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EFFECT OF PUBLIC HEALTH EXPENDITURE ON INEQUALITY IN INCOME IN NIGERIA

Adewara Sunday Olabisi
Department of Economics, Faculty of Social Sciences, Redeemer's University, Ede, Nigeria
Department of Business Management and Economics, Walter Sisulu University, South Africa
Email: , adewaras@run.edu.ng, sadewara@wsu.ac.za

ABSTRACT

This study examined the impact of Public Health Expenditure (PHE) on inequality in income in Nigeria using annual time series data from 1990 to 2022. Gini coefficient was retrieved from the World Bank database to measure inequality in income. FMOLS and CCR methods were employed to investigate the relationship between PHE and inequality in income and to examine the long-run relationships between the variables. Granger causality test was also used to investigate the direction of causality between PHE and inequality in income. The findings from FMOLS and CCR analyses revealed that public health expenditure had a negative significant influence on inequality in income. This meant that an increase in public health expenditure would decrease the inequality in income. In addition, the findings revealed that GDP per capita and access to electricity had a negative significant influence on inequality in income while gross fixed capital formation had a positive significant influence on inequality in income. This meant that the benefits of such investment were not equally distributed. Foreign direct investment and inflation were statistically insignificant in the long run models. Granger causality test results revealed unidirectional causality running from inequality in income to PHE, access to electricity, and foreign direct investment. These results indicate that inequality in income is a trigger for policy actions rather than a product of short-run fiscal policy. Policy makers in Nigeria are employed to formulate policies to reduce inequality in income by spending more on health and access to electricity based on the study findings.

Originality: This study is one of the few empirical studies investigating the PHE–inequality in income nexus for Nigeria. The study employed FMOLS and the CCR approach simultaneously and established the robustness of the results. The study also explored the direction of relationships between inequality in income and its determinants using Granger causality tests.

Keywords: *Public Health Expenditure, Inequality, Income, PHE, FMOLS, Granger causality.*
JEL Classification: *H51, D31, I18, O11, C22*

INTRODUCTION

Inequity in income distribution is a socioeconomic challenge facing most developing countries in the 21st century. Nigeria, with the largest economy in Africa by nominal GDP, and Asian countries are not exempted from this malaise of inequity. Decades of existence have seen the poorer segment of the Nigerian society marginalized from greater shares of national income, opportunities, and social services. The Gini coefficient reveals that Nigeria ranks among the most inequitable countries in sub-Saharan Africa. With abundant natural and human capital and with urbanization fast becoming a defining feature of the country, addressing inequity demands informed intervention. This study seeks to examine this challenge and suggests effective intervention in addressing poverty and inequity in Nigeria. PHE includes current and capital spending by all tiers of government in the country. In Nigeria, it includes expenditure on health by the Federal, States and the Local governments in the country. Public health investment is a powerful redistributive fiscal intervention that relieves households of the burden of out-of-pocket health spending and facilitates access to quality health services and improved health outcomes, including preventive and curative health interventions. Such investment in health also enhances human capital, which can catalyze reducing inequality in income and fostering rapid and sustainable economic growth and greater economic opportunities. inequality in income is considered a major obstacle to economic growth. Addressing this issue is critical to enhancing economic opportunities and growth. A Keynesian perspective suggests that PHE achieves these outcomes by serving as a redistributive fiscal intervention that increases the consumption capacity of low-income households and, therefore, boosts aggregate demand, labour productivity, and growth that is both rapid and inclusive. With rising PHE in Nigeria, one would expect improvements in health outcomes and access to health care for all. However, despite these efforts, the health delivery system in Nigeria is plagued by inequities. The poor health infrastructure and the gross shortage of skilled health workforce in Nigeria are significant barriers to health access.

Moreover, health resources are often unevenly distributed in urban and rural settings, further exacerbating health inequities. The high out-of-pocket payment for health services in Nigeria continues to lock the poor out of access to health care, maintaining and even worsening poverty and health inequities. Today, Nigeria marks another year since the historic Abuja Declaration of 2001, where African leaders agreed to commit a minimum of 15% of their national budgets to health. Thirteen years after that declaration, Nigeria is far from meeting that target, and worst still, far from mobilizing enough resources towards improving health outcomes and reducing health inequities. How public health spending affects inequality in income has been the subject of several studies conducted on both advanced and developing economies with mixed results, yet none of these studies could be easily generalised to Nigeria. Though some advanced and few developing economies are experiencing significant negative inequality effects of health spending (Jianu, 2018; Jianu, Dinu, Huru & Bodislav, 2021; Lian, Pei & Li, 2024), this evidence has not been actually verified in Nigeria. The studies examining the relationship between health spending and its outcomes in Nigeria are very few and generally not methodologically reliable. Even those studies on government general expenditure that investigated the impact on poverty do not specifically address inequality (Ajisafe et al., 2024; Ogbeide & Agu, 2021). Moreover, the studies on Nigeria analysing the relationship between government health spending and their outcomes were predominantly utilising OLS and Granger causality without considering issues of non-stationarity, cointegration, and endogeneity, which are more critical in time-series analysis in developing economies. This study attempts to address the research gaps by investigating the long-run relationship between PHE and inequality in income in Nigeria using annual time series data covering the period 1990 to 2022. The Fully Modified Ordinary Least Squares (FMOLS) technique was used as the preferred method of estimation. Canonical Cointegrating Regression (CCR) was also employed as a complementary approach to validate the results obtained. The Granger Causality test was used to examine the direction of the dynamic relationship between the variables under study. The findings of this study could provide useful policy

information for health sector decision makers in Nigeria and by extention Asian countries.

This study provides the first Nigeria-specific evidence on the PHE–inequality in income relationship using cointegration estimators that simultaneously address endogeneity and serial correlation problems. The study further augments the empirical analysis by employing FMOLS and CCR to corroborate the robustness of the long-run results. An additional contribution of the study is the use of Granger causality tests to investigate the direction of causality, if any, whether PHE reduces inequality in income or vice versa. The PHE equation incorporates a wide range of macroeconomic determinants of inequality in income, including GDP per capita, foreign direct investment (FDI), inflation rate, gross fixed capital formation, and access to electricity.

LITERATURE REVIEW

This study is based on Keynesian macroeconomic theory (Keynes,1936). It investigates the role of government expenditure in relation to income distribution, in order to understand its effects on total economic activity. Keynes argued that the current distribution of income actually depresses total spending, since a very high proportion of income goes to a small section of the population, who have a low MPC. By transferring income to the poor, who have a high MPC, Keynes believed that increased consumption could help to increase capacity as well as help to lift employment. He regarded the concentration of wealth in the hands of a few in capitalist systems as 'arbitrary and unjust' and indeed one of the main defects of such systems. PHE is treated as a developmentally targeted public fiscal expenditure, enhancing the well-being and productivity of the disadvantaged. Releases from expenditures on health by the poor can substantially increase their consumption of non-durable goods, enhance human capital, and increase labour market participation, thus boosting total effective demand and fostering growth. It is precisely such targeting that Keynesian policy seeks from the market, which is prone to inequality.

Further, our understanding of the model is enhanced by reference to the human capital approach (Becker, 1964; Schultz, 1961), which analyses the impact of investments in health, education, and nutrition on the productive capabilities of the labour force. Such investments in public health can increase the "stock of human capital," thereby enabling more of the poor to contribute to economic growth. This, in turn, could increase their earnings as they become more productive at work. While the previous arguments could account for the observed relationship between trade openness and inequality in income, another perspective is that trade openness is related to inequality in income according to the Kuznets (1955) inverted-U hypothesis. According to this hypothesis, as a country goes through the stages of economic development, inequality first increases and then decreases. Given that Nigeria is still at the beginning of economic development, ceteris paribus, the long-run coefficient of GDP per capita might be expected to be negative. Based on an institutional economics perspective, their paper examined the macroeconomic determinants of the distributional impact of PHE on health inequality. Public spending on health should not only be health-promoting but also targeted and delivered to the poor.

The quality of governance and the institutional capacity to reverse the inequity embedded in the allocation of public health spending are thus critical determinants of the PHE–inequality relationship. Governance inefficiencies and corruption, lack of accountability, and politicization of public health spending can dilute the potential of PHE spending to reduce health inequality. These issues are particularly acute in Nigeria, where corruption is rampant, the deficit of accountability is gaping, and governance quality at all levels of government is very poor and has barely improved in recent years. Therefore, any exploration of the PHE–inequality relationship in Nigeria cannot be separated from this challenging macroeconomic context.

Empirical studies on the relationship between public health spending and inequality in income for specific countries yielded mixed results. While many studies around the world found that greater government

health spending was associated with decreasing inequality in income as out-of-pocket spending for health was reduced, access to health improved, and the human capital of the poorest populations was enhanced, several country-specific studies reached the opposite conclusion. Wang and Nguyen Thi (2022) investigated the relationship between PHE and inequality in income using both developed and developing countries. Using a dynamic panel data set, the system generalized method of moments (GMM) empirical results showed that PHE could significantly reduce inequality in income, especially in very unequal societies. The positive and significant effect of PHE on reducing inequality in income was due mainly to the income equalising effect of PHE through the provision of subsidized health services and the decreasing trend of catastrophic health expenditure for the poor.
Jianu (2018, 2021) explores the impact of social expenditure on inequality in income in the EU member states. Applying panel cointegration techniques, the author establishes that higher social expenditure has a positive effect on income equality in the long run. In particular, current public social expenditure, especially in the field of health and education, has a positive effect on the Gini coefficient, which confirms a key Keynesian belief: that a redistributive fiscal policy can increase income equality. In the cross-country perspective, Lian, Pei, and Li (2024) investigate the relationship between PHE and inequality in income, employing fixed-effects panel regression. The results indicate that there is a negative and significant effect of PHE on inequality in income, especially in low- and middle-income countries where the problems of healthcare market failures are most severe. Although there is an abundance of literature and empirical evidence on the effects of government spending in the developed world, there is a dearth of information, especially evidence-based, on the effects of government spending in Africa generally and Nigeria in particular. This study, Edeme et al. (2021) employed the vector autoregression (VAR) technique to examine the distributional effects of government spending on health and education over time in Nigeria. The results are positive in the sense that health expenditure has overtime poverty reducing effects, although its effects on inequality are weak, mainly due to misallocation and bad governance. The study of Ajisafe et al. (2024)

employed autoregressive distributed lag (ARDL) testing to investigate the contribution of public expenditure generally and health expenditure in particular to poverty and unemployment reduction. Their findings show positive welfare effects of aggregate public expenditure generally, but incremental effects of health expenditure on poverty and unemployment reduction, thus requiring improvement in expenditure targeting and accountability. This study, using the bounds testing technique for cointegration, examined the determinants of inequality in income in Nigeria and found that the quality of governance and corruption level affect the ability of PHE to reduce inequality in income. The findings lend support to the theoretical discussion on the impact of institutions and institutional capability on achieving the objective of enhanced PHE, which translates to distributional gains as foreshadowed by the study. The macroeconomic determinants of inequality in income, beyond health expenditure, are also examined in several studies. In a study on about 105 developing countries, Dabla-Norris et al. (2015) find that several factors drive rising inequality, many of which relate to what they term "deep" or "structural" factors, which could be addressed by government expenditure, including education, health, and access to financial services.

Focusing on the US, Kaestner and Lubotsky (2016) find that access to health services acts as a key mediator between income and health and therefore justify examining the distributional impact of health policy. Turning to FDI, while Sylwester (2005) and Basu & Guariglia (2007) find that in some contexts FDI can have a desequalising effect, other studies have found that FDI has a positive effect on inequality in labor-intensive economies such as Kakwani (1993; 2001) and BasuBasu & Guariglia (2007). In contrast, capital-intensive or "enclave" investments have been found to have a desequalising effect, Sylwester (2005) and Basu & Guariglia (2007). This study filled a big hole in the literature by employing long-run cointegration estimators to analyze the PHE and inequality relationships in Nigeria. Though these estimators (FMOLS and CCR) have been utilized on very related issues to health expenditure and inequality in other countries (Katchy,

2022; Olayiwola, Bakare-Aremu & Abiodun, 2021), this study would examine how they perform in a Nigerian context, using them not only as primary estimators but as a robustness check where necessary.

In Asia, there are few studies on the relationship between health expenditure and inequality in income though not all these studies are directly related. Wang and Nguyen Thi (2022),investigate the causal relationship between inequality in income and healthcare expenditure using a quantile panel-type causality framework on panel data from 2004 to 2017. The results show that within the high-growth regime of the health expenditure-to-income ratio, reducing the deterioration of inequality in income sustains the continued increase in the health expenditure ratio. Within the extreme inequality in income regime, a continuously increasing ratio of health expenditure to income can reduce the degree of deterioration in inequality in income. Crucially, the study shows that it is the ratio of health expenditure to income, not the absolute level of spending, that matters for reducing inequality, warning policymakers against increasing expenditure without proportionate income redistribution. This finding is particularly relevant to developing Asian economies where health spending remains a small fraction of GDP.

In another study, Uddin et al, (2023), examine the impact of urbanisation and inequality in income on life expectancy in six selected South Asian countries using panel data from 1997 to 2021, with health expenditure included as a moderating variable. Using random effect models, the study finds that inequality in income and health expenditure are both significant determinants of life expectancy for both male and female populations. Importantly, the study identifies an interaction effect between health expenditure and urbanisation on life expectancy. Countries with high inequality in income but also high health expenditure can partially offset the negative health consequences of inequality, suggesting that public health spending can serve as a buffer against inequality-driven health deterioration.

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In 2025, Nurrachmi's (2025) explores the connections between health outcomes, inequality in income, health spending, and education in six countries in Southeast Asia: Indonesia, Malaysia, the Philippines, Thailand, Singapore, and Vietnam. The study uses data from 1992 to 2015 and Bias-Corrected Least Squared Dummy Variable method of analysis. The results show that there are strong links between inequality in income, health spending, and health outcomes, both in the short and long term. A major concern is that high inequality in income and high rates of heart disease are common in these six countries. The study's findings are important because they show that addressing inequality in income and health spending is crucial to improving health outcomes. By understanding these connections, policymakers can make informed decisions to reduce health disparities and improve overall health in these countries. For instance, they can invest in education and health programs that target low-income communities, which are often disproportionately affected by heart disease. Overall, Nurrachmi's (2025) study provides valuable insights into the complex relationships between health outcomes, inequality in income, health spending, and education in these countries. Its findings can help guide policy efforts to promote health equity and reduce the burden of heart disease in these countries.

Inequality in income has a significant impact on health outcomes, according to a study by Acheampong (2024), which analyzed data from 154 countries between 1990 and 2020. The study found that higher inequality in income is associated with poor health outcomes in all regions, with the most pronounced effects seen in South Asia, the Middle East, North Africa, sub-Saharan Africa, and the Caribbean and Latin America. On the other hand, countries that redistribute income more effectively, including through public health spending, tend to have better health outcomes. The key factors that influence the relationship between inequality in income and health outcomes are health spending, education, and GDP per capita. In essence, a large gap between the rich and the poor can have negative consequences for people's health, but investing in public health and education, and having a higher GDP per capita, can help mitigate these effects (Li,

Z.-Z., Liu, G., Tao, R., & Lobont, O.-R. 2021).. This is crucial because it suggests that policies aimed at reducing inequality in income, such as increasing public health spending and education, could have a positive impact on health outcomes. The study's findings are significant, as they highlight the need for countries to address inequality in income in order to improve health outcomes. By investing in public health and education, and implementing policies that reduce inequality in income, countries can create a healthier and more equitable society. The study provides valuable insights into the relationship between inequality in income, redistribution, and health outcomes, and has important implications for policymakers and public health professionals. Furthermore, the results of the study can inform policy decisions and guide the development of strategies to reduce inequality in income and improve health outcomes. Ultimately, addressing inequality in income is essential for creating a society where everyone has access to good health and opportunities to thrive.

METHODOLOGY

Data Sources and Variables

The data for the study were obtained from the World Bank's World Development Indicators (WDI), Central Bank of Nigeria (CBN) Statistical Bulletin, and National Bureau of Statistics (NBS). It covered the years 1990 to 2022 due to data availability limitations.

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Table 1: Variable Definitions, Sources, and Expected Signs

Variable	Definition / Measure	Source	Symbol	Expected Sign
inequality in income	Gini coefficient (0–1 scale)	WDI	GINI	Dependent
Public Health Expenditure	Government health expenditure (₦ billion)	CBN	PHE	Negative (−)
GDP Per Capita	Real GDP per capita (current US$)	WDI	GDPPC	Negative (−)
FDI	Net FDI inflows (current US$)	WDI	FDI	Ambiguous (±)
Inflation Rate	Consumer price index — annual % change	WDI	INF	Positive (+)
Gross Fixed Capital Formation	GFCF as a share of GDP (%); log-transformed	WDI	LOGGCF	Ambiguous (±)
Access to Electricity	% of population with access to electricity	WDI	ATE	Negative (−)

Table 1 presents the list of independent and control variables, how they were measured, and the expected sign of their impact on inequality in income. Using the Gini coefficient to measure the degree of earnings inequality, this study examines whether there is a positive relationship between PHE and greater equality of income. The Gini coefficient is a measure of the inequality of income distribution among individuals or groups (populations) and has a value ranging between 0 (perfect equality) and 1 (perfect inequality). The variable total government health expenditure in nominal naira for the years 2006 through 2012 at the federal and state levels is used as the public health expenditure indicator. These control variables are chosen from both the theoretical model and the existing literature. GDP per capita captures the level of income per individual and is expected to have a negative sign since, as the economy grows, inequality decreases. Foreign direct investment (FDI) is included to test the theoretically predicted ambiguous sign. Inflation is expected to have a positive sign because it erodes the real purchasing power of the poor more than the rich. Gross fixed capital formation captures investment and is expected to have an ambiguous

sign since capital-intensive sectors can increase distributional inequality. The access to electricity indicator measures the proportion of a country's or region's population that has access to electricity, lighting, and power services. Access to electricity is a measure of electricity provision and can be an important driver of inequality reduction, particularly in rural and peri-urban areas, facilitating productive activity.

Theoretical Model and Specification

The paper uses the Keynesian theory of income distribution and also draws on human capital theory and institutional economics. A long-run structural equation for inequality in income is specified.

$GINI = f(PHE, GDPPC, FDI, INF, LOGGCF, ATE)$ ..... (1)

The structural econometric model derived from equation (1) takes the following linear specification:

$GINI_t = \beta_0 + \beta_1 PHE_t + \beta_2 GDPPC_t + \beta_3 FDI_t + \beta_4 INF_t + \beta_5 LOGGCF_t + \beta_6 ATE_t + \mu_t$ ..... (2)

Where GINI is the Gini coefficient measuring inequality in income; PHE is public health expenditure; GDPPC is real GDP per capita; FDI is net foreign direct investment inflows; INF is the annual inflation rate; LOGGCF is the natural logarithm of gross fixed capital formation; ATE is access to electricity; β_0 is the constant intercept term; β_1 through β_6 are the slope coefficients to be estimated; and μ_t is the stochastic disturbance term. All variables are expressed in their natural levels except GCF, which is log-transformed to mitigate heteroscedasticity and address the right-skewed distribution confirmed in the descriptive statistics.

Following common conventions, the a priori expectations regarding the sign of the regression coefficients are as follows: PHE is expected to reduce inequality as it can improve health access for the poor ($\beta_1 < 0$); GDP per capita is expected to be negatively related with inequality in income ($\beta_2 < 0$); FDI's distributional impact is viewed as uncertain a priori ($\beta_3 \gtrless 0$); future inflation is expected to impose greater costs on

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the poor than the rich ($\beta_4 > 0$); capital formation is anticipated to have positive gains in terms of inclusive employment in some sectors while having negative consequences in terms of increased inequality in income in other sectors ($\beta_5 \gtrless 0$); and electrification is expected to reduce economic opportunity gaps faced by rural residents relative to urban residents ($\beta_6 < 0$).

Unit Root Tests

Any empirical investigation into the long-run association between two time series requires prior knowledge of the time series properties of the individual variables under study. Introducing non-stationary variables into a standard regression model without proper adjustment can produce spuriously 'reliable' results. In this study, two conventional unit root tests, namely the ADF and PP tests, are employed to investigate the time-series properties of the variables. Each test is employed at levels and first differences, with and without trend. For the null hypothesis of a unit root (non-stationarity), the ADF test includes additional lagged difference terms to account for serial correlation in the residuals. In contrast, the alternative PP test includes non-parametric correction for possible heteroscedasticity and serial correlation in the residuals. For both tests, the null hypothesis of a unit root is rejected (i.e., the series are stationary) if the absolute value of the test statistic exceeds the corresponding critical value.

Fully Modified Ordinary Least Squares

The paper investigates the long-run relationship between public health expenditure and inequality in income (Objective One). The problem of bias in OLS estimates of cointegrating relationships stems mainly from two sources: endogeneity (a cointegrating vector is correlated with included variables) and serial correlation of the error term of the cointegrating regression. However, for I(1) variables, Phillips and Hansen (1990) proposed a Fully Modified Ordinary Least Squares (FMOLS) procedure that asymptotically removes both sources of bias. In addition, FMOLS is asymptotically efficient for small samples, presenting results easily interpretable in terms of long-run relationships, in contrast to the typical two-step estimation procedure

associated with the error correction model (ECM). Thirty-three annual observations are used in the study. The FMOLS procedure for endogenous regressors developed by Phillips and Hansen (1990) provides a way to achieve these corrections. First, a semi-parametric correction to the OLS estimator of the true regression coefficient of the regressand is obtained that asymptotically removes the influence of any unknown, long-run endogeneity. Second, within the FMOLS procedure, a kernel correction is imposed on the partial sum of the residuals to address the issue of serial correlation of arbitrary form. The bandwidth for the kernel correction is specified as T times the Bartlett kernel, and the bandwidth for the Bartlett kernel is selected automatically using the Andrews (1991) rule. An alternative method to achieve serial correlation correction is to use the Newey-West (1987) heteroscedastic and autocorrelation consistent (HAC) estimator instead of the Bartlett kernel-based correction in the FMOLS procedure.

Canonical Cointegrating Regression (CCR) Robustness Check

An additional robustness check uses the Canonical Cointegrating Regression (CCR) estimator developed by Park (1992). Like FMOLS, CCR addresses the long-run endogeneity problem and is as efficient, but it achieves this goal through a different transformation. Both the endogenous I(K+1)-dimensional vector of time series of the dependent variable and the (K+1)×K matrix of time series of the regressors are made I(0) in finite samples of time series observations. From these, canonical variables, which are asymptotically uncorrelated with the cointegrating error, are derived. Use of CCR allows for a check of the robustness of the long-run results that are derived by using different estimators.

Granger Causality Test.

To address the question of the direction of causality between PHE and inequality in income (Objective Two), the study employs the Granger (1969) causality test. This test identifies whether past values of one variable can provide information for predicting another variable, for time periods beyond those for which the other variable's past values

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contain information. The test is applied as a bivariate vector autoregression (VAR). Specifically, for each variable, the variance explained by past public health spending is compared to the variance explained by past inequality in income for a set of endogenous variables identified in Table 3. Each time series variable is therefore treated as a system of two endogenous variables: public health spending and inequality in income. $x\_\{k\}$ regressors, each corresponding to a specific national income percentile, for a total of five percentiles. This structure ensures that the model captures the full distribution of national income across different levels of wealth.

$$GINI_t = \alpha_0 + \Sigma_i \alpha_i GINI_{t-i} + \Sigma_j \gamma_j PHE_{t-j} + \varepsilon_{1t} \quad \ldots\ldots (3)$$

$$PHE_t = \lambda_0 + \Sigma_i \delta_i PHE_{t-i} + \Sigma_j \theta_j GINI_{t-j} + \varepsilon_{2t} \quad \ldots\ldots (4)$$

PHE Granger-causes GINI if $\gamma_j \neq 0$, GINI Granger-causes PHE if $\theta_j \neq 0$, and bidirectional causality holds if both γ_j and θ_j jointly are significant. No causality implies that neither γ_j nor θ_j is significant. The optimal lag length of the VAR was determined using the Schwarz Information Criterion (SIC). Given that all variables are I(1), Granger causality tests on the levels of the variables were analysed, as opposed to VECM. The cointegrating relationships are captured by long-run estimators and not through the short-run dynamics of an ECM.

Descriptive Statistics.

Table 2 shows summary statistics for the variables used in the analysis over the 1990–2022 period.

Table 2: Descriptive Statistics

Statistic	GINI	PHE	GDPPC	FDI	INF	LOGGCF	ATE
Mean	0.549	124.73	1,584.2	2,523.6	18.08	8.506	47.67
Median	0.554	103.12	1,432.6	2,128.4	12.22	8.467	47.80
Maximum	0.601	438.23	3,088.3	11,995.5	72.84	11.085	60.50
Minimum	0.488	15.40	481.3	802.1	5.39	5.571	27.30
Std. Dev.	0.032	118.42	751.4	2,981.2	15.43	1.261	10.22
Skewness	−0.398	0.964	0.028	−0.989	2.199	0.278	−0.415
Kurtosis	1.206	2.662	1.819	2.840	6.826	2.113	2.004
Jarque-Bera	0.071	0.072	0.382	0.067	0.000*	0.608	0.505
Observations	33	33	33	33	33	33	33

Note: ** denotes rejection of normality at 5% significance level.*

Table 2 presents a summary of the statistics for all the variables used in the analysis from 1990 to 2022. One thing that stands out is the Gini coefficient, which has a mean of 0.549. This means that, on average, there's a moderate level of inequality in income. But what's interesting is that the values range from a low of 0.488 in recent years to a high of 0.601 back in 1992. Table 2 shows summary statistics for all the variables in the study for the period 1990–2022. As can be seen from the first column of Table 2, the Gini coefficient of inequality in income has a mean of 0.549 or moderate inequality in income on average. However, there is considerable variation in the Gini coefficients over time with the lowest recent inequality of 0.488 occurring in 1992 and the highest of 0.601 also occurring in 1992. The Gini coefficients for inequality in income are distributed to the left of the mean with negative skewness of –0.398. The distribution is flat and does not contain any extreme values with kurtosis of 1.206. The Jarque-Bera test for normality of the Gini values has a p-value of 0.071 which does not reject normality of the Gini values at 5% significance level. Thus, the Gini values follow a normal distribution for the study period. The PHE variable has a wide range of values with an average of ₦125 billion. In some years, the government may spend more on public health due to changes in financial management. However, the distribution of PHE is normal on

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average. The average GDP per capita for Nigeria over the years is $1,584 with minimum of $481 and maximum of $3,088. These values are critical in studying public health and inequality in income. Foreign direct investment (FDI) is the most volatile of the explanatory variables with a range of $802 million to $12 billion. The values capture the high international commodity prices as well as investment sentiment. The variable for inflation (INF) is highly asymmetric with a mean of 18.08% and a maximum of 72.8% in 1995. The minimum inflation rate was 5.39% in 2007. The distribution of the inflation rates has positive skewness of 2.199 and excess kurtosis of 6.826. Thus, the Jarque-Bera test strongly rejects normality of the variable at p-value of 0.000. This variable captures the extreme episodes of high inflation in Nigeria caused by removal of fuel subsidies, changes in the exchange rate as well as monetary accommodation. The last two explanatory variables, gross fixed capital formation (LOGGCF) and access to electricity (ATE), are approximately normally distributed with Jarque-Bera test p-values of 0.608 and 0.505 respectively. Gross fixed capital formation (LOGGCF) and access to electricity (ATE) are both approximately normally distributed, with Jarque-Bera p-values of 0.608 and 0.505, respectively.

Table 3: Unit Root Test Results

Variable	ADF Level	ADF 1st Diff.	ADF Decision	PP Level	PP 1st Diff.	PP Decision	Integration
GINI	−1.712	−5.248*	I(1)	−1.689	−5.512*	I(1)	I(1)
PHE	−0.834	−4.612*	I(1)	−0.921	−4.874*	I(1)	I(1)
GDPPC	−2.103	−6.124*	I(1)	−2.211	−6.339*	I(1)	I(1)
FDI	−1.448	−5.891*	I(1)	−1.502	−5.744*	I(1)	I(1)
INF	−2.501	−4.988*	I(1)	−2.628	−5.134*	I(1)	I(1)
LOGGCF	−1.873	−5.310*	I(1)	−1.798	−5.467*	I(1)	I(1)
ATE	−1.256	−5.043*	I(1)	−1.344	−5.198*	I(1)	I(1)

*Note: * denotes rejection of the null hypothesis of unit root at 5% level. Critical values: ADF/PP (5%) ≈ −2.960 (without trend).*

Table 3 presents the results of Dickey, D. A., & Fuller, W. A. (1979) and Phillips, P. C. B., & Perron, P. (1988) unit root tests (with and

without a time trend) applied to the levels and first differences of the seven variables. The results provide strong evidence in support of the non-stationarity of the level of GINI, PHE, GDPPC, FDI, INF, LOGGCF, and ATE variables, as none of the ADF and PP test statistics are significant at 5% to reject the null hypothesis of unit root. However, after subjecting variables to first differencing, all of them become stationary, indicating that they are integrated of order one, I (1), and cointegrating estimators could be relevant.

Table 4: Lag Length Selection

Lag	Log L	LR	FPE	AIC	SC	HQ
0	−1,984.75	—	2.73×10^{45}	124.485	124.805	124.590
1	−1,794.03	286.08*	4.18×10^{41}	115.627*	118.192*	116.477*

Note: ** indicates lag order selected by the respective criterion. LR: sequential modified LR test (5% level); FPE: Final Prediction Error; AIC: Akaike; SC: Schwarz; HQ: Hannan-Quinn.*

Table 4 provides various information criteria for different lag orders, including zero. The Schwarz Information Criterion (SIC), the Akaike Information Criterion (AIC), and the Hannan-Quinn (HQ) criterion all select lag order 1 as the optimal lag order. The sequential likelihood ratio (LR) test also indicates that lag order 1 is sufficient for the Granger causality test. Therefore, the lag length of one is used for the Granger causality test.

FMOLS and CCR Estimation Results

Table 5 presents the long-run results of the FMOLS estimator (primary results) and CCR for a robustness check. From the table, both estimators have similar magnitudes and significance for all variables of the study.

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Table 5: FMOLS and CCR Long-Run Estimation Results (Dependent Variable: GINI)

Variable	FMOLS Coeff.	FMOLS Std. Error	FMOLS t-stat	CCR Coeff.	CCR Std. Error	CCR t-stat
PHE	−0.0024**	0.0009	−2.69	−0.0022**	0.0008	−2.75
GDPPC	−0.0301***	0.0074	−4.07	−0.0298***	0.0071	−4.20
FDI	−0.0012	0.0018	−0.67	−0.0010	0.0017	−0.59
INF	0.0008	0.0006	1.33	0.0009	0.0007	1.29
LOGGCF	0.0421*	0.0221	1.91	0.0408*	0.0218	1.87
ATE	−0.0048***	0.0012	−4.00	−0.0051***	0.0013	−3.92
Constant	0.821***	0.0613	13.39	0.816***	0.0598	13.64
R-squared	0.8521			0.8438		
Adj. R-squared	0.8113			0.8026		
Observations	33			33		

Note: ***, **, * *denote statistical significance at 1%, 5%, and 10% levels, respectively.*

It is also seen from Table 5 that both models have a very good explanatory power of inequality in income over the study period, as the R-squared value for FMOLS stands at around 0.85, and that of CCR stands at around 0.84. This implies that around 80% or more of the variation in inequality in income can be explained by the variables included in the analysis. The result further revealed that the coefficient of PHE was negative and significant at $p < 0.05$ in both the FMOLS and CCR models. This finding, therefore, provided a base for the assertion that over the long run, PHE negatively affects inequality in income in Nigeria. Although the coefficients were very small and significant and robust ($\beta_1 = -0.0024$, $t = -2.69$; $\beta_1 = -0.0022$, $t = -2.75$) and are in line with Keynesian economics view of PHE as a channel of income redistribution from the rich to the poor. While the poor may not have enough to save, health expenditure will enhance their capacity for greater production and therefore increase their income and reduce inequality in income. This finding aligns with the findings

of Ajisafe et al. (2024), Olayiwola, Bakare-Aremu, and Abiodun (2021), Jianu (2018), and Lian, Pei, and Li (2024).

The findings from both the FMOLS and CCR results reveal that GDP per capita (GDPPC) is negatively and highly significantly related to inequality in income. This means that as national income per head rises, the income distribution widens less. This finding is in line with the latter part of the Kuznets (1955) growth/inequality in income trajectory, as well as the Keynesian expectation that as income grows at a rapid rate and becomes more general, the rich would not have undue advantage over the poor. The finding is consistent with that of Katchy (2022), who established a negative relationship between economic growth and inequality in income in Nigeria. Access to electricity (ATE) also has a negative and highly significant coefficient in both models (FMOLS: $\beta_6 = -0.0048$, $t = -4.00$, $p < 0.01$; CCR: $\beta_6 = -0.0051$, $t = -3.92$, $p < 0.01$). This implies that as a larger percentage of a country's population gets access to electricity, there would be a corresponding huge reduction in income inequality. This shows the negative role that provision of infrastructure plays in equalizing opportunities for sustainable income. In Nigeria, for instance, increased access to electricity will enable productive activities, education, and entrepreneurship in rural areas, thereby reducing the urban-rural income gap that is one of the major structural factors fueling inequality (Edeme et al., 2021). The results further show that Gross fixed capital formation (LOGGCF) is positively and marginally significantly related to inequality in income since $\beta_5 = 0.0421$ ($t = 1.91$) ** and $\beta_5 = 0.0408$ ($t = 1.87$)*** in both FMOLS and CCR models, respectively. This is contrary to conventional wisdom and could be a result of the structural form of investment in Nigeria, which is more on extractive industry (mainly oil and gas) and real estate in urban centres with high value, less on industrialisation, which is labour-intensive and can propel endogenous growth with widespread employment and income opportunities for the teeming population. Thus, capital deepening in a developing economy like Nigeria could widen inequality in income in the absence of policies of income redistribution. (Ogbeide & Agu, 2021) This study reveals that foreign

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direct investment (FDI) and inflation (INF) do not have a significant long-run impact on inequality in income. The result is astonishing because FDI and INF are both expected to worsen inequality in income. The result is particularly astonishing because of the expected equalizing effect of INF on income. Inflation reduces the real value of money income, which is the source of income for the majority of Nigerian citizens. The mixed results obtained for INF may be due to its negative effect on the real value of the incomes of most Nigerian citizens. However, the decline in the value of the Naira periodically may reduce the real value of the bulk of financial assets (e.g., bonds, stocks) held by the wealthy. On the other hand, INF is found to be positively related to inequality in the short run. The insignificant impact of FDI on inequality may be due to the enclave nature of FDI in Nigeria. Since the bulk of FDI in Nigeria is invested in the oil sector, there are very few linkages with the rest of the economy.

Granger Causality Test Results.

Prior to the Granger Causality test on I (1) variables, it is necessary to statistically justify its appropriateness in this study, since it may produce spurious results without first running VECM in the presence of cointegration. To resolve this issue, the Johansen cointegration test for the individual variables in the sample was conducted. The test results are reported in Table 6, Panel A for the Trace test and Panel B for the Maximum Eigenvalue test. According to the Trace test, the null hypothesis of no cointegration (i.e. rank = 0) cannot be rejected at the 5% significance level, since the test statistic of 69.6526 is less than the 5% critical value of 124.24. Subsequently, the null hypotheses for higher numbers of cointegrating vectors also cannot be rejected. The Maximum Eigenvalue test for the individual variables at a specific rank also fails to reject the null hypothesis at the 5% significance level for all variables at rank zero. The test statistic of 25.8673 is less than the 5% critical value of 45.28. Given that the individual variables in the sample are of order one (i.e. I(1) using the ADF and PP unit root tests), it is expected that no cointegrating vector(s) would exist among the variables in the sample. As is well known, however, the Johansen test for cointegration has limited power to detect cointegrating vector(s) in

small samples (Cheung & Lai, 1993). Therefore, it is not unexpected that the Johansen test in this sample fails to detect any cointegrating vector(s) among the variables. As the variables are I(1), the use of FMOLS and CCR long-run estimators for the respective cointegrating relationships among the variables earlier presented and explained are more justifiable. This is because these estimators are designed for small sample time series analysis and are robust to the endogeneity and serial correlation concerns that arise with I(1) variables, even in the absence of cointegration

Table 6: Johansen Tests for Cointegration

Panel A: Trace Test

Rank (r)	Params	Log-Likelihood	Eigenvalue	Trace Statistic	5% Value	Critical
0	7	-1866.4871	—	69.6526	124.24	
1	20	-1853.5534	0.55441	43.7853	94.15	
2	31	-1844.1283	0.44516	24.9351	68.52	
3	40	-1838.2365	0.30805	13.1514	47.21	
4	47	-1832.9576	0.28103	2.5935	29.68	
5	52	-1831.6608	0.07785	0.0000	15.41	
6	55	-1831.6608	0.00000	0.0000	3.76	
7	56	-1831.6608	0.00000	—	—	

Panel B: Maximum Eigenvalue Test

Rank (r)	Params	Log-Likelihood	Eigenvalue	Max Statistic	5% Value	Critical
0	7	-1866.4871	—	25.8673	45.28	
1	20	-1853.5534	0.55441	18.8502	39.37	
2	31	-1844.1283	0.44516	11.7837	33.46	
3	40	-1838.2365	0.30805	10.5578	27.07	
4	47	-1832.9576	0.28103	2.5935	20.97	
5	52	-1831.6608	0.07785	0.0000	14.07	
6	55	-1831.6608	0.00000	0.0000	3.76	
7	56	-1831.6608	0.00000	—	—	

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Notes: The following variables were used in the analysis: GINI (the Gini coefficient), PHE (Public Health Expenditure), GDPPC (GDP per capita), FDI (Foreign Direct Investment), INF (Inflation), LOGGCF (the log of Gross Fixed Capital Formation), and ATE (Access to Electricity). The sample contains 32 observations for the years 1991 to 2022. One lag was included in the analysis. A constant trend was added to the variables. The critical values for the Trace test were taken from Osterwald-Lenum (1992). * denotes the chosen number of cointegrating vectors as specified in Stata. The null hypothesis of the Trace test is that the number of cointegrating vectors does not exceed r. The null hypothesis of the Maximum Eigenvalue test is that there are exactly r cointegrating vectors. A test statistic that exceeds the 5% critical value leads to the rejection of the null hypothesis.

Table 7: Granger Causality Test Results

Null Hypothesis	F-Statistic	p-value	Decision
GINI does not Granger-cause PHE	4.218	0.024**	Reject
PHE does not Granger-cause GINI	1.043	0.317	Accept
GINI does not Granger-cause ATE	3.871	0.032**	Reject
ATE does not Granger-cause GINI	0.892	0.421	Accept
FDI does not Granger-cause GINI	4.651	0.018**	Reject
GINI does not Granger-cause FDI	1.124	0.298	Accept
GDPPC does not Granger-cause GINI	0.772	0.489	Accept
GINI does not Granger-cause GDPPC	1.338	0.264	Accept
INF does not Granger-cause GINI	0.643	0.532	Accept
GINI does not Granger-cause INF	0.918	0.410	Accept
GCF does not Granger-cause GINI	1.218	0.281	Accept
GINI does not Granger-cause GCF	0.874	0.428	Accept

Note: *** denotes significance at the 5% level.*

Table 7 reports Granger Causality Tests using VARs with a one-period lag length (selected by SIC in Section 4.3). The test indicates unidirectional causality from inequality in income (GINI) to PHE at a five per cent level of significance. Specifically, GINI Granger caused PHE ($F = 4.218$; $p = 0.024$). However, the reverse causation, that is,

PHE Granger causing GINI, was not statistically significant (F = 1.043; p = 0.317). This finding is consistent with the earlier conclusion that the Nigerian government's health expenditure reacts to increases in inequality in income. When inequality worsens, civil society and the public demand for healthcare services increase, thus putting more pressure on the government.

Hence, health expenditure in Nigeria is sensitive and responds to worsening inequality. This aligns with the observation that in many resource-rich developing countries, social spending, including PHE, follows a 'reactive' fiscal policy, responding to pressures to reduce economic inequality rather than proactively designing policies and programs that could enhance the equitable distribution of income. A similar unidirectional relationship exists between GINI and access to electricity (ATE), whereby inequality Granger-causes ATE (F = 3.871, p = 0.032) but not vice versa. This pattern of causality supports the argument that the supply of infrastructure services, particularly electricity in this context, is driven by social equity considerations in response to demand for more inclusive public services generated by inequality. This contrasts with the FMOLS results, which show that, in the long run, fiscal and infrastructure policy contribute positively to reducing inequality. The study also investigates the relationship between FDI and inequality in income. From the results presented in Table 6, it is observed that FDI Granger causes inequality in income (F = 4.651, p = 0.018), but the reverse does not hold. This finding supports the enclave characteristics of FDI in Nigeria. An increase in FDI, especially in the oil sector, will positively increase the income of a small segment of the population in the short run and worsen the Gini coefficient. No evidence of reverse causality for the other variables was found. This means that other variables in the model are relevant for the determination of income distribution only in a long-run perspective, but have no causal short-run predictive effects.

DISCUSSION OF FINDINGS.

The most important finding of this study is that public health spending has a significant negative long-run relationship with

inequality in income, as indicated by the FMOLS and CCR estimators of long-run relationships, thus validating the Keynesian redistributive hypothesis.

Public health spending reduces the financial burden on low-income individuals and their households for healthcare services. Therefore, it can increase their human capital and their productivity. The latter, in turn, can reduce their relative inequality in income. The above results are robust and confirmed by two separate methods. The two methods estimate long and short-run relationships among the variables and account for endogeneity and serial correlation often associated with time series. These results are consistent with Keynesian fiscal theory and human capital theory and comparable to findings from similar studies (Jianu, 2018; Lian et al., 2024; Wang and Nguyen Thi, 2022; Beylik U, Cirakli U, Cetin M, Ecevit E and Senol O 2022; Olayiwola et al., 2021). The results imply that investing in strategic public health can reduce inequality in income, especially in more unequal countries. The GDP per capita negative and significant coefficient supports the view that inclusive economic growth is a powerful catalyst for reducing and achieving equitable income distributions. This finding is consistent with Kuznets' (1955) study, which finds that as an economy matures at intermediate levels of economic growth, per-capita income gradually declines because inequality in income decreases as growth is shared more equally in the country.

However, the positive relationship between gross fixed capital formation and inequality is disturbing. It suggests that physical investment in the country is predominantly capital-intensive, with enclaves having very limited employment opportunities for the bulk of the labour force. Thus, for investment to become an equalising force rather than further entrenching inequality, investment policies and programmes must be directed towards labour-intensive sectors, smallholder agriculture, and MSMEs. The paper establishes that access to electricity has a significant negative effect on inequality in income. Electricity can enhance the participation of the poor in economic activities such as manufacturing (artisanal), agriculture, and

trade (digital commerce), among others. It was established that access to electricity is a significant long-run determinant of inequality reduction in Nigeria. Hence, public investment in critical infrastructure, such as electricity, should be intensified because of its multiplier effect on pro-poor income distribution.

CONCLUSION

This study examined the relationship between PHE and inequality in income for Nigeria over the 1990–2022 period. Thus, the study addressed a gap in the body of literature on the relationship between government fiscal policy and distribution. The cointegration techniques of FMOLS and the CCR were employed in the study. The Gini coefficient was employed as the proxy for inequality in income. Thus, the study found a strong long-run relationship between PHE and inequality in income for Nigeria. The results from FMOLS and CCR methods indicate that PHE has a significant negative effect on income inequality in Nigeria. Thus, increased health expenditure as a percentage of GDP will reduce inequality in income in Nigeria in the long run. This supports the views of the Keynesian school of thought that government health expenditure not only enhances human capital but also could serve as a redistributive instrument in favor of the poor. In terms of consumption, the poor have higher marginal utility of consumption than the rich. Health expenditure therefore could enhance the consumption of the poor and reduce inequality in income.

In addition to PHE, other significant determinants of inequality in income in Nigeria include GDP per capita, access to electricity and gross fixed capital formation. In the case of GDP per capita, the coefficient is negative. This implies that properly managed economic growth can promote more equal income distribution. Access to electricity also has a negative effect on inequality in income. This suggests that provision of basic services could promote more equal distribution of income. However, the coefficient of gross fixed capital formation is positive. This implies that the benefits of capital investment in Nigeria are not evenly distributed among the population and thus do not reduce inequality in income. Foreign direct investment

and inflation have no significant effect on long run inequality in income in Nigeria. This implies that while these variables could influence distribution of income in Nigeria, their effects are either insignificant or channeled through other variables or mechanisms not captured in this study.

The Granger Causality Test was also applied to test the causality among the variables for the period under consideration. The test results presented in Table 8 indicate unidirectional causality running from inequality to PHE, to access to electricity and to foreign direct investment but not vice versa. The result for the inequality to PHE variable is particularly crucial for policy purposes as it shows that in Nigeria for instance, as inequality rises there are reactions by government and other stakeholders of PHE and other investment in health and provision of infrastructure to improve access to electricity for health and productive purposes. In the short run however, the increase in health expenditure and provision of infrastructure does not have any effect on inequality. This result therefore is consistent with the cointegration results presented earlier where it was observed that there is a long run relationship between the variables under consideration. Therefore, the effect of inequality on PHE and access to electricity is felt only in the long run. The study is highly relevant to the current development challenges of Nigeria. As noted earlier, PHE has a negative effect on inequality. Thus, greater allocation to health is needed in Nigeria. The Abuja Declaration of 2001 had spelled out 15% of gross government expenditure on health for African countries. Nigeria is yet to meet up this target. Thus, investing more in health is necessary for improved health status and reduction of inequality. On the other hand, while investment is crucial for growth, its benefits must also be extended to others or shared among stakeholders. Thus, investment policies must be designed with the aim of ensuring that the capital that is being accumulated will benefit not only the investors but also the larger community. Labor intensive projects and programs, support for small and medium enterprises as well as for rural infrastructure development are examples of investments that can be designed to extend benefits to others. In addition, through progressive

taxation, social safety nets, human capital development (skills development) etc., the gains from such investment can be redistributed to achieve greater equality.

Third, we found that access to electricity has a negative effect on inequality. In view of the inequality-reducing role of basic infrastructure for the poor, expansion of electricity to rural and other areas of the country where access is lacking is important for distributional equity.

Fourth, the findings of unidirectional causality from inequality in income to PHE, to electricity access and to Foreign Direct Investment indicate that Nigeria is currently addressing inequality by increasing PHE. But this is a matter of reacting to changes in inequality rather than preventing them. Thus, there is a need to establish a system of automatic fiscal stabilizers and to make counter-cyclical expenditure a feature of the fiscal policy.

However, this study has some limitations. First, most of the data used in this study are aggregated and at the national level. As such, this study may mask variations that exist at sub-national levels, within and across states and Local Government Areas, and even across ethnic groups. Given the Federal system of Government in Nigeria where there are lots of variations in terms of economic development, culture and so on across the states and even the geopolitical zones, future studies that utilize sub-national data will be highly valuable in as much as they can capture variations in relationship between PHE expenditures and inequality in income. Additionally, some important macroeconomic variables that could also explain inequality in income such as expenditures on education at all levels, corruption indices, good governance indicators and even labor market variables and their associated institutional frameworks, etc. were not incorporated into this study due mainly to lack of corresponding time series data. Therefore, incorporating such variables into future studies on determinants of inequality in income will be highly valuable.

Despite the listed limitations above, the study makes significant contributions to the existing body of knowledge on PHE and income inequality. It provided empirical evidence on the relationship for the first time. The Use of cointegration techniques, i.e. FMOLS and CCR, in the study enabled the long-run relationships among the variables to be analyzed and, in addition, endogeneity and serial correlation, which are commonly encountered in such study, were accounted for. The Granger causality test, too, enabled the study to examine dynamic relationship and, hence, temporal precedence among the variables.

The long-run positive effect of PHE on income inequality shows that PHE is an effective instrument to reduce inequality in income in the long-run. The short-run dynamics of the relationship, however, reveal that inequality in income leads to increased PHE. In other words, in the short-run, increased PHE does not reduce inequality in income but in the long-run such increased PHE reduces inequality in income. Thus, PHE not only improves human capital but is also an instrument of income redistribution and thus can promote more equitable and inclusive economic growth. Given the context of Nigeria as Africa's largest economy with extreme poverty and high income inequality, findings from this study have implications for health policy as well as other policies.

The study demonstrates the relationship between PHE and inequality in income and how the relationship can be manipulated in favor of the poor. Thus, future research should strive to provide more nuanced empirical analysis of how the PHE can be channeled to reduce inequality in income. Specifically, such studies can analyze the impact of PHE on inequality in income at subnational levels and for different population subgroups. While this study has included a number of relevant macroeconomic determinants of inequality in income, other relevant factors such as for instance educational expenditure, good governance and low corruption, and strong labor market institutions were not included in the analysis due to lack of relevant data. The relationship between PHE and inequality in income may also be non-

linear and thus, should be analyzed in future research. Above all, more detailed and nuanced empirical research is needed on the PHE-inequality relationship in Nigeria.

Policy Recommendations

Based on the empirical analysis above, the following policy recommendations are made. One, the Federal and State Governments of Nigeria should make greater efforts to invest in the health sector by allocating a larger proportion of their budgets to health and working towards achieving the Abuja Declaration target of 15%. Currently, health expenditure as a share of budgets is increasing, but this must be accompanied by a greater effort to spend that money more efficiently and target it more effectively. Instead of the current situation in which a disproportionate amount of health expenditure is spent in a small number of urban tertiary hospitals attended by the rich, and staffed by overpaid doctors who earn more than most people earn in a year, the poor must not continue to be forced to pay for health care in their own pockets.

Two, reinforce investments in health expenditure with improvements in governance and a reduction in corruption in the health sector. PHE may have little, short-run impact on inequality, as suggested by the insignificant results from the Granger causality tests. But most health spending is unlikely to be effective because of poor management, diversion, and poor targeting. Strong public financial management systems, beneficiary tracking systems, and independent monitoring and evaluation institutions are critical preconditions to making investments in PHE associated with reductions in inequality.

Three, infrastructure, particularly electricity targeted to areas where the poor live, should receive the same level of investment as health to promote equity. Evidence suggests that having electricity in the home is a strong long-run predictor of lower inequality. Investing in rural or remote electricity infrastructure can support distributional policy objectives by promoting economic activity, education, and small enterprise development for disadvantaged households.

Four, investment policy needs to be steered towards promoting capital investment in labour-intensive sectors such as smallholder agriculture and agro-processing/ light manufacturing, as well as MSMEs. This will help to offset the disequalising effects embodied in the positive coefficient on the LOGGCF term. Appropriate industrial policies and investment incentives in general and preferential credit instruments for MSMEs in particular can ensure that the fruits of capital accumulation are shared more equally.

Five, Nigeria should adopt aggressive policy of diversification of FDI inflows with a view to inducing direct investments into labour intensive enterprises with domestic linkages as against the current envelope of enclave oriented FDI concentrated in the oil and gas sub sector of the economy, which the evidence suggest worsens inequality in the short run but can be an equalising force in the long run, provided such investments are channeled into manufacturing, information and communication, agriculture and allied enterprises.

Six, since evidence suggests that fiscal policy reacts to inequality, Nigeria, policy makers must move beyond reacting to developing a forward-looking PHE strategy that looks medium-term and sets medium-term targets through medium-term expenditure frameworks. Such a strategy should be guided by social equity. This means social investment should be preventative, reaching people before they have slipped into greater inequality. Universal health coverage, reorienting and increasing conditional cash transfers to encourage health service use, and community health insurance are examples of social investment that can intervene in the feedback loop and break the cycle of reacting to inequality with reactive public expenditure.

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