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Growth effect of income inequality in sub-Saharan Africa: exploring the transmission channels

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Abstract: Sub-Saharan Africa (SSA) ranks as the second most unequal region globally (in terms of income distribution), harboring 10 of the 19 most unequal countries in the world. This paper explores the channels through which income inequality exerts its effects on economic growth in SSA. The study spans the period 1995–2015, focusing on 31 SSA countries. Findings from the two-step system generalized method of moments suggest that income inequality exerts a significant positive effect on economic growth via the saving transmission channel, while it has a statistically significant negative effect on economic growth in the region through the channels of fertility, credit market imperfection, and fiscal policy.

Keywords: income inequality, growth, transmission, channels, Africa
JEL Classification: C23, C33, D31, F43, N47

1 Introduction

The relationship between income inequality and economic growth is undoubtedly intricate as inequality can promote the effective functioning of the economy and provide incentives required for investment and growth. It could, on the other hand, amplify the risk of crisis and pose a serious difficulty for the poor to invest in education, thereby constituting a threat to the economic growth process. It has generated a series of protests in the Middle East and North Africa (MENA) region since 2011, with unprecedented demand for more economic and political inclusion, as several individuals can no more bear the prevailing gross socioeconomic inequality [Ncube et al., 2013]. The rise in the concern over the widening gap between the rich and the poor also led to the Occupy Wall Street movement,[1] as well as motivating a series of backlashes against international trade in many industrialized nations. Economists across the world remain perturbed as the lopsidedness in the sharing of growth dividend can undermine the support required for progrowth policies and could probably lead to political instability [Yang and Greaney, 2017]. Ferreira [1999], Barro [2000, 2008], Neves and Silva [2014], Knowles [2005], Charles-Coll [2013], Yang and Greaney [2017], Kennedy et al. [2017], and Grundler and Scheuermeyer [2018], among others, identified six main channels through which income inequality can exert an effect on economic growth. These channels are as follows:

1 A protest movement that began on September 17, 2011, in Zuccotti Park in New York City's Wall Street financial district in reaction to widespread economic inequality across the world.

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the saving channel, the credit market imperfection channel, the human capital investment channel, the political economy or fiscal policy channel, the fertility differential channel, and the sociopolitical instability channel.

Emerging trends on the inequality–growth nexus for Africa indicate rising levels of income inequality in the region, which poses serious and potential challenges for the economic growth in Africa. In accordance with Bhorat and Naidoo [2018], the average Gini coefficient in Africa stands at 0.43, constituting 1.1 times the coefficient for the rest of the developing economies (at 0.39), therefore depicting extreme inequality in income. Specifically, the Gini coefficient for countries such as Namibia, Botswana, South Africa, and Zambia lies above 0.55, while those for Tanzania, Democratic Republic of Congo, and Nigeria are in a relatively lower range, between 0.34 and 0.44. Nearly 50% of Africans reside in economies having Gini index in the range of about 0.40–0.51. Based on the share of income of the top 20% of the population relative to the bottom 20%, the top 20% of earners in Africa, on average, have an income that is >10 times above that of the bottom 20%. Ten[2] out of the 19 most unequal countries in the world are in Sub-Saharan Africa (SSA). Meanwhile, over the years, the African region has recorded a boom in its growth, with rates of per capita GDP growth being higher than those of the Caribbean region and Latin America but lower than those of East Asia. Despite recording remarkable and historic growth in her economy, South Africa (the only African member of the G-20) has the highest income inequality in the SSA region. Therefore, the consequences of income inequality tend to be graver for the region. However, empirical studies unraveling its implications for growth and ascertaining the channels through which it affects growth in SSA economies are very rare. Due to the peculiarity, ubiquity, and severity of income inequality in SSA, it is quite apt to explore the channels of transmission of these effects for a better understanding of its features and mechanisms for appropriate policy measures. This study is novel in this regard. It contributes to knowledge as it provides insight into the channels through which income inequality affects economic growth in SSA. The study establishes credit market imperfection, fertility differential, human capital investment, and fiscal policy (or political economy) as channels through which the negative effects of income inequality are transmitted to economic growth in SSA.

2 Literature review

Despite the overarching effect of income inequality on economic growth, empirical studies investigating the channels of transmission of its effect on economic growth are sparse. Persson and Tabellini [1994], Alesina and Perotti [1996], Perotti [1996], Deininger and Squire [1998], Deininger and Olinto [2000], Barro [2000], Sylwester [2000], Pineda and Rodríguez [2006], Cingano [2014], and Grundler and Scheuermeyer [2018] have assessed the relevance and validity of savings, credit market imperfection, fiscal policy (political economy), fertility differentials, and the sociopolitical channels via which income inequality exerts its effects on economic growth. Deininger and Squire [1998] confirm, for a panel of 81 countries, credit market imperfections as the channel through which income inequality negatively affects economic growth. Barro [2000] has tested but refuted the saving mechanism as the channel through which income inequality exerts positively on economic growth. However, Cingano [2014] finds evidence in support of human capital as the channel via which income inequality affects economic growth.

Grundler and Scheuermeyer [2018] examine the fertility differential, credit market imperfections, fiscal policy, sociopolitical instability, and the saving rate channels in a panel of 164 countries. Evidence from system generalized method of moments (GMM) reveals acceptance of the transmission of the effect of income inequality on economic growth via the fertility, human capital accumulation, and the saving channels. They deduce that income inequality hinders access to education and brings about increase in fertility rate. Madsen et al. [2018] also investigate the transmission of the effects of income inequality on economic growth through the saving, investment, education, and knowledge production channels.

2 South Africa, Namibia, Botswana, Central African Republic, Comoros, Zambia, Lesotho, Swaziland, Guinea-Bissau, and Rwanda [United Nations Development Programme (UNDP), 2017].

Estimates from models using instrumental variables provide evidence in support of these pathways for transmitting the effects of inequality in income distribution in 21 Organization for Economic Cooperation and Development (OECD) countries from 1870 to 2011. Studies examining the transmission channels of the effects of income inequality on economic growth are quite rare for the SSA region. Table 1 provides a synthesis of these studies.

3 Methodology

3.1 Model specification

In line with Perotti [1996], Barro [2000], and Mo [2000], to examine these transmission channels, it is necessary to examine the effect of income inequality on the measures of each channel; and how the measure of the channel directly affects economic growth. Subsequently, an interaction term for income inequality and the measure of the respective channel is introduced to ascertain the validity of the channel [Perotti, 1996; Deininger and Olinto, 2000; Grundler and Scheuermeyer, 2018]. Following this approach, the models on the tested transmission channels are specified.

3.1.1 Saving channel

$$\ln y_{i.t} = a_0 + \alpha \ln y_{i,t-1} + \phi \ln SAV_{i,t} + yINQE_{i,t} + \beta X_{i,t} + \pi INEQ^{*} SAV_{i,t} + \mu_i + \varepsilon_{i,t}. \quad (1)$$

Saving (SAV) in the economy contributes positively to growth; hence, ϕ should be >0 [Barro, 2000]. Here, π is the coefficient of the interaction term for income inequality and saving, viz., *INEQ* SAV*.

3.1.2 Credit market imperfection channel

$$\ln y_{i.t} = a_0 + \alpha \ln y_{i,t-1} + \phi \ln M2_{i,t} + yINQE_{i,t} + \beta X_{i,t} + \sigma INEQ^{*} M2_{i,t} + \mu_i + \varepsilon_{i,t}. \quad (2)$$

M_2/GDP is the proxy for this channel. It measures the level of development of the financial sector. This is in line with Barro [2000]. *INEQ* M2* is the interaction term, and the coefficient should be negative [Galor and Zeira, 1993; Perotti, 1996; Deininger and Squire, 1998; Cingano, 2014; Kennedy et al., 2017].

3.1.3 Human capital investment channel

$$\ln y_{i.t} = a_0 + \alpha \ln y_{i,t-1} + \phi \ln H_{i,t} + yINQE_{i,t} + \beta X_{i,t} + \theta INEQ^{*} H_{i,t} + \mu_i + \varepsilon_{i,t}. \quad (3)$$

The coefficient of *INEQ* H*, i.e., θ, should be <0, as inequality in the income distribution exacerbates the inability of the poor to invest in quality education and health. This could indirectly retard growth, given the crucial role of human capital investment in the growth process [Deininger and Olinto, 2000; Mo, 2000; Charles-Coll, 2013; Cingano, 2014; Madsen et al., 2018].

3.1.4 Fiscal policy channel

$$\ln y_{i.t} = a_0 + \alpha \ln y_{i,t-1} + \phi \ln GGOV_{i,t} + yINQE_{i,t} + \beta X_{i,t} + \theta INEQ^{*} GGOV_{i,t} + \mu_i + \varepsilon_{i,t}. \quad (4)$$

*INEQ*GGOV* is the interaction term for income inequality and fiscal policy. We used general government expenditure (GGOV) as the measure for this channel. The choice of this variable as a proxy for the fiscal policy channel is consistent with Gouveia and Masia [1998].

Table 1. Empirical studies on the transmission channels of the effect of income inequality on economic growth

Authors	Mechanism/channel	Sample	Data structure	Measure of inequality	Estimation method	Validity or relevance of tested mechanism
Persson and Tabellini [1994]	Political economy (fiscal policy)	13/43 countries (1960–1985)	Cross section	Income share of the fourth quintile	OLS; 2SLS	Rejected
Alesina and Perotti [1996]	Sociopolitical instability; Credit market imperfection	71 countries (1960–1985)	Cross section	Income share of the third and fourth quintiles	2SLS	Accepted
Perotti [1996]	Credit market imperfections	62 countries (1960–1985)	Cross section	Income share of the third and fourth quintiles	OLS; 2SLS	Ambiguous result
Perotti [1996]	Fiscal policy	49/27 countries (1960–1985)	Cross section	Income share of the third and fourth quintiles	OLS; 2SLS	Rejected
Perotti [1996]	Sociopolitical instability; Fertility	64 countries (1960–1985)	Cross section	Income share of the third and fourth quintiles	OLS; 2SLS	Accepted
Deininger and Squire [1998]	Credit market imperfections	52/81 countries (1960–1992)	Cross section	Land Gini coefficient	OLS	Accepted
Deininger and Squire [1998]	Fiscal policy	52/81 countries (1960–1992)	Cross section	Land Gini coefficient	OLS	Rejected
Svensson [1998]	Political economy (Sociopolitical instability)	101 countries 1960–1985	Cross section	Income ratio between the share of income by the poorest 40% to the richest 20%	OLS	Accepted
Sylwester [2000]	Sociopolitical instability	52 countries (1960–1992)	Cross section	Gini coefficient	3SLS	Accepted (short run); Rejected (long run)
Barro [2000]	Saving	84 countries (1965–1995)	Panel	Gini coefficient	OLS	Rejected
Deininger and Olinto [2000]	Human capital	31/60 countries (1966–1990)	Panel	Land Gini coefficient	System GMM	Accepted
Mo [2000]	Human capital; Sociopolitical instability; Fiscal policy	1970–1985	Cross section	Gini index	2SLS	Accepted
Keefer and Knack [2002]	Sociopolitical instability	56/89 countries (1970–1992)	Cross section	Income; Land Gini coefficient	OLS	Accepted
Pineda and Rodríguez [2006]	Fiscal policy	Number of countries not available (1960–1997)	Panel	N/A	Random effects	Accepted
De Mello and Tiongson [2006]	Fiscal policy	54 countries (1981–1998)	Cross section	Income Gini coefficient	OLS; Tobit	Accepted
Barro [2008]	Fertility	(1960–2000)	Cross section	Gini index	3SLS	Accepted
Cingano [2014]	Human capital	31 OECD countries (1970–2010)	Panel	Net and gross Gini	System GMM	Accepted
Cingano [2014]	Fiscal policy	31 OECD countries (1970–2010)	Panel	Net and gross Gini	System GMM	Rejected
Grundler and Scheuermeyer [2018]	Human capital; Fertility; Saving; Fiscal policy	164 countries (1965–2014)	Panel	Net and gross Gini	System GMM	Accepted
Madsen et al. [2018]	Saving; Investment; Education/ knowledge production	21 OECD countries	Panel	Gini index; Income share of top 10%	2SLS; OLS	Accepted

OLS, ordinary least squares; 2SLS/3SLS, two-stage/three-stage least squares.

3.1.5 Fertility rate transmission channel

The relationship between fertility rate and economic growth tends to be negative. As fertility rate rises, human capital investment (or investment per child) tends to decline. This eventually undermines the growth process [Liu et al., 1996; Bleaney and Nishiyama, 2004; Barro, 2008; Bonner and Sarkar, 2018]. Thus, the coefficient of fertility rate should be negative.

$$\ln y_{i,t} = a_0 + \alpha \ln y_{i,t-1} + \phi \ln FR_{i,t} + yINQE_{i,t} + \beta X_{i,t} + \theta INEQ^* FR_{i,t} + \mu_i + \varepsilon_{i,t}. \quad (5)$$

In the same vein, income inequality has a negative effect on economic growth via the fertility transmission pathway [Barro, 2000; Knowles, 2005; Charles-Coll, 2013; Cingano, 2014; Grundler and Scheuermeyer, 2018]. Hence, the coefficient of *INEQ* FR* should be negative. Here, *X* is the vector of the control variables that affect economic growth, apart from our variables of interest. These variables are capital labor force, trade openness, urbanization, and inflation rate.

The sociopolitical instability channel could not be examined, as data on its measure were not readily available for virtually all the SSA countries considered in this study.

3.2 Estimation technique

Given the nature of these models and the inherent problem of endogeneity, we used the system GMM of Blundell and Bond [1998]. This GMM technique makes it possible to use more instruments than the difference GMM. In addition, our panel data have the feature of large cross section (N) but short time (*T*), which makes the use of the GMM appropriate.

3.3 Sources of data

The sources of data and the variables used in the study are presented in Table 2.

The study covers 31 SSA countries: Angola, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Cote d'Ivoire, Ethiopia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Swaziland, Uganda, Zambia, and Tanzania. Our country coverage is based on availability of data.

4 Results and findings

Table 3 shows that all the series display a high level of consistency as their mean and median values of these series. The core variable in the study, the market Gini coefficient, a measure of income inequality, has an average value of 40.5 (normalized as 0.405). This depicts a high level of income disparities in the SSA region. The table also shows that average inflation rate for the region stands at 48.88%. Both fertility rate and infant mortality rate are still high, with mean values of 5.06 children per woman and 70.46 per 1,000 live births, respectively. Meanwhile, the average life expectancy at birth is 57 years. It is also obvious that the degree of trade openness in the region is very high, which could be partly accountable for the high rate of growth in the region. The SSA has a number of economies ranked among the fastest growing in the world. However, this has not reduced the level of income inequality in the region.

4.1 Analysis of the effect of income inequality on economic growth via the saving channel

The results for effect of income inequality on economic growth through the saving channel are shown in Table 4.

Results from the estimation of the saving model show that income inequality has a positive but insignificant relationship with saving. This suggests that higher income inequality tends to increase

Table 2. Sources of data, description, and measurement of variables

Variable	Description	Measurement	Source (s) of data
INEQ	Market Gini	Gini index of inequality in equivalized household (pretax and pretransfer) income	Standardized World Income Inequality Database (SWIID)
Y	GDP per capita	Income per head for individuals in the population obtained as the GDP divided by the total population	WDI
K	Physical capital	Gross fixed capital formation	WDI
L	Labor force	Total labor force	WDI
H	Human capital	Primary school enrollments	WDI
OPEN	Openness	Exports plus imports/GDP	WDI
FR	Total fertility rate	Number of births per woman	WDI
HCE	Health care expenditure	General government expenditure on health per capita in constant (2005) dollars	World Health Organization (WHO)
INF	Inflation rate	Consumer prices (annual %)	WDI
GGOV	General government expenditure	General government final consumption expenditure	United Nations database
M_2	M_2/GDP	Broad money as a percentage of GDP	WDI
SAV	Saving	Gross national savings	IMF World Economic Outlook
UPR	Urbanization	Urban population growth (annual %)	WDI
LE	Life expectancy	Life expectancy at birth	WDI
IMR	Infant mortality rate	This is expressed per 1,000 live births	WDI

GDP, gross domestic product; WDI, World Development Indicator.

saving in the economy. The coefficient of per capita GDP is also positive and statistically insignificant in terms of its relationship with saving. The coefficient of capital formation is positive and statistically significant at 5%.

On the other hand, the coefficient of GGOV is negative and statistically significant at 5%, with about 0.11% reduction in saving attributable to 1% increase in government expenditure. The result in Column 2 shows that the coefficient of income inequality is negative, depicting the inhibiting effect of unequal income distribution on growth.

By controlling for saving in the growth equation, the coefficient of the Gini index becomes positive but insignificant after introducing saving into the growth model. This is contrary to its negative sign in the growth equation without the saving variable (Column 2). The coefficient of saving is positive and statistically significant at 5%, with a 1% increase in saving resulting in about 0.03% increase in per capita GDP. Our models also consistently show that initial per capita GDP has a positive and statistically significant effect on the contemporaneous per capita GDP.

We introduced the interaction term for saving and income inequality into the growth model (in Column 4). The coefficient of income inequality is positive and statistically significant at 1%. The result indicates that inequality in income distribution promotes growth via the saving channel in the SSA region. This is in line with Kaldor's postulation. Kaldor argued that the rich, who are usually the beneficiaries of the dispersions in income distribution, tend to save and undertake huge investments because of their high marginal propensity to save. These investments promote growth in the economy.

4.2 Analysis of the effect of income inequality on economic growth via the credit market imperfection channel

Column 1 of Table 5 contains the results on the effect of income inequality and other variables on the measure of credit market imperfection. Column 2 provides the result from the estimation of the growth model without the measure of credit market imperfection, while results in Column 3 are from the model that controlled for this variable. The interaction term for the measure of credit market imperfection and income inequality is then included in the growth model, and the results thereof are shown in Column 4. The results

Table 3. Descriptive statistics

Variable	GDP	SAV	INEQ	L	OPEN	INF	LE	M_2	H	UPR	HCE	IMR	FR
Mean	1570.08	14.92	40.50	6895886	445.39	48.88450	56.55	85.73	2401450	5676360	33.54	70.46	5.06
Median	835.97	14.76	43.50	4081389	202.80	5.826429	56.17	23.24	980033	2214526	31.00	68.60	5.31
Maximum	9468.94	45.84	68.50	55789427	6181.44	24411.03	77.79	18347.09	26167544	86561390	93.00	152.30	7.73
Minimum	182.70	−18.03	0.00	132168	0.15	−9.616154	33.33	0.00	0.000000	189769	3.00	12.70	1.36
Standard deviation	1885.53	10.56	17.96	9938663	846.39	957.5849	7.58	1001.35	3975386	11201148	20.27	27.17	1.34

Table 4. Effect of income inequality on economic growth (saving channel)

Dependent variable	Saving	Per capita GDP	Per capita GDP	Per capita GDP
$Saving_{t-1}$	0.7874*** (0.1302)			
Per capita GDP_{t-1}		0.9633*** (0.0216)	0.9628*** (0.0177)	0.9724*** (0.0133)
Per capita GDP	0.0748949 (0.0860451)			
Gini index	0.0141 (0.2531)	−0.0169 (0.0839)	0.0148 (0.0944)	0.0898*** (0.0343)
Gross capital formation	0.1207** (0.0554)	0.0608*** (0.0222)	0.0377* (0.0201)	−0.0005 (0.0104)
Saving			0.0305** (0.0153)	
General government expenditure	−0.1141** (0.0521)			
Labor force		−0.0438 (0.0302)	−0.0248 (0.0327)	0.0025 (0.0122)
Openness		−0.0634*** (0.0231)	−0.0404 (0.0222)	0.0012 (0.0110)
Inflation		−0.0005*** (0.0001)	0.0001 (0.0004)	0.0015 (0.0016)
Life expectancy		−0.1852* (0.1031)	−0.0274 (0.1247)	0.2073** (0.0777)
Saving*Gini index				0.0194*** (0.0069)
Constant	−0.1916 (0.7285)	0.4571 (0.7065)	−0.1704 (0.9698)	−1.1311 (0.3665)
Cross sections	31	31	30	30
Instruments	19	21	21	28
Hansen test	0.557	0.300	0.328	0.229
AR (1)	0.027	0.009	0.004	0.000
AR (2)	0.361	0.328	0.786	0.697

Notes: The values in parentheses are the standard errors. The values for AR (1), AR (2), and the Hansen test are the *p*-values. ***, **, and * denote the 1%, 5%, and 10% levels of significance.

AR (1), first-order autocorrelation; AR (2), second-order autocorrelation.

Table 5. Effect of income inequality on growth (credit market imperfection channel)

Dependent variable	M_2/GDP	Per capita GDP	Per capita GDP	Per capita GDP
M_2/GDP_{t-1}	0.8675*** (0.0183)			
Per capita GDP_{t-1}		0.9847*** (0.0094)	0.9868*** (0.0169)	1.0098*** (0.0165)
Per capita GDP_t	0.0560*** (0.0127)			
Gini index	−0.1213* (0.0727)	−0.0204 (0.0355)	−0.0054 (0.0468)	−0.0544* (0.0310)
Gross capital formation	0.0269 (0.0239)	0.0272*** (0.0092)	0.0168* (0.0099)	0.0285* (0.01609)
M_2/GDP			0.0001 (0.0025)	
Human capital			0.0127 (0.0103)	−0.0159 (0.0142)
General government expenditure	−0.0397* (0.0230)			
Labor force	0.0013 (0.0082)	−0.0259*** (0.0104)	−0.0277*** (0.0099)	−0.0282 (0.0176)
Openness		−0.0274*** (0.0094)	−0.0196* (0.0107)	−0.0370** (0.0181)
Inflation	−0.0015*** (0.0002)	4.73e−07 (3.63e−07)	−0.0004 (0.0002)	−0.0007* (0.0004)
Life expectancy		−0.0100 (0.0262)		−0.0071 (0.0627)
Gini index*M_2				−0.0498 * (0.0288)
Constant	0.8562 (0.3647)	0.0495 (0.2226)	0.0247 (0.1785)	0.4040 (0.2861)
Cross sections	31	31	31	31
Instruments	28	28	29	19
Hansen test	0.428	0.281	0.282	0.528
AR (1)	0.243	0.000	0.001	0.009
AR (2)	0.308	0.877	0.593	0.528

Notes: The values in parentheses are the standard errors. The values for AR (1), AR (2), and the Hansen test are the *p*-values. ***, **, and * denote 1%, 5%, and 10% levels of significance.

AR (1), first-order autocorrelation; AR (2), second-order autocorrelation.

in Column 1 suggest that the coefficient of the Gini index is negative and statistically significant at 10%, with income inequality causing about 0.12% decline in money supply. This implies that disproportionate income distribution exacerbates imperfection in the credit market.

The coefficient of per capita gross domestic product (GDP) is statistically significant at 1%, implying that the growth in the economy increases money supply and contributes positively to growth in the financial market. The result indicates that a 1% increase in per capita GDP causes an increase of about 0.06% in the broad money supply. By controlling for the measure of credit market imperfection, the result in Column 3 suggests that income inequality still has a negative effect on economic growth. Inflation and trade openness have consistently negative effects on economic growth.

In Column 4 of Table 5, we controlled for the effect of the interaction term for income inequality and credit market imperfection (Gini index*M_2). Income inequality affects economic growth adversely as the coefficient of the Gini index is negative and statistically significant, suggesting that income inequality inhibits economic growth through credit market imperfection. When there is high inequality in the dispersion of income, it causes unequal effects on credits and investible funds.

4.3 Analysis of the effect of income inequality on economic growth via the human capital investment channel

Column 1 of Table 6 shows the effect of income inequality and other relevant variables on human capital. Column 2 contains the result from the estimation of the growth equation excluding the measure of human capital investment, while the results in Column 3 are from the growth model including the measure of human capital. The result in Column 1 reveals that the coefficient of the Gini index is negative and statistically significant at 1%. This implies that imbalanced income dispersion is detrimental to human capital investment in SSA.

In addition, investment in human capital enhances economic growth, as the coefficient is positive and statistically significant at 5%, indicating that a 1% increase in human capital brings about a 0.04% increase in per capita GDP. The results in Column 4 indicate that income inequality has a significant negative effect on economic growth. On the other hand, the coefficient of the interaction term for human capital and income

Table 6. Effect of income inequality on economic growth via the human capital channel

Dependent variable	Human capital	Per capita GDP	Per capita GDP	Per capita GDP
Human capital$_{t-1}$	0.9987 (0.0054)			
Per capita GDP$_{t-1}$		1.0001*** (0.0062)	0.9857*** (0.0077)	0.9998*** (0.0148)
Gini index	−0.0723*** (0.0246)	−0.0446* (0.0248)	−0.0541 (0.0410)	−0.1811* (0.0975)
Gross capital formation		0.0147** (0.0077)	0.02029*** (0.0057)	0.0548*** (0.0223)
Fertility rate	0.0538** (0.0219)			
Human capital			0.0428** (0.0216)	
Labor force		−0.0107 (0.0076)	−0.0626*** (0.0241)	−0.0394 (0.0488)
Openness		−0.0179** (0.0087)	−0.0236*** (0.0061)	−0.0623*** (0.0225)
Inflation		−0.0004*** (0.0001)	−0.0005*** (0.0001)	−0.0018* (0.0010)
Life expectancy		−0.0271 (0.0318)		−0.4167*** (0.1601)
Urbanization	0.0041 (0.0051)			
Human capital*Gini index				−0.0173 (0.0543)
Constant	0.2330 (0.1351)	0.1633 (0.1895)	0.2483 (0.1915)	2.1651 (0.8149)
Cross sections	31	31	31	31
Instruments	22	31	29	18
Hansen test	0.204	0.288	0.651	0.847
AR (1)	0.028	0.008	0.013	0.000
AR (2)	0.651	0.429	0.974	0.561

Notes: The values in parentheses are the standard errors. The values for AR (1), AR (2), and the Hansen test are the *p*-values. ***, **, and * denote 1%, 5%, and 10% levels of significance.

AR (1), first-order autocorrelation; AR (2), second-order autocorrelation.

inequality is not statistically significant. This implies that the effect of inequality in income distribution on economic growth via the human capital channel is tenuous in the SSA region.

4.4 Analysis of the effect of income inequality on economic growth via the political economy (fiscal policy) channel

The result in Column 1 of Table 7 shows that the coefficient of the Gini index is positive and statistically insignificant. This result suggests that an upward trend in income inequality is likely to increase government expenditure. Urbanization also increases government expenditure, as the coefficient is positive and statistically significant at 1%. This indicates that urbanization is a core driver of GGOV through increased spending on provision/maintenance of socioeconomic infrastructure, waste management, security, and so on.

Juxtaposing the coefficients of the Gini index in Columns 2 and 3, they are both negative. However, the estimate of the coefficient as shown in Column 2 is insignificant. With the inclusion of the GGOV in the growth equation (Column 3), the coefficient becomes statistically significant at 5%. This result shows that, through the GGOV channel, income inequality affects economic growth, i.e., income inequality impedes growth in the economy via this channel. The results in Column 4 indicate that income inequality has a significant, adverse effect on economic growth in the SSA region through the fiscal policy channel. The coefficient for the interaction term for government expenditure and the Gini index is negative and statistically significant at 5%. Therefore, the fiscal policy or the political economy is a strong avenue through which income inequality adversely affects economic growth in the SSA region. This finding conforms to theoretical descriptions. The estimated model also shows that the coefficient of the Gini index is significant and negative in its effect on growth.

Table 7. Effect of income inequality on economic growth via the fiscal policy channel

Dependent variable	General government expenditure	Per capita GDP	Per capita GDP	Per capita GDP
General government expenditure$_{t-1}$	1.0033*** (0.0050)			
Per capita GDP$_{t-1}$		1.0183*** (1.0183)	1.0182*** (0.0041)	1.0106*** (0.0150)
Gini index	0.0218 (0.0744)	−0.0307 (0.0327)	−0.0474** (0.0211)	−0.0016** (0.0574)
Gross capital formation		0.0007 (0.0020)	−0.0125 (0.0099)	0.0683*** (0.0214)
General government expenditure			0.0119 (0.0097)	
Life expectancy				−0.1193** (0.0612)
Labor force		0.0014 (0.0037)	0.0038 (0.0028)	−0.0084 (0.0182)
Inflation	−8.09e−06*** (1.57e−06)	1.46e−06*** (3.64e−07)	−0.0004*** (0.0001)	−0.0013* (0.0008)
Health care expenditure	0.0242* (0.0144)			
Urbanization	0.0137*** (0.0052)	0.0063*** (0.0015)	0.0048*** (0.0011)	
Openness				−0.0185 (0.0189)
Gini index*General government expenditure				−0.0568** (0.0268)
Constant	−0.2489 (0.3794)	−0.0544 (0.12780)	0.0253 (0.1207)	0.5546 (0.3173)
Cross sections	31	31	31	31
Instruments	24	29	21	20
Hansen test	0.583	0.293	0.336	0.570
AR (1)	0.048	0.001	0.002	0.000
AR (2)	0.346	0.831	0.958	0.850

Notes: The values in parentheses are the standard errors. The values for AR (1), AR (2), and the Hansen test are the *p*-values. ***, **, and * denote 1%, 5%, and 10% levels of significance.

AR (1), first-order autocorrelation; AR (2), second-order autocorrelation.

4.5 Analysis of the effect of income inequality on economic growth via the fertility differential channel

Results from the estimated fertility model are shown in Column 1 of Table 8. The coefficient of income inequality is positive, suggesting that income inequality raises the fertility rates in SSA. This is in line with the hypothesized positive relationship between income inequality and fertility rate.

The coefficient of the contemporaneous per capita GDP is negative and statistically significant at 1%, with every 1% increase in income translating into about 0.15% decline in fertility rate. Higher income earners are likely to wish for a smaller number of children than the low-income earners, as they place a high premium on the investment per child. When income inequality increases, fertility tends to increase, while human capital investment (investment per child) declines. Individuals and households that are disproportionately poor tend to have little investment in child education and health. This finding is justifiable based on the inference from the economic analysis of fertility behavior, which indicated a trade-off between quality and quantity of children in rich and poor households [Liu et al., 1996; Odusanya and Adegboyega, 2015; Bonner and Sarkar, 2018; Hatton et al., 2018].

The coefficient of adolescent fertility rate (i.e., births per 1,000 women of ages 15–19 years) is positive and statistically significant at 1%. This indicates that higher adolescent fertility rate significantly increases the total fertility rate. The results in Column 2 are from the estimation of the growth model (excluding the measure of fertility). The results suggest that the coefficient of the Gini index is negative. This shows that income inequality is inimical to economic growth in the SSA region.

With the inclusion of the fertility rate in the growth model, the coefficient of income inequality becomes negative and is statistically significant at 10%, with a 1% increase in the Gini index leading to a decline of about 0.072% in per capita GDP. This reveals that fertility, as a key channel, hinders economic growth in SSA through income inequality. To further confirm the validity of this channel, we introduced the interaction term for the Gini index and fertility rate (Gini index*Fertility) into the growth model. The coefficient is

Table 8. Effect of income inequality on economic growth via the fertility channel

Dependent variable	Fertility rate	Per capita GDP	Per capita GDP	Per capita GDP
Fertility rate$_{t-1}$	1.0304*** (0.0198)			
Per capita GDP$_{t-1}$	0.1497*** (0.0435)	1.0082*** (0.0096)	1.0298*** (0.0147)	0.9853*** (0.0083)
Per capita GDP	−0.1473 (0.0438)			
Gini index	0.0098 (0.0158)	−0.0285 (0.0384)	−0.0729* (0.0409)	−0.0180 (0.0514)
Adolescent fertility rate	0.0083*** (0.0033)			
Infant mortality rate	−0.0146** (0.0072)			
Gross capital formation		0.0095** (0.0046)	0.0021 (0.0023)	−0.0268*** (0.0092)
Labor force		−0.0087* (0.0049)	−0.0051 (0.0046)	−0.0247** (0.0109)
Fertility rate			−0.0103 (0.0394)	
Openness		−0.0096* (0.0051)		−0.0285*** (0.0097)
Inflation		1.22e−06***	2.48e−06***	−0.0006***
		(3.73e−07)	(6.00e−07)	(0.0001)
Urbanization		0.0060*** (0.0021)	0.0104*** (0.0018)	
Life expectancy				−0.2286*** (0.0917)
Gini index*Fertility rate				−0.0686*** (0.0215)
Constant	−0.0910 (0.0637)	−0.0235 (0.1402)	0.0923 (0.1358)	1.2872 (0.5421)
Cross sections	31	31	31	31
Instruments	26	28	16	21
Hansen test	0.371	0.121	0.553	0.777
AR (1)	0.110	0.001	0.003	0.001
AR (2)	0.339	0.808	0.423	0.980

Notes: The values in parentheses are the standard errors. The values for AR (1), AR (2), and the Hansen test are the *p*-values. ***, **, and * denote 1%, 5%, and 10% levels of significance.

AR (1), first-order autocorrelation; AR (2), second-order autocorrelation.

negative and statistically significant at 5%. Thus, income inequality also affects growth through this channel. Many of the countries in the region (such as Mali, Niger, Nigeria, and so on) still have very high fertility rates.

5 Discussion and implications of findings

Theoretically, saving is the only channel through which income inequality could exert a positive effect on economic growth. We have confirmed this as the interaction term between saving and income inequality is positive and statistically significant. The results from the analysis of this channel imply that income inequality in the SSA region promotes, rather than inhibits, economic growth via this channel. This view is in line with the results of Voitchovsky [2005] and Yang and Greaney [2017]. This observation is quite reasonable for the SSA region, as few but stupendously rich individuals undertake massive investments in capital-intensive projects that promote economic growth.

We also find evidence for the validity of the credit market imperfection channel as a strong avenue through which income inequality influences economic growth in SSA. This hinges on the significance of the interaction term for the measure of credit market imperfection and income inequality, as well as the significance of the Gini index in the growth model that controlled for the measure of credit market imperfection. These findings corroborate those of Deininger and Squire [1998], Alesina and Perotti [1996], Perotti [1996], De Mello and Tiongson [2006], as well as Grundler and Scheuermeyer [2018]. The coefficient of the Gini index is negative and significant in the model on the measure of financial development. This reveals the negative consequences of income inequality on financial development. However, our finding on the validity of this channel is inconsistent with the study of Madsen et al. [2018]. Madsen et al. [2018] report a positive coefficient of the interaction between the Gini index and the measure of financial development for the OECD countries. This shows that the negative effect of income inequality is not transmitted via this channel in developed economies where capital markets are devoid of pronounced imperfections.

The impact of income inequality on economic growth through the human capital investment channel is negative. This is in line the theoretical argument that families/households with subsistence incomes lack investment in human capital (like enrolling their wards in schools) as poor individuals find it extremely difficult accessing quality education. This finding supports the findings of Mo [2000]. The negative value of the interaction of the human capital variable with the Gini index implies that income inequality retards growth via this channel. Other studies that confirm the validity of this channel include those by Deininger and Olinto [2000] and Cingano [2014].

The coefficient of the interaction term for GGOV and the Gini index is negative and statistically significant. This indicates that inequality in income distribution negatively affects economic growth via the fiscal policy pathway. Bleaney and Nishiyama [2004] find similar evidence. The coefficient of the Gini index becomes statistically significant in the growth model after the inclusion of the measure of fiscal policy. These results confirm the transmission of the effect of income inequality on growth through this channel and corroborate the findings of Persson and Tabellini [1994], Deininger and Squire [1998], and Pineda and Rodríguez [2006]. This is also consistent with the studies of Perotti [1996], Barro [2000], and Bagchi and Svejnar [2015]. In addition, the more an economic system is unequal, the more expedient becomes the redistribution, with more redistribution causing impediment to growth [Alesina and Rodrik, 1994; Persson and Tabellini, 1994].

The estimation result of the fertility model indicates a positive relationship between income inequality and fertility rate, i.e., as inequality in income increases, the fertility rate tends to rise. This finding corroborates the inference drawn by, among other authors, Liu et al. [1996] in their study on the Chinese economy, as well as Odusanya and Adegboyega [2015] for Nigeria. This notion relies on the concept that fertility tends to be high among the poor than the rich as rich households give higher preference to child quality than child quantity, i.e., they place high premium on investment per child and tend to give birth to lower number of children [see Bonner and Sarkar, 2018]. It is also in line with the view of Grundler and Scheuermeyer [2018] that poor parents see an increase in the family size as a means of increasing the family

income and bear more children for support during their old age. When income inequality is high, many people are disproportionately poor and are likely to place little or no premium on child quality, and they end up giving birth to higher number of children than do rich households.

6 Conclusion

The study explored the channels through which income inequality affects economic growth, as well as the direct effects of lopsidedness in income distribution on growth in the economies of SSA countries. We deduced that income inequality influences economic growth strongly via the saving, credit market imperfection, and the fiscal policy (or political economy) channels, while the fertility and human capital investment pathways are weak. The saving channel is the only pathway through which income inequality affects economic growth positively. This finding is consistent with the view of Kaldor [1956] that income inequality affects capital accumulation and economic growth positively through savings of the disproportionately rich. Findings on the credit market imperfection channel specifically indicate that high rate of income inequality causes fettered access to investible funds by poor individuals in SSA. It debars them from undertaking profitable investments. Barro [2000] specifically noted that the credit market imperfections channel has more implications for growth in the poor countries than in the rich countries.

Our findings also suggest that income inequality directly undermines human capital accumulation in SSA. Currently, the region has a very high number of children from poor homes, who are out of school. The interaction of the human capital variable with the Gini index is negative and thus shows that income inequality retards growth via this channel. These findings have serious implications for the achievement of Goal 6 of the Sustainable Development Goals [United Nations, 2015], which focuses on ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. The achievement of this goal may be difficult in many SSA countries.

We also found evidence for the negative effect of income inequality on growth via the fiscal policy mechanism. The reasons behind these findings are not far-fetched. With high disparity in income inequality in the SSA region, the redistribution expenditure of the government rises. This increases the recurrent components of government expenditure due to spending on special intervention programs and projects to mitigate the effects of income inequality. It unduly increases government transfers to poor households. It also causes a reduction in the capital expenditure relative to recurrent expenditure and reduces the incentive for investments in capital projects that will genuinely promote productivity and growth in the economy. One other important inference from this study is the adverse effect of income inequality on growth via the fertility channel. Perotti [1996] has inferred that societies that are more equal have lower fertility rates but higher rates of investment in education. Evidence from the World Development Indicators (WDIs) of the World Bank [2015] reveals that the OECD member countries have an average fertility rate of 1.75 per woman, while countries in the SSA region have an average fertility rate of five births per woman. Thus, income has an inverse relationship with fertility, while income inequality has a direct relationship with fertility.

Based on the findings, the study recommends the following:

a) Due to the significance of credit market imperfection in the income inequality–growth nexus, there is a need to put in place policies that will remove rigidities in the financial market toward providing equal and better access to loanable funds. This is achievable via deliberate monetary policy initiatives that will reduce the cost of borrowing and minimize inaccessibility to funds by low-income earners. This will increase productivity, reduce income inequality, and enhance growth.
b) Efforts should be geared toward improving the capital components of government expenditure relative to the recurrent or redistributive components toward provision of quality socioeconomic infrastructure. This has the tendency to improve the business environment; promote innovations, self-employment, and investments; stem income inequality; and reduce redistributive spending.
c) Government should initiate policies that will alleviate the challenges of human capital accumulation for the disproportionately poor. This could involve massive investment in education at all levels of the

government, as well as increased funding for research and development. The promotion of human capital accumulation is vital given its long-term socioeconomic implications.

d) High fertility has been found to increase income inequality and inhibit economic growth in the SSA region. Therefore, efforts should be geared toward improving the knowledge and practice of family planning in the region.

It is important to reiterate that the current study could not examine the sociopolitical instability channel due to lack of data on its measures for most SSA countries. Hence, further studies need to explore this channel for the region in order to understand how income inequality-induced sociopolitical crises or protests affect economic growth.

References

Alesina, A., Perotti, R. (1996), Income distribution, political instability and investment, *European Economic Review*, Vol. 40, No. 6, pp. 1203–1228.

Alesina, A., Rodrik, D. (1994), Distributive politics and economic growth, *Quarterly Journal of Economics*, Vol. 109, pp. 465–490.

Bagchi, S., Svejnar, J. (2015), Does wealth inequality matter for growth? The effect of billionaire wealth, income distribution and poverty? *Journal of Comparative Economics*. doi: 10.1016/j.jce.2015.04.002.

Barro, R.J. (2000), Inequality and growth in panel of countries, *Journal of Economic Growth*, Vol. 5, pp. 5–32.

Barro, R.J. (2008), Inequality and growth revisited, ADB *Working Paper Series on Regional Economic Integration* No. 11, Asian Development Bank, pp. 1–14.

Bhorat, H., Naidoo, K. (2018), Economic growth and the pursuit of inequality reduction in Africa, Working Paper of the Group of 24 and Friedrich Ebert Stiftung, New York.

Bleaney, M., Nishiyama, A. (2004), Income inequality and growth: does the relationship vary with the income level? *Economic Letters*, Vol. 84, No. 3, pp. 349–355.

Blundell, R., Bond, S. (1998), Initial conditions and moment restrictions in dynamic panel data models, *Journal of Econometrics*, Vol. 87, pp. 115–143.

Bonner, S., Sarkar, D. (2018), The quality-quantity trade-off among Australian children, *Economic Modelling*, Vol. 70, pp. 383–389.

Charles-Coll, J.A. (2013), The debate over the relationship between income inequality and economic growth: does inequality matter for growth? *Research in Applied Economics*, Vol. 5, No. 2, pp. 1–18.

Cingano, F. (2014), Trends in income inequality and its impact on economic growth, OECD *Social, Employment and Migration Working Papers*, No. 163, World Bank, Washington.

De Mello, L., Tiongson, E.R. (2006), Income inequality and redistributive government spending, *Public Finance Review*, Vol. 34, No. 3, pp. 282–305.

Deininger, K., Olinto, P. (2000), Asset distribution, inequality and growth, *World Bank Policy Research Paper* No. 2375, World Bank.

Deininger, K., Squire, L. (1998), New ways of looking at old issues: inequality and growth, *Journal of Development Economics*, Vol. 57, pp. 259–287.

Ferreira, F.H.G. (1999), Inequality and economic performance: a brief overview of theories of growth and distribution, retrieved from http://www.worldbank.org/poverty/inequal/index.htm.

Galor, O., Zeira, J. (1993), Income distribution and macroeconomics, *The Review of Economic Studies,* Vol. 60, No. 1, pp. 35–52.

Gouveia, M., Masia, N.A. (1998), Does the median voter model explain the size of government?: evidence from the States, *Public Choice*, Vol. 97, pp. 159–177.

Grundler, K., Scheuermeyer, P. (2018), Growth effects of inequality and redistribution: what are the transmission channels? *Journal of Macroeconomics*, Vol. 55, pp. 293–313.

Hatton, T.J., Sparrow, R., Suryadarma, D., van der Eng, P. (2018), Fertility and the health of children in Indonesia. *Economics and Human Biology*, Vol. 28, pp. 67–78.

Kaldor, N. (1956), Alternative theories of distribution, *The Review of Economic Studies*, Vol. 23, No.2, pp. 83–100.

Keefer, P., Knack, S. (2002), Polarization, politics and property rights: links between inequality and growth, *Public Choice,* Vol. 111, pp. 127–154.

Kennedy, T., Smyth, R., Valadkani, A., Chen, G. (2017), Does income inequality hinder economic growth? New evidence using Australian taxation statistics. *Economic Modeling*, Vol. 65, pp. 119–128.

Knowles, S. (2005), Inequality and economic growth: the empirical relationship reconsidered in the light of comparable data. *CREDIT Research Paper* No. 01/03. Centre for Research in Economic Development and International Trade, University of Nottingham.

Liu, G.G., Yamada, T., Yamada, T. (1996), Economic analysis of Chinese fertility behaviour. *Social Science and Medicine*, Vol. 42, No. 7, pp. 1027–1037.

Madsen, J.B., Islam, M.R., Doucouliagos, H. (2018), Inequality, financial development and economic growth. *European Economic Review*, Vol. 101, pp. 605–624.

Mo, P.H. (2000), Income inequality and economic growth, *KYKLOS,* Vol. 53, pp. 293–316.

Ncube, M., Anyanwu, J.C., Hausken, K. (2013), Inequality, economic growth and poverty in the Middle East and North Africa (MENA), *Working Paper Series No. 195,* African Development Bank, Tunis.

Neves, P.C., Silva, S.M.T. (2014), Inequality and growth: uncovering the main conclusions from the empirics, *The Journal of Development Studies*, Vol. 50, No. 1, pp. 1–21.

Odusanya, I.A., Adegboyega, S.B. (2015), Impact of income, schooling and mortality on fertility in Nigeria, *Ife Journal of the Humanities and Social Studies*, Vol. 2, No. 1, pp. 1–12.

Perotti, R. (1996), Growth, income distribution and democracy: what the data say, *Journal of Economic Growth*, Vol. 1, pp. 149–187.

Persson, T., Tabellini, G. (1994), Is inequality harmful for growth? *The American Economic Review*, Vol. 84, No. 3, pp. 600–621.

Pineda, J., Rodríguez, F. (2006), The political economy of investment in human capital, *Economics of Governance*, Vol. 7, pp. 167–193.

Svensson, J. (1998), Investment, property rights and political instability: theory and evidence, *European Economic Review,* Vol. 42, pp. 1317–1341.

Sylwester, K. (2000), Income inequality, education expenditures, and growth, *Journal of Development Economics,* Vol. 63, pp. 379–398.

UNDP (2017), Income inequality trends in sub-Saharan Africa: divergence, determinants and consequences, in: A. Odusola, G. Cornia, H. Bhorat, P, Conceição, (Eds), A Publication of United Nations Development Programme (UNDP), New York.

United Nations (2015), Transforming our world: the 2030 agenda for sustainable development. https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf

Voitchovsky, S. (2005), Does the profile of income inequality matter for economic growth? Distinguishing between the effects of inequality in different parts of the income distribution. *Journal of Economic Growth*, Vol. 10, No.3, pp. 273–296.

World Bank. (2015), *World Development Indicators*, World Bank, Washington, DC.

Yang, Y., Greaney, T.M. (2017), Economic growth and income inequality in the Asia-Pacific region: a comparative study of China, Japan, South Korea and the United States. *Journal of Asian Economics*, Vol. 48, pp. 6–22.