




Financial Inclusion and Income Inequality in Sub-Saharan Africa: Taking Socio-Cultural Particularities into Account

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Abstract

According to the United Nations 2030 Agenda for Sustainable Development, financial inclusion has a crucial role to play in achieving sustainable development goals in this case, reducing inequalities and reducing poverty. Certain cultures can be at the root of financial system imperfections and therefore influence financial inclusion and its effect on income inequality. This work analyzes the effect of financial inclusion on income inequalities in sub-Saharan African countries, taking into account cultural particularities. The data cover the period from 2002 to 2015 and are analyzed by the dynamic panel method generalized method of moments (GMM). Our overall sample is made up of 27 countries of sub-Saharan Africa grouped into 4 sub-groups: countries with predominantly Christian obedience, countries with obedience dominated by Islam, countries with French as the official language, and countries with English as official language. The first two are distinguished by the fact that Islam forbids interest-bearing savings and loans. The latter two have known different colonial systems which have forged their attitude to public life differently. Our results show that financial inclusion contributes to reducing income inequality in all the SSA countries considered, and also in the Christian-dominated and French-speaking countries. We found no effect of financial inclusion in Islamic-dominated and English-speaking countries. Similarly, we found evidence of an inverted U-shaped relationship in all the Sub-Saharan African countries considered and in Christian-dominated countries only. These results suggest on the one hand that the socio-cultural aspect has an influence on the relationship between financial inclusion and income inequality and the other hand that financial inclusion may be essential to reduce income inequality in SSA countries, but that it is important to tailor it taking into account the cultural, religious, political, institutional, and structural specificities of each country's economy to have even more significant effects. Given this interference of socio-cultural and political factors on financial inclusion and its effect on income inequality, in addition to ensuring an effective regulatory system and a sound institutional framework, financial and public authorities should capitalize on the cultural and religious fiber to raise awareness on the use of financial

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products and services in order to improve financial access and its effect on wealth redistribution.

Keywords Financial inclusion · Inequality · Poverty · Financial development · Cultural factors · Sub-Saharan Africa

Introduction

Many studies have tried to explain income inequalities in terms of externalities to which people in a certain area are subject and advantages linked to people's predispositions and efforts (Ramos Morilla & Gaer, 2012; Roemer, 1998). These individual-specific predispositions may be innate or may be acquired during their human development process. In the latter case, the environment and lifestyle can strongly influence. Because inequality of opportunity is an inadmissible social injustice, as ideally, it is only the efforts of individuals that explain the differences (Kolm, 1996), these authors call for economic development programs to tackle only inequality of opportunity and let individuals compensate for inequality through their efforts. One way to fight against inequalities of opportunity would be to give everyone, especially the poorest, the possibility to invest in their physical or human capital. And for this to happen, the latter must have access to capital.

The World Bank (2007) defines financial inclusion as the ability of individuals and businesses to access, at low cost, a range of useful and appropriate financial products and services (transactions, payments, savings, credit, and insurance) from reliable and responsible providers. A person or business is said to be financially included when they have an account, the ability to save and take out a loan in a formal financial institution or a decentralized financial system (DFS), and the ability to use banking services such as obtaining a credit card or using a mobile phone for payments. These services must be available, accessible, and affordable.

This view of financial inclusion stems from the theoretical framework that, as the financial system expands, it broadens the financial opportunities available to the poorest, allows them to invest in building their human and physical capital, and can thus contribute to equalizing the distribution of income (Aghion et al., 2005; Beck et al., 2004; Dollar & Kraay, 2002; Kirkpatrick & Jalilian, 2001; Kpodar, 2004). But empirical work on the impact of financial inclusion on reducing poverty and income inequality by Aslan et al., 2017; Tita & Aziakpono, 2017; Agyemang-Badu et al., 2018; Seshamani & Tounkara, 2018; Esther, 2019; Demir et al., 2020; Huang and Zhang, 2020; Kling et al., 2020 have shown discordant results. These works did not take into account socio-cultural specificities in their analyses. Yet these factors, according to the World Bank (2007) and the literature on the determinants of financial inclusion (Claessens, 2006; Beck et al., 2006; Kpodar et al., 2009; Guérineau et Jacolin, 2014; Rojas-Suarez et Amado, 2014; Neba et Mbotta, 2018), strongly influence people's attitudes towards working with the financial system and using financial services. These socio-cultural factors can lead to market imperfections and information asymmetries, undermine the optimal allocation of capital resources, and thus influence the link between financial inclusion and income inequality. And yet,

there are no studies that investigate whether socio-cultural factors influence the relationship between financial inclusion and income inequality.

First, this article uses a macroeconomic view of how financial inclusion affects the distribution of income in SSA and then dissects the continent into several socio-cultural groups to see if cultural factors have a bearing: Thus, this paper seeks to answer the following research questions:

- (i) What is the effect of the use of different financial products on income distribution in sub-Saharan Africa?
- (ii) What is the impact of socio-cultural factors on income inequality in sub-Saharan Africa?

To answer these questions, we first build from the different variables of financial inclusion, an annual financial inclusion index (FII) which will then be used in a dynamic panel made up of 27 SSA countries over the period going from 2002 to 2015 to test its effect on the income inequality (Gini index).

Literature Review

The Theoretical Framework of Financial Inclusion and Income Inequality

The link between finance and seizing opportunities has already attracted the attention of many authors who have shown that the formation and persistence of income inequalities are the results of imperfections in credit markets that do not favor an accumulation dynamic of capital by certain (poor) households and, at the same time, limits their access to certain opportunities due in particular to a lack of investment in physical and human capital. For this study, imperfections in financial markets, such as information asymmetries and transaction costs, prevent the poor from escaping poverty by limiting their access to formal financial products and services (Aghion & Bolton, 1992; Banerjee & Newman, 1993; Durlauf, 1996; Galor & Zeira, 1993; Piketty, 1997). Financial inclusion can affect income inequality by promoting investment in physical capital (Aghion & Bolton, 1992; Banerjee & Newman, 1993; Piketty, 1997) and investment in education (Durlauf, 1996; Galor & Zeira, 1993). By having access to financial products and services, the poor can save or borrow money to invest in the formation of their human capital or the creation of income-generating activities. This will directly or indirectly impact income inequality (Bresson, 2004). The direct effect manifests in the short term while the indirect effect manifests itself in the long term (World Bank, 2007; Tita & Aziakpono, 2017). The direct effect occurs if the funds generated from accessing and using financial products and services are directly used and indirectly through remunerative activities. In this case, the impact of financial inclusion on inequality may be small because it would contribute in the short term to the immediate increase in the incomes of the only people who benefit from it. The indirect effect occurs when the poor take advantage of their access to finance to invest in education and training so that in the future they have a better chance of getting a decent job or becoming an entrepreneur, breaking down

thus the cycle of poverty. Education promotes financial literacy in individuals and improves their ability to set up viable projects that can be financed. In addition, by promoting the movement and availability of capital, inclusion will foster innovation and entrepreneurship which over time will lead to increased productivity and the level of employment (Klapper et al., 2006). In the long run, the expansion of economic opportunities will favor the tightening of income distribution gradually as entrepreneurs create more jobs and offer better wages (Galor & Moav, 2004; Tita & Aziakpono, 2017). From these facts, the impact of financial inclusion may resemble the predictions of Greenwood and Jovanovic (1990) which define an inverted U-shaped nonlinear relationship between income inequality and financial system development. Thus, initially, with the low level of economic and financial development, access to financial intermediaries may be restricted to some people due to transaction costs, financial inclusion will lead to strong income inequalities. But, as financial inclusion grows, it will expand its services and impact to all leading to a phase of reducing these inequalities with financial inclusion. But since financial inclusion can be at the origin of new forms of risk, in particular a high debt ratio, the fall in the debt/capital ratio (Guérin et al., 2007), can rather contribute to accentuating the inequality of returned. The poor do not benefit from the know-how, the relational network, and the access to information required to start a business and therefore most of their micro-loans, savings, and transfers are oriented towards consumption and uses. “Low productivity” and “very risky” and also the preeminence that the rich would always have in financial transactions will accentuate the gap between them and the poor. (Guérin et al., 2007; Haber et al., 2003; Rajan & Zingales, 2003).

Financial Inclusion and Income Inequality: the Empirical Case

As caricatured by theory, empirical work on the impact of financial inclusion on reducing income inequality remains largely inconclusive. This work is fairly recent and some analyze the impact of the different dimensions of financial inclusion on income inequality (Kling et al., 2020; Park & Mercado, 2018; Sukmana & Ibrahim, 2018; Aslan et al., 2017) and for others, the impact of global financial inclusion captured by its index on income inequalities (Demir et al., 2020; Omar & Inaba, 2020; Park & Mercado, 2015; Zia & Prasetyo, 2018). Kling et al. (2020) find with Chinese data from 2011 and 2013 that income inequality worsens if households rely on formal or informal loans, while access to bank accounts improves households' prospects in distribution future income. Park and Mercado (2018) find that the increase in the “accessibility,” “availability,” and “use” of financial services measured respectively by the number of ATMs and commercial bank branches per 100,000 adults; the number of borrowers and depositors with commercial banks per 1000 adults and the domestic credit-to-GDP ratio reduces income inequality.

Aslan et al. (2017) find that increasing “the intensity of use of financial services” by a larger population also leads to a reduction in income inequality. But Sukmana and Ibrahim (2018) find in their work carried out on a sample of 73 developing countries by the OLS regression method and by the quantile regression that access to financial services does not serve as a factor of attenuation of inequalities. Income

only when these are low in a country. On a panel of 140 countries, Demir et al. (2020) analyze the impact of financial inclusion on income inequality, drawing on the FinTech-financial inclusion interaction. Using the quantile regression estimation technique, they find that financial inclusion is a key channel through which FinTechs reduce income inequality. They also find that while financial inclusion significantly reduces inequalities in all quantiles of the inequality distribution, these effects are mainly associated with higher-income countries. Likewise, Omar and Inaba (2020) and Park and Mercado (2015) found that financial inclusion significantly reduces the poverty rate and income inequality in developing and Asian countries respectively. While Zia and Prasetyo (2018) find in their study of 33 Indonesian provinces over the period 2014–2016 that financial inclusion reduces poverty, but not income inequality.

Ouechtati (2022) analyzes the effect of financial inclusion on income inequality by examining the role of economic and political institutions in moderating this effect using data on 110 countries over the 2014–2018 period. His empirical results suggest that financial access can be enhanced by the development of effective institutions and that the effect of financial inclusion can be weakened if the institutional quality is poor.

Quoc et al. (2019) employ the ordinary double least squares method and other econometric estimation techniques on panel data from 22 transition economies and find that the financial inclusion index contributes to the reduction of income inequality. Turégano and Herrero (2018) also use the ordinary double least squares method to make a comparative study of the effect of financial deepening and financial inclusion on income inequalities on an unbalanced panel of nearly 75 countries in the 2000–2011 period. They find that the composite index of financial inclusion reduces income inequality while financial deepening has no impact on inequality.

In SSA, the work of Tita and Aziakpono (2017), Agyemang-Badu et al. (2018), Seshamani and Tounkara (2018), Esther (2019), Bkwayep and TSAFACK (2020), and Ngono (2020) analyzed the impact of several aspects of financial inclusion on income inequality. Esther's (2019) study uses panel data and the system-based GMM method to analyze the effect of financial inclusion on income inequality in SSA. The results reveal that inclusion contributes to reducing income inequalities and that its ability to reduce is strongly conditioned by the financial inclusion of poor households and more particularly by the penetration of bank branches and the use of financial services. Bkwayep and TSAFACK (2020) analyze whether remittances by migrants can, through financial inclusion, help reduce income inequalities in SSA. The results obtained by the GMM method on a panel of 47 SSA countries revealed a positive interaction between remittances from migrants and financial inclusion which helps to reduce income inequalities. Ngono (2020) finds the same result in a study that emphasizes the role of mobile money in financial inclusion carried out in 4 SSA countries using the panel-corrected standard error method as an estimation technique. Seshamani and Tounkara (2018) use the ordinary least squares method to analyze the impact of the index of concentration of formal and informal financial inclusion on income inequality in a sample of 12 SSA countries. They find that formal inclusion reduces income inequality while non-formal inclusion tends to increase inequality. Agyemang-Badu et al. (2018) use the fixed-effect regression

method on a panel of 47 African countries to analyze the impact of financial inclusion on poverty and income inequality and find that it contributes to poverty reduction while it does not affect income inequalities. Tita and Aziakpono (2017) do a cross-sectional analysis using data from the World Bank's Global Findex 2011 database to determine which aspects of financial inclusion have the most effect on inequalities in income in SSA. Their results show that the use of accounts by businesses, electronic payments, and formal savings has a positive relationship with income inequality. They find that no aspect of financial inclusion works favorably on these inequalities. Nonetheless, of the seven aspects of inclusion they use, health insurance and formal loans to pay for tuition show a negative, but not significant, relationship with income inequality.

A review of this literature shows that, although culture is a key determinant of financial inclusion, it has not been taken into account in analyses of the relationship between financial inclusion and income inequality. And while culture is a determinant of financial inclusion, it can influence the relationship between financial inclusion and income inequality. This work aims to empirically verify whether cultural factors influence the relationship between financial inclusion and income inequality.

Methodology

Conceptual Framework In this framework, we generally assume that income inequality constitutes a distance between the income of the rich and the income of the poor. The challenge is to reduce the distance between these incomes. We assume that in order to reduce this distance, the income of the latter must be pushed towards that of the former. The aim is to increase or improve the income of the poor, in particular through the fight against poverty. Financial inclusion helps to seize opportunities that lead to an increase in their income and thus to reduce inequalities in this area.

We adopt the conceptual framework developed by Kling et al. (2020) to analyze the impact of financial inclusion on poverty and income inequality in China. This framework aims to understand the process by which financial inclusion (the demand for and use of formal financial services) impacts the income of the poor and thereby inequality. Financial services include a range of services including credit noted D and financial assets (e.g., savings and money transfers) noted A . Credit incurs costs rD in the form of interest payments at the rate r , while financial assets earn rA . Banks, which are not explicitly modeled, financial services institutions, act as intermediaries accepting deposits A and granting loans D . To cover their transaction costs, there must be a positive net interest margin $v = rD - rA > 0$ even in the absence of default risk. This interest margin could be considered a measure of the quality of financial services, including a factor of financial inclusion, as it may vary from country to country.

The demand for financial services stems from the need for households to invest in their human and physical capital (K), i.e., in education, health, consumption, and direct income-generating activities (commercial and productive activities). This investment generates income (Y), i.e., there is a trade-off between current and future consumption, governed by intertemporal preferences. These preferences are

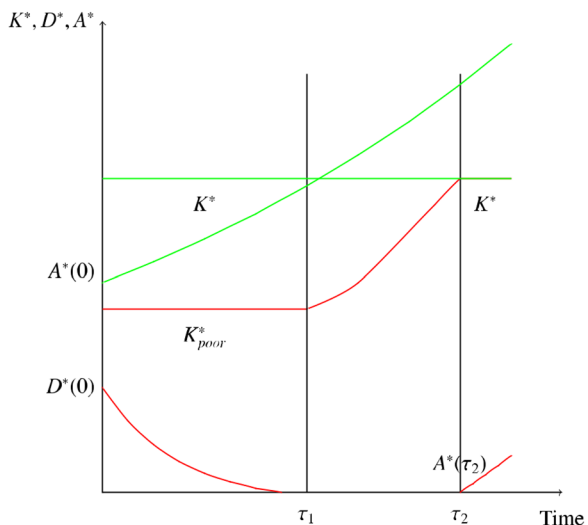
captured in the discount rate r . The link between income and capital (human and physical) is modelled using a strictly concave production function $f(K)$, so $f'(K) > 0$ and $f''(K) < 0$. This implies that there is an optimal capital stock K where marginal benefits are equal to marginal costs. Individuals seek to maximize their overconsumption noted C , i.e., when basic needs such as food are covered, they can choose to invest an amount I in capital K or consume any excess income. Figure 1 shows the optimal paths for rich individuals in green and poor individuals in red. Asset accumulation occurs only if $rA > r$; otherwise, any surplus is consumed.

Figure 1 plots the optimal paths for the poor (in red) who use debt $D(0)$ to reach the transient capital steady state K_{pauvre}^* . (d represents the path of the poor using their savings to build up their capital. Due to inflation, we note that the rate of return on their savings is zero). After paying off the debt at time τ_1 , they use their income to invest in human and physical capital to reach the optimal capital stock K^* at time τ_2 . Any additional income will be invested in the financial asset $A^*(\tau_2)$. The rich (in green) “jump” into the optimal capital stock K^* . Any additional endowment at $t=0$ is invested in the financial asset $A^*(0)$, which accumulates over time with income.

We can establish the impact of financial inclusion on individuals in different parts of the initial endowment distribution. It is clear that distributional effects are ambiguous. Therefore, the claim that financial inclusion, even in ideal settings, reduces inequality may not be easily established. To obtain closed-form solutions, we choose the production function $f(K) = K^\alpha$ which $\alpha \in (0, 1)$, which implies that $f'(K) > 0$ and $f''(K) < 0$, i.e., the production function is strictly concave.

In the context of income inequality, if we assume that income inequality is a distance between the income of the rich and the income of the poor, the rich are already at their optimal capital stock level K^* and have no difficulty in inverting and seizing opportunities. Whether or not there is financial inclusion, the income of the rich follows its course without problems. In contrast, the poor do not yet have the optimal capital stock to invest and seize opportunities K^* necessary to invest and seize

Fig. 1 Optimal investment and debt paths



opportunities. Without financial inclusion, they will find it very difficult to invest and seize opportunities. Financial inclusion will therefore enable them to seize opportunities that lead to increased income and thus reduce income inequality. As financial inclusion is a multi-factor phenomenon, we construct an annual composite index to capture its full scope.

The Annual Financial Inclusion Index

Because of the growing interest of international institutions and governments in financial inclusion, several authors have developed indices that allow for an international comparison of financial inclusion (Cámara & Tuesta, 2014; Sarma, 2008; Sviryzdenka, 2016). The index proposed by Sarma (2008) is based on methods developed by the United Nations Development Programme to calculate popular indices such as the Human Development Index, the Human Poverty Index, and the Gender Development Index. Many studies use this index for work on financial inclusion, including its determinants and effects on economic growth (Gupte et al., 2012; Sarma & Pais, 2011; Sethy, 2016). This index is calculated annually based on the different dimensions (A_i) of financial inclusion. Four aspects of financial inclusion are mainly used: banking penetration measured by the number of bank accounts per 1000 inhabitants, use of financial services measured by bank deposits or savings, availability of financial services measured by the number of branches per 10,000 inhabitants, and finally, the indicator of banking activity performance, credit to the private sector as a percentage of GDP. This index is calculated as follows: A dimension index for each of these dimensions is first calculated by the following formula:

$$d_i = w_i * \frac{A_i - m_i}{M_i - m_i} \text{ where}$$

A_i = is the current value of dimension i

w_i = the weight given to dimension i between 0 and 1

M_i = the maximum value of dimension i

m_i = minimum value of dimension i

d_i = dimension of financial inclusion of i

The previous formula authenticates that $1 \geq w_i \geq 0$ and here, n dimensions of financial inclusion are represented by a point $X = (1, 2, 3\dots)$. Point $W = (1, 2, 3\dots)$ represents an ideal situation and point $0 = (0, 0, 0\dots 0)$ represents the point indicating the worst situation. To calculate the country's financial inclusion index, we have two important factors. The ideal point is W and the worst point is 0 . This FII will indicate the point of financial inclusion. This point will help to determine whether financial inclusion in the country is low or high. If

the gap between 0 and X is wide, it means high financial inclusion and similarly, if the gap is narrow between 0 and X, then it means low financial inclusion.

$$X_1 = \frac{\sqrt{d_1^2 + d_2^2 + d_3^2 + \dots + d_n^2}}{\sqrt{w_1^2 + w_2^2 + w_3^2 + \dots + w_n^2}} \tag{2}$$

$$X_2 = 1 - \frac{\sqrt{(w_1 - d_1)^2 + (w_2 - d_2)^2 + \dots (w_n - d_n)^2}}{\sqrt{w_1^2 + w_2^2 + \dots w_n^2}} \tag{3}$$

$$FII = \frac{1}{2}(X_1 + X_2) \tag{4}$$

In formula (2), for the Financial Inclusion Index (FII), X_1 specifies the average of the Euclidean distance between 0 and X. If the value of X_1 is high, it means that there is more financial inclusion. If the value of X_1 is high, it means that there is more financial inclusion. While the inverse Euclidean distance between X and W was specified by formula (3), for FII, X_2 . Formula (4) calculates the simple average of X_1 and X_2 .

Depending on the value of FII, the study period will be considered as:

1. Weakly included if $0 \leq FII \leq 0.35$
2. Moderately included if $0.35 < FII \leq 0.6$
3. Strongly included if $0.6 < FII \leq 1$

Weights Assigned to Dimensions and Data

The most important task in calculating the FII is to assign appropriate weights to the dimension indices. Since each dimension is equally important for the construction of FII, we have given equal weights to each of the four dimensions we have selected. In the present study, we have given weight 1 to the banking penetration index (D1), 1 to the availability index (D2) and 1 to the financial services usage index (D3), and 1 to the financial activity performance index. Given these weights, we can represent each of the 27 sub-Saharan African countries by a point (D1, D2, D3, D4) in the dimensional space, such that $0 \leq D1 \leq 1, 0 \leq D2 \leq 1, 0 \leq D3 \leq 1, 0 \leq D4 \leq 1$, where D1, D2, D3, and D4 are the dimension indices for these countries calculated using formula (1) = . In the multidimensional space, the point (0, 0, 0,0) will indicate the worst situation which means full financial exclusion and the point (1, 1, 1,1) will indicate the ideal situation which means full financial inclusion in the current context.

$$\begin{aligned} \text{LogGini}_{it} &= \gamma_0 \\ &+ \gamma_1 \text{LogGini}_{it-1} + \gamma_2 \text{FII}_{it} + \gamma_3 \text{LopPIB}/\text{hbt}_{it} \\ &+ \gamma_4 \text{Tx_sco}_{it} + \gamma_5 \text{Infl}_{it} + \gamma_6 \text{LogManu_PIB}_{it} + \gamma_7 \text{LogDep} - \text{Gov}_{it} \\ &+ \gamma_8 \log_Ouv_ccte_{it} + uk + \epsilon_{it} \end{aligned}$$

The Variables

Dependent Variable: Gini Index

LogGini_{kt} is the logarithm of the country's Gini index k and the period t . The Gini index is the most widely used variable for measuring income inequality. This index ranges from 0 to 1 or 100. At zero, it reflects the absence of income inequality, that is, a situation of perfect income equality. At one or 100, it reflects the presence of high-income inequality. Thus, countries with a Gini index close to 1 or 100 are the most unequal countries in terms of income.

The Independent Variable: Financial Inclusion Index

FII_{kt} is the indicator capturing the level of financial inclusion in the country k at the period t . We have seen above how it was constructed. This index ranges from 0 to 1. It can also vary from 0 to 100. This index is calculated annually from the different dimensions of financial inclusion. We have used four dimensions to construct it: banking penetration measured by the number of bank accounts per 1000 inhabitants; the use of financial services measured by bank deposits or savings; the availability of financial services measured by the number of branches per 10,000 inhabitants; and finally, the indicator of the performance of banking activity, the credit to the private sector as a percentage of GDP. Financial inclusion enables people, especially the poor, to seize financial and economic opportunities, and also provides the poor with the opportunity to invest in their education, health and improve their consumption. It allows them to improve their income, to reduce income inequality directly. Access to finance by firms with growth opportunities, by entrepreneurs with investment ideas and by individuals for their investments in physical and human capital helps to improve income distribution directly and indirectly through the promotion of economic growth.

Control Variables

LogPIB/hbt is the logarithm of GDP per capita to capture the impact of economic growth. But the favorable impact of economic growth on people's well-being (the reduction of income inequality) may be conditioned by a number of things, including the quality of institutions. But we expect economic growth to have a positive impact on reducing them.

LogManu_PIB is the value added of the manufacturing sector to GDP. This variable captures the effect of economic development on the said inequalities. We find that in the context of sub-Saharan Africa, this variable better captures the level of economic development and is better able to capture the impact of changes propelled by the interaction with financial inclusion. Indeed, past studies have captured the effect of economic development on GDP growth. This variable has many limitations. Growth in SSA is not always driven by the real or structural aspect of the economy, but more by the exploitation of raw materials. In this case, economic growth can even be a

source of high-income inequality. The exploitation of raw materials does not require a large workforce, but rather a skilled workforce that is not limited to the poor.

Demo is the variable capturing the quality of institutions and governance. The theory argues that quality institutions strengthen the role of government in allocating resources, increase the level of social services available to the poor, increase growth and investment, and also create the conditions for economic and social innovation. Better policies that improve institutional quality will reduce income inequality.

Tx_sco is the enrolment rate, primary and secondary (gross), gender parity index to capture the human capital effect. We expect it to promote better income redistribution.

Infl is the level of consumer price inflation (% annual) to capture the effect of the changing macroeconomic environment on people's income inequality. We note that a high level of inflation is detrimental to reducing inequality.

logDep-Gov is the logarithm of government spending to capture the policy effect. Government spending is a factor in stimulating economic activity and stimulating economic activity can improve income redistribution.

Ouv-cle Trade openness is the sum of exports and imports as a percentage of GDP, to capture the degree of international openness. The global environment can influence income redistribution in the sense that countries are connected to the rest of the world and can therefore, through economic growth and direct pro-poor opportunities (foreign trade), influence their income distribution.

Model specification

Here, we discuss the empirical model used to estimate the relationship between financial inclusion and income inequality. As most of the studies reviewed, we are interested in determining whether there is a linear and/or inverted-U relationship between financial inclusion and income inequality following the hypotheses of Banerjee and Newman (1993), Gala and Zeira (1993), and Greenwood and Jovanovic (1990). To test the hypothesis of a linear relationship, we estimate the following model:

$$\begin{aligned} \text{LogGini}_{kt} = & \gamma_0 + \gamma_1 \text{LogGini}_{k,t-1} + \gamma_2 \text{FII}_{kt} + \gamma_3 \text{LopPIB}/\text{hbt}_{kt} \\ & + \gamma_4 \text{Tx_sco}_{kt} + \gamma_5 \text{Infl}_{kt} + \gamma_6 \text{LogManu_PIB}_{kt} \\ & + \gamma_7 \text{LogDep} - \text{Gov}_{kt} + \gamma_8 \text{log_Ouv_ccl}_{kt} + u_k + \varepsilon_{kt} \end{aligned} \quad (5)$$

where LogGini_{kt} is the logarithm of the country k 's Gini index, FII_{kt} the indicator capturing the level of financial inclusion in the country k , LopPIB/hbt is the logarithm of GDP per capita, Tx_sco is the school enrolment rate, Infl is the level of inflation, $\text{LogManu}_{\text{PIB}}$ is the value-added of the manufacturing sector to GDP, we find that in the sub-Saharan African context, this variable better captures the level of economic development and is more likely to capture the impact of changes driven by financial inclusion, $\text{logDep} - \text{Gov}$ is the logarithm of government spending and

Ouv-cle trade openness. u_k is the unobserved country-specific effect, the error term, the individual panel (country) dimension, and the time dimension.

To test for an inverted U-shaped relationship between financial inclusion and income inequality, we will incorporate the squared terms of financial inclusion FII_carre and manufacturing value-added to GDP $LogManu_PIB_carre$ to obtain the equation:

$$\begin{aligned} LogGini_{kt} = & \gamma_0 + \gamma_1 LogGini_{k\ t-1} + \gamma_2 FII_{kt} + \gamma_3 FII_carre_{kt} \\ & + \gamma_4 LopPIB/hbt_{kt} + \gamma_5 Tx_sco_{kt} + \gamma_6 Infl_{kt} \\ & + \gamma_7 LogManu_PIB_{kt} + \gamma_8 LogManu_PIB_carre_{kt} \\ & + \gamma_9 LogDep - Gov_{kt} + \gamma_{10} Log_Ouv_cle_{kt} + u_k + \varepsilon_{kt} \end{aligned} \quad (6)$$

The purpose of using the square of these variables is to examine whether the relationship between finance and financial development is linear or not, so if the coefficient of FII_carre is negative and significant while the coefficient of FII is positive and also significant, we could validate the hypothesis of an inverted U-shaped relationship implying that as financial inclusion expands, its incremental effect on income inequality decreases. On the other hand, a positive sign of both variables would indicate increasing returns, whereas if the signs are reversed, then, we have evidence to support the threshold effect theory. This would suggest that financial inclusion only significantly affects income inequality when a certain threshold is reached or below a certain threshold of financial inclusion. That is if the coefficient of FII_carre is positive and that of FII is negative this would mean that inclusion only reduces income inequality when it is still below a certain level. But if the coefficient of FII_carre is negative and that of FII is positive, this would mean that financial inclusion only reduces income inequality above a certain threshold.

Model Estimation Method

Studies have shown that there is an interactive link between financial development and poverty which can be a source of endogeneity problems in their analysis making traditional estimators such as ordinary least squares, fixed effects, or random effects models non-convergent. Also, parameter heterogeneity across countries can be a problem when estimating a panel model. To address the problems of possible endogeneity bias that may exist due to the interaction between financial inclusion and income inequality, autocorrelation, individual-specific heteroscedasticity, and omitted variable bias, the generalized method of moment (GMM) estimator developed by Blundell and Bond (1998) is appropriate for estimating these models. The GMM system combines first-difference equations with a level equation, using lagged internal instruments in difference equations. Dynamic panel models incorporate the lagged value of the independent variable as an explanatory variable in the model. Due to the fact that the current income level may strongly depend on

the previous income level, we adopt the latter method which solves the problems of simultaneity bias, reverse causality, and omitted variables that weaken the results of previous studies (Igue, 2013). It is also a conceptual way to give more importance to permanent (income) well-being than to current well-being since it incorporates a dynamic dimension considering the understanding of well-being in a life-cycle perspective rather than in a succession of periods as recommended by Servet (2004). The validity of the additional instruments included is tested using a Hansen test to over-identify restrictions. Consistency of estimates requires that the error terms are not serially correlated at second order, so we report the *P*-values from the Arellano-Bond-AR (2) tests.

Description of the Sample and Data Sources

The data used are from various sources and are spread over the period from 2002 to 2015. The control variables come from the *World Bank's World Development indicators (2019)* and *Polity IV datas (2018)*. The financial inclusion variables used to construct the financial inclusion index are from the *International Monetary Fund's Financial Access Survey 2017*. The Gini index comes to us from the standardized global income inequality database (SWIID) compiled by Solt (2016). Based on data availability, our sample consists of 27 sub-Saharan African countries composed of 19 Christian-dominated countries, 8 Islamic-dominated countries, 16 French-dominated countries, and 11 English-speaking countries. These subgroups were formed according to the official language of the countries during the study period and according to the dominant religion in these countries. For the grouping of countries according to the dominant religion, we used the database of La Porta et al. (2008) giving the percentage of Christians and Muslims in each country. This database is from a survey conducted in 1980 and was updated in 2013. The grouping of countries by official language is inspired by *Ethnologue*, 20th edition, Barbara Grimes, Editor, Summer Institute of Linguistics Inc, 2016. (See Appendix for a complete list of countries).

Results

The results presented in the appendix of the calculation of the financial inclusion index by the Sarma (2008) method show that the majority of SSA countries are weakly included with Sao Tome and Principe being the weakest included country. A fair number of countries were, however, at one time moderately included. Only Rwanda and Burundi have at one time had a high level of financial inclusion. Tables 1 and 2 present the results of regressions of the effect of financial inclusion captured by the annual financial inclusion index (FII) on income inequality measured by the Gini index.

The results of the regression of the model for all countries (model 1, Table 1) show that financial inclusion, school enrolment rates, and the democratization

Table 1 Effect of financial inclusion on income inequality in sub-Saharan Africa

Variables	(1) Set	(2) Christians	(3) Muslim	(4) French and others	(5) English
L.log_Gini	0.0928 (0.0599)	-0.0325 (0.0703)	0.900*** (0.0317)	0.0392 (0.0750)	0.858*** (0.0536)
FII	-0.104*** (0.0337)	-0.0807** (0.0373)	-0.000119 (0.0175)	-0.129*** (0.0398)	0.0109 (0.0145)
Log_PIBHBT	-0.0102 (0.0276)	-0.0480 (0.0304)	-0.00336 (0.0138)	-0.0623 (0.0555)	-0.0153* (0.00798)
log_Manu_Pib	0.0277** (0.0128)	0.0254 (0.0163)	-0.00312 (0.00541)	0.0326* (0.0191)	0.000328 (0.00435)
Tx_sco	-0.106*** (0.0373)	0.00540 (0.0621)	-0.00771 (0.00625)	-0.144** (0.0587)	0.0150 (0.0151)
logDep_Gov	-0.00389 (0.00940)	-0.0112 (0.00985)	-0.00983** (0.00394)	0.0106 (0.0168)	0.00369 (0.00233)
LOG_OUV_cce	-0.0255 (0.0156)	-0.0197 (0.0206)	-0.00172 (0.00440)	0.0243 (0.0303)	0.00414 (0.00423)
Infla	0.000413** (0.000201)	0.000493* (0.000254)	-9.49e-06 (6.98e-05)	0.000548* (0.000299)	-4.11e-05 (6.69e-05)
DEMOC	-0.00148* (0.000892)	-0.000599 (0.00143)	-2.87e-05 (0.000200)	-0.00202* (0.00121)	-7.62e-05 (0.000540)
Constant	1.680*** (0.147)	1.913*** (0.169)	0.193** (0.0852)	1.858*** (0.222)	0.261*** (0.0970)
Comments	324	227	96	192	131
Number of code	27	19	8	16	11
Sargan test	0.0128	0.0000	0.9712	0.0133	0.0450
AR(2)	0.0382	0.0501	0.3139	0.0103	0.3564

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

of institutions reduce income inequalities, whereas the contribution of the manufacturing sector to GDP and inflation tends to increase them. Financial inclusion and school enrolment rates have a strong effect on income inequality. A variation of these variables by one percentage point leads to a reduction in inequality of 10 points at a significance level of 1%. For the regressions by country category, we note that financial inclusion reduces income inequality in Christian and predominantly French-speaking countries while it has no impact on income inequality in Muslim and English-speaking countries. In Christian countries, only financial inclusion and inflation are significant. In these countries, financial inclusion reduces inequality while inflation increases it.

Table 2 Test of the inverted-U relationship between financial inclusion (FII) and income inequality in Sub-Saharan Africa

Variables	(1) Set	(2) Christians	(3) Muslims	(4) French and others	(5) English
L.log_Gini	0.118* (0.0606)	-0.0140 (0.0714)	0.902*** (0.0315)	0.0520 (0.0753)	0.886*** (0.0576)
FII	0.858* (0.520)	1.236** (0.558)	-0.354 (0.384)	0.533 (0.739)	0.270 (0.283)
FII_carré	-1.258* (0.689)	-1.760** (0.746)	0.448 (0.489)	-0.857 (0.989)	-0.328 (0.359)
Log_PIBHBT	-0.0256 (0.0279)	-0.0663** (0.0311)	-0.0124 (0.0169)	-0.0756 (0.0560)	-0.0164** (0.00836)
log_Manu_Pib	0.0927*** (0.0204)	0.0618** (0.0248)	-0.0198 (0.0204)	0.0739*** (0.0234)	-0.0257 (0.0191)
log_Manu_Pib_carré $\tilde{\text{A}}\text{C}$	-0.0514*** (0.0130)	-0.0281* (0.0155)	0.00841 (0.0108)	-0.0447** (0.0177)	0.0131 (0.00917)
Tx_sco	-0.115*** (0.0372)	0.00359 (0.0616)	-0.00447 (0.00796)	-0.145** (0.0589)	0.0167 (0.0155)
logDep_Gov	-0.00590 (0.00941)	-0.00925 (0.00981)	-0.00870** (0.00417)	0.0101 (0.0168)	0.00489* (0.00258)
LOG_OUV_cce	-0.0293* (0.0156)	-0.0233 (0.0206)	-0.000345 (0.00465)	0.0138 (0.0307)	0.00164 (0.00481)
Infla	0.000341* (0.000202)	0.000480* (0.000252)	3.88e-06 (7.00e-05)	0.000406 (0.000303)	-2.36e-05 (6.94e-05)
DEMOC	-0.00139 (0.000891)	-0.000653 (0.00142)	-2.88e-05 (0.000200)	-0.00182 (0.00122)	6.86e-06 (0.000560)
Constant	2.102*** (0.287)	2.523*** (0.307)	0.0782 (0.182)	2.178*** (0.409)	0.334** (0.151)
Observations	324	227	96	192	131
Number of code	27	19	8	16	11
Sargan test	0.0474	0.0000	0.9722	0.0140	0.1099
AR(2)	0.0371	0.7028	0.3295	0.1316	0.3613

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

In Muslim countries, financial inclusion has no impact on inequality, only government spending has a reducing effect. In predominantly French-speaking countries, financial inclusion, school enrolment, the contribution of the manufacturing sector to GDP, and the democratization of institutions have significant effects on inequality: financial inclusion and school enrolment reduce inequality while the contribution of the manufacturing sector to GDP tends to

increase it. In English-speaking countries, financial inclusion has no effect on inequality while only growth has a significant negative effect.

In Table 2, we present the results of the Greenwood and Jovanovic (1990) hypothesis test with the contribution of the manufacturing sector to GDP as the economic development capturing variable. We also include the financial inclusion index squared.

In our overall model and the model for Christian-dominated countries, we find that the coefficient on financial inclusion is positive and significant while the coefficient on its square root is negative and significant, validating the hypothesis of an inverted-U relationship between financial inclusion and income inequality. We do not find evidence of the existence of this inverted U-shaped relationship in Muslim, predominantly French- and English-speaking countries. We also find that the coefficient on the contribution of manufacturing to GDP is positive and significant while the coefficient on its square is negative and significant in our overall model for Christian-majority and French-majority countries. This indicates that countries with a small modern sector tend to have higher income inequality on the one hand, and on the other hand that economic modernization tends to create more income inequality. There is evidence here of a Kuznets curve relationship. Our results obtained in the ensemble model, in Christian-majority and French-majority countries contradict those obtained by Batuo et al. (2010) while those obtained in Muslim-majority and English-majority countries corroborate them.

Discussion and Interpretation of Results

The results obtained in our full sample model, in Christian-dominated and French-dominated countries are consistent with the Galor and Zeira (1993) and Banerjee and Newman (1993) hypothesis that inequality evolves negatively with financial development and are consistent with the results obtained by Ahmed and Masih (2017), Wang and Kinkyo (2016), Li and Yu (2014), and Batuo et al. (2010). In countries with Islamic-dominated obedience, financial inclusion has a negative but insignificant coefficient. This result then seems to converge in the direction of the results obtained in our overall model, in countries with a predominantly Christian obedience and countries with a French-dominated expression.

The results obtained in English-speaking countries where financial inclusion has a positive but insignificant coefficient seem to converge with the hypothesis of Rajan and Zingales (2003) and Haber et al. (2003) that the financial system is designed and operates in favor of the rich, thus contributing to widening the gap between the rich and the poor. This result is still consistent with the result of Fowowe and Abidoye (2013) who found that financial development had no effect on income distribution in sub-Saharan Africa. These results as a whole contradict those obtained by Adams

and Klobodu (2016) who found that financial development is associated with an increase in income inequality in sub-Saharan Africa.

The result obtained in Muslim countries can be explained by the literature. The Muslim religion prohibits interest-bearing loans and borrowings. This also points to the fact that Islamic finance is still very underdeveloped in sub-Saharan Africa. This cultural trait may also be an explanation for the fact that government spending is favorable for reducing income inequality in these countries while it is not in others. It was also observed that in English-speaking countries where financial inclusion does not affect income distribution, growth has a negative and significant effect on income inequality; democratization of institutions, school enrolment, contribution of the manufacturing sector to GDP, and inflation are insignificant. While in the predominantly French-speaking countries where financial inclusion plays a reducing role on inequality, the democratization of institutions, the school enrolment rate, the contribution of the manufacturing sector to GDP, and inflation are significant; the contribution of the manufacturing sector to GDP and inflation have positive coefficients. This can be explained by the fact that growth is already equitably distributed in English-speaking countries unlike in predominantly French-speaking countries where growth only benefits the rich (the coefficient of GDP is insignificant and the coefficient of the contribution of the manufacturing sector to GDP is positive and significant) where it takes a lot of effort for the poor to improve their income (hence the negative and significant coefficient of the school enrolment rate). And also by the fact that the institutions are not at the standards of democracy so that the quality of institutions is a discriminatory element of better income redistribution in this group of countries (the coefficient the democratization of institutions is negative and significant) thus reflecting the colonial institutional design. According to Obeng-odoom (2017) and Gwama (2014), the colonial administration left an uneven developmental structure which in some cases continues to be reinforced by governance practices and processes. The British-inspired system of governance is more conducive to equal economic opportunities than the French-inspired system (Gwama, 2014).

All these results can be explained by the Kuznets hypothesis that income inequality and its evolution depend on the sectoral structure of economies. We can therefore conclude that the relationship between financial inclusion and income inequality depends on the cultural, political, institutional, and economic structure of countries.

Conclusion

The purpose of this work was first to empirically analyze the effect of financial inclusion on income inequality and second to empirically examine whether socio-cultural specificities influence the relationship between financial inclusion and income inequality in sub-Saharan African countries. We conducted

this study in line with the theoretical literature, which predicts a negative and linear relationship between financial development and income inequality (Galor & Zeira, 1993, Banerjee & Newman, 1993), an inverted U-shaped relationship (Greenwood & Jovanovic, 1990), and a positive and linear relationship (Rajan & Zingales, 2003; Haber et al., 2003). We used data from 27 sub-Saharan African countries, and then we distinguished countries according to their official language and also according to the dominant religion for the period from 2002 to 2015 by applying the econometric techniques of the generalized method of moments (GMM). This paper therefore enriches current theoretical literature by emphasizing that socio-cultural factors influence the use of financial products and thus affects income inequality. Our results show that financial inclusion contributes to reducing income inequality in all the SSA countries considered, and also in Christian-dominated and French-speaking countries. We found no effect of financial inclusion in Islamic-dominated and English-speaking countries. Similarly, we found evidence of an inverted U-shaped relationship in all of the sub-Saharan African countries considered and in Christian-dominated countries only. These results suggest that financial inclusion can be critical to reducing income inequality in SSA countries, but that it is important to tailor it to take into account the cultural, religious, political, institutional, and structural specificities of each country's economy in order to have even greater effects. Therefore, policy makers should not only promote financial inclusion but should also consider socio-cultural specificities of different countries or regions in their actions.

Based on the fact that socio-cultural factors have an explanation on the levels of financial inclusion and income inequality and on the effect of financial inclusion on income inequality, in the African context where religion has a real influence on people's behaviors, financial inclusion and its impact on income inequality can be strengthened by raising financial awareness through religion. With regard to the results obtained by grouping countries according to the official language, given that the official language is highly correlated with the colonizing countries in sub-Saharan Africa, these results are in line with the work of La Porta and al. and Beck et al. (2003) on the effect of the legal origin on the financial system and its development. We conclude that financial inclusion and its effect on income inequality can be enhanced by building high-quality institutions.

From this conclusion, we suggest studies considering even more homogeneous countries and within individual countries to better understand the relationship between these two variables. It would also be interesting to analyze individually the effect of each component of financial inclusion on income inequality or financial inclusion and social inequality between urban and rural areas at the national level.

Appendix

Table 3 List of countries

liste complete de pays	pays à obédience dominante chrétienne	pays à obédience dominée par l'islam	pays d'expression majoritairement française	pays d'expression anglaise
Benin	Botswana	Benin	Benin	Botswana
Botswana	Burundi	Burkina Faso	Burkina Faso	Ghana
Burkina Faso	Cabo Verde	Guinea	Burundi	Kenya
Burundi	Cameroon	Guinea-Bissau	Cabo Verde	Lesotho
Cabo Verde	Central African Republic	Mali	Cameroon	Malawi
Cameroon	Cote D'Ivoire	Niger	Central African Republic	Nigeria
Central African Republic	Ghana	Senegal	Cote D'Ivoire	Sierra Leone
Cote D'Ivoire	Kenya	Sierra Leone	Guinea	Tanzania
Ghana	Lesotho		Guinea-Bissau	Uganda
Guinea	Madagascar		Madagascar	Zimbabwe
Guinea-Bissau	Malawi		Mali	
Kenya	Namibia		Namibia	
Lesotho	Nigeria		Niger	
Madagascar	Rwanda		Rwanda	
Malawi	Sao Tome and Principe		Senegal	
Mali	Tanzania		Sao Tome and Principe	
Namibia	Togo		Togo	
Niger	Uganda			
Nigeria	Zimbabwe			
Rwanda				
Senegal				
Sierra Leone				
Sao Tome and Principe				
Tanzania				
Togo				
Uganda				
Zimbabwe				

Table 4 Summary of variables

Variable	Description	Source
<i>FI</i>	The composite financial inclusion index. Calculated from 4 variables: the number of bank accounts per 1000 inhabitants; deposits in the financial system as a proportion of GDP; the number of branches per 10000 inhabitants and credit to the private sector as a percentage of GDP	<i>Author's calculations</i> , Global Financial Development Database June 2017
<i>LopPIB/hbt</i>	This is the logarithm of GDP per capita to capture the impact of economic growth (in constant 2010 US\$ prices)	WDI, 2019
<i>LogManu_PIB</i>	This is the value-added of the manufacturing sector to GDP	
<i>Tx_School</i>	Primary and secondary school enrolment (gross), gender parity index (GPI)	
<i>Inflat</i>	The inflation variable in GDP deflator (% annual)	
<i>Tx_Pop</i>	Annual population growth rate (%)	
<i>LOG_OUV_cce</i>	imports and exports of goods and services in relation to GDP	
<i>Dep_Gov_PIB</i>	The variable government expenditure as a ratio to GDP. Capturing government final consumption expenditure (constant 2010 US\$).	
<i>Democ</i>	The quality of institutions is captured by the variable Institutionalised Democracy.	<i>Polity IV data and 2018 version</i>

Table 5 Descriptive statistics

Variable	Obs	Mean	Std. dev.	Min	Max
log_Gini	378	1.639	.062	1.477	1.895
FII	378	.38	.067	.318	.668
Log_PIBHBT	378	3.311	.295	2.828	4.209
log_Manu_Pib	378	.91	.321	-.58	1.39
Tx_sco	378	.873	.202	0	1.103
logDep_Gov	378	1.096	.292	-.021	1.867
LOG_OUV_cce	378	1.715	.376	0	2.209
Infla	378	6.97	6.799	-3.503	37.142
DEMOC	378	4.725	3.005	0	10

Table 6 Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) log_Gini	1.000								
(2) FII	-0.092	1.000							
(3) Log_PIBHBT	0.461	-0.443	1.000						
(4) log_Manu_Pib	0.116	-0.009	0.082	1.000					
(5) Tx_sco	-0.266	-0.129	-0.166	-0.135	1.000				
(6) logDep_Gov	0.533	0.143	0.049	0.015	-0.140	1.000			
(7) LOG_OUV_cce	0.581	-0.001	0.177	0.099	-0.160	0.773	1.000		
(8) Infla	-0.086	-0.089	-0.041	-0.005	0.082	-0.282	-0.185	1.000	
(9) DEMOC	0.149	-0.152	0.311	-0.004	0.077	0.273	0.267	0.007	1.000

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