Financial development and income inequality in Africa: A panel heterogeneous approach

By

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Abstract:

For about one and a half decades Africa has experienced strong growth rate but this has not translated into improved welfare as income inequality remain high and underdeveloped financial system as well as high exclusion are suspected to be the underlying causes of rising income inequality. This study investigates the relationship between financial development and income inequality in a balanced panel of 15 African countries using Pooled Mean Group approach as proposed by Pesaran *et al*., (1999) and Augment Mean Group as proposed by Eberhardt and Teal (2010). The results from the pooled mean group support the *inverted u-shaped hypothesis* of Greenwood and Jovanoic (1990). Furthermore, we find some support for the Kuznets insights that the sectoral structure of economies also influences income inequality. The Kuznets *inverted u-shaped hypothesis* was only weakly supported by domestic credit in only one nonlinear model. On the other hand, the augmented mean group results support the *inverted u-shaped hypothesis* only for Botswana. Overall evidence from this estimator suggests that lower GDP per capita across African countries is a potential cause of the rising income inequality in the region.

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1. Introduction

Income inequality for some times has not been of great social concern and it is argued that as long as poverty is reduced, there is no need to worry about the superrich (UNRISD, 2010:59). This is based on the premises that wealth concentration generates savings and investment to support economic growth. But this argument fail to stand the test of time as high levels of income inequality are often found in some of the poorest countries. Recently, Fuentes-Nieva and Galasso, (2014:3) argue that extreme concentration of wealth is detrimental to economic growth and poverty reduction and can have a multiplier effect on other forms of inequalities such those between women and men. Extreme inequality can also have an adverse effect on equal political representation. For example, when the rich use their wealth to capture government policy decision making, the rules are bend in their favour at the expensive of everyone else. This causes erosion of democratic governance, pulling apart of social cohesion and increases social unrest[3]. The World Economic Forum also rank extreme inequality as the second greatest threat to global peace on their global agenda for 2014 and income disparity is a major issue for Latin America, sub-Saharan Africa and Asia (World Economic Forum, 2014).

The greatest challenge facing Africa is the rising levels of income disparity and poverty in an era of robust growth for about one and a half decades. The truth is that the robust growth has not translated into significant poverty reduction and this has been attributed to the growing income inequality and financial exclusion in the region. Beck *et al*., (2007: 46) established that greater financial development induces the incomes of the poor to grow faster than average per capita GDP growth, which lowers income inequality. However, Africa is confronted with rising levels of income inequality in an era that has seen its financial sector undergone massive reforms from state owned to market oriented financial sector. But income inequality keeps rising amidst these reforms, thus prompting the question: what is the relationship between financial development and income inequality in Africa? Is there a possibility of a threshold level of financial development that need be reached before a significant effect on income inequality can be felt? Also how is income inequality related to the sectoral structure of African economies? Theories made several predictions about the relationship between finance and income inequality. Kuznets (1955) predict that income inequality increases at the early stage of development and declines at the later stage while Greenwood and Jovanoic (1990) theorise that income inequality increases at the early stages of financial development and falls at the advance stage. Finally, Galor and Zeira (1993) and Banerjee and Newman (1993) predict that financial development reduces income inequality irrespective of the stage of development.

[3] See Tax Justice Network Africa, 2014 (www.taxjusticeafrica.net)

In this study, we investigate the relationship between financial development and income inequality using a balanced panel of 15 African countries from 1985 to 2007. We examine whether financial development has an effect on income inequality and whether this effect depends on the level of financial development or the level of economic development. Presently only two peer-reviewed papers and a working paper have attempted to investigate this relationship in Africa (Batuo *et al.*, 2010; Kai and Hamori, 2009 and Asongu, 2013). Apart from the inherent data limitation problems in Africa, these studies have some empirical shortcomings. Recent development in econometric modelling emphasised that when the time (T) and cross-sectional (N) dimensions are large or when T is greater than N, standard microeconometrics techniques may yield bias and inconsistent estimates due to the potential of parameter heterogeneity across countries and serial correlation in the regressors (Baltagi, 2008:273). Thus, conventional techniques such as fixed and random effects, instrumental variables or generalised method of moment (GMM) can yield unreliable and potentially misleading estimates of the values of the parameter in dynamic panel if the slope coefficients are different (Pesaran and Smith, 1995 and Pesaran *et al*., 1999). Furthermore, arbitrary averaging of data over fixed period without due consideration to the length of business cycles is unlikely to eliminate business cycle effects since the length of business cycles phases fluctuate and varies across countries. This process may instead induce simultaneity and the estimated parameters can easily change signs and magnitude from the underlying parameter (Ericsson *et al*., 2001:245 and Wan *et al*., 2006:656).

This study addresses these empirical issues by employing the Pooled Mean Group (PMG) estimator developed by Pesaran *et a*l., (1999). PMG an intermediate estimator that implement both pooling of the time series for each group as well as averaging. It constraints the long run slope coefficients to be identical across groups but allows the short run parameters including the speed of adjustment to vary across groups. These techniques have been widely applied in dynamic heterogeneous panels (See Loayza and Ranciere, 2006; Frank, 2009; Das *et al*., 2012 and Neal, 2013). In addition, the also study employs the augmented mean group (AMG) estimator of Eberhardt and Teal (2010) that is robust to the presence of cross sectional dependence and also account for country specific slope coefficients.

This study contributes to the existing knowledge on financial development and income inequality in Africa from an empirical perspective. First, we explore the dynamic relationship of income inequality by attempting to provide an empirical explanation to the various theoretical predictions. As such our study provides insights on how income inequality relates to financial development as well as the sectoral structure of the economy. Finally, the empirical evidence will add to the limited evidence available on income inequality and financial development in Africa.

The reminder of the paper is organised as follows: Section 3 reviews of the theoretical and empirical literature and section 3 provides stylised facts about Africa. Section 4 describes the data and Section 5 specifies the econometric modelling. Section 6 discusses the results and the conclusion is presented in section 7.

2. Theoretical and empirical review

Theoretical Review

Development Economics theories have different predictions on how financial development can affect income inequality. For example, Greenwood and Jovanovic, (1990) predicted that the relationship between financial development and income inequality is an inverted u-shaped. Greenwood and Jovanovic (1990) developed a model of economic growth, financial development and income distribution in which financial intermediary develop to facilitate trade. Trading through financial intermediaries allows both higher and safer return because intermediaries can pool risk across large number of individuals. However, there is a cost associated with investing through intermediaries and these costs are higher at the early stages of economic development because financial intermediaries are at the infancy stage. This high costs constraint the poor from investing through financial intermediaries as such only the rich who can afford to invest through financial intermediaries at the early stage of development. According to Greenwood and Jovanovic (1990) at the early stages of economic development, financial intermediaries are virtually non-existent and the growth rate of the economy is slow. As the economy approaches intermediate phase of economic growth, financial intermediaries begin to develop. At this stage growth and saving rates in the economy both increases and income distribution across the rich and the poor widens, given that the poor have lower capacity to save and therefore amass wealth at a slower pace. As the economy passes through the early to the intermediate stages of economic development, financial intermediaries develop further to meet the increasing demand for financial services by the real sector. This will improve efficiency, reduce transaction costs and many people will gain access and income inequality begins to decline. In the advance stage of development, financial intermediary become more efficient and cost effective as well as provide greater access to many people. This therefore translates into an inverted U-shaped relationship with income inequality rising at the early stage of financial development and falling at the advance stage of financial development.

The second theory is based on financial market imperfections. Galor and Zeira (1993) developed a two sector model where income distribution is linked to bequest between generations and investment in human capital accumulation is indivisible. In the first stage, individuals can decide to invest in human capital and acquire skill or work as unskilled worker. In the second stage they work as skilled or unskilled labourers depending on their level of education, consume and leave bequest.

In the model individual inheritance determines whether an individual invests in human capital to become skilled or remain unskilled worker and those who inherited little bequest can borrow to finance human capital accumulation. Lenders of capital require collateral and borrowing incurs monitoring, supervision and enforcement costs. Consequently, those who inherited sufficient bequest can finance their human capital accumulation without borrowing but those who inherited little bequest need to borrow. Because of financial market imperfections, the poor under invest in human capital accumulation and end up being unskilled and live no bequest. In a similar manner Banerjee and Newman (1993) developed a model of occupational choice with four sectors: subsistence, employment, self-employed and entrepreneurship. Each individual can choose any of these sectors but individual choices is limited to initial wealth which is based on inheritance. To be an entrepreneur, individual need to borrow sufficient amount of capital and poor individuals can become entrepreneurs if they succeed to borrow and invest in productive activities thus making the transition across generation possible. These two theories therefore suggest that if financial markets are perfect the society will achieve social efficiency. That is, brilliants children from poor backgrounds and poor entrepreneurs with potential to succeed will gain access to the capital regardless of their initial parental wealth. Consequently, in the absence of financial markets imperfections, schooling and entrepreneurship will be a function of ability and not linked to parental wealth. Therefore, these models predict a linear and negative relationship between financial development and income inequality. However, when financial markets are imperfect, financial development will increase income inequality and this reflects the positive linear term of Greenwood and Jovanoic (1990). Hence, the linear and inverted u-shaped hypotheses complement each other.

Kuznets (1955) also suggested that inequality is related to the sectoral structure of an economy and predicted an inverted u-shape relationship between income inequality and economic development. Kuznets (1955) assumed that per capita income in the rural agricultural sector is lower than that of the urban and industrial sector and that this difference in income shares causes people to move from rural to the urban and industrial sectors. Hence, Kuznets (1955) predicted that income inequality will be higher during the transitional phase of an economy from agricultural to pre-industrialisation. But as the early phase of industrialisation elapsed, several forces converged to enhance economic situation of the new migrants within the urban population. Thus, after a while a new generation will be born in the cities than in the rural areas and will be able to adopt to city life, gain skills through quality education and hence stand a better chance to secure a high paying job. This translates into an *inverted u-shape* relationship between income inequality and economic development. Income inequality will rise at the transition phase and decline at the stage of full industrialisation.

In summary, each theory predicts a completely different mechanism through which financial development is linked to income inequality. These various predictions will be tested to ascertain which one applies in the context of Africa.

Empirical literature

Empirical studies on the finance-inequality relationship started only when the Deininger and Squire (1996) dataset on income inequality was made available. Even with the availability of income inequality data sets, empirical evident still remain scant with developed economies dominating available studies. Empirical evidence from Africa is almost non-existent with two peer-reviewed papers and a working paper being the known available studies (Kai and Hamori, 2009; Batuo *et al*., 2010 and Asongu, 2013). One can generally group the studies into two categories based on the econometric methods used. The first group employs panel data techniques in a cross country analysis (see for instance, Li *et al*., 1998; Beck *et al*., 2004 and 2007; Clarke *et al*., 2006 and 2013; Rehman *et al*., 2008; Kappel, 2010). The second group of studies used country-specific time series methods (e.g. Law and Tan, 2009; Law *et al*., 2014)

One of that earliest studies, is Li *et al*., (1998) that examined the Kuznets hypothesis looking at the international and intertemporal variation in inequality in 49 developed and developing countries from 1947-1994 using ANOVA, LSDV and RE. They found income inequality to be stable while income has been rising for the period under study thereby rejecting the Kuznets hypothesis. Their results further suggest that the determinants of income inequality vary only slowly within countries but are significantly different across countries.

Focusing on the finance-inequality relationship, Beck *et al*., (2004 and 2007) found that income inequality falls faster in countries with well-developed financial system. Their results further suggest that well-developed financial systems induce the incomes of the poor to grow faster than the average per capita GDP growth which lowers income inequality.

In a similarly related cross country studies Clarke *et al*., (2006 and 2013) investigated the relationship between finance and income inequality in 83 countries from 1960 to 1995 and recently (in the 2013 study) expanded the countries to 91 while maintaining the same period. They employ OLS and GMM in both analysis and in the earlier study, empirical evidence strongly support the linear and negative hypothesis with some weak support for Greenwood and Jovanoic (1990) hypothesis. Similar supports for the negative and linear hypothesis were found in the recent study but no support for Greewood and Jovanoic (1990) and some modest support for the augmented Kuznets hypothesis.

Rehman *et al*., (2008) analyse data for 51 countries at different stages of economic growth to understand the factors driving income inequality among these groups of countries and split the data into four groups to test the Kuznets hypothesis. They found government spending, literacy rate and trade openness to be the main factors driving income inequality in low, lower, middle and upper income countries. Their results showed that financial development reduces income inequality regardless of the stages of economic development and they also found supports for the Kuznets inverted u-shaped hypothesis. However, Kappel (2010) found that government spending reduces income inequality in high income but not low income countries. Evidence from regression analysis showed that inequality and poverty are not only reduced through better loan markets but also through well-developed stock markets. The results also identify ethnic diversity and land distribution as key factors driving income inequality.

Recently emerging evidence suggests the existence of a threshold effect of financial development and institutional quality on income inequality. For example, Kim *et al*., (2011) employed an instrumental variable threshold regression approach for a panel of developed and developing countries and found the existence of a nonlinear threshold effect of financial development. Their results indicate that financial development (banks and stock markets) will disproportionately help the poor and reduce income inequality only when a country has reached a certain threshold level of financial development. Below such threshold level, financial development will hurt the poor and worsen income distribution. Tan and Law (2012) also found evidence of a threshold effect but their results suggest that financial development will reduce income inequality at the early stage of financial development only below a certain threshold level of financial development. However, further development above this threshold level will increase income inequality. Recently, Law *et al*., (2014) employ a threshold regression approach and found that financial development will reduce income inequality only after a certain level of institutional quality has been achieved and that below such level, the effect of financial development on income inequality will not exist.

We now turn to studies that focused on African countries. All the studies are cross country in approach. Kai and Hamori (2009) is the first known peer-reviewed study in Africa which examines the effect of globalisation and financial depth on income inequality in 29 SSA countries from 1980-2002 using GMM. Their empirical evidence revealed that globalisation worsens income inequality but that this effect dampens with economic development of countries. Their evidence further suggests that financial development reduces inequality but the reducing effect of financial development on inequality declines as globalisation intensifies.

Batuo *et al*., (2010) is another study that investigated the effect of financial development on income inequality in 22 African countries from 1980-2004 by testing the various theoretical hypotheses.

They found empirical support for the linear and negative hypothesis that financial development reduces income inequality. Meanwhile Asongu (2013) examine the channel through which investment affect inequality and which channels are good for the poor in 13 African countries. The overall result revealed that financial development in Africa does not help the poor. The results showed that financial depth and activity reduces income inequality whereas financial efficiency increases income inequality which provides support for Greenwood and Jovanoic (1990) inverted u-shaped hypothesis. That is, large average loan sizes and deposits per capita are likely to benefit the rich and well established firms.

Gries and Meirrieks, (2010) also found in a group of SSA countries that weak institutional quality undermines the effectiveness of financial development to reduce income inequality in the region.

Apart from cross country studies, there are also single country studies that have examined this dynamic relationship between financial development and income inequality. However, none of these studies looked at African countries. The linear and negative hypothesis of Galor and Zeira (1993) and Banerjee and Newman (1993) enjoy overwhelming support from single country studies regardless of the method used in the analysis (see Shahbaz and Islam, 2011; Bittercout, 2010; Liang, 2006 and Hoi and Hoi, 2012). In contrast, Ang (2010) found that underdevelopment of financial sector in India hurt the poor more than the rich. Law and Tan (2009) failed to find any statistically significant effect of financial development on income inequality in Malaysia. Instead they found a statistically significant effect of institutional quality in reducing income inequality and GDP per capita as well as inflation appeared to be the most significant determinants of income inequality. They concluded that to reduce income inequality effort should be directed at improving economic development and maintaining low levels of inflation.

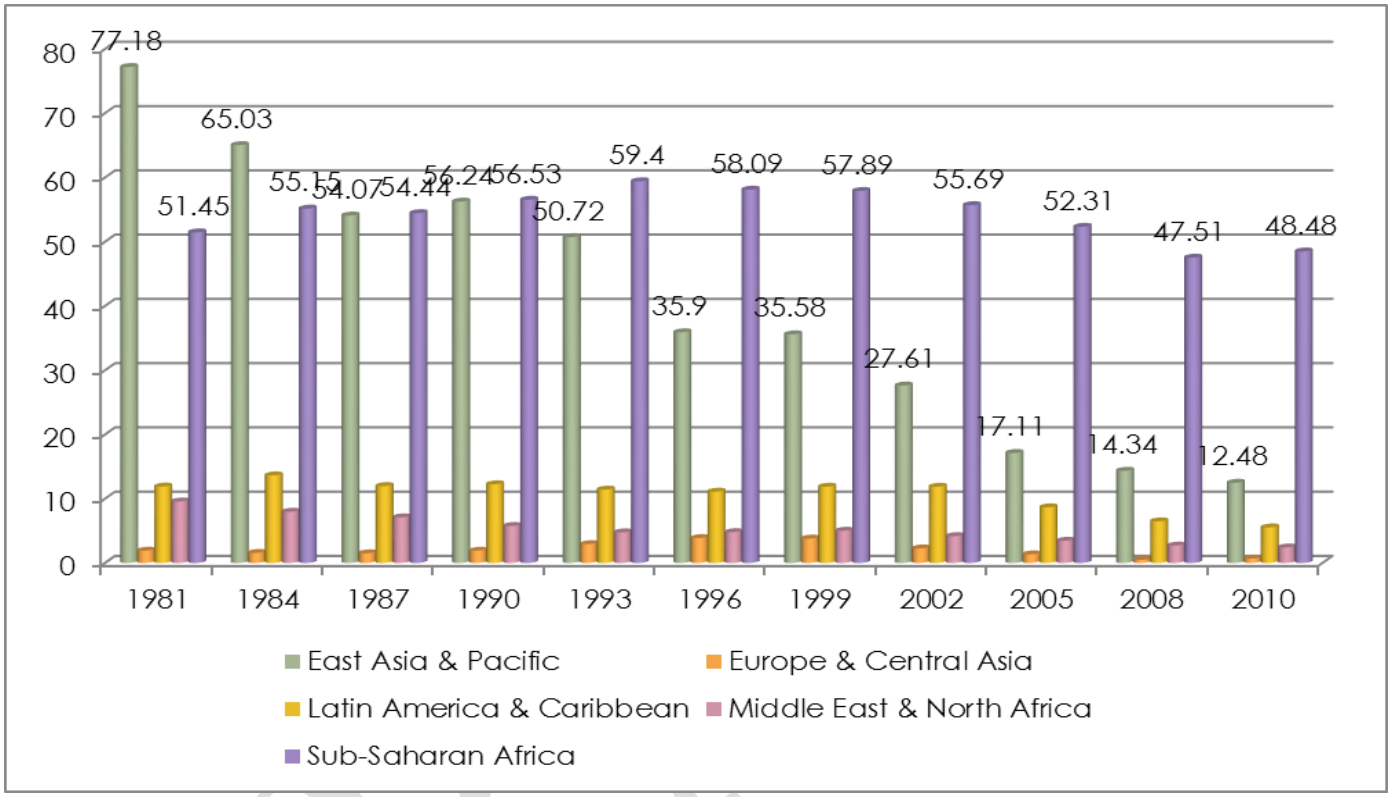
The foregoing review clearly shows that, empirical evidence though not clear cut comes mostly from developed and developing countries and presently only two published papers from Africa. Secondly, apart from single country studies outside Africa that have employed ARDL in their analysis, most cross country studies applied the conventional method of data averaging which is not in line with empirical modelling for heterogeneous non-stationary panel data. This study argues that assuming homogeneity of slope coefficient when in fact the slopes are different may lead to misleading inferences.

3. Some stylised facts about Africa.

African countries remain among the poorest countries in the world and the sub-region also has been among the highest unequal countries with six out of the most unequal countries in the world in 2010 being from Africa (AfDB, 2012). Besides having the lowest average per capita income compared to other regions, sub-Saharan Africa has the highest headcount poverty ratios. As shown in Figure 1,

the headcount poverty ratio which was 52% in 1981 has marginal dropped to 49% in 2010. In contrast, the East Asia and Pacific region which had headcount poverty ratio of 77% in 1981 has witnessed a significant drop to 12% in 2010. Other regions also experienced significant drop in their headcount poverty over the years

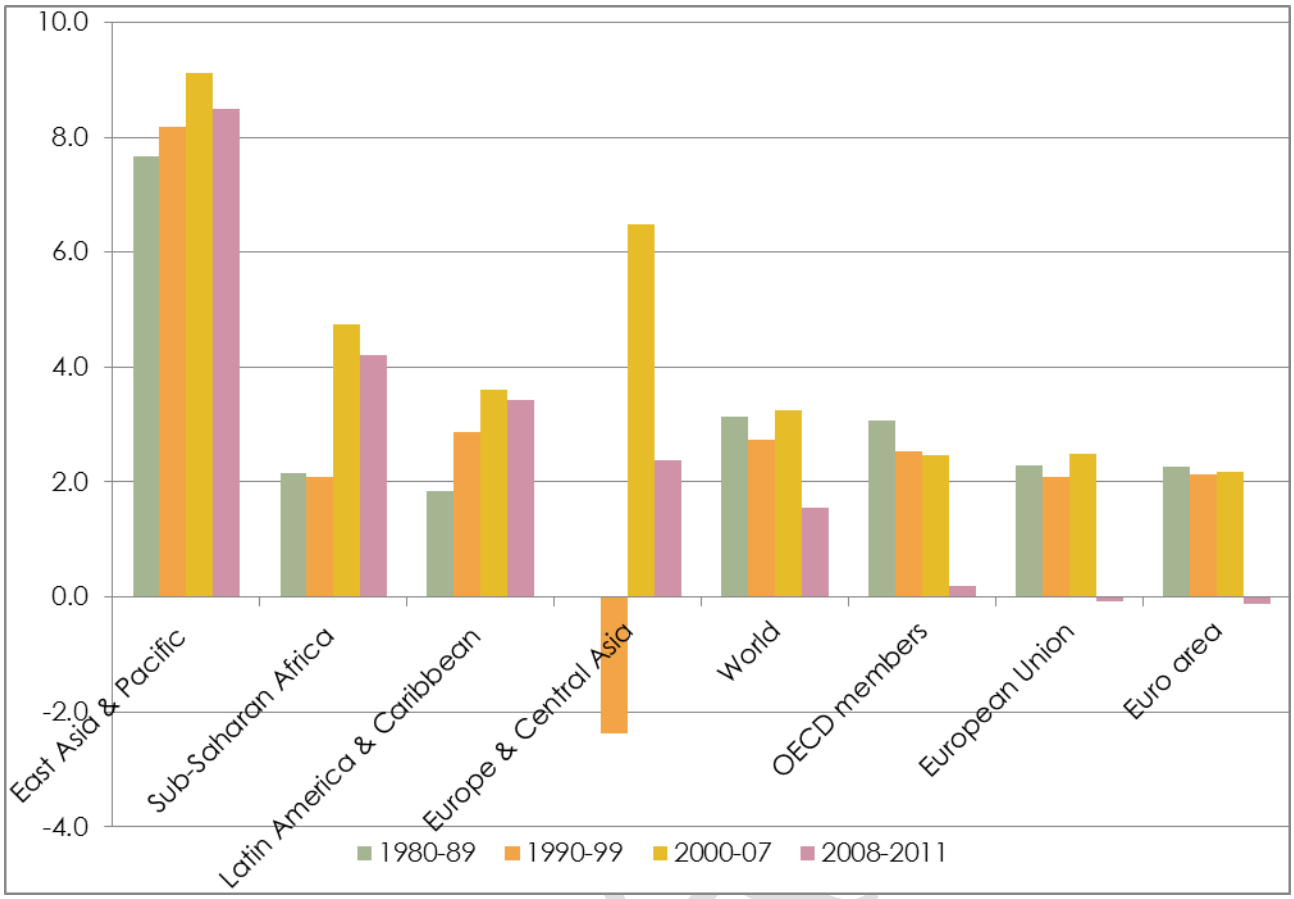
Figure 1: Poverty headcount ratio at $1.25 a day (PPP) (% of population)



Sources: World Bank World Development Indicators 2014

Despite the high poverty rate in the region, African countries have been among the fastest growing countries in the world in last one and half decade. As Figure 2 shows the SSA region is second to the East Asia and Pacific in recording high economic growth rate since the 2000 decade. This clearly demonstrates that the growth experience is not evenly distributed. This has led to the high income inequality being experienced in the region. For instance, some of the most unequal countries in the world are based in the SSA region- South Africa, Botswana, Lesotho, Angola, Comoros, Namibia, Swaziland and Central Africa Republic (AfDB, 2012: 4).

Figure 2: Relative performance of SS Africa and other regions: 1980-2011



Sources: World Bank World Development Indicators 2014

Could the relatively high income inequality and poverty rate despite the high growth rate be attributed to the state of the financial system in Africa? In the past three decades many SSA countries have adopted several financial sector reforms which put emphasis on market oriented policies. For instance, in the 1980s and 1990s many of the countries in the region adopted the structural adjustment programme which emphasised the liberalization and opening of the financial sectors as opposed to government controlled eras of the past. A look at indicators of financial development in the region reveals that though the region has experienced some progress in the financial sector, the sector remains largely underdeveloped and among the least developed around the world. The level of financial exclusion also remains very high with only 35% of the adults' population having access to the banking sector and other financial institutions (Global Findex, 2015). A cursory look at the indicators of financial development vis-à-vis Gini coefficient, a measure of income inequality, in Figures 3 and 4 seems to suggest some correlation between income inequality and financial development. One can observe that in countries where the domestic private credit as a ratio of GDP is rising the Gini coefficient tend to fall. This can easily been seen in Egypt, Ethiopia, Malawi and Mauritius. On the other hand, in countries where the domestic private credit declines there are also some indications that the Gini coefficient rose. This is evident

in Cote d'Ivoire, Ghana Lesotho, and Mauritania. What is not clear though is the extent to which the level of financial development explains the behaviour of income inequality in these countries. Moreover, it is not obvious from the simple graphs whether the relationship between financial development and income inequality is a linear or a non-linear one. These can only be established using more advanced econometric techniques. We will turn attention to the methods that the study uses to accomplish this in the next section.

Figure 3: Gini net and domestic credit

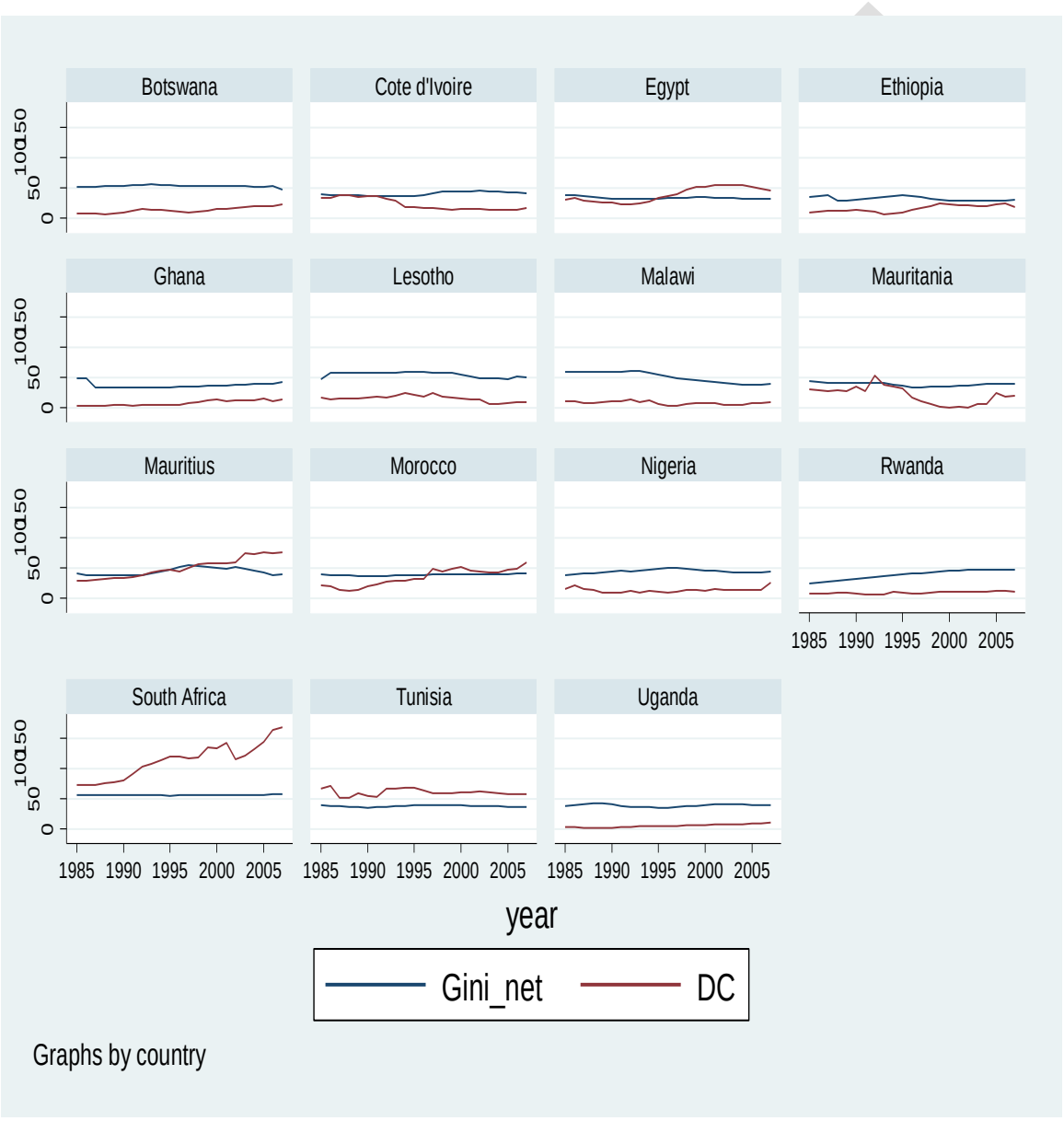
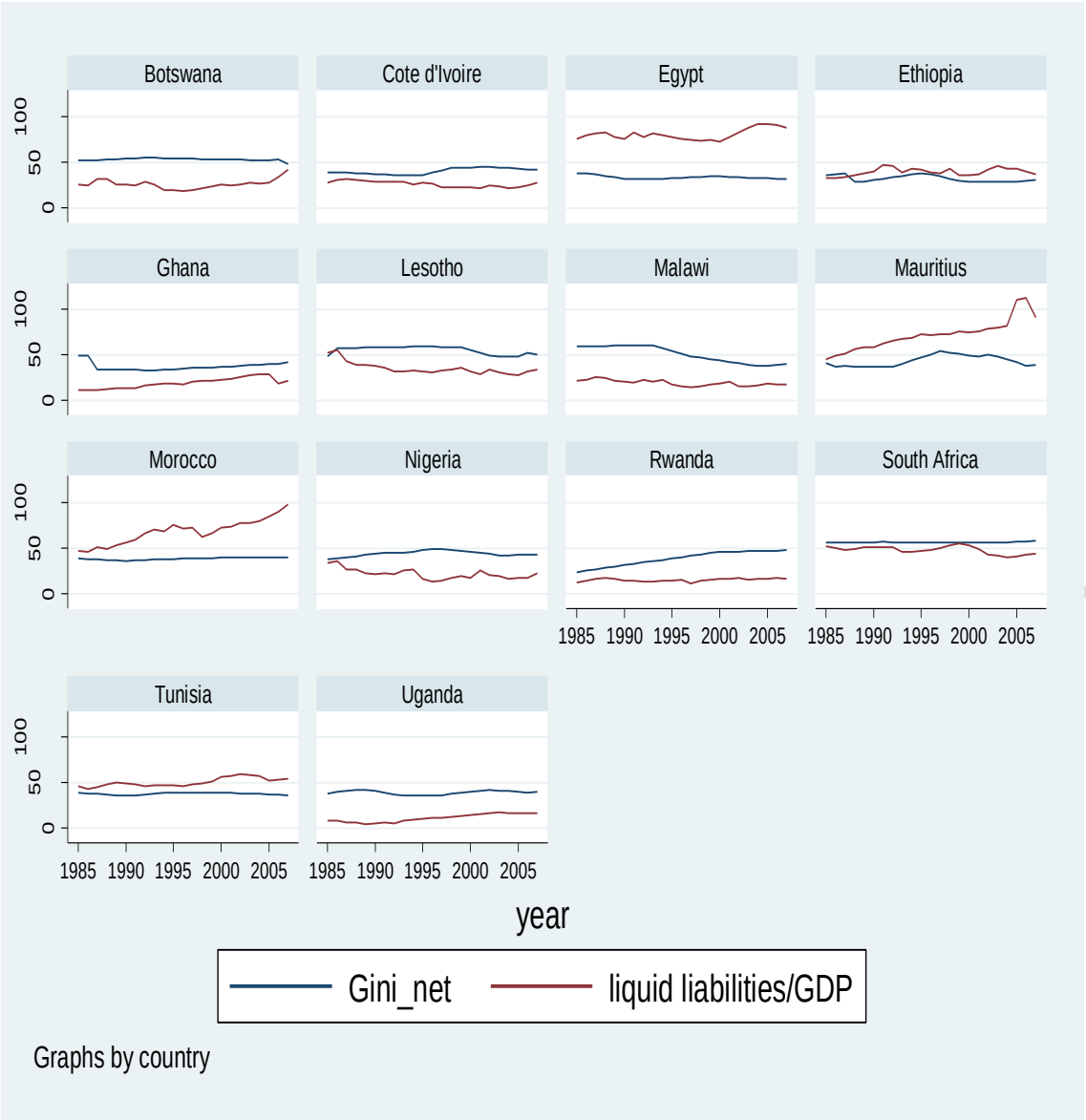


Figure 4: Gini net and liquid liabilities



Source: By Author

4 Data Description

Several sources have been used to collect data for this study. Financial development indicators are sourced from the World Bank global financial development database. Following the finance-growth literature, financial development is measured using two indicators (Beck, Levine and Loaya, 2000 and Beck *et al*., 2004). First, domestic credit to GDP which equals credits provided to the private sector by deposit money banks and other financial institutions. This measure excludes credit granted to the government and state owned enterprises as well as credits issued by the central bank. Domestic credit therefore reflects the degree to which the private sector has access to financial

intermediation. Secondly, the ratio of liquid liabilities of the banking system to GDP and these two proxies are retrieved from the Global Financial Development Database.

The data for income inequality or Gini coefficient are sourced from the Standardised World Income Inequality Dataset (SWIID) created by Solt (2009). The SWIID dataset is created by using several techniques to calculate the ratios between different types of Gini coefficients- relying heavily on information about the ratios for the same country in proximate times- to increase the number of comparable observations. The SWIID combines information from other income inequality datasets[4] to create a standardised income inequality dataset with greater coverage that maximises comparability of available income inequality data for the broadest possible sample of countries and years. The SWIID uses the Luxembourg Income Study (LIS) dataset to serve as the base for standardisation (Solt, 2009:1). Empirical research based on SWIID dataset has been published in peer-reviewed journals such as *The Economic and Social Review; Emerging Markets Finance and Trade* and *Social Science Quarterly*. Thus, we believe the dataset has some credibility and can be used for our study. Due to data limitation, our sample comprise of a panel of 15 African countries from 1985 to 2007. In addition, GDP per capita, inflation rate, trade openness, gross primary school enrolment and value added by the manufacturing sector to GDP are also used in the analysis as control variables. These indicators are sourced from the World Bank World Development Indicator Database, 2014.

5 Empirical framework and econometric specification

Empirical literature has applied several techniques to analyse dynamic heterogeneous panel with medium to large N and large T dimensions. Traditionally the fixed-effect (FE) which pooled the times series and allow only the intercepts to vary across countries has been used. A major limitation with the FE is that if the slope coefficients are not identical, the estimated parameters from FE are inconsistent. Secondly, if the cross sectional dimension (N) and times series (T) are sufficiently large, a mean group (MG) approach can be used where a model is fitted separately for each panel unit and a simple mean of the coefficients is calculated. This method allows the intercepts, slope coefficients and error variances to vary across panel units. Thirdly, a Pooled Mean Group (PMG) which allows the short run coefficients and intercepts to vary freely across groups but constraint the long run to be homogeneous can be used. The PMG is therefore an intermediate estimator that averages as well as pool time series data together (Pesaran *et al.*, 1999 and Blackburne and Frank, 2007). Other advanced techniques that account for cross sectional dependence such as Common

[4] The United Nations University- World Income inequality Dataset version 2.0c, the OECD Income Distribution Database, the OECD Income Distribution Database, the Socio- Economic Database for Latin America and the Caribbean generated by CEDLAS and the World Bank, Eurostat, the World Bank's PovcalNet, the UN Economic Commission for Latin America and the Caribbean, the World Top Incomes Database and national statistical offices around the world.

Correlated Effect Mean Group (CCEMG) and Augmented Mean Group (AMG) are suitable when cross-section and time series dimensions are large. The main estimator adopted for this study is the PMG. The PMG is particularly useful when there are reasons to expect the long run relationships between variables to be similar across groups. For example, the structural adjustment programme implemented by almost African countries in the 1990s, mobile banking that is influencing African financial system almost in the same manner and financial markets imperfections. On the other, there are reasons to allow for short run dynamics because countries have different ways to respond to shocks depending on the degree of vulnerability. PMG is suitable for small sample size and can effectively estimate the long run effect even when the individual long run cannot be identified as a result of exact multi-collinearity between the elements of x in particular groups (Smith and Fuertes, 2006:35). Furthermore, PMG will generate consistent and reliable average estimate of the short run coefficients across groups by taking the simple averages for each country coefficients (Loayza and Ranciere, 2006: 1056). However, the efficiency and consistency of the parameters estimated by PMG relies on certain specifications. First, that the residuals of the regression are serially uncorrelated and that the independent variables are exogenous. To ensure this, we estimate the PMG in an autoregressive distributed lag model (ARDL) framework with one lag of the dependent and independent variables.

The second condition requires that country specific effects and cross country common factors be control for. We control for country specific effects with the inclusion of an intercept for each country and common country factors by demeaning the data using the corresponding cross sectional mean for each period. Finally, for a dynamic stable long run relationship to exist, the error correction term should be negative and not greater than -1 (Loayza and Ranciere, 2006: 1059). The next section describes the empirical modelling of PMG in an autoregressive distributed lag (ARDL) framework.

5.1 Pooled mean group (PMG) Model

Assume data on time periods, t = 1, 2… T and groups, i = 1, 2… N and we wish to estimate an ARDL (p, q, q… q) model.

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} \mathrm{X}_{i,t-j} + \mu_i + \varepsilon_{it} \qquad 3$$

where X_{it} is a k x 1 vector of explanatory variables, δ_{ij} are k x 1 coefficient vectors and λ_{ij} are the coefficient of the lagged dependent variable, μ_i is the group specific fixed effects and ε_{it} is the error term. The time series dimension (T) must be large enough such that a separate model can be fitted for each group. Thus if the variables are I (1) a linear combination of them will produce an error term that is I (0) for all *i*. An important feature of co-integrated variables is their ability to restore

long run equilibrium due to any temporary shock to the system. This means an error correction mechanism in which the short run changes of the variables in the system are influenced by deviations from long run equilibrium (Blackburne and Frank, 2007: 198). As such Equation 3 is reparametrized into an error correction equation as follows:

$$\Delta y_{it} = \phi_i (y_{i,t-1} - \theta_i' \mathrm{X}_{it}) + \sum_{j=1}^{p} \lambda_{ij}^{*} \Delta y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij}'^{*} \Delta \mathrm{X}_{i,t-j} + \mu_i + \varepsilon_{it} \qquad 4$$

where $\phi_i = -(1 - \sum_{j=1}^{p} \lambda_{ij})$, $\theta_i = \sum_{j=0}^{q} \delta_{ij} / (1 - \sum_{k} \lambda_{ik})$, $\lambda_{ij}^{*} = -\sum_{m=j+1}^{p} \lambda_{im}$ j= 1, 2. . . p -1 and $\delta_{ij}^{*} = -\sum_{m=j+1}^{q} \delta_{im}$ j = 1, 2… q -1. ϕ_i is the error correction speed of adjustment and should be negative and significant to ensure return to long run equilibrium after a shock. However, if ϕ_i = 0 then there is no evidence of a long run relationship. $y_{i,-j}$ and $x_{i,-j}$ are j period lagged values of y_i and x_i, $\Delta y_i = y_i - y_{i,-1}, \Delta x_i = x_i - x_{i,-1}$, $\Delta y_{i,-j}$ and $\Delta x_{i,-j}$ are j period lagged of Δy_i and Δx_i (Pesaran *et al*., 1999).

Apart from the PMG, we also estimate the relationship using augmented mean group (AMG) which account for cross-sectional dependence and heterogeneous slope coefficients across groups.

The AMG is then estimated in two stages as follows:

AMG Stage (i): $\Delta y_{it} = b' \Delta x_{it} + \sum_{t=2}^{T} c_t \Delta D_t + \varepsilon_{it} \Rightarrow \hat{C}_t \equiv \hat{\mu}_t^{\bullet}$ 5

AMG Stage (ii): $y_{it} = \alpha_i + b_i' x_{it} + c_i t + d_i \hat{\mu}_t^{\bullet} + \varepsilon_{it}$ 6

$$\hat{b}_{AMG} = N^{-1} \sum_{i} \hat{b}_i$$

Stage (i) represents an OLS regression with T-1 year dummies in first differences from which the coefficients of the year dummies are collected and relabelled as $\hat{\mu}_t^{\bullet}$. According to Eberhardt and Teal, (2010:7) the coefficients of the year dummies are extracted from a pooled regression in first difference because non-stationary variables and unobservables are assumed to bias the estimates in the pooled levels regression. In the stage (ii) $\hat{\mu}_t^{\bullet}$ is included in each of the N standard country regression with a linear trend to account for omitted idiosyncratic processes evolving in a linear fashion over time. Also $\hat{\mu}_t^{\bullet}$ can be subtracted from the dependent variable meaning a common process is imposed on each country with a unit coefficient. The estimates of AMG in any case are averaged across countries following the Mean Group approach of Pesaran and Smith (1995).

Econometric specification of the model

The study adopts the empirical specification of Clarke Xu and Zou (2013:501). Thus, the relationship between financial development and income inequality is specified as follows:

$$LogInequality_{it} = \alpha_i + \delta_i t + f(finance_{it}) + \beta_2 CV + \varepsilon_{it} \quad 7$$

Where α_i are country specific fixed effects, $\delta_i t$ represents country specific time trends, which captures any country specific omitted variables that are either relatively stable over time or evolve smoothly overtime. Inequality represents the natural log of Gini net. Finance is measure by two proxies: domestic credit to GDP and liquid liabilities to GDP, CV is a set of control variables, *i* and *t* represent country and time period respectively and ε_{it} is the error term. The focus is on finance and following the theoretical discussion in section 3, the functional form to be estimated is given as:

$$LogInequality_{it} = \alpha_i + \delta_i t + \beta_1 \log fin_{it} + \beta_2 \log fin_{it}^2 + \beta_3 \log Y_{it} + \beta_4 \log Y_{it}^2 + \beta_5 \log \mathrm{mod\,sec}_{it} + \beta_6 \log \mathrm{inf}_{it} + \varepsilon_{it} \quad 8$$

Mod sec is value added by the manufacturing to GDP. We expect β_1 to be negative and significant, holding β_2 constant for the *linear hypothesis* to hold. Secondly, for the *inverted u-shaped hypothesis*, β_1 should be positive and significant while β_2 negative and significant. However, if the coefficients of β_1 happens to be negative and significant and that of β_2 is positive and significant, a "*threshold effect*" of financial development is suggested. For the *Kuznets inverted u-shaped hypothesis*, the coefficient of β_3 should be positive and significant while β_4 will be negative and significant. Finally to capture the effect that income inequality may be related to the sectoral structure of an economy, rising at the transition phase of industrialisation and decline at the mature phase, we include value added by the manufacturing sector. If β_5 is positive and significant it means countries where agriculture account for a greater share of GDP will experience lower levels income inequality and vice versa.

A set of control variables are included to account for other factors that are likely to influence income inequality. For example, inflation to capture the macroeconomic instability since high inflation rate hurts the poor more than the rich because the rich can easily hedge their exposure with sophisticated financial instruments. Thus, inflation is expected to have a positive effect on income inequality. The effect of globalisation on income inequality is captured by trade openness, and the role of the government to redistribute wealth through government spending. The exact effect of these two variables on income inequality is less clear.

5.2 Panel Unit Root Tests

Two panel unit root and stationarity tests can be distinguished from the literature: the first generation test which assumes cross-sectional independence in the panel and the second generation tests that allows for cross sectional dependence in the panel (Baltagi, 2008: 275-284). We employ two different types of tests in this analysis. The Im, Pesaran and Shin (2003), a first generation test and the Pesaran (2007) cross-sectional augmented (CIPS) panel unit root which is a second generation test. The starting point of Im, Pesaran and Shin (2003) (henceforth IPS) is to assume that the stochastic process, y_{it} is generated by the first order autoregressive process as:

$y_{it} = (1-\rho_i)\mu_i + \rho_i y_{i,t-1} + \varepsilon_{it,}\ i = 1\ldots \text{N}, t = 1\ldots \text{T},$

where initial values, y_{i0} are given, the interest will be to test the null hypothesis of unit roots $\rho_i = 1$ for all *i* then the equation can be expressed as:

$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \varepsilon_{it},$

where $\alpha_i = (1-\rho_i)\mu_i, \beta_i = -(1-\rho_i)$ and $\Delta y_{it} = y_{it} - y_{i,t-1}$. The null hypothesis under the IPS (2003) is that each series have a unit root, $H_0 : \beta_i = 0$ for all *i* against the alternative hypothesis that some but not all of the individual series has a unit roots, $H_1 : \beta_i < 0, i = 1, 2,\ldots, \text{N}, \beta_i = 0,$

$i = N_1 + 1, N_1 + 2, \ldots, N.$ This alternative formulation allows the autoregressive coefficients (β_i) to vary cross groups (Im *et al*., 2003:56).

The study also conducted the Pesaran (2007) cross-sectional augmented (CIPS) panel unit root test. The test augments the standard ADF regression with cross-sectional averages of lagged levels and first differences of the individual series. The standard panel unit root tests are then based on the simple averages of individual cross sectional augmented ADF (CADF) statistics. Separate cross-sectional augmented ADF (CADF) regressions are then estimated for each country which allows for different autoregressive parameters for each panel member (Pesaran, 2007: 265). The CADF model is stated formally as:

$$\Delta y_{it} = a_i + b_i y_{i,t-1} + c_i \bar{y}_{t-1} + \sum_{j=0}^{p} d_{ij} \Delta \bar{y}_{t-j} + \sum_{j=1}^{p} \delta_{ij} \Delta y_{i,t-j} + \ell_{it} \qquad 9$$

where $\bar{y}_t$ is the cross sectional mean of $y_{it,}$ $\bar{y}_t = N^{-1} \sum_{i=1}^{N} y_{it}$. The null hypothesis is that all series are non-stationary (H_0: $b_i = 0$) for all *i* and is tested against the alternative hypothesis that at least one of the individual series in the panel is stationary (H_1: $b_i < 0$) for at least one *i*. The CIPS statistics is calculated as the averages of the individual CADF statistics as follows:

$$CIPS = N^{-1} \sum_{i=1}^{N_i} t_i \qquad 10$$

Where t_i is the OLS t-ratio of b_i in equation 3 above.

6 Discussion of Results

The unit root tests results are reported in Table 2. The Im *et al*., (2003) failed to reject the null of unit root at levels only for Gini net and inflation rate at 10% and 1% respectively. On the other hand, the CADF test rejects the null of unit root at levels for all the variables but fails to reject the null of unit root at first difference. Thus, the overall evidence suggest that the variables are integrated of order I(1) except for Gini net and inflation rate in the case of Im *et al*., (2003). This suggests the possibility of a long run relationship between the two measures of income inequality and financial development.

Table 1: Panel unit root tests

Variables	Deterministic terms	CADF test (Pesaran2007)	Im *et al*. (2003)
Levels		**Z(t-bar)**	**W-t-bar**
Log Gini net	Constant	0.49 (0.69)	-1.58 (0.06)*
Log primary school enrolment	Constant and trend	-0.46 (0.32)	1.46 (0.93)
Log domestic credit/GDP	Constant and trend	4.47 (1.00)	3.91 (1.00)
Log domestic credit/GDP Sq	Constant and trend	5.35 (1.00)	3.85 (0.99)
Log Liquid Liab/GDP	Constant and trend	3.49(1.00)	0.94 (0.83)
Log Liquid liab/GDP Sq	Constant and trend	3.55 (1.00)	4.08 (1.00)
Log government spending	Constant and trend	2.19 (0.99)	-0.97 (0.17)
Log trade	Constant and trend	3.44 (1.00)	0.43 (0.67)
Inflation	Constant	1.50(0.93)	-4.87 (0.00)***
Log GDP per capita	Constant and trend	1.67 (0.95)	1.87 (0.97)
Log GDP per capita Sq	Constant and trend	1.85 (0.97)	2.01 (0.98)
Log value added	Constant and trend	3.47 (1.00)	-1.02 (0.15)
First differences			
Δ Log Gini net	Constant	-4.05 (0.00)***	-2.75 (0.00)***
Δ log primary school enrolment	Constant	-3.01 (0.00)***	-7.07 (0.00)***
Δ Log domestic credit/GDP	Constant	-6.88(0.00)***	-8.25 (0.00)***
Δ log domestic credit/GDPSq	Constant	-6.88 (0.00)***	-8.17 (0.00)***
Δ Log Liquid liab/GDP	Constant	-6.72 (0.00)***	-8.08 (0.00)***
Δ Log Liquid liab/GDP Sq	Constant	-7.46 (0.00)***	-8.01 (0.00)***
Δ Log trade	Constant	-7.18 (0.00)***	-9.33 (0.00)***
Δ Government spending	Constant	-4.99 (0.00)***	-9.25 (0.00)***
Δ Inflation	Constant	-9.02(0.00)***	---
Δ Log GDP per capita	Constant	-6.13 (0.00)***	-7.26 (0.00)***
Δ Log GDP per capita Sq	Constant	5.81(0.00)***	-7.15 (0.00)***
Δ Log value added	Constant	-3.17(0.00)***	-9.59 (.00)***

***, ** and * indicate 1%, 5% and 10% levels of significance. The null hypothesis of all three tests is that the panels contain unit roots. Δ is the first difference operator. Lag selection in IPS is automatic using AIC and 2 lags for CADF at levels.

Three linear and nonlinear models for each of the proxies for financial development were estimated. Our baseline model mirrored Clarke *et al.*, (2013) except for the fact that our specification does not include risk of expropriation and ethno-linguistic fractionalisation. The results are presented in table 2 and 3 below.

Table 2: Long and short runs parameter using domestic credit to GDP: Dependent variable:

Dependent Variable: DLog Gini net

Model estimated: ARDL (1, 1, 1, 1, 1, 1)

Variables	Model 1	Model 2	Model 4	Model 5	Model 6
Long run coefficients	**Linear**	**Linear**	**Nonlinear**	**Nonlinear**	**Nonlinear**
Log domestic credit/GDP	-0.223***	0.036***	-0.549***	0.862***	0.066*
	(-7.09)	(5.69)	(4.41)	(9.95)	(1.82)
Log domestic credit/GDP Sq			0.154***	-0.392***	-0.036**
			(3.67)	(10.04)	(-1.97)
Log GDP per capita	0.278	0.707***	-0.321**	-0.271	0.288**
	(1.14)	(5.25)	(-2.39)	(-1.28)	(2.53)
Log GDP per capita Sq	-0.076	-0.107***	0.056**	0.054	-0.048**
	(-1.59)	(-5.41)	(2.24)	(1.34)	(-2.55)
Log Government spending	0.036	0.022	-0.087***	0.014	
to GDP	(1.14)	(1.13)	(-2.64)	(0.62)	
Log trade openness		0.184***		-0.040	0.181***
		(9.37)		(-1.49)	(8.22)
Inflation	0.001**	0.002***	0.003***	0.002***	
	(2.36)	(4.52)	(4.18)	(7.34)	
Log modern sector	0.083	-0.062***	0.072	-0.169**	-0.268***
	(1.28)	(-3.13)	(1.04)	(-2.54)	(-5.02)
Log primary enrolment					0.091**
					(2.42)
Error correction coefficient					
Adjustment speed (ECM)	-0.100**	-0.274*	-0.135**	-0.128*	-0.183***
	(-2.09)	(1.88)	(-2.11)	(-1.70)	(-2.89)
Short-Run Coefficients					
Δ log Gini net(t-1)	0.326**	0.469***	0.279	0.385**	0.437***
	(1.99)	(3.63)	(1.35)	(2.03)	(2.73)
Δ log domestic credit/GDP(t-1)	0.013	0.006	-0.075	0.161	0.021
	(0.77)	(0.40)	(-0.49)	(0.88)	(0.10)
Δ domestic credit/GDP Sq(t-1)			0.034	-0.055	-0.021
			(0.70)	(-1.01)	(-0.33)
Δ GDP per capita(t-1)	-0.206	-0.384	-0.574	-0.261	0.270
	(-0.65)	(-0.73)	(-0.91)	(-0.45)	(0.44)
Δ GDP per capita Sq(t-1)	0.044	0.063	0.132	0.065	-0.053
	(0.74)	(0.71)	(0.99)	(0.60)	(-0.49)
Δ Government spending	-0.036	-0.027	-0.030	-0.130	
to GDP(t-1)	(-1.18)	(-0.79)	(-0.98)	(-0.34)	
Δ trade openness(t-1)		-0.000		0.041	0.029
		(0.01)		(0.95)	(0.80)
Δ Inflation (t-1)	-0.000	-0.0003***	0.000	-0.000	-0.001
	(-0.24)	(-3.25)	(0.28)	(-1.56)	(-1.15)
Δ Modern sector(t-1)	0.078	0.041	0.113	0.009	0.026
	(0.96)	(0.96)	(1.28)	(0.50)	(0.47)
Δ log primary enrolment(t-1)					-0.029
					-(0.53)
Constant	0.153**	0.037	0.332**	0.204*	0.166***
	(2.22)	(1.55)	(2.17)	(1.73)	(2.88)
No of countries	15	15	15	15	15
Total of observations	345	345	345	345	345

t-stats are in brackets. *, **, *** represents 10%, 5% and 1% significance level respectively

NB. Mode 3 failed to converge and the process was aborted after 51iterations, hence it was dropped from table 2.

Table 3: Long and short run parameters using liquid Liabilities to GDP
Dependent variable: DLog Gini net
Model estimated: ARDL (1, 1, 1, 1, 1, 1, 1)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Long run coefficients	**Linear**	**Linear**	**Linear**	**Nonlinear**	**Nonlinear**	**Nonlinear**
Log liquid liabilities/GDP	0.279***	0.208***	0.289***	1.522***	1.328***	1.063***
	(20.7)	(8.32)	(9.17)	(6.55)	(7.39)	(6.35)
Log liquid liabilities/GDP SQ				-0.468***	-0.415***	-0.353***
				(-5.57)	(-7.47)	(-5.77)
Log GDP per capita	-0.028	-0.247**	-0.064	-0.417***	-0.016	0.030
	(-0.27)	(-2.24)	(-0.40)	(-2.95)	(-0.19)	(0.25)
Log GDP per capita SQ	0.001	0.038**	0.011	0.075***	0.009	0.014
	(0.06)	(1.90)	(0.36)	(2.73)	(0.71)	(0.71)
Log Government spending	-0.137***	-0.055**		-0.214***	-0.146***	
to GDP	(-6.15)	(-2.14)		(-10.23)	(-6.00)	
Log trade openness		0.035*	0.013		0.043***	0.135***
		(1.88)	(0.59)		(3.31)	(4.47)
Inflation	0.0004***	0.001***	0.0004***	0.001***	0.003***	0.0004**
	(4.78)	(8.52)	(3.57)	(2.93)	(12.83)	(2.24)
Log modern sector	-0.213***	-0.003	-0.062	-0.376***	-0.294***	-0.236***
	(-4.32)	(-0.08)	(-1.03)	(-6.60)	(-10.79)	(-6.38)
Log primary enrolment			-0.180***			-0.237***
			(-5.80)			(-6.68)
Error correction coefficient						
Adjustment speed (ECM)	-0.216***	-0.175**	-0.180**	-0.193**	-0.161**	-0.187**
	(-2.75)	(-2.50)	(-2.36)	(-2.24)	(-2.50)	(-2.53)
Short-Run Coefficients						
Δ log Gini net$_{(t-1)}$	0.417**	0.397**	0.498***	0.384**	0.374**	0.401**
	(2.42)	(2.18)	(3.84)	(2.31)	(1.98)	(2.46)
Δ log liquid liabilities	-0.041*	-0.042*	-0.043	-1.935	-1.508	-0.620
to GDP(t-1)	(-1.84)	(-1.79)	(-1.45)	(-1.25)	(-0.91)	(-0.49)
Δ log liquid liabilities				0.587	0.506	0.228
to GDP Sq(t-1)				(1.20)	(0.97)	(0.57)
Δ log GDP per capita(t-1)	-0.398	-0.198	-0.013	-0.159	-0.450	0.201
	(-0.74)	(-0.46)	(-0.02)	(-0.28)	(-0.74)	(0.40)
Δ log GDP per capita Sq(t-1)	0.089	0.048	0.030	0.058	0.105	-0.027
	(0.86)	(0.62)	(0.26)	(0.50)	(0.87)	(-0.31)
Δ log Government spending	0.011	-0.194		0.015	0.001	
to GDP(t-1)	(0.66)	(-0.64)		(0.46)	(0.03)	
Δ log trade openness(t-1)		0.025	0.023		0.017	0.019
		(0.92)	(1.05)		(0.41)	(0.67)
Δ Inflation(t-1)	0.000	-0.0002	-0.0002	0.000	-0.0004*	-0.0002
	(0.03)	(-1.20)	(-1.13)	(0.24)	(-1.77)	(-1.17)
Δ log modern sector(t-1)	0.106	0.025	0.029	0.106*	0.047*	0.023
	(1.24)	(0.54)	(0.86)	(1.86)	(1.68)	(0.61)
Δ Log primary enrolment(t-1)			0.072			0.079*
			(1.63)			(1.81)
Constant	0.341***	0.288**	0.286**	0.290**	0.140***	0.195***
	(2.78)	(2.42)	(2.37)	(2.43)	(2.71)	(2.74)
No of countries	14	14	14	14	14	14
Total of observations	322	322	322	322	322	322

t-stats are in brackets. *, **, *** represents 10%, 5% and 1% significance level respectively

To investigate the linear hypothesis of Galor and Zeira (1993) and Banerjee and Newman (1993), the Gini net was regressed on the natural log of domestic credit and liquid liabilities and a set of control variables. The results are not consistent across the two measures of financial development.

When domestic credit is used as a measure of financial development, the linear term of domestic credit is negative and statistically significant at 1%. However, when liquid liabilities is used as a measure of financial development, the linear term of liquid liabilities is positive and statistically significant at 1% level. In both cases, the short run speed of adjustment is negative and significant at 10% (Tables 2 and 3; columns 2). This seems to suggest that the effect of financial development on income inequality may vary depending on the measure of financial development. Also the coefficient of GDP per capita and its square are not significant when either of financial development indicators are used as such no support for the Kuznets *inverted u-shaped hypothesis.* But the coefficient of the modern sector (sectors other than agriculture) is negative and significant when liquid liabilities are used as a measure of financial development. This suggests that the sectoral structure of African economies play a role in explaining variations in income inequality across countries (Kuznets insights).

In the second estimation, the effect of globalisation is taken into account with the inclusion of trade openness to the Clarke *et al*., (2013) model. The linear term of domestic credit now become positive and significant at 1% while the linear term of liquid liabilities remains positive and significant at 1%. Furthermore, the coefficient of GDP per capita and its square term are significant at least 5% in both cases but the signs are not consistent. The Kuznets *inverted u-shaped hypothesis* is supported only when domestic credit is used as a measure of financial development and the coefficient of the modern sector is negative and significant at 1% level (Table 2 and 3; columns 3). The effect was further investigated by replacing government spending with primary school enrolment and for this model; convergence could not be achieved after over 40 iterations when domestic credit is used as a measure of financial development. However, when liquid liabilities is used as a measure of financial development, convergence was achieved and again the evidence suggest that financial development increases income inequality in Africa. No support for the Kuznets *inverted u-shaped hypothesis* as well as the sectoral effect on income inequality in this case (Table 3, column 4 above)

We now test the *inverted u-shaped hypothesis* of Greenwood and Jovanvoic (1990) by including the square terms of domestic credit and liquid liabilities respectively to the base line model and the other two specifications. When the square term of domestic credit is added to the baseline model, the linear term remain negative and significant while the square term enters positively and significant suggesting a *u-shaped relationship*. This U-shaped evidence is somehow strange but is likely to be typical of the aftermath of financial liberalisation which increases efficiency and competition within the financial sector. Income inequality reduces with financial development and reached a level where dis-economies of scale set in, may be due to reckless lending which may result in financial crisis and banks then react by rationing credit and access. Consequently, income

inequality starts to rise with increase in financial development leading to the *u-shaped relationship* observed. Also the coefficient of the linear term of GDP per capita is negative and the square term positive for the two financial development indicator and all are statistically significant at least at 5%. Similarly, the coefficient of the modern sector is negative but significant only when domestic credit is used as a measure of financial development. In both cases, the speed of adjustment captured by the short run error correction is negative and significant at 5% (Table 2 columns 4 and Table 3 columns 5). Thus, our results for the baseline model does not support the linear and negative finding of Clarke *et al.,* (2013) that financial development reduces income inequality. Instead, we find evidence of *inverted u-shaped* when liquid liabilities is used as a measure of financial development and *u-shaped* when domestic credit is used as a measure of financial development.

When trade openness is added to the base line model to account for the effect of globalisation the results become consistent across the two indicators. The results provide strong support for Greenwood and Jovanoic (1990) *inverted u-shaped hypothesis* between financial development and income inequality. The linear and square terms of the two measures of financial development are positive and negative and statistically significant at 1% respectively. The short run adjustment coefficients are negative and statistically significant at least 10% (Table 2 column 5 and Table 3, columns 6). The *inverted u-shaped* implies that income inequality will increase at the early stage of financial development and decline at the later stage of financial development with increase in openness. Furthermore, when the effect of education is account for, the results remain the same across the two indicators confirming the *inverted u-shaped hypothesis* (Table 2 columns 6 and Table 3 columns 7). Asongu (2013) also found in a group of 13 African countries an *inverted u-shaped relationship* between financial development and income inequality. That is, financial development increases income inequality at the early stage of financial development and as the financial sector develop, income inequality will start to decline as many gain access. Table 2 columns 5, 6 and Table 3 columns 6, 7 satisfy the PMG condition of a dynamically stable long run relationship. That is the coefficient of our error correction models lies within the unit circle (less than -1) thereby suggesting that the *inverted-shaped relationship* is dynamically stable. The error correction coefficients are negative and statistically significant at least at 10% level of significance for both measures of financial development.

The *inverted u-shaped* relationship clearly mirrored the underdevelopment of the financial system (banking sector) in Africa. For instance, countries like Uganda, Rwanda, Nigeria, Malawi, Lesotho, Ghana, Ethiopia and Botswana has mean domestic credit provided to the private sector of below 17% with a maximum of 26% from 1985 to 2007. Only in South Africa, Mauritania, Mauritius,

Morocco, Tunisia and Egypt that domestic credit extension has exceeded a maximum of 50% for the period under study. Furthermore, in terms of financial inclusion, the African region has the lowest rate of account penetration with about 35% adults that are banked. For example, countries such as Burundi, Niger, Central Africa Republic, Guinea and Madagascar having account penetration of below 10% (Global Findex, 2014). This low account penetration supports Greenwood and Jovanoic (1990) argument that at the early stages of financial development costs of intermediation are high and only a few rich individuals will gain access. As such financial development will hurt the poor more than the rich at this stage of financial development. Similarly, Ang (2010) also found in the case of India that financial markets underdevelopment hurts the poor more than the rich.

Table 2 columns 5, 6 and Table 3 columns 6, 7 also provide support for the Kuznets insights that sectoral structure influences income inequality. The coefficient of the modern sector is negative and statistically significant at least 1% suggesting that countries with larger modern sectors will experience lower income inequality while smaller modern sectors are associated with higher income inequality. The implication for Africa is that income inequality can be reduced to some extent by growing the size of the modern sector. An alternative and much easier way to reduce income inequality is to increase the contribution of agricultural sector to GDP through improved agricultural productivity particularly in the rural areas. Such effort will boost rural income and reduce income inequality since poverty and income inequality is highest in the rural areas. Apart from the average results presented above, we also report country specific short run parameters and speed of adjustment in Table 4 and 5 below.

Table 4: Country specific speed of adjustment and short run parameters– domestic credit

Variables	ECM	Gini net	Domestic credit	Domestic Credit Sq	GDP per capita	GDP per Capita Sq	Modern Sector
Botswana	0.347	-1.993[a]	0.415	-0.194	-0.199	0.032	-0.150[a]
	(1.56)	(-4.24)	(1.52)	(-1.45)	(-0.26)	(0.28)	(-2.75)
Cote d'Ivoire	-0.183[a]	0.534[a]	-0.092	0.050	4.835[a]	-0.842[a]	0.103[a]
	(-4.90)	(5.92)	(-0.38)	(0.54)	(3.24)	(-3.24)	(4.00)
Egypt	-0.043[a]	0.601[a]	-0.461[a]	0.171[a]	0.566[a]	-0.087[a]	-0.106[a]
	(-6.06)	(9.51)	(-3.74)	(4.23)	(3.10)	(-2.90)	(-8.46)
Ethiopia	-0.978[a]	0.252[b]	0.508	-0.120	-4.842[b]	1.059[b]	0.091
	(-7.48)	(2.00)	(1.43)	(-0.73)	(-2.16)	(2.09)	(1.16)
Ghana	-0.488[a]	-0.188[a]	-0.255[a]	0.118[b]	-1.890[a]	0.335[a]	0.046
	(-9.41)	(-3.40)	(-3.16)	(2.15)	(-3.39)	(3.14)	(0.39)
Lesotho	-0.002	0.091	0.249[c]	-0.087	-0.537	0.131	-0.032
	(-0.03)	(0.75)	(1.69)	(-1.32)	(-0.67)	(0.87)	(-0.79)
Malawi	-0.011	0.650[a]	0.147	-0.054	0.273	-0.037	0.047
	(-0.82)	(4.71)	(1.28)	(-0.87)	(0.30)	(-0.19)	(1.38)
Mauritania	-0.006	0.381[c]	-0.007	0.003	1.261	-0.228	-0.053
	(-0.41)	(2.12)	(-0.82)	(0.54)	(0.65)	(-0.65)	(-0.96)
Mauritius	-0.093	0.638[a]	2.300	-0.685	-2.860	0.434	0.123
	(-1.59)	(3.92)	(1.04)	(-1.07)	(-1.46)	(1.54)	(0.29)
Morocco	-0.001	0.846[a]	0.189[a]	-0.064[a]	0.383	-0.061	0.047[c]
	(-0.16)	(6.38)	(4.29)	(-3.94)	(1.45)	(-1.43)	(1.86)
Nigeria	-0.188[a]	0.640[a]	0.251[c]	-0.107[c]	0.240	-0.059	-0.023
	(-5.15)	(4.95)	(1.88)	(-1.81)	(1.00)	(-1.14)	(-1.38)
Rwanda	-0.019	0.845[a]	0.139	-0.073	0.457	-0.095	0.015
	(-1.45)	(7.74)	(1.04)	(-0.95)	(1.56)	(-1.55)	(1.48)
South Africa	-0.008[b]	0.474[a]	-1.122[a]	0.269[a]	-0.547[a]	0.079[a]	-0.134
	(-2.01)	(3.98)	(-6.03)	(6.07)	(-3.59)	(3.64)	(-0.88)
Tunisia	-0.064[b]	0.876[a]	0.134	-0.042	1.515[b]	-0.222[b]	0.024
	(-2.58)	(6.63)	(0.06)	(-0.07)	(2.56)	(-2.50)	(0.43)
Uganda	-0.176[a]	1.133[a]	0.026	-0.013	-2.575[a]	0.543[a]	0.030
	(-3.38)	(6.84)	(0.56)	(-0.29)	(-3.47)	(3.49)	(0.87)
No of countries	15	15	15	15	15	15	15
Total of obs	345	345	345	345	345	345	345

a, b, c indicates 1%, 5% and 10% respectively

Table 4 shows that eight short run speed of adjustment are negative and statistically significant at 10% level. Similar results are obtained in Table 5 when liquid liabilities are used as a measure of financial development. This relationship is stronger in Cote d'ivoire, Egypt, Ethiopia, Ghana, South Africa, Nigeria, Tunisia and Uganda.

For some countries such as Malawi, Mauritania, Mauritius, Morocco and Lesotho the error correction is negative but not significant using domestic credit as a measure of financial development. On the other hand, the error correction is positive and not significant for Botswana for both measures of financial development.

Table 5: Country specific speed of adjustment and short run parameters– liquid liabilities

Variables	ECM	Gini net	Liquid liab	liquid liab SQ	GDP per capita	GDP per Capita SQ	Modern Sector
Botswana	0.021	-1.636[a]	1.546[c]	-0.562[c]	0.911[b]	-0.126[c]	-0.087
	(0.23)	(-3.08)	(1.70)	(-1.75)	(2.02)	(-1.85)	(-1.31)
Cote d'Ivoire	-0.121[a]	0.537[a]	-2.221	0.793	3.938[b]	-0.688[b]	0.093[a]
	(-3.96)	(5.87)	(-1.46)	(1.44)	(2.56)	(-2.58)	(3.23)
Egypt	-0.090[a]	0.758[a]	3.595	-0.960	0.451	-0.075	-0.053[b]
	(-4.37)	(6.62)	(1.02)	(-1.04)	(1.33)	(-1.35)	(-2.41)
Ethiopia	-0.838[a]	-0.114	-22.319[a]	7.081[a]	-5.712[a]	1.292[a]	0.331[a]
	(-8.90)	(-0.94)	(-3.08)	(3.12)	(-2.73)	(2.75)	(4.15)
Ghana	-0.445[a]	-0.307[a]	-2.413[a]	0.908[a]	-3.426[a]	0.627[a]	0.183[b]
	(13.31)	(-7.00)	(-3.37)	(3.17)	(-4.68)	(4.44)	(2.59)
Lesotho	0.005	0.141	-1.721	0.549	-1.004	0.204	-0.047
	(0.04)	(0.83)	(-0.89)	(0.87)	(-0.92)	(1.00)	(-1.03)
Malawi	-0.021	0.862[a]	0.229	-0.070	0.917	-0.185	0.031
	(-1.44)	(6.19)	(0.38)	(-0.30)	(0.85)	(-0.79)	(0.91)
Mauritius	0.196[b]	0.739[a]	-0.512	0.069	-1.508	0.223	-0001
	(-2.81)	(4.99)	(-0.14)	(0.07)	(-0.71)	(0.73)	(0.00)
Morocco	-0.026	1.057[a]	0.581	-0.152	0.475	-0.073	0.024
	(-0.69)	(5.47)	(0.79)	(-0.75)	(1.17)	(-1.13)	(0.79)
Nigeria	-0.054[a]	0.711[a]	0.224	-0.100	-0.042	0.002	0.001
	(-3.29)	(6.37)	(1.23)	(-1.42)	(-0.28)	(0.06)	(0.05)
Rwanda	-0.014	0.897[a]	0.050	-0.024	0.136	-0.027	0.009
	(-1.00)	(8.93)	(0.10)	(-0.11)	(0.58)	(-0.56)	(1.01)
South Africa	-0.367[a]	0.143	1.315[a]	-0.381[a]	-1.069[a]	0.148[a]	0.079[a]
	(-8.02)	(1.23)	(5.01)	(-4.96)	(-6.55)	(6.40)	(5.84)
Tunisia	-0.123[a]	0.753[a]	0.662	-0.169	1.138[b]	-0.165[b]	0.049
	(-3.01)	(7.22)	(0.41)	(-0.36)	(2.21)	(-2.11)	(1.10)
Uganda	0.017	0.699[a]	-0.132	0.106	-1.500	0.319	0.052
	(0.68)	(3.42)	(-0.42)	(0.56)	(-1.35)	(1.36)	(1.08)
No of countries	14	14	14	14	14	14	14
Total of obs	322	322	322	322	322	322	322

a, b, c indicates significant at 1% 5% and 10% respectively

The study also employs the augmented mean group (AMG) estimator, to account for country specific slope heterogeneity as well as cross sectional dependence. The country specific results are reported in the appendix (Table A2 to A5b). None of the hypothesis discussed so far is supported by the cross country average results reported in Appendix Table A2 and A3. However, the interest is on country specific results. The cross country and country specific results reported are based on Clarke *et al*., (2013) linear and nonlinear models.

For the linear specification, only Egypt and Nigeria support the negative and linear hypothesis of Galor and Zeira (1993) and Banerjee and Newman (1993) when either domestic credit or liquid liabilities are used as a measure of financial development. On the other hand, financial development increases income inequality in Lesotho for both measures of financial development. For Mauritania and Morocco financial development as measured by domestic credit to GDP increases income inequality whiles it reduces income inequality in Rwanda and Nigeria. Furthermore, income inequality increases in Uganda and Malawi when financial development is measured by liquid liabilities to GDP. The Kuznets inverted *u-shaped hypothesis* is supported in Botswana, Lesotho

and Uganda for both measures of financial development and for Malawi only when liquid liabilities is used as a measure of financial development (Appendix Table A4a and 4b).

For the nonlinear hypothesis, the evidence is weak when both measures of financial development are used. Our results instead finds evidence of a *u-shaped relationship* in cote d'Ivoire, Ghana and Uganda using both measures of financial development and Nigeria and Rwanda only when domestic credit is used as a measure of financial development. It is only in Botswana that Greenwood and Jovanoic (1990) *inverted u-shaped hypothesis* is supported using liquid liabilities as a measure of financial development. Botswana, Lesotho and Uganda support the Kuznets *inverted u-shaped hypothesis* for both measures of financial development (Appendix Table A5a and 5b). This suggests that low GDP per capita is a major reason of the rising levels of income inequality in these countries.

Our findings differ from previous studies principally from the methodological perspective adopted to examine the relationship. We divert from the conventional way of arbitrary averaging the data in attempt to smooth business cycle fluctuations and pay particular attention to the time series properties of the data. We employ an intermediate estimator that constraint the long run to be the same across the group but allows the short run, speed of adjustment and intercepts to vary across groups as well as technique that account for slope heterogeneity across groups.

Our results provide possible explanations for the rising level of income inequality in Africa despite robust economic growth for over a decade and a half. That is, the potential role that financial markets ought to play to reduce income inequality in Africa has been severely constraint by under-development of the financial sector on the continent. We find weak evidence *u-shaped relationship* which can be linked to the episode of financial liberalisation – the opening up of the financial sector to be more market oriented increased competition by banks compete to gain market share up to a certain point where diseconomies of scale set in and banks start to practice discrimination. Then income inequality start to rise as financial sector develops further. However, when trade openness is added into the model, the evidence now supports the *inverted u-shaped hypothesis* of Greenwood and Jovanoic (1990). The *inverted u-shaped hypothesis* is robust to the addition of education to the model. That is, financial development will increase income inequality at the early stages of financial development and as the financial sector develop and provide access to many people income inequality will decline. Our empirical analysis also finds only weak support for the Kuznets *inverted u-shaped* hypothesis that income inequality increases with GDP per capita and declines as GDP per capita grows. Finally, our results suggest that the sectoral structure of African economies plays a crucial role to influence the income distribution. That is, countries with smaller modern sector will have higher income inequality. These results suggest that growing and commercialising

the agriculture sector in African economies is essential to lower income inequality particularly improving rural productivity.

7. Conclusion

This study explores the dynamic relationship between financial development and income inequality in Africa. This relationship has received little attention in the context of Africa owing to data limitation and the few attempts that have examined this relationship have some methodological shortcomings. The conventional approach has been arbitrary averaging of the data as a means to smooth business cycle fluctuations and then applied empirical techniques design to analyse micro panel with large cross-sectional dimension and small time series. Empirical literature contest such averaging may lead to bias in the parameters estimated. We follow recent development in empirical modelling and pay particular attention to the time series properties of the data.

Our results differ from the previous cross country studies that find linear and negative relationship using the conventional approach of data averaging (Clarke *et al*., 2006; 2013, Batuo *et al*., 2010; Kai and Hamori, 2009). Overall, our study finds strong support for *inverted u-shaped relationship* between financial development and income inequality. That is, financial development benefits the rich most at the early stage of financial development and as the financial sector develops, it becomes more efficient and cost effective thus providing access to many people leading to the *inverted u-shaped*. Our evidence provide only weak support Kuznets *inverted U-shaped hypothesis* between GDP per capita and income inequality that income inequality increases at the early stage of economic development and as the economy develop, income inequality will decline. Furthermore, the Kuznets insight that sectoral structure of economies influences income inequality is also supported as well in Africa. That is, the small contribution of the modern sector to GDP in African countries contributes to the rising level of income inequality in the region.

Policies to develop to develop the financial system should pay particular attention to the development of stronger institutions to enhance the effectiveness of financial sector to reduce income inequality (see Kim *et al*., 2011; Law *et al*., 2014 and Gries and Meirrieks, 2010). Consequently, institutional constraints that hinders effective development of the financial system in Africa should be given due consideration to facilitate the role of the financial sector to reduce income inequality. Efforts should also be directed to increase agricultural productivity particularly in the rural areas to boost rural income.

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Appendix: Table A1

Variables	Definition	Sources
Gini net	Gini index of inequality after tax and transfers	Solt (2013) version 4.0
Financial development indicators	Domestic credit to GDP and liquid liabilities to GDP	World Bank Global Financial Development (2012)
Global development indicators	Annual cross country indicators	World Bank World Development Database, 2014

Augment Mean Group estimated output

Table A2: Domestic credit linear and nonlinear

	logGnet	logGnet	logGnet	logGnet	logGnet	logGnet
Log domestic credit	0.015	0.021	0.0004	-0.111	0.066	0.094
	(0.68)	(1.32)	(0.02)	(-0.45)	(0.46)	(0.46)
Log domestic credit Sq				0.095	0.028	-0.046
				(0.86)	(0.35)	(-0.42)
Log GDP per capita	-0.476	0.123	-0.904	-0.539	-0.737	-1.318
	(-0.55)	(0.19)	(-0.99)	(-0.40)	(-0.70)	(-1.47)
Log GDP per capita Sq	0.049	-0.055	0.156	0.055	0.069	0.224
	(0.34)	(-0.50)	(0.87)	(0.26)	(0.37)	(1.24)
Log Government Spending	0.011	0.006		0.014	0.014	
	(0.14)	(0.10)		(0.20)	(0.29)	
Inflation	0.0001	0.0001	0.0003	0.0002	0.0002	0.0002
	(0.37)	(0.48)	(0.95)	(0.93)	(0.66)	(0.62)
Log value added by manufacturing	-0.024	0.014	-0.046	-0.057	-0.018	-0.036
	(-0.35)	(0.24)	(-1.53)	(-0.98)	(-0.45)	(-1.59)
Common dynamic process	0.349	0.209	0.295	0.915*	0.432	0.718
	(0.65)	(0.42)	(0.86)	(1.79)	(1.07)	(1.33)
Log trade		-0.031	-0.067**		-0.060*	-0.072*
		(-1.15)	(-2.00)		(-1.68)	(-1.87)
Log primary school enrolment			0.007			0.013
			(0.04)			(0.08)
Constant	2.437*	1.659*	2.865**	2.526	2.004*	3.541***
	(1.78)	(1.78)	(2.26)	(1.35)	(1.69)	(2.74)
N	345	345	345	345	345	345

z statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A3: Liquid liabilities linear and nonlinear

	logGnet	logGnet	logGnet	logGnet	logGnet	logGnet
Log liquid Liabilities	-0.028	0.003	0.0172	1.552	0.961	-0.930
	(-0.46)	(0.06)	(0.37)	(1.08)	(1.32)	(-1.04)
Log liquid liabilities Sq				-0.290	-0.175	0.311
				(-0.63)	(-0.52)	(1.01)
Log GDP per capita	-0.381	-0.106	-0.741	-0.521	-0.688	-0.945
	(-0.66)	(-0.14)	(-0.87)	(-0.72)	(-0.82)	(-1.16)
Log GDP per capita Sq	0.110	0.0133	0.128	0.120	0.134	0.157
	(1.10)	(0.09)	(0.78)	(0.82)	(0.86)	(1.00)
Log government spending	-0.035	0.006		-0.009	0.0183	
	(-0.57)	(0.10)		(-0.12)	(0.30)	
Inflation	0.0001	-0.00003	-0.00005	0.00005	-0.00005	-0.00004
	(0.20)	(-0.10)	(-0.19)	(0.17)	(-0.21)	(-0.18)
Log value added by manufacturing	-0.061	0.010	-0.018	-0.078***	-0.032	-0.016
	(-0.98)	(0.13)	(-0.48)	(-2.78)	(-1.10)	(-0.47)
Common dynamic process	0.581	0.336	0.250	0.866**	0.621	0.612*
	(1.29)	(0.79)	(1.27)	(2.49)	(1.46)	(1.94)
Log trade		-0.098*	-0.079		-0.114**	-0.105**
		(-1.78)	(-1.46)		(-2.36)	(-2.07)
Log primarily school enrolment			-0.002			0.011
			(-0.01)			(0.06)
Constant	2.223**	1.993*	2.466**	2.324	4.683***	4.088***
	(2.14)	(1.80)	(2.26)	(1.08)	(2.64)	(2.97)
N	322	322	322	322	322	322

z statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A4a: country specific slope coefficients-domestic credit

Countries	Domestic credit	GDP per capita	GDP per capita sq	Modern sector
Botswana	-0.001 (-0.05)	0.801*** (2.63)	-0.117** (-2.53)	-0.175*** (-3.12)
Cote d'Ivoire	0.051 (052)	-1.770 (-0.35)	0.291 (0.34)	0.057 (0.47)
Egypt	-0.116** (-2.40)	-1.124 (-1.31)	0.198 (1.43)	0.199*** (3.29)
Ethiopia	-0.066 (-1.40)	0.396 (0.14)	-0.238*** (-2.97)	0.018 (0.22)
Ghana	0.064 (1.34)	0.348 (0.19)	-0.038 (-0.12)	1.352*** (3.58)
Lesotho	0.127*** (2.75)	1.931* (1.92)	-0.365* (-1.91)	-0.106 (-0.80)
Malawi	0.027 (0.33)	9.991 (1.44)	-2.176 (-1.45)	0.692*** (7.05)
Mauritania	0.028*** (3.01)	-7.043*** (-2.75)	1.259*** (2.75)	0.064* (1.71)
Mauritius	0.101 (1.08)	-6.776*** (-3.71)	1.006*** (3.70)	1.464*** (4.19)
Morocco	0.019* (1.83)	-1.324*** (-5.07)	0.213*** (4.96)	-0.149*** (-3.02)
Nigeria	-0.120** (-2.29)	0.385 (0.76)	-0.103 (-1.01)	-0.804*** (-3.43)
Rwanda	-0.454* (-1.67)	-6.283 (-1.08)	1.256 (1.03)	-0.782*** (-4.09)
South Africa	0.003 (0.34)	0.092 (0.38)	-0.013 (-0.39)	-0.110*** (-4.33)
Tunisia	0.017 (0.51)	-0.372 (-0.79)	0.056 (0.79)	-0.013 (-0.22)
Uganda	-0.016 (-0.29)	3.973** (2.51)	-0.828** (-2.49)	0.018 (1.31)

Table A4b: country specific slope coefficients-liquid liabilities

Countries	Liquid liabilities	GDP per capita	GDP per capita sq	Modern sector
Botswana	-0.042 (-1.42)	0.725*** (2.67)	-0.107*** (-2.63)	-0.135** (-2.16)
Cote d'Ivoire	0.056 (0.26)	0.297 (0.06)	-0.071 (-0.08)	0.110 (1.23)
Egypt	-0.192** (-2.45)	-1.141 (-1.26)	0.186 (1.26)	0.076 (1.46)
Ethiopia	-0.232 (-1.20)	-2.812 (-0.94)	0.644 (0.98)	-0.080 (-0.90)
Ghana	0.125 (1.26)	-0.038 (-0.02)	0.036 (0.11)	1.413*** (3.69)
Lesotho	0.602*** (3.22)	5.539*** (4.62)	-1.030*** (-4.62)	-0.172 (-1.52)
Malawi	0.576*** (3.08)	11.849** (2.31)	-2.526** (-2.27)	0.597*** (7.82)
Mauritius	0.037 (0.27)	-7.273*** (-3.76)	1.080*** (3.82)	1.430*** (3.35)
Morocco	-0.009 (-0.25)	-1.398*** (-4.51)	0.228*** (4.57)	-0.179*** (-3.15)
Nigeria	-0.192*** (-4.59)	-0.352 (-0.82)	0.040 (0.47)	-0.125* (-1.76)
Rwanda	-0.393 (-0.97)	-1.931 (-0.41)	0.364 (0.36)	-0.564*** (-4.27)
South Africa	0.025** (2.20)	0.018 (0.07)	-0.003 (-0.06)	-0.118*** (-5.77)
Tunisia	0.004 (0.08)	-0.527 (-0.95)	0.077 (0.93)	-0.009 (-0.16)
Uganda	0.127* (1.83)	3.551*** (2.59)	-0.750*** (-2.62)	0.145 (1.20)

Table A5a: Nonlinear Country specific slope coefficient- domestic credit

Countries	Domestic credit	Domestic credit square	GDP per capita	GDP per capita square	Modern sector
Botswana	0.379 (1.50)	-0.181 (-1.50)	0.716** (2.43)	-0.104** (-2.32)	-0.147*** (-2.60)
Cote d'Ivoire	-3.278*** (-4.75)	1.195*** (4.84)	-7.693** (-2.22)	1.314** (2.19)	0.034 (0.44)
Egypt	-0.203 (-0.36)	0.028 (0.16)	-1.097 (-1.07)	0.194 (1.19)	0.189*** (3.08)
Ethiopia	0.073 (0.14)	-0.060 (-0.26)	1.012 (0.30)	0.197 (-0.26)	0.007 (0.08)
Ghana	-0.763*** (-2.72)	0.493*** (2.98)	0.958 (0.64)	-0.149 (-0.55)	1.250*** (4.06)
Lesotho	0.160 (0.37)	-0.016 (-0.08)	1.968* (1.77)	-0.372* (-1.77)	-0.106 (-0.75)
Malawi	1.264 (1.56)	-0.692 (-1.52)	9.582 (1.45)	2.056 (-1.43)	0.791*** (6.88)
Mauritania	0.009 (0.79)	0.021** (2.40)	-4.852** (-2.03)	0.864** (2.02)	0.029 (0.81)
Mauritius	1.162 (0.50)	-0.306 (-0.46)	-7.163*** (-3.33)	1.060*** (3.36)	1.468*** (4.01)
Morocco	0.093 (0.87)	-0.026 (-0.69)	-1.392*** (-4.93)	0.224*** (4.85)	-0.159*** (-3.10)
Nigeria	-1.058** (-2.03)	0.412* (1.81)	0.666 (1.34)	-0.155 (-1.55)	-0.249*** (-3.74)
Rwanda	-7.272** (-2.19)	3.920** (2.06)	-7.162 (-1.34)	1.483 (1.32)	-0.658*** (-3.56)
South Africa	-0.188 (-0.75)	0.048 (0.76)	0.136 (0.54)	-0.020 (-0.55)	-0.099*** (-3.46)
Tunisia	-1.389 (-0.41)	0.396 (0.42)	-0.318 (-0.64)	0.049 (0.65)	-0.024 (-0.38)
Uganda	-0.400*** (-3.24)	0.339*** (3.26)	5.262*** (4.11)	-1.120*** (-4.14)	0.076 (0.70)

Table A5b: Nonlinear Country specific slope coefficient- liquid liabilities

Countries	Liquid liabilities/GDP	Liquid liabilities/GDP sq	GDP per capita	GDP per capita sq	Modern sector
Botswana	0.948*** (3.00)	-0.350*** (3.14)	0.498** (2.20)	-0.072** (-2.12)	-0.079 (-1.50)
Cote d'Ivoire	-16.987*** (-3.41)	6.178*** (3.42)	1.099 (0.27)	-0.235 (-0.34)	-0.121 (-1.26)
Egypt	7.801 (0.80)	-2.098 (-0.82)	-0.752 (-0.73)	0.124 (0.74)	0.069 (1.28)
Ethiopia	-12.123 (-1.32)	3.737 (1.29)	-2.323 (-0.79)	0.530 (0.81)	-0.036 (-0.39)
Ghana	-5.549*** (-6.47)	2.190*** (6.63)	-2.370** (-2.47)	0.470*** (2.69)	0.757*** (3.46)
Lesotho	2.688 (0.56)	-0.681 (-0.43)	5.118*** (3.26)	-0.952*** (-3.27)	-0.151 (-1.20)
Malawi	0970 (0.29)	-0.152 (-0.12)	11.972** (2.21)	2.552** (-2.18)	0.598*** (7.54)
Mauritius	6.117 (1.45)	-1.540 (-1.45)	-8.997*** (-4.07)	1.304*** (4.15)	1.505*** (3.62)
Morocco	1.415 (1.29)	-0.400 (-1.30)	-1.909*** (-3.84)	0.312*** (3.85)	-0.218*** (-3.46)
Nigeria	1.206 (1.35)	-0540 (-1.57)	-0.553 (-1.29)	0.089 (1.02)	-0.027 (-0.29)
Rwanda	8.932 (0.64)	-4.063 (-0.67)	-2.490 (-0.51)	0.485 (0.47)	-0.600*** (-4.12)
South Africa	-0.044 (-0.04)	0.021 (0.07)	0.022 (0.08)	0.003 (-0.07)	-0.118*** (-5.57)
Tunisia	-1.504 (-0.49)	0.442 (0.49)	.0549 (-0.96)	0.080 (0.94)	-0.009 (-0.16)
Uganda	-1.067*** (-3.18)	0.603*** (3.60)	2.322** (2.16)	-0.484** (-2.14)	-0.080 (-0.73)