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Remittances and Income Inequality in Africa: Financial Development Thresholds for Economic Policy

Forthcoming: Research in Globalization

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The study employs macro data on 42 African countries to examine whether remittances and financial development (including its sub-components of access, depth and efficiency) contribute to the equalisation of incomes across the continent. Robust evidence from the dynamic GMM estimator shows that: (i) remittances heighten income inequality in Africa, (ii) Africa's financial system is not potent enough for repacking remittances towards the equalisation of incomes, and (iii) vis-à-vis financial access and depth, inefficiencies characterising Africa's financial institution is the main reason remittances contribute to the widening of the income disparity gap. Nonetheless, the optimism which we provide by way of threshold analysis shows that channelling efforts into the development of Africa's financial sector could yield shared income distribution dividends. In particular, efforts should be made to achieve a minimum of 23.05 per cent of financial access, and 3.02 per cent for that of efficiency of financial institutions if Africa's financial sector is to repackage external finance towards the equalisation of incomes. A few policy recommendations are provided in the end.

1. Introduction

The income gap in Africa continues to widen, casting doubts on the achievement of Sustainable Development Goals (SDGs) 5 and 10 (United Nations, 2020, 2019; World Bank, 2020). Indeed, information gleaned from Chandy and Seidel (2017) indicates that out of the 5 most unequal countries in the world in terms of incomes and wealth, 4[1] (i.e., South Africa, Namibia, Swaziland, and Zambia) are in Africa. The need to equalise incomes in settings like these rests on the argument that in societies where within- and between-household inequalities are low, there is social cohesion[2], low corruption, and durable growth (Piketty, 2018; Bourguignon, 2017; Atkinson, 2016; Asongu & Nwachukwu, 2016; Pickett & Wilkinson, 2015). It is in this regard that African leaders have stepped up efforts aimed at bridging the continent's marked income gap, evidence of which is the institution of the continental framework dubbed, '*The Africa We Want*'[3] (African Union, 2015). However, with the onset of the coronavirus pandemic, which has triggered massive setbacks on SDGs 1, 5, 8, and 10 (World Bank, 2020; ILO, 2020), Africa is begging for attention and policy recommendations on how shared income growth and distribution can be realised.

We contribute to the discourse in this regard by identifying two key factors that present policymakers interested in Africa's development agenda opportunities for addressing the continent's huge income gap. The first is the remarkable inflow of external finance in the form of diaspora investment (*hereafter*: used interchangeably with remittances) and financial development. The optimism regarding the former lies in its power to spur growth, and poverty alleviation in the developing world (see Azizi, 2021; Pal *et al.*, 2021; Peprah et al., 2019). Crucially, in finance-constrained settings like Africa, the contribution of remittances to social progress could go beyond enabling low-income households to meet day-to-day consumption needs to supporting investments in healthcare, education, and businesses (Nweke & Nyewusira, 2015; World Bank, 2018). The criticality of remittances to Africa's shared growth agenda is seen in its resilience in the past 2 decades even in the heat of the coronavirus pandemic (Cazachevici, Havranek & Horvath, 2020; KNOMAD, 2019). And with remittances inflow to Africa surpassing both foreign direct investments (FDI) and official development assistance over the recent 2 decades[4], greater growth-inducing and income inequality-reducing dividends can be envisaged.

Although a plethora of prior contributions suggest that remittances can boost economic growth (see Fayissa & Nsiah, 2010; Kumar, 2013; Nyamongo, *et al.*, 2012; Olubiyi, 2014), there are also the concerns that it heightens income inequality in the developing

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[1] This figure rises to 8 if 20 countries are considered: South Africa (63%), Namibia (59.1%); Zambia (57.1%); Sao Tome and Principe (56.3%); Central African Republic (56.2%); Eswatini (54.6%); Mozambique (54.0%); Botswana (53.3%) (see Seery *et al.*, 2019)

[2] Indeed, heightened inequality and unemployment have been cited as one the reasons that fuelled the Arab uprising in 2011 (Asongu & Nwachukwu, 2016).

[3] The Africa Agenda 2063 denotes the resolve on the part of African leaders to build human capital, make resources count, and foster shared prosperity.

[4] The inflow of remittance to Africa has been remarkable since 2000- rising from 42 per cent in 2010 to 51 per cent in 2016 (UNCTAD, 2018).

world (see Pal *et al.*, 2021; Song *et al.,* 2021; Shen *et al.,* 2010). It is in this regard that this study pays attention to the role of financial development[5] in moderating the remittances-inequality relationship. We do this by taking cues from the recommendations by Song *et al.* (2021) and Law and Tan (2009) that financial development could play a salient role in the equalisation of incomes. Our main argument is that a thriving financial sector is necessary to propel or repackage remittances towards the equalisation of incomes.

We argue that in the presence of a well-developed financial sector, remittances passing through the financial system could be allocated efficiently to contribute to equitable income growth and distribution— providing grounds to defeat the Kuznets and Greenwood-Jovanovic hypotheses. This stems from the arguments that efficient financial institutions can deliver remittance services at the least cost per capita and high yields on deposits (Svirydzenka, 2016; Sahay *et al.* 2015; Demirguc-Kunt & Levine, 2008; Levine, 2005). This follows the argument that an efficient financial sector innovates to provide financial services and products to support private sector innovation, dynamism and growth (Demirguc-Kunt *et al.*, 2011; Law & Tan, 2009; King & Levine, 1993; Mckinnon 1973; Shaw, 1973). In this regard, while financial sector efficiency is necessary for incentivizing greater remittances inflow, greater financial access and depth are also necessary for allocating remittances in the economy.

However, in the face of a weak financial sector, access to financial products or services could be polarised, deepening inequalities in opportunities, productivity and incomes. Additionally, in a setting where most countries fall short of the average financial sector efficiency score of 0.5 as apparent in Figure 1, external inflows like remittances may not be allocated efficiently, potentially widening the income disparity gap. For instance, information garnered from Figure 1 reveals that while countries such as Seychelles (0.72), Ethiopia (0.71), Botswana (0.71), Benin (0.69) and Namibia (0.68) have achieved remarkable gains in financial sector efficiency, conspicuous lags are evident in countries such as South Africa (0.18), Comoros (0.21%), Democratic Republic of Congo (0.28) and Sao Tomè and Principè (0.29).

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[5] We pay attention to the sub-components of financial development: access, depth and efficiency as well.
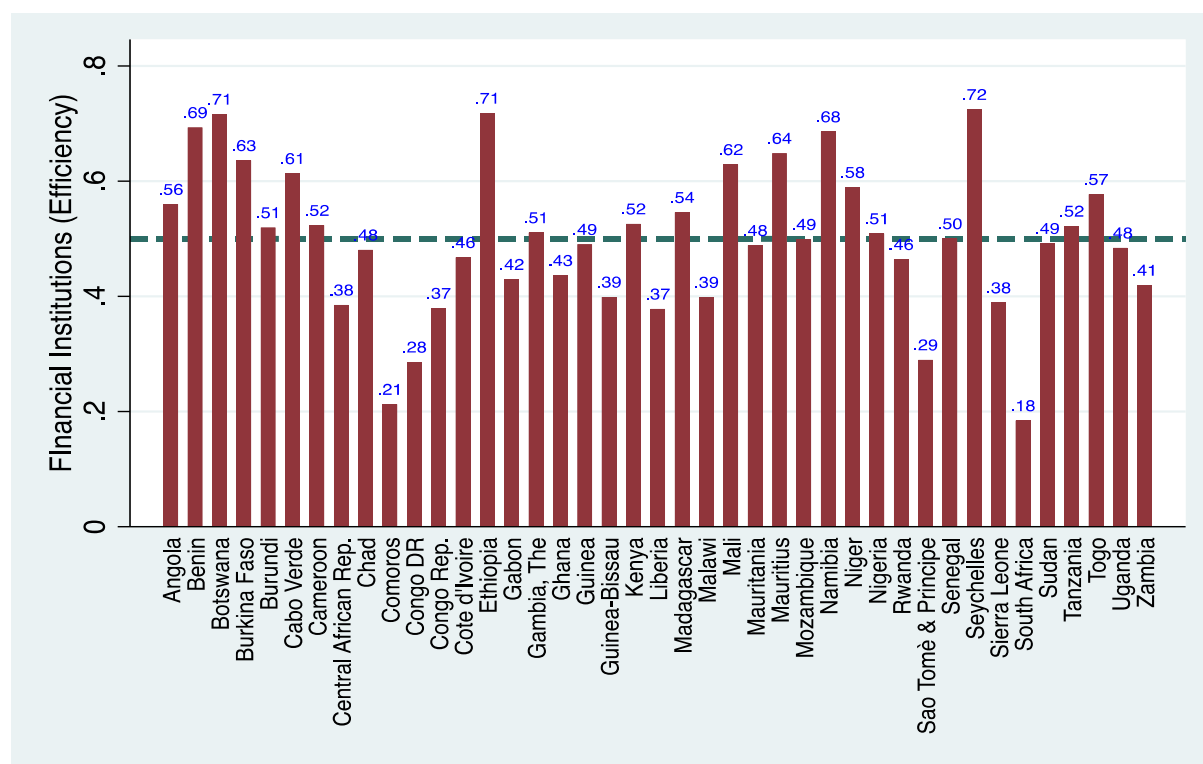
Figure 1: In-country Financial Institutions Efficiency in Africa, 1996 – 2020

Despite the aforementioned finance-remittances linkages, two issues remain unanswered in the literature. First, prior contributions have not examined the effects of financial development and its key subcomponents of access, depth and efficiency on income inequality in Africa. Second, the extant literature is deficient as to whether there exist some thresholds (critical masses) needed for financial development (including the subcomponents of access, depth and efficiency) to form relevant synergies with other income-inequality reducing modules towards the equalisation of incomes in Africa. These critical masses as Asongu (2018) and Asongu and Odhiambo (2020) are essential for policy formulations as it ex-ante indicates whether investing in complementary variables are feasible and worthwhile[6]. Our study attempts to fill these gaps in the extant scholarship by drawing macrodata from 42 SSA countries for the period 1996 – 2020 for the analysis. We do this by responding to three objectives. First, we explore whether both remittances and financial development (including its dynamic components of access, depth and efficiency) unconditionally contribute to the equalisation of incomes in Africa. Second, we examine whether financial development propels remittances to reduce income inequality in Africa. Third, we investigate whether there exist threshold levels (critical masses) needed for financial development and its subcomponents to contribute towards reducing income inequality in Africa.

The evidence we show by way of instrumental variable regression could trigger appropriate policy actions in the light of SDG 10 and Aspiration 1 of Agenda 2063. First, we

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[6] See the rational for employing this approach in Section 4.4

find that remittances increase income inequality. Second, vis-à-vis financial access and depth, inefficiencies characterising Africa's financial institution is the main reason remittances contribute to the widening of Africa's income disparity gap. Third, the optimism which we provide by way of threshold analysis, however, is that going forward, channelling resources into the development of Africa's financial sector could yield shared income distribution dividends.

The rest of the paper is organised as follows: the next section provides a theoretical link between remittances, financial development, and income inequality, while Section 3 outlines the empirical strategy. We present our findings in Section 4 and conclude with some policy implications in Section 5.

2. Literature review

2.1 Theoretical and empirical literature survey: remittances and income inequality

The optimistic and pessimistic perspectives are the closest theories supporting the linkage between remittance and income inequality. Considering the optimistic perspective, Beijer (1970), Todaro (1969), and Kindleberger (1965) reckoned that remittance can spur economic growth through increasing savings, and investment in physical and human development (education and health). Kindleberger (1965) argued that remittance can provide the means for the poor and financially excluded households to address liquidity constraints, which can go a long way to promote entrepreneurship, innovation, labour market participation, and jobs creation, providing concrete grounds to reduce income inequality. Contrariwise, Lipton (1980), Rubenstein (1992), Russell (1992), and Binford (2003) argued that remittance can retard economic growth as it is linked to external shocks. While empirical evidence on the income inequality-reducing effect of remittances is found in prior contributions such as Colombelli *et al.* (2021), Akobeng (2021), Acheampong *et al.* (2021), Zardoub and Sboui (2021), Abduvaliew and Bustillo (2019), Mamun *et al*. (2015), Anyanwu (2011) and Koechlin and Leon (2007), studies such as Song *et al*. (2021), Pal *et al*. (2021), Shen *et al*. (2010) and (World Bank, 2021) report the contrary.

2.2 Theoretical and empirical literature review: financial development and income inequality

The theoretical link between financial development and income inequality can be looked at from the perspective of the finance-led growth theory (Patrick, 1966; Schumpeter, 1911) and the Kuznets (1955) hypothesis. In the spirit of these theories, though financial development can spur growth in the early stages of development as McKinnon (1973), Levine (2005), King and Levine (1993) argue, it can heighten income inequality due to skewed/polarised financial access. Though limited access to financial services and products are more of structural impediments characteristic of countries in the early stages of development, internal factors such as high transaction costs and lending rates also play a key role in widening the income gap between the high-income and low-income households. This, as Galor and Zeira (2003) argue, arms high-income households to invest more in human capital development (education, health or skills), providing grounds to widen between-household inequalities. However, in later stages of development, a burgeoning financial sector in terms of access, depth and efficiency can drive entrepreneurship and innovation, which by extension can provide durable jobs opportunities, improved wages and shared incomes (see Banerjee & Newman, 1990; Greenwood & Jovanovic, 1990).

2.3 In-country developments on Inequality, remittances and financial development in Africa

In this section, we present developments regarding the variables of interest to put the study into perspective. We first pay attention to our outcome variable, income inequality. The data shows that across all the two most recognised income distribution measures— the net Gini index, and the Palma ratio, income inequality is high in Africa (Figure 2). The overview of the income inequality situation in Africa as shown in Figure 2 (Column 1) conforms to the concerns raised by the World Bank (2020) and United Nations (2020) that inequalities in Africa remain high despite remarkable growth gains chalked since the turn of the Millennium. While on the average, Africa's income inequality measured by the net Gini index is one of the worse compared to other continents of the world, the in-country developments from 1996 – 2020 show that the socioeconomic concern is marked in countries such as Botswana (0.65), Comoros (0.61), Central African Republic (0.58), Gabon (0.57), Namibia (0.7), South Africa (0.69), and Zambia (0.59) (see Column 1, Figure 2). Casting the net a bit wider to incorporate within- and between-household income inequalities as shown in Column 2 of Figure 2, the data shows that household inequalities are glaring in countries such as Botswana (10.16), Burkina Faso (9.23), Central Africa Republic (7.66), Comoros (8.36), Namibia (8.02), South Africa (9.93) and Zambia (8.11).
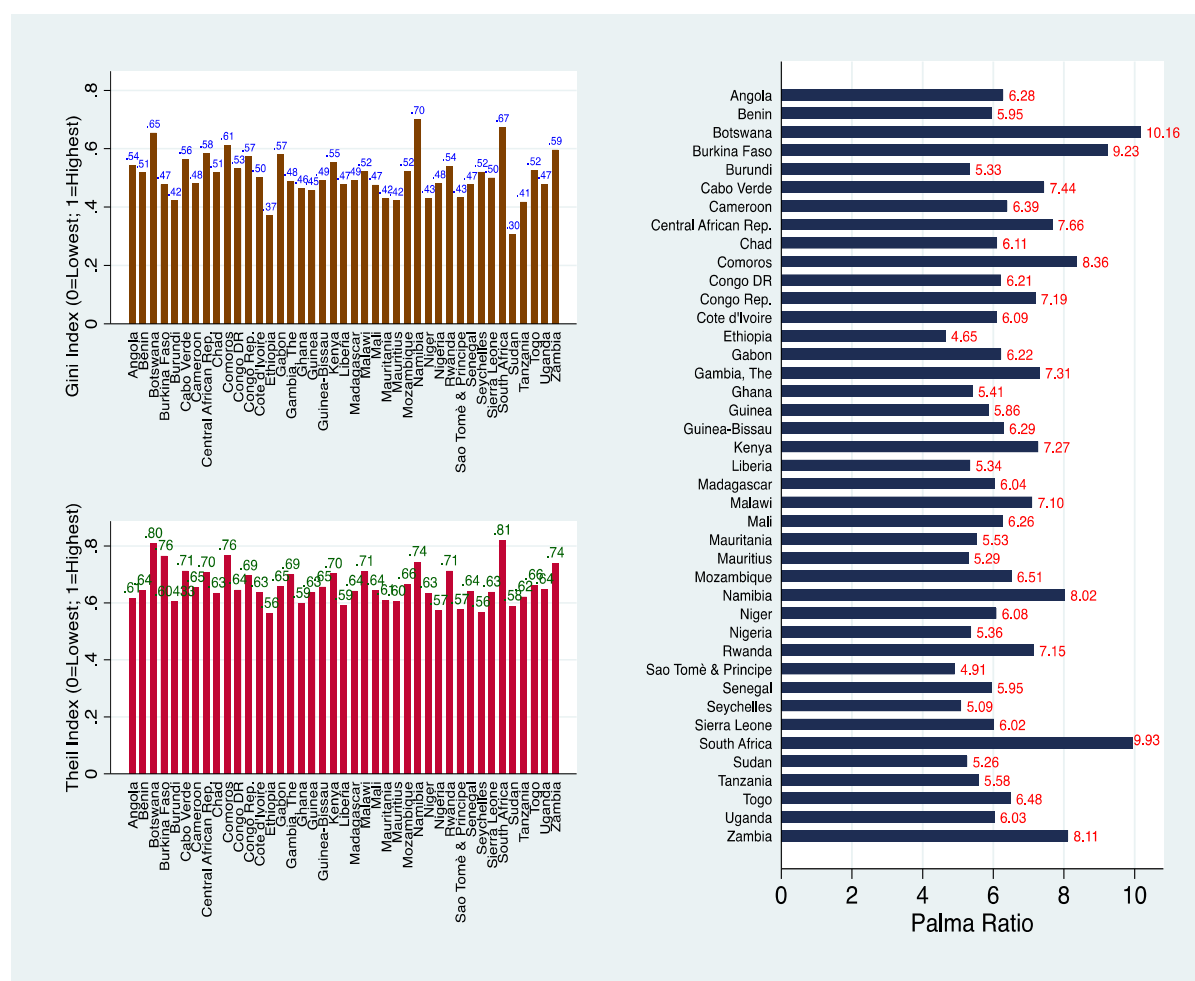

Figure 2: Average In-country Income Inequality in Africa, 1996 – 2020

The criticality of this picture in a politically fragile setting like Africa is its pernicious implications for social cohesion and sustainable development, which is already being felt considering the rise in the number of coup d'états[7] in Africa in 2021 and the rise in arm group across the Sahel[8]. Indeed, it is a development that casts doubt on the achievement of SDGs 1, 5, 8 and 10 in the medium term and Aspiration 1 of Africa's Agenda 2063 in the longer term.

It is in the spirit of this that the United Nation's Agenda 2030 identifies external finance as a major factor that can be harnessed to foster equitable income distribution. One of such key external resource inflows is remittances[9] which have exceeded both foreign direct investment and development assistance (World Bank 2021a; Black 2021; IMF 2021; KNOMAD, 2019). The optimism with remittances equalising income in Africa centres on the evidence that it can be an engine for economic growth, job creation, poverty alleviation and human capital development (World Bank, 2018, 2014; Chowdhury 2016, African Development Bank, 2014). Nonetheless, prior contributions such as Prokhorova (2017) and Anyanwu (2011) raise the concerns that remittances can heighten income inequality if the bulk of inflows benefits affluent households or uninvested in productive ventures.

This is where Africa's financial system, though in early stages of development as vividly shown in Figure 3, could prove crucial for turning remittances into significant socioeconomic successes. In developing jurisdictions where credit constraints remain a major constraint to firm innovation, performance and sustainability, a burgeoning financial sector act as a vehicle for spearheading efficient resource allocation and investment in infrastructure and human capital development (Tchamyou, 2021). Additionally, an efficient financial sector could also double as an (i) incentive for boosting the inflow of remittances and (ii) channelling it into productive ventures (World Bank, 2016; King & Levine, 1993; Levine, 2005).

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[7] Mali (2), Guinea (1), Chad (1), Sudan (1) and Niger (1) (see Ofori et al. 2022a; Ofori et al., 2021).
[8] Examples are Boko Haram, the ISIS affiliates of Mali, Cameroon and Burkina Faso.
[9] In 2019, remittances reached a remarkable US$550 billion from US$520 in 2018, exceeding FDI by US$5 billion and Official Development Assistance by over US$300 billion (see KNOMAD, 2019)
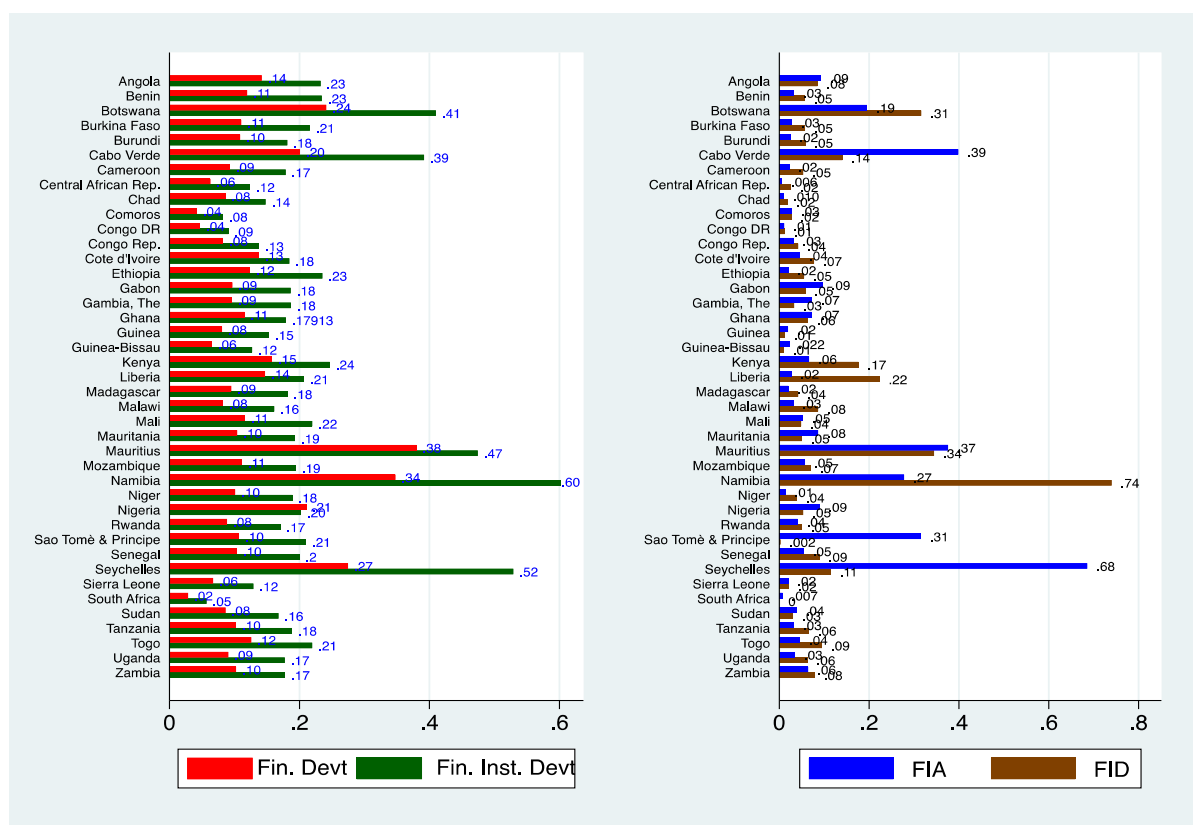
Figure 3: Average Within-country Financial Development, Financial Institutions Index, and Remittances in Africa, 1996 – 2020

Nevertheless, in the presence of a weak financial sector in terms of access, depth and efficiency as we show in Figure 1 and Figure 3, even if remittances flow through the financial system it can polarise resource allocation, further deepening income inequalities in the process (Prokhorova, 2017; Anyanwu, 2011).

3.0 Data and methodology

3.1 Data

The study employs a balanced macro panel on 42 African countries[10] for the period 1996 – 2020 for the analysis. The main income inequality variable used for the analysis is the Palma ratio as it captures both the within- and between-household income inequalities across the richest and poorest segments of a country (Lahoti *et al.*, 2016). To evaluate the robustness of our Palma ratio estimates, the net Gini index is employed as an alternative income inequality indicator (Solt, 2020). The variable of interest in this study is remittances and is captured as personal remittances[11] received by residents of a country as a percentage of GDP (Peprah *et al*. 2019). For our moderators, we draw data on financial development and its sub-components of access, efficiency and depth from the International Monetary Fund's Financial Development Index Database (Svirydzenka, 2016).

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[10]Angola; Benin; Botswana; Burkina Faso; Burundi; Cabo Verde; Cameroon; Central African Republic; Chad; Comoros; Congo DR.; Congo Republic; Cote d'Ivoire; Ethiopia; Gabon; The Gambia, Ghana; Guinea; Guinea-Bissau; Kenya; Lesotho; Liberia; Madagascar; Malawi; Mali; Mauritania; Mauritius; Mozambique; Namibia; Niger; Nigeria; Rwanda; Senegal; Seychelles; Sierra Leone; South Africa; Sudan; Sao Tomè and Principè; Tanzania; Togo; Uganda; Zambia

[11] The data are taken from the World development Indicators (World Bank, 2021).

For control variables, we consider covariates such as inflation, corruption control, human capital, ICT diffusion, and FDI to (1) mitigate possible omitted variable bias (2) take into account the effect of macroeconomic instability on income growth and (3) capture the effect in institutions in fostering equitable income growth and distribution. Our attention on human capital is anchored in the human capital theory, which postulates that it arms the masses not to gain only to take advantage of opportunities like one presented by the AfCFTA but build capacity to mitigate socioeconomic shocks (Tchamyou *et al.* 2019). We keep tabs on corruption control considering the relevance of institutions in (i) ensuring that resources count for all and (ii) provision of a level-playing field to gain from growth (Kaufmann *et al.*, 2010). Our attention on foreign direct is informed by the implementation of the AfCFTA and the projection rebound of FDI inflows to Africa from 2022 (UNCTAD, 2021). The relevance of FDI for income inequality centres on the conventional dictum that it can accelerate industrial revolution by deepening global value chain participation, horizontal- and vertical-firm interdependences while providing durable opportunities for fairer income growth and distribution (Opoku *et al.* 2019; Obeng-Odoom, 2020). Also, we pay attention to ICT diffusion following prior contributions by Ofori and Asongu (2021), Ofori *et al.* (2021a), Asongu and Odhiambo (2019) that digital infrastructures are effective social inclusion modules for delivering basic needs and the creation of shared opportunities. Contingent on empirical evidence that macroeconomic instability has a high destabilizing effect on the real incomes and purchasing power of especially the poor, we include inflation, which is recurrent in Africa in the conditioning information set (Ofori *et al.*, 2022b; Saimi-Namini & Hudson, 2019). The description and data sources of all the variables are reported in Table 1.

Table 1: Description of variables and data sources

Variables	Descriptions	Sources
Outcome variables		
Palma ratio	The ratio of national income shares of the top 10 per cent of households to those of the bottom 40 per cent	GCIP
Gini index	Income inequality after taxes and transfers (0=Lowest; 1=Highest)	SWIID
Independent variable		
Remittance	Personal remittances received (% GDP)	WDI
Moderating variables		
Financial development	Financial development (overall) index	Findex
Financial institutions	Financial institutions development index	Findex
Financial institutions access	Financial institution access index	Findex
Financial institutions depth	Financial institution depth index	Findex
Financial institutions efficiency	Financial institution efficiency index	Findex
Control variables		
Human capital	Average secondary school duration in years	WDI

Inflation	Consumer price index (2010=100)	WDI
Foreign direct investment	Foreign direct investment, net inflows (% GDP)	WDI
ICT diffusion	The composite index for the construction, extension, improvement, operation, and maintenance of communication systems (postal, telephone, telegraph, wireless, and satellite communication systems).	AIKP
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	WGI

Note: WDI is World Development Indicators; Findex is IMF's Financial Development Index; GCIP is Global Consumption and Income Project; WGI is World Government Indicators; AIKP is Africa Infrastructure Knowledge Program, and SWIID is Standardized World Income Inequality Database
Source: Authors' construct, 2022

3.2 Estimation Strategy

In this section, we delve into the specification of our empirical models. Our empirical strategy is premised on the established wisdom advocated by the exogenous growth theory and finance-led growth hypotheses that financial development (Schumpeter, 1911; Patrick, 1966; Levine, 2005) and remittances (Russell, 1992; Lipton, 1980) are modules for fostering effective resource allocation and equitable income growth and distribution. Following Ofori *et al*. (2021b; 2021c) and Ofori and Grechyna (2021), we precede the presentation of our main model by specifying a baseline model where we analyse the effects of our control variables on income inequality. Our baseline model is specified as:

$$palma_{it} = \lambda_0 + \delta_1 palma_{it-1} + \beta_1 corrupt_{it} + \beta_2 hci_{it} + \beta_3 ictdif_{it} + \beta_4 fdi_{it} + \beta_5 inf_{it} + \epsilon_i + \mu_t + \varepsilon_{it} \tag{1}$$

In line with hypotheses 1 and 2, we modify Equation (1) by incorporating the conditional and unconditional effects of remittances and financial development[12] (i.e., including the components of financial institutions) on income inequality as seen in Equation (2):

$$palma_{it} = \lambda_0 + \delta_1 palma_{it-1} + \beta_1 corrupt_{it} + \beta_2 hci_{it} + \beta_3 ictdif_{it} + \beta_4 fdi_{it} + \beta_5 inf_{it} + \beta_6 remit_{it} + \beta_7 findev_{it} + \beta_8(remit_{it} \times findev_{it}) + \epsilon_i + \mu_t + \varepsilon_{it} \tag{2}$$

Though the standard pooled least squares, the random effect and fixed effect estimators can be employed in estimating Equations (1) and (2), we opt for the instrumental variable approach put forward by Arrelano and Bover (1995). Our choice is informed by the fact that

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[12] Additional pairwise interaction terms for remittances and financial institutions development, financial institutions(access), financial institutions(depth), and financial institutions(efficiency) are introduced in our models.

Equations (1) and (2) present some endogeneity problems which if unresolved can bias our estimates and render the attendant inferences flawed. First, the endogeneity concern arises due to the simultaneity between weak institutional governance (i.e., corruption) and income inequality (Acemoglu & Robinson, 2012; Kaufmann *et al.*, 2010). The second endogeneity concern surfaces since $palma_{it-1}$ depends on ε_{it-1}, which is also a function of the country-specific effect ϵ_i. Additional caveats for applying the GMM estimator is that the sample countries (i.e., N) employed in this empirical analysis is higher than the number of time period (i.e., T) (Ofori *et al*, 2021d; Asongu & Odhiambo, 2020). Moreover, the panel dataset reveals cross-country variations, which are accounted for in GMM estimation (Ofori *et al.*, 2022c). Third, the Roodman approach accounts for limited proliferation of instruments as well as cross-sectional dependencies (Fosu & Abass. 2019). With these conditions satisfied, we transform Equation (2) into Equations (3) and (4) to capture the level and first difference specifications, which encapsulate the dynamic two-system GMM estimation.

$$palma_{it} = \lambda_0 + \delta_1 palma_{it-1} + \beta_1 remit_{it} + \beta_2 findev_{it} + \sum_1^5 \theta_k V_{kit-\tau} + \mathcal{I}_i + \mu_t + \varepsilon_{it} \quad (3)$$

$$palma_{it} - palma_{it-\tau} = \delta_1(palma_{it-\tau} - palma_{it-2\tau}) + \beta_1(remit_{it} - remit_{it-\tau}) + \beta_2(findev_{it} - findev_{it-\tau}) + \sum_1^5 \theta_k(V_{kit-\tau} + V_{kit-2\tau}) + (\mu_t - \mu_{it-\tau}) + (\varepsilon_{it} - \varepsilon_{it-\tau})$$
$$(4)$$

Next, to capture the hypothesised joint effect of remittances and financial development on income inequality, Equation (4) is modified to obtain Equation (5).

$$palma_{it} - palma_{it-\tau} = \delta_1(palma_{it-\tau} - palma_{it-2\tau}) + \beta_1(remit_{it} - remit_{it-\tau}) + \beta_2(findev_{it} - findev_{it-\tau}) + \beta_3(remit \times findev_{it} - remit \times findev_{it_{it-\tau}}) + \sum_1^5 \theta_k(V_{kit-\tau} + V_{kit-2\tau}) + (\mu_t - \mu_{it-\tau}) + (\varepsilon_{it} - \varepsilon_{it-\tau})$$
$$(5)$$

Finally, to compute the joint effects of the remittance-financial development interaction terms on income inequality as specified in Equations (5), Equation (6) is presented

$$\frac{\partial(palma_{it})}{\partial(remit_{it})} = \beta_1 + \beta_3\overline{(findev_{it})} \quad (6)$$

where $\overline{findev_{it}}$ is the mean of financial development in country *i* at time *t*; *palma* is the Palma ratio; *inf* is inflation; *ictdif* is ICT diffusion index; *hci* is human capital; *corrupt* is control of corruption; *fdi* is foreign direct investment, and *remit* is remittances. Also, $remit \times findev$ is the interaction term for remittances and financial development; *i* is country; *t* is time; ϵ_i is the country-specific effects; and ε_{it} is the idiosyncratic error term. Based on the human capital theory, we expect human capital to reduce income inequality (Tchamyou, 2021). Further, in the light of the supply-leading hypothesis and the extensive margin theory, we expect financial development and its components to reduce income inequality (De Haan *et al.*, 2021). Also, while we expect remittances and corruption control to reduce income inequality (Acemoglu & Robinson, 2010; Peprah *et al*. 2019; Anyanwu, 2011), we expect inflation to heighten income inequality (Siami-Namini & Hudson, 2019). Foreign direct

investment, meanwhile, is ambiguous (Kaulihowa & Adjasi, 2018). Finally, we expect the signs of all the interaction terms to be negative.

It is imperative to point out that, the effectiveness of the GMM estimator in yielding robust estimates depends on some post-estimation tests, which we pay attention to. First, we evaluate the validity of the instruments based on the Hansen test of over-identification, which is evaluated against the null hypothesis that the set of identified instruments and the residuals are uncorrelated (Asongu & Nting, 2021; Asongu, Nnanna, & Acha-Anyi, 2020). Additional post-estimation tests regarding whether: (i) there is evidence of second-order serial correlation in the residuals or not; (ii) the interaction terms are significant, and (iii) the estimated models are jointly significant, are evaluated.

4. Presentation of findings

4.1 Summary Statistics

In Table 2, we show the development regarding our variables over the study period using summary statistics. The data show an average value of 6.4 per cent for ICT diffusion, which is an indication of the growing proliferation of information and communication technology in Africa over the past two decades. Also, the average values of inflation and human capital development are 8.85 per cent and 6.25 per cent, respectively. The mean value of control of corruption is -0.582, signifying the need to strengthen Africa's institutional fabric.

Table 2: Summary statistics, 1996 – 2020
Note: Obs = Observations; Std Dev. is Standard Deviation

Variables	Obs	Mean	Std. Dev.	Minimum	Maximum
Dependent variable					
Palma ratio	816	6.574	1.782	2.484	21.79
Gini index (net)	812	0.510	0.096	.031	0.719
The key variable of interest					
Remittances	906	3.757	7.707	0.000	34.134
Modulating variables					
Financial development index	967	0.125	0.075	0.000	0.503
Financial institutions index	967	0.216	0.117	0.000	0.700
Financial institutions (access) index	967	0.089	0.140	0.000	0.880
Financial institutions (depth) index	967	0.094	0.130	0.000	0.780
Financial institutions (efficiency) index	967	0.499	0.156	0.000	0.84
Control variables					
ICT diffusion index	756	6.401	10.267	0.000	71.813
Control of corruption	882	-0.582	0.619	-1.723	1.217
Human capital	1048	6.260	0.762	4.000	7.000
Inflation	792	8.851	26.682	-8.975	513.907
Foreign direct investment	861	4.541	8.331	-11.625	103.337

Further, the data reveal that the averages for financial institutions and its sub-indices of access, depth, and efficiency are 0.21, 0.08, 0.09, and 0.49, respectively. For our outcome variables, the data show mean values of 6.57, and 0.51 for the Palma ratio and the net Gini index, respectively. On the variable of interest, remittances, the data show an average value of 3.75 per cent, signifying a significant inflow of external finance to Africa. Perusing the data further in terms of in-country examination as apparent in Figure 4, we observe that remittances occupy a significant share of the GDP of African countries, notable among them being Lesotho (15.49%), Cape Verde (12.355), Liberia (7.99%), Comoros (7.47%) and Senegal (7.38%).
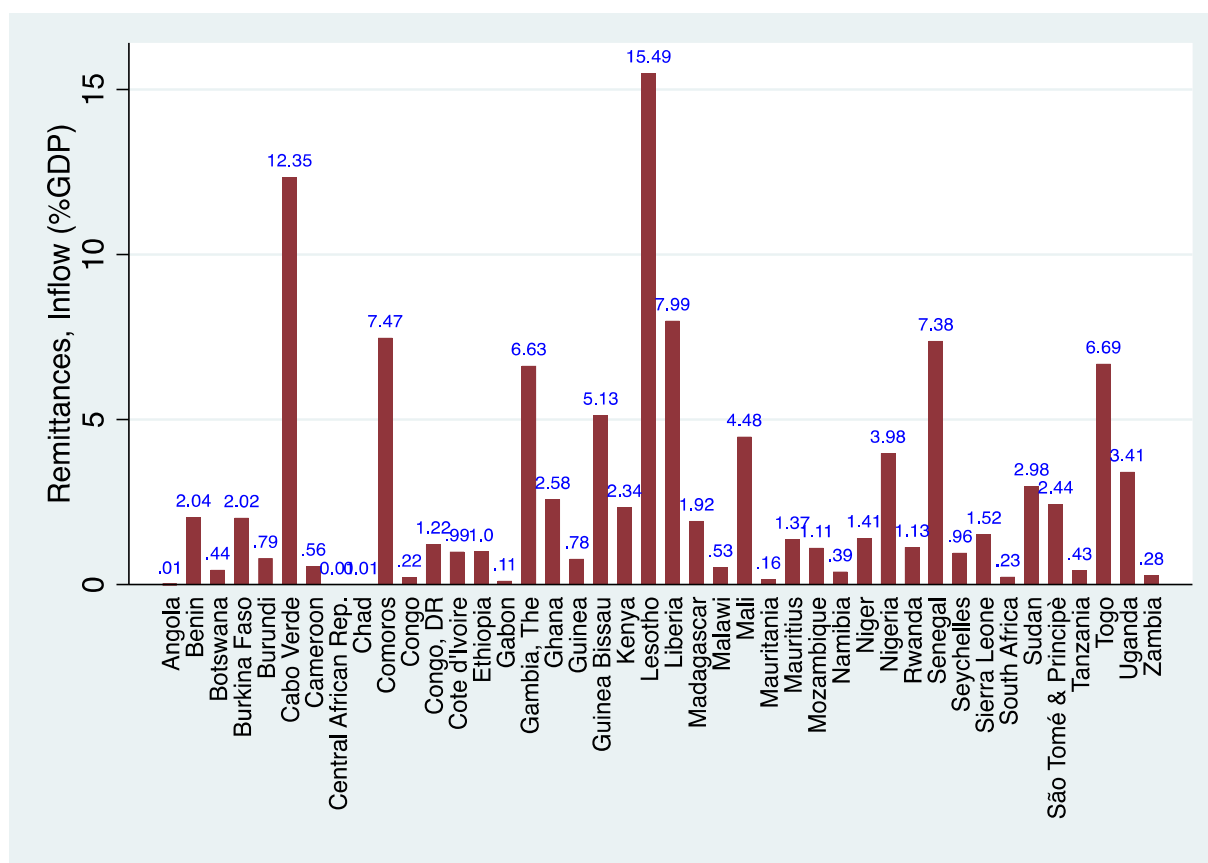
Figure 4: Remittance inflows (%GDP) to Africa, 1996 – 2020

4.2 Results for the effects of remittances and financial development on income inequality

Table 3 presents the result from our main estimations. In interpreting these results, it is important to note that because income inequality increases with the Palma ratio, negative (positive) coefficients should be interpreted as a positive (negative) effect on equitable income distribution.

We begin the presentation of our results by focusing on our baseline results in Column 1. We find that control of corruption promotes equitable income distribution in Africa. This supports the position by Doumbia (2020) and the OECD (2016) that corruption control is critical to the effectiveness of government for sharing growth gains and generating equal opportunities. Similarly, the negative coefficient of human capital implies the income inequality-reducing effect of investing in education and the health of the populace. Our findings support the empirical notion that expenditure on human development projects namely; education and health could be pivotal to income equity in marginalized settings like Africa via innovation, labour productivity and human resource wastage (Mutiiria *et al.*, 2020; Raheem *et al.*, 2018; Asongu & Odhiambo, 2018). We also find, in line with Tchamyou *et al.* (2019), that ICT diffusion reduces income inequality in Africa. Albeit not statistically significant, FDI is negatively related to income inequality. The evidence on inflation also suggests that macroeconomic instability widens the income disparity gap in Africa (see Siami-Namini & Hudson, 2019).

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From Columns 2 – 7, we report our results in the light of our first objective (i.e., unconditional effects of remittances on income inequality). The results reveal that unconditionally, remittance is not effective in bridging Africa's glaring disparity gap (Column 2). In terms of magnitudes, we report an increase in income inequality by 0.02 per cent for every 1 increase in remittances inflow to Africa. This is not farfetched since, in Africa, the majority of migrants are from middle- or high-income households. In this regard, remittances will have a subdued direct effect on both poverty and income inequality (Vacaflores, 2018). Furthermore, because of the prohibitive costs of migration and the strict immigration policies in developed countries that favour rich and skilled workers, poorer and lower-skilled households may receive limited gains from remittances. In this sense, remittances may deepen the income gap in unequal societies like Africa (Nyamongo *et al.*, 2012).

Similarly, we find that, overall, financial development induces income inequality in Africa (Column 3). Our result is in line with the claim that in the early stages of development, financial development can heighten income inequality. However, at the disaggregated level, we find strong evidence that the financial institutions in general (Column 3), and its sub-components of depth (Column 6), and efficiency (Column 7) reduce income inequality in Africa.

Table 3. GMM results for the effects of remittances and financial development on income inequality in Africa (Dependent variable: Palma ratio)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Corruption control	-0.0958***	-0.0933***	-0.1713***	0.0393**	-0.0957***	-0.0218	-0.0636***	-0.0666*	0.0460	-0.0025	0.0289	-0.0819*
	(0.0236)	(0.0222)	(0.0267)	(0.0188)	(0.0309)	(0.0239)	(0.0177)	(0.0339)	(0.0485)	(0.0232)	(0.0462)	(0.0478)
Human Capital	-0.1430***	-0.1179***	0.1150***	-0.0299***	-0.0206	-0.1272***	-0.1532***	0.1171***	-0.1126	0.0194	-0.1994***	0.1463**
	(0.0400)	(0.0386)	(0.0229)	(0.0102)	(0.0168)	(0.0236)	(0.0324)	(0.0245)	(0.0777)	(0.0312)	(0.0654)	(0.0674)
ICT diffusion	-0.0026***	-0.0005	-0.0076***	-0.0002	-0.0043***	-0.0006	-0.0011	0.0001	0.0083***	0.0037***	0.0033**	0.0001
	(0.0005)	(0.0004)	(0.0013)	(0.0005)	(0.0003)	(0.0004)	(0.0008)	(0.0008)	(0.0014)	(0.0013)	(0.0013)	(0.0016)
FDI	-0.0001	-0.0016***	0.0018***	-0.0005**	0.0003*	-0.0004*	-0.0016***	-0.0011***	0.0002	-0.0003	-0.0020***	0.0004
	(0.0003)	(0.0001)	(0.0006)	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.0003)	(0.0005)	(0.0003)	(0.0004)	(0.0006)
Inflation	-0.0028***	-0.0034***	-0.0013**	-0.0012***	-0.0022***	-0.0025***	-0.0007*	-0.0005	0.0013**	0.0003	-0.0021***	-0.0001
	(0.0006)	(0.0004)	(0.0005)	(0.0003)	(0.0002)	(0.0002)	(0.0004)	(0.0003)	(0.0005)	(0.0007)	(0.0005)	(0.0012)
Remittances		0.0284***						-0.0525***	-0.1712***	-0.0166*	0.0234*	-0.1907***
		(0.0030)						(0.0147)	(0.0186)	(0.0093)	(0.0126)	(0.0250)
Financial development (FD)			0.5049**					-2.1308***				
			(0.2335)					(0.3047)				
Financial institutions (FI)				-1.0429***					-3.8252***			
				(0.1310)					(0.3283)			
FIA (access)					0.0252					-2.2875***		
					(0.1261)					(0.2503)		
FID (depth)						-0.3547**					-0.8562***	
						(0.1600)					(0.2955)	
FIE (efficiency)							-0.6504***					-1.4365***
							(0.0909)					(0.2076)
Remittances × FD								0.4618***				
								(0.0992)				
Remittances × FI									0.7977***			
									(0.0792)			
Remittances × FIA										0.3827***		
										(0.0611)		
Remittances × FID											-0.0196	
											(0.0469)	
Remittances × FIE												0.5769***
												(0.0731)
Palma (-1)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.2147	-0.1927	-0.5200***	0.2627**	-0.2002*	0.2249*	0.9347***	-0.5844***	0.8800	-0.6461**	0.4367	-0.9138*
	(0.2300)	(0.2299)	(0.1436)	(0.0970)	(0.1028)	(0.1182)	(0.2110)	(0.1498)	(0.5544)	(0.2773)	(0.3719)	(0.5105)
Observations	489	442	489	489	489	489	489	442	442	442	442	442
Time effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Net effect	na	na	na	na	na	na	na	0.0052	0.0011	0.0175	–	0.0972
Joint Significance Test Statistic	na	na	na	na	na	na	na	21.65***	101.34***	39.25***	–	62.28***
Joint Significance Test P-value	na	na	na	na	na	na	na	0.000	0.000	0.000	–	0.000
Countries/ Instruments	40/35	39/39	40/39	40/39	40/39	40/39	40/39	39/39	39/39	39/39	39/39	39/39
Wald Statistic	80262***	123271***	463099***	529829***	3.290e+06***	558901***	374250***	9.970e+07***	174698***	3.406e+06***	138071***	79971***
Wald P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen P-Value	0.504	0.440	0.793	0.642	0.307	0.253	0.447	0.460	0.487	0.419	0.751	0.698
AR(1)	0.096	0.094	0.092	0.092	0.095	0.095	0.0912	0.098	0.084	0.095	0.092	0.076
AR(2)	0.299	0.263	0.250	0.309	0.285	0.317	0.286	0.284	0.291	0.322	0.307	0.251

*Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1*

We turn attention to the estimates in Columns 8 – 12 to respond to our second hypothesis. Interestingly, the study finds some 'worrying effects' regarding the mediating role of financial development. Specifically, the results show that the underdeveloped nature of Africa's financial sector contributes to the widening of the continent's disparity gap even in the presence of the remarkable inflow of remittances. Crucially, the results show that the inefficiency of Africa's financial institutions is the key factor inhibiting the potential income inequality-reducing effects of remittances[13]. That said, we follow Equation (6) by presenting the calculation of the attendant net effects. First, for the financial development-remittances interaction, we report a net effect of 0.005 (see Column 8). This is computed as:

$$\frac{\partial(palma_{it})}{\partial(remitt_{it})} = -0.0525 + (0.4618 \times 0.125) = 0.005$$

where -0.0525 is the unconditional effect of remittances on income inequality, 0.4618 is the indirect effect of remittances and 0.125 is the mean of financial development. Following the same computational procedure, realise a net effect of 0.001 for the financial institutions-remittance interaction (see Column 9).

$$\frac{\partial(palma_{it})}{\partial(remitt_{it})} = -0.1712 + (0.7977 \times 0.216) = 0.001$$

where -0.1712 is the direct effect of remittances on income inequality, 0.7977 is the coefficient of the remittance-financial institutions interaction, and 0.089 is the mean of financial institutions. Likewise, the income inequality-deepening effect of financial access polarisation in Africa is evident as it moderates remittances to yield a positive net effect of 0.017 (see Column 10). Similarly, the weak financial efficiency of Africa interacts with remittances to yield a net effect of 0.097. These net effects are computed respectively as:

$$\frac{\partial(palma_{it})}{\partial(remitt_{it})} = -0.0166 + (0.3827 \times 0.089) = 0.017$$

where the unconditional effect of remittances is -0.0166, the conditional effect is 0.382 and 0.089 is the average for financial institutions access.

$$\frac{\partial(palma_{it})}{\partial(remitt_{it})} = -0.1907 + (0.5769 \times 0.499) = 0.097$$

where -0.1907 denotes the direct effect of remittance, 0.5769 is the coefficient of interaction between remittances and efficiency of financial institutions, and 0.499 is the mean of financial institutions efficiency in Africa.

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[13] See the negative unconditional effects of remittances from Columns 8 – 12

A key finding from this study, therefore, is that the weak financial sector of Africa partly contributes to the region's marked income gap even in the face of the remarkable inflow of external finance. The implication is that the current state of Africa's financial sector is not sufficient enough to engender favourable synergistic effects with remittances towards the equalisation of incomes. Particularly, in the face of inefficient financial institutions and polarised financial access, results from the remittances-financial access, and remittances-financial efficiency pathways suggest that worse income inequality effects are feared considering the projected rebound of remittance inflows to Africa from 2022 (World Bank 2021; KNOMAD, 2021). This is linked with the caution by Čihák *et al*. (2012) that inefficient financial systems impede social progress, key of which is income inequality. For instance, where financial institutions are highly concentrated in the urban areas[14], it may provide the means to entrench rural-urban inequalities as financial access and products elude rural folks. In settings like this, external finance such as remittances could benefit urban dwellers more compared to their rural counterparts. The alternative, which involves the use of informal financial channels for receiving remittances or not investing remittance in the financial system as Aggarwal *et al*. (2011) argue, could aggravate the inequality situation.

Per our post-estimation tests, our estimates are robust. Our results are free from second-order serial autocorrelation in the residuals. The Hansen tests of instrument validity also show that our instruments are robust and valid. Finally, results of the Wald statistics confirm that all our models have been accurately specified and thus reliable for explaining the link between remittances, financial development and income inequality.

4.3 Robustness check: results using the net Gini index as the dependent variable

In evaluating the robustness of our estimates in Table 3, we pay attention to the unconditional and conditional effects of our variables of interest– remittances and financial development using the net Gini index as an alternative measure of income inequality. The attendant results as presented in Tables A1 in the Appendices section are similar to our Palma ratio estimates in Tables 3. For our baseline results in Column 1 of Table A1, we find that human capital and inflation are harmful to shared income distribution. We, however, do not find evidence for the income equalisation effect of ICT diffusion as reported by Ofori *et al*. (2021b).

In the remit of our first objective, we find that unconditionally, remittances contribute to the deepening of income inequality in Africa. Our result concurs that of Bouoiyour and Miftah (2014). Consistent with Batuo *et al*. (2010) and Shahbaz and Islam (2011**),** we find that financial development reduces income inequality. Additionally, albeit modest effects, both financial access and depth reduce income inequality. This could be attributed to the fact the net Gini index does take into account the tails in the distribution of incomes.

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[14] According to Culpeper (2012), the financial reforms in Africa in the 1980s led to bank concentration, limited competition, and limited banking service coverage, particularly in rural areas. The reforms were meant to stop misallocation of cash and corruption in the financial sector, but they did so at the detriment of the rural poor (see Tita & Aziakpono, 2016)

We now turn attention to Objective 2 where we find that only the remittances-financial access interaction is significant although it yields an overall income inequality-reducing effect of 0.005. This is calculated from Equation 6, taking into account the direct (-0.0058) and indirect (0.0095) effects of remittances (see Column 10).

$$\frac{\partial(gini_{it})}{\partial(remitt_{it})} = -0.0058 + (0.0095 \times 0.089) = -0.005$$

4.4 Policy relevant thresholds for financial development

In the light of the alternating conditional and unconditional effects of remittances, we proceed to inform policy by way of thresholds. We do this, taking cues from evidence in the contemporary literature that critical masses for complementary policies can be computed per the signs and significance levels of interactions terms and the moderating variable(s). Indeed, as Asongu (2018) and Asongu and Odhiambo (2020a, 2020b) reckon, this approach is consistent with the attendant literature on the computation of critical mass for evaluating the effectiveness (ineffectiveness) of complementary policies through the establishment of initial conditions and inflexion points. For instance, Asongu (2018) used this approach to establish the threshold at which any increase in environmental degradation will hamper inclusive development. Similarly, while Cummins (2000) used to this approach to determine initial conditions for rewarding effects, Asongu et al. (2019) employed the approach to identify inflexion points at which information sharing harms market power for the enhancement of financial access.

Following this approach, we answer the question as to what levels of financial development and its dynamic components of access, depth and efficiency are necessary to form relevant synergies with other income inequality-reducing modules towards the equalisation of income in Africa. Since the Palma ratio is our main income inequality indicator, these thresholds are based on the estimates reported in Table 3. First, following recent threshold literature as evident in Asongu *et al.* (2020) and Asongu and Nwachukwu (2018), we find a critical mass of 8.796 per cent for financial development (Column 8) given that the absolute direct and indirect effects of remittances are 0.0525 and 0.4618, respectively. This is calculated as:

Threshold for overall financial development = $\frac{0.4618}{0.0525}$ = 8.796 (per cent)

Hence, with the established threshold of 8.796, financial development should be complemented with other policy measures to foster equitable income distribution. Following similar computations, the thresholds for the financial institutions and its attendant components access and efficiency are also calculated. Along the same line of understanding, policymakers should target a minimum of 23.05 per cent for financial

institutions access, and 3.025per cent for financial institutions efficiency. We present the calculation of these critical masses in what follows:

Threshold for financial institutions (Column 9) = $\frac{0.7977}{0.1712}$ = 4.659 (per cent)

Threshold for financial institutions access (Column 10) = $\frac{0.3827}{0.0166}$ = 23.054 (per cent)

Threshold for overall financial institutions efficiency (Column 12) = $\frac{0.5769}{0.1907}$ = 3.025 (per cent)

The optimism with these thresholds is that should policymakers channel resources into the development of Africa's financial system, they can turn around the 'worrying effects' reported in the preceding sections. And indeed, from both economic- and resource-sense, these critical masses are achievable since they are situated within their maximum and minimum values (see Table 2). In other words, the computed governance thresholds have economic meaning and policy relevance because they are situated within their respective statistical ranges disclosed in the summary statistics.

5.0 Conclusion, policy recommendation and direction for further research

Motivated by renewed calls for African leaders to reduce the continent's marked income disparity gap in the light of SDG 10 and Aspiration 1 of Agenda 2063, we examine the conditional and unconditional effects of remittances on income inequality. To this end, we draw country-level data on 42 African countries for the period 1996 – 2020 for the analysis.

Our findings, which are robust to both the Palma ratio and net Gini index measures of income of inequality are quite striking. First, we find that remittances increase income inequality. Second, Africa's financial system is not potent enough for repacking remittances towards the equalisation of incomes on the continent. Third, vis-à-vis financial access and depth, inefficiencies characterising Africa's financial institution is the main reason remittances contribute to the widening of the income disparity gap. Nonetheless, the optimism which we provide by way of threshold analysis shows that channelling efforts into the development of Africa's financial sector could yield shared income distribution dividends. In particular, efforts should be made to achieve a minimum of 23.0 per cent of financial access, and 3.0 per cent for that of financial institutions efficiency if Africa's financial sector is to repackage external finance towards the equalisation of incomes.

We recommend that African governments engage with financial institutions to ensure a sound and effective financial system that eliminates market frictions to effectively provide financial services to a diverse group of firms and households. Second, financial institutions should work to create processes that make receiving remittances affordable, convenient, and secure, as well as efficient and effective institutional channels for sending and receiving remittances. Third, financial institutions should strive to deepen financial access by expanding financial inclusion modules such as mobile and online banking, automated teller machines, and rural banking. Moreover, with Africa gaining a greater economic integration

following the implementation of the Africa Continental Free Trade Area, we recommend that development partners such as the World Bank and the African Development Bank assist Africa's monetary authorities in setting up improved regulatory and supervisory institutions to boost information flow, consumer protection against cybercrimes and money laundering, and collateral arrangements to enhance financial system stability. That said, if SDG 10 and Aspiration 1 of Africa's Agenda 2063 are to be realized, the results and policy proposals should not be taken lightly.

The study leaves room for future research, particularly in terms of conducting country-specific studies to develop more country-specific policies that are better suited to each country's initial development conditions and differences in financial development across countries. A single country analysis will provide country-oriented policies using the relevant time series approach.

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Table A2. GMM results for the effects of remittances and financial development on income inequality in Africa (Dependent variable: net Gini index)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Corruption control	0.0039	-0.0108	0.0121***	0.0017	-0.0046	0.0157***	0.0075**	-0.0289***	-0.0178***	-0.0162***	-0.0187**	-0.0110*
	(0.0045)	(0.0073)	(0.0045)	(0.0036)	(0.0033)	(0.0055)	(0.0033)	(0.0069)	(0.0049)	(0.0039)	(0.0092)	(0.0056)
Human capital	-0.0219***	-0.0448***	-0.0202***	-0.0174***	-0.0182***	-0.0219***	-0.0200***	-0.0101	-0.0073	-0.0208***	-0.0312**	-0.0179*
	(0.0050)	(0.0052)	(0.0053)	(0.0041)	(0.0037)	(0.0061)	(0.0048)	(0.0098)	(0.0058)	(0.0063)	(0.0116)	(0.0091)
ICT diffusion	0.0009***	0.0007***	0.0012***	0.0008***	0.0009***	0.0013***	0.0010***	0.0003**	0.0006***	0.0007***	0.0005***	0.0004***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)
FDI	-0.0000	0.0002***	-0.0000	0.0001	0.0001*	-0.0001	-0.0001	0.0001*	0.0002***	0.0004***	0.0003**	0.0003***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Inflation	0.0002***	-0.0001	0.0002***	0.0002***	0.0001	0.0003***	0.0002***	0.0004**	0.0004***	0.0002	0.0001	0.0003***
	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.0001)
Remittances		0.0014***						-0.0021	-0.0023	-0.0058***	-0.0056***	0.0008
		(0.0003)						(0.0021)	(0.0016)	(0.0010)	(0.0009)	(0.0011)
FD			-0.1068***					-0.0193				
			(0.0350)					(0.0271)				
FI				-0.0306					-0.0738***			
				(0.0206)					(0.0265)			
FIA					-0.0466***					-0.0645**		
					(0.0092)					(0.0257)		
FID						-0.1132***					0.0434	
						(0.0300)					(0.0340)	
FIE							0.0001					0.0123
							(0.0067)					(0.0159)
Remittances × FD								0.0569***				
								(0.0138)				
Remittances × FI									0.0384***			
									(0.0068)			
Remittances × FIA										0.0095**		
										(0.0041)		
Remittances × FID											0.0027	
											(0.0039)	
Remittances × FIE												0.0131***
												(0.0043)
Net Gini index (-1)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.1151***	0.2360***	0.1239***	0.1075***	0.1067***	0.1298***	0.1083***	0.0158	0.0106	0.0837**	0.1294*	0.0469
	(0.0291)	(0.0320)	(0.0319)	(0.0246)	(0.0198)	(0.0359)	(0.0275)	(0.0613)	(0.0327)	(0.0336)	(0.0703)	(0.0550)
Observations	486	438	486	486	486	486	486	438	438	438	438	438
Time effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Net effect	na	na	na	na	na	na	na	–	–	0.0049	–	–
Joint Significance Test Statistic	na	na	na	na	na	na	na	–	–	5.39**	–	–
Joint Significance P value	na	na	na	na	na	na	na	–	–	0.026	–	–
Countries/Instruments	40/35	39/39	40/39	40/39	40/39	40/39	40/39	39/39	39/39	39/39	39/39	39/39
Wald Statistic	51354***	62120***	37677***	107093***	238240***	62502***	68945***	135838***	173007***	240765***	167168***	82866***
Wald P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen P-Value	0.233	0.600	0.247	0.275	0.272	0.228	0.312	0.298	0.305	0.327	0.373	0.377
AR(1)	0.016	0.033	0.017	0.017	0.018	0.017	0.017	0.031	0.033	0.031	0.031	0.033
AR(2)	0.396	0.899	0.262	0.326	0.394	0.404	0.413	0.132	0.122	0.099	0.284	0.120

*Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1*