Poverty and Health Outcomes ın Nigeria

Peter Ubi*, Bassey Ndem

Department of Economics, University of Calabar, Nigeria. *Email: petersamuelubi@gmail.com

ABSTRACT

The study models the dynamics of poverty as they affect health outcomes in Nigeria. Vector autoregressive econometric approach was used to examine whether health outcomes (life expectancy and ınfant mortality rate) in Nigeria respond to poverty shock. Empirical evidence from the study indicates that poverty shock does not have any significant impact on health outcome variables. Specifically, variations in health outcomes are not actually due to poverty shocks but due to the health outcome shock. It is therefore recommended that improvement in health outcome of the population is a necessity to poverty reduction in Nigeria.

Keywords: Poverty, Health, Outcomes, Vicious
JEL Classifications: I12, I32

1. INTRODUCTİON

There is global awareness that poverty anywhere is dangerous to health everywhere. Developed and developing countries have understood that persistent poverty makes poor countries vulnerable not only to insecurity, social discrimination but also to poor health conditions. Nigeria, like many other developing countries is faced with a number of development challenges, of which poverty and poor health outcomes hold a central place. Majority of the people are poor despite the fact that the country is one of the major oil producing nations endowed with natural resources. Available statistics shows that 27% of the total population was poor in 1980. Between 1985 and 1992, it rose to an average of 43%. It rose to 70% in 2000. In 2005 and 2012, poverty increased to 77% and later declined marginally to 72% respectively. Nigeria was among the top ten African countries with population of people in extreme poverty as at 2018. Precisely, the percentage of population in extreme poverty in Nigeria was approximately 48% ahead of 30% and 23% in Kenya and Ethiopia respectively (World Bank, 2018). The increasing level of poverty in Nigeria is traceable but not limited to incoherent poverty alleviation policies, high misery index (high rates of unemployment and inflation), etc. Thus, the

United Nations' sustainable development goal to end extreme poverty by 2030 is unlikely to be achieved.

It appears that the high level of poverty has to a greater extent contributed to the unimpressive performance of the healthcare sector in Nigeria. Health is a major component of development and healthcare is regarded as one of the necessary conditions to achieving long term economic development. For instance, with the average life expectancy of about 48 years, infant mortality rate of 9% and per capita GDP of $2672, Nigeria's human development ındex is very low (0.52) and ranks 152 out of 179 countries (World Development Indicators, 2017). This is a pointer to the fact that Nigeria's population health challenges are unabated and the healthcare sector has continued to degenerate with health outcomes currently below national targets and internationally set bench marks. Ample evidence of a significant association between poverty and health outcomes abounds and most of these evidences have shown that the predominant causal relationship is more frequently from poverty to poor health (Orji and Okechukwu, 2015, Akpan and Riman, 2010). This further confirms the old adage, the wealthier are healthier. Perhaps, this is why the World Health Organization (WHO) declared poverty as the single largest determinant of health.

Therefore, the need to provide empirical support for the theories relating to poverty and health outcomes in Nigeria makes this research work imperative. This study seeks to determine whether poverty is a better predictor of population health outcomes in Nigeria using an extended data point (1980-2018) and a macro socio-economic data (misery index) as a measure of poverty index. This is a deviation from previous studies that focus on assessing the relationships between income or consumption poverty and key indicators of health outcomes. Also, most empirical studies in Nigeria are concerned with the determinants of poverty (like Itari et al., 2018) and not health outcomes.

2. LİTERATURE REVİEW AND THEORETİCAL İSSUES

2.1. Conceptual İssues

2.1.1. Poverty and its measures
A review of the relevant literature shows that there is generally no consensus on any meaningful definition of poverty. This is because poverty is multidimensional in nature as it affects different aspects of human life including physical, social, moral and psychological. According to Anyanwu (1997), a concise and universally accepted definition of poverty is vague because different criteria have been used to describe the phenomenon. However, Central Bank of Nigeria (2002-2003) contends that poverty concerns individual's inability to cater adequately for the basic needs of food, clothing and shelter. It reflects the inability to meet social and economic obligations that may be as a result of lack of gainful employment, skills, assets, self esteem and poor environmental and economic conditions.

Poverty is most often considered by using relative income poverty lines. This measure of poverty captures just part of the picture and does not fully consider the complexity of poverty. Other measures of poverty are:

a) Measuring the level of deprivations (this is measured by combining relative income lines with deprivation indicators).
b) The Budget Standard Approach where poverty is calculated based on the cost of a specific basket of goods and services (i.e., covering things like clothing, personal care, food etc.,) that are well thought out by society in general to signify a basic standard of living.
c) The food ratio method where the poor are distinguished from the non poor by how much of their income they spend on basic necessities such as clothes, food and shelter (by and large, research has shown that people on low income spend a higher proportion of their incomes on basic necessities leaving almost nothing for normal recreational and socio-cultural activities).
d) The United Nations Poverty Index which combines measures such as life expectancy, long-term unemployment, literacy and relative income into a single composite measure.
e) The UNICEF report card on child well-being which moves beyond just income poverty and combines indicators of material well-being, educational well-being, health and safety, behaviors and risk, family and peer relationships and subjective well-being.

In view of the lack of consensus on the definition and measurement of poverty, this study defines poverty as a state of human misery

or discomfort made worse by poor economic conditions (high unemployment and inflation rates). Thus, this study is using a composite index of unemployment and inflation rates (misery index) as a measure of poverty. This measure takes into account the extent of discomfort in the society arising from high inflation and unemployment rates.

2.1.2. Health outcome and its measures
Health outcome simply refers to population health status or condition within a given period of time. It is usually measured by health status indicators or indices. Though there seem to be no consensus on how to quantitatively measure health outcome but different scholars on population health have adopted various indices as proxies for measuring health outcome. Some of these indices include self-rated health, infant mortality rate, population mortality rate, life expectancy, average age at death, child nutritional status, diseases burden and maternal mortality (Orji and Okechukwu, 2015).

2.1.3. Determinants of health outcome
Orji and Okechukwu (2015) as well as Marmoth and Wilkinson (2006) chronicled the determinants of health status to encompass societal, psychological, economic, environmental or geographical and social factors that impact individual and population health as well as the mechanisms by which these impacts are transmitted. Different scholars have identified and analyzed some determinants to include housing (Thomson et al, 2003), income (Sorlie et al., 1995), social class (Turner and Marino, 1994), social networks (Geckova et al., 2003), employment (Mathers and Schofield, 1998), type of job as well as the level of control that individuals have in their job (Kuper and Marmot, 2003) and poverty (Lynch et al, 2000) to mention but a few.

2.2. Poverty and Health Outcome
Several studies have attempted to investigate and establish the relationship that exists between poverty and health outcomes with mixed results. Akawu and Charles (2018) referenced World Health Organisation (WHO) as having asserted that poor health status is both a cause and a consequence of poverty. Poor health status can reduce household savings, reduce productivity, and lead to a declining quality of life thereby creating or perpetuating poverty. On the other hand, the poverty can make household to be susceptible to greater personal and environmental risk, less well nourished and less able to access health care facilities. The poor household is therefore more at risk of poor healthcare vis-a-vis low health outcomes. In the same vein, Kennedy and Kaplan (2011) reported that Wilkinson's observation in 1998 when two sets of data were assembled showed at first that there exist no clear relationship between poverty (income or wealth) and health outcomes (life expectancy) when comparisons were made between developed countries at similar levels of industrialization. But in 1999, Wilkinson's observation showed a strong positive relationship between poverty and health outcomes (mortality) within countries.

A study by Itari et al. (2018) investigated the nexus between poverty and health outcomes in Nasarawa state, Nigeria using logit regression technique. Though the study focused more on

the determinants of poverty but it concluded that the relationship between poverty and health outcome is bidirectional in nature. This conclusion further gives credence to WHO's position that poor health status is both a cause and a consequence of poverty.

Wagstaff (2002) also analyzed the correlation involving poverty and health using a non parametric technique. The study found that poverty and health outcome is knotted. Poor countries are likely to contain poorer health outcomes than wealthier countries. Interestingly too, it was identified that inside a country, underprivileged citizens record poorer health outcomes than wealthier or privileged citizens. Globally, ill-health can also worsen and perpetuate poverty. Thus, poverty rears ill health and ill health rears poverty. This association reinforces the evidence of causality running in both directions.

Contrastingly, a study by Musyoka et al. (2018) in which Ordered Probit estimation technique was employed to investigate the relationship between poverty and good health status in Kenya, it was discovered that the benefits associated with good health status may not be enjoyed in the presence of high poverty rates. Thus, poverty reduction is important in ensuring enjoyment of good health. The study concludes that poverty decreases the probability of reporting good health and therefore, it is important for the government to formulate and implement policies that reduce or eradicate poverty.

Using a descriptive approach, Lanre-Abass (2008) opined that poverty is a powerful brake on accelerated progress toward the access to quality healthcare and consequently human development in Nigeria. According to Lanre-Abass (2008), Poverty greatly amplifies every other risk factor associated with diminishing health outcome in Nigeria ranging from high mortality rate to low life expectancy. The study concluded by emphasizing the importance of "care ethics or ethical orientation" in the mist of rising poverty to remedy some of the deficiencies associated with the unimpressive health outcomes in Nigeria.

Akawu and Charles (2018) empirically investigated the relationship between poverty and healthcare in Nasarawa State, Nigeria using Instrumental Variable approach and anchored the study on the Grossman model. The authors (Akawu and Charles, 2018) discovered that the increase in poverty rate in the state and by extension across Nigeria has been coupled with a corresponding increase in the incidence of diminishing health status. The study advocated for the payment of subsidized charges by rural communities, especially in Nasarawa state, Nigeria, to enable those with low income (the poor) access available health care services.

Akpomuvie (2010) examined the poverty profile of Nigeria and its consequences on access to health care services and human capital development in Nigeria using a non-parametric statistical technique. The study revealed a startling paradox that about two – thirds of Nigerians are poor despite living in a country endowed with vast potential wealth. It further revealed that Nigeria's declining health outcomes is not unconnected with its rising poverty profile. The paper however, recommended comprehensive health sector reforms aimed at enhancing the delivery of effective and affordable health services.

Generally speaking, it is obvious that the determinants of health status or outcomes include the social and economic environment, the physical environment and the person's individual characteristics and behaviours. However, from the review, it is certain that the poor bear a disproportionately higher burden of illness, injury and disease than the rich. Perhaps, that is why World Health Organization (2009) buttressed the need for poverty reduction as an important prerequisite for improving Health outcomes in any and every economy.

Theoretically, the health production function and the vicious circles of poverty are the most relevant theories for this study. The theory of health production function as developed by Grossman (1972) and clearly simplified in the works of Matthew et al. (2015) is quite suitable for this research. In this framework, individuals consume healthcare not because they value healthcare per se, but because it improves their stock of health which is used as a productive resource. The theory is specified thus:

$$H=f(X)$$

Where H is a measure of individual health outcome or status and X is a vector of individual inputs to the health production function. The elements of the vector include nutrient intake, income, consumption of public goods, initial individual endowments, education and community endowments such as the environment. Grossman's theoretical health production function model was designed for investigation of health production at micro level. The focus here is, however, to examine the production function at macro level. To change from micro to macro analysis, without losing the theoretical ground, the elements of the vector X were represented by macro variables and regrouped into sub-sectoral vectors of economic, social and environmental factors as poverty, literacy rate, physician per patient, carbon dioxide emission and urbanization rate. Where "H" is individual's health status captured by life expectancy at birth and infant mortality rate.

The Vicious Circles of Poverty as stated by Jhingan (2003) is simply the circular relationships that tend to perpetuate the low level of development in developing countries. It implies a circular gathering of forces that tend to act and react upon one another in such a way as to keep a poor country or a person in a state of poverty. For instance, a poor person may not have enough to be well fed; his health may be weak because of malnourishment, being weak physically and health-wise means that his productive capacity is low. Given a low productive capacity implies that he cannot generate enough resources to be well fed, which in turn means that his health may be weak and so on. Thus, this situation implies that he is poor because he is poor. What is certain in this analysis is the fact that an individual's poor health status is both a consequence and a cause of poverty.

2.3. Poverty and Health Status of Nigeria: An Overview

Nigeria lies on the West coast of Africa and occupies approximately 923,768 sq. kilometers of land bordering Niger, Chad, Cameroon and Benin. The country operates a federal system of government with 36 states including Abuja and 774 Local Government

Areas. The population of Nigeria was 88.99 million in 1991 while the projection for 2020 is put at 200 million (Population Reference Bureau, 2010). With an annual population growth rate of approximately 2.8% (compared to the global average of 1.17%) and a rapidly increasing urbanization rate, over 60% of the population lives in rural areas (UNDP, 2010). Economically, Nigeria's major source of revenue is oil and gas which accounts for 53% of the country's gross domestic product and over 93% of Nigeria's export revenues (World Bank, 2010). In spite of the huge income generated from the oil and gas sector, Nigeria remains one of the poorest countries in the world with an average per capita GDP of barely US$2670 (UNDP, 2017, World Bank, 2010). The Nigerian economy has remained under-developed and the quality of life of the average citizen has worsened progressively with growing numbers of citizens below the critical poverty level. In the late 2016, the National Bureau of Statistics (NBS, 2016) reported that about 112 million Nigerians (representing 67.1%) of the country's total population of 167 million are living below the poverty line. This implies that the country's huge population size simply translates into human suffering on a large scale arising from socio-economic hardship. Interestingly, poverty in Nigeria differs in pattern as the North- West and North –East geopolitical zones have continuously been leading in poverty indices (Dauda, 2017). Specifically, poverty (discomfort or misery) index as shown in Table 1 indicates that the population in poverty as at 1980 is 13.97 million given a population of 73.5million and health outcomes of 127/1000 live birth for infant mortality and life expectancy of 47. In 2018, the population in poverty increased to 69 million with no significant improvement in health outcomes as life expectancy marginally increased to 53 and infant mortality decreased averagely to 70 per 1000 live births. It is obvious that as the population in poverty increases, it impacts negatively on health outcomes in Nigeria.

Health-wise, there is a large disparity in health status between the rural and urban areas of the country. This is evidenced in the United Nation Population Division report that <49% of rural dwellers in Nigeria can access clean water and sanitation compared to over 72% accessibility in urban areas. This might be attributed to the dearth of basic social and health infrastructures in rural areas. This is worse in the Northern part of Nigeria that is semi-arid in nature and is usually faced with relatively large scale drought and over 90% of the population lack access to safe clean water (Olaniyan, 2012, World Bank, 2010). Though in the South-south region of the country where oil exploration activities occur, polluted underground water is common due to oil spillage and leaks. This automatically also limits accessibility to safe clean water.

There had been a gradual deterioration of key national health outcomes for over two decades as a result of socio-economic crisis cum health policy instability in the country. Nigeria fares worse in almost all of the key health outcomes compared to similar Sub-Saharan African countries as only an average of 56.3% of the entire population can access organized health care services (UNDP, 2014). For example, the under-5 year's average mortality of 138/1000 live births is one of the highest globally as compared to 127/1000 live births in other Sub-Saharan countries and a global average of 60/1000 live births (National Health and Development Survey, 2006). A cursory look at the geo-political zones indicates that the highest under-five mortality rates are common in the Northern part of Nigeria and the lowest in the Southern part of the country. Also, life expectancy in Nigeria had increased slowly over the years to reach a level of 53 years in 1991 but declined to an average of 47.6 in 2000s. (United Nations, 2012). Infant mortality rate on the other hand, had a marginal improvement of 75/1000 births in 2010 as against 80/1000 births in 2001 but rose to 114/1000 births in 2015. Nigeria's maternal mortality ratio of an average of 814/100,000 is one of the highest in Sub-Saharan Africa (and in the world) as it is far above South Africa (138), Algeria (140), Egypt (33) and even Togo (368) per 100,000 live births (CIA World Fact Book, 2018). The main victims of these unimpressive health outcomes are usually those who are poverty stricken.

Unfortunately, health sector funding had been abysmally low and the sector is experiencing a number of basic structurally fundamental problems which accounts for the poor health outcomes. Lack of political will to improve the sector, infrastructural deficit, inadequate manpower (especially, skilled), mismanagement of funds, harsh socioeconomic environment as manifest in high poverty (misery) index and the ever increasing population are the factors that have further compounded Nigeria's poor health outcomes. From the foregoing, the Nigerian health sector could not be adjudged to be any better when looked at from any perspective.

3. MODEL AND DATA

Before putting forward the empirical model for this study, it is imperative to acknowledge the complexity in modeling health outcome determinants. Health outcome is a multidimensional

Table 1: Relative poverty (misery) index and health outcomes in Nigeria

Year	POV (misery index)*	Estimated population (millions)**	Population in POV (misery)***	Life expectancy****	Infant mortality rate*****
1980	19	73.5	13.97	46.63	127.00
1985	21.4	83.6	17.89	47.40	124.50
1990	17.7	95.3	16.87	47.19	126.20
1995	84.7	108.0	91.48	47.01	123.60
2000	20.5	122.4	25.1	47.19	112.30
2005	30.2	138.9	30.39	49.02	96.50
2010	34.9	157	54.79	51.56	81.10
2018	35.1	195.9	68.76	53.76	70.0

Source: *NBS/CBN Bulletin, 2018, **World population prospects (www.worldometres.info), 2017, *****CIA World Factbook, 2018. NBS: National Bureau of Statistic, CBN: Central Bank of Nigeria, POV: Poverty

phenomenon and a given country's health status cannot be explained fully by simple quantitative or econometric modeling. Be that as it may, the model developed in this paper does not claim to fully explain and capture all the various determinants of health outcome in Nigeria, but the methods employed and explained below were meant to achieve the specific objective(s) of economic analysis. The model is anchored on the theory of health production function as developed by Grossman (1972) and clearly simplified in the works of Matthew et al. (2015). In this framework, individuals are assumed to consume healthcare not necessarily because they value healthcare per se, but because it improves their stock of health, which is used as a productive resource. The basic model assumes the following health production function:

$$H=f(X)$$

Where H is a measure of individual health output or status and X is a vector of individual inputs to the health production function. The elements of the vector in this study include poverty index (misery index), adult Literacy rate, patients per physician, skilled birth attendants, carbon dioxide emission and urbanization rate. Where "H" is individual's health status captured in this study by life expectancy at birth and infant mortality rate.

Given this analysis, the models for this study are:

$$LEX=f(POV,LIT,CO_2, PPP, UBR) \qquad (1)$$

$$IMR=f(POV, LIT, PPP, CO_2) \qquad (2)$$

Where:
LEX=Life expectancy
IMR=Infant mortality rate
POV=Poverty index as measured by misery ındex
LIT=Adult literacy rate (a measure of education attainment)
PPP=Patients per physician (both general and specialist medical personnel)
CO_2=Carbon dioxide emissions (measured in metric tons per capita)
UBR=Urbanization rate

Putting the models in an econometric form, we have:

$$LEX=\beta0+\beta1POV+\beta2LIT+\beta3CO_2+\beta4PPP+\beta5UBR+Ω1 \qquad (3)$$

$$IMR=a0+a1POV+a2LIT+a3CO_2+a4PPP+\mu1 \qquad (4)$$

All the variables are as previously defined and `Ω1 and µ1 are the error terms for equations 3 and 4 respectively. The period of analysis for this study is 1980-2018. The sign of all the elasticity coefficients are expected to be positive except poverty and carbon dioxide emission. Specifically, poverty index as captured by misery index indicates the level of misery in the economy. This index is used in order to capture the socio-economic dimension of poverty. It is expected that Poverty will have a negative effect on health outcomes. On the other hand, literacy rate, patients per physician (measuring access to health services) and urbanization rate variables are expected to have a positive relationship with health outcomes. Carbon dioxide emission is expected to have a negative relationship with health outcomes. The study employs multivariate time series methodology of vector autoregressive (VAR) estimation technique because of its relatively simple computational procedure and fairly satisfactory results. The application of VAR technique in estimating the response of health outcome to the various macroeconomic variables shocks would not lead to specification bias since most of the macroeconomic variables in the model are strictly endogenous to the Nigerian economy. In the received literature, VAR models can be applied in levels irrespective of whether the variables are I(0) or I(1) (Persaran and Persaran, 1997).

The estimation procedure is begun with a conventional pre-estimation test of the time series properties of the variables. This is simply the unit root test which is often performed to ascertain the stationarity properties of variables in the model given that most economic series are non-stationary in nature (Granger and Newbold, 1974).

The time series data set was obtained from different sources. Specifically, data on life expectancy, infant mortality rate, carbon dioxide emission, adult literacy rate, physician per patients were obtained from CIA world factbook, 2018 while misery index data that captures poverty index was calculated from the data obtained from National Bureau of Statistics (NBS) and Central Bank of Nigeria (CBN) Statistical bulletin 2018.

4. PRESENTATİON AND DİSCUSSİON OF RESULTS

4.1. The Results of Life Expectancy Equation
Positive correlation exists between life expectancy and all other variables except carbon dioxide emissions and poverty index as shown in Table 2; most variables have relatively very low correlation while others have very high. For example, the positive

Table 2: Correlation matrix for life expectancy equation

Correlation	CO_2	LEX	LIT	POV	PPP	UBR
CO_2	1.000000					
LEX	−0.055652	1.000000				
LIT	−0.564814	0.414915	1.000000			
POV	−0.385457	−0.230922	0.050036	1.000000		
PPP	−0.187173	0.732191	0.675363	−0.200894	1.000000	
UBR	−0.281748	0.897380	0.732975	−0.140222	0.831044	1.000000

Source: Author's Computation Using E-views (2019). CO_2: Carbon dioxide emission, LEX: Life expectancy, LIT: Literacy rate, POV: Poverty, PPP: Patients per physician, UBR: Urbanization rate

correlation between life expectancy and poverty is 23% negative correlation while life expectancy and patients per physician is 73% positive correlation. It should be emphasized that this analysis relies more on the VAR results of impulse response and variance decomposition for policy analysis.

Table 3 indicates that all the variables are non-stationary at levels except infant mortality rate and poverty index that are stationary at levels. The unit root tests applied to the variables at each level accepts the null hypothesis of stationarity of infant mortality and poverty index but rejects the null hypothesis of stationarity of all the other variables. The variables (exception of infant mortality and poverty index) are therefore differenced once and they are confirmed to be stationary. Thus, infant mortality and poverty index are integrated of order zero while the other variables are integrated of order one.

4.2. Variance Decomposition for Life Expectancy Equation

Variance decomposition further captures the qualitative features of the VAR model. This is useful in evaluating whether the poverty

data contains information about health outcomes sufficiently far into the future to be operationally meaningful. The fractions of the forecast error variance for each variable that is attributable to its own innovations and to the innovations in another variable are presented in Table 4. Own shocks constitute a significant source of variation in health outcome of life expectancy (LEX) and forecast errors in the short run, ranging from 41.6% to 100% over the 10 quarters horizon. Innovations to poverty (POV) and carbon dioxide emissions (CO_2) (environmental factor) explain 0% variance of health outcome of life expectancy in the first quarter and these increased to 1.26% and 19.4% respectively in the fifth quarter. In the tenth quarter, innovations to poverty and carbon dioxide emission increased to 12.6% and 34% respectively. On the other hand, life expectancy has 0%, 3.9% and 1.4% of the forecast-error variance explained by patients per physician (PPP) in the first, fifth and tenth quarters respectively. This implies that in the short-run, poverty does not significantly predict health outcome of life expectancy in Nigeria and life expectancy seems to have a very strong prediction.

This result to some extent does not buttress the works of Itari et al. (2018) in Nigeria who asserted that the relationship between health outcome and poverty is bidirectional. From the results, it is obvious that Nigeria's poor health status may not necessarily be caused by poverty. That is, poverty is necessarily not a better predictor of population health outcomes (specifically, life expectancy) in Nigeria. Thus, the important feature of the variance decomposition results in this study is that the predominant sources of health outcome (life expectancy) fluctuations are due largely to own shocks, and to a lesser extent, to poverty in Nigeria.

4.3. Impulse Response Functions

The impulse response functions, according to Adebiyi (2004), as reported in Figure 1, are simply a device to display the dynamics

Table 3: Augmented Dickey-Fuller test

Variables	ADF statistics		Remark
	Level	1st difference	
LEX	−2.036414	−4.074982	I (1)
IMR	−3.056871	-	I (0)
CO_2	−2.222455	−6.589436	I (1)
LIT	−2.297609	−6.217260	I (1)
POV	−3.615588	-	I (0)
PPP	−2.112085	−6.481283	I (1)
UBR	−0.418884	−3.584425	I (1)

ADF at 5% level=−2.941145 and ADF at 5% 1st difference=−2.943427.
Source: Computed by the authors using E-views (2019). ADF: Augmented Dickey-Fuller, CO_2: Carbon dioxide emission, LEX: Life expectancy, LIT: Literacy rate, POV: Poverty, PPP: Patients per physician, UBR: Urbanization rate, IMR: Infant mortality rate

Table 4: Variance decompositions for the vector autoregressive model of life expectancy in Nigeria

Period	SE	LOG (LEX)	LOG (POV)	LOG (LIT)	LOG (CO_2)	LOG (PPP)	LOG (UBR)
1	0.005539	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.007920	98.73980	0.005774	0.001216	1.233956	0.019135	0.000116
3	0.009847	90.72754	0.135601	0.220790	5.973319	2.907443	0.035306
4	0.011926	82.42997	0.159266	0.154894	12.47922	4.469518	0.307134
5	0.014060	74.20958	1.263854	0.190923	19.35918	3.945263	1.031200
6	0.016189	65.96759	3.481212	0.428347	24.89225	3.175176	2.055425
7	0.018354	58.27371	6.120052	0.963335	28.89864	2.521883	3.222387
8	0.020519	51.56584	8.650321	1.751341	31.54257	2.020556	4.469376
9	0.022585	46.02120	10.84468	2.643704	33.12683	1.671668	5.691917
10	0.024488	41.56622	12.64503	3.538332	34.00509	1.432996	6.812336

Source: Author's computation using E-views (2019). SE: Standard error, CO_2: Carbon dioxide emission, LEX: Life expectancy, LIT: Literacy rate, POV: Poverty, PPP: Patients per physician, UBR: Urbanization rate

Table 5: Correlation matrix for infant mortality equation

Correlation	IMR	POV	LIT	PPP	CO_2
IMR	1.000000				
POV	0.274272	1.000000			
LIT	−0.543423	0.050036	1.000000		
PPP	−0.809639	−0.200894	0.675363	1.000000	
CO2	0.046394	−0.385457	−0.564814	−0.187173	1.000000

Source: Author's Computation Using E-views (2019). LIT: Literacy rate, POV: Poverty, PPP: Patients per physician, CO_2: Carbon dioxide emission, IMR: Infant mortality rate

of the variables tracing out the reaction of each variable to a particular shock at time *t*. The response of life expectancy to one standard innovation in poverty (misery index) is initially positive and then negative, ending in the short run. That is, initially, it is neutral. Afterwards, it descends significantly and gradually, ending with a negative impact in the 4th and 10th quarters. This implies that a high poverty level may cause poor health outcome in the short run. The response of life expectancy to urbanization rate is positive from the 1st quarter to the 10th quarter. The explanation for this result is evident. This clearly indicates that the rate of urbanization is high and this may boosts life expectancy in Nigeria. Literacy rate (a measure of educational attainment) and patients per physician shocks have positive effects on Life expectancy in the short run. This means that rising literacy rate will increase life expectancy in the short run. On the other hand, patients per physician have the capacity to improve life expectancy in Nigeria.

Table 6: Variance decompositions for the vector autoregressive model of infant mortality rate in Nigeria

Period	SE	LOG (IMR)	LOG (POV)	LOG (LIT)	LOG (PPP)	LOG (CO2)
1	0.011121	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.022497	99.06295	0.286177	0.342988	0.002254	0.305627
3	0.035215	97.58262	0.166825	1.267907	0.041893	0.940758
4	0.048483	95.47383	0.088446	2.630792	0.055508	1.751421
5	0.061856	93.25501	0.054527	4.196932	0.069193	2.424336
6	0.075072	91.19022	0.037678	5.834722	0.095976	2.841404
7	0.087914	89.36220	0.028912	7.444533	0.128574	3.035784
8	0.100154	87.76033	0.022277	8.978412	0.163780	3.075196
9	0.111602	86.32082	0.021619	10.43238	0.213421	3.011757
10	0.122147	84.97100	0.033028	11.81965	0.294906	2.881425

Source: Author's computation, 2019. LIT: Literacy rate, POV: Poverty, PPP: Patients per physician, CO_2: Carbon dioxide emission, IMR: Infant mortality rate, SE: Standard error

Figure 1: (a-e) Response to 1 S.D. Innovations ± 5 S.E
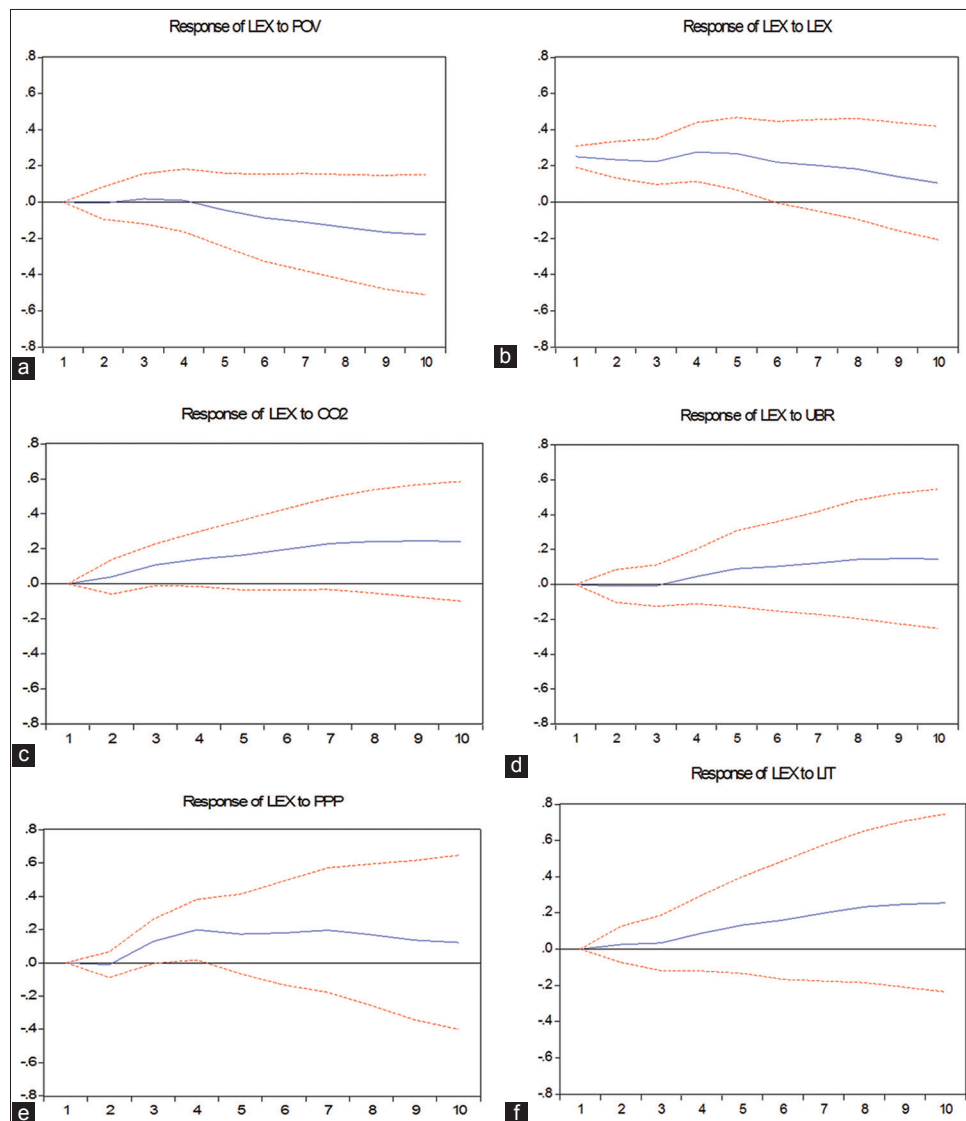
Interestingly, the response of life expectancy to carbon dioxide emission is positive from the 1st to the 10th quarter. This is at variance with economic theoretical expectations. This implies that a rise in carbon dioxide emission is likely to increase life expectancy in Nigeria in the short run. In a nutshell, from the impulse responses, it is clear that there is a long-run significant negative impact of the shocks of poverty index (misery index) on Life expectancy for the period under study.

4.4. The Results of Infant Mortality Equation

Positive correlation exists between infant mortality and all other variables except carbon dioxide emissions and poverty index as shown in Table 5; most variables have relatively very low correlation while others have very high. For example, the positive correlation between infant mortality and carbon dioxide emission is 4% positive correlation while infant mortality and patients per physician is 80% negative correlation. Though a high correlation between two variables is not good for econometric analysis, this study concentrates its analysis on the output of VAR.

4.5. Variance Decomposition for Infant Mortality Equation

A look at Table 6 reveals that own shocks constitute a significant source of variation in health outcome of infant mortality (IMR) and forecast errors in the short run, ranging from 84.9% to 100% over the 10 quarters horizon. Innovations to poverty (POV) and literacy rate (LIT, a proxy for educational attainment) explain 0% variance in health outcome of infant mortality in the first quarter and these increased to 0.05% and 4.19% respectively in the fifth quarter. In the tenth quarter, innovations to poverty decreased to 0.03% and literacy rate increased to 11.8% respectively. On the other hand, infant mortality rate has 0%, 2.42% and 2.88% of the forecast-error variance explained by carbon dioxide emission in the first, fifth and tenth quarters respectively. This implies that in the short-run, poverty does not significantly predict health outcome of infant mortality in Nigeria and infant mortality seems to have a very strong prediction.

4.6. Impulse Response Functions

Figure 2 has shown that the response of infant mortality to one standard innovation in poverty (misery index) is initially positive

Figure 2: (a-e) Response to 1 S.D. ınnovations ± 5 S.E
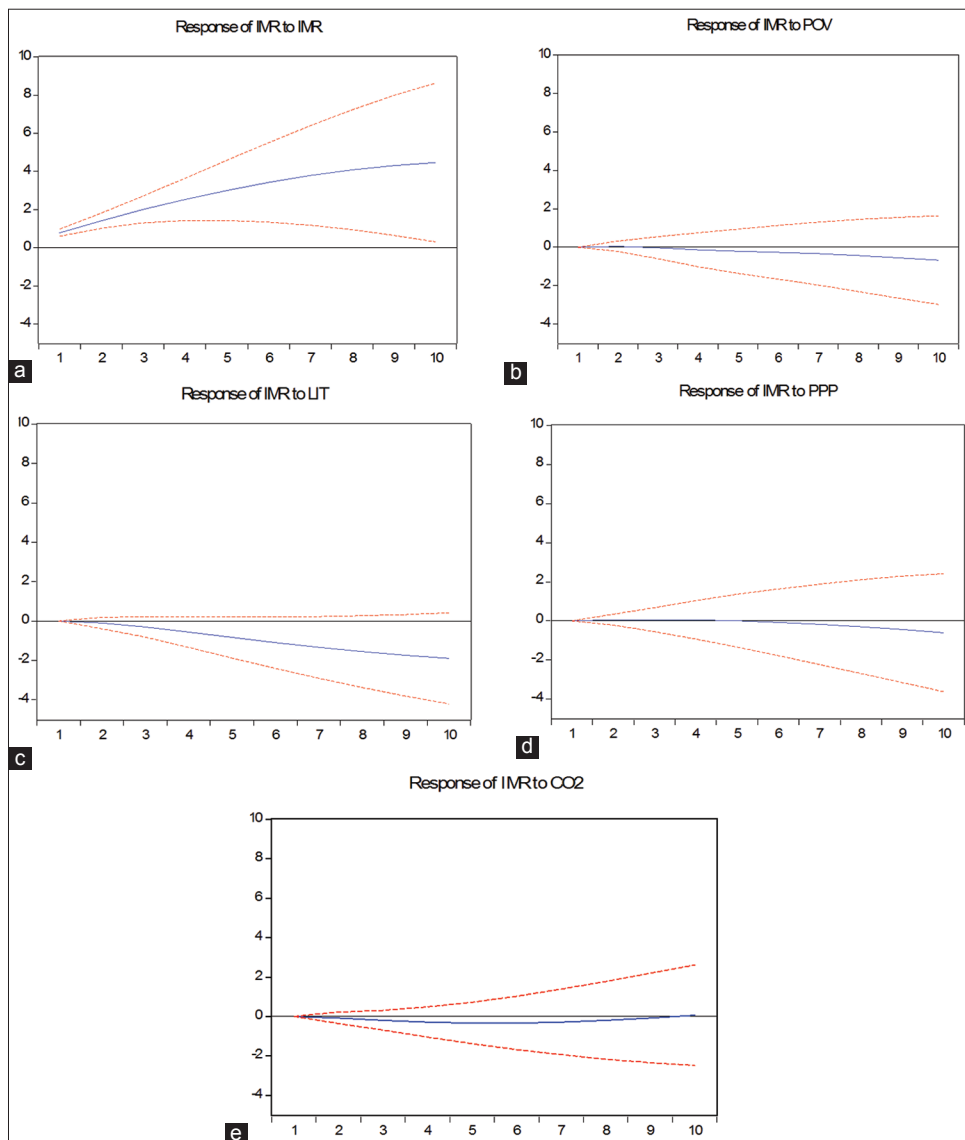
and then negative, ending in the short run. That is, initially, it is neutral. Afterwards, it descends significantly and gradually, ending with a negative impact in the 4th and 10th quarters. This implies that a high poverty level may cause poor health outcome in the short run. The response of infant mortality rate to patients per physician is positive from the 1st quarter and then negative in the 6th quarter to the 10th quarter. Also, literacy rate is negative and is likely to reduce infant mortality in the short run. Interestingly, the response of infant mortality to carbon dioxide emission is negative from the 1st to the 9th quarter and then began to rise in the 10th quarter. This implies that a rise in carbon dioxide emission is likely to decrease infant mortality rate in Nigeria in the short run. Summarily, from the impulse responses, it is clear that there is a long-run significant negative impact of the shocks of poverty index (misery index) on infant mortality for the period under study.

5. CONCLUSİON AND POLİCY IMPLİCATİONS

Arising from the received literature, this study investigated whether poverty is a better predictor of population health outcomes (specifically, life expectancy and infant mortality) in Nigeria using a macro socio-economic data (misery index) to capture poverty. The contribution of this study had been to validate or refute this assertion in the context of Nigeria. The study used VAR econometric approach to model the dynamics of poverty shocks on health outcomes in the Nigerian economy. Findings from the empirical analyses have shown that poverty shock does not have any significant influence on health outcome target variables (life expectancy and infant mortality).

The implication of this result is that health outcomes in Nigeria are not necessarily significantly the consequence of poverty. It is equally important to emphasize that this result be interpreted with caution. Therefore, the policy implication of this analysis is simply that there should be a significant improvement in health status or outcome of the population as this can to a greater extent have a positive trickledown effect on poverty reduction in Nigeria. The emphasis on poverty reduction has become necessary given that the poor suffer from a lot of deprivations in all its ramifications including access to healthcare.

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