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Inequality and gender economic inclusion: the moderating role of financial access in Sub-Saharan Africa [1]

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Inequality and gender economic inclusion: the moderating role of financial access in Sub-Saharan Africa

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Abstract

This study assesses how financial access can be used to modulate the effect of income inequality on gender economic inclusion. The focus is on 42 countries in sub-Saharan Africa (SSA) for the period 2004-2014 and the empirical evidence is based on Generalised Method of Moments (GMM) and Fixed Effects (FE) regressions. Significant results are not apparent in the FE regressions. The following main findings are established from the GMM estimations. There is a negative net effect from the role of financial access in modulating the effect of the Palma ratio on female labour force participation while there is a positive net effect from the relevance of financial access in moderating the effect of the Gini coefficient on female unemployment. There are also net negative effects from the role of financial access in modulating the Gini coefficient and the Palma ratio for female employment. The unexpected findings are elucidated and implications are discussed in the light of challenges to Sustainable Development Goals in the sub-region. *Inter alia*: financial access is a necessary but not a sufficient moderator of income inequality for the enhancement of women's participation in the formal economic sector.

1. Introdution

Inequaltiy is logically a fundamental driver in the exclusion of women from the formal economic sector and financial access is an instrument by which the effect of inequality in gender economic exclusion can be moderated. This is essentially because with financial access, women are provided with income-generating opportunites that engender positive development externalities in terms of investment, employment and economic prosperity. Such positive development externalities obviously provide favourable avenues for enhanced economic participation of excluded factions of society, including women. Against this background, the present research is positioned on assessing the importance of the financial access channel in moderating the effect of income inequality on female economic participation in sub-Saharan Africa[2]. The corresponding research question is: how does financial access moderate the effect of inequality on gender economic inclusion? Answering this question provides insights into at least two main 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"*).

Apart from the logical elements engaged so far, the positioning of this research is also motivated by three core factors in the scholarly and policy literature, notably: (i) the importance of engaging more women in formal economic activities in the post-2015 development agenda of Sustainable Development Goals (SDGs), in the light of the policy syndrome of inequality in SSA; (ii) the fundamental role of financial access in promoting inclusive development and (iii) shortcomings in the extant contemporary literature. These motivational elements are expanded in the same order as they are highlighted.

First, inequality is a serious policy concern in SSA, fundamentally because many countries in the sub-region have not been benefiting from the over 20 years of economic growth resurgence. Accordingly, many countries in the sub-region did not achieve the Millennium Development Goal (MDG) extreme povety target (Ncube, Anyanwu & Hausken, 2014; Fosu, 2015; Asongu, 2018). Moreover, the concern of women exclusion in SSA is particularly relevant because, *inter alia*: (i) the World Bank has concluded that the cost of gender exclusion in the sub-region is estimated at about 2.5 trillion USD (Nkurunziza, 2018;

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[2] The terms "income inequality" and inequality are used interchangeably throughout this study. Moreover, the terms "gender inclusion", "gender economic participation", "female labour force participation", "female employment", "female economic participation" and "gender economic inclusion" are also used interchangeably throughout the study

World Bank, 2018); (ii) SSA has the highest female poverty rate in the world (Hazel, 2010) and (iii) compared to other regions of the world, women in SSA are mostly consigned to informal economic operations, such as subsistence agriculture, domestic activities and small trading (Ellis, Blackden, Cutura, MacCulloch & Seebens, 2007; FAO, 2011; Tandon & Wegerif, 2013). The broad consensus from the underlying literature is that the inclusion of women in the formal economic sector improves dynamics in the labour market, reduces overall poverty levels and augments the welfare of women (Efobi, Tanankem & Asongu, 2018). A means through which women can be empowered to engage more in the formal economic sector is through financial access. Accordingly, when women are empowered financially, they are equally provided with opportunities which dampen existing levels of inequality that are skewed to their disfavor. The relevance of financial access in inclusive development is consistent with comptemporary socio-economic development literature (Asongu & Odhiambo, 2018a; Tchamyou, 2020).

Second, as elucidated in the second section, the extant theoretical and empirical literature broadly agrees on the importance of financial access in, *inter alia*: prompting opportunities of investments both in households and corporations; enhancing living standards and providing job opportunities (Odhiambo, 2010; 2013; 2014; Amankwah-Amoah & Sarpong, 2016; Chikalipah, 2017; Daniel, 2017; Wale & Makina, 2017; Osah & Kyobe, 2017; Oben & Sakyi, 2017; Bocher, Alemu, & Kelbore, 2017; Ofori-Sasu, Abor & Osei, 2017; Chapoto & Aboagye, 2017; Boadi, Dana, Mertens, & Mensah, 2017; Iyke & Odhiambo, 2017; Amankwah-Amoah, 2015, 2016, 2019; Tchamyou, Erreygers, Cassimon, 2019; Tchamyou, 2019, 2020). In essence, this literature is broadly in accordance with the view that financial development is both a driver of inclusive and socio-economic development. The positioning of this research on financial access as a moderator of inequality for enhanced female economic participation is motivated by an apparent gap in the attendant scholarly literature.

Third, the contemporary inclusive development literature can be discussed in two main strands, notably: (i) a strand on inclusive and sustainable development and (ii) another strand on gender inclusiveness. On the one hand, the extant literature from the first strand has mostly focused on: the connection between inequality and external flows (Kaulihowa & Adjasi, 2018); the importance of information technology in inclusive development (Abor, Amidu & Issahaku, 2018; Asongu & Nwachukwu, 2018; Minkoua Nzie, Bidogeza & Ngum, 2018; Isszhaku, Humbani & Wiese, 2018; Gosavi, 2018; Asongu & Odhiambo, 2019a);

linkages between income, the poorest in society and consumption (De Magalhães & Santaeulàlia-Llopis, 2018); understanding the African poverty tragedy from the perspectives of genetic make-up (Asongu & Kodila-Tedika, 2017) and contemporary dominant models of economic development such as the Beijing model and the Washington consensus (Asongu and le Roux, 2019); insights into how environmental pollution affects human development that is adjusted for inequality (Asongu & Odhiambo, 2019b) and the linkage between corruption and inequality (Sulemana & Kpienbaareh, 2018). A stream of the literature within this strand has articulated the relevance of rethinking policies of foreign aid in order to improve socio-economic development in the post-2015 development agenda (Page & Söderbom, 2015; Jones & Tarp, 2015; Asongu, 2016) whereas another stream has been concerned with nexuses between education, the sharing of information, the redistriction of income and financial access (Asongu & Meniago, 2018; Tchamyou, 2019, 2020).

On the other hand, the contemporary literature on gender inclusion has not engaged the problem statement in this study. Elu (2018) presents a case for the involment of women and girls in science education. The relationship between gender inequality and access to microfinancial services is the focus of Mannah-Blankson (2018). Bayraktar and Fofack (2018) provide a framework for the investigation of gender in financial and informal sectors. The connection between mobile phones and access to finance has been assessed by Bongomin, Ntayi, Munene and Malinga (2018). The authors moderate the connection with networks of social and gender nature. Uduji and Okolo-Obasi (2018a, 2018b, 2019, 2020) and Uduji, Okolo-Obasi and Asongu (2019) argue for corporate social responsibility and the involvement of women in agricultural projects that are technology-driven in rural areas while Efobi *et al*. (2018) conclude that information and communication technology (ICT) promotes female economic participation in the labour sector.

The present research is closest to Efobi *et al*. (2018) in the perspective that it employs the same variables of gender economic participation as in the underlying study. However, an apparent distinguishing feature is that, this research employs inequality and financial access as principal independent variables of interest as apposed to ICT. The justification for the adoption of these independent variables of interest has been provided in the first paragraph of the introduction[3]. In the light of the motivation of the study, the positioning of the study also

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[3] The motivation of this research is also based on the fact that to the best of our knowledge, the contemporary African financial development literature has failed to engage nexuses between financial access, inequality and female economic participation (Gevorkyan & Kvangraven, 2016; Asongu, Nwachukwu & Tchamyou, 2017; Kusi, Agbloyor, Ansah-Adu & Gyeke-Dako, 2017; Danquah, Quartey & Iddrisu, 2017; Amponsah, 2017;

departs from Asongu, Nnanna and Acha-Anyi (2020) in at least four ways: (i) it focuses on the inequality mechanism instead of the financial access channel; (ii) the modulating variable is financial access instead of education; (iii) moderating policy thresholds is not the focus of the study and (iv) Fixed effects regressions are further used to account for the unobserved heterogeneity in terms of country-specific effects that are not considered in the Generalised Method of Moments (GMM) regressions.

The rest of the study is structured as follows. Section 2 covers the theoretical underpinnings motivating the relevance of financial access as a moderator in the relationship between inequality and female economic participation while section 3 discusses the data and presents the methodology. The empirical findings are disclosed in section 4. The research concludes in section 5 with implications and future research directions.

2. Theoretical underpinnings: the moderating role of financial access

This section articulates how financial access can be used as a moderator or policy variable to mitigate the effect of inequality on female gender economic participation. Consistent with contemporary financial development literature, two constrasting theoretical positions are apparent on the role of financial access in development outcomes (Tchamyou *et al.*, 2019; Asongu et al., 2020). There is a first strand which argues that financial access plays a central role in the promotion of economic growth and reduction of income inequality. Conversely, a second strand posits that owing to concerns of collateral, cost of transactions and information asymmetry, financial access to the poor can be limited (Asongu & Odhimabo, 2018b). The former strand is more aligned with the theoretical arguments of this research on the role of financial access in mitigating inequalities in order to promote socio-economic development, which include the enhancement of women's involvement in the formal economic sector. This former strand also posits that income inequality can be curtailed through profitable investment projects, improved financial allocation efficiency and financial access facilities (Galor & Zeira, 1993; Galor & Moav, 2004; Aghion & Bolton, 2005). The perspective that females are averagely less involved in the formal economic sector and relatively poorer than their male counterparts, is an indication that owing to the theoretical

Boamah, 2017; Kusi & Opoku- Mensah, 2018; Bayraktar & Fofack, 2018; Boateng, Asongu, Akamavi & Tchamyou, 2018; Senga, Cassimon & Essers, 2018; Asongu, Batuo, Nwachukwu & Tchamyou, 2018a; Senga & Cassimon, 2018; Gyeke-Dako, Agbloyor, Turkson & Baffour, 2018; Asongu, Raheem & Tchamyou, 2018b; Bokpin, Ackah & Kunawotor, 2018; Dafe, Essers & Volz, 2018).

underpinnings, financial access can curtail the unfavourable effect of inequality on gender inclusion.

The latter or contending strand posits that the benefits of financial access are fundamentally restricted to wealthier factions of the population because they can more easily address the constraints to financial access highlighted in the previous paragraph (Asongu, Nwachukwu & Tchamyou, 2016). Therefore, poorer factions in society are relegated to rely principally on remittances and the informal sector of the economy for financial resources used for, *inter alia*: petty trading, agricultural activities and household subsistence (Beck, Demirgüç-Kunt & Levine, 2007). Futhermore, another reconciling strand of the literature supports positions from the two contending strands by maintaining that the relationship between financial access and inequality is non-linear or non-monotonic (Greenwood & Jovanovic, 1990; Asongu & Tchamyou, 2014). The non-monotonic perspective is involved in this research because the empirical framework is desgined such that interactive regressions are involved in order to articulate the nexus between financial access and proxies for exclusive development (i.e. income inequality and female unemployment).

The viewpoints for, against and conditional relevance of access to finance in the reduction of income inequality can be further motivated by the intensive and extensive margin theories which underpin the relationship between financial access and income distribution (Tchamyou *et al*., 2019; Asongu et al., 2020). First, with regard to the intensive margin theory, access to finance impacts inequality via indirect and direct channels as well as through the consolidation of services received by agents already being served by formal financial institutions (Chipote, Mgxekwa & Godza, 2014). Second, from the position of the extensive margin theory, externalities which involve the population in the periphery or the margins of society can be the outcome of enhanced financial services in the formal economic sector (Odhiambo, 2014; Orji, Aguegboh & Anthony-Orji, 2015; Chiwira, Bakwena, Mupimpila & Tlhalefang, 2016). In the light of this strand of literature, policy syndromes such as intergenerational persistence of inequality can be reduced with the help of improved access to finance to the poorer segments of society such as women (Evans & Jovanovic, 1989; Holtz-Eakin, Joulfaian & Rosen, 1994; Black & Lynch, 1996; Bae, Han & Sohn, 2012; Batabyal & Chowdhury, 2015).

The underpinning of this study that financial access can modulate the effect of inequality on female economic participation is in accordance with both the extensive and intensive margin theories. First of all, the relevance of the intensive margin theory to the

moderating role of financial access in this study is valid because financial access is tailored to affect gender economic inclusion through its interaction with income inequality. This fundamentally concerns those that are already using formal financial services for access to finance. Second, the extensive margin theory is also relevant because financial access which is designed to reduce inequality can be tailored by policy makers to involve the previously unbanked population. In summary, financial access can be leveraged by women to enhance their participation in the formal economic sector when inequality levels are low, compared to when income inequality levels are high. In the light of the motivation in the introduction, compared to men, women experience more income inequality. The theoretical connections between inequality, financial access and economic participation have been discussed above.

3. Data and methodology

3.1 Data

In the light of the motivation of this study, the research focuses on forty-two countries in SSA using annual data for the period 2004-2014. The choices of countries and periodicity are also motivated by data availability constraints at the time of the study, notably: availability of the inequality variables. The data are obtained from five sources. First, consistent with Efobi *et al.* (2018) who are partly motivating this research, three gender economic inclusion variables are sourced from the International Labour Organisation. These are: female labour force participation; female unemployment and female employment. Consistent with Efobi *et al.* (2018), the use of alternative outcome variables is a means of robustness check.

Second, in line with Tchamyou *et al.* (2019), three inequality indicators are employed in the study, namely: the Gini coefficient, the Atkinson index and the Palma ratio. They are sourced from the Global Consumption and Income Project (GCIP). These indicators are also consistent with recent African inequality literature on the importance of engaging more inequality indicators for robustness purposes (Meniago & Asongu, 2018; Tchamyou, 2019, 2020). In accordance with the corresponding literature, the Atkinson index and Palma ratio are used to complement the Gini coefficient because the Gini coefficient does not capture tails or extreme values of the inequality distribution.

Third, the financial access indicator (or private domestic credit) is obtained from the Financial Development and Structure Database (FDSD) of the World Bank. Compared to the deposit moderator, the credit access moderator is more aligned with financial access because it is logically more associated with access to financial resources. In essence, financial system

deposits have to be transformed into credit before women can have the financial resources needed to engage in economic operations.

Fourth, a control variable (i.e. remittances) is obtained from the World Development Indicators (WDI) of the World Bank while another control variable (i.e political stability) is sourced from World Governance Indicators (WGI) of the World Bank. The choice of these two variables in the conditioning information set is motivated both by recent literature and the need to avoid instrument proliferation in the GMM estimation approach. On the one hand, the variables have been used in contemporary inclusive development literature (see Anyanwu, 2011; Meniago & Asongu, 2018; Asongu & Odhiambo, 2019c; Tchamyou, 2019, 2020). Political stability is logically expected to induce a favorable climate for investment and economic activities that engender employment opportunities from which women obviously benefit. As concerns remittances, Anyanwu (2011) and Meniago and Asongu (2018) have recently established that remittances increase inequality in Africa because majority of those migrating abroad are from wealthier sections of society. The perspective of income inequality has been extended to gender inclusion by Asongu and Odhiambo (2018a) who have established that remittances promote gender exclusion in the formal economic sector.

On the other hand, the adoption of limited elements in the conditioning information set in order to avoid concerns pertaining to instrument proliferation is not uncommon in the scholarly GMM-centric literature. Examples of studies that have used no control variable in the GMM-centric literature are Osabuohien and Efobi (2013) and Asongu and Nwachukwu (2017) while Bruno, De Bonis and Silvestrini (2012) is an exampled of another study that has used no control variable. Appendix 1 discloses the definitions of countries; Appendix 2 provides the summary statistics (Panel A) and sampled countries (Panel B) while Appendix 3 captures the correlation matrix.

3.2 Methodology

3.2.1 GMM: Specification, identification and exclusion restrictions

In the light of contemporary literature, the choice of the estimation strategy is consistent with the data behavior (Kou et al., 2012, 2014, 2016, 2019a, 2019b; Li et al., 2014, 2016; Zhang et al., 2019). The choice of the GMM empirical strategy builds on four main justifications which are in accordance with contemporary GMM-centric literature, notably: Tchamyou (2019, 2020) and Asongu and Nwachukwu (2016a). (i) A primary condition for the adoption of the empirical approach is that the number of agents (or countries as in this

research) should be higher than the number of time-related observations from each agent. This is actually the case from the dataset because the panel structure consists of 42 countries with 11 yearly observations (i.e. from 2004 to 2014). (ii) The outcome variables of the study are persistent given that the correlation between their level and first level series' are higher than 0.800 which is a rule of thumb in the establishment of persistence in a variable (Tchamyou *et al.*, 2019). (iii) Endogeneity is addressed in the study from two main perspectives, notably: reverse causality or simultaneity is handled with the help of internal instruments while the unobserved heterogeneity is taken on board by accounting for time-invariant omitted variables. (iv) In the light of the panel data structure used in this study, cross-country differences are engaged in the estimation processes.

Among the available GMM types, this study follows the Roodman (2009a, 2009b) approach which is an extension of Arellano and Bover (1995) that has been established in the contemporary GMM-centric literature to limit the proliferation of instruments and produce more robust estimated coefficients (Boateng, Asongu, Akamavi & Tchamyou, 2018). The following equations in level (1) and first difference (2) summarise the standard *system* GMM estimation procedure.

$$G_{i,t} = \sigma_0 + \sigma_1 G_{i,t-\tau} + \sigma_2 I_{i,t} + \sigma_3 FA_{i,t} + \sigma_4 IFA_{i,t} + \sum_{h=1}^{2} \delta_h W_{h,i,t-\tau} + \eta_i + \xi_t + \varepsilon_{i,t} \tag{1}$$

$$G_{i,t} - G_{i,t-\tau} = \sigma_1(G_{i,t-\tau} - G_{i,t-2\tau}) + \sigma_2(I_{i,t} - I_{i,t-\tau}) + \sigma_3(FA_{i,t} - FA_{i,t-\tau}) + \sigma_4(IFA_{i,t} - IFA_{i,t-\tau})$$
$$+ \sum_{h=1}^{2} \delta_h (W_{h,i,t-\tau} - W_{h,i,t-2\tau}) + (\xi_t - \xi_{t-\tau}) + (\varepsilon_{i,t} - \varepsilon_{i,t-\tau}) \tag{2}$$

where, $G_{i,t}$ is a gender economic participation variable (i.e. female labor force participation, female unemployment and female employment) of country i in period t, σ_0 is a constant, I is an inequality measurement (i.e. the Gini coefficient, the Atkinson index and the Palma ratio), FA reflects a proxy for financial access (or private domestic credit), IFA is the interaction between inequality indicators and financial access ("the Gini coefficient" × "private domestic credit", "the Atkinson index" × "private domestic credit", "the Palma ratio" × "private domestic credit"), W is the vector of control variables (i.e. constisting of remittances and political stability), τ represents the coefficient of auto-regression which is represented by one because in the study, 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. The *two-step* procedure is used instead of the *one step* procedure because it accounts for heteroscedasticity.

3.2.2 Identification and exclusion restrictions

According to the attendant contemporary GMM-centric literature, for a robust specification, the narrative on the identification strategy and the corresponding exclusion restrictions is indispensible (Asongu & Nwachukwu, 2016b; Tchamyou & Asongu, 2017; Boateng *et al.*, 2018; Tchamyou *et al.*, 2019). Borrowing from the corresponding literature, years are acknowledged to represent the strictly exogenous variables while the predermined variables are considered to be elements in the conditioning information set and the independent variables of interest. Roodman (2009b) supports the strategy of exlusion restrictions because he has argued that it is unlikey for years to be endogenous after a first difference[4].

It is worthwhile to note that in the less contemporary instrumental variable (IV) approach, the validity of the identification strategy is assessed with a rejection of the Sargan/Hansen overidentifying restrictions test. Hence the null hypothesis of the corresponding test should not be rejected in order for the instruments to be valid (Demirgüç-Kunt & Levine, 2003; Asongu & Nwachukwu, 2016c; Amavilah, Asongu & Andrés, 2017). However, with a GMM strategy using forward orthogonal variations, the Differnce in Hansen Test (DHT) is employed to examine the validty of exclusion restrictions and related identification strategy. Therefore, when the null hypothesis of the DHT is not rejected, it implies that the instruments are valid in that, they elucidate the outcome variable exclusively through the exogenous components of the predetermined indicators.

4. Empirical results

4.1 Presentation of results

Tables 1-3 below show the empirical findings. Whereas Table 1 discloses nexuses between inequality, financial access and female economic participation, Table 2 is concerned with connections between inequality, financial access and female unemployment. In Table 3, the linkages pertain to associations between inequality, financial access and female employment. Each of the tables comprises three sets of specifications related to each of the inequality variables. For every inequality-specific regression, two estimations are apparent: one with the set of control variables and another without the set of control variables. Four information criteria are employed to investigate whether the estimated models are valid[5]. Based on these

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

[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,*

criteria of information, the estimated models are overwhelmingly valid, with a slight exception of the second column of Table 1 in which, the Hansen test is significant. Accordingly, the Hansen test is usually preferred to the Sargan test because it is more robust. However, contrary to the Sargan test, the Hansen test is weakened by instrument proliferation. A strategy with which to address these conflicting criteria is to adopt the Hansen test and then control for instrument proliferation by making sure that in every specification, the number of cross sections is higher than the corresponding number of instruments.

Consistent with contemporary literature on interactive specifications (Tchamyou & Asongu, 2017), net effects are computed in order to assess the incidence of financial access in modulating the effect of inequality on gender economic inclusion. For instance in the penultimate column of Table 1, the net effect of financial access is modulating the effect of the Palma ratio on female labour force participation is -0.020([0.008× 20.913] + [-0.188]). In this computation, 20.913 is the average value of private domestic credit, -0.188 is the unconditional effect of the Palma ratio while 0.008 is conditional effect from the interaction between the Palma ratio and private domestic credit. It is important to note that, the motivation for using different inequality variables provided in the data section (i.e. that compared to the Gini coefficient, the other inequality indicators capture tails of the income distribution), is reflected in the differences in magnitude of the unconditional estimated inequality coefficients in Tables 1-3.

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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: Inequality, financial access and female economic participation (GMM regressions)

| | Dependent variable: Female Labour Force Participation (FLEPart) | | | | | |
	The Gini Coefficient (Gini)		The Atkinson Index (Atkinson)		The Palma Ratio (Palma)	
FLEPart (-1)	0.945***	0.966***	0.972***	0.969***	0.966***	0.976***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Domesstic Credit (Credit)	0.037	-0.109***	-0.084***	-0.090***	-0.049***	-0.057***
	(0.448)	(0.000)	(0.005)	(0.000)	(0.000)	(0.000)
The Gini Coefficient (Gini)	7.967*	-0.376	---	---	---	---
	(0.066)	(0.824)				
The Atkinson Index (Atkinson)	---	---	-1.647	-1.154	---	---
			(0.319)	(0.176)		
The Palma Ratio (Palma)	---	---	---	---	-0.188***	-0.237***
					(0.002)	(0.000)
Credit × Gini	-0.082	0.179***	---	---	---	---
	(0.368)	(0.000)				
Credit × Atkinson	---	---	0.130***	0.135***	---	---
			(0.003)	(0.000)		
Credit × Palma	---	---	---	---	0.008***	0.009***
					(0.000)	(0.000)
Political Stability	---	0.283***	---	0.233***	---	0.194***
		(0.006)		(0.000)		(0.002)
Remittances	---	-0.069***	---	-0.045***	---	-0.030**
		(0.000)		(0.008)		(0.024)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	na	na	na	na	-0.020	-0.048
AR(1)	(0.069)	(0.027)	(0.053)	(0.034)	(0.048)	(0.035)
AR(2)	(0.552)	(0.457)	(0.213)	(0.280)	(0.178)	(0.189)
Sargan OIR	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Hansen OIR	(0.081)	(0.404)	(0.163)	(0.526)	(0.189)	(0.338)
DHT for instruments						
(a)Instruments in levels						
H excluding group	(0.168)	(0.187)	(0.067)	(0.167)	(0.042)	(0.131)
Dif(null, H=exogenous)	(0.097)	(0.546)	(0.298)	(0.719)	(0.421)	(0.532)
(b) IV (years, eq(diff))						
H excluding group	---	(0.278)	---	(0.241)	---	(0.203)
Dif(null, H=exogenous)	---	(0.502)	---	(0.713)	---	(0.497)
Fisher	18515.47***	3154.84***	1115.85***	360994.68***	896.36***	301881***
Instruments	24	32	24	32	24	32
Countries	41	39	41	39	41	39
Observations	387	349	387	349	387	349

***,**,*: 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. The mean value of private domestic credit is 20.913. na: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant. Constants are included in all regressions.

 The following findings can be established from Tables 1-3. There is a negative net effect from the role of financial access in modulating the effect of the Palma ratio on female labour force participation while there is a positive net effect from the relevance of financial access in moderating the effect of the Gini coefficient on female unemployment. There are also net negative effects from the role of financial access in modulating the Gini coefficient and the Palma ratio for female employment. Most of the significant control variables have the expected signs.

Table 2: Inequality, financial access and female unemployment (GMM regressions)

	Dependent variable: Female Unemployment (FU)					
	The Gini Coefficient (Gini)		The Atkinson Index (Atkinson)		The Palma Ratio (Palma)	
FU (-1)	**0.820*****	**0.955*****	**0.861*****	**0.934*****	**0.861*****	**0.929*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Domesstic Credit (Credit)	**-0.303*****	-0.100	**-0.085***	-0.021	**-0.023***	-0.015
	(0.000)	(0.127)	**(0.071)**	(0.559)	**(0.093)**	(0.215)
The Gini Coefficient (Gini)	**-8.467***	**4.981***	---	---	---	---
	(0.057)	**(0.096)**				
The Atkinson Index (Atkinson)	---	---	-0.108	1.910	---	---
			(0.965)	(0.402)		
The Palma Ratio (Palma)	---	---	---	---	**0.189***	**0.235*****
					(0.071)	**(0.004)**
Credit × Gini	**0.523*****	0.173	---	---	---	---
	(0.000)	(0.111)				
Credit × Atkinson	---	---	**0.119***	0.019	---	---
			(0.099)	(0.725)		
Credit × Palma	---	---	---	---	0.003	0.001
					(0.162)	(0.323)
Political Stability	---	0.103	---	0.226	---	0.148
		(0.711)		(0.404)		(0.517)
Remittances	---	0.021	---	0.006	---	-0.001
		(0.281)		(0.606)		(0.907)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	2.470	na	na	na	na	na
AR(1)	**(0.200)**	**(0.211)**	**(0.201)**	**(0.201)**	**(0.200)**	**(0.205)**
AR(2)	**(0.375)**	**(0.392)**	**(0.421)**	**(0.384)**	**(0.381)**	**(0.371)**
Sargan OIR	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Hansen OIR	**(0.356)**	**(0.908)**	**(0.274)**	**(0.554)**	**(0.248)**	**(0.560)**
DHT for instruments						
(a)Instruments in levels						
H excluding group	**(0.199)**	**(0.194)**	**(0.166)**	**(0.367)**	**(0.261)**	**(0.293)**
Dif(null, H=exogenous)	**(0.409)**	**(0.992)**	**(0.337)**	**(0.577)**	**(0.253)**	**(0.635)**
(b) IV (years, eq(diff))						
H excluding group	---	**(0.501)**	---	**(0.317)**	---	**(0.197)**
Dif(null, H=exogenous)	---	**(0.952)**	---	**(0.662)**	---	**(0.813)**
Fisher	**4978.88*****	**2193.95*****	**662.22*****	**2964.72*****	**2365.19*****	**28224.07*****
Instruments	24	32	24	32	24	32
Countries	39	37	39	37	39	37
Observations	367	329	367	329	367	329

***,**,*: 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. The mean value of private domestic credit is 20.913. na: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant. Constants are included in all regressions.

Table 3: Inequality, financial access and female employment (GMM regressions)

	Dependent variable: Female Employment (FE)					
	The Gini Coefficient (Gini)		The Atkinson Index (Atkinson)		The Palma Ratio (Palma)	
FE (-1)	0.988***	0.993***	0.996***	0.987***	0.996***	0.983***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Domesstic Credit (Credit)	0.035	0.078**	-0.008	0.036	-0.007	0.015*
	(0.565)	(0.022)	(0.777)	(0.213)	(0.358)	(0.067)
The Gini Coefficient (Gini)	-3.278	-5.152**	---	---	---	---
	(0.468)	(0.015)				
The Atkinson Index (Atkinson)	---	---	-2.243	-0.983	---	---
			(0.184)	(0.532)		
The Palma Ratio (Palma)	---	---	---	---	-0.184***	-0.105**
					(0.000)	(0.047)
Credit × Gini	-0.067	-0.133**	---	---	---	---
	(0.550)	(0.022)				
Credit × Atkinson	---	---	0.012	-0.051	---	---
			(0.792)	(0.223)		
Credit × Palma	---	---	---	---	0.001	-0.002**
					(0.428)	(0.012)
Political Stability	---	-0.200	---	-0.113	---	-0.175
		(0.220)		(0.491)		(0.252)
Remittances	---	-0.0003	---	-0.005	---	-0.007
		(0.966)		(0.484)		(0.357)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	na	-7.933	na	na	na	-0.146
AR(1)	(0.142)	(0.148)	(0.147)	(0.148)	(0.148)	(0.147)
AR(2)	(0.261)	(0.247)	(0.310)	(0.292)	(0.293)	(0.257)
Sargan OIR	(0.003)	(0.003)	(0.004)	(0.007)	(0.003)	(0.009)
Hansen OIR	(0.515)	(0.348)	(0.394)	(0.462)	(0.234)	(0.400)
DHT for instruments						
(a)Instruments in levels						
H excluding group	(0.183)	(0.130)	(0.149)	(0.114)	(0.188)	(0.174)
Dif(null, H=exogenous)	(0.608)	(0.548)	(0.501)	(0.723)	(0.273)	(0.555)
(b) IV (years, eq(diff))						
H excluding group	---	(0.098)	---	(0.130)	---	(0.761)
Dif(null, H=exogenous)	---	(0.722)	---	(0.805)	---	(0.209)
Fisher	1382.14***	6472.73***	2565.00***	374187.99***	3226.15***	550463***
Instruments	24	32	24	32	24	32
Countries	39	37	39	37	39	37
Observations	367	329	367	329	367	329

***,**,*: 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. The mean value of private domestic credit is 20.913. na: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant. Constants are included in all regressions.

4.2 Fixed Effects regressions

In order to further assess the robustness of the findings, Fixed Effects (FE) regressions are used to replicate the models in Tables 1-3. The corresponding findings are reported in Table 4 in which political stability is raplaced with education in the conditioning information set. The choice of education as a control variable is consistent with recent literature (Elu, 2018). The purpose of using FE regressions is to account for the unobserved heterogeneity, not considered in the GMM regressions because of the country-specific effects eliminated from the GMM modeling exercise in order to avoid endogeneity resulting from the correlation between the lagged dependent variable and country specific effects. Accordingly, accounting for country fixed effects can mitigate a problem of differences among 42 SSA countries under

study. Unfortunately, while the results are overwhelmingly not significant, they are still reported in order to avoid the concern of publication bias in economics sciences where null or insignificant findings are largely discarded in preference for significant findings (Rosenberg, 2005; Franco et al., 2014; Boateng et al., 2018). Hence, our best estimator is the GMM estimator because it accounts more for concerns of endogeneity that are not accommodated in the FE regressions. The advantages of the GMM technique have been discussed in the methodology section.

Table 4: Inequality, finance and female economic participation (Fixed Effects regressions)

	Dependent variable: Female Economic Inclusion								
	Female Labour Force Participation			Female Unemployment			Female Employment		
Credit	2.194*** (0.000)	0.938*** (0.001)	0.341*** (0.001)	0.637 (0.188)	0.350 (0.190)	0.041 (0.660)	1.318** (0.019)	0.652 (0.065)	0.239** (0.028)
Gini	37.859*** (0.000)	---	---	17.262 (0.113)	---	---	17.642 (0.159)	---	---
Atkinson	---	-12.337 (0.104)	---	---	9.355 (0.191)	---	---	3.925 (0.633)	---
Palma	---	---	0.385 (0.165)	---	---	0.025 (0.921)	---	---	0.227 (0.445)
Credit × Gini	-3.653*** (0.000)	---	---	-1.158 (0.165)	---	---	-2.136** (0.027)	---	---
Credit × Atkinson	---	-1.218*** (0.002)	---	---	-0.547 (0.150)	---	---	-0.813* (0.064)	---
Credit × Palma	---	---	-0.042*** (0.009)	---	---	-0.012 (0.422)	---	---	-0.026 (0.132)
Education	5.174** (0.017)	5.441** (0.014)	5.606** (0.013)	-2.180 (0.304)	-2.545 (0.231)	-2.928 (0.169)	6.509*** (0.008)	5.800** (0.019)	6.432** (0.010)
Remittances	0.166*** (0.000)	0.135*** (0.000)	0.147*** (0.000)	0.236*** (0.000)	0.226*** (0.000)	0.237*** (0.000)	-0.025 (0.514)	-0.050 (0.215)	-0.043 (0.279)
Net Effects	-38.536	na	na	na	na	na	na	na	na
Within R²	0.275	0.236	0.222	0.285	0.284	0.281	0.176	0.174	0.154
Fisher	15.65***	12.79***	11.75***	15.12***	15.01***	14.77***	8.09***	7.97***	7.10***
Countries	36	36	36	34	34	34	34	34	34
Observations	247	247	247	228	228	228	228	228	228

***,**,*: significance levels at 1%, 5% and 10% respectively. The mean value of private domestic credit is 20.913. na: not applicable because at least one estimated coefficient need for the computation of net effects is not significant. Bold values are the significant estimated coefficients and the Fisher Statistics. Constants are included in all regressions.

5. Concluding implications and future research directions

This study assesses how financial access can be used to modulate the effect of income inequality on gender economic inclusion. The focus is on 42 countries in sub-Saharan Africa (SSA) for the period 2004-2014 and the empirical evidence is based on Generalised Method of Moments (GMM) and Fixed Effects (FE) regressions. Financial access is proxied with private domestic credit while inequality is measured with: the Gini coefficient, the Atkinson index and the Palma ratio. Three gender inclusion measurements are involved: female labour force participation, female employment and female unemployment. Significant results are not apparent in the FE regressions. The following main findings are established from the GMM

estimations. There is a negative net effect from the role of financial access in modulating the effect of the Palma ratio on female labour force participation while there is a positive net effect from the relevance of financial access in moderating the effect of the Gini coefficient on female unemployment. There are also net negative effects from the role of financial access in modulating the Gini coefficient and the Palma ratio for female employment. In what follows, the unexpected findings are elucidated and implications are discussed in the light of challenges to Sustainable Development Goal in the sub-region.

In the light of the theoretical underpinnings, financial access was anticipated to modulate inequality dynamics for the promotion of gender economic inclusion. The unexpected effects can be explained from three main perspectives: (i) the prevalent high levels of income inequality in SSA; (ii) low levels of financial access and (iii) very high rates of female economic exclusion. They are substantiated in the same chronology as they are disclosed.

First, high inequality in SSA is constraining the achievement of socio-economic development on a multitude of fronts. Hence, the financial access channel has to be complemented with other policy initiatives in the modulation of the effect of income inequality on gender economic inclusion. Accordingly, high inequality levels may require actionable policies that are implemented simultaneously in order to have a significant effect on modulating the effect of income inequality for a favorable outcome on female economic participation. The narrative is consistent with a recent United Natons report on SDGs which has concluded that tackling the concern of inequality in SSA is fundamental in the reduction of socio-economic exclusion, mitigation of poverty and making considerable progress towards SDGs (UN, 2017). As a main policy implication or recommendation to policy makers, financial access is a necessary but not a sufficient moderator of income inequality for the enhancement of women's participation in the formal economic sector.

Second, the ineffectiveness of financial access may also be traceable to the low financial development in the sub-region and the prevalence of a significant informal economy. As recently documented by Tchamyou *et al*. (2019), access to the formal banking sector in SSA is still very low because many adults do not still own bank accounts. Hence, the overly reliance of women on the informal financial sector as well as cultural issues pertaining to the role of women in society and the economy, may explain why the extensive margin theory is not sufficiently substantiated by the empirical analysis. It is important to recall that the extensive margin theory motivating the analysis posits that elements of society that were

previously excluded from the formal economic sector (i.e. including women) can leverage on financial access to empower themselves financially in order to become involved in the formal economic sector. As a main policy implication or recommendation to policy makers, it is relevant for sampled countries to enhance policies that are designed to boost financial access to previously unbanked women.

Third, existing levels of gender economic participation may be so high that direct policies requiring certain quotas of female economic participation are imposed by policy makers in order to mitigate female economic exclusion to thresholds that can be affected in the moderation of income inequality by financial access. Such a policy framework or recommendation to policy makers for the direct involvement of women should be motivated by the facts that, *inter alia*: (i) women in the sub-region are the poorest and least included in the formal economy in the world and (ii) the exclusion of women represents a significant waste of development resources and no society can sustainably develop (politically, economically and socially) if majority of its population is excluded from contributing to economic development through enhanced participation in the formal economic sector.

In the light of the results, elucidation of findings and corresponding implications policy, it will be worthwhile for future studies to complement financial access with other policy variables to assess how moderating indicators can complement one another to dampen the unfovorable effect of income inequality on gender economic inclusion. Moreover, it would also be relevant to extend extant results by empirically establishing how the findings in this research withstand scrutiny in country-specific frameworks for more targeted country-specific implications.

6. Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendices

Appendix 1: Definitions of Variables

Variables	Signs	Definitions of variables (Measurements)	Sources
Female Economic Participation	FLFpart	Labor force participation rate, female (% of female population ages 15+) (modeled ILO estimate)	ILO
	FU	Unemployment, female (% of female labor force) (modeled ILO estimate)	ILO
	FE	Employment to population ratio, 15+, female (%) (modeled ILO estimate)	ILO
Financial Credit	Credit	Privates Domestic Credits (% of GDP)	FDSD
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 by determining 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
Secondary School	SSE	School enrolment, secondary (gross), gender parity index (GPI)	WDI

WDI: World Bank Development Indicators of the World Bank. FDSD: Financial Development and Structure Database of the World Bank. WGI: World Governance Indicators of the World Bank. ILO: International Labour Organisation. GCIP: Global Consumption and Income Project.

Appendix 2: Summary statistics (2004-2014) and sampled countries

Panel A: Summary statistics

	Mean	SD	Minimum	Maximum	Obs
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
Private Domestic Credit	20.913	24.628	0.873	150.209	440
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
Secondary School Enrolment	0.867	0.214	0.333	1.422	287

S.D: Standard Deviation.

Appendix 3 : Correlation matrix

	FLFpart	FU	FE	Credit	Gini	Atkinson	Palma	PolS	Remit	SSE
FLFpart	1.000									
FU	-0.268	1.000								
FE	0.941	-0.568	1.000							
Credit	-0.257	-0.002	-0.225	1.000						
Gini	-0.091	0.442	-0.215	-0.106	1.000					
Atkinson	-0.073	0.677	-0.288	-0.140	0.752	1.000				
Palma	-0.097	0.605	-0.278	-0.122	0.922	0.911	1.000			
PolS	0.007	0.263	-0.100	0.356	0.287	0.338	0.354	1.000		
Remit	-0.105	0.441	-0.244	-0.087	0.022	0.364	0.209	0.124	1.000	
SSE	-0.240	0.647	-0.409	0.250	0.401	0.599	0.564	0.468	0.500	1.000

FLFpart: Female Labour Force participation. FU: Female Unemployment. FE: Female Employment. Credit: Private Domestic Credit. Gini: the Gini coefficient. Atkinson: the Atkinson index. Palma: the Palma ratio. PolS: Political Stability. Remit: Remittances. SSE: Secondary School Enrolment.

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