ECONOMIC DEVELOPMENT
AND WELL-BEING
RESEARCH GROUP

EDWRG Working Paper Series
September 2023

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Working Paper Number 03-23

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Cite this paper: Asongu S.A., & Odhiambo, N.M. (2023). Microfinance institutions and female entrepreneurship in Sub-Saharan Africa: avoidable female unemployment thresholds. *EDWRG Working Paper Number 03-23.*

Microfinance institutions and female entrepreneurship in Sub-Saharan Africa: avoidable female unemployment thresholds

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Abstract

The present study contributes to the extant literature by assessing how microfinance institutions (MFIs) affect female entrepreneurship, contingent on female unemployment levels. The study focuses on 44 countries in sub-Saharan Africa (SSA) for the period 2004 to 2018. The empirical evidence is based on interactive quantile regressions, which put emphasis on nations with high, low and intermediate levels of business constraints. The analysis is tailored to provide avoidable female unemployment levels in the implementation of policies designed for MFIs to promote female business ownership. The hypotheses that MFIs are favorable for female business owners and some critical rates of female unemployment should be avoided in order for the favorable incidence to be maintained is exclusively valid in the 10^{th} quantiles of the cost of business by females and time to start-up a business by females. Policy implications are discussed. This study has complemented the extant literature by providing actionable female unemployment critical masses that governments can act upon in tailoring the nexus between the relevance of MFIs in the doing of business by females.

Keywords: Africa; Microfinance; Gender; Inclusive development
JEL Classification: G20; I10; I32; O40; O55

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1. Introduction

Four main fundamental motivations in the policy and scholarly literature motivate the positioning of this study on assessing avoidable female unemployment thresholds in order for microfinance institutions (MFIs) to mitigate business constraints such as the cost to startup a business by females and the time required to start-up a business by females (or entrepreneurship). These motivational and policy lapses are: (i) the policy concern of economic development that is not inclusive in sub-Saharan Africa (SSA); (ii) the comparative exclusion of women in the economic sector in Africa; (iii) the relevance of MFIs in driving the business sector, especially as it pertains to self-employment prospects and (iv) gaps in the relevant literature. The underlying four motivational elements are expanded in the same chronology as highlighted in what follows.

First, consistent with the relevant literature focusing on millennium development goals (MDGs) and sustainable development goals (SDGs) (Bicaba *et al*., 2017; Tchamyou, 2020), on the one hand, most countries in SSA failed to achieve most MDGs poverty and inequality targets because the recent period of economic growth resurgence was not leveraged by governments in the sampled countries to promote inclusive development. On the other, if bold policies towards promoting inclusive development are not promoted in the sub-region (Tchamyou, 2020), it is equally projected that most of the countries in the sub-region are unlikely to achieve most 2030 SDGs targets related to poverty reduction and inequality mitigation (Bicaba *et al*., 2017). Accordingly, there is consensus in the literature that SSA is the region that is characterized by the highest rate of exclusive development in the world (Asongu & Nwachukwu, 2016; Tchamyou, 2019). Furthermore, according to Nwani and Osuji (2020), in 2019, SSA outpaced Asia to become the region in the world, habouring the highest number of people living below the international poverty line. According to the extant literature on the subject, gender exclusion is a significant part of the underlying policy syndrome, because women in the sub-region are some of the most excluded from politico-economic activities in the world. Amongst others, mobile banking (Kim, 2022; Awel & Yitbarek, 2022) and MFIs (Ngono, 2021) are some of the documented mechanisms by which gender economic inclusion can be promoted. The present study is framed on providing critical masses of female unemployment that should not be excluded in order for MFIs to promote the doing of businesses, not least, because the exclusion of women from economic activities represents a substantial economic loss in terms of gross domestic product (GDP).

Second, the policy importance of engaging more women in political and socio-economic activities is evidently apparent in SDG5 of the United Nations' Agenda 2030. It is worthwhile to emphasize that SDG5 articulates the relevance of involving more women in social, economic and political activities that are important in the achievement of enhanced economic prosperity and, by extension, the reduction of gender exclusion of all forms in society. To put this underlying policy view in greater perspective, both the scholarly and policy literature support the fact that about 160 trillion USD of GDP is lost as a result of the exclusion of women from most economic activities (World Bank, 2018; Asongu *et al*., 2021a,b). It follows that by providing policy makers with actionable critical levels of female unemployment that should be avoided for MFIs to promote female businesses; the present study is equally premised as a scholarly response to the underlying policy concern of female economic exclusion.

Third, the relevance of MFIs in promoting businesses, especially those owned by the female gender, has been substantially documented in the extant literature (Maldonado & González-Vega, 2008; Kendall *et al*., 2012; Swapna, 2017; Fox & VanDroogenbroeck, 2017; Tariq, 2019; Gasperin *et al*., 2019; Obadha *et al*., 2019; Assairh *et al*., 2020; Ngono, 202). Moreover, the importance of financial access in the achievement of most of the 17 SDGs has also been documented in both the policy and scholarly literature on the subject (Tchamyou *et al*., 2019a; UNCDF, 2022; Abdulqadir & Asongu, 2022). Given this insight, it is not surprising that MFIs are considered as the main channel for the mitigation of female business constraints, a channel that is also considered within the remit of the present exposition owing to an apparent gap in the gender inclusion literature.

Fourth, to the best of our knowledge, the extant contemporary gender inclusion literature has failed to engage the problem statement being considered in the present study. Accordingly, a substantial bulk of the extant literature has been mainly concerned with *inter alia*: the importance of involving more women in education frameworks in view of promoting their contributions in various walks of society (Elu, 2018; Asongu *et al*., 2019); nexuses between

technology, corporate social responsibility and the involvement of more women with economic activities (Uduji *et al*., 2019; Uduji & Okolo-Obasi, 2018, 2019, 2020); linkages between mobile money, MFIs and financial institutions for the enhancement of female economic participation (Ngono, 2021); the nexus between innovations in mobile money and female access to financial services (Kim, 2022); boosting the representation of women in decision-making that engender more prospects of environmental sustainability (Achuo *et al*., 2022); the nexus between political participation and gender (Bezinna *et al*., 2022); interactions between access to finance by women, information technology and innovations in mobile money (Asongu & Odhiambo, 2018a; Osabuohien & Karakara, 2018); and gender differences, especially as it is relates to equitable financial access avenues (Mndolwa & Alhassan, 2020).

Of the highlighted extant studies, the closest in the literature to the present positioning is Ngono (2021) which has examined how MFIs, mobile banking and access to finance from banks promote female self-employment. The main similarity between Ngono (2021) and the present exposition is in terms of data and periodicity. Accordingly, the present study uses the same sample as in Ngono (2021), notably: data from 48 countries in SSA for the period 2004 to 2018. However, three main distinctive features are worth articulating.

(i) While the outcome variable employed in Ngono (2021) is female self-employment, female employment is used in the present study as a control variable, while female unemployment is the moderating variable. Hence, contrary to the underlying study, the objective is not to assess how various mechanisms influence self-employment, but to establish which levels of female unemployment should be avoided in the promotion of female businesses, contingent on the considered MFIs mechanism.

(ii) In terms of methodology, while Ngono (2021) has employed the generalized method of moments (GMM), the present study employs the quantile regressions technique. Accordingly, since the GMM is based on mean values of the outcome variable, blanket policies from the resulting estimations may not be effective, unless such policies are contingent on initial levels of business constraints and hence, tailored differently across countries with varying initial levels of business constraints. The quantile regression technique incorporates these initial levels of the outcome variable in the estimation exercise.

(iii) While the findings of Ngono (2021) provide direct nexuses between the considered channels and the outcome variable, we argue in the present study that, while such linkages are relevant for policy makers, providing policy makers with actionable thresholds of policy syndromes and/or policy variables has greater policy relevance, because policy makers are provided with insights into critical levels of the moderating variable(s) to act upon in order to tailor macroeconomic linkages in the desired direction. Within the remit of the present study, we provide avoidable female unemployment levels in the implementation of policies designed for MFIs to promote females in business.

The remainder of the study is structured as follows. The relevant theoretical insights and corresponding testable hypotheses are disclosed in Section 2, while Section 3 presents the data and empirical strategy. The empirical results are presented and discussed in Section 4, while Section 5 concludes with implications and future research directions.

2. Theoretical underpinnings and testable hypotheses

The section is engaged in three main strands, namely: (i) an exposition of the theoretical basis motivating the study; (ii) some contextualization of the theoretical underpinnings for consistency with the positioning of the present study, and (iii) corresponding testable hypotheses that emanates from the previous-two premises.

First, the theoretical connection between MFIs and female businesses is fundamentally drawn from contemporary literature on the nexus between financial access and inclusive development, granting that female entrepreneurship is a dimension of inclusive development. In accordance with Tchamyou *et al*. (2019a), on the linkage between financial access and inclusive development, financial access from MFIs can promote female businesses from two main theoretical standpoints, notably: the intensive and extensive margin theoretical underpinnings. The two theoretical streams are in accordance with the perspective that inclusive development opportunities become more apparent when the population is provided with enhanced financial access opportunities. The financial access opportunities are provided by MFI, *inter alia*, and such provision constitute avenues by which females can be empowered to engage more in business activities. Moreover, the two theoretical premises are consistent with both contemporary and non-contemporary literature on the subject, especially as it pertains to the theoretical basis of financial access in inclusive development prospects (Greenwood & Jovanovic, 1990; Galor& Zeira, 1993; Galor & Moav, 2004; Aghion & Bolton, 2005; Beck *et al*., 2007; Tchamyou & Asongu, 2017a; Asongu & Odhiambo, 2018a, 2018b). In what follows, the two theoretical premises are substantiated in more perspective.

According to the intensive margin theory, inclusive development, such as the encouragement of women to engage in business activities, can be apparent when financial institutions, such as MFIs provide existing customers of the attendant financial institutions with more opportunities for financial access, such that they benefit from more financial avenues by which to explore opportunities in doing of business (Chipote *et al*., 2014). It follows that when existing female customers of MFIs are provided with enhanced financial access opportunities, the theoretical framework reflected in such a process is the intensive margin theory. Conversely, the extensive margin theory argues that beyond existing MFIs customers, when such financial services are extended to females who were not previously using these MFIs for financial access, such extension of financial services to new female customers provides them with more avenues with which to seize business opportunities, *inter alia* (Odhiambo, 2014; Orji *et al*., 2015; Chiwira *et al*., 2016). The literature on the nexus between financial access and opportunities for inclusive development is largely underpinned by the intensive and/or extensive margin theories (Evans & Jovanovic, 1989; Holtz-Eakin *et al*., 1994; Black & Lynch, 1996; Bae *et al*., 2012; Batabyal & Chowdhury, 2015).

Second, with respect to the contextualization of the theoretical premises, MFIs have been documented to provide access to financial opportunities to both new clients (the extensive margin theory) and existing customers (the intensive margin theory). For example, as argued by Assairh *et al*.(2020), MFIs promote the involvement of more women in, *inter alia*, business activities, which is consistent with the doing of business outcome variables employed in the present study. Moreover, according to Maldonado and González-Vega (2008), MFIs can promote female empowerment through, *inter alia*, a risk management effect, an income impact and a household gender incidence. According to Swapna (2017), female entrepreneurship is promoted by MFIs, while with respect to Tariq (2019), access to MFIs services promote female business prospects within the remit of micro-enterprises. Moreover, there is an abundant supply of literature supporting the role of MFIs in terms of microinsurance and microcredit services (Kendall *et al*., 2012; Fox & VanDroogenbroeck, 2017; Obadha *et al*., 2019). Of the plethora

of externalities from MFIs associated with financial institutions (i.e., premised on the intensive and extensive margin theories), the literature is also consistent with the view that business by the female gender is a fundamental externality (Gasperin *et al*., 2019; Ngono, 2021).

Third, concerning the positioning of this study in view of the discussed empirical and theoretical literature as well as engagement of the relevant stylized facts, MFIs are assumed in the present study to promote female businesses while high levels of female unemployment can dampen the underlying favorable incidence, because information asymmetry on the expected benefits of MFIs can be enhanced with increasing female unemployment levels, *inter alia*. Accordingly, with rising female unemployment levels, there could be a general notion that MFIs are not promoting female businesses, which can further discourage MFIs from promoting the doing of businesses. It follows that the present study posits that MFIs promote female businesses below some critical levels of female unemployment.

Contextualizing the above leads to the following testable hypotheses:

Hypothesis 1: Microfinance institutions are favorable to female businesses.

*Hypothesis*2: Some critical levels of female unemployment should be avoided in order for the favorable incidence in *Hypothesis* 1 to the maintained.

3. Data and methodology

3.1 Data

In light of the motivation of the study in the introduction, the present exposition focuses on 44 countries in SSA for the period 2004 to 2018. The data is obtained from three main sources, notably: (i) World Development Indicators of the World Bank (2020a), (ii) the Financial Access Survey (IMF, 2020), and (iii) the Gender and Parity Statistics for Men and Women of the World Bank (2020b).The number of sampled countries and corresponding periodicity are consistent with Ngono (2021) which is closest to the present study in the literature and which has also employed the same dataset. How this study departs from Ngono (2021) has been clarified in the introduction.

Consistent with the motivation of the study, two main outcome variables are employed, which reflect business constraints, namely: (i) the time it takes for a female to start a business and (ii) the cost it takes for a female to start a business. These two variables are business constraints, because an increase in the numerical value of the respective indicators is associated with an unfavorable business climate. Two principal independent variables are used within the context of interactive regressions: (i) female unemployment rate (considered as the moderating variable) and (ii) MFIs dynamics employed as the main channel. The two MFIs channels are: MFIs per 1000 km2 and MFIs per 100 000 adults.

To account for variable omission bias, six control variables are involved in the conditioning information set, namely: inclusive education, trade openness, female self-employment, and the procedure that females have to go through in order to start a business and own a bank account like men. Apart from these five variables, alternative dependent variables have been included in the specifications as additional control variables.

For instance, when the cost of starting a business is employed as the outcome variable, the time required to start a business is used as the sixth control variable. In the same vein, when the time to start a business is used as the outcome variable, the cost of starting a business is employed

as the sixth control variable. The choice variables in the conditioning information set is motivated by the extant business and inclusive development literature (Duflo, 2012; Asongu & le Roux, 2019; Asongu & Odhiambo, 2019, 2020; Tchamyou *et al*., 2019b; Nchofoung *et al*., 2021; Ngono, 2021; Ofori *et al*., 2021). Concerning the expected signs, because the concern of multicollinearity is overlooked in interactive regressions as argued by Brambor *et al*. (2006), expected signs from variables in the conditioning information set cannot be established with certainty. It is for this reason that in order to take into account the concern of multicollinearity that is overlooked; net effects and/or thresholds are computed. Such computation entails both the conditional and unconditional incidences of the main channels.

The definitions and sources of variables are provided in Appendix 1, while Appendix 2 shows the corresponding summary statistics that are used to assess whether the computed avoidable female unemployment thresholds are within statistical range. The appendix section is completed with a correlation matrix in Appendix 3.

3.2 Methodology

Consistent with the elements of motivation exposed in the introduction, the objective of this study is to assess the nexuses between female unemployment, MFIs and business constraints in terms of the cost of starting a business and the time needed to start a business. Moreover, in accordance with the same motivational elements of the introduction, the quantile regression (QR) approach is employed because it enables the examination of underlying linkages throughout the conditional distribution outcome variables. In other words, the assessment is tailored such that low, intermediate and high initial levels of business constraints are articulated.

Building on the above, the purpose of the present research is to account for nexuses between MFIs, female unemployment and business constraints throughout the conditional distribution of business constraints. Moreover, the QR approach provides more room for policy implications, because it is also motivated by the need to depart from Ngono (2021), which is based on a GMM approach that assesses the investigated linkages at the mean value of the outcome variable. There is a growing body of knowledge on the importance of the QR approach in providing more room for policy implications (Billger & Goel, 2009; Tchamyou & Asongu, 2017b; Boateng *et al*., 2018).

It is worthwhile to emphasize that compared to the OLS technique, which is largely premised on the assumption that associated error terms are normally distributed, with the QR approach, such an assumption is not necessary. This is because the nexuses are assessed throughout the conditional distribution of the dependent variable which is proxied by business constraints in this present study. The narrative is consistent with extant literature on quantile regressions (Koenker & Bassett, 1978; Keonker & Hallock, 2001; Asongu, 2017)

In view of the estimation technique, the θ^{th} quantile estimator of business constraint is derived by solving for the optimization problem in Equation (1), that is provided without subscripts for the purpose of simplicity in the presentation.

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

where $\theta \in (0,1)$. Compared to the OLS approach that is fundamentally based on the sum of squared residuals, the estimation premise on which the quantile regression operates consists of maximising of absolute deviations of the associated quantiles. As a case in point, in the corresponding technique, a multitude of quantiles such as the 75th quantile or the 10thquantile (respectively, corresponding to θ=0.75 or 0.10) are estimated by approximately weighing the residuals. The corresponding conditional quantile of business constraint or y_i given x_i is:

$$Q_y(\theta / x_i) = x_{i'}\beta_\theta \quad (2)$$

where for the relative θth quantile that is modelled, parameters are estimated for unique slopes. The corresponding formulation is parallel to $E(y / x) = x_{i'}\beta$ within the framework of the OLS slope for which, parameters are largely examined at the average of the conditional distribution of business constraints. For the model in Eq. (2), the dependent variable y_i is the *cost it takes for a woman to set up a business* or *time for women to set up a business* while x_i contains a constant term, *female unemployment, MFIs, female self-employment, trade openness, the procedures a woman has to go through to start a business* and *women ownership of bank accounts like men.*

4. Empirical results

The empirical results are presented in this section in Table 1 and Table 2, while Table 1 focuses on nexuses between female unemployment, MFIs and the cost of business start-up, Table 2 is concerned with corresponding linkages pertaining to female unemployment, MFIs and the time to startup a business. Each of the tables is divided into two main panels, focusing respectively on MFIs per 1000 km2 on the left-hand side and MFIs per 100 000 adults on the right-hand side. It is worthwhile to articulate that, in the light of the estimated findings, the selection of the QR approach is justified on the basis of the fact that when the corresponding QR estimates are compared with those of OLS, significant differences are apparent both in terms of significance and magnitude of estimated coefficients.

In order to achieve the goals of this study, as articulated in the introduction and hypothesized in Section 2, thresholds are computed in the light of contemporary interactive regressions literature (Nchofoung & Asongu, 2022a, 2022b; Nchofoung *et al*., 2022). Such thresholds are important in order to address the concern of multicollinearity, as documented in Brambor et al. (2006) on the pitfalls of interactive regressions. Accordingly, in this computation, both the unconditional and conditional incidences of the independent variables of interest are used in the computation.

To put the above in perspective, in the 10th quantile of Table 1 on the left-hand side, the female unemployment thresholds avoidable to maintain the negative effect of MFIs per 1000 km2 on the cost of female business start-up is 0.632 (1.128/1.784) (% of the female labor force). It follows that in Table 1, the tested hypotheses are exclusively valid in the 10th quantile. In other words, the corresponding female unemployment (% of the female labor force) level should not be exceeded in order for MFIs per 1000 km2 to promote entrepreneurship by means of reducing the cost of female business start-ups. The corresponding results in the right-hand side of Table 1 are not specifically applicable to the testable hypotheses because a threshold cannot be computed in order to assess the investigated hypotheses, not least, because both the conditional and unconditional effects have the same signs. In Table 2, focusing on the time for the female to start a business, the tested hypotheses are also exclusively valid in the 10th quantile of both the left-hand side and right-hand side focusing on MFIs per 1000 km2 and MFIs per 100 000 adults, respectively. The corresponding thresholds are 7.032 female unemployment (%

of the female labor force) for nexuses involving MFIs per 1000 km2 and 6.573 female unemployment (% of the female labor force) for nexuses involving MFIs per 100 000 adults. It is important to note that while the female unemployment thresholds are low, some are unreasonable from an economic perspective because it shows that female unemployment targets should be complemented with other policy measures in order to enable MFIs to promote the doing of business by females.

Table 1: Female unemployment, microfinance institutions and cost of female business start-up

	Dependent variable: Cost of female business start up											
	Microfinance institutions per 1000 km2						Microfinance institutions per 100 000 adults					
	OLS	**Q.10**	**Q.25**	**Q.50**	**Q.75**	**Q.90**	**OLS**	**Q.10**	**Q.25**	**Q.50**	**Q.75**	**Q.90**
Constant	-43.449	**-190.98*** **	-39.692	143.450	-255.340	**-147.478***	134.315	**364.77*** **	**496.94*** **	**509.933***	65.332	-70.865
	(0.815)	**(0.000)**	(0.835)	(0.583)	(0.228)	**(0.070)**	(0.561)	**(0.000)**	**(0.004)**	**(0.069)**	(0.812)	(0.503)
FUmpl	**-3.840***	-0.235	-0.335	-4.383	-2.087	**-3.829*** **	**-6.958*** **	**-4.247*** **	**-5.443*** **	**-9.526*** **	-7.018	**-6.921*** **
	(0.041)	(0.315)	(0.870)	(0.124)	(0.359)	**(0.000)**	**(0.005)**	**(0.000)**	**(0.004)**	**(0.003)**	(0.024)	**(0.000)**
Nmfi1	-0.473	**-1.128** **	4.601	1.794	2.511	-1.709	---	---	---	---	---	---
	(0.919)	**(0.044)**	(0.340)	(0.785)	(0.636)	(0.398)						
Nmfi2	---	---	---	---	---	---	3.932	**11.051*** **	**10.609*** **	7.177	8.016	0.009
							(0.294)	**(0.000)**	**(0.002)**	(0.194)	(0.147)	(0.996)
FUmpl× Nmfi1	**4.327** **	**1.784*** **	1.457	**4.835***	2.915	**3.584*** **	---	---	---	---	---	---
	(0.011)	**(0.000)**	(0.455)	**(0.076)**	(0.180)	**(0.000)**						
FUmpl× Nmfi2	---	---	---	---	---	---	**1.526***	0.523**	0.752	1.722	0.669	**1.664*** **
							(0.041)	(0.019)	(0.226)	(0.100)	(0.515)	**(0.000)**
SES	-1.171	0.062	-0.930	**-2.295***	-1.217	**-1.461*** **	-1.318	**-2.263*** **	**-2.544*** **	**-2.568** **	-1.270	**-0.980** **
	(0.172)	(0.553)	(0.315)	**(0.075)**	(0.235)	**(0.000)**	(0.173)	**(0.000)**	**(0.001)**	**(0.044)**	(0.308)	**(0.045)**
Trade	**-0.801** **	**-0.115** **	0.066	-0.490	**-0.917** **	**-1.321*** **	**-0.889*** **	**0.202** **	0.179	-0.322	**-1.215** **	**-1.631*** **
	(0.010)	**(0.010)**	(0.862)	(0.348)	**(0.033)**	**(0.000)**	**(0.006)**	**(0.046)**	(0.527)	(0.496)	**(0.013)**	**(0.000)**
F.SelfEmploy	0.561	**1.947*** **	0.708	-1.278	3.058	**2.274** **	-1.655	**-4.280*** **	**-5.601*** **	**-5.939***	-0.770	1.340
	(0.770)	**(0.000)**	(0.729)	(0.649)	(0.180)	**(0.011)**	(0.525)	**(0.000)**	**(0.004)**	**(0.061)**	(0.804)	(0.265)
TimeBusiness	0.844	**0.606*** **	0.920	1.383	-0.138	**-1.032** **	1.315	**2.225*** **	**1.827** **	**2.845***	2.022	-0.301
	(0.366)	**(0.000)**	(0.432)	(0.390)	(0.915)	**(0.040)**	(0.199)	**(0.000)**	**(0.046)**	**(0.062)**	(0.180)	(0.600)
Startupprocd	**15.237*** **	**4.954*** **	3.561	**14.689** **	**17.978*** **	**20.826*** **	**14.636*** **	**4.239*** **	**6.578***	**12.107***	**13.252***	**19.882*** **
	(0.000)	**(0.000)**	(0.483)	**(0.039)**	**(0.002)**	**(0.000)**	**(0.001)**	**(0.003)**	**(0.091)**	**(0.064)**	**(0.043)**	**(0.000)**
Bankaccount	-0.794	-0.955	-21.002	-21.049	14.212	**30.084*** **	26.249	5.064	0.993	19.740	**56.290***	**39.361*** **
	(0.961)	(0.734)	(0.396)	(0.535)	(0.602)	**(0.006)**	(0.126)	(0.405)	(0.954)	(0.493)	**(0.055)**	**(0.001)**
Thresholds	na	0.632	na	na	na	na	na	na	na	na	na	na
R^2/Pseudo R^2	0.694	0.430	0.323	0.431	0.595	0.704	0.699	0.453	0.391	0.418	0.578	0.693
Fisher	**13.06*** **						**12.84*** **					
Observations	52	52	52	52	52	52	52	52	52	52	52	52

*,**,***: significance levels of 10%, 5% and 1% respectively. OLS: Ordinary Least Squares. R^2 for OLS and Pseudo R^2 for quantile regression. Lower quantiles (e.g., Q 0.1) signify nations where female self-employment is least. FUmpl: Female Unemployment. Nmfi1: microfinance institutions per 1000 km2. Nmfi2: microfinance institutions per 100 000 adults. SES: Secondary female high school enrollment rate. Trade: trade openness. F.SelfEmploy: Female Self-Emloyment. TimeBusiness: The time of women to set up a business. Startupprocd: The procedures a woman has to go through to start a business. Bankaccount: dummy variable who takes the value 1 if women can open bank accounts like men, 0 otherwise. Contract: dummy variable who takes the value the value 1 if women can sign contracts like men, 0 otherwise. Business: dummy variable who takes the value the value 1 a woman can register a business in the same way as a man, 0 otherwise. na: not applicable because at least one estimated coefficient needed for the computation of the threshold is not significant.

Source: authors

Table 2: Female unemployment, microfinance institutions and time for female business start-up

	Dependent variable: Time for female business start up											
	Microfinance institutions per 1000 km2						Microfinance institutions per 100 000 adults					
	OLS	**Q.10**	**Q.25**	**Q.50**	**Q.75**	**Q.90**	**OLS**	**Q.10**	**Q.25**	**Q.50**	**Q.75**	**Q.90**
Constant	**-50.857***	**-25.48*** **	**-36.887***	**-69.47*** **	**-75.470** **	-52.211	**-90.587***	**-40.91*** **	**-60.74*** **	**-72.92*** **	**-80.12*** **	-64.298
	(0.052)	**(0.000)**	**(0.063)**	**(0.001)**	**(0.026)**	(0.219)	**(0.039)**	**(0.000)**	**(0.001)**	**(0.004)**	**(0.002)**	(0.205)
FUmpl	**0.737*** **	**0.827*** **	**1.065*** **	**1.101*** **	**1.080*** **	0.708	**1.038***	**0.883*** **	**1.212*** **	**1.027*** **	1.013	0.884
	(0.002)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.004)**	(0.130)	**(0.064)**	**(0.000)**	**(0.000)**	**(0.002)**	(0.002)	(0.168)
Nmfi1	-0.641	**-0.647*** **	0.434	0.429	0.469	-0.422	---	---	---	---	---	---

	(0.448)	**(0.000)**	(0.396)	(0.421)	(0.587)	(0.702)						
Nmfi2	---	---	---	---	---	---	-1.150	**-0.539*** **	**-0.883** **	**-1.434*** **	-0.398	-0.073
							(0.107)	**(0.000)**	**(0.028)**	**(0.004)**	(0.464)	(0.974)
FUmpl× Nmfi1	0.088	**0.092*** **	0.096	-0.061	-0.022	-0.035	---	---	---	---	---	
	(0.813)	**(0.005)**	(0.670)	(0.794)	(0.953)	(0.942)						
FUmpl× Nmfi2	---	---	---	---	---	---	0.029	**0.082*** **	-0.019	0.064	-0.048	-0.017
							(0.864)	**(0.000)**	(0.811)	(0.556)	(0.666)	(0.938)
SES	0.015	**-0.089*** **	-0.134	0.094	0.017	0.057	0.168	**-0.041***	0.054	0.065	0.116	0.040
	(0.938)	**(0.000)**	(0.189)	(0.376)	(0.921)	(0.794)	(0.444)	**(0.091)**	(0.561)	(0.605)	(0.369)	(0.878)
Trade	**-0.115*** **	**-0.066*** **	-0.025	-0.063	0.027	0.014	**-0.114*** **	**-0.057*** **	-0.058	**-0.085***	-0.064	0.024
	(0.009)	**(0.000)**	(0.538)	(0.146)	(0.688)	(0.871)	**(0.001)**	**(0.000)**	(0.112)	**(0.085)**	(0.203)	(0.813)
F.SelfEmploy	**0.593***	**0.394*** **	0.463	**0.727*** **	**0.754** **	0.534	**1.054** **	**0.529*** **	**0.791*** **	**0.916*** **	**0.890*** **	0.657
	(0.031)	**(0.000)**	(0.029)	**(0.002)**	**(0.036)**	(0.237)	**(0.046)**	**(0.000)**	**(0.000)**	**(0.001)**	**(0.002)**	(0.249)
CostBusiness	0.020	**-0.007** **	0.028	**0.063*** **	0.025	0.033	0.029	0.0003	**0.049*** **	**0.049** **	**0.043***	0.026
	(0.429)	**(0.012)**	(0.150)	**(0.003)**	(0.443)	(0.425)	(0.245)	(0.936)	**(0.005)**	**(0.034)**	**(0.067)**	(0.567)
Startupprocd	**2.720*** **	**1.994*** **	**2.233*** **	**2.141*** **	**2.781*** **	**2.641** **	**2.312***	**2.181*** **	**1.359*** **	**1.998*** **	**2.281*** **	**2.709** **
	(0.007)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.003)**	**(0.022)**	**(0.056)**	**(0.000)**	**(0.006)**	**(0.003)**	**(0.001)**	**(0.046)**
Bankaccount	-1.379	**-5.843*** **	**-8.118*** **	-2.401	-2.039	0.131	-3.535	**-7.132*** **	**-7.052*** **	-6.539**	-0.206	-0.678
	(0.730)	**(0.000)**	**(0.004)**	(0.386)	(0.649)	(0.982)	(0.120)	**(0.000)**	**(0.002)**	(0.029)	(0.945)	(0.911)
Net Effects												
Thresholds	na	7.032	na	na	na	na	na	6.573	na	na	na	na
R^2/Pseudo R^2	0.869	0.750	0.723	0.736	0.754	0.671	0.880	0.750	0.727	0.751	0.755	0.670
Fisher	**119.56*** **						**145.61*** **					
Observations	52	52	52	52	52	52	52	52	52	52	52	52

*,**,***: significance levels of 10%, 5% and 1% respectively. OLS: Ordinary Least Squares. R^2 for OLS and Pseudo R^2 for quantile regression. Lower quantiles (e.g., Q 0.1) signify nations where female self-employment is least. FUmpl: Female Unemployment. Nmfi1: microfinance institutions per 1000 km2. Nmfi2: microfinance institutions per 100 000 adults. SES: Secondary female high school enrollment rate. Trade: trade openness. F.SelfEmploy: Female Self-Emloyment. CostBusiness: The cost of women to set up a business. Startupprocd: The procedures a woman has to go through to start a business. Bankaccount: dummy variable who takes the value 1 if women can open bank accounts like men, 0 otherwise. Contract: dummy variable who takes the value the value 1 if women can sign contracts like men, 0 otherwise. Business: dummy variable who takes the value the value 1 a woman can register a business in the same way as a man, 0 otherwise. na: not applicable because at least one estimated coefficient needed for the computation of the threshold is not significant.

Source: authors

The established findings have confirmed a strand of the literature supporting the view that MFIs are relevant in promoting development outcomes only under certain conditions. In the case of this study, our findings on the favorable relevance of MFIs are contingent on existing levels of female unemployment and business constraints. The findings in the study thus confirm the position that MFIs do not exclusively engender favorable development outcomes without contingencies, notably: "*Although its effects on financial inclusion cannot be denied, microfinance does not only have positive effects on women. Part of the loan obtained is not used in productive activity. This can promote poverty among women who, in this case, will have to repay a loan without a source of income. In fact, like banking, microfinance services are not made for 'poor and hungry people who have no income or reliable means of repayment*" (Assairh *et al*., 2020, p. 403). The underlying position is reflected in the present study in the perspective that some contingencies in terms of business and female unemployment are worthwhile in order for MFIs to promote female entrepreneurship. In essence, while the findings in the 10th quantiles are broadly in line with Tariq (2019) on the relevance of microfinance in promoting female entrepreneurs, the finding from the remaining quantiles are also in line with the studies that question the role of microfinance in promoting entrepreneurship (Brana, 2013).

5. Concluding implications and future research directions

The present study has contributed to the extant literature by assessing how microfinance institutions (MFIs) affect female entrepreneurship, contingent on female unemployment levels. The study focuses on 44 countries in Sub-Saharan Africa (SSA) for the period 2004 to 2018. The empirical evidence is based on interactive quantile regressions, which put emphasis on

nations with high, low and intermediate levels of business constraints. The analysis is tailored to provide avoidable female unemployment levels in the implementation of policies designed for MFIs to promote female business ownership.

The hypothesis that MFIs are favorable for female entrepreneurship and some critical levels of female unemployment should be avoided in order for the favorable incidence to be maintained is exclusively valid in the 10^{th} quantiles of the cost of female entrepreneurship and time to startup a business by females. First, the female unemployment threshold needed to maintain the negative effect of MFIs per 1000 km2 on the cost of a female business start-up is 0.632 female unemployment (% of the female labor force) while corresponding thresholds are 7.032 female unemployment (% of the female labor force) for nexuses involving MFIs per 1000 km2 and 6.573 female unemployment (% of the female labor force) for nexuses involving MFIs per 100 000 adults.

Two main policy implications are apparent from the findings, especially as it pertains to improving business conditions and fighting initial levels of female unemployment in order to promote female entrepreneurship. These two policy implications are expanded in turn. First, it is relevant to improve business conditions because the findings have shown that the tested hypotheses are valid exclusively in quantiles in which business constraints (cost of starting up a business and time required to startup a business by a female) is least. Hence, policy makers have to devise policies that are tailored towards substantially reducing business constraints in order for MFIs to promote businesses. Second, given that the critical levels of female unemployment that should be avoided in order for MFIs to reduce business constraints are quite low, it is worthwhile for policy makers to also work towards implementing policies that mitigate female unemployment. In summary, for MFIs to reduce business constraints contingent on female unemployment, complementary policies designed to reduce business constraints and female unemployment are indispensable. It important to note that while the female unemployment thresholds are low, some are unreasonable from an economic perspective because it shows that female unemployment targets should be complemented with other policy measures in order to enable MFIs to promote the doing of business by females.

The results in this study evidently leave space for future studies, especially in view of assessing how the investigated hypotheses can be valid in other quantiles of the conditional distribution of business constraints. Moreover, considering other mechanisms and moderating variables in assessing how female entrepreneurship can be promoted is worthwhile. In essence, considering the underlying suggestions within the remit of other United Nations' SDGs will improve both scholarly and policy understanding of the subject. Furthermore, future studies should also consider an analysis involving the gender gap by incorporating male unemployment and the doing of business by males.

Compliance with Ethical Standards

Conflict of Interest: The authors declare that they have no conflict of interest.
Ethical approval: This article does not contain any studies with human participants or animals performed by the authors.
Data availability: the data for this research are available upon request.

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Appendices

Appendix 1: Definitions and sources of variables

Variables	Definitions	Sources
Female Self-Employment	Self-employed, female (% of female employment)	WDI (World Bank)
Female Unemployment	Unemployment, female (% of female labor force)	WDI (World Bank)
Education	School enrollment, high, female (% gross)	WDI (World Bank)
Trade	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	WDI (World Bank)
Cost to start business	The cost it takes for a woman to set up a business.	Gender and parity statistics for men and women (2020)
Time to start business	The time it takes for a woman to set up a business.	Gender and parity statistics for men and women (2020)
Start up procedure	The procedures a woman has to go through to start a business	Gender and parity statistics for men and women (2020)
Bank accounts	Dummy variable which takes the value 1 if women can open bank accounts like men, 0 otherwise.	Gender and parity statistics for men and women (2020)
Microfinance 1	Microfinance institutions per 1000 km2.	Financial Access Survey (2020)
Microfinance 2	Microfinance institutions per 100 000 adults	Financial Access Survey (2020)

WDI: World Development Indicators.

Source: authors

Appendix 2: Summary Statistics

	Mean	S.D	Min	Max	Obs
Female Self-Employment	76.840	22.988	11.816	99.081	645
Female Unemployment	9.206	8.512	0.218	38.265	645
Education	43.377	26.076	6.542	112.824	391
Trade	74.769	34.486	19.100	225.023	604
Time to start business	40.416	39.625	4.000	261	635
Cost to start business	108.518	140.472	0.200	1229.100	635
Start up procedure	9.468	3.089	3.000	18.000	635
Bank accounts	0.836	0.370	0.000	1.000	660
Microfinance 1	1.799	1.877	0.020	9.282	97
Microfinance 2	4.189	3.092	0.244	11.532	97

SD: Standard Deviation. Min: Minimum. Max: Maximum.
Source: authors

Appendix 3: correlation matrix (uniform sample size: 52)

	FSE	FUmpl	SES	Trade	Cost	Time	StartupP	Account	Nmfi1	Nmfi2
FSE	1.000									
FUmpl	-0.629	1.000								
SES	-0.631	0.306	1.000							
Trade	0.607	-0.439	-0.196	1.000						
Cost	0.512	-0.295	-0.461	0.160	1.000					
Time	0.103	0.398	-0.213	0.052	0.488	1.000				
StartupP	0.038	0.116	-0.109	0.277	0.481	0.774	1.000			
Account	0.009	0.104	-0.349	0.117	-0.017	-0.032	-0.027	1.000		
Nmfi1	-0.224	-0.363	0.338	-0.199	-0.225	-0.689	-0.492	0.029	1.000	
Nmfi2	0.461	-0.144	0.122	0.184	0.066	-0.202	-0.412	-0.279	0.196	1.000

FSE: Female Self Employment. FUmpl: Female Unemployment. SES: Secondary female high school enrollment rate. Trade: trade openness. Cost: The cost it takes fora woman to set up a business. Time: The time of women to set up a business. StartupP: The procedures a woman has to go through tostart a business. Account: dummy variable who takes the value 1 if women can open bankaccounts like men, 0 otherwise. Contract: dummy variable who takes the value the value 1 if women can sign contracts like men, 0 otherwise. Business: dummy variable who takes the value the value 1 a woman can register a business in the same way asa man, 0 otherwise.Nmfi1: microfinance institutions per 1000 km2. Nmfi2: microfinance institutions per 100 000 adults.
Source: authors