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Thresholds of income inequality that mitigate the role of gender inclusive education in promoting gender economic inclusion in Sub-Saharan Africa [1]

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Thresholds of income inequality that mitigate the role of gender inclusive education in promoting gender economic inclusion in Sub-Saharan Africa

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Abstract

This study provides thresholds of inequality that should not be exceeded if gender inclusive education is to enhance gender inclusive formal economic participation in sub-Saharan Africa. The empirical evidence is based on the Generalised Method of Moments and data from 42 countries during the period 2004-2014. The following findings are established. First, inclusive tertiary education unconditionally promotes gender economic inclusion while the interaction between tertiary education and inequality is unfavourable to gender economic inclusion. Second, a Gini coefficient that nullifies the positive incidence of inclusive tertiary education on female labour force participation is 0.562. Second, the Gini coefficient and the Palma ratio that crowd-out the negative unconditional effects of inclusive tertiary education on female unemployment are 0.547 and 6.118, respectively. Third, a 0.578 Gini coefficient, a 0.680 Atkinson index and a 6.557 Palma ratio are critical masses that wipe-out the positive unconditional effects of inclusive tertiary education on female employment. Findings associated with lower levels of education are not significant. As the main policy implication, income inequality should not be tolerated above the established thresholds in order for gender inclusive education to promote gender inclusive formal economic participation. Other implications are discussed in the light of Sustainable Development Goals. This research complements the existing literature by providing inequality thresholds that should not be exceeded in order for gender inclusive education to promote the involvement of women in the formal economic sector.

JEL Classification: G20; I10; I32; O40; O55

Keywords: Africa; Inequality; Gender; Inclusive development

1. Introduction

Inclusive policies for education that are designed to involve more girls in education and training are obviously designed to improve the participation of the female gender in economic development through *inter alia*: employment in the formal economic sector. An important policy syndrome that can limit the effectiveness of gender inclusive education policies in translating into gender economic participation is income inequality in society[2]. These two sentences summarise the intuition and policy relevance of this research, which is also motivated by three main factors in the scholarly and policy literature. These factors are:
(i) the policy syndrome of inequality in the achievement of Sustainable Development Goals (SDGs) in sub-Saharan Africa (SSA); (ii) the issues of gender exclusion in the education and formal economic sectors and (iii) gaps in the literature.

First, income inequality is an important preoccupation for policy makers in the development of SSA is the post-2015 era for a multitude of policy and scholarly reasons. On the policy front, according to a recent report by the United Nations Development Programme (UNDP), SSA is unlikely to achieve most SDGs unless the concern of income inequality is addressed (UNDP, 2017). The recommendation of the United Nations is supported by the attendant empirical literature (Asongu & Kodila-Tedika, 2017; McGeown, 2017; Asongu & le Roux, 2019; Tchamyou, 2019a, 2019b) which is consistent on the importance of substantially curtailing inequality in order to put the sub-region on track to the achievement of SDGs. For instance, Bicaba, Brixiova and Ncube (2017) have established that countries in the sub-region are unlikely to reduce extreme poverty to the target of below 3% unless inequality is critically dealt with: "*This paper examines its feasibility for Sub-Saharan Africa (SSA), the world's poorest but growing region. It finds that under plausible assumptions extreme poverty will not be eradicated in SSA by 2030, but it can be reduced to low levels through high growth and income redistribution towards the poor segments of the society*" (p. 93). Among factors accounting for the policy syndrome of inequality in SSA is the issue of gender economic exclusion.

[2]The terms "gender economic participation", "gender inclusion", "female labour force participation", "female economic participation","female employment" and "gender economic inclusion" are used interchangeably throughout the study. The terms "income inequality" and inequality are used interchangeably throughout this study.According to Asongu (2017) a policy syndrome is a gap in knowledge economy between countries. In this research, however, the conception of policy syndrome is consistent with a contemporary strand of inclusive development and pro-poor growth literature which associates exclusive development and inequality to policy syndromes (Asongu & Nwachukwu, 2017a; Tchamyou, Erreygers &Cassimon, 2019; Tchamyou, 2019a, 2019b).

Second, women in SSA are the poorest in the world, and gender economic exclusion is most apparent in the sub-region compared to other regions of the world (Hazel, 2010; Efobi, Tanakem & Asongu, 2018). Moreover, the concerns about gender exclusion are clearly articulated in the SDG agenda: (i) SDG 5 (i.e. "*achieve gender equality and empower all women and girls*") and (ii) SDG 8 (i.e. "*promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all*"). The concerns pertaining to gender exclusion are further articulated in a recent World Bank report which has estimated the economic loss from the exclusion of women from the formal economic sector to represent about 2.5 trillion USD (World Bank, 2018; Nkurunziza, 2018). The conclusions of the report are broadly in accordance with the attendant scholarly and policy literature on the subject matter which, has established that in SSA, women are largely occupied with subsistence agriculture, petty trading and domestic chores (Ellis, Blackden, Cutura, MacCulloch & Seebens, 2007; FAO, 2011;Tandon & Wegerif, 2013;International Labour Organization, 2013; World Bank, 2015; Efobi *et al*., 2018). Moreover, the positioning of this research is also motivated by gaps in the corresponding literature.

Third, as discussed in Section 2, the extant inclusive development literature has not focused on the problem statement being tackled in this study. In the attendant section, the scholarly and policy relevance of the study is provided: these centre on the importance of inequality thresholds that should not be exceeded if gender inclusive education is to enhance gender inclusive formal economic participation in sub-Saharan Africa. In the light of contemporary development literature (Batuo, 2015; Asongu & Odhiambo, 2020a, 2020b), the notion of a threshold is understood as a maximum level of income inequality thatpolicy makers should watch in order for gender inclusive education to promote gender economic participation. In other words, above the inequality threshold, a policy of gender inclusive education nolonger promotes gender economic participation.

The rest of the study proceeds as follows. The positioning of the study in the light of existing literature is discussed in Section 2. The data and methodology are covered in section 2, while the empirical results and corresponding discussion are disclosed in section 3. Section 4 concludes with implications and future research directions.

2. Literature review and research objective

This section articulates the positioning of the research in the light extant studies. To the best of our knowledge, the extant contemporary literature focusing on the concerns developed in

this introduction has failed to inform policy makers about thresholds of inequality that are detrimental for the favorable relevance of inclusive education in inclusive economic participation. Ntayi, Munene and Malinga (2018) have provided linkages between financial access and mobile money while emphasising on the modulating roles of social networks and gender. According to Uduji, Okolo-Obasi and Asongu (2019) and Uduji and Okolo-Obasi (2018a, 2018b, 2018c, 2018d), it is important to implement corporate social responsibility policies and involve women in schemes that are designed to improve agricultural productivity in rural areas. The nexus between differences in gender and finance that is inclusive has been the focus of a study by Kairiza, Kiprono and Magadzire (2017) while Elu (2018) has presented a case for the involvement of women in science education. Bayraktar and Fofack (2018) are concerned with how gender is relevant within financial and informal sectors, whereas Mannah-Blankson (2018) investigates linkages between access to finance and the exclusion of gender in a microfinance setting. A strand of the literature has also been interested in the participation of women in the agricultural sector in the light of SDGs (Theriault, Smale & Haider, 2017) while another strand has been motivated by the effect of information technology on gender inclusion either through direct (Efobi *et al.*, 2018) or indirect mechanisms (Asongu & Odhiambo, 2018).

Noticeably, in the engaged literature, Efobi *et al.* (2018) is the research that is closest to the positioning of this study. The authors have concluded that information technology has a positive incidence of female economic participation. This study is similar to Efobi *et al.* (2018) in that, it employs the three female economic participation indicators used in the underlying study as outcomes variables, namely: female labour force participation, female unemployment and female employment. Conversely, instead of employing information technology proxies as the independent variables of interest, in the light of the motivation of this study (which is summarised in the first paragraph and substantiated in subsequent paragraphs), the main independent variables of interest are inclusive education indicators and income inequality variables which respectively, represent policy variables and policy syndromes. Moreover, beyond departing from Efobi *et al.* (2018) in the perspective of differences in variables, the analytical scope of the study is tailored such that macroeconomic variables with positive (i.e. policy variables) and negative (i.e. policy syndromes) signals interact in order to affect the macroeconomic outcome variables used by Efobi *et al.* (2018). In so doing, this research takes on board concerns pertaining to SDGs that are missing in the motivation and policy implications of Efobi *et al.* (2018).

In addition to the clarified difference between this research and the underlying study, we further argue that it is not enough to simply provide policy makers with signs and magnitude of effects between macroeconomic variables, as established by Efobi *et al.* (2018) and other studies in the strand of gender-centric extant inclusive development literature. This research goes beyond establishing such signs and magnitude of effects (i.e. between independent variables and outcome indicators) by establishing maximum limits of policy syndromes that should not be exceeded if policy variables are to have the targeted effect on policy outcomes. In other words, this research provides maximum thresholds of inequality that should not be exceeded in order for inclusive education policies to engender inclusive economic participation.

In the light of the motivational elements expanded above, it is apparent that this is an applied economics study that is motivated by: (i) intuition, (ii) policy concerns surrounding economic development in SSA in the post-2015 agenda and (iii) the need to complement extant literature. The authors of this study are also very knowledgeable of concerns that may be raised when an empirical analysis is not buttressed with solid and/or established theoretical underpinnings. The research argues that the premise for applied econometrics should not exclusively be motivated by the need to either validate or reject an established theoretical underpinning. Accordingly, in accordance with a recent strand of literature on the importance of applied econometrics (Costantini & Lupi, 2005; Narayan, Mishra & Narayan, 2011; Asongu & Nwachukwu, 2016a), this study argues that applied econometrics that is motivated by sound intuition and contemporary policy concerns is a useful scientific activity that can: (i) lead to theory-building, (ii) complement extant literature and (iii) provide policy makers with actionable policy recommendations. In essence, the intuition for this study is straight forward and simple to follow: income inequality affects how gender inclusive education promotes gender inclusive economic participation. Hence, it is policy-relevant to provide policy makers with critical masses of income inequality that mitigate the role of gender inclusive education in promoting gender economic inclusion. In so doing, this research complements Efobi *et al.* (2018) as critically engaged in the last-two paragraphs.

3. Data and methodology

3.1 Data

The focus of the research is on 42 nations in SSA with annual data for the period 2004 to 2014[3]. The choice of countries and temporal scopes are constrained by data availability concerns at the time of the study as well as the motivation underpinning the study covered in the introduction. The data come from four principal sources. (i)The three inequality indicators are from the Global Consumption and Income Project (GCIP). These include the Gini coefficient, the Atkinson index and the Palma ratio. The last-two indicators are used to complement the first because the first does not capture tails or extreme points of the inequality distribution. These justifications are consistent with contemporary African inequality literature that is based on the three income inequality variables, notably: Meniago and Asongu (2018), Tchamyou (2019a, 2019b) and Tchamyou *et al*. (2019).

(ii) Following Efobi *et al*. (2018) on which this research is partly positioned, the three gender participation indicators used as outcome variables are from the International Labor Organization. They include: female labour force participation, female unemployment and female employment.

(iii) Three gender parity inclusive education indicators are obtained from World Development Indicators of the World Bank, namely: "primary and secondary education", secondary education and tertiary education[4]. The motivation for engaging the three levels of education is from a contemporary strand of knowledge economy literature which argues for the need to engage all levels of education in order to articulate the relevance of lifelong learning and provide more room for policy implications (Tchamyou, 2017; Tchamyou, 2019a; Asongu & Tchamyou, 2016, 2019a, 2019b). One control variable (i.e. remittances) is also obtained from the World Development Indicators of the World Bank while another control variable (i.e. political stability) is sourced from World Governance Indicators of the World Bank. In what follows, the study providesjustifications for: (i) the expected signs of the control variables, and (ii) limiting elements in the conditioning information set to two.

[3]The 42 countries include: "Angola, Benin, Botswana, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo Democratic Republic, Congo Republic, Côte d'Ivoire, Djibouti, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome & Principe, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda and Zambia".

[4] "Primary and secondary education" and "inclusive primary and secondary education" are used interchangeably throughout the study. "Secondary education" and "inclusive secondary education" are used interchangeably throughout the study. "Tertiary education" and "inclusive tertiary school education" are used interchangeably throughout the study.

On the front of limiting control variables to two, in the attendant Generalised Method of Moments (GMM)-centric literature, it is tolerable to adopt limited control variables or no control variable in so far as the motivation for doing so is to have robust and efficient estimates. Accordingly, because the involvement of more variables in the conditioning information set increases instrument proliferation (even when the collapse option in the specification exercise is employed), in order to avoid the proliferation of instruments that subsequently bias and invalidate estimated models, studies in the GMM-centric literature have employed: (i) two control variables as in this research (Bruno, De Bonis &Silvestrini, 2012) and (ii) no control variable (Osabuohien & Efobi, 2013; Asongu & Nwachukwu, 2017b).

Concerning the expected signs from the control variables, it is important to first of all clarify that the control variables are consistent with contemporary inclusive development literature motivating this research (Asongu & Nwachukwu, 2018; Efobi *et al*., 2018; Asongu &Odhiambo, 2019a; Tchamyou, 2019a, 2019b; Tchamyou *et al*., 2019). In the light of the attendant literature, remittances have been documented to increase income inequality in Africa because majority of the population migrating abroad is from wealthier factions of African society (see Meniago & Asongu, 2018). This narrative on the nexus between remittances and income inequality has been empirically extended to female economic participation by Asongu and Odhiambo (2018)[5]. Conversely, political stability, *ceteris paribus*, is anticipated to engender favorable economic conditions for investment, job creation, employment and economic prosperity which are likely to benefit the female gender from the perspective of employment and/or participation in the labour force of the formal economic sector. Having clarified the expected signs from the conditioning information set, in the light of the outcome variables, political stability is anticipated to boost female labour force participation and female employment and by extension, reduce female unemployment. By analogy, the opposite effects are expected from remittances. The full definitions of the variables as well as their corresponding sources are disclosed in Appendix 1, Appendix 2 provides the summary statistics, whereas Appendix 3 discloses the correlation matrix.

[5]Remittances have been documented to increase income inequality for the reasons outlined in the data section, notably: a greater proportion of those migrating abroad are from wealthier fractions of society. If income inequality is associated with gender inequality given the fact that women in SSA are poorest in the world (i.e. as clarified in the introduction), then remittances should intuitively be expected to increase gender economic inequality or reduce gender economic inclusion.

3.2 Methodology

3.2.1 GMM Specification

Following the narrative on GMM-centric literature engaged in the preceding section, the GMM specification used for this research is also motivated by justifications for the choice of the estimation approach from the attendant literature. Hence, in the light of Tchamyou (2019a, 2019b) and Tchamyou *et al.* (2019), four main justifications underpin the choice of the GMM technique as our empirical strategy. The first criterion requires that the number of yearly observations in each cross-section should not be higher than the corresponding number of cross-sections. This criterion is met because the research is based on 42 countries and annual observations for the period 2004-2014 (or 11 years). Second, the outcome variables exhibit features of persistence because the correlation coefficients pertaining to their level and first difference series' are greater than 0.800 which is a rule of thumb for confirming the presence of persistence in an indicator (Asongu & Odhiambo, 2019b, 2019c). Third, in the light of the panel datastructure used for the empirical analysis, it follows that cross-country variations are not eliminated from the empirical exercise. Fourth, the challenging concern of endogeneity is addressed from two main perspectives: (i) the unobserved heterogeneity is taken on board by controlling for time-invariant omitted variables while (ii) reverse causality or simultaneity is accounted for by means of a process of instrumentation based on internal instruments. Among available GMM strategies, that employed in this study is the Roodman (2009a, 2009b) technique based on forward orthogonal deviations because consistent with the engaged GMM-centric literature, it provides more robust estimates.

The following equations in level (1) and first difference (2) summarise the standard *system* GMM estimation procedure.

$$G_{i,t} = \sigma_0 + \sigma_1 G_{i,t-\tau} + \sigma_2 E_{i,t} + \sigma_3 I_{i,t} + \sigma_4 EI_{i,t} + \sigma_5 P_{i,t} + \sigma_6 R_{i,t} + \eta_i + \xi_t + \varepsilon_{i,t} \quad (1)$$

$$\begin{aligned} G_{i,t} - G_{i,t-\tau} = {} & \sigma_1 (G_{i,t-\tau} - G_{i,t-2\tau}) + \sigma_2 (E_{i,t} - E_{i,t-\tau}) + \sigma_3 (I_{i,t} - I_{i,t-\tau}) + \sigma_4 (EI_{i,t} - EI_{i,t-\tau}) \\ & + \sigma_5 (P_{i,t} - P_{i,t-\tau}) + \sigma_6 (R_{i,t} - R_{i,t-\tau}) + (\xi_t - \xi_{t-\tau}) + (\varepsilon_{i,t} - \varepsilon_{i,t-\tau}) \end{aligned} \quad (2)$$

where, $G_{i,t}$ representsan indicator of gender economic participation(i.e. female labour force participation, female unemployment and female employment) of country i in period t, σ_0 is a constant, E entails inclusive education ("primary and secondary education", secondary education and tertiary education), I denotes an income inequality indicator (i.e. the Gini coefficient, the Atkinson index and the Palma ratio), EI reflects interactions between education and inequality indicators ("primary and secondary education" × "the Gini

coefficient";"secondary education" × "the Gini coefficient"; "tertiary education"×"the Gini coefficient";"primary and secondary education" × "the Atkinson index"; "secondary education" × "the Atkinson index"; "tertiary education"×"the Atkinson index"; "primary and secondary education" × "the Palma ratio"; "secondary education" × "the Palma ratio"; "tertiary education"×"the Palma ratio"), P is political stability, R is remittances, τ is the coefficient of auto-regression which is one in this study because one year lag appropriately captures past information, ξ_t is the time-specific constant, η_i is the country-specific effect and $\varepsilon_{i,t}$ the error term.

3.2.2Identification and exclusion restrictions

In order to establish GMM estimates that are robust, a discourse on identification and exclusion restrictions is imperative. Identification within the context of the study is the processes of classifying variables as strictly exogenous and predetermining or endogenous explaining. Still following the GMM-centric literature, the years are considered as strictly exogenous variables whereas the independent variables of interest (i.e. inequality and education indicators) and elements in the conditioning information set (i.e. remittances and political stability) are considered as predetermined or endogenous explaining. This strategy which assumes that with the exception of years, all other indicators have both endogenous and exogenous components is in accordance with contemporary literature based on forward orthogonal deviations, notably: Asongu and Nwachukwu (2016c); Tchamyou and Asongu (2017); Boateng *et al*.(2018) and Tchamyou *et al*.(2019). The identification and exclusion restrictions approach is consistent with the arguments of Roodman (2009b) because he has argued that years are appropriate as strictly exogenous variables because years are unlikely to be endogenous after a first difference[6].

Given the underlying clarifications, in the results that are reported in the empirical results section, the criterion used to assess the validity of exclusion restrictions is the Difference in Hansen Test (DHT) for instrument exogeneity. The null hypothesis of this test is the position that the identified strictly exogenous variables are valid instruments because they influence female economic participation exclusively via the exogenous components of the predetermined variables. Hence, this null hypothesis should not be rejected if the identification strategy and corresponding exclusion restrictions are to withstand empirical

[6]Hence, the procedure for treating *ivstyle* (years) is 'iv (years, eq(diff))' whereas the *gmmstyle* is employed for predetermined variables.

scrutiny. This elucidation pertaining to the GMM approach with forward orthogonal deviations is not different from more traditional approaches in which, a rejection of the null hypothesis corresponding to the Sargan/Hansen test is an indication that the employed instruments explain the outcome variables beyond the identified exogenous components of the endogenous explaining variables (Beck, Demirgüç-Kunt & Levine, 2003; Asongu & Nwachukwu, 2016d; Amavilah, Asongu & Andrés, 2017).

4. Empirical results

Findings from the empirical analysis are disclosed in this section in Tables 1-3. Table 1 is concerned with inclusive education, inequality and female labour force participation, Table 2 focuses on inclusive education, inequality and female unemployment, while Table 3 provides linkages between inclusive education, inequality and female employment. Each table is divided into three categories which are further divided into three sub-categories. The main focus of the categories is on respectively, "primary and secondary school education", secondary education and tertiary school education while the sub-categories provide empirical insights into the three inequality indicators, namely: the Gini coefficient, the Atkinson index and the Palma ratio.

For every estimated model, four main information criteria are employed to assess the validity of estimated models[7].In the light of these criteria, results in the 2nd of 5th columns of Table 1 are not valid because the estimated models do not pass all post-estimation diagnostics tests. This is essential because in the corresponding two columns, after estimations,there is the presence of second-order serial correlation. Hence, thresholds are not computed for the two invalid models, though they are associated with significant conditional and unconditional estimated coefficients relevant for the computation of such thresholds.

The approach to the computation of thresholds is consistent with recent threshold literature (Asongu, 2018; Asongu & Odhiambo, 2019d). In line with the motivation of the study, the purpose of the threshold is to establish a critical mass at which, a rise in inequality is

[7] "*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).

detrimental to the positive nexus between inclusive gender education and inclusive gender economic participation. Hence, the research expects the unconditional effects of inclusive education to be positive on female economic participation, whereas the unconditional effects from the interaction between inequality and inclusive education to be negative. Hence, given the negative conditional or interactive effects, inflexion points at which the positive unconditional effect can be totally dampened for a zero effect on female economic participation can be established.

Consistent with the expectations of the study, in Table 1 and Table 3, the unconditional effects on female labour force participation and female employment are positive, whereas the corresponding conditional effects are negative. Conversely, in Table 2, the unconditional effects on female unemployment are negative, whereas the corresponding conditional effects are positive. These tendencies are consistent with the intuition for the study because the outcome variables in Table 1 and Table 3 are favourable to gender economic participation, whereas the outcome variable in Table 2 is a negative signal and hence unfavourable to gender economic participation.

As an exampleof threshold computation, in the 8th column of Table 1, 0.562 (5.250/9.331) is the threshold of the Gini coefficient from which inclusive tertiary education no longer induces a positive effect on female labour force participation. In the calculation, 5.250 is the unconditional effect of inclusive tertiary education on female labour participation while 9.331 is the absolute value of the corresponding conditional effect from the interaction between inclusive tertiary education and the Gini coefficient. It follows that above a Gini coefficient of 0.562, the Gini coefficient completely dampens the positive impact of inclusive tertiary education on the attendant outcome variable.

The following findings can be established from Tables 1-3. First, inclusive tertiary education unconditionally promotes gender economic inclusion while the interaction between tertiary education and inequality is unfavourable to gender economic inclusion. Second, a Gini coefficient that nullifies the positive incidence of tertiary education on female labour force participation is 0.562. Second, the Gini coefficient and the Palma ratio that crowd-out the negative unconditional effects of tertiary school education on female unemployment are 0.547 and 6.118, respectively. Third, a 0.578 Gini coefficient, a 0.680 Atkinson index and a 6.557 Palma ratio are critical masses that wipe-out the positive unconditional effect of tertiary education on female employment. Fourth, the significant control variables have the expected signs.

Table 1: Inclusive Education, Inequality and Female Labour Force Participation

	Dependent variable: Female Labour Force Participation (FLFPart)								
	Primary and Secondary School Enrolment (PSSE)			Secondary School Enrolment (SSE)			Tertiary School Enrolment (TSE)		
	Gini	Atkison	Palma	Gini	Atkison	Palma	Gini	Atkison	Palma
FLFPart (-1)	**0.983*** (0.000)**	**0.986*** (0.000)**	**0.983*** (0.000)**	**0.976*** (0.000)**	**0.978*** (0.000)**	**0.979*** (0.000)**	**0.971*** (0.000)**	**0.967*** (0.000)**	**0.966*** (0.000)**
Gini Coefficient (Gini)	17.522 (0.250)	---	---	16.450 (0.133)	---	---	**15.064* (0.051)**	---	---
Atkinson Index (Atkinson)	---	-6.900 (0.421)	---	---	**-12.725* (0.076)**	---	---	2.233 (0.390)	---
Palma Ratio (Palma)	---	---	-0.316 (0.399)	---	---	-0.499 (0.161)	---	---	0.019 (0.830)
PSSE	**13.399* (0.084)**	-5.145 (0.435)	0.201 (0.918)	---	---	---	---	---	---
SSE	---	---	---	**12.180** (0.046)**	-9.401 (0.115)	-3.440 (0.182)	---	---	---
TSE	---	---	---	---	---	---	**5.250* (0.088)**	3.012 (0.209)	1.085 (0.146)
Gini × PSE	**-26.054* (0.077)**	---	---	---	---	---	---	---	---
Gini × SSE	---	---	---	**-23.102** (0.025)**	---	---	---	---	---
Gini × TSE	---	---	---	---	---	---	**-9.331* (0.083)**	---	---
Atkinson × PSE	---	3.688 (0.690)	---	---	---	---	---	---	---
Atkinson × SSE	---	---	---	---	10.590 (0.181)	---	---	---	---
Atkinson × TSE	---	---	---	---	---	---	---	-4.493 (0.138)	---
Palma × PSE	---	---	0.019 (0.958)	---	---	0.317 (0.387)	---	---	---
Palma × SSE	---	---	---	---	---	---	---	---	---
Palma × TSE	---	---	---	---	---	---	---	---	**-0.177** (0.042)**
Political Stability	**0.578*** (0.000)**	**0.549*** (0.000)**	**0.614*** (0.000)**	**0.753*** (0.000)**	**0.757*** (0.000)**	**0.808*** (0.000)**	**0.332*** (0.001)**	**0.172* (0.089)**	**0.228** (0.014)**
Remittances	**-0.040*** (0.000)**	**-0.020*** (0.005)**	**-0.030*** (0.001)**	**-0.030*** (0.000)**	**-0.022*** (0.001)**	**-0.031*** (0.001)**	**-0.015* (0.068)**	-0.007 (0.508)	-0.010 (0.274)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Thresholds	nsa	na	na	nsa	na	na	0.562	na	na
AR(1)	(0.072)	(0.067)	(0.078)	(0.076)	(0.036)	(0.058)	(0.082)	(0.087)	(0.076)
AR(2)	(0.064)	**(0.180)**	**(0.100)**	(0.086)	**(0.144)**	**(0.119)**	**(0.310)**	**(0.293)**	**(0.268)**
Sargan OIR	(0.000)	(0.000)	(0.002)	(0.014)	(0.018)	(0.036)	(0.000)	(0.002)	(0.008)
Hansen OIR	**(0.454)**	**(0.617)**	**(0.632)**	**(0.507)**	**(0.711)**	**(0.547)**	**(0.210)**	**(0.415)**	**(0.336)**
DHT for instruments									
(a)Instruments in levels									
H excluding group	**(0.362)**	**(0.228)**	**(0.259)**	**(0.265)**	**(0.317)**	**(0.635)**	**(0.279)**	(0.050)	(0.063)
Dif(null, H=exogenous)	**(0.465)**	**(0.754)**	**(0.744)**	**(0.596)**	**(0.786)**	**(0.441)**	**(0.228)**	**(0.825)**	**(0.684)**
(b) IV (years, eq(diff))									
H excluding group	**(0.283)**	**(0.509)**	**(0.250)**	**(0.467)**	**(0.607)**	**(0.351)**	**(0.258)**	**(0.312)**	**(0.665)**
Dif(null, H=exogenous)	**(0.564)**	**(0.578)**	**(0.830)**	**(0.470)**	**(0.629)**	**(0.619)**	**(0.249)**	**(0.481)**	**(0.191)**
Fisher	**16276***	**1.41e+07 ***	**720301***	**10725***	**54942***	**12829***	**22892***	**394503***	**38122***
Instruments	32	32	32	32	32	32	32	32	32
Countries	36	36	36	35	35	35	34	34	34
Observations	254	254	254	236	236	236	192	192	192

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. Constants are included in all regressions. nsa: not specifically applicable because the model is not valid. na: not applicable because at least estimate needed for the computation of thresholds is not significant.

Table 2: Inclusive Education, Inequality and Female Unemployment

	Dependent variable: Female Unemployment (FU)								
	Primary and Secondary School Enrolment (PSSE)			Secondary School Enrolment (SSE)			Tertiary School Enrolment (TSE)		
	Gini	Atkison	Palma	Gini	Atkison	Palma	Gini	Atkison	Palma
FU(-1)	**0.970*** (0.000)**	**0.971*** (0.000)**	**0.970*** (0.000)**	**0.956*** (0.000)**	**0.937*** (0.000)**	**0.944*** (0.000)**	**0.880*** (0.000)**	**0.981*** (0.000)**	**0.822*** (0.000)**
Gini Coefficient (Gini)	15.445 (0.285)	---	---	5.989 (0.676)	---	---	**-34.651** (0.021)**	---	---
Atkinson Index (Atkinson)	---	13.507 (0.197)	---	---	-2.637 (0.669)	---	---	9.228 (0.666)	---
Palma Ratio (Palma)	---	---	0.443 (0.143)	---	---	-0.211 (0.295)	---	---	-1.086 (0.118)
PSSE	8.247 (0.271)	7.442 (0.365)	2.217 (0.159)	---	---	---	---	---	---
SSE	---	---	---	3.176 (0.687)	-1.346 (0.792)	0.156 (0.932)	---	---	---
TSE	---	---	---	---	---	---	**-45.817*** (0.000)**	-12.842 (0.559)	**-17.456** (0.027)**
Gini × PSE	-14.074 (0.287)	---	---	---	---	---	---	---	---
Gini × SSE	---	---	---	-4.388 (0.753)	---	---	---	---	---
Gini × TSE	---	---	---	---	---	---	**83.662*** (0.000)**	---	---
Atkinson × PSE	---	-11.035 (0.333)	---	---	---	---	---	---	---
Atkinson × SSE	---	---	---	---	3.668 (0.568)	---	---	---	---
Atkinson × TSE	---	---	---	---	---	---	---	21.264 (0.501)	---
Palma × PSE	---	---	-0.410 (0.138)	---	---	0.200 (0.307)	---	---	---
Palma × SSE	---	---	---	---	---	---	---	---	---
Palma × TSE	---	---	---	---	---	---	---	---	**2.853*** (0.009)**
Political Stability	0.133 (0.101)	-0.037 (0.531)	0.121 (0.104)	0.233 (0.125)	0.145 (0.187)	0.206 (0.156)	**-0.472** (0.019)**	-0.581 (0.176)	**-0.921*** (0.008)**
Remittances	**-0.011*** (0.003)**	**-0.014*** (0.001)**	**-0.011*** (0.003)**	**-0.033*** (0.000)**	**-0.025*** (0.000)**	**-0.029*** (0.000)**	-0.004 (0.844)	-0.032 (0.685)	**0.180*** (0.001)**
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Thresholds	na	na	na	na	na	na	0.547	na	6.118
AR(1)	(0.024)	(0.025)	(0.025)	(0.042)	(0.042)	(0.040)	(0.021)	(0.070)	(0.034)
AR(2)	**(0.776)**	**(0.821)**	**(0.801)**	**(0.840)**	**(0.833)**	**(0.814)**	**(0.441)**	**(0.375)**	**(0.313)**
Sargan OIR	**(0.331)**	**(0.346)**	**(0.421)**	**(0.284)**	**(0.409)**	**(0.553)**	(0.000)	(0.030)	(0.007)
Hansen OIR	**(0.204)**	**(0.368)**	**(0.285)**	**(0.474)**	**(0.408)**	**(0.381)**	**(0.372)**	**(0.834)**	**(0.347)**
DHT for instruments									
(a)Instruments in levels									
H excluding group	(0.077)	**(0.297)**	**(0.169)**	**(0.151)**	**(0.348)**	**(0.256)**	**(0.513)**	**(0.711)**	**(0.806)**
Dif(null, H=exogenous)	**(0.426)**	**(0.406)**	**(0.407)**	**(0.679)**	**(0.420)**	**(0.450)**	**(0.307)**	**(0.751)**	**(0.207)**
(b) IV (years, eq(diff))									
H excluding group	**(0.134)**	(0.039)	(0.083)	**(0.187)**	**(0.155)**	**(0.175)**	**(0.492)**	**(0.753)**	**(0.429)**
Dif(null, H=exogenous)	**(0.382)**	**(0.945)**	**(0.664)**	**(0.721)**	**(0.684)**	**(0.608)**	**(0.298)**	**(0.710)**	**(0.306)**
Fisher	**495748***	**72193***	**609618***	**5.20e+06 ***	**32363***	**4.43e+06 ***	**16781.82 ***	**32372.63 ***	**4054.54 ***
Instruments	32	32	32	32	32	32	32	32	32
Countries	34	34	34	33	33	33	32	32	32
Observations	237	237	237	219	219	219	181	181	181

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. Constants are included in all regressions.na: not applicable because at least estimate needed for the computation of thresholds is not significant.

Table 3: Inclusive Education, Inequality and Female Employment

	Dependent variable: Female Employment (FE)								
	Primary and Secondary School Enrolment (PSSE)			Secondary School Enrolment (SSE)			Tertiary School Enrolment (TSE)		
	Gini	Atkison	Palma	Gini	Atkison	Palma	Gini	Atkison	Palma
FE(-1)	**0.990*** (0.000)**	**0.989*** (0.000)**	**0.989*** (0.000)**	**0.990*** (0.000)**	**0.984*** (0.000)**	**0.987*** (0.000)**	**0.957*** (0.000)**	**0.964*** (0.000)**	**0.943*** (0.000)**
Gini Coefficient (Gini)	0.434 (0.969)	---	---	-0.195 (0.985)	---	---	**41.081*** (0.000)**	---	---
Atkinson Index (Atkinson)	---	-1.066 (0.883)	---	---	-7.197 (0.117)	---	---	2.552 (0.663)	---
Palma Ratio (Palma)	---	---	-0.401 (0.177)	---	---	-0.207 (0.251)	---	---	**1.205*** (0.007)**
PSSE	2.500 (0.647)	1.622 (0.758)	0.233 (0.817)	---	---	---	---	---	---
SSE	---	---	---	3.248 (0.574)	-5.996 (0.105)	-0.685 (0.523)	---	---	---
TSE	---	---	---	---	---	---	**34.896*** (0.000)**	**11.651*** (0.000)**	**9.233*** (0.001)**
Gini × PSE	-5.243 (0.602)	---	---	---	---	---	---	---	---
Gini × SSE	---	---	---	-5.724 (0.590)	---	---	---	---	---
Gini × TSE	---	---	---	---	---	---	**-60.364*** (0.000)**	---	---
Atkinson × PSE	---	-1.891 (0.795)	---	---	---	---	---	---	---
Atkinson × SSE	---	---	---	---	7.181 (0.131)	---	---	---	---
Atkinson × TSE	---	---	---	---	---	---	---	**-17.116*** (0.000)**	---
Palma × PSE	---	---	---	---	---	0.060 (0.702)	---	---	---
Palma × SSE	---	---	0.204 (0.396)	---	---	---	---	---	---
Palma × TSE	---	---	---	---	---	---	---	---	**-1.408*** (0.001)**
Political Stability	**0.246*** (0.000)**	**0.209*** (0.007)**	**0.218*** (0.001)**	**0.275** (0.034)**	**0.221* (0.087)**	**0.268** (0.024)**	0.225 (0.250)	-0.070 (0.737)	0.289 (0.163)
Remittances	0.0001 (0.966)	**0.007* (0.062)**	-0.001 (0.642)	0.009 (0.162)	0.002 (0.533)	0.005 (0.197)	**0.017* (0.079)**	**-0.032*** (0.004)**	**-0.061*** (0.000)**
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Thresholds	na	na	na	na	na	na	0.578	0.680	6.557
AR(1)	(0.010)	(0.012)	(0.011)	(0.016)	(0.015)	(0.014)	(0.032)	(0.040)	(0.031)
AR(2)	**(0.421)**	**(0.482)**	**(0.494)**	**(0.975)**	**(0.982)**	**(0.976)**	**(0.269)**	**(0.196)**	**(0.253)**
Sargan OIR	**(0.416)**	**(0.620)**	**(0.674)**	**(0.281)**	**(0.586)**	**(0.568)**	(0.002)	(0.000)	(0.000)
Hansen OIR	**(0.151)**	**(0.277)**	**(0.334)**	**(0.330)**	**(0.377)**	**(0.377)**	**(0.837)**	**(0.511)**	**(0.709)**
DHT for instruments									
(a)Instruments in levels									
H excluding group	(0.024)	**(0.358)**	**(0.374)**	**(0.174)**	**(0.531)**	**(0.575)**	**(0.302)**	**(0.338)**	**(0.321)**
Dif(null, H=exogenous)	**(0.539)**	**(0.269)**	**(0.324)**	**(0.463)**	**(0.305)**	**(0.292)**	**(0.918)**	**(0.547)**	**(0.781)**
(b) IV (years, eq(diff))									
H excluding group	**(0.399)**	**(0.340)**	**(0.289)**	**(0.259)**	**(0.486)**	**(0.513)**	**(0.514)**	**(0.429)**	**(0.141)**
Dif(null, H=exogenous)	**(0.115)**	**(0.280)**	**(0.394)**	**(0.418)**	**(0.306)**	**(0.293)**	**(0.848)**	**(0.505)**	**(0.983)**
Fisher	**450801*** **	**268082*** **	**3.15e+06 *** **	**99742.60 *** **	**1.29e+07 *** **	**226728.65 *** **	**5.28e+06 *** **	**182224*** **	**2145.95*** **
Instruments	32	32	32	32	32	32	32	32	32
Countries	34	34	34	33	33	33	32	32	32
Observations	237	237	237	219	219	219	181	181	181

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. Constants are included in all regressions.na: not applicable because at least estimate needed for the computation of thresholds is not significant.

5. Concluding implications and future research directions

This study provides thresholds of inequality that should not be exceeded if gender inclusive education is to enhance gender inclusive formal economic participation in sub-Saharan Africa. The empirical evidence is based on Generalised Method of Moments and data from 42 countries during the period 2004-2014. Income inequality is measured with the Gini coefficient, the Atkinson index and the Palma ratio while inclusive gender economic participation is measured with female labour force participation, female employment and female unemployment. Three gender parity indicators are also used for the analysis, namely: "primary and secondary education", secondary education and tertiary education.

The following findings are established. First, inclusive tertiary education unconditionally promotes gender economic inclusion while the interaction between tertiary education and inequality is unfavourable to gender economic inclusion. Second, a Gini coefficient that nullifies the positive incidence of inclusive tertiary education on female labour force participation is 0.562. Second, the Gini coefficient and the Palma ratio that crowd-out the negative unconditional effects of inclusive tertiary education on female unemployment are respectively, 0.547 and 6.118. Third, a 0.578 Gini coefficient, a 0.680 Atkinson index and a 6.557 Palma ratio are critical masses that wipe-out the positive unconditional effects of inclusive tertiary education on female employment. Findings associated with lower levels of education are not significant. As the main policy implication, income inequality should not be tolerated above the established thresholds in order for gender inclusive education to promote gender inclusive formal economic participation.

It is worthwhile for policy makers to restrict inequality levels, not exclusively because doing so will boost inclusive economic participation but also because the engagement of more women in the formal economic sector also improves the negative responsiveness of extreme poverty to economic prosperity. Accordingly, more engagement of women also concurrently reduce income inequality and hence, a more favourable extreme poverty reduction from economic growth. It is important to recall that the response of poverty to economic growth is a negative function of inequality and that providing more women with job opportunities is a means of reducing income inequality because as articulated in the introduction, women in SSA are the poorest and most excluded from formal economic activities in the world. Moreover, empowering women with job opportunities has a plethora of positive development externalities outlined in the introduction.

Accordingly, no country can be developed sustainably if the majority of its population is excluded from partaking in the process of wealth creation. As such, reducing income inequality will not only engender more reduction of extreme poverty (owing to the reduction of income inequality pertaining to gender exclusion) but will also increase the overall wealth created by sampled nations because as outlined in the motivation of the study, a World Bank report has established that a significant loss in the wealth of countries in SSA is the result of women being excluded from formal economic activities.

Ultimately, checking income inequality levels will help sampled countries in the target of reducing extreme poverty to a below 3% threshold by 2030 in the light of the SDG extreme poverty target. Moreover, the positioning of the study and corresponding findings also directly speak to two specific SDGs: (i) SDG 5 (i.e. "*achieve gender equality and empower all women and girls*") and (ii) SDG 8 (i.e. "*promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all*"). In a nutshell, policies that are tailored to mitigate income inequality and concurrently promote inclusive education will lead to positive economic ramifications associated with female employment that engenders potential externalities in *inter alia*: improvements in the structural distribution of labour, poverty reduction and boosts in household and societal welfare.

The findings have also shown that the level of inequality affects the effectiveness of inclusive education policies on inclusive economic participation and the significance of such inequality is more apparent in the relevance of tertiary education in promoting economic inclusion, compared to other levels of education. An implication of the comparative relevance of tertiary education is that females should be encouraged to school upto higher levels of education in order to improve their chances of participating in economic prosperity through the formal economic sector. This comparative finding is also a caution to scholarship or research that justifies the use primary school enrolment instead of higher levels of education with the fact that compared to higher levels of education, primary education has been documented to be more instrumental in promoting socio-economic participation and economic development when countries are at initial stages of industrialisation (Petrakis& Stamatakis, 2002; Asiedu, 2014; Asongu & Nwachukwu, 2018). Accordingly, going by the findings in this study, *ceteris paribus*, the justifications for exclusively using primary school education as indicators of human capital do not withstand empirical scrutiny. Such failure to withstand empirical scrutiny may be traceable to the fact that sampled African countries are averagely not at their initial stages of industrialisation.

The extant literature can be improved if future studies could use relevant country-specific empirical techniques to assess whether the established findings in this study withstand empirical scrutiny from country-specific frameworks. This recommendation builds on the caveat that country-specific effects are eliminated in GMM modelling in order to avoid endogeneity resulting from the correlation between the lagged outcome variable and country-specific effects.

Appendices

Appendix 1: Definitions of Variables

Variables	Signs	Definitions of variables (Measurements)	Sources
	FLFpart	Labor force participation rate, female (% of female population ages 15+) (modeled ILO estimate)	ILO
Female Economic Participation	FU	Unemployment, female (% of female labor force) (modeled ILO estimate)	ILO
	FE	Employment to population ratio, 15+, female (%) (modeled ILO estimate)	ILO
Primary and Secondary School	PSSE	School enrolment, primary and secondary (gross), gender parity index (GPI)	WDI
Secondary School	SSE	School enrolment, secondary (gross), gender parity index (GPI)	WDI
Tertiary School	TSE	School enrolment, tertiary (gross), gender parity index (GPI)	WDI
Gini Index	Gini	"*The Gini index is a measurement of the income distribution of a country's residents*".	GCIP
Atkinson Index	Atkinson	"*The Atkinson index measures inequality bydetermining which end of the distribution contributed most to the observed inequality*".	GCIP
Palma Ratio	Palma	"*The Palma ratio is defined as the ratio of the richest 10% of the population's share of gross national income divided by the poorest 40%'s share*".	GCIP
Political Stability	PolS	"Political stability/no violence (estimate): measured as the perceptions of the likelihood that the government will be destabilised or overthrown by unconstitutional and violent means, including domestic violence and terrorism"	WGI
Remittances	Remit	Remittance inflows to GDP (%)	WDI

WDI: World Bank Development Indicators of the World Bank. FDSD: Financial Development and Structure Database of the World Bank.

Appendix 2: Summary statistics (2004-2014)

	Mean	SD	Minimum	Maximum	Observations
Female Labor Force participation	62.515	15.685	30.00	88.80	451
Female Unemployment, female	10.831	8.736	0.300	44.800	429
Female Employment	57.201	15.828	23.700	86.400	429
Primary & Secondary School Enrolment	0.919	0.111	0.600	1.105	307
Secondary School Enrolment	0.867	0.214	0.333	1.422	287
Tertiary School Enrolment	0.731	0.433	0.064	3.295	232
Gini Coefficient	0.586	0.034	0.488	0.851	461
Atkinson Index	0.705	0.058	0.509	0.834	461
Palma Ratio	6.457	1.477	3.015	14.434	461
Political Stability	-0.471	0.905	-2.687	1.182	462
Remittances	4.313	6.817	0.00003	50.818	416

S.D: Standard Deviation.

Appendix 3: Correlation matrix (uniform sample size: 156)

FLFpart	FU	FE	PSSE	SSE	TSE	Gini	Atkinson	Palma	PolS	Remit	
1.000	-0.267	0.948	0.106	-0.180	-0.414	0.093	0.036	0.074	0.012	-0.141	FLFpart
	1.000	-0.548	0.276	0.511	0.562	0.340	0.560	0.470	0.169	0.397	FU
		1.000	0.032	-0.295	-0.510	-0.025	-0.146	-0.084	-0.066	-0.247	FE
			1.000	0.866	0.701	0.392	0.374	0.421	0.538	0.327	PSSE
				1.000	0.873	0.425	0.519	0.519	0.538	0.507	SSE
					1.000	0.315	0.430	0.384	0.393	0.407	TSE
						1.000	0.844	0.922	0.373	0.130	Gini
							1.000	0.944	0.319	0.379	Atkinson
								1.000	0.394	0.288	Palma
									1.000	0.169	PolS
										1.000	Remit

FLFpart: Female Labour Force participation. FU: Female Unemployment. FE: Female Employment. PSSE: Primary &Secondary School Enrollment. SSE: Secondary School Enrollment. TSE: Tertiary School Enrollment. Gini: the Gini coefficient. Atkinson: the Atkinson index. Palma: the Palma ratio. PolS: Political Stability. Remit: Remittances.

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