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THE EFFECTS OF POVERTY ON HEALTH OUTCOMES IN NIGERIA: AN ARDL APPROACH

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Abstract. There is no doubt that individual makes up a nation. Thus, as health is a crucial component of one's welfare, access to good healthcare is a prerequisite to attaining long-term economic growth that is both sustainable and prosperous. This study looks at the impact of poverty on people's health in Nigeria. A time series data spanning 29 years, from 1991 to 2021 was used for the study. This data was estimated using Auto Regressive Distributed Lag (ARDL). In order to simulate how poverty affects health outcomes in Nigeria, the study utilized mathematical models to determine whether Nigeria health results (CO_2 emission, patients per physician, life expectancy rate, and poverty rate) responds to poverty shock. The study implies that, poverty shock has a big short-term influence on health outcome factors. The study suggested that in order to reduce high mortality rates government should focus more on improvement in health sector, particularly in the areas where there are less hospitals and basic healthcare facilities care is inadequate.

Keywords: *carbon emission, health outcomes, life expectancy, misery index, poverty.*

JEL Classifications: I10, I3, I32

INTRODUCTION

It is estimated that about (50 %) of the population in Sub-Saharan Africa is living in extreme poverty (Mahembe & Odhiambo, 2018; Saghir & Saantoro, 2018; WHO, 2009). Based on the 2016 projection, the population structure leads toward youth with about 46 % of Nigeria total population less than 15 years of age and 20 % of children under five years. With the country fast growing population and development challenges, the nation moves down the socio-economic indicators for the entire African continent (WHO, 2018). It is obvious from the foregoing that, if poverty were to be considered as extending beyond economic poverty, the estimate of its prevalence in Sub-Saharan Africa would rise (Sahn & Stifel, 2012). Contrary to other regions that have been consistently advancing in living conditions, Africa is particularly plagued by stalled social growth (Defo, 2014). In addition to monetary disparities, important aspects of poverty that rob majority of people in Africa of their human dignity include social exclusion, violations of human rights, and gender inequality. Apartheid policies and their effects on the black race

population that prevented them from having equal access to resources like social services, work opportunities, and educational opportunities (Klasen, 2010; Carter & May, 2011). Thus, the rate at which poverty persists in less developing countries is extremely high, especially in the countriess that are vulnerable to economic crisis since the outbreak of COVID-19 pandemic (Sanchez-Paramo et al., 2021). The crushing effects of the pandemics on the developing nations are not just due to health hazards it brings, but also its effects on social and economic crisis for the foreseeable future (OECD, 2020).

Poverty has significant racial, social, and political elements that is disproportionately prevalent among African people. In Nigeria, the prevalence of illnesses and fatalities has increased in tandem with the country's rising poverty rate. This result is consistent with the findings of (Sindiga, 2015), who put an average life expectancy in Nigeria at 51 years. The death rate is significant, particularly with small children that are below five years of age. The available data from the World Development Indicators indicates that infant mortality rate in Nigeria increased in many Sub-Saharan nations where poverty is widespread, with life expectancy at birth fell to 15 years between 49 years in 1990 to 47 years in 2015 (World Bank, 2016). Sindiga (2015), opined that 14.5 million children die each year in underdeveloped nations, with 10 % of all births resulting in mortality by the time they turn one and 20 % as they become five years of age. The significance of parasitic infectious illnesses is underlined as the cause of Nigeria's comparatively high death rate. Many regions in Nigeria are plagued by endemic diseases that reduce production, including trypanosomiasis, schistosomiasis, and malaria.

According to the World Bank, Nigeria was among the ten leading African nations that have the biggest proportion of its residents living in severe poverty. In fact, 48 % of Nigerians live in extreme poverty, which is higher than the corresponding figures for Kenya and Ethiopia of 30 % and 23 %, respectively (World Bank, 2018). Poorly implemented poverty reduction programs, a high misery index (high rates of unemployment and inflation), among other factors, contribute to the country’s rising level of poverty. Therefore, the possibility of United Nations to end severe poverty by 2030 appears bleak. The underwhelming performance of health sector is one of the major impacts of high poverty rate in Nigeria. For instance, Nigeria has a very low human development index of 0.52, which ranked Nigeria 152 out of 179 nations. Its per capita GDP is $ 2672 with its infant mortality rate at 9 % (World Development Indicators, 2017). The fact that health outcomes are below national standards and benchmarks established worldwide point to the reality that Nigerian population health difficulties are persistent, while the healthcare sector has continued to deteriorate. The United States Agency for International Development (Declan, 2021) observed that health indicators in Nigeria are classified among the worst in Africa, with a projected population spurt of over 440 million people by 2050, with a rapid development challenge. This poses the entire African continent into a risk of threats on socio-economic enhancement.

Nigeria financing on health care has frequently been criticized as being insufficient, with financial allocations on health hardly topping 3 % of the country's overall budgetary allocations (Orubuloye & Oni, 1996). Nigeria health spending is

divided into private and state spending. The private expenditures make up 70–80 % of the overall health spending, while governmental spending makes up 20–30 % of this total. Over 90 % of private health expenses are made out of pocket, which is the predominant private expenditure (Soyibo et al., 2009). The 2003 and 2004 fiscal allotment on health made up of 2 % and 1.2 % based on the overall budgetary forecasts for the years, respectively. This amount was less than 15 % of the suggested by the World Bank. Since then, the health sector has been receiving not more than 2 % of its total budget.

In a similar report from the National Bureau of Statistics (NBS, 2019), about 40 % of the total population in Nigeria, or 83 million people, still live below the nation's poverty line of N137 430 ($381.75) per year. Nonetheless, the past records also show poverty level to be on the increase. Poverty is seen as a major impediment to nation's population health. According to Alfred (2022), based on the approved budgetary allocation for the year 2022, with the country's population of 206.1 million estimates, an average Nigerian is only entitled to N3510 worth of medical care, which is equivalent to about 8.50 US dollars when converted using the dollar official rate of N413. In utilizing a longer time period (1991–2021) and misery index, a macroeconomic data was used to measure poverty, and the study objective was to ascertain if poverty is a strong determinant of people's health in Nigeria.

The results emanating from this paper add a new dimension to the literature. This is because most previous studies focused on poverty determinants, the relationships between money-metric indicators of poverty or consumption expenditure, using health outcomes as a major indicator of poverty. This study used an extended data point from 1999 to 2021, through a macro socio-economic data (misery index) as a measure of poverty index. This is quite a deviation from the previous studies that have been previously conducted. From the evidence supporting the hypothesis of this study, the result indicates that no long-term relationship exists between poverty and health outcomes in Nigeria. These results are robust to different panel estimation techniques used for the study in that the outcomes demonstrated the likelihood to be statistically significant and found long term effects of carbon emission on health outcomes to be positive and the long-term health outcomes to be negative when connected with the misery index (measure of poverty). The findings from this study have contributed to the literature on the severity of poverty on health outcome in Nigeria. Hence, poverty to a larger extent, makes remarkable impact on the poor performance of healthcare sector in Nigeria. Therefore, the need to provide further empirical support for the existing theories on poverty and health outcomes make this study much more unique. This study provides the review of related literature, methodology and data sources treated in Section 2, results in Section 3, while Section 4 discusses and concludes the study.

1. LITERATURE REVIEW

1.1. Conceptual Framework

With varying degrees of success, researchers have tried to determine the correlation between poverty and health outcomes. Bad health is both a cause of

poverty and its effects (Akawu & Charles, 2018). Bad health reduces productivity, eats-up household savings, and invariably leads to decreasing quality of life and perpetuates poverty. Thus, poverty may result in household being less well-nourished, less able to access medical services, and more vulnerable to personal and environmental risks. Kennedy and Kaplan (2011), cited in Wilkinson (1998), found no support between poverty and health outcome when two sets of data were combined and comparisons were made between developed nations, with comparable levels of industrialization. However, Wilkinson (1998) revealed a significant, but positive correlation between poverty and health outcomes (mortality) across nations. The UNICEF (2019) supports the argument that when Nigeria is compared with other Sub-Saharan African countries, it has failed to meet most of its targeted goals and objectives. It could be attributable to bureaucracy, poor resource management, particularly in health sector, which is sequential to healthcare workers' industrial action, kidnappings, "Boko Haram" insurgency, which was the aftermath effect of war on health: malnutrition, destruction of health centres and clinics, etc. Hence, the country's overarching objective now remains – how to accelerate economic growth and reduce the widespread of poverty.

Itari et al. (2018) examine the relationship between poverty and health outcomes in the Nasarawa state of Nigeria using logit regression approach. The study found that there is a bidirectional link between poverty and health outcomes in spite of its concentration on factors that contribute to poverty. This idea supports the WHO assertion that poor healthcare is a cause of poverty as well as a result of it. Wagstaff (2002) examines the relationship between poverty and health using a non-parametric method. The study found a connection between poverty and health outcomes. Health results are likely to be worse in impoverished nations than in affluent ones. Globally, poor health has the potential to exacerbate and sustain poverty. Therefore, as poverty breeds illness, illness also breeds poverty. The evidence of causation flowing in both ways is strengthened by this relationship. Akawu and Charles (2018) used instrumental variable method to empirically analyse the connection between healthcare access and poverty using Grossman model. The study found correlation between the occurrence of declining health sector and a rise in poverty rates in the Nasarawa state and by extension, Nigeria.

However, these two ideas are most pertinent to this study, that is, the health production function and the poverty-spiralling cycles. Therefore, the study adopts Grossman's (1972) model on health production function modified in the works of Matthew et al. (2015). This theory contended that people seek medical attention not because they value medical treatment in particular, but rather because it enhances their stock of health, that is a valuable resource, expressed as $H = \mathrm{f}(X)$, where X is a vector of distinct individual inputs to the health production function and H is the measure of individual's health status.

Intake of nutrients, money, and consumption of public goods begins endowment for individual's education, and communal endowments are some of the components of this vector. Grossman's production model was developed to study health production at the micro level, which focused on production function on a large scale. Without compromising the theoretical basis, the indicators of the independent variables were reorganized into sub-sectorial variables to reflect

economic, social, and environmental issues. These was proxy by poverty, literacy rate, physician per patient, carbon dioxide emission, and urbanization rate represented at macro variables.

1.2. Empirical Review

Research organizations and social scientists have studied poverty and health concerns in great detail throughout the years. The bulk of these studies dealt with poverty and health problems separately, and the connection between the two ideas was frequently obscured and unrelated to financial well-being (Peggy, 2003). Lack of basic needs is what is meant by poverty in its broadest sense. The basic necessities include food, shelter, healthcare, and safety, which are widely regarded as essentials because of their ethical standards for human decency. Needs may be based on what is promising and communal definition as well as prior knowledge (Sen, 1999). The Central Bank of Nigeria (2003) observed that a person's inability to adequately meet basic needs for food, clothing, and shelter constitutes poverty. This shows a disregard for one's social and financial obligations, as well as a lack of lucrative employment opportunities and respect for oneself. The location of CBN is based on the restricted availability to social and economic facilities like health, education, convenient water and sanitation that limits the likelihood of expanding well-being to its maximum potential. Augère-Granier (2017) described rural poverty as the existence of precise vulnerabilities in rural districts that lead to increased threats of poverty in contrast to metropolitan districts. Rural areas' isolation, limited access to healthcare and educational resources, a fragile labour market, and predominance of the elderly to mention, but a few.

The World Health Organization constitution, as cited in Stuart (2004), argued that health was a condition of complete physical, mental, and social well-being and not only the absence of sickness or disability. Other health-related scholars, however, criticized this definition as idealistic. Similarly, (Oladosu et al., 2022) carried out a survey on the effect of public health expenditure on health outcomes in Nigeria and Ghana. The study revealed a low public health expenditure in both countries, despite the fact that, there is an inverse relationship that was established in the Ghanaian case and a positive relationship found in Nigeria. Achia et al. (2010) examined demographic and health assessment data from Nairobi to determine the main causes of poverty. The study used a set of demographic variables which include household head's age, size, level of education, type of settlement (rural or urban), ethnicity, and religion as an explanation to variables in the model estimation, with the social and economic categories (i.e., privileged and underprivileged) serving as the unexplained variables. The results of their findings show that villages located further away from Nairobi have tendency for higher level of poverty. Thus, it is possible to identify and correlate the level of poverty using the demographic and health survey data.

Nurudeen and Ibrahim (2014) used Granger causality test, bound testing technique, and co-integration measures to establish the link between human poverty and inequality in Nigeria economic progress. The study discovered a one-way directional linking connection between real gross domestic product (RGDP) and poverty. When Nigeria's RGDP rises, poverty level also increases, and vice-versa.

The study established that literacy and poverty are related to each other in the two directions. The study concluded that in order to reduce the rate of inequality in the country, initiatives aimed at closing the gap between the rich and the poor must be vigorously pursued consecutively. Similarly, Riman and Akpan (2012) discuss the relationship between poverty, government health spending, and health status in Nigeria. The Granger causality test and the vector error correction model (VECM) were used to establish a strong two-way directional connection between life expectancy and poverty in Nigeria. Their findings demonstrate persistent long-term relationship between human poverty and health outcomes. However, their research reveals a negligible long-term relationship between health status and government health spending.

2. METHODOLOGY AND DATA

2.1. Methodology

The synergy between poverty and health outcomes in Nigeria is examined using a multivariate regression model. Specifically, the goal of this study was to identify the role poverty plays in population health outcomes in Nigeria using secondary data source obtained from the World Development Index (WDI), Nigeria Bureau of Statistics (NBS), and the CBN Statistical Bulletins. The study was based on panel data collected for 30 years, precisely between 1991 and 2021. This selection was based on data availability for the period under study. Augmented Dickey-Fuller test (ADFT), autoregressive distributed lag (ARDL), and ordinary least square (OLS) approaches were used to determine how poverty has fared in the light of health sector in Nigeria. Descriptive statistics was used to determine the carbon dioxide emissions, life expectancy rate, poverty index, and number of patients to a doctor over the period.

2.2. Model Specification

The complexity in modelling the factors that affect health outcome must be acknowledged before presenting the empirical model for this study. An individual country's health condition cannot be fully described by straightforward quantitative or economic modelling, since health outcomes are complex phenomenon. The model adopted for this study does not purport to fully explained and capture all the numerous factors of health outcome in Nigeria, but the methodologies were used to capture the specific objective(s) of economic analysis. The idea of health production function, which Grossman (1972) proposed and which were modified by Achia et al. (2010), Nurudeen & Ibrahim (2014) and Matthew et al. (2015), serves as the model's foundation. As a consequence, the study did not deviate much from earlier empirical investigations of the variables used to gauge poverty and health outcomes. Here, people are expected to utilize healthcare facility not because they value it themselves, but because it increases their stock of health that is a valuable resource for business. Hence, the health production function assumes: $H = \mathrm{f}(X)$.

In this study, *X* represents a vector of distinct individual inputs to the health production function, while *H* represents a measure of each person's health output or status.

The poverty index (or misery index), the adult literacy rate, the number of patients to a doctor, the number of trained birth attendants, the carbon dioxide emission, and the rate of urbanisation are all components of the vector in this study. For this study, the health condition of an individual is represented by the letter *H* and is measured by the infant mortality rate and life expectancy at birth.

Given this analysis, the models for this study are expressed as:

$$LEX = \text{f}\,(POV,\ CO2EM,\ PPP), \tag{1}$$

where:
LEX – life expectancy;
POV – poverty (proxy by misery index);
PPP – patients per physician;
CO2EM – metric ton per capita of carbon dioxide.

The econometric form of models becomes:

$$LEX = \beta 0 + \beta 1 POV + \beta 2 CO2 + \beta 4 PPP + \mu 1, \tag{2}$$

$$IMR = a0 + a1 POV + a2 LIT + a3 CO2 + a4 PPP + \mu 1. \tag{3}$$

2.3. Measurement of Variables

All the variables are specified as indicated above, and the error terms for Eq. (1) are represented by 1. This study examination spans between 1991 and 2021. Except for poverty, it is anticipated that all elasticity coefficients will have a positive value. The amount of economic misery is specifically indicated by the poverty index as measured by the misery index. To measure the socio-economic components of poverty, the following 4index are used (i.e. life expectancy, poverty rate, patients per physician, and metric ton/capita of carbon dioxide). It is anticipated that poverty would have a detrimental effect on health results. On the other hand, metrics that measure the number of patients per physician to healthcare are anticipated to be positively correlated with health outcomes. It is anticipated that carbon dioxide emissions and health outcomes would be positively correlated. The study uses the ARDL technique's multivariate time series methodology because of its comparatively straightforward computing process and generally acceptable outcomes.

2.4. Unit Root Test

The augmented Dickey Fuller (ADF) unit root test will be used in this study to confirm the series' unit root property. The ADF test will be run on all the model variables. Therefore, Eqs. (4)–(7) reflect the ADF models for the study variables.

$$\Delta LEXt = \beta 11 + \beta 12t + \delta 1 LEXt{-}1 + \sum \beta 13 \Delta LEXt{-}1 + \mu 1t, \tag{4}$$

$$\Delta POVt = \beta 31 + \beta 32t + \delta 3 POVt{-}1 + \sum \beta 33 \Delta POVt{-}1 + \mu 3t, \tag{5}$$

$$\Delta PPPt = \beta 51 + \beta 52t + \delta 5 PPPt{-}1 + \sum \beta 53 \Delta PPPt{-}1 + \mu 5t, \quad (6)$$

$$\Delta CO2t = \beta 61 + \beta 62t + \delta 6\ CO2t{-}1 + \sum \beta 63 \Delta CO2t{-}1 + \mu 6t. \quad (7)$$

2.5. Bound Test for Co-integration

The study used Pesaran, Shin, and Smith's bounds testing or the autoregressive distributed lag (ARDL) co-integration method to determine the relationship between poverty and health outcomes in Nigeria.

The bound test is appropriate when there is a mixture of time series variables with differing degrees of integration in contrast to the Johansen approach where all variables are assumed to be stationary at first difference I(1). Kakar et al. (2011), as cited in Oyeniran et al., (2015), says that the ARDL technique is marginally successful when sample size is small. In the same vein, Pesaran et al. (2001) found the long-run equation modelled as a general vector autoregressive (VAR) model, as observed in Eq. (3), while the limits test approach is then used to construct the model:

$$\Delta LEXPt = \beta 0 + \beta 1 C02EMt{-}1 + \beta 2 POVt{-}1 + \beta 3 PPPt{-}1 + \sum p\varphi 1 \Delta LEXPt{-}1 + \sum p\varphi 2 \Delta C02EMt{-}1 + \sum p\varphi 3 \Delta POVt{-}1 + \sum p\varphi 4 \Delta PPPt{-}1 + \mu t, \quad (8)$$

where βi and φ are the multipliers in relation to long and short run; β_0 is the drift; p is the optimal lag length; and μ_t is white noise error term.

The estimation of Eq. (8) using the autoregressive distributed lag (ARDL) approach and calculating the F-test result in the goodness of fit of the coefficients of the lagged levels of the variables is expressed as:

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ (there is no long run relationship);
H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$ (there is a long run relationship)

Using Eq. (8), the estimated F-stat is compared to the critical value provided in Pesaran et al. (2001). That is, once the underplaying order of integration of the variables is '0' or '1', if the computed F-statistic is greater than the upper critical value, the null hypothesis of a missing long run connection may be rejected.

2.6. Long Run Autoregressive Distributed Lag (ARDL) Model

Once co-integration is manifested, the long run ARDL model can be estimated as:

$$LEXPt = \beta 0 + \sum pi{=}0\ \beta 1 LEXPt{-}1 + \sum q1i{=}0\ \beta 2 C02EMt{-}1 + \sum q2i{=}0\ \beta 3 POVt{-}1 + \sum q3i{=}0\ \beta 4 PPPt{-}1 + \mu t. \quad (9)$$

The order of lag, i.e., ARDL ($q1$, $q2$, $q3$, $q4$), will be selected on the basis of Akaike information criteria (AIC). All variables are as previously defined.

2.7. Short Run ARDL Model or Error Correction Model (ECM)

The short-run active parameters must be derived using the ARDL bound techniques, which also requires estimating an error correction model (ECM) connected to the long-run estimates. In order to quantify the rate of adjustment in the model's equilibrium, Eq. (3) can be transformed. This will advance the initial difference (Δ) and lag of error term by one period. The error correction mechanism (ECM) gauges how quickly the variables are adjusted from the long run to the short run, lags the error term by one period (David et al., 2016). Using the following details:

$$\Delta LEXPt = \beta 0 + \sum pi=1\ \varphi 1 \Delta LEXPt-1 + \sum pi=2\ \varphi 2 \Delta C02EMt-1 + \sum pi=3\ \varphi 3 \Delta POVt-1 + \sum pi=4\ \varphi 4 \Delta PPPt-1 + \delta 7 ECMt-1 + \mu t. \quad (10)$$

Eq. (10) depicts the ARDL model, where Φ is the short run active coefficient of the model, δ describes the speed to which the dynamic model re-establishes equilibrium.

3. RESULTS

3.1. Augmented Dickey Fuller Test

The results of the augmented Dickey-Fuller (ADF) test used to determine the stationarity of the time series data integrated into the model are shown below.

Table 1. ADF Result at Level

Variable	ADF test statistic (level)	Critical value (level)	Probability (5%)	ADF test statistic (first diff.)	Critical value (first diff.)	Probability (5 %)	Order of integration
C02EM	−1.372135	−2.963972	0.5824	−4.587659	−2.967767	0.0010	I(1)
LEXP	−5.479135	−2.967767	0.0001	-	-	-	I(0)
POVRATE	−2.332509	−2.963972	0.1689	−5.621142	−2.967767	0.0001	I(1)
PPP	−1.736042	−2.963972	0.4036	−5.513718	−2.967767	0.0001	I(1)

Source: Author's computation from E-view.

The results of the augmented Dickey Fuller (ADF) test show *CO2EM*, *POVRATE*, and *PPP* not stationary at 5 % significant level, indicating the presence of a unit root, but was found at level 1, where *LEXP* is stationary. This indicates that the series included in the dynamic regression model are stationary at orders I(0) and I(1).

3.2. Determination of Lags

The study applies the OLS regression from lag 1 to lag 2. As a result of the short observation period of 29 years of this study, only two maximum lag lengths were included in the model.

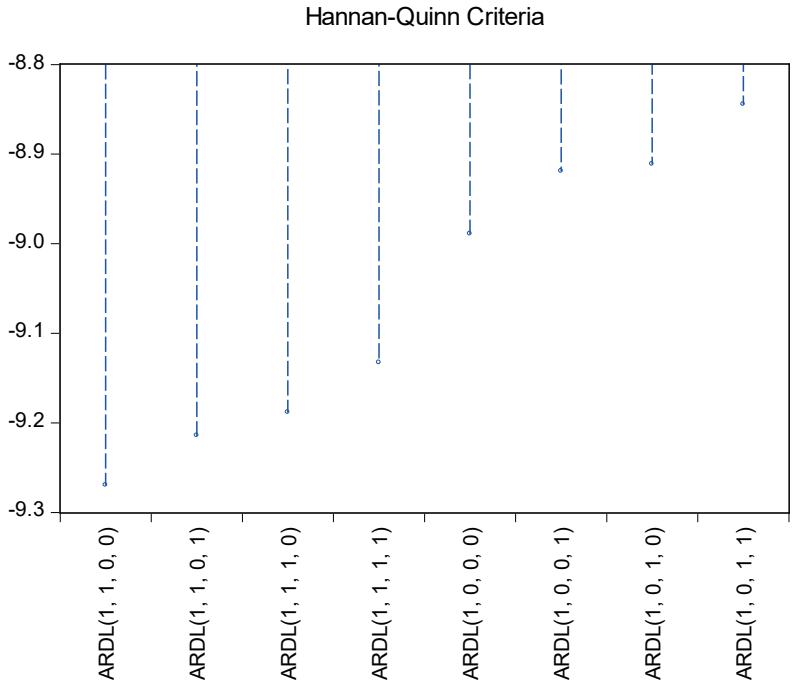


Fig. 1. Determining the number of lag length.

The lag time is determined using the Hannan Quinn Criterion (HQC), which measures how well a statistical model fits the data. The findings indicate that lag is the ideal selection criterion (1, 1, 0, and 0).

3.3. Bound Test for Co-integration

Considering the variables in the model, the findings of the bound testing method for the long-run co-integrating association are shown in Table 2.

Table 2. ARDL Bounds Test

Null Hypothesis: No long-run relationship exists

Test statistic	Value	K
F-statistic	19.92614	3
Significance	I(0) bound	I(1) bound
10 %	2.72	3.77
5 %	3.23	4.35
1 %	4.29	5.61

Source: Author's Computation (2022) (export from E-view 10).

The model prediction on F-statistic (19.92614) is above I(0) and I(1) critical values at 10 %, 5 %, and 1 %, indicating a preference for long-term relationships. Thus, it is concluded that there is a long-term relationship between dependent and independent variables.

3.4. Presentation of Panel ARDL Model Results

Having confirmed that the dependent and independent variables were connected over the long term, the short run parameters were estimated using the ARDL method. The Hannan Quinn criteria were used to determine the lag duration in the long run and short run models (HQ).

Table 3. Estimated Long-run Coefficients Using the ARDL Approach

Variables	Coefficient	Std. Error	t-Statistics	Prob
LC02EM	0.431786	0.178627	2.417248	0.0236
LPOV	−0.086236	0.063607	−1.355763	0.1878
LPPP	−0.045216	0.123011	−0.367581	0.7164
C	−0.498317	1.890207	−0.263631	0.7943

Source: Author's computation from E-view, 2022.

From the result of the findings displayed in Table 3, carbon emission log value (*LC02EM*) has a favourable effect on Nigeria health outcomes. The study shows that *LC02EM* increase of 1 % will cause an *LEXP* rise of 0.43 %. Additionally, the results further demonstrate the likelihood value to be statistically significant, and hence, long-term effects of *LC02EM* on health outcomes to be positive.

Long-term health outcomes have a negative connection with the misery index (a measure of poverty) (*POV*). Long-term *LPOV* has a −0.086 % detrimental effect on health outcomes. The results indicate that an increase in *LPOV* of 1 % will result in an *LEXP* drop of roughly −0.086 %. In addition, the associated p-value is statistically negligible at 0.05 %, indicating that a detrimental effect of *LPOV* on *LEXP* will have little economic impact.

Patients per doctors and *LEXP* of the nation have a long-term indirect association. The long-term indirect impact of *PPP* is −0.045. This implies that a unit rise in *PPP* may result in −0.0045-unit decline in *LEXP*. The p-value is statistically negligible, indicating that PPP will have little effect on the economy.

3.5. Short Run Estimation

Since a long-term relationship has been established, the following process will use the error correction model. This is done to determine how quickly the variables will alter before reaching long-term equilibrium. Table 4 shows the findings for short run calculated coefficients.

The error correction coefficient (ECM_{t-1}) has a detrimental effect on health outcomes and is statistically significant at 5 % level of significance. The predicted coefficient of ECM_{t-1} has a value of −0.024220 or 2 % in the long-term equilibrium, indicating a low rate of adjustment during the procedure.

In the long run, all variables in the short run equilibrium maintained their respective signs. With a positive elasticity effect of 0.00008 %, carbon emission (*LC02EM*) is correlated favourably with health outcomes in Nigeria. This means that with other factors remaining constant a 1 % rise in *LC02EM* will result in a

0.0008 % increase in health outcomes. This result is consistent with the findings of a priori expectation of variables of Wachukwu et al. (2018).

Table 4. Error Correction Representation for the Selected ARDL (1, 0, 0, and 0) Selected Based on AIC Criterion. Dependent Variable is Δ*LGDP*

Variables	Coefficient	Std. Error	t-Statistics	Prob.
D(LC02EM)	0.000736	0.002979	0.247153	0.8069
D(LPOV)	−0.002089	0.000950	−2.197491	0.0379
D(LPPP)	−0.001095	0.002650	−0.413330	0.6830
CointEq(−1)	−0.024220	0.010718	−2.259831	0.0332

Source: Author's computation from E-view, 2022.

In the short run, an increase in *LPOV* of 1 % will result in a fall in *LEXP* of around −0.002 % in the nation ceteris paribus. The relationship between poverty rate (misery index) and *LEXP* is shown to be negatively related with each other, with a value of −0.002. The outcome is contrary to the presumption that *POV* and *LEXP* are inversely connected. This result corroborates with the findings of Apere (2016), Murad & Idewele (2017), and Ofeimun (2020) who found a weak and negative relationship between MFBLA and GDP.

Patients per physicians (*PPP*), which has a negative sign, demonstrates a negative correlation between *PPP* and *LEXP*, indicating that a percentage increase in *PPP* will, in the short run, result in a −0.001 % decline in health outcomes. The result that is contrary to the a priori prediction.

The summary of the a priori expectation of the short run model is given in Table 5.

Table 5. Summary of the a priori Expectation of the Short Run Model

Variables	Expected sign	Observed sign	Remark
ΔLOG(C02EM)	+	+	Conform
ΔLOG(POV)	-	-	Conform
ΔLOG(PPP)	+	-	Not conform
ECM(−1)	-	-	Conform

Source: Author's Computation, 2022.

4. DISCUSSION

The ARDL model's findings indicate that in the long and short terms *C02EM* has a statistically significant and statistically insignificant positive connection with health outcomes. Positive impacts and effects have respective percentages of 0.43 and 0.0008. This implies that an increase in *C02EM* will have a longer-term, more favourable impact on health outcomes than it will have in short-term effect, ceteris paribus.

Additionally, the country's poverty index had a statistically significant negative effect of −0.002 % in the short run and insignificant negative effect of 0.086 % in

the long run. This shows that an increase in *LPOV* may not result in a −0.08 % improvement in health outcomes over the long term, but may cause a −0.02 % improvement over the short term, since *LPOV* is substantial in the short term but inconsequential over the long term.

With a long-term influence of about −0.045 and a short-term effect of about −0.001, the patient per physician (*PPP*) was shown to be unfavourable and inconsequential in both long and short terms. This demonstrates that *PPP* is minor in both term periods but more beneficial over the long term. The probability value of the variables was also known, as the T-statistic was utilized to analyse the individual importance of *C02EM*, *POV*, and *PPP*. In contrast to *C02EM* (0.8069) and *PPP* (0.6830), *POV* was shown to be negligible in the short term (0.0379).

4.1. Diagnostic Test

Table 6 shows no heteroskedasticity, with the error term normally distributed, and the probability value larger than 0.05, which is not significant.

Table 6. Diagnostic Test Result

Heteroskedasticity Test: Breusch-Pagan-Godfrey

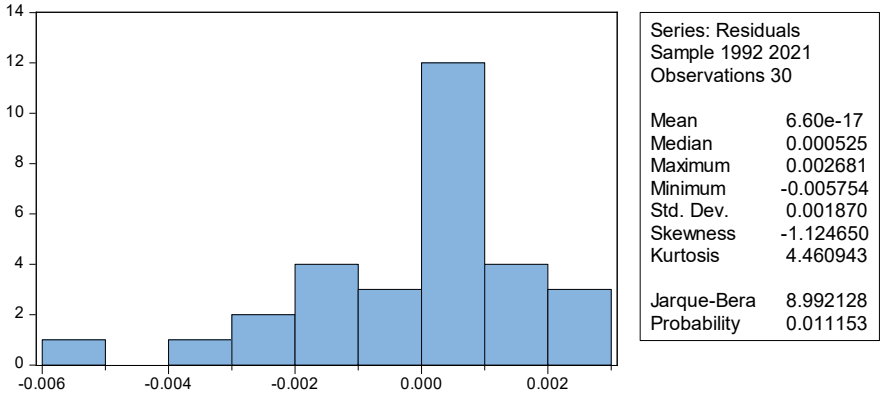
F-statistic	**1.027157**	**Prob. F(5,24)**	**0.4241**
Obs*R-squared	5.288121	Prob. Chi-square(5)	0.3817
Scaled explained SS	5.856603	Prob. Chi-square(5)	0.3204

Source: Author's Computation, 2022.

Fig. 2 was plotted on the RECURSIVE COEFFICIENT estimate in the ARDL model. At 5 % significance level, the PRECURSIVE ESTIMATE blue line is positioned between the two red lines, which indicates that the figures do not exist inside the crucial bounds and hence, the model is stable.

4.2. Normality Test

Fig. 2 shown displays the findings of the normality test. The outcome indicates that the residual is not normally distributed and the alternative hypothesis is accepted, since the probability value does not exceed 0.05 %.

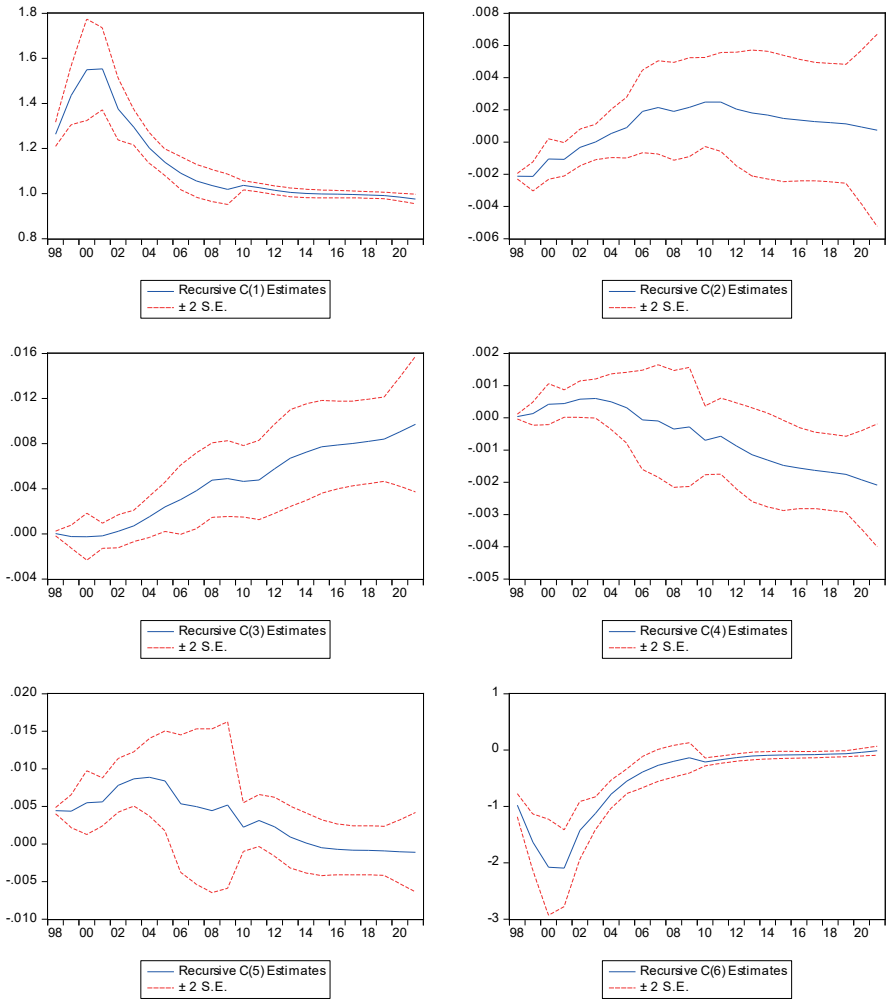


Source: Author's computation, 2022.

Fig. 2. The normality test.

4.3. Stability test

RECURSIVE ESTIMATE



Source: Author's computation, 2022.

Fig. 3. Presentation of stability test result.

Fig. 3 displays the stability test results. The residual is stable if the blue line falls between the two red lines. Since the blue line falls between the two red lines, this implies that the recursive estimation test is stable.

CONCLUSIONS

There is a widespread understanding that poverty is a threat to human health. Both advanced and developing countries are aware that a continuous poverty situation leaves developing nations more susceptible to instability, social discrimination, and poor health conditions. Poor health and poverty are two major development challenges that Nigeria, like other developing nations, have to overcome. The implication of this is that health outcomes in Nigeria are not covertly

the consequence of poverty. It is equally important to emphasize that the results need to be interpreted with caution. Hence, the policy implication of this study is that there should be a momentous improvement in the health sector. In other words, the outcome of the population can to a greater extent have positive trickle-down effect on poverty reduction in Nigeria. The study upholds improvement in the health sector, since poverty does not always have a substantial impact on health outcomes; but it is crucial to stress that this conclusion should be viewed more carefully. Hence, population health outcomes should be significantly improved, since they may be contributing more to Nigeria's effort towards poverty reduction.

Given that the poor experience various deprivations in all manifestations, such as lack of access to healthcare, emphasis on reducing poverty becomes a necessity. The contribution of this study had been to authenticate or negate the notion in the context of Nigeria health status. The aforementioned makes it clear that poverty has a key significant but stable impact on the nation's health status, thereby rejecting the null hypothesis and accepting the alternative. Considering the unavailability, and in some cases, limited access to well-equipped healthcare facilities, it becomes crucial for government to review its policy on health sector, particularly in the rural areas, where little well-equipped healthcare centres, well-trained personnel and basic healthcare facilities are available. This will reduce high death tolls recorded yearly due to inadequate patient treatment, severity of disease occurrence, resulting in escalation of diseases that could otherwise be prevented or controlled. Having discussed the practical policy and theoretical implications of this study extensively, future studies can be done on other policy variables that can reduce the spread of poverty in Nigeria. Further studies can be conducted in the context of Africa, Middle East and North Africa countries to see if the same results can be achieved.

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