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The Impact of Fiscal Policy on Income Inequality and Health Outcomes in Sub-Saharan Africa Countries

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Abstract: *This study estimates the relative effect of fiscal policy 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. It is shown that income tax (ICT) exerts a positive and significant effect on MORT. Government health expenditure (GXH) and population growth (POP) negatively but insignificantly influence MORT, while the effect of carbon emission (CO2) is positive, but not statistically significant. The effect of health-oriented development assistance (HODA) on MORT is negative and statistically significant. Additionally, government health expenditure (GXH) exerts a positive but insignificant effect on LFX. The effect of health-oriented development assistance (HODA) on LFX is also positive and statistically significant. Both income tax (ICT); the effect of POP is negative and significant. Finally, the study reveals that a one-period lag in income inequality (INQ) has a negative and significant effect on current INQ. In addition, government health expenditure (GXH), income tax (ICT), and population growth all exert a negative effect on INQ, with ICT being the most significant of all of them. The effect of health-oriented development assistance (HODA) and carbon emission (CO2) is found to be positive, but not statistically significant. Amongst others, the study recommends that countries across SSA formulate policies that will help in slowing down population growth to levels that are manageable and will not pose adverse health challenges in the region.*

Keywords: *Fiscal Policy; Income Inequality; Health Outcome; GMM; SSA.*

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Introduction

With the emergence of the Keynesian school of thought, fiscal policy has conventionally been considered a valuable instrument in influencing aggregate demand, promoting productive capacity, enhancing human development and the achievement of sustained growth with equity (Musgrave, 1959). The achievement of equitable income distribution and improved health outcomes of countries in Sub-Saharan African and in some emerging economies seem unattainable due to limited opportunities of the poor or less privileged in increasing their income and wealth level. These limited opportunities are reflected by a range of factors, such as lack of access to education (including early childhood and tertiary education), lack of access to certain professions or business opportunities and limited access to basic health care system (The Organization for Economic Cooperation and Development (OECD), 2011; Corak, 2013). The limited opportunities have contributed in increasing inequality gap between the deprived and the wealthy, particularly in less developed countries, and equally have made the achievement of meaningful health status by the poor very difficult.

To circumvent or perhaps address the adverse consequences of income inequality and poor health indices, fiscal policy measures have been identified as a vital redistributive macroeconomic policy that can aid the achievement of reduced income inequality and improve health status through instruments such as social spending and taxation policy (Lustig, 2017; Heshmati & Kim, 2014). Consequent to the above, the focus and debate on the relationship among fiscal policy, income inequality and health outcomes have gathered increasing attention in both less developed and advanced countries (Odusanya & Akinlo, 2021). In the advanced countries, studies have largely agreed that direct income taxes and transfers have decreased inequality by an average of one-third. This is believed to have positively improved health outcomes in the advanced countries (IMF, 2014). However, income inequality and health outcomes in Africa have been alarming which require urgent attention. The Arab spring crisis of 2010 - 2012 is a serious example of the adverse consequence of inequality in the African region. Since the Arab spring, the issue of inequality has attracted heightened attention as many African countries have taken caution through government fiscal reforms in spending and taxation geared at plummeting inequality and poverty in the continent, while at the same time addressing the issue of deplorable health conditions of the region. The entire African continent has experienced increased yearly fiscal budgets, but the level of income inequality has been high in comparison to other regions of the world (UNDP, 2017, Adesina, 2016), and the level of health indicators have been unimpressive.

In spite of the rising income inequality and poor health indicators in the face of fiscal policy reforms and increased yearly budgetary estimates, there exists limited empirical works on the relation between fiscal policy measures, income inequality and health outcomes in the African continent in general. Available literature has only focused on the developed and emerging economies (IMF, 2014; Claus et al., 2012; Bastagli et al., 2012; Afonso *et al.*, 2010; Barreix, Roca & Villela, 2007), while previous studies on SSA have largely concentrated on the connection between income inequality, reduction in poverty and economic growth (Nwosa & Ehinomen, 2020; Akanbi, 2016; Fosu, 2015; 2009; Oseni & Onakoya, 2012; Fanta & Upadhyay, 2009; Omitogun & Ayinla, 2007; Adams, 2003). Consequently, this research work aimed at investigating the relative impact of fiscal policy on income inequality and health outcomes of countries in Sub-Saharan African for the period 2010 to 2022. 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.

Literature Review

With respect to empirical literature Jha (1999) examined the relationship among fiscal policy, income distribution and growth in India and Taipei, China. The study covered the period 1953 – 1992 and employed the weighted two stages least squares method. The results of the study showed that fiscal channel is operative in linking initial income distribution to future income distribution and economic growth. The study noted that a rise in the median voter's share of national income for a given level of democracy reduces transfer payments. A reduction in transfer payments on average across countries enhances the rate of economic growth. However, a reduction in transfer payments worsens the future post-transfer distribution of income. Furthermore, the study noted that an inegalitarian initial income distribution boost future economic growth. The study also observed that for India and Taipei, China, increase in tax ratio hinders economic growth and enhance income distribution.

Nixon and Ulmann (2006) examined the relationship between health care expenditure and health outcomes for the former 15 members of the European Union over the period 1980–1995. Employing panel fixed effects estimation technique, the study observed that increases in health care expenditure contributed significantly to reduction in infant mortality but only marginally in relation to life expectancy.

Bokhart, Gai and Gottret (2007) analyzed the relationship between government health expenditure and health outcomes for a panel of 127 countries. Government health expenditure was proxy by per capita government health expenditure while the health outcomes are proxy by under-five and maternal mortality rates. The study utilized generalized moments of method estimation technique, and the result of the showed that health expenditure contributed significantly in reducing under-five and maternal mortality rates.

Afonso *et al.* (2008) examined the effect of public spending, education, and institutions on income distribution in advanced economies. Also, the study analyzed the efficiency of public spending in redistributing income in the advanced countries. The study used the Data Envelopment Analysis (DEA) nonparametric approach, and the result of the study showed that public policies had direct and significant impact on income distribution, notably through social spending, and indirectly through high quality education/human capital and sound economic institutions. Furthermore, the study noted that within the two-step approach applied, non-discretionary factors helped in explaining the inefficiencies of public social spending.

Yaqub, Oapinwa and Yussuff (2012) examined the role of governance in the relationship between public health expenditure and health outcomes (infant mortality, under-five mortality and life expectancy) in Nigeria. Using the ordinary least squares and two-stages least squares estimation techniques, the study observed that public health expenditure negatively impacted on infant and under five mortality rates when governance is accounted for in the model. The study suggests the need to reduce corruption, in order to achieve the Millennium Development Goal (MDG) of reducing infant and under-five mortality rate by two-third in 2015, and improving life expectancy of the people.

Claus, Martinez-Vazquez and Vulovic (2012) analyzed the relationship between government fiscal policies and income inequality in Asia. Specifically, the study analyzed the role and effectiveness of redistributive fiscal policies and quantified the impacts of taxation and government expenditure on income distributions in Asia. The study covered the period 1970 to 2009. Using general method of moments (GMM) estimation techniques, the study observed that the taxation had significant impact on income redistribution while government expenditure was more effective in redistributing income. Furthermore, the study observed some distinctive differential distributive impacts of government expenditure on social protection in Asia. Social protection spending was observed to have contributed in increasing income inequality in Asia while social protection spending contributed to reducing income inequality in the rest of the

world. Also, government expenditure on housing had significant adverse impact on income distribution in Asia.

Arthur (2015) analyzed the nexus among health expenditure, health outcomes and economic growth for a panel of 45 Sub-Saharan African (SSA) countries for the period 1995 to 2011. Specifically, the study examined the impact of health expenditure on health outcomes, the impact of health expenditure on economic growth, and the causal nexus among health expenditure, health outcomes and economic growth. The study employed panel fixed effects model, generalized method of moments (GMM) estimation technique, and panel vector autoregressive (PVAR) estimation techniques. The panel fixed effects estimate showed that health expenditure had significant on health outcomes in SSA, lowering mortality rates and enhancing life expectancy at birth. Decline

Ahmed and Hasan (2016) analyzed the extent to which public health expenditure and governance affect health outcomes in Malaysia for the period 1984 – 2009. The study used Autoregressive Distributed Lag (ARDL) estimation technique. The bound co-integration estimate showed stable long-run relationship between health outcomes and their determinants - income level, public health expenditure, corruption and government stability. The ARDL estimate showed that public health expenditure and corruption had both long- and short run impacts on health outcomes in Malaysia.

In their study, Odusanya and Agboola (2017) investigated the influence of income and income inequality on health in Nigeria from 1980 to 2014. The study employed autoregressive distributed lag estimation and found that income had a positive and significant long-term and short-term impact on health. On the other hand, income inequality had a negative and significant long-term and short-term effect on health in Nigeria.

Similarly, Obst, Onaran, and Nikolaidi (2017) examined the effects of income distribution and fiscal policy on growth, investment, and budget balance in Europe. The study focused on 15 EU countries during the period of 1960 to 2013. They developed a multi-country post-Kaleckian demand-led growth model that incorporated the role of the government. Findings from their study demonstrated that implementing a combination of pro-labor wage policies, expansionary fiscal policies, and progressive tax policies in all EU countries had a powerful impact on economic growth within the EU-15. According to the study, wage reforms had a modest yet favorable influence, while significant momentum in economic stimulus was achieved through fiscal expansion. Additionally, the analysis indicated that this policy mix led to an improvement in the budget balance across all EU-15 nations, suggesting the feasibility of incorporating expansionary fiscal policies alongside wage and progressive tax policies.

Shafuda and De (2020) analyzed the effects of government spending on human capital on human development indicators in Namibia for the period 1980 to 2015. Human development indicators were proxy by healthcare outcomes, education achievements and increase in national income. The study used both error–correction model (ECM) and vector auto-regression estimation techniques. The estimated error correction model (ECM) revealed that over the long term, government expenditure on healthcare exerts a negative and statistically significant influence on fertility rate, infant mortality rate, and under-5 mortality rate. However, no evidence of co-integration was observed between government spending on healthcare and life expectancy or adult mortality rate. Conversely, the study identified a significant and positive long-term impact of government expenditure on education. Nonetheless, no co-integration between government spending on education and gross enrolment rates at the primary and secondary levels was observed. The application of vector autoregression analysis demonstrated noteworthy long-term effects of healthcare and education expenditures on economic growth.

Gaps in the Reviewed Literature

The reviewed literature showed the existence of the paucity of information on the relationship among fiscal policy, income inequality and health outcomes in Sub-Saharan African. Previous studies on Sub-Saharan Africa largely focused on the link between income inequality, poverty and economic growth (Nwosa & Ehinomen, 2020; Fosu, 2015; Oseni & Onakoya, 2012; Omitogun & Ayinla, 2007). Furthermore, previous studies have focused exclusively on the separate impact of government expenditure on income inequality on the one hand (see Aremo & Abiodun, 2020; Odusola, 2017), and the impact of government expenditure on health outcomes on the other hand (see Novignon et al., 2012; Arthur, 2015; Ashiabi et al., Novignon & Lawanson, 2017, Sango-Coker & Bein, 2018). None exists on the impact of taxes on income inequality and health outcomes in Sub-Saharan Africa. In the light of the above identified gaps in the literature, this study seeks to investigate the impact of fiscal policy on income inequality and health outcomes in Sub-Saharan Africa.

Research Method

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:

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

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:

$$Y = f(\Psi GXH\ ICT\ POP\ C02) \tag{3}$$

Expressing (3) in estimation form,

$$\mathrm{Y_{i,t}} = \delta_0 + \delta_1 \mathrm{GXH_{i,t}} + \delta_2 \mathrm{ICT_{i,t}} + \delta_3 \mathrm{POP_{i,t}} + \delta_4 \mathrm{CO2_{i,t}} + \delta_5 \mathrm{HODA_{i,t}} + (\emptyset_{i,t} + \varepsilon_{i,t}) \tag{4}$$

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, The term "$(\emptyset_{i,t} + \varepsilon_{i,t})$" represents the combined error term in this context. It accounts for the specific random effects of individual countries($\emptyset_{i,t}$), and the error that varies across both individual countries and time($\varepsilon_{i,t}$). These components capture unobservable factors that influence the dependent variable but are unique to each country or vary over time.

In order to address potential issues related to endogeneity and unobserved country-specific effects present in panel data, this study employed the dynamic Generalized Method of Moments (GMM). The dynamic form of equations (5) can be expressed as follows, following the approach initially developed by Holtz-Eakin, Newey, and Rosen (1988).

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

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.

A Priori Expectations

With respect to the estimating equation (5), it is theoretically expected that government expenditure (GXH) and income tax (ICT) would contribute in enhancing health outcome and also improve income distribution in Sub-Saharan Africa. 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. Symbolically, it is expected that:

$$\frac{\delta Y}{\delta GXH} > 0; \frac{\delta Y}{\delta ICT} > 0; \frac{\delta Y}{\delta CO2} < 0; \frac{\delta Y}{\delta POP} < 0; \frac{\delta Y}{\delta HODA} > 0 \quad (6)$$

Measurement of Variables

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.

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.

The sources of data are presented on the table below. Table 1 contains a description of the variables used in the study.

Table 1. Summary on Description of Variables and Sources

S/N	Variable	Abbr.	Definition	Source
1	Health Outcomes (Under-five mortality and life expectancy at birth)	Y	Under-five mortality and life expectancy at birth	WDI, 2021
2	Income Inequality	INQ	Gini coefficient	SWIID, 2021
3	Carbon dioxide emission	C02	The rate of carbon dioxide emission	WDI, 2021
4	Population	POP	Population growth rate	WDI, 2021
5	Health Oriented Official Development Assistance	HODA	Inflow of official foreign aids directed to the health sector	OECD, 2021
6	Government expenditure on health	GXH	Ratio of budgeted expenditure to the health sector to the total government budget expenditure.	WDI, 2021
7	Income tax	ICT	Personal income tax.	OECD, 2021

Note: WDI is World Development Indicator; SWIID is Standardized World Income nequality Database; and OECD is Organization of Economic Co-operation and Development.

Source: Authors' computation (2023).

Results

To meet the objectives of this study, three equations were estimated. The first equation is about the relative impact of fiscal policy measures on health outcomes, with under-five mortality as the first health outcome variable. The second equation is about the relative impact of fiscal policy measures on life expectancy, which is the second health outcome variable. The third equation estimates the relationship between fiscal policy measures and income inequality.

Relative impact of fiscal policy measures on health outcomes – under-Five Mortality – in SSA

The result in Table 2 shows that income taxes (ICT) exert 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 0.15 percent. This effect is statistically significant ($P<0.01$). This is not in line with the study *apriori.*

Table 2. Result of the relative impact of fiscal policy measures on health outcomes in SSA
Dependent Variable: Under-five mortality

	Main Results			**Robustness Check Results**					
	Two-Step System GMM			Pooled OLS model			Fixed Effect Model		
	Coeff.	S.E.	t-value	Coeff.	S. E.	t-value	Coeff.	S. E.	t-value
Const.	0.6335	0.7233	0.88	0.1592	0.0445	3.5	0.5720***	0.1519	3.77
L1.MORT	0.9606***	0.0382	25.13	0.9761***	0.0055	178.82	0.9019***	0.0129	70.09
LNICT	0.1483***	0.0538	2.78	-0.0139***	0.0033	-4.24	-0.0091*	0.0053	-1.71
LNGXH	-0.0462	0.0512	-0.90	-0.0018	0.0022	-0.82	0.0001	0.0035	0.03
POP	-0.0232	0.0616	-0.38	-0.0021	0.0022	-0.92	-0.0100	0.0085	-1.17
$LNCO_2$	0.0168	0.0189	0.89	0.0001	0.0011	0.06	-0.0169	0.0107	-1.57
LNHODA	-0.0282**	0.0113	-2.49	-0.0036	0.0019	-1.92	0.0036	0.0031	1.17
AR(1) (p-value)	-3.38 (0.001)	NA	NA	NA	NA	NA	NA	NA	NA
AR(2) (p-value)	-1.21 (0.544)	NA	NA	NA	NA	NA	NA	NA	NA
Hansen test (p-value)	4.04 (0.544)	NA	NA	NA	NA	NA	NA	NA	NA
Sargan test (p-value)	3.94 (0.559)	NA	NA	NA	NA	NA	NA	NA	NA
R-Squared	NA	NA	NA	0.99	NA	NA	NA	NA	NA
Adj. R^2	NA	NA	NA	0.99	NA	NA	0.98	NA	NA
F-Stat (Prob)	NA	NA	NA	6453 (0.000)	NA	NA	2032.35 (0.0000)	NA	NA
No. of instru-ments	12	NA	NA	NA	NA	NA	NA	NA	NA

Note: L1 is one period lag of variable; LN is natural log of variable; S.E = Standard Error; *, ** and *** imply significance at 10%, 5% and 1% respectively.

Source: Authors' computation (2023).

It is observed that government expenditure on health (GXH) is negatively related to under-five mortality rate. The result shows that for every 1 percent rise in GXH, under-five mortality rate declines by about 0.05 percent. This declining effect on under-five mortality of government expenditure on health is statistically significant (P<0.01), in line with expectation. Population growth rate (POP) is found to have an insignificant negative effect on under-five mortality rate (P>0.05). The result shows that that under-five mortality rate falls by 0.023 percent for every 1 percent rise in population growth rate. Furthermore, the coefficient of carbon dioxide emission is found to be positive and insignificant (P>0.05), against expectation. The result indicates that a percentage increase in carbon dioxide emission leads to 0.02 percent rise in under-five mortality rate.

Finally, the result shows that the coefficient of health-oriented development assistance (HODA) is negatively and significantly related to under-five mortality rate (P<0.01). From the estimated result, it is found that for every 1 percent rise in HODA, under-five mortality falls by about 0.028. This outcome is in line with the *a priori* of the study.

Post Estimation Assessment

Serial Correlation Test

Given 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. 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 2)

The Sargan and Hansen test

Given that the probability value of the Sargan and Hansen tests statistics are 0.559 and 0.544 respectively, it can be concluded that the null hypothesis is not rejected, thus, the instruments used in estimation are valid.

Robustness check

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 <0.9606<0.9761.

Relative impact of fiscal policy measures on health outcomes – Life expectancy – in SSA

From the results presented in Table 3, it is observed that life expectancy in the previous year, has a positive and significant effect (P<0.01) on present life expectancy. An increase in previous year life expectancy by 1 percent resulted in a further increase in present life expectancy by 0.93 percent.

Table 3. Result of the relative impact of fiscal policy measures on health outcomes in SSA

Dependent Variable: Life expectancy

	Main Results			**Robustness Check Results**					
	Two-Step System GMM			Pooled OLS model			Fixed Effect Model		
	Coeff.	S.E.	t-value	Coeff.	S. E.	t-value	Coeff.	S. E.	t-value
Const.	-0.3225	0.3588	-0.90	0.1628***	0.0198	8.24	0.3360***	0.0257	13.07
L1.LFX	0.9262***	0.0588	15.76	0.9552***	0.0054	176.00	0.9214***	0.0085	108.47
LNICT	-0.0088	0.0010	-0.88	0.0032***	0.0008	4.05	0.0032**	0.0012	2.60
LNGXH	0.0144*	0.0079	1.83	0.0019***	0.0006	3.24	-0.0002	0.0008	-0.22
POP	-0.0262**	0.0129	-2.03	-0.0011*	0.0006	-1.90	0.0080	0.0020	4.08
$LNCO_2$	-0.0012	0.0033	-0.36	-0.0002	0.0003	-0.62	-0.0033	0.0023	-1.45
LNHODA	0.057**	0.0271	-0.90	0.0025	0.0005	0.52	-0.0014	0.0007	-2.03
AR(1) (p-value)	-1.17 (0.024)	NA	NA	NA	NA	NA	NA	NA	NA
AR(2) (p-value)	0.05 (0.959)	NA	NA	NA	NA	NA	NA	NA	NA
Hansen test (p-value)	1.00 (0.607)	NA	NA	NA	NA	NA	NA	NA	NA
Sargan test (p-value)	5.53 (0.063)	NA	NA	NA	NA	NA	NA	NA	NA
R-Squared	NA	NA	NA	0.99	0.99	NA	NA	NA	NA
Adj. R^2	NA	NA	NA	0.99	0.99		0.98	NA	NA
F-Stat (Prob)	NA	NA	NA	6453 (0.000)	7107.88 (0.0000)	NA	3978.49 (0.0000)	NA	NA
No. of instru-ments	9	NA	NA	NA	NA	NA	NA	NA	NA

Note: L1 is one period lag of variable; LN is natural log of variable; S.E = Standard Error; *, ** and *** imply significance at 10%, 5% and 1% respectively.

Source: Authors' computation (2023).

The estimated result further shows that income taxes (ICT) exert a negative effect on life expectancy, in line with expectation; indicating that an increase in ICT reduces life expectance. More specifically, an increase in ICT by 1 percent leads to a decrease in life expectancy by about 0.01 percent. This effect is however not statistically significant (P>0.05)

Results further show that government expenditure on health (GXH) is positively related to life expectancy, as expected. The result shows that for every 1 percent rise in GXH, life expectancy rises by about 0.01 percent. This rising effect on life expectancy of government expenditure is not statistically significant (P>0.05).

Population growth rate (POP) is found to have a significant negative effect on life expectancy (P<0.05), which is in line with the *a priori* expectation. The result shows that that life expectancy falls by 0.03 percent for every 1 percent rise in population growth rate.

Furthermore, the coefficient of carbon dioxide (CO_2) emission is found to be negative and insignificant (P>0.05), in line with expectation. The result indicates that a percentage increase in carbon dioxide emission leads to 0.01 percent fall in life expectancy.

Finally, the result shows that the coefficient of health-oriented development assistance (HODA) 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 0.026. This outcome is in line with the *a priori* of the study.

Post Estimation Assessment

Serial correlation test

Given that the AR(1) test, which tests for the presence of serial correlation at first difference is statistically significant (P<0.05), it can be concluded that there is the presence of autocorrelation. However, 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 3)

The Sargan and Hansen test

Given that the probability value of the Sargan and Hansen tests statistics are 0.063 and 0.607 respectively, it can be concluded that the null hypothesis is not rejected, thus, the instruments used in estimation are valid.

Robustness check

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, 0.9262 <0.9552<0.9214.

Relative impact of fiscal policy measures on income inequality in SSA

From the estimated model presented in Table 4, it is observed that inequality in the previous year, has a negative and significant effect (P<0.01) on present inequality. An increase in previous year inequality by 1 percent resulted in a further decrease in present inequality by 0.79 percent.

Table 4. Result of the relative impact of fiscal policy measures on income inequality in SSA

Dependent Variable: Income inequality

	Main Results			**Robustness Check Results**					
	Two-Step System GMM			Pooled OLS model			Fixed Effect Model		
	Coeff.	S.E.	t-value	Coeff.	S. E.	t-value	Coeff.	S. E.	t-value
Const.	4.3740***	1.3689	3.20	0.2772***	0.0654	4.24	2.1829***	0.1604	13.61
L1.INQ	-0.7948***	0.2375	3.34	0.9312***	0.0143	65.18	0.5334***	0.0311	17.14
LNICT	-0.0743**	0.0348	-2.14	-0.0036	0.0034	-1.07	-0.0142***	0.0051	-2.80
LNGXH	-0.0782*	0.0466	-1.68	-0.0034	0.0023	-1.43	-0.0383***	0.0036	-10.65
POP	-0.0495	0.0490	-1.01	-0.0005	0.0023	-0.23	0.0090	0.0080	1.13
$LNCO_2$	0.0169	0.0218	0.78	-0.0020*	0.0012	-1.66	-0.0097	0.0068	-1.43
LNHODA	0.0556	0.0274	2.03	0.0115***	0.0024	4.86	0.0315	0.0031	10.09
AR(2) (p-value)	-1.42 (0.045)	NA	NA	NA	NA	NA	NA	NA	NA
Hansen test (p-value)	-0.35 (0.730)	NA	NA	NA	NA	NA	NA	NA	NA
Sargan test (p-value)	5.25 (0.386)	NA	NA	NA	NA	NA	NA	NA	NA
AR(2) (p-value)	87.77 (0.059)	NA	NA	NA	NA	NA	NA	NA	NA
R-Squared	NA	NA	NA	0.96	NA	NA	NA	NA	NA
Adj. R^2	NA	NA	NA	0.96	NA	NA	0.86	NA	NA
F-Stat (Prob)	NA	NA	NA	1144.50 (0.0000)	NA	NA	288.89 (0.0000)	NA	NA
No. of instru-ments	12	NA	NA	NA	NA	NA	NA	NA	NA

Note: L1 is one period lag of variable; LN is natural log of variable; S.E = Standard Error; *, ** and *** imply significance at 10%, 5% and 1% respectively.

Source: Authors' computation (2023).

The estimated result also showed that income taxes (ICT) exerted a negative effect on inequality, in line with expectations, indicating that an increase in ICT reduces income inequality. More specifically, an increase in ICT by 1 percent leads to a decrease in income inequality by about 0.07 percent. This effect is shown to be statistically significant (P<0.01).

Results further show that government expenditure on health (GXH) is negatively related to inequality. The result shows that for every 1 percent rise in GXH, income inequality falls by about 0.08 percent, as expected. This declining 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 0.05 percent for every 1 percent rise in population growth rate.

Furthermore, the coefficient of carbon dioxide emission is found to be positive but not statistically significant (P>0.05), implying rising income inequality as carbon emission rises. The result indicates that a percentage increase in carbon dioxide emission leads to 0.02 percent rise in income inequality.

Finally, the result shows that the coefficient of health-oriented development assistance (HODA) is positively but insignificantly related to income inequality (P>0.05). From the estimated result, it is found that for every 1 percent rise in HODA, income inequality rises by about 0.056 percent. This outcome is not in line with the *a priori* of the study.

Post Estimation Assessment

Serial correlation test

Given that the AR(1) test, which tests for the presence of serial correlation at first difference is statistically significant (P<0.05), it can be concluded that there is the presence of autocorrelation. However, 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).

The Sargan and Hansen Test

Given that the probability value of the Sargan and Hansen tests statistics are 0.059 and 0.730 respectively, it can be concluded that the null hypothesis is not rejected, thus, the instruments used in estimation 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. 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, -0.7948< 0.5334 <0.9312.

Discussion of Findings

The first estimated model, presented in Table (2) showed evidence that income tax exerted a positive and significant effect on under-five mortality rate. This effect is statistically significant and is cause for concern. What it showed was that income taxes is injurious to children under-five. This may imply that income of the average African, after tax becomes too little to be able to afford health care for the under-five. This result is in agreement with the findings of Kim and Lane (2013) whose study on the OECD found a significant negative effect of health spending on health outcomes.

It is observed that government expenditure on health, on its own, exerted a significant negative effect on under-five mortality rate in SSA, which is an outcome that policy makers across SSA will appreciate. Comparing this outcome to the result of income tax, it becomes obvious that government expenditure does not necessarily require income tax to have a reducing effect on under-five mortality rate. However, income tax requires to be appropriately channeled to reduce under-five mortality rate. This finding is against that of Fadlli, Khusaini and Syafitri (2019), that found a negative relationship between government expenditure and health performance, that is, declining health performance with increasing government expenditure. The study was not specific about the aspect of government expenditure. On the other hand, the findings of a declining effect of government health spending on infant mortality rate is confirmed by the study of Anyanwu and Erhijakpor (2007) and Yusuf (2016).

Another important finding of the study is that health-oriented development assistance significantly reduced under-five mortality rate in SSA. This points to a productive utilization of the development assistance that is directly channeled to health-related issues. For development partners, this is encouraging and a sign of the effectiveness of funds meant for a specific purpose. The significant effect of health-oriented development assistance is in line with the studies of Aremo & Abiodun (2020) and Novignon & Lawanson (2017).

From the second model, the result obtained indicated that population growth rate exerted a negative and significant effect on life expectancy. This implies that growth in population

reduces life expectancy, thus, health outcomes in SSA. This is to be expected given that a growing population is likely to put a strain on public health, thus, reduce health outcomes. With SSA projected to become the next population spurt for the world by (find out), the public health implication of that projection should bother policy makers. This is in line with the findings of Arthur (2015) where the prevalence of disease and urban population growth is associated with a reduction in health outcomes in SSA.

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 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 outcomes.

On the effect of health-related fiscal policy on income inequality, it is observed that income tax had a negative and significant effect on income inequality. Hence, the higher the income tax, the lower the income inequality. This is possible because an effective tax system serves to transfer benefits to economic agents that are at the lower wrung of the economic ladder through the provision of social services like health and education. This finding is confirmed by IMF (2014) where direct income taxes and transfers have decreased inequality by an average of one-third in developed countries. Furthermore, Martinez-Vazquez, Moreno-Dodson and Vulovic (2012) showed that both personal income tax and corporate taxes contributed to reducing income inequality in developing countries.

Conclusions and Policy Recommendation

This study provides valuable insights into the relationship between fiscal policy, income inequality, and health outcomes in Sub-Saharan Africa (SSA) countries. By utilizing panel data from 12 countries over the period 2010-2022 and employing the System GMM estimation technique, the study reveals several important findings.

Firstly, the study demonstrates that income tax (ICT) has a positive and significant effect on mortality rates (MORT). This suggests that higher income taxes are associated with increased mortality rates in the SSA region. On the other hand, government health expenditure (GXH) and population growth (POP) exhibit a negative influence on MORT, although these effects are not statistically significant. The study also finds a positive, but not statistically significant, relationship between carbon emissions (CO2) and MORT. In contrast, health-oriented development assistance (HODA) shows a negative and statistically significant effect on MORT, indicating that increased assistance focused on health outcomes can lead to lower mortality rates.

Furthermore, the study examines the impact of fiscal policy on income inequality (INQ) and reveals notable results. Government health expenditure (GXH) and income tax (ICT) both exert a negative effect on INQ, with ICT being the most significant factor. This suggests that higher government spending on health and progressive income tax systems can contribute to reducing income inequality. Population growth (POP) also demonstrates a negative and significant effect on INQ, highlighting the importance of managing population growth to mitigate adverse health challenges and inequality. However, the effects of health-oriented development assistance (HODA) and carbon emissions (CO2) on INQ are positive but not statistically significant.

The following are recommended for policy:

1. Government expenditure on health has been shown to lead to significant decline in under-five mortality rates in SSA. Given this, it is necessary for policy makers in SSA to find as utmost importance, the provision for more spending on health.
2. Given that the study showed a reduction in life expectancy with rising population, it is imperative that countries across SSA formulate policies that will help in slowing down population growth to levels that are manageable, and will not pose adverse health challenges in the region.
3. Government can reduce income inequality (INQ) through policies that aim to increase income for low-income families and reduce the income gap between the rich and poor. This can be done by implementing progressive tax policies, providing social safety nets, and increasing access to education and job training.
4. Policymakers can reconsider the use of income tax (ICT) as a policy tool, as it was found to have a positive effect on MORT and a negative effect on LFX. Policymakers should explore alternative methods of raising revenue that do not have negative impacts on health outcomes.

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