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**Microfinance institutions and gender
health in sub-Saharan Africa**



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Abstract

This research examines the nexus between microfinance institutions (MFIs) and gender health. The current study adopts the quantile regression technique, which assesses the linkage between the variables of interest throughout the conditional distribution of gender health performance, to analyze data for 43 Sub-Saharan African countries. The study uses the risk of maternal death and female life expectancy as proxies for gender health performance, thus obtaining two key findings. First, the study results show that MFIs reduce the risk of maternal death, exclusively in the below-median quantiles of the risk of maternal death distribution. Second, MFIs improve female life expectancy throughout the conditional distribution of female life expectancy. The study further offers policy implications. The paper complements the extant literature by assessing how microfinance institutions affect gender health contingent on initial levels of gender health.

Keywords: Africa; Microfinance; Gender; Health Performance

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

1. Introduction

The positioning of the present study on assessing the nexus between microfinance institutions (MFIs) and gender health in sub-Saharan Africa (SSA) is premised on three fundamentals in the policy and scholarly literature on the subject, notably: (i) the growing policy syndrome of gender exclusion in the region; (ii) the importance of financial inclusion in sustainable development outcomes, especially the United Nations' sustainable development goal (SDG) that is related to health and wellbeing (i.e., SDG3) and (iii) gaps in the extant female health literature¹. These critical elements are substantiated in what follows in the same chronology as highlighted.

First, compared to other regions of the world, the proportion of women who benefit from socioeconomic amenities, which include health services, is considerably limited in SSA. Notwithstanding, the concern of gender exclusion is not specific to SSA because the United Nations Sustainable Development Goals (SDGs) agenda clearly articulates the importance of mitigating gender inequalities in SDG 5. Furthermore, as documented in both policy (World Bank, 2018) and contemporary scholarly (Asongu *et al.*, 2021a, 2021b) literature on the subject, at the global level, the exclusion of women in many walks of life costs about 160 trillion USD in terms of gross domestic product (GDP). It is relevant to note that research evidence shows that financial inclusion improves population health outcomes (Acheampong & Tetteh, 2024).

Second, contemporary policy literature documents the relevance of MFIs as an instrument of financial inclusion in improving socio-economic prospects, including SDGs (UNCDF, 2022). Accordingly, MFIs can be leveraged predominantly by households to gain access to education and health services, *inter alia*. Some inclusive development externalities entail female health performance dynamics in terms of reduced risk of maternal death and increased female life expectancy. In essence, improving female health performance through MFIs is consistent with SDG 3, linked to wellbeing and health, and SDG 5, oriented towards gender equality and female empowerment. Also, using MFIs to improve female health performance is consistent with SDG17 on enhancing the implementation channels, especially in relation to improving the consumption of health services by the female gender (Tchamyou *et al.*, 2019a; Abdulqadir & Asongu, 2022; UNCDF, 2022). Furthermore, the study focuses on an apparent gap in the extant health performance literature.

Third, the attendant studies on health performance have been concerned with, among others, the linkage between life expectancy and educational instruction in the USA (Hansen & Strulik, 2017; Hendi, 2017), with relative insights on how the education of white men and women affect

¹ Gender and female are used interchangeably throughout the study. Moreover, female health performance is understood in terms of reduced risks of maternal death and/or increase in female life expectancy.

the development of the health sector (Olshansky *et al.*, 2012); the influence of education and maternal awareness on Kenyan children's survival rate (Mustafa & Odimegwu, 2008), findings which have been broadly confirmed by McTavish *et al.* (2010) in the context of comparative emphasis on differences between mothers with less education against mothers with more education. Furthermore, African-focused studies have substantially been concerned with the linkage between child mortality and the educational level of the mother (Bado & Susuman, 2016; Shapiro & Tenikue, 2017; Anyamele *et al.*, 2017; Aristovnik *et al.*, 2020); the linkage between child care and immigration that is characterized by highly skilled labour (Immurana, 2022); the nexus between mental health and environmental change (Atwoli *et al.*, 2022) and the linkage between inclusive education and life expectancy (Kouladoun, 2022).

Among the engaged studies in the literature, the closest to the present exposition is Kouladoun (2022), which investigated the linkage between health performance and education in 48 countries in SSA. The empirical strategies used were the generalized method of moments (GMM) and the Driscoll/Kraay technique. The empirical results reveal a positive nexus between life expectancy and inclusive education. However, the two main common denominators between the present research and the underlying study are the focus on SSA and the consideration of health performance as the dependent variable.

Moreover, three principal elements of distinction are also apparent between the present study and Kouladoun (2022). First, health performance is not exclusively understood within the remit of life expectancy because the present study focuses on the risk of maternal death and female life expectancy. Second, this study pinpoints the linkage between MFIs and health performance, while the underlying study highlights the linkage between education and life expectancy. Third, the present exposition assesses the nexus between MFIs and health performance, contingent on existing levels of health performance such that countries with low, intermediate, and high existing levels of health performance respond differently to the nexus between MFIs and health performance. Meanwhile, the results of Kouladoun (2022) are likely to produce blanket policy implications because they rest on average values of the health performance outcome variable. Given the underlying insights, the research question that this study attempts to answer is: how do Microfinance institutions affect gender health in sub-Saharan Africa when we take existing levels of gender health into account?

The rest of the research is structured as follows. The second section provides insights into theoretical underpinnings and attendant testable hypothesis while the data and methodology are provided in the third section. The fourth section discloses the empirical results and the study concludes in the fifth section with implications and future research directions.

2. Theoretical underpinnings and testable hypothesis

The theoretical insights of this study build on recent financial inclusion literature (Tchamyou *et al.*, 2019b), which has established the nexus between financial inclusion and inclusive development. MFIs in this study are a means of financial inclusion while health performance (i.e., in terms of risk of maternal death and female life expectancy) can also be acknowledged as an aspect of inclusive development. This section is engaged in three main strands, notably: (i) a statement of the theoretical underpinnings; (ii) insights into how the theoretical underpinnings are contextualized within the remit of this study and (iii) the testable hypothesis that is in line with the previous two strands.

First, building on Tchamyou *et al.* (2019b), the relevance of instruments for financial inclusion such as MFIs in boosting development that is inclusive can be seen from two main theoretical angles, namely: the intensive margin and extensive margin theoretical insights. The two angles of the theoretical insights are in accordance with the perspective that when people are provided with opportunities for improving their socio-economic conditions, they leverage these opportunities to enhance their standards of living in many walks of life. These theoretical viewpoints are in line with both current and less current studies on the relevance of inclusive finance 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; Tchamyou, 2019, 2020).

With regard to the intensive margin theory, enhancing economic development that is inclusive can be apparent when extant clients within a financial establishment are offered more financial access avenues (Chipote *et al.*, 2014). Conversely, according to the extensive margin theory, when the attendant financial services are provided to a population that did not previously have access to financial services, an extensive theoretical postulation is apparent because most of those to whom such financial services are extended are from the poorer fraction of the population or the financially-excluded societal margin (Odhiambo, 2014; Orji *et al.*, 2015; Chiwira *et al.*, 2016). Accordingly, the female gender that is excluded from the formal financial transactions can benefit from these novel financial service opportunities to reduce risks of maternal death as well as improve prospects of higher life expectancy. The extensive margin theoretical postulation is consistent with the extant contemporary and non-contemporary literature (Evans & Jovanovic, 1989; Holtz-Eakin *et al.*, 1994; Black & Lynch, 1996; Bae *et al.*, 2012; Batabyal & Chowdhury, 2015).

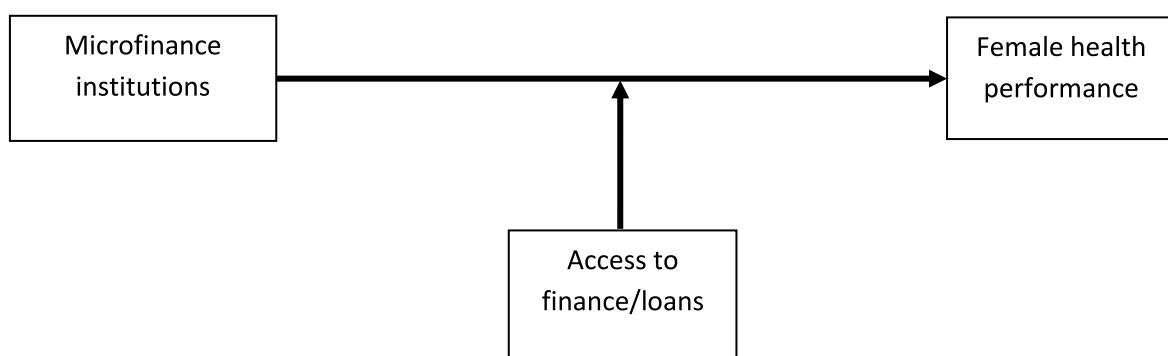
The second strand of the study is concerned with a contextualization of the theoretical insights of the first strand within the motivation of the present study. As previously discussed, MFIs have been documented to provide opportunities of access to finance to new (i.e. the extensive margin theory) as well as existing (i.e. the intensive margin theory) clients. For example, as posited by Assairh *et al.* (2020), MFIs are important in promoting female inclusive development. This narrative is consistent with Maldonado and González-Vega (2008) who have shown that gender empowerment is an

externality of MFIs, through *inter alia*, risk management and changes in household income, which do not preclude the possibility of using the corresponding income to improve female life expectancy and correspondingly reduce the risk of maternal death. According to Swapna (2017), MFIs promote female entrepreneurship while Tariq (2019) has established that MFIs boost micro-enterprises that are run by women. In essence, beyond the offer of microcredits, the extant studies supporting the relevance of MFIs in providing microinsurance services, include insurance against potential health issues such as the risk of maternal death and low life expectancy (Kendall *et al.*, 2012; Fox & Van Droogenbroeck, 2017; Gasperin *et al.*, 2019; Obadha *et al.*, 2019; Ngono, 2021). It is relevant to note that both the intensive and extensive margin theories are used as theoretical underpinnings. Accordingly, the intensive margin theory applies when MFIs increase their services to existing customers while the extensive margin theory is when MFIs increase their services beyond existing customers.

Third, reconciling the first-two strands of this section leads to the following testable hypothesis that is formulated on the discussed premise of the relevance of MFIs in promoting female development outcomes, which entail favorable health externalities. As clarified in the introduction, female health performance is understood in terms of reduced risks of maternal death and/or increase in female life expectancy. Moreover, before formulating the hypothesis, in the light of the theoretical contextualization, it is relevant to clarify that within the remit of the study, females are empowered when fewer die from maternal birth and/or when females live longer.

Hypothesis 1: Microfinance institutions improve female health performance in terms of reduced risk of maternal death and increased female life expectancy.

Figure 1: Conceptual framework



The corresponding conceptual framework underlying the testable hypothesis is provided in Figure 1. In the light of the conceptual framework, MFIs affect female health performance, contingent on access to finance/loans. Whether the conceptual framework withstands empirical scrutiny is a matter of empirical scrutiny which is the focus of the next section.

3. Data and methodology

3.1 Data

The present exposition is concerned with a panel of 43 nations in SSA based on data from 2004 to 2018 which are obtained from a plethora of sources, namely: (i) Kouladoum (2022) for the health performance and control variables; (ii) Ngono (2021) for the MFIs independent variable of interest and (iii) the World Bank's World Development Indicator (WDI) which is the primary source of the corresponding data². Furthermore, given that the data is sourced from two main studies that are close to the present exposition (Ngono, 2021; Kouladoum, 2022), it is relevant to articulate that the selected number of countries and corresponding periodicity are motivated by constraints in data availability at the time of this study. Building on the motivational elements, especially on the front of departing from Kouladoum (2022), two main outcome variables are employed in the study, notably: risk of maternal death and female life expectancy. The corresponding variables have been established in the extant literature to be relevant proxies for health performance (Hansen & Strulik, 2017; Hendi, 2017; Chen *et al.*, 2021).

Building on the extant literature on female empowerment (Ngono, 2021) and elements of the motivation of this study, MFIs are used as the main independent variables of interest. Furthermore, to take in account concerns surrounding variable omission bias that can potentially compromise the estimated coefficients, five main variables are involved in the conditioning information set, notably: trade in services, inflation, savings, gross domestic product (GDP) growth, and female education. These determinants of health performance have been documented in the extant literature on health sector development (Jakovljevic *et al.*, 2016; Hendi, 2017; Shapiro & Tenikue, 2017; Hansen & Strulik, 2017; Shahraki, 2019; Aristovnik *et al.*, 2020; Kouladoum, 2022). The expected signs are engaged in what follows.

First, as argued in the attendant literature (Assari, 2018; Tahir, 2020; Kouladoum, 2022), trade in services is expected to considerably improve the performance of the health sector, especially as it is related to female life expectancy and the risk of maternal death. In essence, trade and trade in services have been documented to improve health performance by Assari (2018) and Tahir (2020), respectively. Furthermore, the expected signs cannot be established with 100% certainty because the nexus also depends on whether the incremental income from trade in services is evenly distributed across the population in order to avail the corresponding population with supplementary income that can be used to address health concerns.

² The 43 countries are: “Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo Democratic Republic, Congo Republic, Côte d’Ivoire, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, South Africa, South Sudan, Sudan, Tanzania, Togo, Uganda, Zambia and Zimbabwe”.

Second, the incidence of inflation on the performance of the health sector is contingent on if the attendant inflation is high or low/stable. In essence, whereas high inflation levels have been established in the extant literature to mitigate purchasing power and boost extant levels of poverty, *ceteris paribus* (Asongu, 2013), stable and/or low levels of inflation are essential for increased living standard and economic development. Moreover, as posited by Kelsey and le Roux (2017, 2018), investors prefer to engage their economic activities in economic environments that are not characterized by concerns of ambiguity, which stem from high price volatility or substantial risks of inflation. Consequently, the expected sign of inflation on health performance depends on the height/rate of inflation.

Third, savings represent a proxy for financial development because banks fundamentally have an objective to mobilise savings and subsequently transform these savings into credit for economic operators (Alam *et al.*, 2021). These economic operators include those operating in the health sector. Hence, the potential positive linkage between savings and health performance from a macroeconomic perspective. Furthermore, at a microeconomic level, the availability of savings implies that households can have recourse to the saved funds in time of need, especially in scenarios of health risks such as the risk of maternal death and corresponding concerns that influence female life expectancy. Moreover, the value of savings being used for inclusive development purposes is also contingent on the value of these savings in the short, medium and long terms. Hence, extant interest rates on savings and price volatility can reduce the value of savings and corresponding purchasing power (Lien *et al.*, 2021), and hence, influence health performance in the opposite direction.

Fourth, whereas it is expected that economic growth is associated with higher levels of socio-economic amenities which include public goods such as improved health access (Kunze, 2014; He & Li, 2020; Chen *et al.*, 2021), in countries in which poor governance is the order of the day, it can be expected that the fruits of economic prosperity are not equitably distributed across the population and thus, leading to poor health services accompanying economic growth.

Fifth, education has been established to be associated with improved health performance in a substantial bulk of the literature (Mustafa & Odimegwu, 2008; McTavish *et al.*, 2010; Olshansky *et al.*, 2012; Hansen & Strulik, 2017; Hendi, 2017). This is essentially because literacy informs people on the benefits of health services, especially as it pertains to risks of maternal death and measures that are necessary to improve life expectancy. Hence, female education is expected to reduce the risk of maternal death and increase female life expectancy. The definitions of the variables as well as corresponding sources of the attendant variables are disclosed in Appendix 1 while the summary statistics is captured in Appendix 2. Accordingly,

Appendix 1 provides the definitions of variables in which, various variables used in the study are provided. Moreover, the correlation matrix is provided in Appendix 3.

3.2 Methodology

Motivated by the elements of the introduction, which propose to depart from Kouladoum (2022) in terms of methodological positioning, the present research adopts an empirical strategy that is tailored such that initial levels of the outcome variable are put in perspective. In other words, the methodology adopted in the present study is one that allows for variations in the manner in which the outcome variable responds to the main independent variable of interest. In other words, the variations are such that countries with low, intermediate and high initial levels of the outcome variable respond differently to the independent variable of interest. Put in the context of the exposition, it is expected that health performance dynamics respond differently to MFIs when such health performance dynamics are at low, intermediate and higher initial levels of the conditional distribution of attendant health performance dynamics. In other words, the incidence of MFIs on female health performance is assessed throughout the conditional distribution of female health performance.

In the light of the above, the quantile regressions (QR) estimation approach is adopted for the purpose of investigating the testable hypothesis because it is consistent with the motivational elements of examining the main independent variable on the outcome variable as the outcome variables varies in terms of its initial values. The underlying justification for the choice of the QR estimation strategy in the light of the problem statement is consistent with narratives in the attendant QR-centric literature (Billger & Goel, 2009; Tchamyou & Asongu, 2017b; Boateng *et al.*, 2018).

It is equally imperative to articulate that compared to the ordinary least squares (OLS) approach that is fundamentally motivated on the assumption that error terms are distributed normally, the QR approach is not based on an assumption of normality, which is the reason, unit root and cointegration tests do not constitute preliminary tests prior to QR implementation. The underpinnings for application of the empirical approach are also in accordance with the extant contemporary and non-contemporary literature on the empirical approach (Koenker & Bassett, 1978; Keonker & Hallock, 2001; Asongu, 2017).

Against the above background, the θ^{th} quantile estimator of female health performance is derived by solving for the optimization problem in Equation (1), that is provided without subscripts in view of improving simplicity in presentation.

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

where $\theta \in (0,1)$. Comparing the OLS technique, which are largely based on reducing the total sum of residuals that are squared, with the quantile regression framework, the estimation operationalization is tailored such that absolute deviations in the attendant quantiles are maximised instead. For instance, in the QR approach, the multitude of quantiles such as the 75th quantile (respectively, corresponding to $\theta=0.75$) is reduced by weighing the residuals approximately. The corresponding conditional quantile of female health performance or y_i given x_i is:

$$Q_y(\theta / x_i) = x_i' \beta_\theta \quad (2)$$

where for the relative θ th quantile that is estimated, parameters are modelled such that they are specific in terms of unique slopes. The corresponding formulation is parallel to $E(y / x) = x_i' \beta$ when an OLS slope is considered in which, parameters are largely assessed at the average of the conditional distribution of female health performance. For the model in Eq. (2), the dependent variable y_i is the female health performance indicator while x_i contains a constant term, *MFIs*, *trade in services*, *inflation*, *savings*, *gross domestic product (GDP) growth* and *female education*. It is relevant to note that the female health performance indicator considered as the outcome variable can either be risk of maternal death or female life expectancy, as apparent in the findings presented in the empirical results section that follows.

4. Empirical results

The empirical findings are presented in this section in Table 1, which is divided into two main sections. The left-hand side (LHS) of the table shows findings on nexuses between MFIs and risk of maternal death, while the right-hand side (RHS) correspondingly shows results on linkages between MFIs and female life expectancy. It is important to note that since the nexuses are assessed throughout the conditional distribution of the outcome variables, the bottom quantiles of the LHS show situations in which the risk of maternal health is less whereas the corresponding top quantiles depict situations in which the risk of maternal health is more. In the same vein, on the RHS, the bottom quantiles show a situation where female life expectancy is low while the corresponding top quantiles show a scenario where female life expectancy is comparatively low.

For the testable hypothesis that is enunciated and motivated in Section 2 to be valid, MFIs should negatively affect the risk of maternal death and positively influence female life expectancy. Based on the findings provided in Table 1, the testable hypothesis is valid on the LHS exclusively in the bottom quantiles of the conditional distribution of the risk of maternal death while it is valid on the RHS throughout the conditional distribution of female life expectancy. In other words, MFIs reduce the risk of maternal death exclusively in below-median quantiles of the risk of maternal death distribution while MFIs improve female life expectancy throughout the conditional distribution of female life expectancy.

It is important to further articulate how this study departs from Kouladoum (2022) in terms of conditional findings. This is essentially because, in accordance with the motivation of this study, the findings of Kouladoum, (2022) are somehow blanket because the author concludes that inclusive education promotes health performance. However, our findings are conditional in the perspective that MFIs reduce the risk of maternal death in countries in which the risk of maternal death is below the median of risk of maternal death. It follows that MFIs are not significantly instrumental in reducing the risk of maternal death in counties in which the risk of maternal death is already above the median of risk of maternal death. Moreover, while MFIs increase female life expectancy throughout the conditional distribution of female life expectancy, the responsiveness of female life expectancy to MFIs increases in terms of magnitude from the 10th to the median or 50th quantile before decreasing at the 75th quantile and ultimately increasing again at the 90th quantile. Hence, the nexus is S-shape when viewed throughout the conditional distribution of female life expectancy.

Most of the control variables are significant with the expected signs according to the narrative in the data section, notably: (i) trade in services reduces the risk of maternal death and increases female life expectancy (Assari, 2018; Tahir, 2020; Kouladoum, 2022). (ii) The incidence

of inflation is ambiguous not least, because such is contingent on the rate of inflation and corresponding price volatility, as well as on initial levels of the outcome variable. (iii) Savings, which is a proxy for financial development, reduces the risk of maternal death and increases life expectancy (Alam *et al.*, 2021; Lien *et al.*, 2021). (iv) While GDP is likely to improve health performance (Kunze, 2014; He & Li, 2020; Chen *et al.*, 2021), in the presence of exclusive growth, the opposite effect can be apparent as recently documented in African-centric inclusive development literature (Bicaba *et al.*, 2017; Asongu & le Roux, 2019; Nwani & Osuji, 2020; Tchamyou, 2021). (v) Female education improves health performance because it overwhelmingly increases female life expectancy and reduces the risk of maternal death (Mustafa & Odimegwu, 2008; McTavish *et al.*, 2010; Olshansky *et al.*, 2012; Hansen & Strulik, 2017; Hendi, 2017).

Table 1: Microfinance institutions and female health performance

	Dependent variable: Health Performance											
	Risk of maternal death						Female life expectancy					
	OLS	Q.10	Q.25	Q.50	Q.75	Q.90	OLS	Q.10	Q.25	Q.50	Q.75	Q.90
Constant	5.385*** (0.000)	4.407*** (0.000)	4.617*** (0.000)	5.849*** (0.000)	5.789*** (0.000)	8.010*** (0.000)	44.721*** (0.000)	43.953*** (0.000)	41.936*** (0.000)	41.698*** (0.000)	44.471*** (0.000)	50.327*** (0.000)
MFI	-0.043* (0.085)	- (0.000)	-0.051* (0.097)	-0.034 (0.296)	-0.046 (0.424)	0.017 (0.809)	1.356*** (0.000)	1.350*** (0.000)	1.376*** (0.000)	1.654*** (0.000)	1.092*** (0.001)	1.361*** (0.000)
Tradeserv	-0.037** (0.011)	- (0.002)	- (0.921)	- (0.011)	-0.028 (0.048)	-0.034 (0.237)	-0.030 (0.053)	0.091*** (0.385)	0.058 (0.442)	0.042 (0.020)	-0.127 (0.144)	-0.157** (0.090)
Inflation	0.024** (0.014)	- (0.002)	-0.0006 (0.921)	0.017** (0.011)	0.024** (0.048)	0.017 (0.237)	0.072* (0.053)	0.007 (0.385)	0.014 (0.442)	0.125** (0.020)	0.086 (0.144)	0.060* (0.090)
Savings	- (0.000)	- (0.000)	- (0.004)	- (0.000)	- (0.004)	-0.020 (0.287)	0.130 (0.071)	0.308*** (0.000)	0.282*** (0.000)	0.163** (0.041)	0.045 (0.599)	0.064 (0.217)
GDPg	0.044 (0.329)	0.049*** (0.005)	0.025 (0.365)	-0.010 (0.726)	-0.0004 (0.993)	0.024 (0.724)	-0.330 (0.100)	-0.493*** (0.000)	-0.384*** (0.000)	-0.214 (0.426)	-0.455 (0.132)	-0.440** (0.017)
FemEdu	- (0.000)	- (0.000)	- (0.000)	- (0.000)	- (0.001)	- (0.000)	14.914*** (0.000)	10.110*** (0.000)	13.037*** (0.000)	14.144*** (0.001)	21.505*** (0.000)	15.519*** (0.000)
R ² /Pseudo R ²	0.842	0.627	0.627	0.629	0.662	0.708	0.851	0.714	0.672	0.630	0.647	0.655
Fisher	58.15***						35.56***					
Observations	46	46	46	46	46	46	49	49	49	49	49	49

*, **, ***: significance levels of 10%, 5% and 1% respectively. OLS: Ordinary Least Squares. R² for OLS and Pseudo R² for quantile regression. Lower quantiles (e.g., Q 0.1) signify nations where health performance is least. MFIs: Microfinance finance institutions. Tradeserv: Trade in services. GDPg: Gross Domestic Product growth. FemEdu: Female Education.

Concerning how the established findings connect with the extant literature, the findings of the study are broadly consistent with extant studies that have shown the positive relevance of MFIs in female socio-economic empowerment (Assairh *et al.*, 2020), *inter alia* via: (i) household risk management and income prospects (Maldonado & González-Vega, 2008), which obviously entail more opportunities for the improvement of health performance and (ii) enhancement of microeconomic and insurance opportunities linked to female entrepreneurship (Kendall *et al.*, 2012; Fox & Van Droogenbroeck, 2017; Swapna, 2017; Gasperin *et al.*, 2019; Obadha *et al.*, 2019; Ngono, 2021), which obviously engender externalities in terms of female benefits.

5. Conclusion, implications, limitations, and future research directions

5.1. Conclusion

This research has examined the nexus between microfinance institutions (MFIs) and gender health using data from 2004 to 2018 in 43 countries in sub-Saharan Africa. The empirical strategy that is adopted is the quantile regression technique, which enables an assessment of the linkage throughout the conditional distribution of gender health performance. Gender health performance is understood in terms of risk of maternal death and female life expectancy. From the findings, MFIs reduce the risk of maternal death exclusively in below-median quantiles of the risk of maternal death distribution while MFIs improve female life expectancy throughout the conditional distribution of female life expectancy.

5.2. Policy implications

The two main policy implications are discussed in what follows. First, policies designed to enhance MFIs should be consolidated in the sampled countries in view of improving female health performance within the remit of reducing the risk of maternal death. Moreover, the findings should be tailored such that above-median countries in terms of risk of maternal death are given more policy attention, not least, because MFIs do not significantly reduce the risk of maternal death in top quantiles of the risk of maternal death distribution. Two complementary measures could be considered by policy makers in order to increase the relevance of MFIs in reducing the risk of maternal death: (i) design policies that reduce initial levels of risk of maternal death to below-median levels in order for existing MFIs to have a negative effect on the corresponding risk of maternal death and (ii) enhance the penetration of MFIs in the above-median sample in order to prospect significant negative linkages between MFIs and the risk of maternal death in the top quantiles of the risk of maternal death distribution.

Second, given the S-shape nexus between MFIs and female life expectancy, policy makers should be cognizant of the perspective that blanketed MFIs policies designed to improve female life expectancy are unlikely to succeed unless these policies are contingent on initial levels of female life expectancy and hence, tailored differently across countries with low, intermediate and high initial levels of female life expectancy. In other words, initial conditions of sampled countries determine the responsiveness of female life expectancy to MFIs.

5.3 Limitations and future research directions

A limitation in this study is that more gender inclusion variables can still be considered to improve insights from the analysis, especially as it pertains to other gender economic inclusion and political variables. Hence, findings in this study can be improved by reconsidering the analysis within the remit of other female development outcomes that are relevant in promoting SDG 5 premised on gender politico-economic inclusion. Another limitation of this study is that

findings from quantile regressions are associated with broad policy implications. Hence, country-specific studies should also be considered with the relevant time series estimation approaches in order to disclose findings with more focused policy implications on the considered countries.

Appendices

Appendix 1: Definitions and sources of variables

Variables	Definitions	Sources
Panel A: Dependent variables		
Risk of maternal death	Lifetime risk of maternal death (1 in: rate varies by country)	WDI (World Bank)
Female life expectancy	Life expectancy at birth, female (years)	WDI (World Bank)
Panel B: Independent variable		
Microfinance institutions	Microfinance institutions per 1000 km ²	Financial Access Survey (2020)
Panel C: Control variables		
Trade in services	Trade in services (% of GDP)	WDI (World Bank)
Inflation	Inflation, consumer prices (annual %)	WDI (World Bank)
Savings	Gross savings (% of GDP)	WDI (World Bank)
GDP growth	Gross Domestic Growth (GDP) growth	WDI (World Bank)
Female Education	School enrollment, secondary (gross), gender parity index (GPI)	WDI (World Bank)

WDI: World Development Indicators. GDP: Gross Domestic Product.

Appendix 2: Summary Statistics

	Mean	S.D	Min	Max	Obs
Risk of maternal death	103.157	201.013	10	1200	602
Female life expectancy	60.720	6.889	44.846	82.000	645
Microfinance institutions	1.799	1.877	0.020	9.282	97
Trade in services	17.755	15.084	2.855	114.719	560
Inflation	8.114	18.556	-8.974	379.999	625
Savings	18.462	11.965	-19.902	57.850	506

GDP growth	4.467	5.168	-46.082	37.998	637
Female education	0.880	0.206	0.332	1.388	380

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

Appendix 3: correlation matrix (uniform sample size: 46)

	ltrmd2	lifexpfem	MFls	Tradeserv	Inflation	Savings	GDPg	FemEdu
ltrmd2	1.000							
lifexpfem	0.855	1.000						
MFls	0.453	0.601	1.000					
Tradeserv	0.413	0.120	0.174	1.000				
Inflation	-0.043	-0.002	-0.450	-0.252	1.000			
Savings	0.471	0.432	-0.171	-0.200	0.284	1.000		
GDPg	0.030	-0.064	0.256	0.384	-0.575	-0.262	1.000	
FemEdu	0.816	0.741	0.408	0.421	-0.243	0.361	0.292	1.000

ltrmd2: lifetime risk of maternal. Lifexpfem: life expectancy at birth. MFls: Microfinance institutions.

Tradeserv: Trade in services. GDPg: Gross Domestic Product growth. FemEdu: Female Education.

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