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How Enhancing Gender Inclusion Affects Inequality: Thresholds of Complementary Policies for Sustainable Development [1]

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How Enhancing Gender Inclusion Affects Inequality: Thresholds of Complementary Policies for Sustainable Development

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Abstract

This study investigates how enhancing gender inclusion affects inequality in 42 African countries for the period 2004-2014. The empirical evidence is based on the Generalized Method of Moments. Three inequality indicators are used, namely, the: Gini coefficient, Atkinson index, and Palma ratio. The two gender inclusion measurements used include female labour force participation and female employment. The following main findings are established. There are positive net effects on inequality from the enhancement of gender inclusion dynamics. An extended threshold analysis is used to assess critical masses at which further increasing gender inclusion enhances inequality. The established thresholds are: (i) 55.555 "employment to population ratio, 15+, female (%)"for the nexus with the Gini coefficient. (ii) 50 "labor force participation rate, female (% of female population ages 15+)" and between 50 to 55 "employment to population ratio, 15+, female (%)", for the Atkinson index. (iii) 61.87 "labor force participation rate, female (% of female population ages 15+)" for the Palma ratio.These established thresholds are worthwhile for sustainable development because, beyond the critical masses, policy makers should complement the gender inclusion policy with other measures designed to reduce income inequality. Some complementary measures that can be taken on board beyond the established thresholds could focus on enhancing, *inter alia*: information and communication technology, infrastructural development; financial inclusion and inclusive education.

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

Keywords: Africa; Gender; Inclusive development; Sustainable development

1. Introduction

It is worthwhile to involve women in the formal economic sector because according to Abney and Laya (2018), such involvement could increase global annual gross domestic product (GDP) by approximately 28 trillion USD by 2025. The author maintains that there are a plethora of rewards that are associated with enhanced gender equality in formal sector economic activities. They include: poverty reduction;environmental sustainability; consumer choice;and innovation. Compared to other regions in the world, in Africa, the concern of gender exclusion is particularly important because the continent is characterised by the lowest level of female economic participation in the formal economic sector (Efobi, Tanankem & Asongu, 2018). The focus of this research on assessing how enhancing female economic participation affects inequality in Africa is motivated by three main factors, namely: (i) the low gender inclusion in the formal economic sector[2]; (ii) the perilous character of inequality in the post-2015 agenda of sustainable development goals (SDGs and (iii) gaps in the literature. These factors are expanded in the passages that follow.

First, contemporary development literature is broadly consistent on the position that women in Africa are largely relegated to secondary and peripheral activities (Efobi *et al.*, 2018; Asongu & Odhiambo, 2018a). Such activities include: unpaid domestic activities;petty trading;and small holding farming. The narrative is in line with the scholarly and policy literature on gender inclusion in the formal economic sector (Ellis, Blackden, Cutura, MacCulloch & Seebens, 2007; FAO, 2011; Tandon & Wegerif, 2013). Moreover, according to the World Bank (2015) and the International Labour Organisation (2013), the non-involvement of women in the formal economic sector represents an issue that should be addressed in order for countries to enjoy substantial benefits from shared economic prosperity. According to these multilateral institutions of development, the fragile and meager externalities of welfare that is linked to economic growth are partly traceable to gender exclusion from formal economic projects. The account is supported by Hazel (2010), who maintains that the highest poverty rate among females in the world is in Africa. Furthermore, Efobi *et al.* (2018) argue that engaging more women in formal economic activities will improve socio-economic development on a multitude of fronts, *inter alia*: reduce poverty, ameliorate labour market structural transformation and augment female gender welfare. The

[2] The terms “female economic participation”, “gender inclusion” and “gender economic participation” are used interchangeably throughout the study.

contemporary importance of these benefits is even more worthwhile because of the inclusive development issues in the achievement of SDGs.

Second, inclusive development is a central theme to the achievement of SDGs in Africa for at least two main reasons: (i) it increases the negative responsiveness of poverty to economic growth and (ii) most African countries did not achieve the Millennium Development Goal (MDG) extreme poverty target because of inequality (Asongu & Kodila-Tedika, 2017; Asongu & le Roux, 2019; Tchamyou, 2019a, 2019b; Tchamyou *et al.*, 2019). The latter is essentially because the responsiveness of poverty to economic growth decreases with growing levels of inequality (Fosu, 2015;Asongu & Kodila-Tedika, 2018). It follows from this account that reducing gender inequality will enhance the negative incidence of economic growth on poverty. The challenge of reducing extreme poverty to a threshold of below 3% by 2030 cannot feasibly be achieved unless inequality is substantially curtailed in order to enhance shared prosperity (Asongu & Odhiambo, 2019a, 2020). This concern is supported by the findings of Bicaba, Brixiova and Ncube (2017): "*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). According to Ncube, Anyanwu and Hausken (2014), the reference to SSA extends to North Africa. This study focuses on the relevance of enhancing gender equality in income inequality because of an apparent gap in the literature.

Third, to the best of our knowledge, the contemporary literature on gender inclusion has focused on, *inter alia*: the nexus between financial inclusion and mobile money in SSA with a moderating role of gender and social networks (Bongomin, Ntayi, Munene & Malinga, 2018); the participation of rural women in information technology programmes for agricultural development (Uduji& Okolo-Obasi, 2018, 2019a, 2019b;Uduji, Okolo-Obasi& Asongu, 2019); gender gap prevalence in financial inclusion (Kairiza, Kiprono & Magadzire, 2017); the importance of gender in science education (Elu, 2018); a model for the analysis of gender within the informal and financial productive sectors (Bayraktar & Fofack, 2018); the nexus between gender inequality and access to microfinance (Mannah-Blankson, 2018); the importance of gender in sustainable agricultural production (Theriault, Smale & Haider, 2017) and the role of ICT in gender inclusion (Efobi *et al.*, 2018).

The study in the literature closest to this research is Efobi *et al.* (2018). The paper has assessed how the advancement in ICT has affected the participation of women in the formal economic sector using data from 42 African countries for the period 1990-2014. Employingordinary least squares, fixed effects and generalized method of moments regressions, the study has concluded that ICT increases women's participation in the formal economic sector in the following order to increasing magnitude: mobile phone penetration, internet penetration and fixed broadband subscriptions. We extend the study by: (i) employing the outcome variable (i.e. gender inclusion) as in independent variable of interest in this study and (ii) using three inequality dynamics as proxies for the outcome variable (i.e. the Gini coefficient, the Atkinson index and the Palma ratio). Furthermore, we do not stop at providing scholars and policy makers with direct linkages between the investigated economic phenomena. Accordingly, we go a step further by providing actionable policy thresholds at which enhancing female economic participation affects inequality. Hence, by providing such policy thresholds, we argue that it is not enough to simply provide linkages between macroeconomic variables from empirical analyses. Going a step further and disclosing specific policy thresholds is more actionable and relevant to policy makers.

The research question being studied is the following:how does enhancing female economic participation affect inequality in Africa? Attempting to answer this question is framed within the context of applied economics. Hence, the study builds on the premise that increasing the participation of women in the formal economic sector should logically have an incidence on income inequality in the light of the narratives from the above paragraphs that, women are among the poorest fractions of society in Africa. Thus, this study observes that applied econometrics should not exclusively be acknowledged in the light of accepting or rejecting existing theoretical frameworks. Accordingly, the research argues that a study framed on logical intuition is a useful scientific activity that can inform theory-building.

The positioning of this study also departs from contemporary sustainable development literature which has focused on *inter alia*: linkages between environmental performance of nation states, income inequality and income (Morse, 2018); voluntary sustainability standards (Bennett, 2018); trends and future tendencies of sustainable development (Wichaisri & Sopadang, 2018); challenges to sustainable development (Fearnside, 2018) and nexuses between movements, mining and sustainable development (Bebbington&Bebbington, 2018;Bainton, Owen & Kemp, 2018). The rest of the study is structured as follows. The data and methodology are covered in section 2, while the empirical results are disclosed in section 3. Section 4 concludes with implications and future directions.

2. Data and methodology

2.1 Data

This study focuses on forty-two African countries with annual data from 2004 to 2014[3]. The number of sampled countries and periodicity are motivated by constraints in data availability at the time of the study. The data is obtained from various sources, notably: (i) the Global Consumption and Income Project (GCIP) for the inequality variables (i.e. the Gini coefficient, the Atkinson index and the Palma ratio); (ii) the International LaborOrganization for the variables on female economic participation (i.e. female labor force participation andfemale employment); (iii) the World Governance Indicators of the World Bank for a control variable (i.e. remittances) and (iv) the Financial Development and Structure Database of the World Bank for two control variables (i.e. remittances and financial stability).

The three inequality indicators are consistent with recent income inequality literature in Africa (Tchamyou, 2019a, 2019b; Asongu & Odhiambo, 2019b) while the adopted gender inclusion variables are also in accordance with recent literature on the participation of women in the formal economic sector (Efobi *et al.*, 2018). The three control variables are also motivated by recent inclusive human development and income inequality literature (Anyanwu, 2011; Tchamyou *et al.*, 2019;Asongu & Odhiambo, 2018b; Meniago & Asongu, 2018). Indicators in the conditioning information set are limited to three; in order to avoid concerns about instrument proliferation in post-estimation diagnostics tests that could substantially bias the estimated coefficients. Such restriction of elements in the conditioning information set is not uncommon because studies in the empirical literature based on the generalized method of moments (GMM) have used less than three control variables (Bruno, De Bonis & Silvestrini, 2012). In some cases, no control variables are involved (Osabuohien & Efobi, 2013; Asongu & Nwachukwu, 2017). It what follows we discuss the expected signs of the control variables.

First, the importance of political stability is predicted to be positive because it avails a promising environment for investment and entrepreneurship opportunities. Such opportunities increase social mobility and reduce unemployment, which, by extension, can promote the participation of women in the formal economic sector. Second, in accordance with recent

[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".

inclusive development literature (Anyanwu, 2011; Meniago & Asongu, 2018), remittances increase inequality in Africa because most of those migrating abroad are from wealthier fractions of the population. This explanation can be extended to gender exclusion. Third, the incidence of financial stability depends on market dynamics, and the expected signs cannot be established a priori. What is important to note is that financial stability affects gender inclusion. The definitions and sources of variables are provided in Appendix 1, whereas the summary statistics is disclosed in Appendix 2. The correlation matrix is covered in Appendix 3.

2.2 Methodology

2.2.1 GMM: Specification, identification and exclusion restrictions

This research is consistent with recent literature which has adopted the Generalised Method Moments as estimation strategy for four main reasons (Asongu & Nwachukwu, 2016a; Tchamyou, 2019a, 2019b; Asongu & Odhiambo, 2019a). First, the number of cross sections is considerably higher than the corresponding number of periods in each cross section. Accordingly, N (or 42 countries)>T(2004-2014 or 11 years). Second, the adopted two indicators of gender inclusion are persistent in the light of the fact that the correlations between their level and first lag values are higher than 0.800, which is the rule of thumb for establishing persistence in a variable (Tchamyou, 2019b). Accordingly, the underlying correlations from the female labor force participation rate and the female employment rate are respectively, 0.999 and 0.998. Third, in the light of the panel data structure of this study, cross-country variations are considered in the estimation processes. Fourth, the issue of endogeneity is addressed because, on the one hand, there is control for the unobserved heterogeneity in terms of time-invariant omitted variables and on the other, reverse causality or simultaneity is addressed through a process of instrumentation.

The GMM techniqueadopted in this study is the Arellano and Bover (1995) improvement by Roodman (2009a, 2009b) which has been documented in the attendant literature to reduce the proliferation of instruments (Asongu & Nwachukwu, 2016b; Boateng *et al.*, 2018).

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

$$I_{i,t} = \sigma_0 + \sigma_1 I_{i,t-\tau} + \sigma_2 F_{i,t} + \sigma_3 FF_{i,t} + \sum_{h=1}^{3} \delta_h W_{h,i,t-\tau} + \eta_i + \xi_t + \varepsilon_{i,t} \quad (1)$$

$$I_{i,t} - I_{i,t-\tau} = \sigma_1 (I_{i,t-\tau} - I_{i,t-2\tau}) + \sigma_2 (F_{i,t} - F_{i,t-\tau}) + \sigma_3 (FF_{i,t} - FF_{i,t-\tau}) + \sum_{h=1}^{3} \delta_h (W_{h,i,t-\tau} - W_{h,i,t-2\tau}) + (\xi_t - \xi_{t-\tau}) + (\varepsilon_{i,t} - \varepsilon_{i,t-\tau}) \quad (2)$$

where, $I_{i,t}$ is an inequalityindicator (i.e. the Gini coefficient, the Atkinson index and the Palma ratio) of country i in period t, σ_0 is a constant, F entails gender inclusion (female labour force participation and female employment), FF denotes quadratic interactions between gender inclusion indicators("female labour force participation" × "female labour force participation" and "female employment" × "female employment"), W is the vector of control variables (political stability, remittances and financial stability), τ represents the coefficient of auto-regression which is one within the framework of this study because a year lag is enough to capture past information, ξ_t is the time-specific constant, η_i is the country-specific effect and $\varepsilon_{i,t}$ the error term.

2.2.2Identification and exclusion restrictions

The strategies of identification and exclusion restrictions are consistent with recent literature (Asongu & Nwachukwu, 2016c; Tchamyou & Asongu, 2017; Boateng *et al.*, 2018; Tchamyou *et al.*, 2019). These strategies are indispensable for a robust GMM specification. In line with the corresponding literature, "years" are acknowledged as variables that are strictly exogenous, and gender inclusion variables are assumed to be predetermined or endogenous explaining. In other words, the identified strictly exogenous variables are presumed to affect the inequality outcomes variables exclusively through the endogenous explaining mechanisms of gender inclusion. This approach is not very different from the arguments of Roodman (2009b), which maintain that it is not very feasible for time-invariant indicators to be endogenous upon a first difference[4].

In light of the above, the criterion for assessing the validity of the identification strategy is the Difference in Hansen Test (DHT) for the exogeneity of instruments. The null hypothesis of this test is the position that the instruments affect the outcome variable exclusively via the predetermined variables or endogenous explaining channels. Hence, the null hypothesis of the DHT findings that are reported in the next section should not be rejected in order for the exclusion restriction assumption to hold. The criterion for exclusion restriction is consistent with the standard instrumental variable (IV) framework which requires that the alternative

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

hypothesis of the Sargan overidentifying restrictions test should be rejected in order for the instruments not to affect the outcome variable beyond the proposed mechanisms or exogenous explainingchannels (Beck,Demirgüç-Kunt& Levine, 2003; Asongu & Nwachukwu, 2016d).

3. Empirical results

3.1 Presentation of results

The findings are presented in Tables 1 to 3 in this section. Accordingly, Table 1, Table 2 and Table 3, respectively, focus on the Gini coefficient, the Atkinson index and the Palma ratio. Each table has two main specifications corresponding to the two main independent variables of interest, namely: female labor force participation and female employment. For each category of specifications, two sub-specifications are apparent, notably: one without a conditioning information set and another with a conditioning information set. It is worthwhile to note that, in the light of the narrative in the data section (on empirical studies with GMM models that have been based on no control variable or less than three control variables), the specifications with and without the conditioning information set are valid for the interpretation of results and corresponding concluding implications.

Four information criteria are used to assess the post-estimation validity ofresults[5].In the light of these criteria, the second specification of Table 1 is not valid because the null hypothesis of the Hansen test is rejected. This research places more emphasis on the Hansen test vis-à-vis the Sargan test because the former is more robust, though affected by the concern of instrument proliferation. Accordingly, the Sargen test, while not robust, is not affected by concerns of instrument proliferation. A way of addressing the conflicting criteria is to adopt the robust test (i.e. the Hansen) and then ensure that the drawback corresponding to the adopted test (i.e. the concern of instrument proliferation) is addressed by ensuring that for each specification, the number of cross sections is higher than the corresponding number of instruments.

[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 Fischer test for the joint validity of estimated coefficients is also provided*" (Asongu& De Moor, 2017, p.200).

Table 1: Gender inclusion and the Gini coefficient

	Dependent variable: the Gini coefficient			
	Female Labor Force participation (FLFpart)		Female Employment (FE)	
Gini coefficient (-1)	**0.912***** **(0.000)**	**0.924***** **(0.000)**	**0.896***** **(0.000)**	**0.996***** **(0.000)**
FLFpart	-0.00003 (0.976)	0.0007 (0.400)	---	---
FLFpart × FLFpart	0.000001 (0.897)	-0.000004 (0.400)	---	---
FE	---	---	**-0.010**** **(0.017)**	0.0007 (0.172)
FE×FE	---	---	**0.00009**** **(0.013)**	-0.000006 (0.201)
Political Stability	---	0.0001 (0.866)	---	0.0008 (0.541)
Remittances	---	0.00002 (0.762)	---	-0.00001 (0.809)
Financial Stability	---	**0.0003***** **(0.000)**	---	**0.0005***** **(0.000)**
Time Effects	Yes	Yes	Yes	Yes
Net Effects	na	na	0.010	na
Thresholds	na	na	55.555	na
AR(1)	(0.093)	(0.096)	(0.107)	(0.097)
AR(2)	**(0.398)**	**(0.258)**	**(0.213)**	**(0.289)**
Sargan OIR	(0.000)	(0.002)	(0.009)	(0.050)
Hansen OIR	(0.071)	**(0.682)**	**(0.181)**	**(0.518)**
DHT for instruments				
(a)Instruments in levels				
H excluding group	---	**(0.158)**	---	(0.088)
Dif(null, H=exogenous)	(0.094)	**(0.883)**	(0.901)	**(0.834)**
(b) IV (years, eq(diff))				
H excluding group	---	**(0.331)**	---	**(0.305)**
Dif(null, H=exogenous)	---	**(0.808)**	---	**(0.627)**
Fisher	**1119.73*****	**187244.51*****	**4034.11*****	**223392.95*****
Instruments	20	32	20	32
Countries	41	38	39	36
Observations	409	325	389	307

***,**,*: 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. FLFpart: Female Labor Force Participation. FE: Female Employment. 130.03, 113.19 are mean values for respectively, female labor force participation, and female employment. Constants are included in the regressions. n.a: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant.

Table 2: Gender inclusion and the Atkinson index

	Dependent variable: the Atkinson index			
	Female Labor Force participation (FLFpart)		Female Employment (FE)	
Atkinson index (-1)	**0.953*** **	**0.940*** **	**0.958*** **	**0.946*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**
FLFpart	**-0.005*** **	-0.002	---	---
	(0.001)	(0.111)		
FLFpart × FLFpart	**0.00005*** **	**0.00002** **	---	---
	(0.000)	**(0.060)**		
FE	---	---	**-0.011** **	**-0.005* **
			(0.011)	**(0.051)**
FE×FE	---	---	**0.0001*** **	**0.00005** **
			(0.008)	**(0.035)**
Political Stability	---	0.003	---	0.003
		(0.414)		(0.463)
Remittances	---	0.0008	---	0.0004
		(0.127)		(0.385)
Financial Stability	---	**0.001*** **	---	**0.001*** **
		(0.000)		**(0.006)**
Time Effects	Yes	Yes	Yes	Yes
Net Effects	0.0080	na	0.0116	0.0063
Thresholds	50	na	55	50
AR(1)	(0.077)	(0.086)	(0.074)	(0.076)
AR(2)	**(0.436)**	**(0.573)**	**(0.287)**	**(0.190)**
Sargan OIR	(0.186)	(0.003)	(0.000)	(0.000)
Hansen OIR	**(0.107)**	**(0.308)**	**(0.426)**	**(0.671)**
DHT for instruments				
(a)Instruments in levels				
H excluding group	---	**(0.245)**	---	**(0.268)**
Dif(null, H=exogenous)	**(0.192)**	**(0.369)**	**(0.880)**	**(0.779)**
(b) IV (years, eq(diff))				
H excluding group	---	**(0.316)**	---	**(0.468)**
Dif(null, H=exogenous)	---	**(0.336)**	---	**(0.679)**
Fisher	**378.25*** **	**1673.93*** **	**77.88*** **	**2000.74*** **
Instruments	20	32	20	32
Countries	41	38	39	36
Observations	409	325	389	307

***,**,*: 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. FLFpart: Female Labor Force Participation. FE: Female Employment. 130.03, 113.19 are mean values for respectively, female labor force participation, and female employment. Constants are included in the regressions. Constants are included in the regressions. n.a: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant.

Table 3: Gender inclusion and the Palma ratio

	Dependent variable: the Palma ratio			
	Female Labor Force participation (FLFpart)		**Female Employment (FE)**	
The Palma ratio (-1)	**0.988*** **	**1.003*** **	**1.010*** **	**1.031*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**
FLFpart	**-0.099*** **	-0.036	---	---
	(0.003)	(0.156)		
FLFpart × FLFpart	**0.0008*** **	0.0003	---	---
	(0.002)	(0.114)		
FE	---	---	-0.172	-0.041
			(0.178)	(0.187)
FE×FE	---	---	0.001	0.0003
			(0.147)	(0.146)
Political Stability	---	-0.0007	---	-0.011
		(0.989)		(0.789)
Remittances	---	0.005	---	**0.015*** **
		(0.463)		**(0.007)**
Financial Stability	---	**0.014*** **	---	**0.010** **
		(0.004)		**(0.040)**
Time Effects	Yes	Yes	Yes	Yes
Net Effects	0.1090	na	na	na
Thresholds	61.875	na	na	na
AR(1)	(0.091)	(0.093)	(0.113)	(0.095)
AR(2)	**(0.341)**	**(0.332)**	**(0.712)**	**(0.390)**
Sargan OIR	(0.001)	(0.005)	(0.000)	(0.000)
Hansen OIR	**(0.144)**	**(0.449)**	**(0.359)**	**(0.276)**
DHT for instruments				
(a)Instruments in levels				
H excluding group	---	**(0.279)**	---	**(0.315)**
Dif(null, H=exogenous)	**(0.297)**	**(0.516)**	**(0.893)**	**(0.287)**
(b) IV (years, eq(diff))				
H excluding group	---	**(0.178)**	---	**(0.195)**
Dif(null, H=exogenous)	---	**(0.701)**	---	**(0.412)**
Fisher	**5342.58*** **	**2385.30*** **	**149.07*** **	**102361.1*** **
Instruments	20	32	20	32
Countries	41	38	39	36
Observations	409	325	389	307

***,**,*: 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. FLFpart: Female Labour Force Participation. FE: Female Employment. 130.03, 113.19 are mean values for respectively, female labor force participation, and female employment. Constants are included in the regressions. Constants are included in the regressions. n.a: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant.

In order to investigate the overall effect of enhancing gender inclusion on inequality, net effects are computed, in accordance with the contemporary literature on interactive regressions (Asongu & Odhiambo, 2019b; Tchamyou *et al.*, 2019). For example, in the penultimate column of Table 1, the net impact on the Gini index from the enhancement of female employment is 0.010(2×[0.00009 × 113.19] + [-0.010]). In this calculation, the average value of female employment is 113.19, the marginal impact of female employment is 0.00009, the unconditional effect of female employment is -0.010 and the leading 2 is from the quadratic derivation.

The following findings can be established from Tables 1-3. (i) There is a positive net effect from the enhancement of female employment on the Gini coefficient. (ii) There are positive net effects from the improvement of female labor participation and female employment on the Atkinson index. (iii) A positive net effect is apparent from the enhancement of female labor participation on the Palma ratio. The control variables have the expected signs.

3.2 Discussion and extension with policy thresholds

The established positive net effects are unexpected because we anticipatedthat enhancing gender inclusion will reduce inequality. From the findings, while the unconditional effects of gender inclusion are consistently negative, the conditional or marginal effects are consistently positive. This is an indication that while gender inclusion does reduce inequality, enhancing gender inclusion increases inequality. This may be traceable to the fact that the additional women involved in the formal economic sector make a transition to the wealthier fraction of the population or are alreadyfromthe wealthier fraction of the population. It follows that enhancing gender inclusion is a necessary but not a sufficient condition for the reduction of inequality. This motivates the computation of thresholds at which further enhancing gender inclusion increases inequality. These thresholds are worthwhile for policy because beyond the critical masses, further enhancement of gender inclusion should be complemented with alternative measures destined to mitigate the incremental inequality associated with the further enhancement of gender inclusion.

In the light of these clarifications, in the penultimate column of Table 1, a threshold of 55.555 (0.010/ [2×0.00009]) "employment to population ratio, 15+, female (%)" is the critical mass at which the net effect of enhancing female employment on the Gini coefficient is 0 (2×[0.00009× 55.555] + [-0.010]). Hence above the established threshold of 55.555, further increasing female employment will increase inequality (i.e. the Gini coefficient). It follows that above this threshold, policies should be designed to involve women from poorer fractions of society into the formal economic sector.

The corresponding positive thresholds in Table 2 are: (i) 50 “labor force participation rate, female (% of female population ages 15+)” and (ii) between 50 to 55 “employment to population ratio, 15+, female (%)”, for the Atkinson index. Moreover, in Table 3,61.87 is the threshold of “labor force participation rate, female (% of female population ages 15+)” for the Palma ratio. The computed thresholds have economic relevance and make economic sense because they fall within the policy ranges disclosed in the summary statistics (i.e. between the minimum and maximum values).

Before concluding this paper, it is worthwhile to emphasise that the underlying conception of threshold is consistent with the attendant critical mass literature, notably: thresholds upon which growing environmental degradation has a negative incidence on inclusive development (Asongu, 2018); initial conditions for rewarding effects (Cummins, 2000); critical masses for favourable effects (Roller & Waverman, 2001; Batuo, 2015)and inflexion points at which information sharing reduces market power for the enhancement of financial access (Asongu, le Roux, Tchamyou, 2019).

4. Concluding implications and future research directions

This study investigates how enhancing gender inclusion affects inequality in 42 African countries for the period 2004-2014. The empirical evidence is based on the Generalized Method of Moments. Three inequality indicators are used, namely, the: Gini coefficient, Atkinson index and Palma ratio. Two gender inclusion measurements are employed: female labor force participation and female employment. The following main findings are established. There are positive net effects on inequality from the enhancement of gender inclusion.

An extended threshold analysis is used to assess critical masses at which further increasing gender inclusion enhances inequality. Accordingly, from the findings, while the unconditional effects of gender inclusion are consistently negative, the conditional or marginal effects are consistently positive. This may be traceable to the fact that the additional women involved in the formal economic sector make a transition to the wealthier fraction of the population or are already in the wealthier fraction of the population. It follows that enhancing gender inclusion is a necessary but not a sufficient condition for the reduction of inequality. This has motivated the computation of thresholds at which further enhancing gender inclusion increases inequality.

The thresholds are: (i) 55.555 "employment to population ratio, 15+, female (%)" as the critical mass for the Gini coefficient. (ii) 50 "labor force participation rate, female (% of female population ages 15+)" and between 50 to 55 "employment to population ratio, 15+, female (%)", for the Atkinson index. (iii) 61.87 "labor force participation rate, female (% of female population ages 15+)" for the Palma ratio. The computed thresholds have economic relevance and make economic sense because they fall within the policy ranges disclosed in the summary statistics (i.e. between the minimum and maximum values).

These established thresholds are worthwhile for policy because beyond the critical masses, further enhancement of gender inclusion should be associated with complementary measures destined to mitigate the incremental inequality. Future research should focus on country-specific cases in order to provide country-specific policy implications. This recommendation is motivated by the fact that country-specific effects are not involved in the GMM because of the need to avoid endogeneity resulting from the correlation between the lagged dependent variable and country-specific effects.

Appendices

Appendix 1: Definitions of Variables

Variables	Signs	Definitions of variables (Measurements)	Sources
Income Inequality	Gini Coefficient	“*The Gini coefficient is a measurement of the income distribution of a country's residents*”.	GCIP
	Atkinson Index	“*The Atkinson index measures inequality bydetermining which end of the distribution contributed most to the observed inequality*”.	GCIP
	Palma Ratio	“*The Palma ratio is defined as the ratio of the richest 10% of the population's share of gross national income divided by the poorest 40%'s share*”.	GCIP
Female economic participation	FLFpart	Labor force participation rate, female (% of female population ages 15+) (modeled ILO estimate)	ILO
Female Employment	FE	Employment to population ratio, 15+, female (%) (modeled ILO estimate)	ILO
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
Financial Stability	Z-score	Prediction of the likelihood that a bank might survive and not go bankrupt.	FDSD

WDI: World Bank Development Indicators of the World Bank. FDSD: Financial Development and Structure Database of the World Bank. WGI: World Governance Indicators. ILO: International Labour Organization.

Appendix 2: Summary statistics (2004-2014)

	Mean	SD	Minimum	Maximum	Observations
Gini Index	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
Female Labor Force participation	130.03	83.996	1.000	287.00	462
Female Employment	113.19	69.850	1.000	256.00	462
Political Stability	-0.471	0.905	-2.687	1.182	462
Remittances	4.313	6.817	0.00003	50.818	416
Financial Stability	8.713	4.994	-12.024	25.736	404

S.D: Standard Deviation.

Appendix 3: Correlation matrix (uniform sample size: 364)

Inequality			Female participation		Control variables			
Gini	Atkinson	Palma	FLFpart	FE	PolS	Remit	Z-score	
1.000	0.797	0.931	0.109	0.076	0.290	-0.014	0.135	Gini
	1.000	0.918	0.041	-0.012	0.315	0.216	-0.006	Atkinson
		1.000	0.062	0.018	0.357	0.115	0.091	Palma
			1.000	0.656	0.025	0.024	-0.181	FLFpart
				1.000	-0.134	0.087	-0.090	FE
					1.000	0.061	0.108	PolS
						1.000	-0.099	Remit
							1.000	Z-score

Gini: the Gini Index. Atkinson: the Atkinson Index. Palma: the Palma Ratio. FLFpart: Female Labour Force Participation. FU: Female Unemployment. FE: Female Employment. PolS: Political stability. Remit: Remittances. Z-score: Financial Stability.

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