021), who found that life expectancy, as a proxy for health outcome, strongly influenced economic development. This discovery highlights the critical role that health plays in the process of economic progress in the area. Additionally, Orji, Ogbuabor, Mba, and Anthony-Orji (2021) found

that government spending on health care considerably lowers the under-5 death rate and raises life expectancy. Alhassan, Adedoyin, Bekun, and Agabo (2020) state that economic growth increases by 3.85 and decreases by 1.84%, respectively, for every 1% increase in life expectancy and 1% decrease in the death rate. Three unidirectional causal linkages were shown by Ogunjimi and Adebayo (2019): one link between real GDP and health spending, one between health expenditure and infant mortality, and one between health expenditure and real GDP and life expectancy and maternal mortality. Furthermore, there is no connection of causation between infant mortality and real GDP.

5. Conclusion and Recommendations

The following results were reached after looking at how air pollution and health outcomes affected Nigeria's economic growth: there was a long-term negative correlation between air pollution, health outcomes, and economic growth in Nigeria. Stated differently, there

exists an indirect and adverse correlation among air pollution, health outcomes, and economic growth in Nigeria. Furthermore, there is a noteworthy interaction between air pollution and health outcomes that impacts health performance in the country.

It was recommended that the government's initiatives to guarantee ecologically friendly manufacturing and consumption would reduce air pollution and avert

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