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FINANCIAL DEVELOPMENT AND INCOME INEQUALITY IN SUB-SAHARAN AFRICAN COUNTRIES

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ABSTRACT

The objective of this study is to analyze the effect of financial development on income inequality in sub-Saharan Africa. Unlike previous work on African countries, we adopt a non-linear approach using the Panel Smooth Transition (PSTR) model. Our panel is composed of 17 sub-Saharan African countries with a period ranging from 1980 to 2018. Data were extracted from various sources. The results suggest an inverted U-shaped relationship between financial development and income inequality. Facilitating access to credit could enable historically marginalized segments of the population to participate fully in the economy. The non-linear inverted-U effect shows that increasing financial development can lead to greater equality. Furthermore, the significant effects of urbanization, economic growth and inflation on income inequality show that financial development measures need to be supported by good urban planning, sustained economic growth and inflation control.

Keywords: Financial development, income inequality, PSTR, Sub-Saharan Africa

1. INTRODUCTION

The rapid rise in income inequality in recent decades is one of the most worrying problems facing the international community. Income inequality refers to the relative income gaps in the overall population in a given geographic area. (Bourguignon, 2004). A significant increase in these income gaps within society can be harmful to economic growth.

There are other channels through which inequality could undermine economic growth. In particular, excessive inequality would lead to high levels of crime and violence in all its forms by the most disadvantaged, and even to armed conflicts that jeopardize the dynamics of economic and social systems, all of which would contribute to the slowdown in economic growth. According to Alesina and Perotti (1996), inequality can lead to socio-political instability that threatens property rights. This threat to property rights can discourage investors and slow down economic activity. For Barro (2000), redistribution reduces crime and anti-social activities. In the same vein, Putman (2000) points out that reducing social cohesion through inequality would reduce the financing of public goods, which would be detrimental to economic growth.

In view of these many consequences, income inequality is a major concern for States, particularly for African countries. Thus, among the Sustainable Development Goals (SDGs), the theme of

reducing inequalities occupies a major place. Since the problems of income inequality can be economic, some economists suggest that financial sector development can play an important role in reducing inequality. Galor and Zeira (1993) and Banerjee and Newman (1993) predict a negative linear relationship between financial development and income inequality. On the other hand, some economists predict a positive linear relationship between financial development and inequality Rajan and Zangales (2003), financial intermediaries only transact with the rich because of their ability to offer collateral. Thus, financial development only benefits the rich and increases inequality.

Contrary to these conceptions, Greenwood and Jovanovic (1990) predict a non-linear relationship in the shape of an inverted U-shape between financial development and inequality. This theory implies that at the beginning of financial development, inequality increases due to the costs of access that discourage the poor, and then decreases, as there are more and more economic agents in the financial sector. To reduce income inequality in Africa, several policies have been implemented by the different governments of different African countries. The objective of this strategy was to promote the financial inclusion of the poor and excluded from the formal financial system in order to enable them to benefit from a wide range of microcredit products. This strategy was strengthened in 2013. Some initiatives to reduce inequalities have been taken in favour of women. These initiatives aim to ensure women's economic empowerment. These funds enable women to access financial resources to create or strengthen income-generating activities (IGAs). These initiatives are reinforced by the Women's Empowerment and Demographic Dividend in the Sahel (SWEDD) project aimed at reducing women's inequalities and vulnerability by increasing their empowerment with a view to achieving the demographic dividend.

Despite these many policies to reduce inequalities, sub-Saharan Africa has remained one of the most unequal regions in the world. Today, it is home to 10 of the 19 most unequal countries in the world (UNDP report, 2017). While major indicators of financial development show that financial sectors have developed rapidly in most SSA countries since the early 1990s. In addition, SSA banks remain dominant institutions that provide credit, mainly to large companies. Despite excess liquidity, firms, entrepreneurs, and households struggle to access finance in many countries, even with limited maturities (Gelbard et al, 2014).

These facts show that despite the improvement in the financial development index in sub-Saharan Africa, income inequality still remains high. This paradoxical evolution is the basis of the object of our study. The overall objective of this study is therefore to analyze the effect of financial development on reducing inequality in sub-Saharan Africa. To carry out this investigation, the rest of the document is organized as follows: section 1 literature review, section 2 methodology, section 3 results and discussions and section 4 conclusion.

2. LITERATURE REVIEW

The relationship between financial development and the reduction of inequality has been the subject of much debate in the economic literature. To this end, two theoretical approaches oppose economists. One predicts that the relationship between financial development and inequality is linear (Lamoreaux, 1995). On the other hand, the other predicts that this relationship is non-linear (Greenwood and Jovanovic, 1990). At the empirical level, some work confirms that the relationship between financial development and inequality is linear and positive. Other authors show, however,

that this relationship is linear and negative. It should be noted that other authors have found no relationship between financial development and inequality.

For African countries, several empirical studies have also been conducted on the relationship between financial development and the reduction of inequalities. In this case, Adams and Klobodou (2016) conducted their study on a sample of 21 countries in Sub-Saharan Africa, including Côte d'Ivoire, for the period from 1985 to 2011. After applying the pooled mean group (PMG) estimator, the empirical results of these authors show that the two indicators of financial development used have a positive impact on inequality. However, these results have been called into question by the work of Meniago and Asongu (2018). Indeed, they used data from 48 African countries covering the period 1996 to 2014. Using the GMM estimator, their results showed that financial development, in terms of depth and efficiency, reduces income inequality. These contradictory results could be explained by the study periods and also by the sample size used. Also, at the African level, Jobarteh and Kaya (2019) used annual data from 23 African countries covering the period from 1990 to 2014. The estimation results of the regime-change model used by these countries indicate that financial development increases income inequality in the African countries studied.

Pour leur part, Chen et Kinkyo (2016) ont quant à eux, étudié la relation entre le développement financier et la réduction des inégalités pour un panel de 88 pays sur la période allant de 1961 à 2012. Pour ce faire, ils ont utilisé le crédit domestique privé rapporté au PIB comme proxy du développement financier. Comme modèle économétrique, ils ont utilisé un modèle ARDL en panel. Après avoir appliqué l'estimateur PMG, les résultats obtenus indiquent que le développement financier réduit les inégalités à long terme. Mais, à court terme, le développement financier accroît les inégalités dans les pays étudiés.

While some researchers have found a linear relationship between financial development and inequality in developing countries, others have found no relationship at all. In particular, Azleen and Mansur (2017) who studied the long-term dynamics between financial development and income inequality in Malaysia over the period 1970 to 2007. To reach their conclusions, they used the bound-test approach for cointegration. They conclude that financial development has no effect on income inequality in Malaysia. Similarly, Khan et al. (2018) studied the impact of financial development on inequality in three developing countries in Asia: Bangladesh, India, and Pakistan. After applying tests and estimation techniques, they conclude that financial development has no impact on inequality in the three Asian countries studied. According to the authors, these results imply that these developing countries are not effectively allocating domestic private credit to poor **segments of the population.**

In sum, the empirical results reported in the review are often contradictory. Indeed, while some studies indicate a positive relationship between financial development and inequality, others suggest a negative relationship while some argue that there is no relationship at all. This variability could be better explained by contextual factors (the economic structure of the countries studied), the limitations of methodologies (PMG, GMM, ARDL), which postulate a linear relationship between financial development and income inequality. It should also be noted that these methods are limited in capturing complex dynamics that evolve over time, especially in contexts where threshold effects may exist, which can influence the results. In addition, study periods and sample sizes vary considerably from study to study, making it difficult to compare

results. In the next section, we will present our methodology as well as the data used and their source.

3. METHODOLOGY AND DATA

In contrast to existing studies that support a linear relationship, we propose an empirical approach to a non-linear relationship between financial development and income inequality in sub-Saharan Africa. To do this, we choose to use a flexible transition panel threshold model (PSTR). Indeed, the economic and social specificities of sub-Saharan Africa, marked by persistent inequalities and varying levels of development, make the PSTR particularly suitable for modeling the nuances of this complex reality. In this section, and as we have pointed out above, we will present our methodology on the one hand and the sources of the data used on the other.

3.1 Econometric model

In this subsection, we first present the specified model and then the estimation method used.

To specify our model, we drew on the work of Azleen and Mansur (2017). But unlike the authors who have adopted a linear approach, we favor a non-linear approach between financial development and income inequality using the PSTR model. This model is advantageous over Hansen's (1999) PTR model, which involves abrupt regime changes.The PSTR allows for the capture of more gradual regime transitions, which is often more realistic in economic and social phenomena. Second, it is particularly suitable for handling the non-linearity and endogeneity frequently encountered in panel data. Finally, it offers the possibility of modeling heterogeneity between individuals and over time, by allowing the coefficients of the model to vary according to the level of the transition variable in this case, financial development. From the above,

The main equation is written as follows:

$$GNI_{it} = \alpha_i + \delta_1 CBSP_{it} + \delta_n X_{it} + \sum_{j=1}^{r} (\beta_{1j} CBSP_{it} + \beta_{nj} X_{it}) * g(\mathrm{CBSP}_{it}; \gamma_j; c_j) + \mu_{it} \quad [1]$$

where GNI and CBSP represent respectively the level of inequality, measured by the Gini index and the financial development captured by the ratio of bank credit granted to the private sector as a percentage of GDP. Several indicators are used in the literature to measure financial development. However, in the case of our study, we used the ratio of bank credit to the private sector as a percentage of GDP. It is the main component of financial development in African countries [Keho, 2012].

μ_{it} is the error term and α refers to the individual fixed effect factor. X represents the variables controlling for inequality. As control variables, we will use climate variability, urbanization, economic growth, macroeconomic stability, fiscal policy.

r represents the number of transition functions included in this PSTR template and the template contains r+1 schemes corresponding to the transition variable. In addition, γ_j is the slope parameter describing the speed of transition between the schemes and c_j is the location parameter

for each transition function. The transition function $g(.)$ is a continuous function from 0 to 1 with the variable transitions (CBSP). The transition function is set up in the form of a logistics transition function written as:

$$g(\text{CBSP}_{it};\gamma_j;c_j)=\left\{1+\exp\left[-\gamma_j\prod_{j=1}^{m}(\text{CBSP}_{it}-c_j)\right]\right\} \qquad (2)$$

$\gamma_j>0; c_1\le c_2\le\ldots\le c_m$

The elasticity coefficient of urbanization to inequality for country i at time t is calculated as the following equation (3).

$$e_{it}=\frac{\partial GNI_{it}}{\partial CBSP_{it}}=\delta_1+\sum_{j=1}^{r}g(\text{CBSP}_{it};\gamma_j,c_j)*\beta_{1j} \qquad (3)$$

The value of this coefficient can be considered as the weighted average of the elasticity coefficients β_{1j} Obtained from R+1 transitional schemes.

3.1.1: Method of estimating the PSTR

We performed the usual preliminary tests in panel data, namely the correlation test, the global homogeneity test, the dependency test. Subsequently, we perform the tests prior to the estimation of the PSTR model. These are the linearity test and the remaining linearity test. To detect the potential presence of regime transitions, a linearity test is performed. The rejection of the null hypothesis of linearity suggests the existence of a nonlinear relationship between variables. Secondly, if the nonlinearity is confirmed, the optimal number of regimes [r] must be identified. For linearity tests, this study considers one or two localization parameters, the latter being usually sufficient to capture the complexity of nonlinear relationships. Assuming the null hypothesis of linearity [H0], the PSTR model presents a problem in identifying the nuisance parameters. To overcome this difficulty, Gonzalez et al (2005) propose a solution by replacing the transition function with its first-order linear approximation around a specific point. In doing so, the auxiliary regression model takes the following form:

$$GNI_{it}=\alpha_i+\tau_0^{'}x_{it}+\tau_1^{'}x_{it}CBSP_{it}+\ldots+\tau_m^{'}x_{it}CBSP_{it}^{m}+\mu_{it}^{*} \qquad [4].$$

where $x_{it}=(GNI_{it},\text{CBSP}_{it},\ln URB_{it})$ ***et*** $\tau_1^{'},\ldots,\tau_m^{'}$ ***are multiples of*** γ_1. $\mu_{it}^{*}=\mu_{it}+R_m\tau_1^{*}x_{it}$ ***and*** R_m ***represents the remainder of Taylor's expression. Thus, testing the linearity relationship between urbanization, climate variability, and income inequality is the same as testing*** $H_0^{*}=\tau_1^{'}=\tau_2^{'}=\ldots=\tau_m^{'}=0$.

As for the null hypothesis of the nonlinearity test, it takes the following form:

$$GNI_{it}=\alpha_i+\tau_0^{'}x_{it}+\tau_1^{'}x_{it}g_1(\text{CBSP}_{it};\gamma_1,c_1)+\tau_{21}^{'}x_{it}CBSP_{it}$$
$$+\tau_{22}^{'}x_{it}CBSP_{it}^{2}+\ldots+\tau_{2m}^{'}xCBSP_{it}^{m}+\mu_{it}^{*} \qquad [5].$$

In this case, the null hypothesis $\gamma_2 = 0$ ***is equivalent to*** $H_0^* = \tau_{21}^{'} = \tau_{22}^{'} = ... = \tau_{2m}^{'} = 0$***. Similarly, the procedure consists of comparing the null hypothesis*** $H_0 : r = r*$ ***with the alternative hypothesis*** $H_1 : r = r^* + 1$ ***considering a model with*** $r*$ ***transition functions.***

In addition, to avoid using unnecessarily large models, the level of significance must be continually reduced by a constant factor $\tau(0 < \tau > 1)$ ***at each stage of the sequential test. We postulate τ = 0,5 as did Gonzalez and al. (2005). The remaining nonlinearity test will not end until we accept the null hypothesis.***

3.2. Data

Our panel is made up of 17 countries in sub-Saharan Africa with a period ranging from 1980 to 2018. Data were extracted from a variety of sources. Data for the Gini Index come from the United Nations University's Global Income Inequality Database (WIID) (UNU WIDER). The data are based on household surveys, which can introduce biases related to how income is reported. Households may underestimate their income or omit certain sources of income, especially informal income. Data on bank credit to the private sector are from the World Bank's World Development Indicators (WDI). The data may not capture the entire financial sector, especially in countries where a significant portion of transactions occur outside the formal banking system. This can lead to an underestimation of the credit available to the private sector. Data on climate variability from the CRU (Climatic Research Unit) database. While this data is sufficient for many countries and over a long period of time, it may not capture important local variations, which is crucial for some studies on climate change impacts. The other indicators come from WDI. These variables sometimes have data shortages for some countries in a given year and may contain measurement errors.

Table 1 : Summary Of Variable's Description

Variable	Code	Measure	Expected signs	Source
Explained variable				
Income inequality				
	GNI	GINI Index		WIID
Explanatory variables				
Urbanization	URB	Number of the population in urban areas	Nonlinear	WDI
Climate variability	PRECIP	Rainfall	Nonlinear	CRU
Economic growth	PIBHC	GDP per capita [2015 constant US dollars]	Nonlinear	WDI
Macroeconomic stability	INFL	GDP deflator [% annual]	-	WDI
Fiscal policy	DEPUB	Government final consumption expenditure [% of GDP]	+/—	WDI
Financial development	CBSP	Bank credit ratio to the private sector as a % of GDP	+/—	WDI

Source: author, based on the literature review

4. RESULTS AND DISCUSSIONS

In this section, we present the results of the preliminary tests of the PSTR model as well as the main results of our study. Preliminary testing of panel data is presented in the appendix.

4.1. Preliminary Testing

Before the PSTR model is estimated, two main tests are performed. Those that make it possible to assess the non-linear nature of the relationship. Then the number of regimes associated with this nonlinearity. ***The results used to detect structural breaks in the relationship between inequality and financial development strongly reject the hypothesis of a linear relationship at the 1% threshold for the two specified models***

- **Linearity testing**

The results used to detect structural breaks in the relationship between inequality and urbanization strongly reject the hypothesis of a linear relationship at the 1% threshold for the two specified models.

Table 2 : Linearity Test Result

	LM Stat	LM_F Stat	LRT Stat
m=1	25,817***	5,194***	26,333***
	(0,000)	(0,000)	(0,000)
m=2	59,351***	6,253***	62,177***
	(0,000)	(0,000)	(0,000)

Source: *Author, based on data from the World Income Inequality Database (2022), World Development Indicator (2022) and Climatic Research Unit (2023)*
Note: (***) denotes significance at the 1% threshold

Since the nonlinear relationship between the study variables is confirmed, let's test the optimal number of schemes.

Table 3: Results of the remaining nonlinearity test

	LM Stat	LM_F Stat	LRT Stat
m=1	4,303	0,824	4,317
	(0,507)	(0,533)	(0,505)
m=2	22,810**	2,230**	23,212**
	(0,011)	(0,015)	(0,010)

Source: *Author, based on data from the World Income Inequality Database (2022), World Development Indicator (2022) and Climatic Research Unit (2023)*
Note: (**) denotes significance at the 5% threshold

Looking at the results of the remaining nonlinearity test, two opposing results emerge. First, in the model with a single position parameter, the null hypothesis is accepted. So, the appropriate model is the one with a single threshold. Second, in the model with 2 position parameters, the null hypothesis is rejected at the 5% threshold. So, there is more than one threshold. However, this empirical finding that there is more than one threshold in the relationship between inequality and urbanization has no theoretical basis. Therefore, for the purposes of our research, the optimal choice is the PSTR model with a single position parameter, a threshold, and 2 schemes.

4.2. Presentation and Discussion of the Main Results.

The PSTR model, estimated using the nonlinear least squares method, is characterized by two main parameters: the slope parameter and the location parameter. The slope parameter measures the speed at which the transition occurs between the linear and nonlinear components, while the location parameter determines the threshold at which the transition occurs. The results of our estimates are shown in Table 4 below.

Table 4 : PSTR results

	Linear component	**Nonlinear component**
	Transition Variable : Precip	
	Linear component	Nonlinear component
	Coefficient (t-statistique)	Coefficient (t-statistique)
LnPURB	**0,454***** **(6,336)**	**0,043** **(1,351)**
LnPIBHC	-0,522*** (-4,236)	0,217 (1,368)
INFL	0,676** (1,946)	-0,975*** (-2,605)
CBSP	0,941 (1,537)	-2,207*** (-2,763)
DEPUB	-0,007 (-0,394)	0,032 (1,686)
Slope Parameter	31,479	
Location parameter	6,230	
RSS	58,877	
AIC	-2,365	
BIC	-2,284	

Source: Author, based on data from the World Income Inequality Database (2022), World Development Indicator (2022) and Climatic Research Unit (2023)
Note: (***); (**) denotes significance at the 1% and 5% thresholds

The results in Table 4 indicate the existence of an inverted U-shaped relationship between financial development and income inequality. In the linear component, the effect is positive, but not significant, while in the nonlinear component, it is negative and significant, with an estimated elasticity of -1.266 or (0.941 - 2.207). This means that a 1% increase in gross credit to the private sector leads to a decrease in inequality of 1.266 units.

Our result reveals several important economic implications. First, the estimated elasticity of -1.266 suggests that an increase in gross credit to the private sector can play a significant role in reducing inequality. This shows the importance of increased access to finance for households and businesses, especially for the most vulnerable. Facilitating access to credit could enable historically marginalized segments of the population to participate fully in the economy. Second, the inverted U-shaped nonlinear effect shows that increasing or boosting financial development can lead to greater equality. This could mean that a policy focused on financial development, especially for

SMEs and national entrepreneurs or national champions, can contribute to significant economic growth that will benefit a wider segment of the population, while thus reducing income disparities.

Our findings also make the case for government policies to support the financial sector. This could include incentives for financial institutions to provide loans at affordable interest rates or microfinance programs. Such measures could encourage the emergence of new businesses and self-employment, thus contributing to a fairer distribution of income. In addition, urbanization has a positive and significant elasticity estimated at 0.454. In the nonlinear component, this elasticity amounts to 0.497 or (0.454 + 0.043), although it is not significant. A 1% increase in the urban population leads to a 0.45% increase in inequality. In addition, we see a reduction in inequality of 0.522% following a 1% increase in GDP per capita. In contrast to economic growth, the elasticity of inflation (INFL) is positive and significant in the linear component, and becomes negative and significant in the nonlinear component, with values of 0.676 and -0.299 respectively, i.e. (0.676 - 0.975). Specifically, a 1% increase in the inflation rate leads to an increase in inequality of 0.676 units.

5. Conclusion

Despite the improvement in the financial development index in sub-Saharan Africa, income inequality remains high. It is in this context that this study analyzes the effect of financial development on reducing inequality in sub-Saharan Africa. Unlike previous work on African countries, we take a non-linear approach using the Panel Smooth Transition Model (PSTR). Our panel is made up of 17 countries in sub-Saharan Africa with a period ranging from 1980 to 2018. Data were extracted from a variety of sources. The results suggest an inverted U-shaped relationship between financial development and income inequality. This shows the importance of increased access to finance for households and businesses, especially for the most vulnerable. Facilitating access to credit could enable historically marginalized segments of the population to participate fully in the economy. The nonlinear inverted U-shaped effect shows that increased financial development can lead to greater income equality in sub-Saharan Africa.

On the other hand, a 1% increase in the urban population leads to a 0.45% increase in inequality. In addition, we see a reduction in inequality of 0.522% following a 1% increase in GDP per capita. A 1% increase in the inflation rate leads to an increase in inequality of 0.676 units. These findings all imply that to reduce income inequality, measures of financial development must be supported by good urban planning, sustained economic growth, and inflation control.

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ANNEX

Table 5: Descriptive statistics for all countries

Variable	N	Moyenne	Ecart-type	Maximum	Minimum
GNI	663	0,607	0,060	0,776	0,477
lnPURB	663	15,083	1,215	11,904	18,406
PRECIP	663	912,088	503,961	2134,8	75,9
lnPIBHC	663	7,189	0,924	5,396	9,451
INFL	663	0,102	0,180	-0,296	2,190
DEPUB	663	0,141	0,052	0	0,300
CBSP	663	0,178	0,136	0,015	0,782

Source: *Author, based on data from World Income Inequality Database (2022), World Development Indicator (2022) and Climatic Research Unit (2023)*

Table 6: Variable correlation matrix

Variable	GNI	lnPURB	PRECIP	lnPIBHC	INFL	DEPUB	CBSP
GNI	1,000						
lnPURB	-0,023	1,000					
PRECIP	-0,241	-0,066	1,000				
lnPIBHC	0,231	0,283	0,129	1,000			
INFL	-0,187	-0,092	0,162	-0,025	1,000		
DEPUB	0,210	-0,168	0,299	0,384	-0,186	1,000	
CBSP	0,502	-0,207	-0,431	0,192	-0,339	0,329	1,000

Source: *Author, based on data from World Income Inequality Database (2022), World Development Indicator (2022) and Climatic Research Unit (2023)*

Table 7: Fisher Homogeneity Test Results

	FISCHER	HSIAO
Stat Chi2	42,01***	37,12***
Prob	(0,000)	(0,000)

Source: Author, based on data from World Income Inequality Database (2022), World Development Indicator (2022) and Climatic Research Unit (2023)
Note: (***) denotes significance at the 1% threshold

Table 8: Results of the Breusch Pagan test of interindividual independence (1980)

Stat chi2	1908.037
Prob	0.0000

Source: Author based on WIID, CRU and WDI data

Note: (***) denotes significance at the 1% threshold.

Table 9: Second Generation Unit Root Test Results

Variable	Ordre
Gini	I(0)
PURB	I(0)
PRECIP	I(0)
PIBH	I(1)
Infl	I(0)
Depub	I(0)
CBSP	I(1)

Source: Author based on WIID, CRU and WDI data

Note: (***) denotes significance at the 1% threshold.