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Fiscal Policy Measures, Income Inequality and Health Outcomes of Countries in SSA

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Abstract: This study estimates the interactive effect of fiscal policy and government health expenditure on income inequality and health outcomes in Sub-Saharan Africa (SSA) countries. The study covers the period 2010–2022 using panel data on 12 countries. Estimation is done using the System GMM estimation technique. Findings from the estimated model shows that an interaction of fiscal policy and government health expenditure exerts a negative and significant effect on under-five mortality (MORT). On the other hand, the interaction of fiscal policy and government health expenditure leads to a reduction in life expectancy (LFX), but not significantly. Finally, the interaction of fiscal policy and government health expenditure leads to a negative effect on income inequality (INQ). Based on the findings, the study recommended that given that the interaction of both components of fiscal policy – income tax and government expenditure on health – and government health expenditure yields better outcomes on health and inequality (howbeit insignificant in the case of inequality), fiscal policy makers must ensure that there is no mis-match in the revenue and spending components of fiscal policy, and become more deliberate in channeling income tax to health spending

Keywords: fiscal policy; income inequality; health outcome; GMM; SSA

JEL Classification: I28; E62; H51

1. Introduction

Taxation and spending policies are vital fiscal policy measures which are capable of altering income distribution directly or indirectly, over the short and medium term, with consequence on the health of the income earners (Lustig, 2017; IMF, 2014). The direct influence of fiscal policy is through the level of taxation and its

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progressivity. Progressive tax policy makes the distribution of after-tax incomes presumably more equal than the pre-tax distribution. The indirect influence of tax policy is through the different types of tax expenditures which subsidize some classes of private spending (such as health, and education expenditures). Over time, these tax expenditures are likely to have substantial impact on the distribution of income, which may influence the health conditions of the people through affordability of improve medical facilities (Afonso, Schuknecht & Tanzi, 2008).

With respect to government expenditure, the direct impact on income distribution is through public expenditures that inject income or spending power in the hands of individuals, through cash payment or direct support for spending that is important for poorer individuals (such as education and health allowances, free child care for working mothers, subsidized medical services at public health care institutions, etc.). The payment of unemployment benefits and the provision of opportunities for employment, can directly influence the volume of disposable income accruing to the individuals, which can help close the income inequality gap, and also foster the development of individuals' health status (IMF, 2014). Besides, public spending can have indirect but still significant effects on income distribution and health status. Government expenditure on job training or retraining can enhance the development of required knowledge, necessary in assisting the poor in moving from the unemployed group to the employed group. Spending on education can benefit the poor disproportionately if it improves the income potentials of the poor and reduce the gap between the deprived and the wealthy. Also, an efficient public health care system increases the life expectancy and health status of the average citizen, which is expected to contribute to the earning potentials of the citizens and narrow the inequality gap (Afonso *et al.*, 2008).

In spite of the above potential impacts of fiscal measures (taxes and government expenditures) on income inequality and health outcomes, there have been arguments in previous empirical works concerning the differential impacts of fiscal policy measures on income inequality and health outcomes. Lustig and Higgins (2013), Claus et al., (2012) and Wolff and Zacharias (2007) noted that public spending is more effective in reducing inequality compared to taxes. In contrast, IMF (2014) noted that the income redistribution achieved through income taxes is higher than means-tested transfers. Over the years, Sub-Saharan Africa governments have largely employed expenditures (such as expenditures on education and health) and income taxes as policy instruments in narrowing the inequality gap and improving health outcomes.

More so, previous empirical works have been majorly concerned on the separate effect of public spending on income inequality on the one hand (see Aremo & Abiodun, 2020; Odusola, 2017; Jellema, Lustig, Haas & Wolf, 2016), and the effect of public spending on health outcomes on the other hand (see Novignon, Olakojo &

Nonvignon, 2012; Arthur, 2015; Boachie & Ramu, 2015; Ashiabi, Nketiah-Amponsah, & Senadza, 2016; Novignon & Lawanson, 2017, Sango-Coker & Bein, 2018; Weibo & Yimer, 2019). Studies on the influence of taxes on inequality in income and health outcomes in SSA region is very rare. Essentially, previous studies did not provide robust evidence on the possible differential impacts of fiscal policy measures (expenditures and taxes) on income inequality and health outcomes of countries in SSA area. Also, within the scope of differential impacts, this study uniquely confirms whether fiscal policy measures (expenditure and taxes) complement and substitute each other in influencing income inequality and health outcome of countries SSA. Thus, one of the critical issues facing the region is how to deploy fiscal policy measures to achieve a more equitable society and improve health indicators, without undermining fiscal sustainability (Estrada *et al.*, 2015; Heshmati, Kim & Park, 2014). Hence, this study seeks to examine the relationship among fiscal policy measures, income inequality and health outcomes of countries in Sub-Saharan African.

This study contained five sections. Section one focused on the introduction while the literature is contained in section two. Section three discussed the research methods adjusted, the analysis of the study and the interpretation of results is contained in section and section five concludes the research work with summary, conclusion and policy recommendation.

2. Literature Review

With respect to previous empirical works, Baldacci, Guin-Siu and de Mello (2002) examined the relationship between public spending on health care and education, and some social indicators. The study focused on a panel of 111 developing and transition countries over the period 1985 - 1998. The study utilized the ordinary least squares, two-stages least square and the weighted least squares estimation techniques. The results of the study showed that public spending on education is a significant determinant of social indicators. More so, the study observed that the millennium development goal of universal primary education enrollment by 2015 is achievable through an average increase in education spending by one-third.

Comparative analysis of public and private expenditure on health was equally considered by Guissan and Arranz (2003). The study analyzed the impact of public and private health expenditure on economic growth for 24 OECD countries over the period 1970 to 1996. Using the ordinary least square and white heteroskedastic techniques, the study observed the significant impact of health expenditure in promoting individual's welfare and health status. Focusing on a panel of 104 countries, David, David and Jaypee (2004) analyzed the relationship between health expenditure and economic growth for the period 1960–1990. Using non-linear two-

stage least squares estimates (2SLS), the study observed that health expenditure had positive and significant impact on economic growth.

Gani (2009) analyzed the impact of healthcare financing and health outcome in seven Pacific Island countries for the period 1990 to 2002. In the study healthcare financing was proxy by per capita public health expenditure while health outcome was proxy by infant mortality, under-five mortality and crude death rates. The study used the fixed-effects estimation technique, and the results of the study showed that healthcare financing had significant impact on health outcomes.

Ke, Saksena and Holly (2011) explored the trajectory of health expenditure in developing countries. The study focused on a panel of 143 countries over the period 1995 to 2008. The study used both standard fixed effects and dynamic models to understand the factors associated with the growth of total health expenditure as well as its main components namely, government health expenditure and out-of-pocket payments. The results of the study showed great variation across countries in the share of health expenditure as a percentage of GDP which ranged from less than 5% to 15%. In addition to income, the study observed several factors contributing to this variation, which ranged from demographic factors to health system characteristics. According to the study, the findings suggest that health expenditure in general does not grow faster than GDP after taking other factors into consideration. The study observed that income elasticity was between 0.75 and 0.95 in the fixed effect model, which was smaller than the results in the dynamic model. More so, the study found no difference in health expenditure between tax-based and insurance-based health financing mechanisms. The study also confirmed the existence of fungibility, where external aid for health reduces government health spending from domestic sources. The study also found that government health expenditure and out-of-pocket payments follow different paths and that the pace of health expenditure growth is different for countries at different levels of economic development.

Martinez-Vazquez, Moreno-Dodson and Vulovic (2012) examined the impact of taxation and expenditure policies on income distribution. The study covered 150 developed, developing and transition countries over the period 1970 to 2009. Using general method of moments (GMM) estimation techniques, the study showed that progressive personal income taxes and corporate income taxes contribute to reducing income inequality. For taxation, the study observed that customs duties, excise taxes and general consumption taxes had negative impact on income distribution. On the expenditure side, the study observed that greater percentage of GDP on social welfare, health, education and housing public expenditures contributed to increasing income distribution in the surveyed countries.

Dahlby and Ferede (2013) examined the relationship among income inequality, redistribution and economic growth in Canada. The study covered the period 1977-2006 and used multiple regression estimation techniques. The study reviewed

existing literature on income inequality and economic growth and the result of the study found insignificant relationship among income inequality, distribution and economic growth.

Kim and Lane (2013) analyzed the impact of government health expenditure on public health outcomes for a panel of 17 OECD countries over the period 1973 to 2000. The study proxy health outcomes by infant mortality rate and life expectancy at birth, and employed the mixed-effect estimation technique. The result of the study showed significant relationship between health expenditure and health outcomes. Specifically, the study found that government health expenditure had significant and negative impact on infant mortality rate, while government health expenditure had positive and significant impact on life expectancy at birth.

Olarinde and Bello (2014) examined the relationship between public health care expenditure and health sector performance in Nigeria with implication for sustainable economic development. The study covered the period 1970 to 2011 and utilized both the autoregressive distributed lag (ARDL) and VECM granger non-causality estimation techniques. The ARDL estimate showed that government healthcare expenditure had negative and significant impact on health sector performance proxy by infant mortality rate and under five mortality rate both in the long and short run. The VECM granger non-causality estimate showed the absence of causality between government healthcare expenditure and health sector performance.

Boachie and Ramu (2015) analyzed the impact of government health expenditure on health outcomes in Ghana for the period 1990 to 2002. The study used the ordinary least square estimation technique, and observed that government healthcare expenditure had negative impact on health outcomes in outcomes. Aye, Clance and Gupta (2018) analyzed the impact of monetary and fiscal policy on inequality conditioned on low and high uncertainty. The study employed quarterly data over the period 1980Q1 to 2008Q4. The study used various measures of income, labour earnings, consumption and total expenditure inequality as well as economic uncertainty. The study used the impulse responses estimation technique, and the findings of the study revealed that contractionary monetary and fiscal policies enhanced inequality. More so, the study observed that in the presence of relatively higher levels of uncertainty, the effectiveness of monetary and fiscal policies is weakened.

Rezapour *et al*. (2019) compared the impacts of different levels of health expenditure on health indicators for a panel of selected countries. The health indicators used in the study are life expectancy, infant mortality rate, and under-five mortality rate. The study covered the period 2000 to 2015, and panel generalized Least Squares (GLS) fixed effect estimation technique was applied. The result of the study showed that public health expenditure had a significant effect on health indicators in all groups.

Specifically, the study observed that increase in public health expenditure led to increase in life expectancy, and decline in infant and under-five mortality rate in all groups. Also, the study observed that the group with the highest share of health expenditure had a greater impact on life expectancy and infant mortality. However, in regards to the under-five mortality rate, it was contrary. With respect to private health expenditure, the study observed that the effect was different and in most cases it was insignificant.

2.1. Observed Gaps in Reviewed Studies

Within the scope of differential impacts of fiscal policy measures on income inequality and health outcomes, none of the previous studies examined the complementarity and/or substitutability impacts of fiscal policy measures (expenditures and taxes) on income inequality and health outcomes in Sub-Saharan Africa. More so, previous studies have only centered on the joint impact of public and private health expenditures on health outcomes (see Novignon, et al., 2012; Arthur, 2015; Ashiabi, et al., 2016; Novignon & Lawanson, 2017; Weibo & Yimer (2019), while the joint/interactive impact of public expenditure and taxes on income inequality and health outcomes have not been analyzed by previous studies on Sub-Saharan Africa. In the light of the above identified gaps in the literature, this study attempts to analyze the relationship among fiscal policy measures, income inequality and health outcomes in Sub-Saharan Africa.

3. Research Method

3.1. Model Specification

This research study is premised on the Grossman (1972) theory on health capital and Wagner (1883) theory on government expenditure. The Grossman (1972) theory on health capital is essentially concerned with the way and manner in which a person utilizes his/her resources in order to produce health. The Grossman (1972) theoretical proposition is based on the unconstrained utility maximization theory whereby an individual aim at maximizing his utility with a given set of resources. Grossman (1972) theory posits that as the individual aims at maximizing his health, he does so by investing in himself to produce the typical desired health status. Essentially, the theory largely elucidates the relationship between health care spending and health outcomes (Igbinedion & Olele, 2018).

The above theoretical exposition can be expressed as follows:

$$HO = f(Y, S, V) \tag{1}$$

Where HO is aggregate health outcome, Y is a vector of economic variables, S is a vector of social variables and V is a vector of environmental factors. According to Fayissa and Gutena (2008), the economic factors in the health production function include the total health care expenditure in a particular country (Novignon & Lawanson, 2017). More so, given the focus of this study, the economic input is expanded to include income taxes, social factor is denoted by population growth (POP), while environment factor is denoted by carbon dioxide emission (CO_2). Incorporating the above, equation (1) can be re-written as:

$$Y = f\ (\Psi GXH^{\beta 1} ICT^{\beta 2} POP^{\beta 3} C02^{\beta 4}) \quad (2)$$

Equation (2) shows the link between the dependent variable (health outcome) and the independent variables - economic factors (GXH and ICT), social factors (POP) and environmental factor ($C0_2$).

Introducing the control variable - health oriented official development assistant (HODA) - which has been identified by studies as significant determinant of health outcomes and income inequality (see Aremo & Abiodun, 2020; Novignon & Lawanson, 2017). Thus equation (2) becomes:

$$Y = f\left(\psi, GXH, ICT, POP, C02, HODA\right) \quad (3)$$

Expressing (3) in estimation form,

$$Y_{i,t} = \delta_0 + \delta_1 GXH_{i,t} + \delta_2 ICT_{i,t} + \delta_3 POP_{i,t} + \delta_4 CO2_{i,t} + \delta_5 HODA_{i,t} + \left(\phi_{i,t} + \varepsilon_{i,t}\right) \quad (4)$$

From equation (4), *Y* is the dependent variable representing health outcome (*HO*) and income inequality (*INQ*), *GXH* is government expenditure on health, *ICT* is income taxes, *POP* is population, CO_2 is carbon dioxide emission, and *HODA* is health oriented official development assistant, and $\left(\phi_{i,t} + \varepsilon_{i,t}\right)$ is the composed error term which combines the individual countries specific random effect, to control for all unobservable effects on the dependent variable that are unique to the individual countries and do not vary over time $\left(\phi_{i,t}\right)$, and an error that varies over both individual countries and time $\left(\varepsilon_{i,t}\right)$.

To overcome potential endogeneity problems and unobserved country-specific effects which characterize the panel data, this study used the dynamic Generalized Method of Moments (GMM) first developed by Holtz-Eakin, Newey and Rosen (1988). Thus, expressing equations (5) in dynamic form becomes:

$$Y_{i,t} = \delta_0 + \chi_1 Y_{i,t-1} + \delta_1 GXH_{i,t} + \delta_2 ICT_{i,t} + \delta_3 POP_{i,t} + \delta_4 CO2_{i,t} + \delta_5 HODA_{i,t} + (\phi_{i,t} + \varepsilon_{i,t}) \quad (5)$$

With respect to modeling the interactive impact of fiscal policy measures on income inequality and health outcomes, the model below is specified:

$$Y = f(\psi, GXH * ICT, POP, C02, HODA) \quad (6)$$

Expressing equations (6) in dynamic form becomes:

$$Y_{i,t} = \delta_0 + \chi_1 Y_{i,t-1} + \delta_1 GXH * ICT_{i,t} + \delta_2 POP_{i,t} + \delta_3 CO2_{i,t} + \delta_4 HODA_{i,t} + (\phi_{i,t} + \varepsilon_{i,t}) \quad (7)$$

3.2. Post Estimation Assessment

Serial Correlation Test

The GMM estimation technique tests for serial correlation using the Arellano-Bond test; these tests are the autocorrelation tests – AR (1) and AR (2) tests. The null hypothesis of the test states that there is no autocorrelation. Arellano and Bond (1991) also proposes a rejection of the AR (1) test so that the result of the GMM estimation remains valid.

The Sargan and Hansen Test

The Sagan and Hansen test is used to ascertain the validity of the instruments employed in the GMM estimation in terms of over-identification, and estimation process. The null hypothesis states that all instruments used are valid.

Robustness Check

To establish the robustness of the GMM estimation, the pooled OLS and fixed effects models were estimated. In Bond (2002), the estimated coefficient of the lagged dependent variable must fall within the values of the pooled OLS and the fixed effects model.

3.3. Theoretical Expectations

With respect to the estimating equation (7), it is theoretically expected that increase in carbon dioxide emission is expected to impair health outcomes and also expected to narrow income inequality in Sub-Saharan Africa. Increase in population growth ceteris-paribus is expected to reduce health outcomes and widens income inequality

gap. Increase in health-related official development assistance is expected to promote health outcomes and narrow the income inequality gap through improved health conditions of the workers. More so, the expected impact of the interactive term of government expenditure and income tax on health outcome and income inequality is determinate. Symbolically, it is expected that:

$$\frac{\delta Y}{\delta CO2} < 0; \frac{\delta Y}{\delta POP} < 0; \frac{\delta Y}{\delta HODA} > 0; \frac{\delta Y}{\delta GXH}\ indeterminate \quad (8)$$

3.4. Variables Measurement

Health outcomes (HO) is measured by under-five mortality rate and life expectancy at birth. Income inequality (INQ) is measured by Gini coefficient. The Gini coefficient ranges between zero (0) and one (1). Zero (0) indicates complete equality in the distribution of income and one (1) indicates complete unequal income distribution. Carbon dioxide emission (CO2) is measure by rate of carbon dioxide emission in each country. Population (POP) is measured by the growth rate of population of the selected countries in Sub-Saharan African countries. Health Oriented Official Development Assistance (HODA) is measured by the inflow of official foreign aids directed specifically to the health sector in Sub-Saharan Africa countries. Government expenditure on health (GXH) is measured by the ratio of budgeted expenditure to the health sector to the total government budget expenditure, and income tax (ICT) is measured by personal income tax.

3.5. Sources of Data

This study utilized secondary panel data across twelve (12) Sub-Saharan African countries. These countries are Botswana, Lesotho, Namibia, South Africa, Ethiopia, Kenya, Rwanda, Angola, Cameroun, Cote d'Ivoire, Ghana, and Nigeria. The study covered the period 2010 to 2022.

Data on health outcomes (HO), government expenditure on health (GXH), carbon dioxide emission (CO2), and population growth rate (POP), are obtained from the World Development Indicators (WDI), while data on income tax (ICT), and health oriented official development assistant (HODA) are sourced from the Organization of Economic Co-operation and Development (OECD) while data on income inequality (INQ) is sourced from Standardized World Income Inequality Database (SWIID).

4. Results

The joint/interactive effect of fiscal policy measures on income inequality and health outcomes in SSA was carried out by estimating three equations. The first equation is about the joint/interactive effect of fiscal policy measures on health outcomes, with under-five mortality as the first health outcome variable. The second equation is about joint/interactive effect of fiscal policy measures on life expectancy, which is the second health outcome variable. The third equation estimates the joint/interactive effect of fiscal policy measures on income inequality.

4.1. Joint/interactive effect of fiscal policy measures on health outcomes –under-five mortality – in SSA

Table 4.1a Result of the Joint/Interactive Effect of Fiscal Policy Measures on Under-Five Mortality in SSA

Dependent Variable: Under-five Mortality (MORT)

	Main Results		
	Two-Step System GMM		
	Coeff.	S.E.	t-value
Const.	-2.0569	3.4138	-0.60
L1.MORT	0.9234***	0.0336	27.49
LNICT	0.6829**	0.3035	2.25
LNGXH	-0.2113***	0.0797	2.65
POP	0.0227	0.0313	0.73
$LNCO_2$	-0.0016	0.0035	-0.46
LNHODA	0.0068**	0.0028	2.40
ICT*GHX	-0.0633***	0.0238	-2.66
AR (1) (p-value)	-3.43 (0.001)		
AR (2) (p-value)	-1.24 (0.215)		
Hansen test (p-value)	3.93 (0.415)		
Sargan test (p-value)	3.43 (0.488)		
No. of instruments	12		

*S.E = Standard Error; *, ** and *** imply significance at 10%, 5% and 1% respectively. Note: The variable ICT* GXH is fiscal policy interaction variable*
Source: Author's computation (2023)

Table 4.1b. Robustness Check Results

Dependent Variable: Under-five mortality (MORT)

	Pooled OLS model			Fixed Effect Model		
	Coeff.	S. E.	t-value	Coeff.	S. Error	t-value
Const.	0.4219***	0.1530	2.76	0.5905**	0.2623	2.25
L1.MORT	0.9764***	0.0054	179.42	0.9019***	0.0129	69.89
LNICT	-0.0897**	0.0424	-2.12	-0.0145	0.0624	-0.23
LNGXH	-0.0258*	0.0135	-1.90	-0.0015	0.0188	-0.08
POP	-0.0023	0.0022	-1.03	-0.0099	0.0086	-1.16
$LNCO_2$	0.0002	0.0011	0.16	-0.0170	0.0108	-1.57
LNHODA	-0.0035*	0.0019	-1.88	0.0037	0.0033	1.12
ICT*GHX	0.0069*	0.0038	1.80	0.0005	0.0055	0.09
R-Squared	0.99					
Adj. R^2	0.99			0.98		
F-Stat (Prob)	5570.87 (0.0000)			1736.13 (0.0000)		

S.E = Standard Error; *, ** and *** imply significance at 10%, 5% and 1% respectively.
Note: The variable ICT* GXH is fiscal policy interaction variable
Source: Author's computation (2023)

The estimated model in Table 4.1a shows that under-five mortality rate in the previous year, had a positive and significant effect (P<0.01) on present under-five mortality (just as it was obtained in the model without the interaction effect). An increase in previous year under-five mortality by 1 percent resulted in a further increase in present under-five mortality by 0.92 percent.

The result, like in the model without interaction effect, showed that income taxes (ICT) exerted a positive effect on under-five mortality, indicating that an increase in ICT increases under-five mortality. More specifically, an increase in ICT by 1 percent leads to an increase in under-five mortality rate by about 0.68 percent (a much bigger coefficient than in the model without interaction effect). This effect is statistically significant (P<0.01).

It is observed that government expenditure on health (GXH) is negatively related to under-five mortality rate (just like in the model without interaction effect). The result showed that for every 1 percent rise in GXH, under-five mortality rate declines by about 0.21 percent (a coefficient larger than the one for the model without interaction effect). This declining effect on under-five mortality of government expenditure on health is statistically significant (P<0.01).

Population growth rate (POP) is found to have an insignificant positive effect on under-five mortality rate (P>0.05), unlike the negative effect found in the model without interaction. The result shows that under-five mortality rate rises by 0.023

percent for every 1 percent rise in population growth rate. This is like a direct reversal of the same magnitude for the model without interaction.

Furthermore, the coefficient of carbon dioxide emission is found to have a negative and insignificant (P>0.05) effect on under-five mortality (against the negative effect of the model without interaction effect). The result indicated that a percentage increase in carbon dioxide emission leads to 0.002 percent decline in under-five mortality rate.

On the other hand, result showed that the coefficient of health-oriented development assistance (HODA) is positively and significantly related to under-five mortality rate (P<0.05), unlike the model without interaction when the effect was found to be negative. From the estimated result, it is found that for every 1 percent rise in HODA, under-five mortality rises by about 0.01 percent.

Finally, the result showed that income tax interacted with government health expenditure, made the effect of government health expenditure on under-five mortality negative. In essence, tax enhances the effect of government health expenditure on infant mortality, in line with the expected outcome. In the presence of income tax, for every percentage rise in government health expenditure, under-five mortality rate declined by 0.06 percent. This effect is statistically significant (P<0.01).

Post Estimation Assessment

Serial Correlation Test

The serial correlation test shows that the AR (1) test, which tests for the presence of serial correlation at first difference is statistically significant (P<0.01), it can be concluded that there is the presence of autocorrelation. Yet, after considering the probability value of the AR (2) test result (P>0.5), we accept the null hypothesis of no serial autocorrelation. Hence, the estimated GMM model is confirmed to be valid (see Table 4.1)

The Sargan and Hansen Test

Going by the probability value of the Sargan and Hansen tests statistics – 0.488 and 0.415 respectively – it can be concluded that the null hypothesis is not rejected, thus, the instruments used in estimation are valid.

Robustness Check

The robustness test is contained in Table 4.1b. The GMM estimation of the lagged under-five mortality rate shows that it lies between the values of the fixed effects estimates and pooled OLS, that is, 0.9019 <0.9234<0.9764

4.2. Joint/interactive Effect of Fiscal Policy Measures on Health Outcomes – Life Expectancy – in SSA

Table 4.2a. Result of the Joint/Interactive Effect of Fiscal Policy Measures on Life Expectancy in SSA

Dependent Variable: Life expectancy (LFX)

	Main Results		
	Two-Step System GMM		
	Coeff.	S.E.	t-value
Const.	-0.7982	4.6389	-0.17
L1.LFX	0.9437***	0.1575	5.99
LNICT	0.0844	1.2232	0.07
LNGXH	0.0439	0.4024	0.11
POP	-0.0277	0.0554	-0.50
$LNCO_2$	-0.0017	0.0117	-0.15
LNHODA	0.0612**	0.0265	2.31
ICT*GHX	-0.0084	0.1112	-0.08
AR (1) p-value	-1.53 (0.049)		
AR (2) p-value	0.04 (0.971)		
Hansen test (p-value)	0.19 (0.666)		
Sargan test (p-value)	0.03 (0.869)		
No. of instruments	9		

*S.E = Standard Error; *, ** and *** imply significance at 10%, 5% and 1% respectively. Note: The variable ICT* GXH is fiscal policy interaction variable*
Source: Author's computation (2023)

Table 4.2b. Robustness Check Results

Dependent Variable: Life expectancy (LFX)

	Pooled OLS model			Fixed Effect Model		
	Coeff.	S. E.	t-value	Coeff.	S. Error	t-value
Const.	0.1557***	0.0424	3.67	0.3395***	0.0578	5.88
L1.LFX	0.9553***	0.0054	175.69	0.9213***	0.0085	108.22
LNICT	0.0053	0.01607	0.49	0.0022	0.0145	0.15
LNGXH	0.0025	0.0034	0.74	-0.0005	0.0044	-0.11
POP	-0.0011*	0.0006	-1.89	0.0080	0.0020	4.06
$LNCO_2$	-0.0002	0.0003	-0.63	-0.0033	0.0023	-1.44
LNHODA	0.0002	0.0005	0.51	-0.0014*	0.0007	-1.86
ICT*GHX	-0.0002	0.0010	-0.19	0.0001	0.0013	0.07
R-Squared	0.99					

Adj. R^2	0.99			0.98		
F-stat	6073.70 (0.0000)			3398.59 (0.0000)		

*S.E = Standard Error; *, ** and *** imply significance at 10%, 5% and 1% respectively. Note: The variable ICT* GXH is fiscal policy interaction variable*
Source: Author's computation (2023)

From the result presented in Table 4.2a, it is observed that life expectancy in the previous year, has a positive and significant effect (P<0.01) on present life expectancy (just like in the model without interaction effect). An increase in previous year life expectancy by 1 percent resulted in a further increase in present life expectancy by 0.94 percent.

The estimated result further showed that income taxes (ICT) exerted a positive effect on life expectancy (against the negative effect found in the model without interaction effect), indicating that an increase in ICT increases life expectancy. More specifically, an increase in ICT by 1 percent led to an increase in life expectancy by about 0.08 percent. This effect is however not statistically significant (P>0.05).

Furthermore, government expenditure on health (GXH) was positively related to life expectancy, as observed in the previous estimation without interaction effect. The result showed that for every 1 percent rise in GXH, life expectancy rises by about 0.04 percent. Despite the fact that the coefficient is larger than the model without interaction effect, this rising effect on life expectancy of government expenditure is not statistically significant (P>0.05).

The effect of population growth rate (POP) on life expectancy is negative, like in the module without interaction, not significant (P>0.05), unlike the model without interaction. The result showed that that life expectancy falls by 0.03 percent for every 1 percent rise in population growth rate. This magnitude of change is similar to the one found in the more significant model.

In addition, and like in the model without interaction effect, the coefficient of carbon dioxide emission (CO_2) is found to be negative and insignificant (P>0.05). The result indicates that a percentage increase in carbon dioxide emission led to 0.002 percent fall in life expectancy.

On the other hand, the result shows that the coefficient of health-oriented development assistance (HODA), like in the model without interaction effect, is positively and significantly related to life expectancy (P<0.05). From the estimated result, it is found that for every 1 percent rise in HODA, life expectancy rises by about 0.06 percent. This magnitude of change is much larger than in the equation without interaction effect.

Finally, the result showed that income tax, interacted with government health expenditure, made the effect of government health expenditure on life expectancy

negative, just like in the interactive effect model for under-five mortality rate. By implication, income tax depresses the effect of government health expenditure on life expectancy; this is in line with the *a priori* expectation. In the presence of income tax, for every percentage rise in government health expenditure, life expectancy declined by 0.008 percent. This effect is however not statistically significant (P>0.05)

Post Estimation Assessment

Serial Correlation Test

Results of the estimation shows that the AR (1) test, which tests for the presence of serial correlation at first difference is statistically significant (P<0.05). Thus, it can be concluded that there is the presence of autocorrelation. Yet, judging from the probability value of the AR (2) test result (P>0.5), we accept the null hypothesis of no serial autocorrelation. Hence, the estimated GMM model is confirmed to be valid (see Table 4.2)

The Sargan and Hansen Test

The null hypothesis states that all instruments used are valid. Given that the probability value of the Sargan and Hansen tests statistics are 0.869 and 0.666 respectively, it can be concluded that the null hypothesis is not rejected, thus, the instruments used in estimation are valid.

Robustness Check

The robustness test is contained in Table 4.2b. The GMM estimation of the lagged under-five mortality rate shows that it lies between the values of the fixed effects and pooled OLS estimates, that is, 0.9213 <0.9437<0.9553.

4.3. Joint/interactive effect of fiscal policy measures on income inequality in SSA

Table 4.3a. Result of the Joint/Interactive Effect of Fiscal Policy Measures on Income Inequality in SSA

Dependent Variable: Income inequality (INQ)

	Main Results		
	Two-Step System GMM		
	Coeff.	S.E.	t-value
Const.	-1.6443	6.8412	-0.24
L1.INQ	-0.9101	0.4439	-2.05
LNICT	1.7159	2.0038	0.86
LNGXH	0.5059	0.6549	0.77
POP	-0.0197	0.0638	-0.31

$LNCO_2$	0.0065	0.0251	0.26
LNHODA	0.0456**	0.0192	2.37
ICT*GHX	-0.1631	0.0564	-2.89
AR (1) (p-value)	-2.11 (0.015)		
AR (2) p-value	-0.51 (0.608)		
Hansen test (p-value)	2.74 (0.602)		
Sargan test (p-value)	4.71 (0.345)		
R-Squared	12		

*S.E = Standard Error; *, ** and *** imply significance at 10%, 5% and 1% respectively. Note: The variable ICT* GXH is fiscal policy interaction variable*
Source: Author's computation (2023)

Table 4.3b. Robustness Check Results

Dependent Variable: Income inequality (INQ)

	Pooled OLS model			Fixed Effect Model		
	Coeff.	S. E.	t-value	Coeff.	S. Error	t-value
Const.	0.3210*	0.1759	1.82	1.8237***	0.2551	7.15
L1.INQ	0.9309***	0.0144	64.81	0.5317***	0.0310	17.14
LNICT	-0.0158	0.0456	-0.35	0.0896	0.0577	1.55
LNGXH	-0.0072	0.0146	-0.50	-0.0075	0.0175	-0.43
POP	-0.0006	0.0023	-0.24	0.0080	0.0080	1.00
$LNCO_2$	-0.0020	0.0012	-1.65	-0.0069	0.0069	-0.99
LNHODA	0.0115***	0.0024	4.86	0.0296***	0.0032	9.01
ICT*GHX	0.0011	0.0041	0.27	-0.0091*	0.0050	-1.81
R-Squared		0.96				
Adj. R^2		0.96		0.86		
F-stat		978.10 (0.0000)		249.99 (0.0000)		

*S.E = Standard Error; *, ** and *** imply significance at 10%, 5% and 1% respectively. Note: The variable ICT* GXH is fiscal policy interaction variable*
Source: Author's computation (2023)

The effect of the interaction of income tax and government expenditure on income inequality in Sub-Saharan Africa was estimated and presented in Table (4.3a). The estimated model showed that inequality in the previous year, has a negative, but not significant effect (P>0.05) on present inequality. While the signs are similar to the model without interaction effect, the level of significance is higher in the non-interactive model. From the result, an increase in previous year inequality by 1 percent resulted in a further decrease in present inequality by 0.91 percent.

The estimated result also showed that income taxes (ICT) exerted a positive effect on income inequality, unlike the model without interaction terms, whose effect was found to be negative. The result showed that an increase in ICT increases income inequality. More specifically, an increase in ICT by 1 percent leads to an increase in income inequality by about 1.7 percent. This effect is shown not to be statistically significant (P>0.05).

From the results we found further evidence that government expenditure on health (GXH), unlike the model without interaction effect, is positively related to income inequality. The result showed that for every 1 percent rise in GXH, income inequality increased by about 0.51 percent. This increasing effect on income inequality of government expenditure is not statistically significant (P>0.05).

Population growth rate (POP) is found to also exert an insignificant negative effect on income inequality (P>0.05). The result shows that income inequality falls by 0.02 percent for every 1 percent rise in population growth rate. This magnitude of effect is much smaller than in the model without interaction effect.

Additionally, the coefficient of carbon dioxide (CO_2) emission is found to be positive but not statistically significant (P>0.05), with a similar outcome with the model without interaction effect. This result implied that income inequality rises as carbon emission rises. The result specifically showed that a percentage increase in carbon dioxide emission led to 0.01 percent rise in income inequality.

Further, it is found in the estimated model that the coefficient of health-oriented development assistance (HODA) is positively related to income inequality, like the model without interaction effect. However, unlike the previous (no-interaction effect model), this exerted a significant effect on income inequality (P<0.05). From the estimated result, it is found that for every 1 percent rise in HODA, income inequality increased by about 0.05 percent.

Finally, the result from the interaction effect of income tax and government health expenditure showed that income tax, interacted with government health expenditure, made the effect of government health expenditure on inequality to be negative, just like in the interactive effect model for under-five mortality rate. Hence, income tax reduces the effect of government health expenditure on income inequality, in line with expectation. In the presence of income tax, for every percentage rise in government health expenditure, income inequality declined by 0.16 percent. This effect is not statistically significant (P>0.05).

Post Estimation Assessment

Serial Correlation Test

From the estimated result, the AR (1) test, shows statistical significance (P<0.05), meaning there is the presence of autocorrelation. However, since the probability value of the AR (2) test result (P>0.5), we accept the null hypothesis of no serial autocorrelation. Hence, the estimated GMM model is confirmed to be valid (see Table 4.3)

The Sargan and Hansen Test

The probability value of the Sargan and Hansen tests statistics are 0.345 and 0.608 respectively, therefore, it can be concluded that the null hypothesis is not rejected, hence, the instruments used in estimation are valid.

Robustness Check

The robustness check is contained in Table 4.3b. The GMM estimation of the lagged under-five mortality rate shows that it lies between the values of the fixed effects and pooled OLS estimates, that is, 0.5317 < -0.9101<0.9309

4.4. Discussion of Findings

The effect of income tax reduces under-five mortality rate when it is interacted with government health expenditure. What this means is that income tax that is channeled to government health expenditure reduces mortality in children under five years. This result is gratifying knowing that efforts to reduce under-five mortality rate in Africa through government expenditure on health is yielding positive result – that is, it is leading to a reduction in under-five mortality – especially that income tax directed at health expenditure yields favorable outcomes. This result is in agreement with the findings of Kim and Lane (2013). This is one of the major gaps in literature this study has filled, that income tax, interacted with government expenditure on health, exerts a downward pressure on under-five mortality, as against the studies by Novignon, et al (2012), Arthur (2015) and Ashiabi, et al (2016).

However, a careful observation of the result of the estimation of the interactive model for under-five mortality rate reveals that heath-oriented development assistance exerted a significant negative effect on under-five mortality rate. This may be explained on the account that when fiscal policy seems to be working – in this case, with an under-five mortality rate reducing effect of the interaction of income tax and government health expenditure – donors and receiving domestic agencies may become complacent and stop utilizing such funds in areas of its most productive use. The significant effect of health-oriented development assistance is in line with the studies of Aremo & Abiodun (2020) and Novignon & Lawanson (2017).

The result further shows that in the absence of policy on health, under-five mortality perpetuates itself. However, it takes effective fiscal policy (in the form of the interaction of income tax and government expenditure on health).

An interesting finding of the study is that the life expectancy reducing effect of population growth rate is less potent in the model with the interaction of income tax and government expenditure on health. By implication, the public health outcome of the growing population of SSA can be managed with effective public policy on health that involves channeling income tax to government health expenditure. A close examination of the results also indicates a positive and significant effect of the lag of life expectancy on itself. This goes to show that policies to enhance life expectancy experiences lags to be significantly positive.

Furthermore, it is instructive to note that health development assistance had a positive effect on life expectancy. Once again, this is a positive development for donors and development partners. This goes to show that the more the health-oriented development assistance, the better the life expectancy outcome of the citizen of SSA. While this may throw up the debate about continuous dependence on development aid, it will be pertinent to have a narrower view of such development, in this instance, health related. This study has shown that more specific development assistance yields better health outcomes.

Interestingly, both income tax, government health expenditure, and their interaction did not have any significant effect on life expectancy in the model with and without interaction effect. What this implies is that fiscal policy has very little capacity to influence life expectancy in SSA. Life expectancy is a function of a lot of other factors such as the state of the domestic economy, the environment of living, and general socio-economic factors (Sede & Ohemeng, 2015; Kabir, 2008). Perhaps, fiscal policy may become effective life expectancy through its effect on these other variables that determine life expectancy.

While the result obtained showed that the lag of income inequality has a significant negative effect on current inequality, in the estimated model, that effect became less effective, even though negative. This goes to show that policy may have been better at mitigating inequality from the previous experience of its effect. Although this phenomenon is not supported by any of the studies reviewed, it is supported by a 2022 report of the International Monetary Fund (IMF, 2022) where it was observed that inequality is declining faster in SSA than in any other emerging market region.

5. Summary and Policy Recommendations

This study estimated the joint/interactive effect of fiscal policy measures (ICT and GXH) on health outcomes (MORT and LXF), and income inequality (INQ). The result showed that the effect of government health expenditure reduced MORT when it is interacted with income tax. Furthermore, the interaction of ICT and GXH was not statistically significant on LFX; in fact, their joint effect reduced LXF. The result further showed that the interaction of ICT and GXH was not statistically significant on INQ; just like in the life expectancy model, their joint effect reduced INQ (which is a better outcome than the reduction of life expectancy). Based on these findings, the following recommendations are made:

Given that the interaction of both components of fiscal policy – income tax and government expenditure on health – yields better outcomes on health and inequality (howbeit insignificant in the case of inequality), fiscal policy makers must ensure that there is no mis-match in the revenue and spending components of fiscal policy, and become more deliberate in channeling income tax to health spending.

The study found that government health expenditure has a significant effect in reducing mortality rates, particularly when interacted with income tax. Therefore, policymakers should prioritize increasing government spending on healthcare to improve health outcomes and reduce mortality rates.

The study found that the joint effect of ICT and GXH was not statistically significant on life expectancy and reduced INQ. Therefore, policymakers should reconsider the implementation of policies that promote the use of technology in healthcare and explore other strategies to improve health outcomes.

Focus on income tax policies: The study found that income tax plays an important role in reducing mortality rates when interacted with government health expenditure. Therefore, policymakers should consider implementing policies that encourage higher levels of income tax to support increased government spending on healthcare.

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