Income Inequality, Health Expenditure and Outcomes in Nigeria

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Abstract

This study investigated the nexus between income inequality and health status in Nigeria. Life expectancy, public health expenditure and infant mortality rate were used as proxy for health. The study presumed that the link between income inequality and health is better investigated through the use of inter-temporal measures such as growth rate and per capita indicators since income inequality and health are macroeconomic variables with microeconomic foundations. The technique of Autoregressive Distributed Lags (ARDL) was used on secondary data spanning 1980 to 2015. The study sought to ascertain whether a long-run equilibrium condition holds among the variables in the model and a re-parameterized ARDL was used to examine the short-run dynamics of the variables' interaction. The study found the link between income inequality and health to be measure sensitive; depending on the indicator used for empirical investigations. The use of qualitative measures such as life expectancy and infant mortality rate indicate that income inequality does not matter for health status in Nigeria.

Keywords: Income inequality, Health expenditure, Health outcomes, Life expectancy, Infant mortality rate

JEL classification: N3, P36

Introduction

The primary aim of any government is to ensure that the standard of living of its citizenry is enhanced through access to basic security in every aspect of livelihood, such as food, clothing, housing, education, healthcare, social infrastructure, employment and social security, among others. Interestingly, health is a public good which people cannot be excluded from consuming and where the consumption by one individual does not preclude others. For such public goods, no price can be set because it is impossible to exclude anyone who will not pay from consuming it, while everyone benefits. If no price can be set and nobody is willing to pay for such goods or services, it will not be attractive for the private sector to provide. The government therefore becomes responsible for providing this service.

Health care is so complex that individuals are likely to have difficulties in valuing the quality and appropriateness of the service they receive. Government intervention is therefore premised on the need for equity outcomes as it is feared that the private sector has no incentive to care for the poor who are sick and might not have sufficient resources to get health care. It is therefore, the government's role to regulate, fund or provide health care for this class of people who may not be served by the private sector.

Inequality in income distribution is most evidenced in less developed countries, as evidenced in Nigeria. There has been a concentration of wealth and economic power in a few hands to the detriment of the under-privileged and the commoners in Nigeria. Assessing the impact of income disparity on Nigeria, Adegoke (2013) stated that Nigeria falls within the Gini-index ratio of 0.50 to 0.70 compared to other countries with relatively equitable distributions whose Gini-coefficient ranges between 0.20 and 0.35. The observed gap between the haves and the have-nots has widened over time in the country, thus placing Nigeria among the thirty countries with the most unequal income distribution in the world, where the poorest segment of the population holds only about 10% of the national income. This increasing trend of income inequality in Nigeria has over time attracted the attention of researchers and policy makers. While Canagarajah, Ngwafon, and Thomas (1997) reported the increasing level of income inequality between the 1980s and 1990s as shown by an increase in the Gini-coefficient from 0.38 in 1985 to 0.45 in 1992, Aigbokhan's (1997) findings reveal that income inequality worsened after the Structural Adjustment Programme (SAP) of 1986.

Ogwumike et al. (2003) in a World Bank report showed that in 1997, the Gini index of income inequality for Nigeria was 0.506. Using the 2004 National Living Standard Survey (NLSS) data, Oyekale, Adeoti and Oyekale (2006) found that the overall Gini index for Nigeria was 0.580. This invariably reflected on the state of health of the population. Alawode and Lawal (2014) identified two pathways through which income inequality could damage health. First, they stated that a highly unequal society implies that a substantial segment of the population is impoverished, and poverty has bad implications for health. Second, though more contentious and earlier confirmed by Kawachi and Kennedy (1997), is that income inequality is thought to affect the health of not just the poor, but the population segment which enjoys a favourable income distribution as well. In addition, research by epidemiological researchers in the United States of America (USA) showed that approximately one-third of annual deaths in the USA can be credited to the nation's excessive inequality, especially among the black community (Kawachi and Kennedy, 1997). Tackling income inequalities, health outcomes, education and well-being requires breaking down the barriers to inclusive growth and reaching new frontiers in policy-making and implementation. Everyone should be able to realize their potential and to share the benefits of growth and increased prosperity.

To achieve the objective of determining the interactions between income inequality and public health, this study shall be investigating the extent and size of income inequality as well as the impact of income inequality on life expectancy and infant mortality. Following this introductory piece, the next section is a review of extant literature, conceptually, theoretically and empirically. The section that follows sets the methodological framework for the study. The section following this provides the estimations and discussion of findings while the final section concludes and offers necessary recommendations.

Selected Literature Review

There are three basic underlying theoretical links between income inequality and health. These are: the absolute income hypothesis (AIH), the relative income hypothesis (RIH) and income-inequality hypothesis (IIH), which can be in the strong or weak form.

The AIH states that it is income, rather than the direct effect of income inequality, that affects health. This means that the marginal effect of income on health is diminishing, implying that average health in a society will increase as average income increases and income inequality decreases, (Wagstaff and van Doorslaer, 2000). This is also consistent with the predictions from the Grossman model. In the Grossman model, health is both a consumption and production good that yields satisfaction and utility to the individual. As a consumption good, increased income increases the demand for health and health-enhancing goods. At the same time, as a production good, health indirectly yields satisfaction through increased productivity and higher wages (Grossman, 1972).

The RIH states that it is the individual's income relative to the average income of the reference group that has an effect on health. It states that an individual with below-average income will have worse health (Wagstaff and van Doorslaer, 2000) due to the psychosocial stress associated with having low relative income (Wilkinson, 1996). This hypothesis assumes that, at least in the economic domain, upward comparisons are more salient than downward comparisons and that upward comparisons are more likely to be stressful than soothing.

The IIH states that income inequality in a society directly affects all individuals' health negatively (Wagstaff and van Doorslaer, 2000). Wilkinson and Pickett (2008) buttressed this argument further that increasing societal wealth leads to improved population health only to a certain level of economic development. When this threshold of wealth is reached, reducing disparities in income distribution is the key to further improve the health of the population. Several possible mechanisms through which income inequality could have a detrimental effect on health have been presented among which is trust and capital issues.

Empirical Review

Alayande (2003) decomposed income inequality and poverty in Nigeria using the regression-based decomposition approach developed by Morduch and Sinclair (2002). The study showed that primary and post-secondary educational attainments are important in reducing income inequality in Nigeria and also that the number of unemployed in households contributed positively to income inequality. Ogwumike et al. (2003) investigated labour force participation and income inequality in Nigeria and showed that inequality is more pronounced in paid employment than in the self-employed segment of the Nigerian labour force. The study also showed that inequality is higher among women involved in paid employment than in the self-employment segment but higher among self-employed men than that their female counterparts. They further found that inequality is generally higher in the rural areas than in the urban areas and concluded from their findings that within groups, inequality mainly explains income inequality in Nigeria.

Wilkinson (1992) investigated the relationships between income inequality and health using three small international data sets, with one of the data sets looking at changes over time. An analysis of the relationship between income inequality and health revealed that health is independent of average income. However, Judge (1995) and Judge, Mulligan and Benzeval (1998) used an updated data set in a related study and found no association between income inequality and life expectancy but found that it had an association with infant mortality. Elbers et al. (2003) sought to know whether neighbours are equal by estimating income inequality for Ecuador, Mozambique and Madagascar. Based on statistical procedure that combined household survey data with population census, they found that the ratio of within-community inequality to overall national inequality is high. Specifically, the computed Gini-coefficients were between 0.320 and 0.518 and 0.320 and 0.440 in Madagascar and Mozambique respectively.

Denis (2002), in a related study on Canada, found that increasing poverty goes hand-in-hand with increasing income inequality, stressing that poverty directly harms the health of those with low incomes, while income inequality affects the health of all Canadians through the failure of the government's social and economic policies, weakening of social infrastructure, safety nets, supports, and destruction of social cohesion. For Finland, Mikkonen (2013) observed that increases in income have concentrated in the highest income groups as the redistributive effect of taxes and transfers has decreased. However, the study found that income inequality in Finland of 0.26 was still much lower than in many other OECD countries which had an average Gini coefficient of 0.31 in the mid-2000s despite the fact that the poverty rate in Finland had increased since the recession of the 1990s.

In a cross-sectional analysis to ascertain if reducing income inequality distribution in societies will increase population health, Pop, Ingen and Orschoot (2013) showed that countries with higher levels of income inequality also have lower levels of life expectancy (proxy for population health). Though this result was consistent, the relationship was found only among low and middle-developed countries. For the group of high-developed countries however, the relationship between income inequality and life expectancy was not significant, which contradicts popular findings in the literature. Expectations on the relationship between a country's wealth and health were confirmed, as economic growth does contribute to improving population health, but this effect was found weaker in more economically-developed countries. These results imply that a decrease in a country's income inequality equated with an increase in its wealth and can help to improve health in economically less-developed countries, but not in high-developed countries.

Wilkinson and Pickett's (2009) work compiled a compendium of research on the relationship between income inequality, health and social problems among countries over a certain income threshold. Inequality was not found to be related to life expectancy, although they did find that it was associated with infant mortality. Furthermore, in a bid to test the IIH at the individual level, Lorgelly and Lindley (2008) used British Household Panel Survey (BHPS) data from 1991 – 2004. The BHPS is a longitudinal survey carried out annually to collect data on income, employment, health and well-being, demographics, value and opinions. Their measure of individual health is a self-assessed measure found to be a "strong predictor of subsequent mortality", a claim also supported by Idler and Benyamini (1997); and Doorslaer and Gerdtham (2003). Inequality was measured using the Gini-coefficient; and education, household income, age, marriage history, ethnicity and relative income were controlled for. After controlling for attrition bias (individuals dropping out from the data set over time), they found no significant relationship and thus no support for the income inequality hypothesis. Analogous results were also found by Gerdtham and Johannesson (2004) using Swedish data. Also, in a cross-country study testing the IIH, Rodgers (1979) found that population health was negatively associated with inequality, even when the mean income was held constant.

Wilkinson (1992) also found a relationship between life expectancy and income inequality across several industrialized countries. Kawachi and

Kennedy (1997) used a cross section of the United States of America's 1990 data to test for the relationship between income inequality and health. They found a statistically significant relationship at 5% level between age-adjusted mortality and the Robin Hood Index, and these results were found to be robust across the inequality measures used. However, Mellor and Milyo (2001) and Childs (2013) saw these findings as not being robust enough across alternative measures of inequality, using a wider set of countries, especially when the estimating equation is extended to include a number of other factors, such as education, which may influence health.

The investigations of income inequality and health status in empirical studies have majorly used primary as well as qualitative measures. However, this link is better investigated through the use of inter-temporal measures such as the growth rate and per capita indicators. This is because income inequality and health are macroeconomic variables with microeconomic foundations. Also, none of the studies in extant literature has considered a dynamic investigation of the income inequality-health interactions. Empirical studies have employed the use of static analysis through the Johansen co-integration and Error Correction Model (ECM), whereas income inequality and health are continually evolving variables in an economy. The study seeks to add value in this area.

Methodology

This study is anchored on the strong form of the Income Inequality hypothesis which states that inequality itself matters, regardless of an individual's own income level. The proposition underlying this theoretical framework is that in unequal societies, rich individuals pay more to the government in terms of taxes than the transfer and services they receive. They therefore, support policies that favour less public spending. This could result in worse health care (Kawachi and Kennedy 1997). Stemming from this, we have a functional form model specification of the following form for empirical estimations:

$$life\_\exp = f(gini, gfcf, hh\_pc\_cons, gdp\_gr, transfer) \quad (1)$$

$$health\_\exp\_gr = f(gini, gfcf, hh\_pc\_cons, gdp\_gr, transfer) \quad (2)$$

$$\inf ant\_mort = f(gini, gfcf, hh\_pc\_cons, gdp\_gr, transfer) \quad (3)$$

where: $life\_ \exp$ = Life expectancy

$health\_ \exp\_ gr$ = Public health expenditure

$\inf ant\_ mort$ = Infant mortality

$gini$ = Gini coefficient

$gfcf$ = Gross fixed capital formation

hh_pc_cons = Household per capita final consumption

gdp_gr = Gross national income

$transfer$ = Transfers

Equations (1) to (3) suggest that health, as indicated by life expectancy, public health expenditure and infant mortality rates respectively is a function of income inequality, indicated by the Gini coefficient; gross fixed capital formation, an indicator for investment; gross national income; growth rate of household per capita final consumption and transfers. The above functional form model can be translated into econometric or stochastic form model as:

$$life\_exp_t = \alpha_0 + \beta_1 GINI_t + \beta_2 gfcf_t + \beta_3 hh\_pc\_cons_t + \beta_4 gdp\_gr_t + \beta_5 transfer_t + \varepsilon_t \quad (4)$$

$$health\_exp_t = \alpha_0 + \beta_1 GINI_t + \beta_2 gfcf_t + \beta_3 hh\_pc\_cons_t + \beta_4 gdp\_gr_t + \beta_5 transfer_t + \varepsilon_t \quad (5)$$

$$infant\_mort_t = \alpha_0 + \beta_1 GINI_t + \beta_2 gfcf_t + \beta_3 hh\_pc\_cons_t + \beta_4 gdp\_gr_t + \beta_5 transfer_t + \varepsilon_t \quad (6)$$

This study employs the Auto Regressive Distributed Lag (ARDL) bound test as well as the Granger causality test to examine the relationship between income inequality and health. Generally, the ARDL framework is of the following form:

$$Y_t = \alpha_0 + \gamma_1 Y_{t-1} + \beta_i \sum_{i=0}^{n} X_{t-i} + \varepsilon_t \quad (7)$$

where:

Y_t is the dependent variable;

Y_{t-1} is the auto-regressive component that indicates the lagged dependent variable;

$\sum_{i=0}^{n} X_{t-i}$ is the collection of other explanatory variables in their lagged form beginning from the current level up to the maximum lag length suggested by the lag selection criteria.

As such, equations (4) to (6) are re-specified as follows:

$$life\_exp_t = \alpha_0 + \gamma_1 life\_exp_{t-i} + \beta_1 GINI_{t-i} + \beta_2 gfcf_{t-i} + \beta_3 hh\_pc\_cons_{t}-_{i} + \beta_4 gdp\_gr_{t-i} + \beta_5 transfer_{t-i} + \varepsilon_t \quad (8)$$

$$health\_exp_t = \alpha_0 + \gamma_1 health\_exp_{t-i} + \beta_1 GINI_{t-i} + \beta_2 gfcf_{t-i} + \beta_3 hh\_pc\_cons_{t}-_{I} + \beta_4 gdp\_gr_{t-i} + \beta_5 transfer_{t-i} + \varepsilon_t \quad (9)$$

$$infant\_mort_t = \alpha_0 + \gamma_1 infant\_mort_{t-i} + \beta_1 GINI_{t-i} + \beta_2 gfcf_{t-i} + \beta_3 hh\_pc\_cons_{t}-_{I} + \beta_4 gdp\_gr_{t-i} + \beta_5 transfer_{t-i} + \varepsilon_t \quad (10)$$

The stationarity of the variables was verified by testing the presence of a unit root to avoid spurious regressions using both the Augmented Dickey-Fuller (ADF) and Phillips-Perron tests, while data for the study were obtained from secondary sources. The secondary data are annual time series spanning 1980 through 2015. The variables of interest are: Gini coefficient, obtained from the World Income Inequality Database (WIID, 2016); the growth rate of gross national income (GNI); life expectancy and the growth rate of household per capita final consumption, obtained from the World Development Indicators (WDI, 2016); and public health expenditure and gross fixed capital formation (proxied as GFCF), obtained from the Central Bank of Nigeria's (CBN) *Annual Statistical Bulletin* (2016). It is instructive to note that missing data points for the Gini coefficient were obtained through the use of three-year moving averages.

Estimations and Discussion of Findings

Stationarity tests

The results of the stationarity tests suggest that the variables included in the model are a mix of both unit-root and stationary series. The indicator of income inequality, Gini-coefficient (proxied as GINI), household per capita final consumption (proxied as HH_PC_CONS), growth rate of health expenditure (HEALTH_EXP_GR) and growth rate of the gross domestic product (proxied as GDP_GR) are all stationary at levels. This implies that the direct inclusion of these variables in empirical investigations would not result in spurious conclusions. However, the variables of gross fixed capital formation, an indicator for aggregate investment (proxied as GFCF_GR); life expectancy (proxied as LIFE_EXP); transfer (proxied as TRANSFER); and infant mortality (proxied as INFANT_MORT) cannot be directly introduced for empirical estimations without first differencing. The variables were stationary at order one {I(1)}. Furthermore, the technique of analysis for this study, the Autoregressive Distributed Lag (ARDL) approach, favours the mix of both differenced unit-root series (I(1)) and stationary series (I(0). According to Pesaran, Shin and Smith (1991), ARDL is a bound-testing approach to long-run equilibrium condition and impact analysis that is not affected by the stationarity of series or otherwise but cannot be used for wholly stationary or wholly unit-root series. Conducting this test further reinforces the use of the ARDL as an appropriate technique of analysis.

Considering the lag selection criteria, it is evident that models 1 and 2 favour the use of two lags while model 3 requires no lag. The implication is that the estimations of the models earlier specified must accommodate two lag periods each of the dependent and independent variables for the models, where both life expectancy and health expenditure growth rate serve as potential exogenous variables while no lag is required for infant mortality as an exogenous variable.

Table 1: Unit-Root and Stationarity Tests

Variables	ADF Test		Order of Stationarity	Phillip-Perron Test		Order of Integration
	I(0)	I(1)	I(r)	I(0)	I(1)	I(r)
GINI	-3.509**	-	I(0)	-3.3974**	11.2355	I(1)

GFCF_GR	-2.607	-10.646*	I(1)	-4.5684*	-	I(0)
LIFE_EXP	-0.072	-4.202*	I(1)	2.7596***	-	I(0)
HH_PC_CONS	-7.410*	-	I(0)	-7.4097*	-	I(0)
HEALTH_EXP_GR	-6.125*	-	I(0)	-6.2389*	-	I(0)
GDP_GR	-4.207*	-	I(0)	-5.0913*	-	I(0)
TRANSFER	-0.154	-3.648	I(1)	-0.154	-3.648	I(1)
INFANT_MORT	-0.710	-2.674	I(1)	-0.710	-2.674	I(1)

Source: E-views Output.
Note: I(0) critical values are -3.753, -2.998 and -2.639 for 1%, 5% and 10% respectively while I(1) critical values are -3.662, -2.960 and -2.619 for 1%, 5% and 10% critical values respectively.

The Granger causality estimates obtained in Table 2 indicate that the causality flows from income inequality to health since the null hypothesis that Gini coefficient, an indicator of income inequality, does not Granger cause the growth rate of health expenditure was rejected at the 10 percent level of significance, while the null hypotheses that income inequality does not Granger cause both infant mortality and life expectancy, being indicators of health, were rejected at the 5 percent level of significance. Also, the hypothesis that these indicators of health do not Granger cause income inequality were all accepted (see Table 2). On the whole, it suggests that, for Nigeria, causality flows from income inequality to health while the reverse causality does not hold.

Table 2: Granger Causality Estimates

Variables	Causality	Lags	F-test		
	**Ho: x → y*		F-stat.	P-values	Conclusion
GINI, LIFE_EXP,	*HEALTH_EXP_GR → GINI*	2	0.242	0.787	Accept
HEALTH_PC_CONS	*GINI → HEALTH_EXP_GR*	2	2.818	0.079**	Reject
INFANT_MORT	*INFANT_MORT → GINI*	2	0.602	0.555	Accept
	GINI → INFANT_MORT	2	16.713	0.00002*	Reject
	LIFE_EXP → GINI	2	0.013	0.988	Accept
	GINI → LIFE_EXP	2	14.169	0.00006*	Reject

Source: *The Null Hypothesis is that p lags is equal to zero. The F-statistics for the direction $x \rightarrow y$ indicates that the p lags of x in equation y is equal to zero. If accepted, it means x does not Granger cause y and if rejected, then, it causes. (*)** show significance at the (5%)10% critical values.

Model estimations

Long Run Equilibrium Condition and Impact Analyses

The estimates obtained for the long-run equilibrium condition show that the F-statistics of 1363.84 and 4773.4 for Models 1 and 3 respectively are greater than the upper bound critical values, even at the 1 percent level of significance with 5.06 values. This is further reinforced by the probability values for the F-statistics which indicates high significances. For Model 2, however, the F-statistics value of 4.038 is only greater than the 5 percent level of significance with 4.01. This is still within the accepted significance benchmark. As such, the statistics obtained imply that long-run equilibrium condition holds between income inequality, as indicated by the Gini coefficient (GINI), and health status, as indicated by life expectancy (LIFE_EXP for model 1), growth rate of health expenditure (HEALTH_EXP_GR for Model 2) and infant mortality (INFANT_MORT for Model 3) in Nigeria.

Table 3: Long Run Equilibrium Conditions for Models 1 – 3

Models	Bound Test Critical Values						F-statistics	
	Lower Bound			Upper Bound			F-stat.	Prob.
	1%	5%	10%	1%	5%	10%		
1	3.74	2.86	2.45	5.06	4.01	3.52	1363.84	0.000
2	3.74	2.86	2.45	5.06	4.01	3.52	4.038	0.007
3	3.74	2.86	2.45	5.06	4.01	3.52	4773.4	0.000

Source: E-views Output

On the long-run impact analysis, the estimates obtained from Model 1 (Table 4) indicate that three variables such as income inequality, the growth rate of the Nigerian economy and transfer payment matter for health status in the long run. The direction of household consumption per capita (HH_PC_CONS) is unclear, or at best mixed. While both income inequality and GDP growth rate are significantly positively related with 0.011 and 0.005 coefficients coupled with 0.030 and 0.065 probability values respectively, transfer payment given by the government to individuals has a coefficient of -0.002 and 0.001 probability values. Intuitively, this implies that the better the state of the Nigerian economy, the longer Nigerians will live, as proceeds from the aggregate growth is expected to trickle down to all sectors of the economy, including the health sector. On the other hand, the more unequal income is distributed in Nigeria, the longer Nigerians live; thus, refuting the income inequality hypothesis that income inequality matters for health in Nigeria. Also, household per capita consumption and the growth rate of public health expenditure are negatively related to health status in Nigeria, albeit insignificantly. However, aggregate investment, indicated as gross fixed capital formation, is positively but insignificantly related to health status in Nigeria. This indicates that the pattern of individual consumption in Nigeria has been detrimental to their health status while public health expenditure by the government has not been health-enhancing either. For a robust investigation, however, the use of other health indicators such as public health expenditure (see Table 7) and infant mortality (see Table 8) would produce a more far-reaching conclusion on the link between health and income inequality.

Table 4: Long-Run Impact Analysis for Model 1

Panel A: Model 1 (with Life Expectancy as Dependent Variable)			
Variables	Coefficient	T-statistics	Probability
C	-6.031	-8.144	0.000
LIFE_EXP(-1)	1.105	79.934	0.000
GINI	0.011	2.403	0.030
GINI(-1)	0.008	1.929	0.073
GINI(-2)	0.009	2.028	0.061
GFCF_GR(-2)	0.0005	0.603	0.556
HH_PC_CONS	-0.0004	-0.301	0.768
HH_PC_CONS(-1)	-0.003	-1.831	0.087
HH_PC_CONS(-2)	-0.0002	-0.138	0.892
GDP_GR	0.005	1.993	0.065
GDP_GR(-1)	0.006	1.999	0.064
GDP_GR(-2)	0.004	1.384	0.187
HEALTH_EXP_GR	-2.95e-06	-0.075	0.941
HEALTH_EXP_GR(-1)	-2.99e-05	-0.813	0.429
TRANSFER	-0.002	-3.980	0.001
Adj R^2	0.99		
F-stat.	1363.84		
Prob. F-stat.	0.000		
DW stat.	1.83		

Source: E-views Output.

As presented in Table 5, the estimate of the inequality-health nexus, using public health expenditure as indicator for health, suggests that a positive and significant relationship exists between the two variables. The previous (lagged) level of income inequality (proxied as GINI(-1)) has the coefficient 39.76 with 0.068 probability value. This suggests that the higher the inequality in income, the lower the amount available for public health expenditure and the more devastating to the health status of Nigerians. Both the growth rate of the Nigerian economy (proxied as GDP_GR) and the amount given as transfer payment by the government (proxied as TRANSFER) are indirectly and insignificantly related to the health status of Nigerians. However, household per capita consumption (proxied as HH_PC_CONS) and aggregate investment (proxied as GFCF_GR) are positively but insignificantly related to health in Nigeria.

Table 5: Long-Run Impact Analysis for Model 2

Panel B: Model 2 (with Health Expenditure as Dependent Variable)			
Variables	Coefficient	T-statistics	Probability
C	4.954	0.046	0.964
HEALTH_EXP_GR(-1)	-0.507	-3.268	0.004
GINI(-1)	39.763	1.922	0.068
GFCF_GR(-2)	3.311	-0.904	0.376
HH_PC_CONS(-1)	4.057	0.840	0.410
GDP_GR(-2)	-18.205	-1.565	0.132
TRANSFER	-2.047	-0.935	0.360
Adj R^2	0.394		
F-stat.	4.038		
Prob. F-stat.	0.007		
DW stat.	1.95		

Source: E-views Output

Considering infant mortality as an indicator for health, estimates tabulated in Table 8 show that the more unequal income is distributed in Nigeria, the less the number of children that die before their fifth birthdays. This also further reinforces the finding that income inequality does not matter for health in Nigeria. Crucially, one significant finding from this study is that the link between income inequality and health depends on the indicator of income inequality used for empirical investigations. While the use of quantitative measures such as the growth rate of public health expenditure suggests that income inequality matters for health status in Nigeria, the use of qualitative measures such as life expectancy and infant mortality indicate that income inequality does not matter for health status in Nigeria.

Table 6: Long-Run Impact Analysis for Model 3

Panel C: Model 3 (with Infant Mortality as Dependent Variable)			
Variables	Coefficient	T-statistics	Probability
C	5.229	3.551	0.003
INFANT_MORT(-1)	1.043	143.344	0.000
GINI	-0.087	-4.317	0.001
GINI(-1)	-0.083	-4.375	0.001
GINI(-2)	-0.085	-4.425	0.001
GFCF_GR(-2)	-0.004	-1.144	0.271
HH_PC_CONS	0.001	0.168	0.869
HH_PC_CONS(-1)	0.009	1.325	0.205
HH_PC_CONS(-2)	0.003	0.444	0.663
GDP_GR	-0.021	-1.804	0.091
GDP_GR(-1)	-0.017	-1.345	0.199
GDP_GR(-2)	-0.014	-1.043	0.313
HEALTH_EXP_GR	0.0000728	0.413	0.686
HEALTH_EXP_GR(-1)	0.0003	1.543	0.144
TRANSFER	0.003	2.136	0.050
Adj R^2	0.99		
F-stat.	4773.4		
Prob. F-stat.	0.000		
DW stat.	1.81		

Source: E-views output.

Short-Run Dynamics of the Model

The error correction terms (proxied as ECT_1) for Models 1 – 3 are properly signed with -0.0002, -0.976 and -0.0005 coefficients respectively. The implication is that the recovery process for Models 1 and 3 with qualitative measures of health such as life expectancy and infant mortality is very slow and would take a very long period of time before equilibrium would be attained when affected by demographic shocks. Basically, income inequality (indicated as Gini coefficient but proxied as GINI) is significantly positively related to life expectancy and public health expenditure growth rate at 5 percent level of significance with 0.124 and 40.727 coefficients coupled with 0.001 and 0.000 probability values respectively. The implication is that the more unequal income is distributed in Nigeria, the better the improvement in health and the higher the expenditure on the health status of the people. However, income inequality is negatively related to infant mortality (proxied as INFANT) with -0.075 coefficient and 0.031 probability value. This denotes that an increasing trend in income inequality would reduce the number of children that die before their fifth birthday in Nigeria. Although investigations of the income inequality nexus through the use of qualitative measures such as life expectancy and infant mortality as against quantitative measures such as public health expenditure appear counter-intuitive, they are an indication that the measure as well as indicators of health matter for empirical findings.

Table 7: Short-Run Dynamics for Model 1

Panel A: Model 1 (with Life Expectancy as Dependent Variable)			
Variables	Coefficient	T-statistics	Probability
C	-6.809	-18.227	0.000
LIFE_EXP(-1)	1.122	164.617	0.000
GINI	0.015	5.555	0.001
GINI(-1)	1.03e-05	0.004	0.997
GINI(-2)	0.0124	4.858	0.001
GFCF_GR(-2)	0.0002	0.468	0.652
HH_PC_CONS	-0.002	-3.278	0.011
HH_PC_CONS(-1)	-0.004	-5.232	0.001
GDP_GR	0.005	5.365	0.001
GDP_GR(-1)	0.007	6.188	0.000
GDP_GR(-2)	0.004	3.519	0.008
HEALTH_EXP_GR	0.0001	3.438	0.009
HEALTH_EXP_GR(-1)	-9.68e-05	-3.615	0.007
HEALTH_EXP_GR(-2)	-6.85e-05	-2.643	0.030
TRANSFER	-0.001	-6.858	0.000
TRANSFER(-1)	-0.0004	-1.802	0.109
TRANSFER(-2)	-0.0009	-6.243	0.0002
ECT_1	-0.0002	-3.398	0.009
Adj R^2	0.99		
F-stat.	10208.2		
Prob. F-stat.	0.000		
DW stat.	1.72		

Source: E-views output.

In the qualitative health indicators models of 1 and 3, transfer payment is the only negatively related and significant variable for the former and gross fixed capital formation for the latter. This reinforces the strength of non-health factors influencing health status in Nigeria. Considering non-health variables such as aggregate investment, indicated as gross fixed capital formation (proxied as GFCF), growth rate of the economy (proxied as GDP_GR), and transfer payment (proxied as TRANSFER), we found that these variables are negatively related to health status in Nigeria, as indicated by public expenditure growth rate (proxied as HEALTH_EXP_GR) with -4.306, -13.686 and -2.711 coefficients and 0.000 probability values respectively.

Table 8: Short-Run Dynamics for Model 2

Panel B: Model 2 (with Health Expenditure as Dependent Variable)			
Variables	**Coefficient**	**T-statistics**	**Probability**
C	28.940	1.873	0.077
HEALTH_EXP_GR(-1)	-0.513	-24.871	0.000
GINI(-1)	40.727	14.876	0.000
GFCF_GR(-2)	-4.306	-8.249	0.000
HH_PC_CONS(-1)	3.861	5.630	0.000
GDP_GR(-2)	-13.686	-8.835	0.000
TRANSFER	-2.711	-8.460	0.000
ECT(-1)	-0.976	34.950	0.000
Adj R^2	0.99		
F-stat.	378.66		
Prob. F-stat.	0.000		
DW stat.	2.39		

Source: E-views output.

Generally, the adjusted coefficient of determination (Adj. R^2) indicates that the variables included in the models properly explained for the movement in income inequality in Nigeria and that the inclusion or/and exclusion of another variable would not be necessary. This is so in that the models show that the explanatory powers for models 1 – 3 is 99 percent while only 1 percent is due to the extraneous factor that is not captured in the models. Also, the F-statistics ratios have probability values that indicate high significance, even at 1 percent level. This connotes that our models do not suffer from specification errors and the Durbin Watson (DW) statistics indicate no problem of either first order or second order serial correlation since the statistics for the Durbin Watson falls within the threshold range of 1.6 and 2.4. On the whole, the goodness of fit and the appropriateness of the models are guaranteed.

Table 9: Short-Run Dynamics for Model 3

Panel C: Model 3 (with Infant Mortality as Dependent Variable)			
Variables	Coefficient	T-statistics	Probability
C	7.421	7.068	0.0001
INFANT_MORT(-1)	1.026	201.376	0.000
GINI	-0.075	-2.545	0.031
GINI(-1)	-0.088	-2.560	0.031
GINI(-2)	-0.092	-4.113	0.003
GFCF_GR(-2)	-0.005	-1.762	0.112
HH_PC_CONS	0.001	0.135	0.896
HH_PC_CONS(-1)	0.013	2.072	0.068
HH_PC_CONS(-2)	0.015	2.465	0.036
GDP_GR	-0.040	-2.408	0.039
GDP_GR(-1)	-0.026	-2.561	0.031
GDP_GR(-2)	-0.022	-2.127	0.062
HEALTH_EXP_GR	0.0003	1.484	0.172
HEALTH_EXP_GR(-1)	0.0007	3.167	0.011
TRANSFER(-2)	0.0012	0.910	0.386
ECT(-1)	-0.0005	-2.683	0.025
Adj R^2	0.99		
F-stat.	9847.7		
Prob. F-stat.	0.000		
DW stat.	2.27		

Source: E-views output.

Results of Post-Estimation Tests

The test statistics for the various robustness tests of residuals show that the estimates obtained are reliable as the LM test suggests there is no serial correlation problem since the probability values for both the F-statistics and NR^2 are greater than 0.05. This implies that the null hypothesis of no serial correlation should be accepted at the 5 percent level of significance, except for model 3. Also, the heteroscedasticity test confirms that the models have constant variance since the null hypothesis of no heteroscedasticity is accepted at the 5 percent level of significance. This suggests that there exists a homoscedastic variance for each of the models. The implication is that each model has a minimum variance for reliability of estimates. Again, the normality tests, and then, the correlellogram tests could not reject the null hypotheses of normality and stable models respectively. The stability of the specified model is further reinforced with the stability tests depicted in Figures 6a – 8b. The specified models are stable as their estimates lie between the upper and lower confidence intervals at 5 percent level. This is the case for both the CUSUM and CUSUM squared of the stability tests.

Table 10: Residual robustness tests

Test Statistic			Model 1	Model 2	Model 3
Breusch-Godfrey Serial	F-stat.		0.525	0.921	10.397
Correlation LM Test			(0.613)	(0.418)	(0.011)
	NR^2		3.260	2.684	20.178
			(0.196)	(0.261)	(0.000)
Heteroscedasticity Test	F-stat.		0.798	0.129	1.760
			(0.664)	(0.995)	(0.210)
	NR^2		14.270	1.241	20.515
			(0.505)	(0.990)	(0.249)
Normality Test	Jarcque-bera		0.833	7.096	0.597
			(0.659)	(0.029)	(0.742)
Correllelogram Test	Q^2-stat.	Lag 1	2.089	0.306	0.521
			(0.148)	(0.580)	(0.470)
		Lag 2	3.660	0.905	4.902
			(0.160)	(0.636)	(0.086)

Source: E-views outputs.

Stability tests

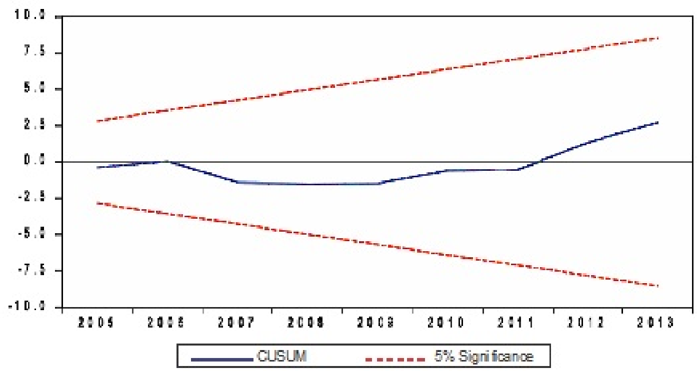

Figure 6a: Stability Test for Model 1.

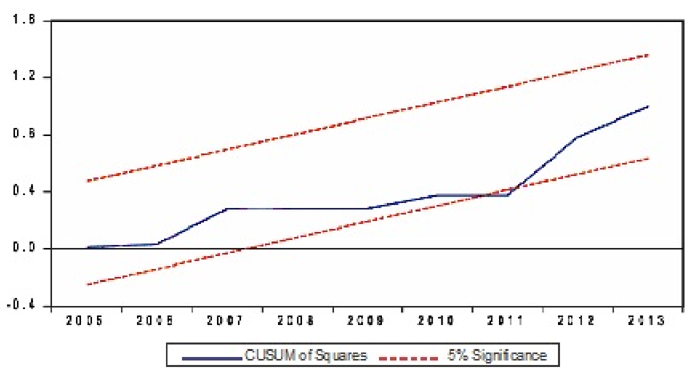

Figure 6b: Stability Test for Model 1.

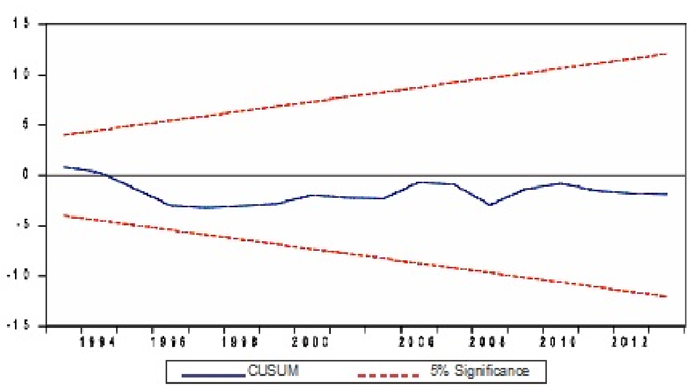

Figure 7a: Stability Test for Model 2.

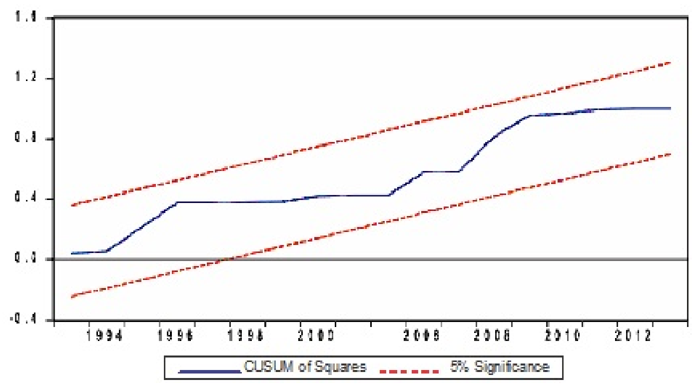

Figure 7b: Stability Test for Model 2.

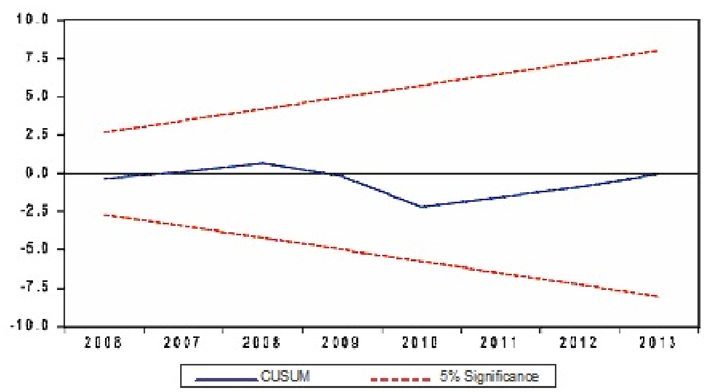

Figure 8a: Stability Test for Model 3.

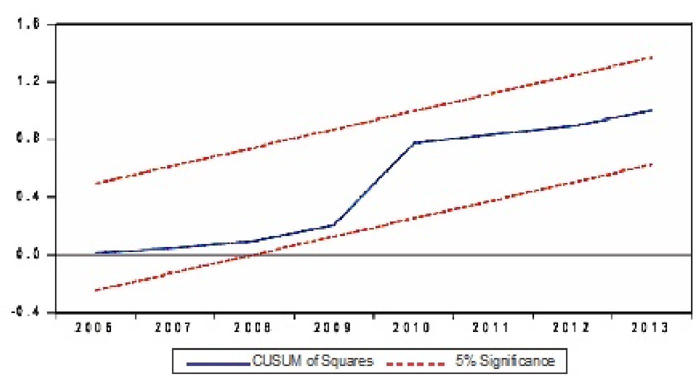

Figure 8b: Stability Test for Model 3.

Conclusion and Recommendation

Given the results obtained from the empirical investigations, it is evident that long-run equilibrium conditions hold between income inequality and health indicators such as life expectancy, public health expenditure and infant mortality. For the long-run impact analysis, however, results show that income inequality matters for health when the quantitative measure of public health expenditure is used but does not matter when both life expectancy and infant mortality are used. The Granger causality test indicates a uni-directional causality where the direction of causality flows from income inequality to health in Nigeria. Results obtained in the study strongly suggest that the drivers of income inequality in Nigeria are non-health factors such as aggregate investment, transfer payment and the growth process of the Nigerian economy. Again, the results show that the effect of income inequality on health largely depends on the indicators as well as the measures of health. Given the conclusion reached from the estimates obtained, the following recommendations are proffered as policy suggestions:

- Given the fact that income inequality is majorly driven by non-health factors, government should provide sound macroeconomic policies that would stimulate the growth process.
- Investments should be encouraged, both domestically and internationally, through the dismantling of unnecessary foreign barriers.
- Transfer payments should be properly directed in order to ensure that those that are genuinely in need of the benefits are those that are provided for. This can be done through the consistent provision of social safety nets for intended beneficiaries within the Nigerian populace.
- Policies that improve income earnings and public health across social demographics should be properly adopted and implemented within Nigeria.
- Most crucially, government should increase its spending on maternal and infant health. Key areas such as immunization and sensitization must be more inclusive of the most vulnerable low income distribution group.

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