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The Role of Informatioin sharing in modulating the effect of financial access on inequality[1]

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Abstract

This study examines the role of information sharing in modulating the effect of financial access on income inequality in 48 African countries for the period 2004-2014. Information sharing is proxied with private credit bureaus and public credit registries. All dynamics of financial development are taken into account, namely: depth (money supply and liquid liabilities), efficiency (at banking and financial system levels), activity (from banking and financial system perspective) and size. The empirical exercise is based on interactive Generalised Method of Moments. It can be established from the findings that: first, a threshold of 18.072 percentage coverage of public credit registries is needed to counteract the unconditional positive effect of banking system efficiency. Second, on the role of private credit bureaus in financial depth, both the unconditional and the conditional effects are negative, implying a negative synergy. Overall, the findings show that, contingent on the type of financial development dynamic, credit registries broadly play their theoretical role of decreasing financing constraints in order to ultimately reduce inequality.

JEL Classification: I30; G20; G29; O16; O55.

Keywords: Inequality; Information asymmetry; Financial development; Africa.

1. Introduction

Four main tendencies in scholarly and policy-making circles motivate an inquiry into the role of information sharing offices in modulating the effect of financial access on inequality in Africa, namely: growing exclusive development, limited financial access, the introduction of information sharing offices to boost financial development and gaps in the literature. In what follows, the four points are substantiated in chronological order.

First, in its 2016 publication on "*Poverty and shared prosperity - Taking on inequality*"; the World Bank established that poverty reduction has been substantial in all regions of the world except in Africa where the phenomenon is still widespread. The report emphasised on the importance of reducing inequality in order to end poverty so that by 2030, shared prosperity could be boosted (World Bank, 2016). Consistent with this report, several nations in the continent failed to meet the extreme poverty target of the Millennium Development Goals (MDGs), despite a growth recovery of more than two decades that started in the mid-1990s (Fosu, 2015). In this vein, Africa has been documented to be the continent where inequality is mostly predominant after Latin America (Klasen, 2016).

Second, although financial development has recently been documented to be a positive engine to poverty mitigation (Asongu & De Moor, 2015), there is a contending strand in literature with the position that financial development has a positive impact on income inequality (Watzka & Jauch, 2012). Moreover, financial access in African financial institutions has been dampened by significant concerns of excess liquidity (Saxegaard, 2006; Fouda, 2009). Consistent with the underlying authors, Nketcha and Samson (2014) have postulated that a quick look at the African banking systems shows that banks substantially hold liquidity for precautionary motives. This

may be due to collateral and/or high interest margins which individuals or Small and Medium Enterprises (SMEs) cannot meet. In addition, sources of finance such as stock markets are still underdeveloped. Hence, financing constraints for enterprises are obviously high. However, it is important to emphasise the significant improvement in access to finance in African countries these recent years, especially for individuals. Even though more than three quarters of adults in Africa do not have a formal bank account within a financial institution, they use informal sources of finance to save (for instances: burial societies, tontines and/or rotating savings and credit associations) and to borrow from family, friends or informal private lenders (AfDB, 2013). To sum up, a deep analysis of a population group shows that women, youth, those living in rural areas, old people and the poor are suffering from financial exclusion[1].

Third, information sharing offices such as private credit bureaus and public credit registries were introduced with the aim of reducing the asymmetric information related to financial development (Triki & Gajigo, 2014). These measures were fundamentally associated with the increase in the sharing of information between banks to reduce moral hazard and adverse selection between lenders and borrowers. This is supported by a bulk of literature substantiating that in Africa, access to basic financial services such as corporate and private insurance, credit, payments, has been considerably limited by factors such as physical access, affordability and eligibility (Batuo & Kupukile, 2010, Allen et al., 2011, Tchamyou & Asongu, 2017). In addition, lenders regularly face adverse selection problems because of their lack of information on borrowers' profiles, particularly regarding their repayment capacity related to the investments for which they would like to receive financial resources. Moreover, the concern is even greater when lenders have no means of controlling borrowers' activities after the credit has been granted. As a result, a borrower may deliberately decide to conceal the

[1] Interested readers can find a detailed analysis in AfDB (2013): https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Financial_Inclusion_in_Africa.pdf

proceeds of the underlying investment in order to reduce liability in case of default or to avoid repayment. However, such actions are not exclusively observed among insolvent borrowers, as solvent borrowers may also be tempted to avoid complying with their financial obligations. Ultimately, to hedge against such risks, lenders often grant loans at high interest rates which unfortunately have unfavourable consequences for growth, financial development and poverty reduction. These disadvantages could be avoided by sharing information on the creditworthiness of borrowers. For this purpose, private credit bureaus (PCBs) and public credit registries (PCRs) serve as brokers by providing the necessary information to banks. According to Jappelli and Pagano (2002), the sharing of information by these brokers also allows for efficiency in the allocation of capital, relaxation of constraints in credit and increased competition in the credit market (Tchamyou & Asongu, 2017).

Fourth, the positioning of this inquiry diverges from the existing literature, which has mainly centred on examining: the impact of information rights by creditors, the role of information asymmetry among creditors and the relationship between information asymmetry and financial development. The first strand has investigated the role of stronger creditor rights in *inter alia*: risk-taking by banks (Acharya et al., 2011; Houston et al., 2010); reducing market power in the banking industry (Asongu et al. 2017b) and bankruptcy (Brockman & Unlu, 2009; Claessens & Klapper, 2005). The second strand of the literature which has focused on how information asymmetry among creditors: improves credit availability (Triki & Gajigo, 2014; Brown et al., 2009; Djankov et al., 2007); decreases costs of credits (Brown et al., 2009), reduces default rates (Jappelli & Pagano, 2002), influences syndicated bank loans (Tanjung et al., 2010; Ivashina, 2009) and affects corruption in lending procedures (Barth et al., 2009). The third strand has focused on information sharing and financial access nexuses (Tchamyou & Asongu, 2017; Asongu et al. 2016; Asongu et al. 2017a).

This inquiry complements the above literature on the relationship between financial access and information asymmetry by adding a dimension of inequality. In the light of the motivation of this study, inequality, extreme poverty and growth resurgence are related in the perspective that, the response of poverty to growth in Africa is a decreasing function of inequality (Fosu, 2010a, 2010b, 2011)[2]. A great bulk of the literature has been focused on emerging economies in Asia and Latin America and on developed countries while, Africa has been documented to be a continent where financial development is lowest (World Bank, 2016; Triki & Gajigo, 2014; Barth et al., 2009; Love & Mylenko, 2003; Galindo & Miller, 2001).

The rest of the study is organised as follows. Section 2 presents the background and theoretical underpinnings. The data and methodology are discussed in Section 3 while Section 4 covers empirical analysis and discussion of results. Conclusion and directions for future research are disclosed in Section 5.

2. Background and Theoretical highlights

Credit registries also known as "credit reference agencies" or "information sharing offices" are institutions whose main purpose is to collect information related to financial transactions of companies and individuals. The sources of information could be banking information and credit cards (for individuals and retailers) and public sources such as annual accounts (for companies). After verification and cross-checking, the gathered information is then combined in a report which can be used by present and future creditors. The information on credit history contained in the consolidated reports can be positive (such as payment behaviour) and negative (such as default rates) information. Information sharing offices are important tools for providing essential information about credits. Such information distributing mechanisms are essential for economic expansion because they help to reduce

[2] In essence: "*The study finds that the responsiveness of poverty to income is a decreasing function of inequality*" (Fosu, 2010a, p. 818); "*The responsiveness of poverty to income is a decreasing function of inequality, and the inequality elasticity of poverty is actually larger than the income elasticity of poverty*" (Fosu, 2010b, p. 1432); and "*In general, high initial levels of inequality limit the effectiveness of growth in reducing poverty while growing inequality increases poverty directly for a given level of growth*" (Fosu, 2011, p. 11).

asymmetric information that may probably limit the ability of lending institutions to comprehensively analyse the risk profiles of borrowers.

According to Mylenko (2008), before 2008, credit registers were mostly limited to certain countries in Latin America and in the Organization for Economic Co-operation and Development. However, after 2008, the development of information and communication technologies has substantially contributed to the establishment of information sharing offices in Eastern Europe, the Middle East, North Africa and sub-Saharan Africa. It should also be noted that, with the exception of South Africa, very few countries in the Sub-Saharan region had information sharing offices by 2008. In addition, some countries such as Mozambique, Nigeria and Rwanda have established credit registries with the main objective of strengthening regulation and supervision in the banking sector.

According to Claus and Grimes (2003) and Asongu et al. (2016), two main theoretical underpinnings have been documented on the linkages between access to finance and information sharing. The first refers to the channels through which banks could increase their liquidity while the second is focused on the transformation of the characteristics of risks associated with the banking system. Moreover, these two aspects of the literature are in accordance with the idea that the principal mission of a bank is financial intermediation, which is to transform deposits into credits for economic agents (such as investors and households).

The relationship between financial access and information sharing offices can be understood from two dimensions: moral hazard from borrowers and adverse selection from lenders. Credit registries provide lenders with financial information, especially credit histories on borrowers which enable them to decrease high interest rates that are most of the time stimulated by adverse selection. When the loan is granted, borrowers are subject to moral hazard as they may conceal the financial activities on the basis of which, the loan was granted in order not to meet their financial obligations. Credit registers therefore have this important role to discipline and inform borrowers about

the disadvantages of these practices. In addition, they can educate borrowers about the negative consequences of default and the willingness to seek refuge in the informal financial sector as a positive alternative to the formal financial sector (Tchamyou & Asongu, 2017).

The connection between financial development and inequality has been widely explored in the financial development literature (see Asongu & Tchamyou, 2014; Batuo et al., 2010; Beck et al. 2007). There is a debate in the literature on the benefits of financial development in reducing inequality. Some theories acknowledge that financial development is benefiting the poor and hence, reduces inequality (see Galor & Zeira, 1993; Aghion & Bolton, 1997; Galor & Moav, 2004). Shortcomings in financial markets such as contract enforcement costs, information asymmetries, transaction costs, among others, can be constraining factors in credit facilities for poor entrepreneurs who lack connections, credit histories and collaterals. These financial difficulties may hinder the flow of capital to the poor who have high-yielding projects and thus reduces efficiency in the allocation of capital. The consequence can be increased income inequality (Galor & Zeira, 1993). To put this argument into perspective, financial development decreases poverty from two main perspectives, i.e. by: (i) easing credit constraints for the poor and diminishing income inequality and (ii) enhancing capital allocation and boosting growth (Beck et al., 2004).

On the contrary, other theories are supporting the idea that financial development largely benefits the rich. Within this strand, Greenwood and Jovanovic (1990) have advocated the idea of an inverted U-shaped relationship between financial sector development and inequality. The underlying discussions are reflected in the extensive and intensive margin theories. According to the extensive margin theory, financial development could enhance access and usage of financial services by agents who do not have access to financial services due to financial constraints (see Chiwira et al., 2016; Orji et al., 2015; Odhiambo, 2014). Conversely, the intensive margin theory stipulates that inequality is affected by finance via direct and indirect

channels. These include: improving financial services of agents (such as wealthy individuals and well-established companies and corporations) which have been already using the formal financial system (Chipote et al., 2014). In other words, financial development can reduce persistent reliance on relative income by improving economic perspectives for the poor (Batabyal & Chowdhury, 2015; Bae et al., 2012).

This inquiry is therefore based on two main theoretical consensuses: the link between credit registries and finance and the relationship between finance and inequality. The introduction of information sharing offices in the latter linkage is relevant in the view that sharing credit history information could mitigate risks of moral hazard and adverse selection on the one hand and facilitate access to finance by the most disadvantaged factions of the population on the other hand. In the light of these underpinnings and motivation, the aim of this inquiry is to assess how information sharing offices could complement financial access in order to reduce income inequality.

3. Data description and Estimation technique

3.1. Data description

We analyse a panel of 48 African countries for the period 2004 to 2014 with data from four different sources, namely: (i) World Development Indicators (WDI) of the World Bank for information sharing variables; (ii) World Governance Indicators (WGI) of the World Bank for governance variables; (iii) the Financial Development and Structure Database (FDSD) of the World Bank for financial access variables and (iv) the Global Consumption and Income Project (GCIP) for inclusive variables. The choice of the periodicity is based on data availability constraints. Accordingly, from WDI, data on information sharing offices (private credit bureaus and public credit registries) is available only from the year 2004 and for income inequality, the last year in the Global Consumption and Income Project is 2014.

This work uses three measures of income inequality as dependent variables, namely: i) the Gini coefficient for the basic regressions and (ii) the Palma ratio

and the Atkinson index for the robustness tests. The Gini index ranges between zero (perfect equality, implying that everyone in the society has the same income level) and one (perfect inequality, meaning that the whole income is concentrated in the hands of one individual). It is computed as the ratio of the areas based on the diagram of the Lorenz curve. It measures, to some extent, the distribution level within an economy. The main limitation of the Gini index is that, it is not easily additive or decomposable. That is the response to income transfers between individuals from opposite tails of the income distribution if different from the transfers to the distribution in the middle of income (UNDESA, 2015). Hence, other measurements of inequality have been introduced. The Atkinson index represents the percentage of total income that a given group should have to renounce so that more equal shares of income among its population should be feasible. This measure depends on a theoretical parameter (decided and fixed by the researcher) which is the degree of the population aversion to inequality. Consistent with Tchamyou (2018) and Tchamyou et al. (2018), the Atkinson index employed in this study ranges from 0 to 1 as the Gini index. It also has the advantage of capturing the tails of the inequality distribution.

Over the past years, interest in the Palma ratio has been growing and the ratio has been proposed to be included in the post-2015 United Nation's global development program. In addition, the United Nations Development Programme (UNDP) annual Human Development Report and the Organization for Economic Co-operation and Development (OECD) Income Distribution Database have recommended this ratio as a standard measure of inequality. One of the advantages of the Palma ratio is that it captures the distribution's tails while the Gini coefficient is mainly based on the entire distribution (see Cobham et al., 2015).

In accordance with Tchamyou and Asongu (2017), Triki and Gajigo (2014), we measure information asymmetry with private credit bureaus (PCBs) and public credit registries (PCRs). Consistent with the underlying literature, there are six main characteristics, which distinguish PCBs from PCRs, notably: mission;

ownership; status; coverage; access and sources of data employed. First, PCBs were created in order to satisfy "demand for" and "needs to obtain" information about borrowers in the banking market while PCRs are public institutions with the main purpose of supervising the banking sector. Second, the ownership of PCBs includes: governments, central banks, lenders, lender associations and independent third parties; while the ownership of PCRs is limited to governments or central banks. Third, PCBs are institutions that aim to make profit while PCRs are not-for-profit credit registries. Fourth, the coverage provided by PCBs reflects large companies as well as small and medium-sized enterprises while PCRs mainly cover only large companies and are sometimes restricted with regard to history and type of data. Fifth, access to PCBs is opened to all types of lenders while PCRs are restricted to the suppliers of information. Sixth, data employed by PCBs consists of tax authorities, PCRs, courts whereas data on PCRs comes from banking and non-banking institutions.

We control for remittances, government consumption expenditure and corruption control. According to Ssozi and Asongu (2016), remittances are mostly used for consumption purposes; hence a decrease in inequality can be expected. However, the actual impact on income distribution depends on the beneficiaries of these funds, which should normally be the fraction of the population that is poor. Control of corruption is supposed to reduce inequality given that it is an institutional governance factor. However, the opposite effect can occur because the variable can unfortunately be skewed to the left side of the distribution. This unpredictable sign could be consolidated with a positive sign from government expenditure if the allocated funds for running government activities are poorly managed by corrupt government officials.

Appendix 2 presents the summary statistics (in Panel A) and the countries (in Panel B). The aim of the descriptive statistics is twofold: it can be observed from the means that variables are comparable and from the standard deviations, variables are substantially varying. Hence, feasible relationships could be deduced from corresponding estimations.

The correlation matrix is presented in Appendix 3. The motivation behind this matrix is to control for the degree of substitution in variables so that we avoid misspecification and therefore prevent concerns of multicollinearity. The issue is apparent in financial dynamics of depth, efficiency and activity on the one hand and in inequality variables on the other hand. In order to address the issues: on the one hand, inequality variables are applied distinctly as dependent variables and on the other hand, financial development indicators are not specified in the same model.

3.2. Estimation technique: Generalized Method of Moments

The estimation strategy employed in this study is the Generalized Method of Moments (GMM). There are four principal reasons for the adoption of this strategy. First, the number of cross-sections (N = 48) is substantially higher than the number of time series (T = 11). Hence, N>T: this is an essential condition for the application of the GMM. Second, inequality variables are persistent because their correlations with their first lags are higher than the threshold of 0.800, which is considered as the rule of thumb for establishing persistence. Third, this empirical technique controls for endogeneity given that it takes into account simultaneity by means of instrumenting the independent variables with corresponding lags and differences. Moreover, the control for endogeneity is further increased when using time-invariant omitted variables to account for some unobserved heterogeneity. Fourth, we are working with a panel data structure, which is consistent with the GMM.

The Roodman (2009a, 2009b), which is the extension of Arellano and Bover (1995) is preferred in this inquiry because it has been acknowledged to take into account cross-sectional dependence and restrict instrument proliferation (or over-identification) (see Love & Zicchino, 2006; Baltagi, 2008; Boateng et al., 2018). The *two-step* procedure is adopted in the specifications because it is *heteroscedasticity*-consistent.

The standard System GMM equations in levels (1) and in first difference (2) are summarised as follows:

$$INE_{i,t} = \sigma_0 + \sigma_1 INE_{i,t-\tau} + \sigma_2 ISO_{i,t} + \sigma_3 FIN_{i,t} + \sigma_4 Inter_{i,t} + \sum_{h=1}^{5} \delta_j W_{h,i,t-\tau} + \eta_i + \xi_t + \varepsilon_{i,t} \quad (1)$$

$$\begin{aligned} INE_{i,t} - INE_{i,t-\tau} &= \sigma_1 (INE_{i,t-\tau} - INE_{i,t-2\tau}) + \sigma_2 (ISO_{i,t} - ISO_{i,t-\tau}) + \sigma_3 (FIN_{i,t} - FIN_{i,t-\tau}) \\ &+ \sigma_4 (Inter_{i,t} - Inter_{i,t-\tau}) + \sum_{h=1}^{5} \delta_j (W_{h,i,t-\tau} - W_{h,i,t-2\tau}) + (\xi_t - \xi_{t-\tau}) + (\varepsilon_{i,t} - \varepsilon_{i,t-\tau}) \end{aligned} \quad (2)$$

where, $INE_{i,t}$ is the income inequality of country i at period t; σ_0 is a constant; τ represents the coefficient of autoregression which is one for present specification because of issues in degrees of freedom; ISO is information sharing offices: public credit registries or private credit bureaus; FIN, is financial development dynamics (depth, efficiency, activity and size); $Inter$, interaction between information sharing and financial access: ($PCR \times FIN$) or ($PCB \times FIN$); W is the vector of control variables (*remittances; government consumption expenditure and corruption control*), η_i is the country-specific effect, ξ_t is the time-specific constant and $\varepsilon_{i,t}$ the error term.

It is important to devote some space to briefly discuss identification, simultaneity and exclusion restrictions. It has been acknowledged in recent literature (see Asongu & Nwachukwu, 2016; Boateng et al., 2018; Tchamyou & Asongu, 2017), that all explanatory variables are supposed to be predetermined (or suspected endogenous) whereas only time invariant omitted variables are considered as strictly exogenous. This is because it is unfeasible for years (or time invariant variables) to be endogenous in first difference (see Roodman, 2009b). Therefore, the procedure for dealing with *ivstyle* (years) is '*iv (years, eq(diff))*' while the process for the predetermined variables is *gmmstyle*. In light of the aforementioned insights, the time invariant omitted variables (years) influence the dependent variable (inequality) only through the suspected endogenous variables (financial access).

Additionally, the Difference in Hansen Test is the statistical test that is used to assess the validity of the exclusion restriction for instrument exogeneity. Consequently, the null hypothesis of the underlying test should not be

rejected for years to elicit inequality exclusively through financial access. It is important to note that in the standard instrumental variable approach, rejecting the null hypothesis of the Sargan Overidentifying Restrictions test means that instruments do not exclusively explain the outcome variable via the suspected endogenous variables (see Beck et al., 2003) while in the GMM estimation technique, the Difference in Hansen Test is the required information criterion used to investigate if years are strictly exogenous.

4. Empirical results and discussion

4.1. Presentation of results

The empirical results are presented in Tables 1 and 2. While Table 4 reports results based on public credit registries, Table 2 displays findings related to private credit bureaus. Appendix 4 and Appendix 5 present results for the Atkinson index and the Palma ratio (robustness check). Each table has seven specifications corresponding to each financial development variable. There are four main information criteria employed to evaluate the validity of the models[3]. Based on these criteria, the models are overwhelmingly valid.

[3] *'First, the null hypothesis of the second-order Arellano and Bond autocorrelation test (AR(2)) in difference for the absence of autocorrelation in the residuals should not be rejected. Second the Sargan and Hansen over-identification restrictions (OIR) tests should not be significant because their null hypotheses are the positions that instruments are valid or not correlated with the error terms. In essence, while the Sargan OIR test is not robust but not weakened by instruments, the Hansen OIR is robust but weakened by instruments. In order to restrict identification or limit the proliferation of instruments, we have ensured that instruments are lower than the number of cross-sections in most specifications. Third, the Difference in Hansen Test (DHT) for exogeneity of instruments is also employed to assess the validity of results from the Hansen OIR test. Fourth, a Fischer test for the joint validity of estimated coefficients is also provided'* (Asongu & De Moor, 2017, p. 200).

Table 1: Public Credit Registries (PCR) in modulating the effect of financial access on inequality

	Gini Index						
	Financial Depth		Financial Efficiency		Financial Activity		Fin. Size
	Money Supply	Liquid Liabilities	Banking sys. Efficiency	Financial sys. Efficiency	Banking sys. Activity	Financial sys. Activity	
	M2(llgdp)	Fdgdp	BcBd	FcFd	Pcrob	Pcrobof	Dbacba
Constant	**0.018****	**0.025*****	0.009	0.006	**-0.021*****	-0.006	-0.012
	(0.011)	**(0.002)**	(0.144)	(0.371)	**(0.008)**	(0.246)	(0.101)
Gini(-1)	**0.971*****	**0.960*****	**0.970*****	**0.971*****	**1.042*****	**1.006*****	**1.032*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Public Credit Registries (PCR)	-0.0002	-0.0002	**0.0003****	**0.0004****	**0.0002*****	0.00008	**-0.002*****
	(0.266)	(0.226)	**(0.011)**	**(0.039)**	**(0.001)**	(0.294)	**(0.008)**
Money Supply	**-0.00007*****	---	---	---	---	---	---
	(0.004)						
Liquid Liabilities	---	**-0.00009*****	---	---	---	---	---
		(0.004)					
Banking Sys. Efficiency	---	---	**0.00006***	---	---	---	---
			(0.068)				
Financial Sys. Efficiency	---	---	----	0.008	---	---	---
				(0.143)			
Banking Sys. Activity	---	---	---	---	**-0.0001****	---	---
					(0.011)		
Financial Sys. Activity	---	---	---	---	---	0.00002	---
						(0.479)	
Financial Size	---	---	---	---	---	---	**-0.00007***
							(0.078)
Money Supply × PCR	0.00000296	---	---	---	---	---	---
	(0.178)						
Liquid Liabilities × PCR	---	0.00000380	---	---	---	---	---
		(0.156)					
Banking Sys. Efficiency × PCR	---	---	**-0.00000332****	---	---	---	---
			(0.010)				
Financial Sys. Efficiency × PCR	---	---	---	**-0.0004***	---	---	---
				(0.051)			
Banking Sys. Activity × PCR	---	---	---	---	**-0.00000183****	---	---
					(0.037)		
Financial Sys. Activity × PCR	---	---	---	---	---	-0.000000887	---
						(0.153)	
Financial Size × PCR	---	---	---	---	---	---	**0.00002*****
							(0.008)
Government Expenditure	0.00001	0.00002	0.00000416	0.00000622	0.00002	0.00006	-0.00001
	(0.686)	(0.629)	(0.937)	(0.904)	(0.734)	(0.110)	(0.885)
Corruption-Control	0.0004	0.0008	**-0.003****	**-0.003***	**0.003****	-0.0003	-0.0001
	(0.714)	(0.545)	**(0.043)**	**(0.066)**	**(0.037)**	(0.797)	(0.948)
Remittances	**0.0001*****	**0.0001*****	**0.0002****	**0.0002****	**0.0002***	**0.0002*****	0.00005
	(0.006)	**(0.005)**	**(0.013)**	**(0.014)**	**(0.053)**	**(0.000)**	(0.516)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Net effects of PCR	n.a.	n.a.	0.00059	n.a.	-0.000105	n.a.	-0.000015
Thresholds of PCR	n.a.	n.a.	18.072	n.a.	Negative Synergy	n.a.	n.s.a.
AR(1)	**(0.114)**	**(0.112)**	**(0.119)**	**(0.119)**	**(0.118)**	**(0.117)**	**(0.115)**
AR(2)	**(0.270)**	**(0.259)**	**(0.327)**	**(0.336)**	**(0.239)**	**(0.294)**	**(0.270)**
Sargan OIR	**(0.786)**	**(0.743)**	**(0.535)**	**(0.567)**	**(0.528)**	**(0.526)**	**(0.947)**
Hansen OIR	**(0.811)**	**(0.821)**	**(0.704)**	**(0.659)**	**(0.499)**	**(0.528)**	**(0.812)**

DHT for instruments							
(a) GMM Instruments for levels							
H excluding group	**(0.862)**	**(0.751)**	**(0.240)**	**(0.275)**	(0.091)	**(0.100)**	**(0.237)**
Dif(null, H=exogenous)	**(0.631)**	**(0.709)**	**(0.866)**	**(0.795)**	**(0.852)**	**(0.863)**	**(0.951)**
(b) gmm (lagged values)	---	---	---	---	---	---	---
H excluding group							
Dif(null, H=exogenous)							
(c) IV (eq (diff))							
H excluding group	**(0.471)**	**(0.462)**	**(0.894)**	**(0.609)**	**(0.155)**	**(0.155)**	**(0.603)**
Dif(null, H=exogenous)	**(0.909)**	**(0.927)**	**(0.340)**	**(0.558)**	**(0.899)**	**(0.926)**	**(0.806)**
Fisher	**14008.93*** **	**12502.53*** **	**1642.59 *** **	**2057.97*** **	**3773.16*** **	**7906.83*** **	**48403.51*** **
Instruments	36	36	36	36	36	36	36
Countries	42	42	42	42	42	42	42
Observations	369	369	369	369	369	369	369

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. na: not applicable due to the insignificance of marginal effects and/or unconditional effect of financial access. nsa: not specifically applicable because the information criteria does not validate the model. Mean value of PCR is 2.750. Mean value of PCB is 4.937. Range of PCR: 0.000 to 71.900. Range of PCB is 0.000 to 66.200.

Table 2: Private Credit Bureaus (PCB) in modulating the effect of financial access on inequality

	Gini Index						
	Financial Depth		Financial Efficiency		Financial Activity		Fin. Size
	Money Supply	Liquid Liabilities	Banking sys. Efficiency	Financial sys. Efficiency	Banking sys. Activity	Financial sys. Activity	
	M2(llgdp)	Fdgdp	BcBd	FcFd	Pcrob	Pcrobof	Dbacba
Constant	**0.098*** **	**0.114*** **	**0.062*** **	**0.060*** **	**0.099*** **	**0.101*** **	**0.027*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Gini(-1)	**0.829*** **	**0.807*** **	**0.862*** **	**0.864*** **	**0.809*** **	**0.806*** **	**0.953*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Public Credit Bureaus (PCB)	**0.001*** **	**0.001*** **	**-0.0007*** **	**-0.0008*** **	**0.001*** **	**0.001*** **	0.00002
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	(0.654)
Money Supply	**-0.00009** **	**---**	---	---	---	---	---
	(0.036)						
Liquid Liabilities	---	**-0.0001*** **	---	---	---	---	---
		(0.001)					
Banking Sys. Efficiency	---	---	**0.0001*** **	---	---	---	---
			(0.001)				
Financial Sys. Efficiency	---	---	---	**0.014***	---	---	---
				(0.053)			
Banking Sys. Activity	---	---	---	---	0.00003	---	---
					(0.655)		
Financial Sys. Activity	---	---	---	---	---	0.00003	---
						(0.560)	
Financial Size	---	---	---	---	---	---	-0.00004
							(0.128)
Money Supply × PCB	**-0.00002*** **	---	---	---	---	---	**---**
	(0.000)						
Liquid Liabilities × PCB	---	**-0.00003*** **	---	---	---	---	**---**
		(0.000)					
Banking Sys. Efficiency × PCB	---	---	**0.00000921*** **	---	---	---	**---**
			(0.000)				
Financial Sys. Efficiency × PCB	---	---	---	**0.001*** **	---	---	**---**
				(0.000)			
Banking Sys. Activity × PCB	---	---	---	---	**-0.00004*** **	**---**	**---**
					(0.000)		
Financial Sys. Activity ×	---	---	---	---	---	**-0.00005*** **	**---**

PCB						**(0.000)**	
Financial Size × PCB	---	---	---	---	---	---	0.000000168 (0.841)
Government Expenditure	**0.0001*** **(0.058)**	**0.0001*** **(0.084)**	0.0001 (0.149)	**0.0002*** **(0.092)**	**0.0002***** **(0.001)**	**0.0003***** **(0.001)**	0.00003 (0.496)
Corruption-Control	**0.002*** **(0.085)**	**0.006***** **(0.001)**	-0.002 (0.153)	-0.003 (0.126)	**0.005**** **(0.029)**	**0.005**** **(0.014)**	-0.0009 (0.363)
Remittances	**0.0007***** **(0.000)**	**0.0008***** **(0.000)**	0.0001 (0.103)	0.0001 (0.328)	**0.001***** **(0.000)**	**0.001***** **(0.000)**	**0.0003***** **(0.000)**
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Net effects of PCB	-0.00018	-0.000248	0.000145	0.0189	n.s.a.	n.s.a.	n.a.
Thresholds of PCB	Negative Synergy	Negative Synergy	Positive Synergy	Positive Synergy	n.s.a.	n.s.a.	n.a.
AR(1)	**(0.119)**	**(0.119)**	**(0.125)**	**(0.122)**	**(0.124)**	**(0.124)**	**(0.123)**
AR(2)	**(0.178)**	**(0.191)**	**(0.216)**	**(0.195)**	**(0.285)**	**(0.287)**	**(0.311)**
Sargan OIR	(0.033)	(0.036)	(0.020)	(0.028)	**(0.224)**	**(0.253)**	**(0.525)**
Hansen OIR	**(0.214)**	**(0.204)**	**(0.316)**	**(0.429)**	(0.038)	(0.047)	**(0.201)**
DHT for instruments							
(a) GMM Instruments for levels							
H excluding group	**(0.577)**	**(0.575)**	**(0.382)**	**(0.393)**	**(0.292)**	**(0.334)**	**(0.182)**
Dif(null, H=exogenous)	**(0.136)**	**(0.128)**	**(0.307)**	**(0.430)**	(0.033)	(0.037)	**(0.297)**
(b) gmm (lagged values)	---	---	---	---	---	---	---
H excluding group							
Dif(null, H=exogenous)							
(c) IV (eq (diff))							
H excluding group	**(0.398)**	**(0.321)**	**(0.740)**	**(0.582)**	**(0.749)**	**(0.773)**	**(0.337)**
Dif(null, H=exogenous)	**(0.164)**	**(0.198)**	**(0.112)**	**(0.284)**	(0.004)	(0.005)	**(0.184)**
Fisher	**25845.23*****	**18261.08*****	**64198.83*****	**424818.91*****	**73314.16*****	**50656.02*****	**31807.38*****
Instruments	36	36	36	36	36	36	36
Countries	42	42	42	42	42	42	42
Observations	369	369	369	369	369	369	369

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. na: not applicable due to the insignificance of marginal effects and/or unconditional effect of financial access. nsa: not specifically applicable because the information criteria does not validate the model. Mean value of PCR is 2.750. Mean value of PCB is 4.937. Range of PCR: 0.000 to 71.900. Range of PCB is 0.000 to 66.200.

Results are presented in terms of net impacts, marginal effects and thresholds at which public credit registries and private credit bureaus modulate financial access in order to reduce inequality. The notion of threshold is consistent with recent literature (see Batuo, 2015; Asongu, 2017; Asongu et al., 2017b). This threshold is a critical mass at which the modulating effect of a policy variable completely neutralizes an undesired effect from the independent variable of interest, so that ultimately there is a combined theoretically anticipated effect on the outcome variable. This concept is important in the perspective of informing policy makers of specific targets of policy-moderating variables required to have some desired effects on development outcomes.

Accordingly, policy makers are better informed when they are knowledgeable of cut-off levels at which credit registries completely counteract negative effect of financial access on inequality. Above the established thresholds, credit registries can interact with financial access to reduce inequality. Moreover, in order for thresholds to make economic sense, they must be within the range (i.e. minimum to maximum) disclosed in the summary statistics. In this case, the established threshold has policy relevance because the corresponding ranges are: "0.000 to 66.200" for private credit bureaus and "0.000 to 71.900" for public credit registries.

If we take for instance the third column of Table 1, we notice that the net effect of employing public credit registries to influence banking system efficiency to reduce inequality is positive (0.00059) and the corresponding marginal effect is negative (-0.00000332). Although this net effect is positive, we extend the analysis by computing the threshold level at which the unconditional effect of banking system efficiency becomes negative. This indicates that a certain level of 18.072% coverage [0.00006 / (-0.00000332)] is required to counterbalance or neutralize the effect of banking system efficiency. In other words, 18.072% coverage in public credit registries is needed to complement banking system efficiency in order to ultimately decrease inequality.

In the first column of Table 2, we investigate the role of private credit bureaus in modulating financial access (money supply) to decrease inequality. The marginal impact and net effect are respectively -0.00002 and -0.00018. Given that the conditional and unconditional effects are both negative, a negative synergy effect is apparent. Hence, it is not statistically feasible to compute a threshold.

The net effect on inequality is obtained from the interaction between information sharing offices (either private credit bureaus or public credit registries) and financial access on the one hand and unconditional effect of financial access on the other hand. For example, when the mean value of public credit registries is 2.750, the unconditional effect of banking system

efficiency is 0.00006 and the corresponding conditional effect equals -0.00000332, the net effect on inequality is therefore: 0.00059 = [-0.00000332 × 2.750] + [0.00006].

The signs of the control variables are not consistent with the expectations but are in most instances significantly positive. We examine if these positive signs are not resulting from a mix between non-stationary and stationary variables. Hence, unit root tests[4] are employed to confirm that the variables are stationary.

4.2. Further discussion of results and policy implications

In this section, we devote some space to further discuss the negative synergies, the positive synergies, the "not specifically applicable" (n.s.a.) mentions and the thresholds. The underlying points are discussed in chronological order.

First, negative synergies are consistent with our theoretical underpinnings because of the double negative effect in reducing inequality, notably, the: (i) negative effect of financial access (for instance banking system activity in Table 1) and (ii) negative impact of the interaction between financial access in public credit registries. Hence, it is reasonable to infer that contingent on financial development variables and specificities of credit registries, the theoretical expectations of linkages between credit registries, finance and inequality withstand empirical validity. Two analogous sub-references are also apparent, notably: (i) information sharing offices reduce information asymmetry associated with constraints to financial access and (ii) financial access ultimately has a positive redistributive effect on income across the population.

Second, positive synergies are not consistent with theoretical underpinnings of this study because the intuition of this study is to assess how financial access is modulated by credit registries to reduce inequality and not the contrary. These positive synergies (for instance in financial system efficiency in Table 2)

[4] The unit root tests are based on Im-Pesaran-Shin and Fisher types because the Breitung and Levin-Lin and Chu tests require a strongly balanced dataset.

could be the result of two factors, notably: (i) the low penetration rate of credit registries in African countries, recalling that they were introduced for the most part from the year 2004 and (ii) the need to improve other instruments that complement credit registries, like information and communication technologies which could facilitate the role of credit registries in reducing information asymmetry between borrowers and lenders.

Third, where thresholds cannot be established, "not specifically applicable (n.s.a.)" are assigned, especially when the following are apparent: when the unconditional effect is negative while the corresponding conditional effect is positive. This is contrary to the intuition for this study because credit registries should modulate financial access to reduce inequality. A possible reason for this unexpected tendency may be the presence of market power in the African banking industry, such that, instead of using information from credit registries to improve financial access, big banks prefer to enjoy a "quiet life" by using the information from credit registries to reduce financial access and improve their profit margins.

Fourth, we articulate thresholds corresponding to estimations for which the unconditional effect is positive while the conditional effect is negative. In other words, a threshold is the critical mass of a credit registry at which the positive effect of financial access on inequality is neutralised. Above the threshold, credit registries complement finance to have a net negative effect on inequality. In essence, above this threshold, the unconditional positive effect of finance becomes negative. To put this point into greater perspective, we substantiate the computed threshold in the previous paragraphs with a graphical representation. Let us consider the corresponding estimation where: 0.00006 is the unconditional effect while -0.00000332 represents the conditional effect from the interaction between financial access and public credit registries.

Figure 1 shows a representative curve of a PCR which depicts the established threshold of 18.072% of the adult population. On the x-axis we have PCR while the y-axis represents the net effect on inequality from the effect of PCR in

modulating financial access. As we have discussed above, the threshold corresponds to a level of penetration by PCR where the PCR modulates financial access (or banking system efficiency) to exert a null net effect on inequality. From the figure, the threshold is the point where the curve cuts across the y-axis. Above this threshold, the corresponding net effect is negative. Hence, from Figure 1, it can be observed that when X = 18.072, Y = 0. The equation representing the graph below is as follows:

$$y = -0.00000332x + 0.00006$$

where y is the net effect while x is the penetration level of PCR.

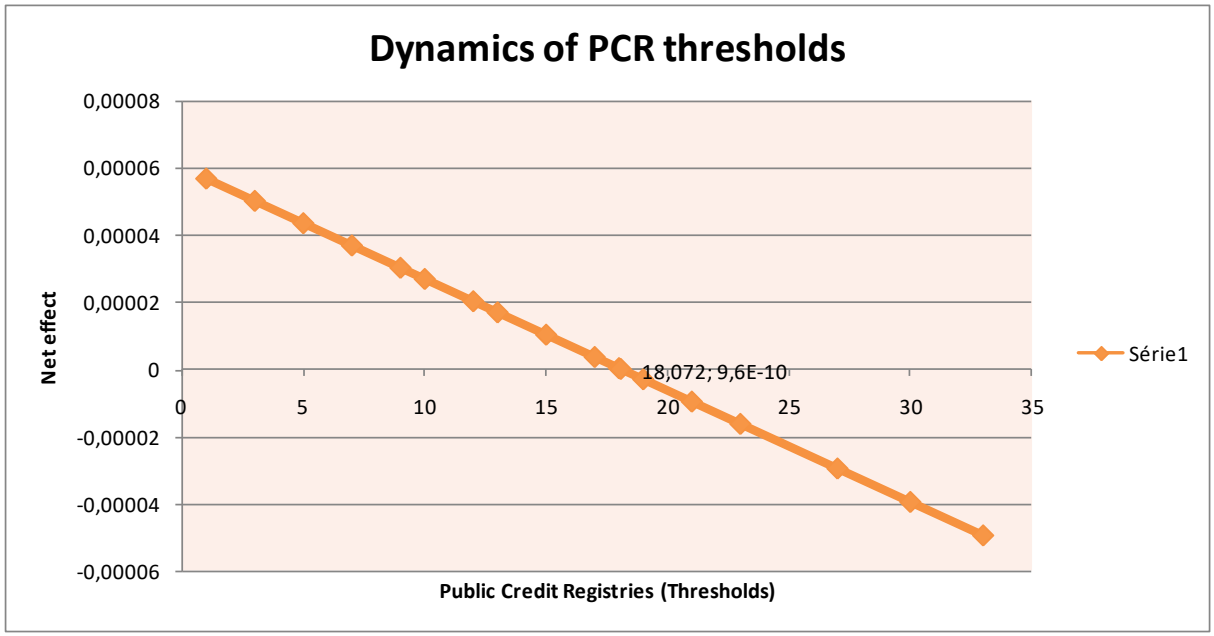

Figure 1: Dynamics of the PCR threshold. Source: Author.

Looking at this graph, we can raise the following policy question: what will be the net effect on inequality from the modulating effect of public credit registries if the penetration rate of public credit registries increases by 2% from the threshold? The net effect is -0.00000663, computed as: 0.00006-(0.00000332×20.072).

We further extend the analysis by computing two sets of averages for each country, notably: an average for the entire period and an average for the last

two years[5]. The average of the last-two years is to provide more contemporary policy insights. The purpose of the computation is to establish which countries are above or below the established thresholds in order to improve room for policy implications. Accordingly, countries below the established threshold are unlikely to be benefiting from reduced inequality owing the complementarity between PCR and finance. We notice that with the exceptions of Gabon, Mauritius and Tunisia that are in the driver's seat, most of the sampled countries need to implement policies that improve the institutions of credit registries in order to leverage on the positive income redistributive effects associated with their interactions with financial development.

The following are some measures that can be considered by policy makers within the framework of improving the penetration of PCR in sampled countries. (i) Enhancement of transparency mechanisms in credit information: availability and high-quality of credit information that are associated with greater transparency; have the advantages of bearing more in reducing adverse selection and asymmetric information between lenders and borrowers. This recommendation builds on the fact that most of the sampled countries rank high in the corruption perception index by Transparency International. (ii) Improvement of credit scoring (an important tool to enhance financial access) based on information collected from credit registries. It is a statistical method employed for the evaluation of the profitability and/or the ability of a potential borrower to comply with his/her financial obligations related to a loan. This recommendation stems from ICT development, as they facilitate collection and storage of customer credit information.

5. Conclusion and future research directions

This study has examined the role of information sharing in modulating the effect of financial access on inequality in 48 African countries for the period

[5] For lack of space, the computations are available upon request.

2004-2014. Information sharing is proxied with private credit bureaus and public credit registries. All dynamics of financial intermediary development articulated by the Financial Development and Structure Database (FDSD) of the World Bank are taken into account, namely: depth (money supply and liquid liabilities), efficiency (at banking and financial system levels), activity (from banking and financial system perspective) and size. The empirical exercise is based on interactive Generalised Method of Moments to control for time-invariant omitted variables and simultaneity.

From the analysis, the following results can be established: first, results with the Gini coefficient are more significant compared to those with the Atkinson index and the Palma ratio. Second, the unconditional effect of using public credit registries to influence banking system efficiency to reduce inequality is positive and the corresponding conditional or marginal effect is negative. A threshold of 18.072 percent coverage in public credit registries is needed to counteract the unconditional positive effect of banking system efficiency. Third, on the role of private credit bureaus in financial depth, both the unconditional and the conditional effects are negative, implying a negative synergy. Fourth, on the role of private credit bureaus in financial efficiency, both the unconditional and the conditional effects are positive, implying a positive synergy. It is relevant to emphasise that a positive synergy is not consistent with the theoretical underpinnings of this study because a negative net effect on inequality is anticipated. Overall, these findings are consistent with those of Asongu et al. (2017b) who concluded that credit registries broadly play their theoretical function of decreasing financing constraints, especially in the banking industry. This relaxation of financial constraints would facilitate access to credit by economic operators and households.

We have elicited unexpected effects by expressing the relevance of further complementing information sharing offices with ICT in order to exert a higher modulating effect on finance for inclusive development. Assessing whether our suggestions withstand empirical validity can be the object of future research. Within this framework, ICT and information sharing offices can be

policy independent variables. We have also provided some country-specific insights into which countries are in the driver's seat and which require more policy action. Extending these insights with country-specific studies will provide more targeted policy implications.

Future research directions can also improve this study by investigating conditional levels in inequality at which the modulating role of credit registries is most apparent. The intuition for this recommendation is that the established findings may be contingent on existing levels of inequality such that some tails of the inequality distribution are less relevant in the investigated relationships. This recommendation builds on the perspective that the results from the Gini measurement may be more significant because compared to other measurements of inequality; it is based on the entire distribution and does not capture tails of the inequality distribution. Hence, by extension, some outliers and tails of the inequality distribution may not be significantly endogenous to the investigated nexuses.

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Appendix 1: Definitions and sources of variables

Variables	Signs	Variable Definitions	Sources
	Panel A: Income Inequality		
Gini Index	Gini	"The Gini index is a measurement of the income distribution of a country's residents".	GCIP
Atkinson Index	Atkinson	"The Atkinson index measures inequality by determining which end of the distribution contributed most to the observed inequality".	GCIP
Palma ratio	Palma ratio	"The Palma ratio is defined as the ratio of the richest 10% of the population's share of gross national income divided by the poorest 40%'s share".	GCIP
	Panel B: Financial Development Dynamics		
Economic Financial Depth	M2	Money Supply (% of GDP)	World Bank (FDSD)
Financial System Depth	Fdgdp	Liquid Liabilities (% of GDP)	World Bank (FDSD)
Banking System Efficiency	BcBd	Bank credit on Bank deposits	World Bank (FDSD)
Financial System Efficiency	FcFd	Financial credit on Financial deposits	World Bank (FDSD)
Banking System Activity	Prcb	Private domestic credit from deposit banks (% of GDP)	World Bank (FDSD)
Financial System Activity	Prcbof	Private domestic credit from financial institutions (% of GDP)	World Bank (FDSD)
Financial Size	Dbacba	Deposit bank assets on Central bank assets plus Deposit bank assets	World Bank (FDSD)
	Panel C: Information Sharing Offices		
Information Asymmetry	PCR	Public credit registry coverage (% of adults)	World Bank (WDI)
	PCB	Private credit bureau coverage (% of adults)	World Bank (WDI)
	Panel D: Control Variables		
Government Consumption Expenditure	GCE	General government final consumption expenditure (% of GDP)	World Bank (WDI)
Remittances	Remit	Remittance inflows to GDP (%)	World Bank (WDI)
Corruption Control	CC	"*Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate gives the*	World Bank (WGI)

	country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5"

GCIP: Global Consumption and Income Project.WDI: World Bank Development Indicators. WGI: World Governance Indicators. FDSD: Financial Development and Structure Database.

Appendix 2: Summary statistics and Presentation of countries

Panel A: Summary statistics

	Variables	Mean	S.D.	Min.	Max.	Obs.
Income Inequality	Gini Index	0.582	0.035	0.488	0.851	527
	Atkinson	0.697	0.061	0.509	0.834	527
	Palma ratio	6.288	1.491	3.015	14.434	527
Financial Development	Economic Financial Depth (M2)	35.460	22.409	4.383	108.899	503
	Financial System Depth (Fdgdp)	29.254	21.144	2.223	92.676	503
	Banking System Efficiency (BcBd)	71.430	26.230	22.200	164.61	504
	Financial System Efficiency (FcFd)	0.747	0.357	0.222	2.531	503
	Banking System Activity (Pcrb)	21.092	18.614	0.873	102.535	503
	Financial System Activity (Pcrbof)	22.939	24.844	0.873	150.209	503
	Financial Size (Dbacba)	79.530	19.162	4.032	99.948	504
Information asymmetry	Private Credit Bureaus (PCB)	4.937	14.445	0	66.2	518
	Public Credit Registries (PCR)	2.750	8.268	0	71.9	518
Control variables	Government Consumption Expenditure	15.085	5.807	4.157	63.935	481
	Corruption control	-0.557	0.559	-1.513	1.139	528
	Remittances	4.250	6.475	0.000	50.818	471

Panel B: Presentation of countries

Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Chad, Central African Republic, Comoros, Congo Democratic Republic, Congo Republic, Côte d'Ivoire, Djibouti, Egypt, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Senegal, Sierra Leone, Sudan, Rwanda, Sao Tomé & Principe, Seychelles, South Africa, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia.

S.D: Standard Deviation. Min: Minimum. Max: Maximum. Obs.: Observations. M2: Money Supply. Fdgdp: Financial deposits (liquid liabilities). BcBd: Bank credit on Bank deposits. FcFd: Financial credit on Financial deposits. Pcrb: Private domestic credit from deposit banks. Pcrbof: Private domestic credit from deposit banks and other financial institutions. Dbacba: Deposit bank assets on central bank assets plus deposit bank assets.

Appendix 3: Correlation matrix

Income Inequality			Information asymmetry		Financial Development Dynamics							Control Variables			
					Financial Depth		Fin. Efficiency		Financial Activity		Fin. Size				
Gini	Atkinson	Palma r	PCB	PCR	M2	Fdgdp	BcBd	FcFd	Prcb	Pcrbof	Dbacba	CC	Remit	GCE	
1.000	0.887	0.966	0.489	-0.105	-0.227	-0.208	0.086	0.019	-0.108	-0.113	-0.069	0.274	0.076	0.123	Gini
	1.000	0.924	0.405	-0.098	-0.213	-0.196	0.019	-0.052	-0.126	-0.145	-0.054	0.237	0.127	0.071	Atkinson
		1.000	0.578	-0.134	-0.206	-0.186	0.041	-0.022	-0.120	-0.131	-0.022	0.338	0.087	0.130	Palma ratio
			1.000	-0.121	0.037	0.072	0.137	0.051	0.100	0.041	0.128	0.508	-0.134	0.267	PCB
				1.000	0.478	0.485	0.273	0.155	0.594	0.421	0.214	0.330	-0.012	0.002	PCR
					1.000	0.968	0.069	0.068	0.781	0.599	0.394	0.394	0.144	0.071	M2
						1.000	0.152	0.225	0.862	0.738	0.445	0.411	0.085	0.049	Fdgdp
							1.000	0.849	0.561	0.554	0.462	0.061	-0.057	0.024	BcBd
								1.000	0.595	0.776	0.393	-0.026	-0.116	-0.073	FcFd
									1.000	0.915	0.505	0.368	0.018	0.038	Prcb
										1.000	0.441	0.222	-0.040	-0.047	Pcrbof
											1.000	0.229	-0.084	0.056	Dbacba
												1.000	-0.054	0.354	CC
													1.000	-0.1232	Remit
														1.000	GCE

Gini: Gini of Income Inequality. Atkinson: Atkinson of Income Inequality. Palma r: Palma ratio of Income Inequality. M2: Money Supply. Fdgdp: Financial deposits (liquid liabilities). BcBd: Bank credit on Bank deposits. FcFd: Financial credit on Financial deposits. Pcrb: Private domestic credit from deposit banks. Pcrbof: Private domestic credit from deposit banks and other financial institutions. Dbacba: Deposit bank assets on central bank assets plus deposit bank assets. PCB: Private Credit Bureaus. PBC: Public Credit Registries. CC: Corruption Control. Remit.: Remittances. GCE: Government Consumption Expenditure.

Appendix 4: Public Credit Registries (PCR) in modulating the effect of financial access on inequality

Panel A: Atkinson

	Financial Depth		Financial Efficiency		Financial Activity		Fin. Size
	Money Supply	Liquid Liabilities	Banking sys. Efficiency	Financial sys. Efficiency	Banking sys. Activity	Financial sys. Activity	
	M2	Fdgdp	BcBd	FcFd	Pcrob	Pcrobof	Dbacba
Constant	0.014	0.019	**-0.018*** **	**-0.026*** **	-0.018	**-0.017***	**-0.036** **
	(0.278)	(0.222)	**(0.001)**	**(0.002)**	(0.194)	**(0.071)**	**(0.034)**
Atkinson (-1)	**0.983*** **	**0.976*** **	**1.030*** **	**1.032*** **	**1.040*** **	**1.028*** **	**1.083*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Public Credit Registries (PCR)	0.0002	0.00007	**0.0005*** **	**0.0007*** **	**0.0007*** **	**0.0005*** **	**-0.002***
	(0.366)	(0.700)	**(0.004)**	**(0.001)**	**(0.000)**	**(0.001)**	**(0.098)**
Financial access	-0.00007	**-0.0001** **	**-0.00006***	0.0007	**-0.0003*** **	**-0.00006** **	**-0.0002** **
	(0.106)	**(0.034)**	**(0.070)**	(0.778)	**(0.001)**	**(0.048)**	**(0.010)**
Financial access × PCR	-0.00000125	0.000000763	**-0.00000366** **	**-0.0006*** **	**-0.00000392** **	**-0.00000478*** **	**0.00002***
	(0.633)	(0.771)	**(0.029)**	**(0.001)**	**(0.013)**	**(0.002)**	**(0.079)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Net effects of PCR	n.a.	n.a.	-0.00007	n.a.	-0.000310	-0.0000731	-0.000145
Thresholds of PCR	n.a.	n.a.	Negative Synergy	n.a.	Negative Synergy	Negative Synergy	n.s.a.
AR(1)	(0.086)	(0.086)	(0.086)	(0.086)	(0.087)	(0.086)	(0.078)
AR(2)	**(0.533)**	**(0.675)**	**(0.245)**	**(0.266)**	**(0.997)**	**(0.571)**	**(0.547)**
Sargan OIR	(0.010)	(0.017)	(0.071)	(0.096)	(0.000)	(0.000)	**(0.482)**
Hansen OIR	**(0.400)**	**(0.488)**	**(0.387)**	**(0.303)**	**(0.485)**	**(0.357)**	**(0.359)**
DHT for instruments							
(a) GMM Instruments for levels							
H excluding group	**(0.372)**	**(0.604)**	**(0.270)**	**(0.340)**	**(0.204)**	**(0.133)**	**(0.437)**
Dif(null, H=exogenous)	**(0.410)**	**(0.382)**	**(0.472)**	**(0.315)**	**(0.667)**	**(0.602)**	**(0.325)**
(b) gmm (lagged values)	---	---	---	---	---	---	---
H excluding group							
Dif(null, H=exogenous)							
(c) IV (eq (diff))							
H excluding group	**(0.410)**	**(0.291)**	**(0.381)**	**(0.318)**	**(0.430)**	**(0.237)**	**(0.478)**
Dif(null, H=exogenous)	**(0.627)**	**(0.665)**	**(0.397)**	**(0.340)**	**(0.486)**	**(0.537)**	**(0.278)**
Fisher	**2255.41*** **	**1556.80*** **	**3476.72*** **	**1410.29*** **	**1911.36*** **	**1676.11*** **	**2413.92*** **
Instruments	36	36	36	36	36	36	36
Countries	42	42	42	42	42	42	42
Observations	369	369	369	369	369	369	369

Panel B: Palma ratio

	Financial Depth		Financial Efficiency		Financial Activity		Fin. Size
	Money Supply	Liquid Liabilities	Banking sys. Efficiency	Financial sys. Efficiency	Banking sys. Activity	Financial sys. Activity	
	M2	Fdgdp	BcBd	FcFd	Pcrob	Pcrobof	Dbacba
Constant	-0.013	0.224	**-0.219** **	**-0.289***	**-0.301** **	**-0.356*** **	-0.440
	(0.930)	(0.198)	**(0.026)**	**(0.064)**	**(0.049)**	**(0.000)**	(0.117)
Palma ratio (-1)	**1.022*** **	**0.988*** **	**1.035*** **	**1.033*** **	**1.102*** **	**1.075*** **	**1.114*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Public Credit Registries (PCR)	0.0008	-0.007	**0.013*** **	**0.014***	0.010	0.002	-0.088
	(0.899)	(0.362)	**(0.009)**	**(0.086)**	(0.209)	(0.621)	(0.113)
Financial access	**-0.002***	**-0.003***	-0.0004	0.070	**-0.007** **	-0.001	-0.003
	(0.080)	**(0.059)**	(0.675)	(0.432)	**(0.028)**	(0.145)	(0.172)
Financial access × PCR	0.00001	0.0001	**-0.0001** **	-0.011	-0.00000559	0.00000497	**0.0009***
	(0.864)	(0.228)	**(0.021)**	(0.106)	(0.910)	(0.911)	**(0.095)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Net effects of PCR	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Thresholds of PCR	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
AR(1)	(0.087)	(0.087)	(0.093)	(0.095)	(0.091)	(0.097)	(0.092)
AR(2)	**(0.352)**	**(0.350)**	**(0.300)**	**(0.310)**	**(0.382)**	**(0.356)**	**(0.301)**
Sargan OIR	**(0.173)**	**(0.145)**	(0.070)	**(0.102)**	**(0.152)**	**(0.113)**	**(0.856)**
Hansen OIR	**(0.562)**	**(0.502)**	**(0.325)**	**(0.336)**	**(0.674)**	**(0.518)**	**(0.425)**
DHT for instruments							
(a) GMM Instruments for levels							
H excluding group	**(0.597)**	**(0.850)**	**(0.181)**	**(0.313)**	**(0.347)**	**(0.182)**	**(0.425)**
Dif(null, H=exogenous)	**(0.466)**	**(0.288)**	**(0.483)**	**(0.373)**	**(0.755)**	**(0.733)**	**(0.407)**
(b) gmm (lagged values)	---	---	---	---	---	---	---
H excluding group							
Dif(null, H=exogenous)							
(c) IV (eq (diff))							
H excluding group	**(0.178)**	**(0.174)**	**(0.195)**	**(0.269)**	**(0.244)**	**(0.394)**	**(0.605)**
Dif(null, H=exogenous)	**(0.926)**	**(0.871)**	**(0.554)**	**(0.453)**	**(0.949)**	**(0.575)**	**(0.265)**
Fisher	**1117.50*** **	**2831.11*** **	**5939.05*** **	**2381.26*** **	**2370.92*** **	**3655.22*** **	**1041.49*** **
Instruments	36	36	36	36	36	36	36
Countries	42	42	42	42	42	42	42
Observations	369	369	369	369	369	369	369

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. na: not applicable due to the insignificance of marginal effects and/or unconditional effect of financial access. nsa: not specifically applicable because the information criteria does not validate the model. Mean value of PCR is 2.750. Mean value of PCB is 4.937. Range of PCR: 0.000 to 71.900. Range of PCB is 0.000 to 66.200.

Appendix 5: Private Credit Bureaus (PCB) in modulating the effect of financial access on inequality

Panel A: Atkinson

	Financial Depth		Financial Efficiency		Financial Activity		Fin. Size
	Money Supply	Liquid Liabilities	Banking sys. Efficiency	Financial sys. Efficiency	Banking sys. Activity	Financial sys. Activity	
	M2	Fdgdp	BcBd	FcFd	Pcrob	Pcrobof	Dbacba
Constant	**0.054*** **	**0.0602*** **	**0.063*** **	**0.0600*** **	**0.0717*** **	**0.0715*** **	0.014
	(0.000)	**(0.001)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	(0.177)
Atkinson (-1)	**0.926*** **	**0.922*** **	**0.916*** **	**0.918*** **	**0.896*** **	**0.899*** **	**1.020*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Public Credit Bureaus (PCB)	**0.0003*** **	**0.0007*** **	**-0.001*** **	**-0.001*** **	**0.002*** **	**0.001*** **	**0.0007*** **
	(0.005)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Financial access	-0.00003	-0.0001	-0.00003	0.0006	0.00004	0.00005	**-0.0002*** **
	(0.647)	(0.120)	(0.582)	(0.930)	(0.628)	(0.535)	**(0.000)**
Financial access × PCB	**-0.00001*** **	**-0.00001*** **	**0.00001*** **	**0.001*** **	**-0.00006*** **	**-0.00005*** **	**-0.00000892*** **
	(0.001)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Net effects of PCB	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-0.000244
Thresholds of PCB	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Negative Synergy
AR(1)	(0.082)	(0.086)	(0.096)	(0.097)	(0.096)	(0.095)	(0.087)
AR(2)	**(0.450)**	**(0.405)**	**(0.436)**	**(0.428)**	**(0.535)**	**(0.497)**	**(0.620)**
Sargan OIR	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	**(0.152)**
Hansen OIR	**(0.162)**	**(0.371)**	**(0.235)**	**(0.278)**	**(0.148)**	**(0.112)**	**(0.117)**
DHT for instruments							

(a) GMM Instruments for levels							
H excluding group	**(0.422)**	**(0.368)**	**(0.191)**	**(0.166)**	**(0.363)**	**(0.363)**	**(0.262)**
Dif(null, H=exogenous)	**(0.128)**	**(0.378)**	**(0.339)**	**(0.432)**	**(0.131)**	(0.095)	**(0.129)**
(b) gmm (lagged values)	---	---	---	---	---	---	---
H excluding group							
Dif(null, H=exogenous)							
(c) IV (eq (diff))							
H excluding group	**(0.688)**	**(0.607)**	**(0.390)**	**(0.433)**	**(0.887)**	**(0.902)**	**(0.516)**
Dif(null, H=exogenous)	(0.044)	**(0.201)**	**(0.191)**	**(0.214)**	(0.019)	(0.011)	(0.047)
Fisher	**15423.49*** **	**97035.88*** **	**134927.31*** **	**169441.83*** **	**8664.55*** **	**7241.01*** **	**21757.16*** **
Instruments	36	36	36	36	36	36	36
Countries	42	42	42	42	42	42	42
Observations	369	369	369	369	369	369	369

Panel B: Palma ratio

	Financial Depth		Financial Efficiency		Financial Activity		Fin. Size
	Money Supply	Liquid Liabilities	Banking sys. Efficiency	Financial sys. Efficiency	Banking sys. Activity	Financial sys. Activity	
	M2	Fdgdp	BcBd	FcFd	Pcrob	Pcrobof	Dbacba
Constant	**0.836*** **	**0.963*** **	**0.444*** **	**0.321*** **	**0.721*** **	**0.713*** **	0.221
	(0.000)	**(0.000)**	**(0.000)**	**(0.007)**	**(0.000)**	**(0.000)**	(0.166)
Palma ratio (-1)	**0.887*** **	**0.896*** **	**0.895*** **	**0.897*** **	**0.910*** **	**0.909*** **	**1.050*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Public Credit Bureaus (PCB)	**0.024*** **	**0.027*** **	**-0.033*** **	**-0.032*** **	**0.040*** **	**0.038*** **	**0.011*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Financial access	-0.0003	**-0.005** **	**0.002** **	0.313	-0.001	0.0006	**-0.004*** **
	(0.841)	**(0.012)**	**(0.024)**	(0.113)	(0.418)	(0.713)	**(0.000)**
Financial access × PCB	**-0.0006*** **	**-0.0006*** **	**0.0003*** **	**0.039*** **	**-0.001*** **	**-0.001*** **	**-0.0001*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Net effects of PCR	n.a.	-0.00796	-0.00051	n.a.	n.a.	n.a.	-0.00449
Thresholds of PCR	n.a.	Negative Synergy	Positive Synergy	n.a.	n.a.	n.a.	Negative Synergy
AR(1)	(0.097)	(0.094)	**(0.100)**	**(0.102)**	(0.098)	**(0.100)**	(0.097)
AR(2)	**(0.705)**	**(0.735)**	**(0.610)**	**(0.596)**	**(0.621)**	**(0.654)**	**(0.415)**
Sargan OIR	(0.000)	(0.000)	(0.000)	(0.000)	(0.017)	(0.023)	**(0.113)**
Hansen OIR	(0.052)	**(0.114)**	**(0.123)**	**(0.106)**	(0.029)	(0.034)	**(0.221)**
DHT for instruments							
(a) GMM Instruments for levels							
H excluding group	**(0.551)**	**(0.539)**	**(0.315)**	**(0.336)**	**(0.406)**	**(0.398)**	**(0.442)**
Dif(null, H=exogenous)	(0.025)	(0.067)	**(0.119)**	(0.095)	(0.017)	(0.022)	**(0.179)**
(b) gmm (lagged values)	---	---	---	---	---	---	---
H excluding group							
Dif(null, H=exogenous)							
(c) IV (eq (diff))							
H excluding group	**(0.525)**	**(0.573)**	**(0.682)**	**(0.610)**	**(0.716)**	**(0.729)**	**(0.316)**
Dif(null, H=exogenous)	(0.015)	(0.038)	(0.030)	(0.030)	(0.003)	(0.004)	**(0.224)**
Fisher	**24840.91*** **	**17581.21*** **	**63693.31*** **	**124304.17 *** **	**6191.46*** **	**5682.98*** **	**5113.81*** **
Instruments	36	36	36	36	36	36	36
Countries	42	42	42	42	42	42	42
Observations	369	369	369	369	369	369	369

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. na: not applicable due to the insignificance of marginal effects and/or unconditional effect of financial access. nsa: not specifically applicable because the information criteria does not validate the model. Mean value of PCR is 2.750. Mean value of PCB is 4.937. Range of PCR: 0.000 to 71.900. Range of PCB is 0.000 to 66.200.