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Thresholds of external flows for inclusive human development in Sub-Saharan Africa

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Thresholds of External Flows for Inclusive Human Development in Sub-Saharan Africa [1]

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Research Department

Thresholds of External Flows for Inclusive Human Development in Sub-Saharan Africa

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Abstract

This research investigates the incidence of enhancing external flows on inclusive human development in a panel of 48 countries in sub-Saharan Africa. It complements the literature by examining the relevance of enhancing three types of external flows, namely: development assistance, foreign investment and remittances. Ordinary Least Squares, Tobit, Fixed effects, Generalised Method of Moments and Quantile regressions are used as empirical strategies. The following main results are apparent: (i) between 60 and 150 (% of GDP) is the threshold of foreign aid; (ii) 33.333 (% of GDP) is the foreign investment threshold and (iii) 25 (% of GDP) is the critical mass of remittances. At the established critical masses or thresholds, external flows start having positive effects on inclusive human development. Countries characterized by inclusive development levels that are low need more investment in foreign aid for inclusive human development compared to their counterparts characterized by inclusive human development levels that are high.

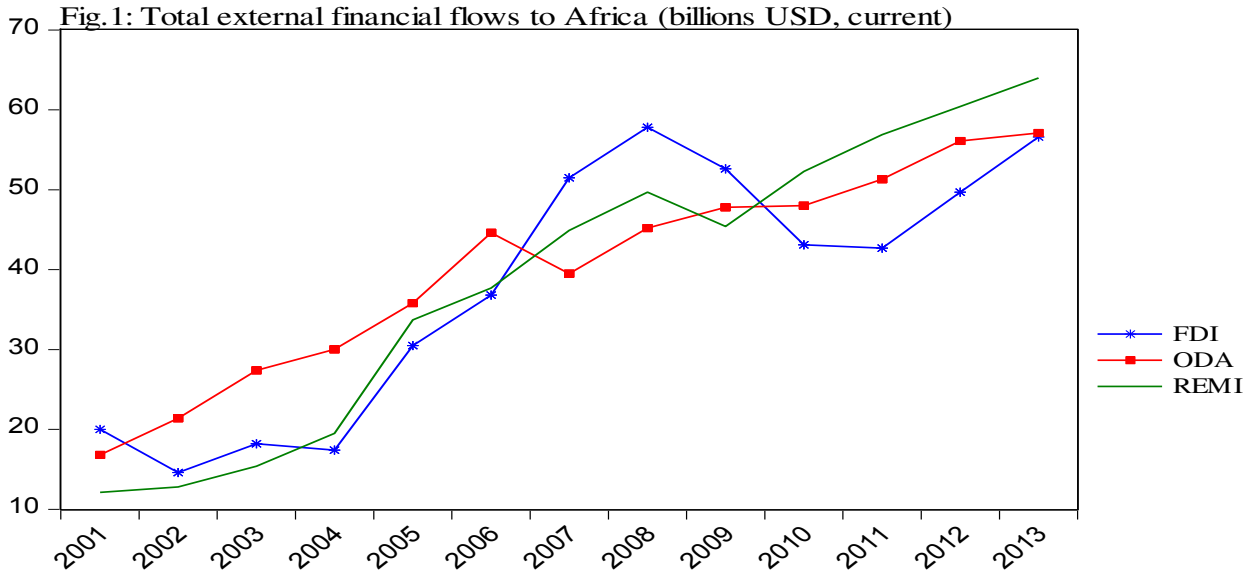
JEL Classification: F21; F24; F35; I30; O55
Keywords: Foreign investment; Remittances; Foreign aid; Inclusive development; Africa

1. Introduction

The research builds on three main tendencies in scholarly and policy-making circles, notably: (i) growing external flows into the African continent; (ii) the contemporary relevance of inclusive human development and (iii) shortcomings in the literature.

First, as documented by the African Economic Outlook (AEO, 2014) and Ssozi and Asongu (2016), external flows (i.e. foreign direct investment, remittances and foreign aid) have been increasing in Africa since the year 2000. The narratives are consistent with the position that between 2000 and 2012, the underlying external flows increased more than threefold. As shown in Figure 1 below, remittances (REMI), official development assistance (ODA) and foreign direct investment (FDI) have substantially increased when values of these flows of the year 2010 are compared with those of the year 2012. The authors maintain that the growth is fundamentally because of increasing flows coming from non-OECD countries[2]. These growing external flows can be instrumented by policy makers in order to assuage economic development concerns related to exclusive development[3].

Fig.1: Total external financial flows to Africa (billions USD, current)



Source: African Economic Outlook 2013 - © OECD 2013

Second, one of the most significant policy concerns in sub-Saharan Africa (SSA) pertaining to the post-2015 development agenda or Sustainable Development Goals (SDGs) is the lack of shared prosperity. Accordingly, the number of people living in extreme poverty has been consistently rising across SSA in spite of the fact that the sub-region has enjoyed more than two decades of resurgence in economic growth (Tchamyou, 2019a, 2019b;

[2] OECD stands for the Organisation for Economic Co-operation and Development.

[3] Policy syndrome within the context of this study is non-inclusive development. This conception and understanding of a policy syndrome is in accordance with recent inclusive development (Asongu & Nwachukwu, 2017a) and inequality (Tchamyou *et al.*, 2019) literature.

Tchamyou *et al*., 2019). Hence, the fact that close to 50% of countries in the sub-region did not attain the Millennium Development Goal (MDG) extreme poverty target (Asongu & le Roux, 2019) is traceable to exclusive development because the response of poverty to economic growth is a negative function of inequality (Fosu, 2015; Asongu & Kodila-Tedika, 2017, 2018).

In the light of the above, in order to reduce poverty to a threshold below 3% by 2030 for the achievement of SDGs, economic development in the sub-region has to be inclusive. This scholarly recommendation is, *inter alia*, articulated by Bicaba *et al*. (2017) who have examined SSA as the poorest region in the world to establish that it would be impossible to eradicate extreme poverty by 2030 in the sub-region under plausible hypotheses. However, the underlying extreme poverty can be mitigated via equitable income distribution and sustained economic growth.

The study is positioned on inclusive human development in the light of the challenging policy syndrome of inequality and an apparent gap in the literature which has not exploited the potential of external flows in the alleviation of the underlying policy syndrome. The inequality-adjusted human development index (IHDI) which is the measurement of inclusive human development in this study is defined as "*The IHDI is the national average of achievements in three main areas, namely: (i) knowledge; (ii) health and long life; and (iii) decent standards of living. In addition to accounting for average rewards in terms of health, education and income, the IHDI also accounts for the distribution of underlying achievements among the population by controlling for mean values of each dimension with regard to inequality*" (Asongu & Odhiambo, 2019a, p. 6). The lack of inclusive human development is associated with poverty because the absence of wealth, low life expectancy (due to unhealthy living) and poor education are characteristics of poverty (Anyanwu, 2013, 2014).

Third, the contemporary literature on the issue of poverty and inequality in Africa has focused on, *inter alia*: the importance of maintaining the 2000 to 2010 economic growth levels with the prospect to completely stamping-out extreme poverty by 2030 (Ravallion, 2013; Chandy *et al*., 2013; Ncube *et al*., 2014; Yoshida *et al*., 2014); nexuses underpinning income distribution, poverty and economic prosperity (Thorbecke, 2013; Fosu, 2017a, 2017b); connections between inequality, consumption and accumulation of wealth among the poorest elements of society (De Magalhães & Santaeulàlia-Llopis, 2018); the linkage between income distribution and corruption (Sulemana & Kpienbaareh, 2018); the importance of reinventing development assistance for inclusive development (Page & Söderbom, 2015; Jones & Tarp, 2015; Asongu, 2016); relationships between education,

finance and inequality (Tchamyou, 2019a, 2019b; Tchamyou *et al.*, 2019; Meniago & Asongu, 2018; Mannah-Blankson, 2018) and nexuses between income inequality, inclusive development, external debts, remittances and foreign investment (Asongu *et al.*, 2015; Asongu & Leke, 2019; Kaulihowa & Adjasi, 2018). Closest to the positioning of this study is the last stream of attendant research. Whereas Kaulihowa and Adjasi (2018) have focused on the relationship between foreign investment and inequality, Asongu and leke (2019) have investigated the influence of external flows on inclusive human development employing Tobit regressions and Generalised Method of Moments (GMM).

The present study departs from the underlying on two main fronts, notably: problem statement and methodology. First, on the problem statement, this study argues that just establishing linkages between external flows and inclusive development is less informative for policy makers unless thresholds at which external flows increase inclusive human development are clearly established. In Section 2, the basis for introducing quadratic estimations is justified in the light of theoretical underpinnings. Accordingly, establishing a threshold at which a policy variable positively influences an outcome variable provides policy makers with more actionable and practical insights compared to establishing the direction of a relationship between the two variables. Hence, contrary to the underlying study that is based on direct (or non-quadratic) estimations, the modelling exercise in this research is based on quadratic estimations.

Second, on the methodological front, the empirical strategies used by Asongu and Leke (2019) which are based on mean values of the outcome variable, are complemented with an empirical approach that assesses the investigated relationships throughout the conditional distribution of inclusive development. The intuition for this methodological improvement is that empirical strategies based on mean values of the outcome variable produce blanket policy outputs that are ineffective unless the modelling exercise is tailored to account for low, intermediate and high initial levels of inclusive human development. Accordingly, quantile regressions used in this study enable the assessment of the nexus between external flows and inclusive human development with emphasize on various initial levels of inclusive human development.

The rest of the study is structured follows. The intuition, theoretical underpinnings and corresponding hypothesis are covered in Section 2. The data and methodology are discussed in section 3 while section 4 covers the empirical results. Section 5 concludes with implications and future research directions.

2. Intuition, theoretical underpinnings and hypothesis development

The theoretical underpinnings supporting the nexus between external flows and inclusive human development in developing countries can be viewed from two main perspectives, namely: the economic development tragedy of Africa and the relevance of external flows in promoting economic development. This is encapsulated by the two-gap model of Chenery and Strout (1966) which articulates the importance of external flows from developed countries in the financing of development needs in poorer countries. Consistent with Asongu and Leke (2019), the Harrod-Domar model motivating the need for development assistance in developing countries is founded on three main arguments, notably: (i) there is a financing gap in Africa because available capital is less than the capital required for investment in sustainable development; (ii) economic development in the long term can be improved by bridging the financing gap and (iii) foreign aid and external debts can be used to bridge the financing gap. Owing to growing scholarly criticism of the two underlying models of development, especially on the effectiveness of foreign aid in promoting economic development in poor countries, there have been calls for alternative mechanisms of external flows and paradigm shifts of economic development (Obeng-Odoom, 2013; Easterly, 1999; Asiedu, 2004; Masud & Yontcheva, 2005; Ndlovu-Gatsheni, 2013; Asongu, 2014; Kuada, 2015).

In the light of the above, it is logical to assess how increasing external flows affect inclusive human development in developing countries because the underpinning models of the economic development supporting the relevance of external flows in developments outcomes are consistent on the need to increase such external flows for more externalities in development outcomes. It follows that there is a direct and explicit linkage between the problem statement of this study and the discussed theoretical underpinnings.

In the course of increasing external flows, it is also logical to suppose that effects on the outcome variable can be non-monotonic or non-linear. This non-linear consideration builds on the longstanding conflicting debate on the effects of foreign aid (Doucouliagos & Paldam, 2008, 2009, 2010), foreign investment (Almfraji & Almsafir, 2014) and remittances (Adams, 2011; Inchauste & Stein, 2013; Asongu *et al.*, 2019) on development outcomes. Hence, building on the attendant literature on positive and negative effects of external flows on development outcomes in developing countries, it is logical to hypothesize that the effects of external flows on inclusive human development can be both positive and negative. Such positive and negative tendencies naturally translate critical masses, inflections points or

thresholds at which the effect changes from one sign to another. The argument leads to the following testable hypothesis.

Hypothesis 1: There is a critical mass or threshold of external flows needed for external flows to positively affect inclusive human development.

In the light of the above, external flows must be increased to a certain benchmark before positive outcomes on inclusive human development can be expected. The use of interactive regressions to capture such non-linear effects is consistent with recent literature, notably, on: increasing information and communication technology for inclusive human development (Asongu & le Roux, 2017); enhancing information technology for inequality mitigation (Asongu & Odhiambo, 2019b) and increasing insurance penetration for economic growth (Asongu & Odhiambo, 2019c).

3. Data and Methodology

3.1 Data

The study focuses on a sample of 48 countries in SSA for the period 2000-2012 with data from four main sources. The choices of sampled countries and periodicity are motivated by constraints in the availability of data. The sources include, the: (i) World Development Indicators of the World Bank for the external flows (i.e. foreign aid, remittances and foreign investment) and a two control variables (i.e. mobile phone penetration and Gross Domestic Product per capita growth) and (ii) Financial Development and Structure Database (FDSD) of the World Bank for a control variable (i.e. private domestic credit). In addition to the above sources, political stability which is another control variable is sourced from the World Bank's World Governance Indicators while the inclusive development proxy is obtained from the United Nations Development Program (UNDP)[4].

Consistent with recent inclusive human development literature (Asongu & Nwachukwu, 2017a), the outcome variable which is the inequality-adjusted human development index (IHDI) is the human development index (HDI) that is adjusted for inequality. The HDI reflects the national average in three main categories of human

[4] More information on the sources of the variables are available in the public domain: (i) World Development Indicators of the World Bank (https://databank.worldbank.org/source/world-development-indicators); (ii) World Governance Indicators of the World Bank (https://info.worldbank.org/governance/wgi/#home); (iii) the Financial Development and Structure Database of the World Bank (https://www.worldbank.org/en/publication/gfdr/data/financial-structure-database) and (iv) the United Nations Development Program (https://www.undp.org/content/undp/en/home.html).

development, namely: health and long life; basic living standards and knowledge. Hence, the IHDI is the HDI that accounts for the equal distribution of the achievements in income, education and health. The IHDI is calculated as the geometric mean of the inequality-adjusted dimension of each of the underlying three constituents (i.e. health and long life; basic living standards and knowledge).

In accordance with the motivation of the study (i.e. Asongu & Leke, 2019), three independent variables of interest are used, namely: remittances inflows, foreign direct investment inflows and net official development assistance. The definitions of the independent variables of interest and how they are measured are provided in Appendix 1. To account for variable omission bias, the research adopts four control variables in accordance with the attendant literature pertaining to inclusive development, namely: political stability, Gross Domestic Product (GDP) per capita growth, mobile phone penetration and private domestic credit (Asongu & Nwachukwu, 2016a, 2017b; Mlachila *et al.*, 2017; Tchamyou, 2019a, 2019b). The research anticipates all adopted control variables to positively influence human development. GDP per capita is an inherent component of the HDI. Access to credit has been documented to promote pro-poor economic development (Mlachila *et al.*, 2017; Tchamyou *et al.*, 2019). The mobile phone is also an instrument of inclusive development in Africa (Asongu, 2015). Political stability provides enabling conditions for the delivery of public commodities that are relevant for inclusive development. The definitions and sources of the variables are provided in Appendix 1 while Appendix 2 discloses the summary statistics. The correlation matrix is presented in Appendix 3.

3.2 Methodology

Five estimation techniques are adopted in this study, notably: (i) Fixed effects estimations to account for the unobserved country heterogeneity; (ii) Generalised Method of Moments (GMM) in order to control for persistence of inclusive development; (iii) Tobit estimations to account for the limited range in the dependent variable; (iv) Quantile regressions (QR) to consider initial levels of inclusive development and (v) Ordinary Least Squares (OLS) for comparative purposes with QR and baseline purposes. The relevance of multiple estimation techniques for robustness purposes is consistent with recent literature (Asongu *et al.*, 2018; Boateng *et al.*, 2018).

3.2.1 Fixed Effects regressions

The panel fixed effects specification is as follows:

$$IHD_{i,t} = \partial + \sum_{j=1}^{7} \theta_j W_{j,i,t} + \eta_i + \varepsilon_{i,t} \quad , \tag{1}$$

where $IHD_{i,t}$ is inclusive human development of country i in period t; ∂ is a constant, W is the vector of determinants which includes the three external flows and four control variables (political stability, GDP per capita growth, mobile phones and private domestic credit), η_i is the country-specific effects and $\varepsilon_{i,t}$ is the error term. Eq. (1) is based on heteroscedasticity and autocorrelation consistent (HAC) standard errors with control for country-specific effects.

3.2.2 Generalised Method of Moments

The GMM is motivated by four main factors. (i) The inclusive human development indicator is persistent given that the correlation between level values and first-differenced values is higher than the threshold for establishing persistence (Tchamyou, 2019a, 2019b). Accordingly, the corresponding correlation which is 0.987 is higher than the 0.800 threshold. (ii) The number of cross sections is higher than the number of time periods in each cross section. Accordingly, the N(48)>T(13) criterion is met. (iii) Cross-country variations are considered in the regressions. (iv) Endogeneity is also taken into consideration by controlling for the unobserved heterogeneity with time invariant variables and simultaneity by means of instrumented variables.

The study adopts the Roodman (2009a, 2009b) extension of Arellano and Bover (1995) which uses forward orthogonal deviations because it has been established to restrict over-identification (Boateng *et al.*, 2018). In the specification, a *two-step* procedure is preferred to the *one-step* process because it accounts for heteroscedasticity. It is relevant to note that the *one-step* approach accounts for homoscedasticity.

The following equations in levels (2) and first difference (3) summarize the standard *system* GMM estimation procedure.

$$IHD_{i,t} = \sigma_0 + \sigma_1 IHD_{i,t-\tau} + \sigma_2 EF_{i,t} + \sigma_3 EFEF_{i,t} + \sum_{h=1}^{4} \delta_h W_{h,i,t-\tau} + \eta_i + \xi_t + \varepsilon_{i,t} \tag{2}$$

$$IHD_{i,t} - IHD_{i,t-\tau} = \sigma_1 (IHD_{i,t-\tau} - IHD_{i,t-2\tau}) + \sigma_2 (EF_{i,t} - EF_{i,t-\tau}) + \sigma_3 (EFEF_{i,t} - EFEF_{i,t-\tau}) + \sum_{h=1}^{4} \delta_h (W_{h,i,t-\tau} - W_{h,i,t-2\tau}) + (\xi_t - \xi_{t-\tau}) + (\varepsilon_{i,t} - \varepsilon_{i,t-\tau}) \quad , \tag{3}$$

where, $IHD_{i,t}$ is inclusive human development of country i in period t; $IHD_{i,t-1}$ is inclusive human development of country i in period $t-1$; $EF_{i,t}$ represents external flows (foreign investment, foreign aid and remittances); $EFEF_{i,t}$ is the quadratic interaction between external flows ("foreign investment" × "foreign investment", "foreign aid" × "foreign aid" and "remittances" × "remittances"); σ_0 is a constant; τ represents the coefficient of auto-regression which is one because a year lag is enough to capture past information; W is the vector of control variables (political stability, GDP per capita growth, mobile phones and private domestic credit) , η_i is the country-specific effect, ξ_t is the time-specific constant and $\varepsilon_{i,t}$ the error term.

With regard to the identification and exclusion restrictions, in line with recent literature (Tchamyou & Asongu, 2017; Asongu & Nwachukwu, 2016b; Dewan & Ramaprasad, 2014), the research assumes that all explanatory indicators are suspected endogenous or predetermined whereas the years are considered to exhibit strict exogeneity. The Difference in Hansen Test (DHT) is used to assess the exclusion restriction, notably, that the identified strictly exogenous variables affect the inclusive development exclusively through the endogenous explaining variables.

3.2.3 Tobit regressions

Consistent with empirical literature, this research further controls for the limited range in the dependent variable by employing a double censored Tobit model (Coccorese & Pellecchia, 2010; Asongu & Nwachukwu, 2016a; Ajide *et al.*, 2019). Accordingly, this motivation is in line with the behaviour of the data in the study because from the summary statistics disclosed in the appendix, the IHDI rangers from 0.129 to 0.768. It is important to note that in the context of the study, the dependent variable is theoretically limited in the range of 0 to 1.

The standard Tobit model (Tobin, 1958; Carsun & Sun, 2007) is as follows in Eq. (4):

$$y_{i,t}^{*} = \alpha_0 + \beta X_{i,t} + \varepsilon_{i,t}, \qquad (4)$$

where, $y_{i,t}^{*}$ is a latent response variable, α_0 is a constant, $X_{i,t}$ is an observed $(1 \times k)$ vector of explanatory variables and $\varepsilon_{i,t} \approx$ i.i.d. N(0, σ^2) and is independent variables in $X_{i,t}$.

Instead of observing $y_{i,t}^{*}$, we observe $y_{i,t}$ in Eq. (5):

$$y_{i,t} = \begin{cases} y^*_{i,t,} \; if \; y^*_{i,t} > \gamma \\ 0, \; if \; y^*_{i,t} \leq \gamma, \end{cases} \tag{5}$$

where, γ is a non-stochastic constant. In other words, the value of $y^*_{i,t}$ is missing when it is less than or equal to γ.

3.2.4 Quantile regressions

The discussed previous estimation approaches are based on mean values of the outcome variable. Unfortunately, the relationship between external flows and inclusive development can be contingent on initial levels of inclusive human development. Hence, the need to account of low, intermediate and high levels of inclusive human development with the Quantile regressions (QR) approach (Koenker & Bassett, 1978; Koenker, 2005; Hao & Naiman, 2007; Okada & Samreth, 2012; Asongu, 2013; Tchamyou & Asongu, 2018). Accordingly, QR are distinct from the Fixed Effects, GMM and Tobit regressions because these estimations technique fail account from existing levels of the outcome variable. Hence, with QR, the relationship between external flows and inclusive human development is assessed at various levels of inclusive human development corresponding to various quantiles which represent, low, intermediate and high levels of inclusive human development.

In order to obtain the θth quantile estimator associated with inclusive human development, an optimization problem that is presented in Eq. (6) is estimated. Subscripts are exempted from the equation for simplicity purposes.

$$\min_{\beta \in R^k} \left[\sum_{i \in \{i: y_i \geq x_i'\beta\}} \theta \left| y_i - x_i'\beta \right| + \sum_{i \in \{i: y_i < x_i'\beta\}} (1-\theta) \left| y_i - x_i'\beta \right| \right], \tag{6}$$

where $\theta \in (0,1)$. Contrary to the OLS procedure that is fundamentally articulated towards reducing the sum of squared residuals, the QR approach consists of reducing the weighted sum of absolute deviations. As a case in point, the 90th quantile corresponding to θ=0.90 is estimated by weighing the residuals approximately.

Given the above, distinct equations of regressions respectively for QR and OLS are as follows:

$$IHD_{i,t} = \sigma_0 + \sigma_1 X_{i,t} + \varepsilon_{i,t} \tag{7}$$

$$IHD_{i,t} = \sigma_0^{(p)} + \sigma_1^{(p)} \sigma_1 X_{i,t} + \varepsilon_{i,t}^{(p)} \tag{8}$$

The OLS and QR respectively in Equation (7) and Equation (8) above focus on the relevance of external flows in inclusive human development, where, $IHD_{i,t}$ is inclusive human development for country i in period t, σ_0 is a constant, X entails external flows (remittances, foreign aid and foreign investment) and other control variables (political stability, GDP per capita growth, mobile phones and private domestic credit), and $\varepsilon_{i,t}$ is the error term.

4. Empirical results

4.1 Presentation of results

This section discloses the empirical findings. While Table 1 discloses the findings on the Fixed Effects, Tobit and GMM regressions, the corresponding OLS and QR are presented in Table 2. Each estimation approach in the tables has specifications pertaining to the three main external flows. In the GMM regressions, four main criteria are used to assess the validity of the GMM model with forward orthogonal deviations[5]. Based on these criteria, two of the three models are valid. This is essentially because the null hypothesis of the Hansen test is rejected in the "foreign aid"-oriented regressions. It is relevant to note that the Sargan test is not robust and not influenced by instrument proliferation whereas the Hansen test is robust but affected by instrument proliferation. In the attendant literature, the Hansen test is preferred to the Sargan test and concerns about instrument proliferation are avoided by ensuring that the number of instruments is less than the corresponding number of cross sections in each specification (Tchamyou *et al.*, 2019; Efobi *et al.*, 2018).

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

Table 1: Fixed effects, Tobit and GMM regressions

	Dependent variable: Inequality-Adjusted Human Development (IHDI)								
	Fixed Effects			Tobit			GMM		
	NODA	Remit	FDI	NODA	Remit	FDI	NODA	Remit	FDI
Constant	**0.434*** (0.000)**	**0.424*** (0.000)**	**0.427*** (0.000)**	**0.459*** (0.000)**	**0.396*** (0.000)**	**0.395*** (0.000)**	omitted	**0.050*** (0.001)**	**0.034*** (0.000)**
IHDI (-1)	---	---	---	---	---	---	**0.967*** (0.000)**	**0.772*** (0.000)**	**0.893*** (0.000)**
NODA	**-0.0006** (0.013)**	---	---	**-0.005*** (0.000)**	---	---	**-0.00007* (0.057)**	---	---
NODA ×NODA	**0.000002* (0.057)**	---	---	**0.00002*** (0.000)**	---	---	-0.0000001 (0.543)	---	---
Remit	---	**0.001** (0.034)**	---	---	-0.002 (0.119)	---	---	**0.001*** (0.000)**	---
Remit ×Remit	---	-0.00001 (0.222)	---	---	0.00004 (0.100)	---	---	**-0.00002*** (0.000)**	---
FDI	---	---	0.0001 (0.479)	---	---	0.0003 (0.757)	---	---	**-0.0002*** (0.003)**
FDI ×FDI	---	---	0.000001 (0.671)	---	---	-0.000003 (0.835)	---	---	**0.000003*** (0.000)**
Political Stability	-0.003 (0.252)	-0.0007 (0.873)	-0.004 (0.150)	**0.029*** (0.000)**	**0.023*** (0.000)**	**0.030*** (0.000)**	-0.001 (0.264)	-0.003 (0.267)	**0.007*** (0.000)**
GDPpcg	**0.0009*** (0.000)**	**0.001*** (0.000)**	**0.001*** (0.000)**	**0.003*** (0.000)**	0.001 (0.191)	**0.003*** (0.000)**	**0.0009*** (0.000)**	0.0002 (0.108)	**0.001*** (0.000)**
Private Credit	-0.000002 (0.985)	0.0001 (0.708)	-0.00003 (0.921)	**0.0008*** (0.001)**	**0.001*** (0.000)**	**0.001*** (0.000)**	0.0001 (0.290)	**0.0008*** (0.000)**	**0.0002** (0.032)**
Mobile phones	**0.0006*** (0.000)**	**0.0006*** (0.000)**	**0.0006*** (0.000)**	**0.001*** (0.000)**	**0.001*** (0.000)**	**0.001*** (0.000)**	**0.0001*** (0.000)**	**0.0005*** (0.000)**	**0.0002*** (0.000)**
Net effects	-0.0005	na	na	-0.0045	na	na	na	0.0008	-0.0001
Thresholds	150	na	na	125	na	na	na	nsa	33.333
R^2 (within)	0.403	0.430	0.397						
LR Chi-Square				**337.91***	**218.86***	**242.16***			
Log Likelihood				443.089	355.875	397.707			
AR(1)							(0.006)	**(0.946)**	(0.030)
AR(2)							**(0.474)**	**(0.330)**	**(0.542)**
Sargan OIR							(0.000)	(0.000)	(0.000)
Hansen OIR							(0.069)	**(0.169)**	**(0.106)**
DHT for instruments									
(a)Instruments in levels									
H excluding group							(0.032)	**(0.142)**	**(0.271)**
Dif(null, H=exogenous)							**(0.204)**	**(0.240)**	**(0.109)**
(b) IV (years, eq(diff))									
H excluding group							(0.019)	**(0.120)**	(0.066)
Dif(null, H=exogenous)							**(0.478)**	**(0.354)**	**(0.331)**
Fisher	**36.58***	**33.38***	**35.82***				**2.03e+06***	**108751.67***	**32606.12***
Instruments							36	36	36
Countries	44	39	44				44	38	44
Observations	374	310	376	374	310	376	312	261	314

*, **, ***: significance levels of 10%, 5% and 1% respectively. NODA: Net Official Development Assistance. Remit: Remittances. FDI: Foreign Direct Investment. GDPpcg: Gross Domestic Product per capita growth. *DHT*: Difference in Hansen Test for Exogeneity of Instruments' Subsets. Dif: Difference. *OIR*: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients, Hausman test and the Fisher statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the *AR(1)*and*AR(2)* tests and; b) the validity of the instruments in the Sargan *OIR* test. na: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant. The mean value of foreign aid is 11.686, the mean value of remittances is 3.977 and the mean value of foreign investment is 5.332. nsa: not specifically applicable because it is based on a negative marginal effect.

In order to assess the overall effect of enhancing external flows on inclusive development, net impacts are computed from unconditional and marginal effects. For instance, in the second column of Table 1, the net impact from increasing foreign aid is -0.0005 (2×[0.000002× 11.686] + [-0.0006]). In the computation, the mean value of foreign aid is 11.686, the marginal effect of foreign aid is 0.000002 while the unconditional effect of foreign aid is -0.0006. The leading 2 is from the quadratic derivation. In the same vein, in the last column of Table 1, the net effect of enhancing foreign investment is -0.0001 (2×[0.000003× 5.332] + [-0.0002]). In the computation, the mean value of foreign direct

investment is 5.332, the marginal effect of foreign investment is 0.000003 while the unconditional effect of foreign investment is -0.0002.

Table 2: Quantile regressions

Dependent variable: Inequality-Adjusted Human Development

Panel A: Enhancing Development Assistance

	OLS	Q.10	Q.25	Q.50	Q.75	Q.90
Constant	**0.459*** **	**0.329*** **	**0.423*** **	**0.464*** **	**0.500*** **	**0.559*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
NODA	**-0.005*** **	**-0.002*** **	**-0.005*** **	**-0.005*** **	**-0.005*** **	**-0.006*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
NODA × NODA	**0.00002*** **	**0.00001*** **	**0.00002*** **	**0.00003*** **	**0.00003*** **	**0.00005*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Political Stability	**0.029*** **	**0.019*** **	**0.027*** **	**0.026*** **	**0.035*** **	**0.047*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
GDPpcg	**0.003*** **	**0.004*** **	**0.003*** **	0.001	**0.027*** **	0.002
	(0.006)	**(0.000)**	**(0.007)**	(0.122)	**(0.000)**	(0.110)
Private Credit	**0.0008*** **	0.0003	0.0004	**0.0005** **	**0.001*** **	0.0009
	(0.003)	(0.148)	(0.178)	**(0.023)**	**(0.000)**	(0.104)
Mobile phones	**0.001*** **	**0.001*** **	**0.001*** **	**0.001*** **	**0.001*** **	**0.001*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.002)**
Net effects	-0.0045	-0.0017	-0.0045	-0.0043	-0.0043	-0.0048
Thresholds	125	100	125	83.333	83.333	60
Fisher	**85.18*** **					
Pseudo R^2/R^2	0.596	0.350	0.346	0.359	0.418	0.441
Observations	374	374	374	374	374	374

Panel B: Enhancing Remittances

	OLS	Q.10	Q.25	Q.50	Q.75	Q.90
Constant	**0.396*** **	**0.278*** **	**0.313*** **	**0.394*** **	**0.441*** **	**0.500*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Remit	**-0.002** **	**-0.002** **	0.0002	-0.0009	**-0.002* **	-0.004
	(0.037)	**(0.023)**	(0.905)	(0.657)	**(0.053)**	(0.136)
Remit ×Remit	**0.00004** **	0.00002	0.00002	0.00002	0.00004	0.00004
	(0.014)	(0.886)	(0.540)	(0.565)	(0.122)	(0.386)
Political Stability	**0.023*** **	**0.011*** **	0.008	**0.015* **	**0.017*** **	**0.035*** **
	(0.000)	**(0.000)**	(0.292)	**(0.053)**	**(0.001)**	**(0.001)**
GDPpcg	0.001	**0.002*** **	0.002	0.00002	0.0008	0.003
	(0.172)	**(0.000)**	(0.177)	(0.987)	(0.515)	(0.161)
Private Credit	**0.001*** **	**0.001*** **	**0.0008** **	**0.001*** **	**0.001*** **	**0.001*** **
	(0.001)	**(0.000)**	**(0.041)**	**(0.000)**	**(0.000)**	**(0.001)**
Mobile phones	**0.001*** **	**0.001*** **	**0.001*** **	**0.001*** **	**0.001*** **	**0.001*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Net effects	-0.0016	na	na	na	na	na
Thresholds	25	na	na	na	na	na
Fisher	**45.50*** **					
Pseudo R^2/R^2	0.507	0.310	0.238	0.213	0.350	0.458
Observations	310	310	310	310	310	310

Panel C: Enhancing Foreign Investment

	OLS	Q.10	Q.25	Q.50	Q.75	Q.90
Constant	**0.395*** **	**0.287*** **	**0.322*** **	**0.396*** **	**0.435*** **	**0.482*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
FDI	0.0003	**-0.001* **	-0.0003	-0.0004	0.001	0.001
	(0.804)	**(0.073)**	(0.788)	(0.730)	(0.177)	(0.443)
FDI × FDI	-0.000003	0.00001	-0.000001	0.000008	-0.00002	-0.00001
	(0.869)	(0.274)	(0.926)	(0.730)	(0.235)	(0.726)
Political Stability	**0.030*** **	**0.017*** **	**0.019*** **	**0.032*** **	**0.027*** **	**0.041*** **
	(0.000)	**(0.000)**	**(0.008)**	**(0.000)**	**(0.000)**	**(0.000)**
GDPpcg	**0.003*** **	**0.004*** **	**0.003** **	0.001	0.0008	**0.003* **
	(0.004)	**(0.000)**	**(0.011)**	(0.129)	(0.483)	**(0.061)**
Private Credit	**0.001*** **	**0.0008*** **	**0.0007* **	**0.001*** **	**0.001*** **	**0.001*** **
	(0.001)	**(0.000)**	**(0.075)**	**(0.001)**	**(0.000)**	**(0.003)**
Mobile phones	**0.001*** **	**0.002*** **	**0.002*** **	**0.001*** **	**0.001*** **	**0.001*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Net effects	na	na	na	na	na	na
Thresholds	na	na	na	na	na	na
Fisher	**60.38*** **					
Pseudo R^2/R^2	0.475	0.325	0.260	0.243	0.315	0.359
Observations	376	376	376	376	376	376

*,**,***: significance levels of 10%, 5% and 1% respectively. NODA: Net Official Development Assistance. Remit: Remittances. FDI: Foreign Direct Investment. GDPpcg: Gross Domestic Product per capita growth. OLS: Ordinary Least Squares. R^2 for OLS and Pseudo R^2

for quantile regression. Lower quantiles (e.g., Q 0.1) signify nations where the inequality-adjusted human development index (IHDI) is least. na: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant. The mean value of foreign aid is 11.686, the mean value of remittances is 3.977 and the mean value of foreign investment is 5.332.

The following findings can be established from Table 1. There is a net negative effect on inclusive human development from enhancing foreign aid in Fixed effects and Tobit regressions. From the GMM findings, enhancing remittances (foreign investment) has a net positive (negative) effect on inclusive development. All the significant control variables display the expected signs.

In Table 2 on the quantile regressions, there are differences between QR and OLS estimates in terms of significance, sign of estimated coefficients and magnitude of the estimated coefficients. This heterogeneity confirms the relevance of complementing estimation approaches based on mean values of inclusive development with an estimation technique that articulates the entire distribution of inclusive development. While the net effect of enhancing foreign aid is consistently negative throughout the conditional distribution of inclusive development in Panel A with an S-shaped pattern, net effects cannot be computed from estimates in Panel B and Panel C pertaining to remittances and foreign investment, respectively. The significant control variables have the expected signs.

The thresholds are presented after net effects, just before the information criteria pertaining to the different models. Moreover, as clarified in the tables' footnotes, thresholds are computed exclusively for models in which both unconditional and marginal effects are significant. Section 4.2 is entirely dedicated to: (i) the conception of thresholds in the light of attendant literature as well as (ii) an example on the calculation of thresholds.

4.2 Extended analysis with policy thresholds

Given the motivation of this research, an extended analysis is engaged in order to provide policy thresholds at which enhancing external flows can bear positively on inclusive development. Thresholds are feasible because whereas the net impacts are largely negative on inclusive human development, the corresponding marginal effects are positive. An implication of a positive marginal effect is that increasing an external flow to a certain critical mass can completely neutralize the negative net effect of the external flow on inclusive human development. Hence, at the critical mass, the underlying net effect is zero. Moreover, in order for the established critical mass to make economic sense and be relevant to policy makers, it should be within the range disclosed in the summary statistics.

The above conception and definition of critical mass in this research is consistent with the empirical literature, notably: the requirements for patterns on nexuses between

macroeconomic variables (Ashraf & Galor, 2013); critical masses for economic policy (Batuo, 2015; Tchamyou, 2019b) and thresholds at which environmental degradation negatively influences human development (Asongu, 2018).

In the light of the above, a positive threshold for inclusive development from increasing foreign aid varies between 150 (0.0006/ [2×0.000002]) and 125 (0.005/ [2×0.00002]) in Table 1. These foreign aid thresholds vary from 60 to 125 in Table 2 and are higher in bottom quantiles compared to top quantiles. Hence, between 60 and 150 foreign aid (% of GDP) is required for foreign aid to start having a positive effect on inclusive human development. These thresholds have economic relevance and make economic sense because they are within the maximum limit of 181.187 (% of GDP) provided in the summary statistics. The corresponding positive threshold of foreign investment in Table 1 is 33.333 (% of GDP) which is also within the range (-6. 043 to 91.007) of foreign investment inflows disclosed in the summary statistics. In Panel B of Table 2, from OLS, a threshold of 25 (% of GDP) remittances is necessary for remittances to positively affect inclusive human development. The remittance threshold is also within policy range (i.e. 0.000 to 64.100).

Overall, the unconditional and marginal effects which have conflicting signs are consistent with the conflicting literature on the relevance of external flows in development outcomes. These studies in the underlying literature pertain to the importance of foreign investment (Almfraji & Almsafir, 2014), remittances (Adams, 2011; Inchauste & Stein, 2013; Asongu *et al.*, 2019) and foreign aid (Doucouliagos & Paldam, 2008, 2009, 2010) in development outcomes.

5. Concluding implications and future research directions

This study has investigated how increasing external flows affects inclusive human development in 48 sub-Saharan African countries for the period 2000-2012. Three external flows are used, notably: remittances, foreign aid and foreign investment. The empirical evidence is based on Ordinary Least Squares, Tobit, Fixed effects, Generalised Method of Moments and Quantile regressions. There is a net negative effect on inclusive human development from enhancing foreign aid in Fixed effects and Tobit regressions. From the GMM findings, enhancing remittances (foreign investment) has a net positive (negative) effect on inclusive development. From Quantile regressions, the net effect of enhancing foreign aid is consistently negative throughout the conditional distribution of inclusive development. OLS results also reveal a net negative effect from increasing remittances.

The analysis is extended to establish policy thresholds at which increasing external flows crowds-out the unconditional negative effect of external flows on inclusive development. From this further analysis: (i) between 60 and 150 foreign aid (% of GDP) is required for foreign aid to start having a positive net effect on inclusive human development; (ii) 33.333 (% of GDP) is the foreign direct investment threshold and (iii) a 25 (% of GDP) critical mass of remittances is also established. At the established critical masses, the last-two external flows also start having positive net effects on inclusive human development. Moreover, with regard to foreign aid, thresholds are higher in the below-median sub-sample compared to the above-median sub-sample. It follows that, countries with comparatively lower levels of inclusive human development need more investment in foreign aid for inclusive development compared to their counterparts with higher levels of inclusive human development. The established thresholds make economic sense and have policy relevance because they are within acceptable economic ranges of external flows.

Future studies can consider other policy channels for enhancing inclusive human development. Moreover, country-specific studies are also worthwhile for more targeted policy implications. The need for such country-specific studies is also motivated by the caveat that established thresholds are broad-based and not specific to countries. This is essentially because country-specific effects are theoretically eliminated from the GMM approach in order to prevent endogeneity pertaining to the correlation between the lagged dependent variable and country-specific effects.

Appendices

Appendix 1: Definitions and sources of variables

Variables	Signs	Definitions/Measurements	Sources
Inclusive development	IHDI	Inequality Adjusted Human Development Index. It is measured as the geographic mean of income, health and education that are adjusted for inequality.	UNDP
Foreign aid	NODA	Official development assistance (ODA) is defined as government aid designed to promote the economic development and welfare of developing countries. Total Net Official Development Assistance (% of GDP)	WDI
Remittance	Remit	Workers' remittances and compensation of employees comprise current transfers by migrant workers and wages and salaries earned by non-resident workers. Remittance inflows (% of GDP)	WDI
Foreign investment	FDI	It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. Foreign Direct Investment net inflows (% of GDP)	WDI
Political Stability	PolS	"Political stability/no violence (estimate): measured as the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional and violent means, including domestic violence and terrorism".	WGI
GDP per capita	GDPpcg	GDP per capita is gross domestic product divided by midyear population. GDP per Capita growth rate (% of annual).	
Private Credit	Credit	Private credit by deposit banks and other financial institutions (% of GDP)	WDI
Mobile phone	Mobile	Mobile cellular telephone subscriptions are subscriptions to a public mobile telephone service that provide access to the public switched telephone network using cellular technology. Mobile phone subscriptions (per 100 people)	WDI

UNDP: United Nations Development Program. WDI: World Development Indicators. WGI: World Governance Indicators. GDP: Gross Domestic Product.

Appendix 2: Summary statistics

	Mean	SD	Min	Max	Obs
Inequality Adj. Human Development	0.721	3.505	0.129	0.768	485
Foreign Aid	11.686	14.213	-0.253	181.187	604
Remittances	3.977	8.031	0.000	64.100	434
Net Foreign Direct Investment Inflows	5.332	8.737	-6.043	91.007	603
Political Stability	-0.543	0.956	-3.323	1.192	578
GDP per Capita growth	2.198	5.987	-49.761	58.363	608
Private Domestic Credit	18.551	22.472	0.550	149.78	507
Mobile phone	23.379	28.004	0.000	147.202	472

SD: Standard deviation. Min: Minimum. Max: Maximum. Obs: Observations. Adj: Adjusted.

Appendix 3: Correlation Matrix (Uniform sample size: 308)

	External flows		Control variables				Dep. Vble	
NODA	Remit	FDI	PolS	GDPpcg	Credit	Mobile	IHDI	
1.000	-0.009	0.427	-0.129	0.134	-0.185	-0.191	-0.395	NODA
	1.000	0.125	0.033	0.026	-0.095	-0.057	-0.043	Remit
		1.000	-0.023	0.170	-0.084	0.085	-0.025	FDI
			1.000	-0.012	0.279	0.312	0.412	PolS
				1.000	0.029	0.044	0.077	GDPpcg
					1.000	0.512	0.536	Credit
						1.000	0.635	Mobile
							1.000	IHDI

NODA: Net Official Development Assistance. Remit: Remittances. FDI: Foreign Direct Investment. PolS: Political Stability. GDPpcg : GDP per capita growth rate. Credit: Private domestic credit. Mobile: Mobile Phone penetration. FDI: Foreign Direct Investment. IHDI: Inequality Adjusted Human Development Index. Dep. Vble: Dependent Variable.

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