

Ebissa, Tarekegn Tariku; Asfaw, Arega Seyoum; Lakew, Deresse Mersha

Article

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Women's participation and cost efficiency in microfinance institutions: a Sub-Saharan study

Tarekegn Tariku Ebissa^a , Arega Seyoum Asfaw^a and Deresse Mersha Lakew^b

^aJimma University, Jimma, Ethiopia; ^bEthiopian Civil Service University, Addis Ababa, Ethiopia

ABSTRACT

This study aims to examine the factors influencing the cost efficiency of microfinance institutions in Sub-Saharan African countries. A ten-year unbalanced panel data consisting of 128 microfinance institutions from 34 countries was used for the analysis. The study included all microfinance institutions in Sub-Saharan Africa that reported to the Microfinance Information Exchange database and had financial reports for at least five consecutive fiscal years between 2009 and 2018. The cost efficiency of the institutions was investigated using a stochastic frontier approach. The findings indicate that microfinance institutions operating in Sub-Saharan African countries are operating beyond the cost frontier line, with only 13% demonstrating efficiency. Key determinants of cost efficiency in microfinance institutions in SSA include the size of the institution, cost per borrower, women's participation, institutional type, and country income category. Notably, increased women's participation as board members, loan officers, and borrowers significantly improves cost efficiency. Microfinance institutions are encouraged to transform their custom practices in line with the rapid changes in the technology and techniques of modern financial service provisions and ensure the involvement of women in board members, supervisory positions and borrowing services. We also recommend that institutions appoint women selectively on nominated work positions.

IMPACT STATEMENT

The primary aim of the study is to investigate the association between women participation and cost efficiency of microfinance institutions. The study examines the participation of women in microfinance institutions from five engagement perspectives, namely board member, management member, loan officer, regular staff and borrowing services. As expected, women's participation on the board, as loan officer and borrower improve the cost efficiency of microfinance institutions in SSA. The findings indicate that allowing women to be engaged in these three positions can significantly enhance the cost efficiency of the microfinance institutions. It is advisable to employ women selectively in designated work positions within microfinance institutions.

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1. Introduction

Access to affordable traditional financial services remains limited in Sub-Saharan Africa (SSA) countries, particularly for low-income individuals, the uneducated, and women (Mlachila et al., 2016). A World Bank report shows that 80% of adults in developing economies have no access to formal financial institutions to save their money while they are using informal and costly methods to save (Pazarbasioglu et al., 2020). Most low-income people, women, and small-scale business enterprises have no easy access to affordable financial services offered by larger banks and insurance companies in many developing economies. Microfinance institutions (MFIs) are designed to serve those people excluded from traditional financial services due to their low economic status, less creditworthiness (Azad et al., 2016) and costly of monitoring and administering small loans that prioritized by poorest class (Churchill, 2018; Tadesse Abate et al., 2014).

CONTACT Tarekegn Tariku Ebissa  tarekegnt.04@gmail.com  Jimma University, Jimma, Ethiopia.

Tarekegn Tariku Ebissa is an academic staff at Wallaga University, Nekemte, Ethiopia.

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Despite their contributions in creating inclusive financial services, MFIs in SSA are struggling with financial inefficiency and noneconomic problems. A study conducted by Gebremichael and Gessesse (2016) concludes that the technical efficiency of MFIs in SSA is below average, at only 48.9%. Below average cost efficiency is also recognized in the MFIs of the region. According to Abdulai and Tewari (2016), the cost efficiency of MFIs in the region is limited to 40.09%. A brief report released by the CGAP¹ research team reflects the existence of multidimensional challenges facing the institutions in the region. The institutions are characterized by holding assets with poor quality, smaller loan size, less access to capital market, weak governance, absence of transparency, and operating in unstable economic and political conditions (Glisovic et al., 2012). These challenges might magnify the inefficiency of MFIs in the region.

As the challenges stand, however, the contributions of women to the cost efficiency of MFIs remain fertile research ground in SSA literature. According to MIX (2021) report, women can engage in five different activities in MFI operations. They could act as a borrower, board member, loan officer, manager and normal staff (personnel) in the day-to-day activities of the institutions. Though these engagements explain why the roles of women are multidimensional in the operations of MFIs, the existing empirical literature has failed to address the significance of the roles, particularly from the loan officer, manager and normal personnel aspects.

The possible reason for this gap is the existence of one side perception with stakeholders of the matter. Because of the disadvantaged group considerations, women are recognized as potential clients of MFIs rather than potential servants of the institutions. This has pressed scholars to focus only on borrowers' and board members' gender diversity aspects in their studies. As a result, many empirical studies have focused on assessing the roles of women only from borrowers' and board members' gender diversity perspectives (Adusei, 2019; Abdulai & Tewari, 2016; Mori et al., 2015; Hermes et al., 2011). This study attempts to fill this gap by assessing the significance of five roles of women in the cost efficiency of MFIs in SSA countries.

This study aims to assess the association between women's roles and the cost efficiency of MFIs in SSA. Specifically, the association between gender diversity in borrowers, board members, managers, loan officers and regular personnel and the cost efficiency of MFIs was widely addressed. Thus, this study is the first in its scope across SSA empirical studies to address the five roles of women in the efficiency of MFIs. On the other hand, the findings of the study enhance the generalizability of the study results from two aspects. First, a larger number of MFIs operating in SSA countries were considered for a longer period (2009–2018). Second, an advanced data analysis technique, that is, the stochastic frontier approach (SFA), was employed to analyze the collected data. Moreover, the study findings inspire policymakers and the governing body of MFIs to recognize the contributions of women in the cost efficiency of MFIs from five scenarios of gender diversity.

The study results reveal that the size of the microfinance institution, cost per borrower, women's engagement, forms of microfinance institutions and country income category are major determinants of the cost efficiency of the institutions. In particular, women's representation in board members, borrowing services and appointments to loan officer positions significantly improve the cost efficiency of MFIs in SSA. Structurally, the remaining contents of this study are presented in five major sections. Related theoretical and literature reviews are presented in the second section. The research methodology and design are presented in the third section. The fourth section presents the empirical findings, and the fifth section summarizes the conclusions and managerial implications of the study findings. Policy implications and suggestions for future research are presented in the sixth section.

2. Theoretical and empirical literature review

Efficiency measures the success of a firm in reaching its optimal target at minimized cost in the given timeframe. Efficiency encompasses two complementary financial goals of a firm: cost minimization and profit maximization (Srairi, 2010). It realizes the maximum possible outputs by spending fewer potential resources in business operations. Cost efficiency measures the achievement of a firm in attaining an optimal output level at the lowest possible cost (Nguyen & Pham, 2020; Hassan & Sanchez, 2009) relative to its best-practiced firm operating in similar conditions. The cost effectiveness of MFIs is the focus of this study.

This section presents the reviewed literature from theoretical and empirical aspects of firm efficiency. Different theories have emerged to illustrate the association between workforce gender diversity and

firm efficiency. The “value-in-diversity perspective” is the most mentioned perspective in recent studies. The perspective proposes that gender diversity in the workforce brings alternative views and knowledge to the decision-making process by increasing the availability of information (Abou-El-Sood, 2021; Brahma et al., 2020; Xie et al., 2020). In line with the view of the “value-in-diversity” hypothesis, Abou-El-Sood (2021) concluded that the presence of females on a board has a meaningful implication in making investment decisions. The author stated that female directors take into caution bank resources, the strength of its capital base and the essential return and related risk to accept or reject investment with less risky or risky opportunities. As a result, female director on a board brings ethical/societal perspectives and new resources to the decision-making process.

Furthermore, Xie et al. (2020) argued that gender diversity promotes the innovation efficiency of a team by generating information and creating social benefits. The authors justify that women are competent in facilitating communication, sharing information, creating a common understanding and building social benefits. The presence of three or more women on a board enhances the financial performance of a firm (Brahma et al., 2020). The authors believe that women are empowered to have enough managerial power, better information and time to influence decision-making as they hold executive positions.

From another perspective, resource dependency theory suggests that a firm accumulates advisory and guidance benefits and get access to potential resources and communication channels when its board is a composite of gender (Duppatti et al., 2019). In their study, Brahma et al. (2020) and Duppatti et al. (2019) suggested that gender diversity on a board enhances the financial performance of a firm by preventing an individual or group of individuals with similar opinions from dominating the decision-making process. It also increases managerial accountability and the quality of monitoring roles. These suggestions also have meaningful implications for gender diversity from an agency theory perspective. This means that women’s participation on a board and in executive positions could minimize agency problems by preventing conflicts of interest and deceptive operations in a firm. In line with the postulate of agency theory, many empirical studies have confirmed the presence of a positive relationship between broad gender diversity and the financial performance of a firm (Brahma et al., 2020; Duppatti et al., 2019).

However, social identity theory has evolved with contradictory opinions. The theory suggests that individuals may use age and gender as attributes to create their personal category (in-group) and other social groups (out-group) with the desire to either share or deny existing facts (Trepte & Loy, 2017). The summarized literature in the study of Ali et al. (2014) realized that social categorization maximizes the difference between in-group and out-group. These social arrangements erode group cohesion, smooth communication and cooperation. In-group members are considered as more trustworthy, honest and cooperative than out-group members. This results in less collaboration with out-group members and may lead to intensive agency problems.

Fortunately, Ali et al. (2014) could not find adequate evidence that confirms the presence of a negative relationship between board gender diversity and the financial performance of firms, consistent with the propositions of social identity theory. The unfortunate is the absence of adequate empirical investigations that justify the view of aforementioned theories from SSA microfinance institutions perspectives. Our study primarily aimed to fill the literature gap from SSA countries lookouts.

On the other hand, the findings of the existing empirical literature are also helpful to use in the study of the efficiency of MFIs. A field report conducted in Ethiopia confirms the difficulty of achieving notable outreach and attaining cost efficiency at a time due to the existence of a systematic trade-off (Tadesse Abate et al., 2014). Other study conducted in Africa countries on microfinance institutions’ financial sustainability and outreach depth confirms the existence of a tradeoff between the two aspects (Churchill, 2018). In addition, Hermes et al. (2011) provided strong evidence that shows the presence of negative association between outreach to the poor and efficiency of MFIs. According to Churchill (2018; Hermes & Lensink, 2011), microfinance institutions are ignoring social mission for ensuring their financial sustainability. Thus, the outreach of microfinance institutions is becoming an opportunity cost for efficiency of the institutions.

Further studies are realizing that determinants of the efficiency of MFIs in SSA countries are multidimensional. According to Oteng-Abayie et al. (2011), an institution’s age, outreach, productivity and cost per borrower play significant roles in determining the economic efficiency of MFIs. Specifically, the

authors confirm the existence of positive relationship between cost per borrower and the efficiency of MFIs. The authors perceive that microfinance institutions invest their time and resources on monitoring, training and advising customers improve efficiency level than those do not; thus, MFIs operating in Ghana have the opportunity of enjoying economics of scale. However, investigation of Abdulai and Tewari (2016) was not successful to suggest the association between cost per borrower and cost efficiency of MFIs in SSA.

In another study, Abdulai and Tewari (2016) suggested that total assets, operating expense to assets ratio, average loan balance per saver, the percentage of female borrowers and borrowers per staff member are the key determinants of cost efficiency of MFIs. Particularly, the authors suggested that lending to more women magnifies the cost inefficiency of MFIs in SSA. Likewise, Hermes et al. (2011) argues that MFIs with larger women borrowers and lower average loan balances are less efficient. However, Agostinho et al. (2021) confirms that providing financial services to women and disadvantaged people makes MFIs financially more profitable and sustainable. This finding fortifies the view of Fadikpe et al. (2022) and Hermes and Lensink (2011) which stated that women borrowers outperform male borrowers in repaying a loan and reliability.

Considerable study findings also exist in the literature regarding the roles of firm ownership structure (form) and operating location in efficiency of MFIs. The study finding of Tadesse Abate et al. (2014) revealed that cooperative form of MFIs is more efficient in managing costs than the specialized form of MFIs. In a similar vein, Hassan and Sanchez (2009) concluded that formal MFIs (banks & credit unions) are technically more efficient than informal MFIs (not-for-profit organizations & nonfinancial institutions). However, the study findings of Agostinho et al. (2021) and Gebremichael and Gessesse (2016) contradict the aforementioned conclusions: nonbank financial institutions (NBFIs) and nongovernmental organizations (NGOs) are financially more efficient than credit union or bank forms of MFIs. A related study performed by Tilahun (2021) states that the legal status and location of MFIs significantly determine the financial performance of financial institutions in SSA. These findings suggest the existence of a considerable role of a firm ownership structure, legal status and location in the efficiency of microfinance institutions. Interesting research findings and reports are also available regarding the role of a country's income category in the efficiency of MFIs. According to Hassan and Sanchez (2009) MFIs operating in South Asia are more efficient than those in Latin America and MENA countries. Moreover, Glisovic et al. (2012) added that MFIs in SSA regions perform worse than MFIs in other regions regarding asset quality and cost management.

Empirical studies assessing the impacts of governing mechanisms applied in MFIs have also drawn meaningful research insight. For instance, Mori et al. (2015) claim that attributes of board members have a significant impact on the performance of microfinance institutions. They stated that the outreach performance of MFIs is improved when the board members become more independent, include females, and clear separation of duties exists between the chief executive officer (CEO) and the chairperson. Similar study findings are revealed in the study of Kyereboah-Coleman and Osei (2008). In related study, Adusei (2019) stated that the effect of board gender diversity on technical efficiency of microfinance institutions depends on the size of the institution. According to the opinion of the author, the presence of female on the boards in smaller microfinance institution hurts technical efficiency of the institution and vice versa. In other words, larger microfinance institutions are benefited from board gender diversity than the smaller one in relation to technical efficiency.

However, existing empirical evidence regarding other roles of women in the cost efficiency of MFIs is not insightful for those operating in SSA countries. More focus has been paid to assessing the roles of women only from borrower and board member points of view (Adusei, 2019; Churchill, 2018; Mori et al., 2015). Nevertheless, women are engaged in day-to-day operations of MFIs as managers, loan officers and regular personnel. Thus, in addition to addressing other determinants, this study aims to understand the relationship between women's participation in managerial, regular personnel and loan officer positions and the cost efficiency of MFIs in SSA.

3. Materials and methods

3.1. Sampling and data source

This study aims to investigate the cost efficiencies of MFIs in SSA countries from the perspective of women's participation. Microfinance institutions operating in SSA countries were selected based on the availability of adequate data. In addition, the following three conditions were used to sample the MFIs. First, a microfinance institution licensed to operate in a specific SSA country with a specified form of financial institutions was considered. Second, microfinance institutions that presented annual financial reports to the global microfinance information exchange (MIX – market)² database between 2009 and 2018 were selected. Third, those MFIs that did not present annual reports to the MIX–market database for at least five concurrent fiscal years within the indicated timeframe were excluded from the study. Subsequently, we extracted secondary data for 128 MFIs operating in 34 Sub-Saharan Africa (SSA) countries and obtained an unbalanced panel dataset for 930 observations.

3.2. Variable definition and measurement

The variables used in this study were grouped as dependent variable (total cost), input prices, output values, firm-specific and country-specific factors. The detailed definition and measurement for each variable are presented in Table 1 with essential remarks.

3.3. Model specification

In this study, the stochastic frontier approach (SFA) proposed by Battese and Coelli (1995) is applied to examine the cost efficiency of MFIs. The stochastic frontier approach is a parametric approach that allows researchers to analyze panel data for stochastic production, cost and/or profit functions. The approach uses an econometric model and specifies the disturbance term in terms of inefficiency term and the idiosyncratic error. Unlike the nonparametric approaches (such as data envelopment analysis (DEA)), SFA provides an effective estimation of the efficiency level by separating inefficiency terms from other stochastic shocks (Battese & Coelli, 1995). Parametric and nonparametric approaches are also different in research findings consistency. According to Nguyen and Pham (2020) argument, cost efficiency scores estimated under the SFA are more consistent than under the DEA model. Moreover, the SFA has the empirical advantage of allowing researchers to introduce country-specific or firm-specific variables into the stochastic frontier model (Srairi, 2010) for further investigation. On the other hand, the parametric approach is less sensitive to multicollinearity problems and outliers effects. However, the SFA is criticized for the functional form specification and normal distribution assumptions imposed on the efficient frontier models. According to Dong et al. (2014) suggestion, functional form misspecifications would subject to inaccurate efficiency score estimation.

As presented in this section, the translog frontier function for cost efficiency estimation is derived from the total cost of sampled MFIs. Total cost (TC) efficiency measures the minimum possible input cost incurred by a firm to achieve the targeted maximum output relative to its best performer. The TC function associates the price incurred to use inputs—such as labor, funds, and physical capital to produce outputs—such as net loan portfolios and other earning assets.

$$TC_{ijt} = f(z)_{ijt} + \varepsilon_{ijt} \quad (1)$$

$$\varepsilon_{ijt} = v_{ijt} + u_{ijt} \quad (2)$$

The stochastic TC function for MFI_i operating in specific country j across time period t is defined in terms of the explanatory variables z_{ijt} and the disturbance term ε_{ijt} . The disturbance term is further

divided into random shock (v_{ijt}) and actual inefficiency term (u_{ijt}). To do this, the translog stochastic cost function is adopted in this study.

$$\begin{aligned}
 \ln\left(\frac{TC}{PPC}\right)_{ijt} = & \alpha_0 + \alpha_1 \ln\left(\frac{Labor}{PPC}\right)_{ijt} + \alpha_2 \ln\left(\frac{Fund}{PPC}\right)_{ijt} + \alpha_3 \ln(Loan)_{ijt} + \alpha_4 \ln(OEA)_{ijt} \\
 & + \alpha_5 \frac{1}{2} \left[\ln\left(\frac{Labor}{PPC}\right)_{ijt} \right]^2 + \alpha_6 \frac{1}{2} \left[\ln\left(\frac{Fund}{PPC}\right)_{ijt} \right]^2 + \alpha_7 \frac{1}{2} [\ln(Loan)_{ijt}]^2 + \alpha_8 \frac{1}{2} [\ln(OEA)_{ijt}]^2 \\
 & + \alpha_9 \ln\left(\frac{Labor}{PPC}\right)_{ijt} * \ln\left(\frac{Fund}{PPC}\right)_{ijt} + \alpha_{10} \ln\left(\frac{Labor}{PPC}\right)_{ijt} * \ln(Loan)_{ijt} + \alpha_{11} \ln\left(\frac{Labor}{PPC}\right)_{ijt} * \ln(OEA)_{ijt} \\
 & + \alpha_{12} \ln\left(\frac{Fund}{PPC}\right)_{ijt} * \ln(Loan)_{ijt} + \alpha_{13} \ln\left(\frac{Fund}{PPC}\right)_{ijt} * \ln(OEA)_{ijt} + \alpha_{14} \ln(Loan)_{ijt} * \ln(OEA)_{ijt} \\
 & + \alpha_{15} T + \alpha_{16} \ln\left(\frac{Labor}{PPC}\right)_{ijt} * T + \alpha_{17} \ln\left(\frac{Fund}{PPC}\right)_{ijt} * T + \alpha_{18} \ln(Loan)_{ijt} * T + \alpha_{19} \ln(OEA)_{ijt} * T \\
 & + \frac{1}{2} \alpha_{20} T^2 + u_{ijt} + v_{ijt}
 \end{aligned} \quad (3)$$

The stochastic frontier approach assumes that the total cost deviates from the targeted cost because of the random disturbance term v_{ijt} and the inefficiency term u_{ijt} (Battese & Coelli, 1995). The disturbance term (v_{ijt}) represents a truncated random error due to measurement error from explanatory variables and is assumed to be independent and identically distributed from u_{ijt} with $N(0, \sigma_v^2)$. The inefficiency term (u_{ijt}) represents the nonnegative random variable that estimates the inefficient effects and is assumed to follow an asymmetric half normal distribution in which both the mean u and the variance σ_u^2 are varied. Furthermore, parametrization techniques suggested by Battese and Coelli (1995) and used in Lu et al. (2018; Srairi, 2010) for σ_v^2 and σ_u^2 are applied in this study: these are $\sigma^2 = \sigma_v^2 + \sigma_u^2$ and $\gamma = \sigma_u^2 / (\sigma_v^2 + \sigma_u^2)$.

The coefficient of parameter γ lies between 0 and 1. The variance of the inefficiency effects is null when the coefficient of parameter γ equals zero (Battese & Coelli, 1995). A small inefficiency effect is recognized as γ being close to zero and a larger inefficiency as γ being close to one (Srairi, 2010). Moreover, a linear homogeneity assumption is imposed on the input prices of labor and funds, and the total cost by normalizing them in terms of the price of physical capital (PPC) before taking their logarithms (Lu et al., 2018; Srairi, 2010). In this case, the cost efficiency (CE) scores for each MFI are estimated using the function: $CE_{ijt} = 1 / \exp(u_{ijt})$.

According to Battese and Coelli (1995), a one-step stochastic frontier model can be used to identify predictors of the efficiency of a firm. The stochastic frontier approach uses the maximum likelihood estimation technique to predict the parameters included in the frontier model. In this study, the following alternative model is formulated to assess the determinants of the cost inefficiency of MFIs after estimating the inefficiency scores through the translog stochastic cost function.

$$\begin{aligned}
 u_{ijt} = & \beta_0 + \beta_1 \ln firmsize_{ijt} + \beta_2 \ln ROA_{ijt} + \beta_3 \ln Costperbro_{ijt} + \beta_4 Boardg_{ijt} + \beta_5 Mgmtg_{ijt} + \beta_6 Femalebr_{ijt} \\
 & + \beta_7 \ln Femalestaf_{ijt} + \beta_8 Femaleof_{ijt} + \beta_9 Income_{ijt} + \beta_{10} Type_{ijt} + z_{ijt}
 \end{aligned} \quad (4)$$

where, \ln is the natural logarithm function, u_{ijt} is cost inefficiency score, $firmsize$ is total assets of MFI, ROA is the return on assets, $Costperbro$ is cost per borrower, $Boardg$ is board gender diversity in %, $Mgmtg$ is management gender diversity in %, $Femalebr$ is the proportion of women borrowers in %, $Femalestaf$ is number female personnel and $Femaleof$ is female loan officer in %. Income is income category of the MFI's country; Type is legal status of MFI and z_{ijt} is the disturbance term in inefficiency determinants estimation.

4. Results and discussion

4.1. Attributes of cost efficiency of MFIs in SSA

A stochastic frontier approach was employed to assess the attributes and determinants of the cost efficiency of MFIs in SSA. An unbalanced panel data set was obtained from the annual reports of 128 selected microfinance institutions. The data set covers ten-year annual reports between 2009 and 2018. The data analysis begins in this section by classifying it into two main sections. The first section presents the basic attributes of cost efficiency and the second section presents the factors affecting the cost efficiency. The attributes of cost efficiency are analyzed based on evidence presented in [Table 2](#) and [Table 3](#) (see the [appendix](#)).

MFIs operating in the SSA region realize cost efficiency below the expected average value, which is only 13.07% demonstrating efficiency. Remarkable efficiency score differences are observed among the sampled MFIs. The cost efficiency of MFIs operating in the region varies between 87 and 2%. On average, MFIs operating in Angola are more cost efficient than those operating in other countries of SSA. MFIs operating in Angola are ranked first by realizing the largest cost efficiency score (87%), followed by Mali and the Congo Republic for scoring 24 and 17% on average, respectively. In contrast, MFIs from Uganda, Malawi and Sudan are the most cost-inefficient financial institutions, realizing less than 10% cost efficiency scores on average. In general, country-specific attributes such as economic policy and political stability are the most likely reasons for the existence of such cost efficiency score discrepancies among the MFIs in the region.

There is no significant difference in the cost efficiency level among other types of MFIs, except for the bank form of MFIs. The cost efficiency of the bank form of MFI (9.4%) was less than that of the other forms of MFI, on average. Similarly, there is no remarkable cost efficiency score variation among the income categories of the MFI countries. However, upper-middle income countries were less efficient in cost management (9.56%) than other income category countries. Regarding the time trend, cost efficiency scores varied between 12.5 and 13.59%, without showing a significant score difference between 2009 and 2018. This means that almost uniform cost efficiency level is observed from period to period. This implies that MFIs in SSA have the tendency to follow routine and customized financial service provision strategies. Thus, the institutions are characterized by slow or weak self-adaptation to human resource reform, new operating techniques and innovative financial technology.

In general, MFIs in the SSA region are either slowly adopting or not adopting financial innovations and new strategies, regardless of the existing vacuum to improve cost efficiency by almost 87%. These results have another insightful implication. It shows the presence of opportunity for improving cost efficiency up to 87% by implementing financial innovation and new service provision strategies. These reforms contribute to the cost efficiency of institutions by minimizing potential resource wastage and ensuring efficient utilization of existing assets. These findings are consistent with the study findings of Glisovic et al. (2012) and Oteng-Abayie et al. (2011).

4.2. Cost inefficiency of MFIs

The cost frontier model is statistically significant and acceptable for analysis for three reasons (see [Table 3](#)). First, the chi-square test of zero coefficient variation in the model was rejected at the 1% significance level ($\chi^2 = 2043.13$). This implies that the explanatory variables have significantly explained the existing variations in the cost efficiency model and that the coefficients of the parameters are highly different from zero. Second, the value of sigma-squared ($\sigma^2 = 0.4216, 8.0330$) was significant at the 1% significance level, implying that the estimate of the parameters is highly significant. Third, the estimated value of Gamma ($\gamma = 0.7694, 77\%$) is also highly significant at the 1% significance level, which implies that a significant amount of variation is derived from the inefficiency of the MFIs, while the variance due to random error is small. In addition, the coefficient of eta (η) (0.0337) is closer to zero, and the value is significant, implying that there is no significant difference between the results of the time-invariant and time-varying decay frontier models in this study. However, a time-varying decay frontier model is preferred to understand the features of changes in the cost inefficiency of the MFIs across time.

Furthermore, Table 3 depicts the statistical relationship between input prices, output values, and the cost inefficiencies of MFIs. The estimated parameters for all input prices and output values show the existence of a statistically significant relationship with the cost inefficiency of MFIs, except for the other earning assets (OEA) variable. As expected, the price of labor and funds increases the cost inefficiency of the institutions. It is obvious that a higher input price produces a higher total cost; however, the magnitude of the price of funds differs in two ways. First, the elasticity of the price of a fund ($\alpha_2=15.1082$, $\alpha_6 = -20.2819$ and $\alpha_9 = -2.3964$) is greater than the elasticity of other input prices and output values in the absolute value terms. This implies that more emphasis should be given to the management of deposits and borrowings available in the hands of MFIs. In particular, deposits and borrowings existing without conversion to loans and incurring interest expenses over their existence period need regular and careful management. For instance, deposits and borrowings producing financial costs but not bearing better financial rewards should put in productive operation or repaid before their maturity period. Second, the price of funds has a statistically significant but negative and quadratic form of association with cost inefficiency. This indicates that deposits and borrowings start to recover the cost efficiency of MFIs after reaching some level of inefficiency. The institutions take this advantage if they are effective in interest expense management and enhancing interest rate spreads.

On the other hand, the effect of output values for net loan portfolio ($\alpha_3 = 0.2265$ and $\alpha_7 = 0.0514$) was positive and statistically significant at the 5% significance level in relation to cost inefficiency. This implies that MFIs in the SSA region are inefficient in the wise utilization and follow up of net loan portfolios (assets), which have significantly contributed to the cost inefficiency of institutions. Moreover, multiplicative input and output terms have both positive (refer to the coefficient of α_{13}) and negative (refer to the coefficient of α_9 and α_{10}) significant impacts on cost inefficiency. This shows the existence of spaces for further improvement in cost efficiency. There is also a significant but weak effect of time trend ($\alpha_{20} = 0.0904$) at the 10% significance level. The price of labor is the only input price significantly contributing to the inefficiency of MFIs across the time-period. This result provides another implication that MFIs in SSA are operating in a costly labor force. Workforces operating the institutions are not recompensing relative to the cost incurred to purchase the labor force and the MFIs were not regularly adopting human resource reforms that improve the efficiency of the labor force.

4.3. Determinants of cost inefficiency

Table 4 (see the (appendix)) presents regression outcomes for factors determining the cost inefficiency of MFIs in the SSA region. The chi-square test and log-likelihood function confirm the good fitness of all proposed models, and they are highly efficient at 1% significance level to explain the existing variations in each model. Variables that are significant in the first model also remain significant in the estimation of the other model. This suggests the robustness of the study findings.

As stated, this study is designed to assess the participation of women in the cost efficiency of MFIs. Women's role in MFI was categorized into five engagements: board member, management member, borrowers, loan officer and normal staff (personnel). These roles were introduced to the proposed models separately and together with other explanatory variables to identify the relative importance of women's roles. We also assessed the effects of other explanatory variables such as firm size, return on assets, cost per borrower, country income group and type of MFI. To do this, we have developed three alternative models. As depicted in Table 4, the regression outputs of the first model show the significance of all variables in cost inefficiency. The regression outputs in the second model deal with only the significance of other explanatory variables. The regression outputs in the third model depict only the significance of women's roles. Except for ROA, upper middle-income group and bank form of MFIs, the effects of other variables are significant at least once in the estimation of the proposed models.

Accordingly, a statistically significant and positive association was observed between MFI size and cost inefficiency. In other words, there is an inverse association between MFI size and cost efficiency in the SSA region. Having a larger amount of total assets does not guarantee the cost efficiency of MFIs. The cost efficiency of institutions decreases as the level of total assets increases. The finding shows that

larger MFIs in SSA are not capable of enjoying cost advantages and economies of scale due to the existence of weak asset management skills. This has two side economic implications. On the one hand, existing economic resources (assets) in MFIs do not generate the expected returns, which might be due to underutilization. On the other hand, those idle resources incur expenses, most likely in the form of depreciation, wastage or rental (for example, idle buildings), which magnifies the cost inefficiency of the institutions. This finding contradicts the conclusion of Abdulai and Tewari (2016) but is consistent with the opinion of Glisovic et al. (2012).

As expected, cost per borrower hurts the cost efficiency of microfinance institutions in SSA. The operating costs incurred to facilitate issues related to active borrowers significantly contribute to the total costs of a microfinance institution. MFIs operating in SSA can add more advantages if they are effective in managing borrower related operating costs. This result is consistent with the findings of Abdulai and Tewari (2016) and Oteng-Abayie et al. (2011). MFI's country income-group does matter for the cost efficiency of a given microfinance institution. Microfinance institutions operating in the low middle-income group have better cost efficiency than microfinance institutions operating in the low-income category. However, there is no strong evidence regarding the cost efficiency of MFIs from the upper-middle income category relative to the low-income category. This finding confirms the findings of Hassan and Sanchez (2009). Moreover, nonbank microfinance institutions (NBFIs) and NGO forms of microfinance institutions perform better in terms of cost efficiency than the credit union (cooperative) form of MFIs. Credit union forms of MFIs operating in the region are less efficient in managing costs. Thus, the forms and legal status of MFIs play a remarkable role in the cost efficiency of institutions (Agostinho et al., 2021; Gebremichael & Gessesse, 2016; Tilahun, 2021). Variations in management practices and philosophy across the types of MFIs might be the possible reason for this finding.

Our study findings also present insightful remarks regarding the role of women in the cost efficiency of MFIs. Our study results reveal that women's participation in three engagements boosts the cost efficiency of MFIs. First, there is a significant and negative association between the presence of women on the board and the cost inefficiency of MFIs. This means that women engagement with board members enhances the cost efficiency of MFIs in SSA. Microfinance institutions with a larger percentage of women in their boardroom are more cost efficient than those with a smaller proportion. Similar suggestions were presented in prior studies conducted to assess the effect of gender diversity on the economic performance and sustainability of MFIs in Africa (Augustine et al., 2013; Mori et al., 2015).

Second, women's appointments to loan officer positions significantly reduce the cost inefficiency of MFIs. In other words, women loan officers' existence in the approval and monitoring of loans strongly enhances cost efficiency of MFIs. Women loan officers economically improve cost efficiency by pushing loan decisions to be relatively reasonable and operational. This finding shares the suggestions of previous empirical studies. Women's involvement in the decision-making process increases the efficiency of decision makers by providing alternative views, generating information, creating a common understanding and building social benefits (Abou-El-Sood, 2021; Brahma et al., 2020; Xie et al., 2020). As a result, loans screened and monitored by female loan officers have lower chance of nonperforming risk than loans screened and monitored by male loan officers (Beck et al., 2013). Reasonable and operational loan decisions minimize loan default risk and costs incurred from nonperforming loans, which enhances the cost efficiency of institutions.

Third, unlike the tradeoff hypothesis suggested in previous studies (Churchill, 2018; Hermes et al., 2011; Tadesse Abate et al., 2014), we found evidence that reveals the existence of a significant and negative association between a large percentage of women borrowers and the cost inefficiency of MFIs. Consistent with the findings of Fadikpe et al. (2022) and Agostinho et al. (2021), MFIs serving a larger percentage of women borrowers are more cost efficient than those providing financial services to a smaller percentage of women borrowers. This strengthens the idea of women borrowers' better performance in loan repayment relative to their counterparts (Fadikpe et al., 2022). Offering borrowing services to women significantly improves the cost efficiency of MFIs in SSA.

In general, women's representation among board members, loan officers and borrowing services plays a remarkable role in enhancing the cost efficiency of MFIs. These findings are robust empirically as well as theoretically. Specifically, the findings are consistent with the view of the value-in-diversity

perspective, resource dependency theory and agency theory (Abou-El-Sood, 2021; Brahma et al., 2020; Duppati et al., 2019). Gender diversity in the workforce has a positive consequence on the efficiency of a firm and the performance of teamwork.

However, this does not mean that women's representation in every activity or work position always contributes to efficiency. Our study findings suggest that MFIs should be selective in appointing women in certain work positions. This is because the contributions of women to cost efficiency differ in their effectiveness across nominated work positions. For instance, women's participation magnifies the cost efficiency of MFIs when they are in board member positions than when they are in managerial or normal staff positions. In other words, the cost inefficiency of MFIs in SSA is intensified when women are engaged in managerial or normal personnel positions compared to when they are board member or loan officers. This implies that allowing women to work in board member and loan officer positions significantly improves their contributions to cost efficiency compared to employing them as managers or regular staff.

5. Conclusions and managerial implications

The cost efficiency of 128 MFIs in SSA regions was investigated in this study. Larger numbers of MFIs in the region have realized cost efficiency below the average value, which is only 13%, and the overall cost efficiency of the financial institution oscillates between 87 and 2%. In other words, microfinance institutions are performing beyond the cost frontier line by approximately 87%, which is part of the overall management inefficiency. Only two microfinance institutions from Angola and Mali have realized cost efficiency scores above 50, 87.19 and 55.13% respectively. This is because the institutions are weak in self-adapting to human resource reform, new operating techniques and innovative financial technology. As a result, significant improvement in cost efficiency was not observed across the time trend.

The NBFI and NGO forms of MFIs are more cost efficient than the bank and credit union forms of MFIs. The size of MFI, cost per borrower, women's engagement, forms of MFI and country income category are major determinants of the cost efficiency of MFIs in the region. Particularly, women's participation as board members and appointment to loan officer positions significantly improve the cost efficiency of the institutions. Women working in MFIs are more effective in supervisory positions than in regular personnel positions. Thus, institutions should be selective in assigning women to nominated work positions.

Finally, we advise MFIs operating in SSA to focus on the wise utilization of economic resources such as assets, human resources and women's involvement in critical decision-making and supervisory positions, to speed up their cost efficiency. Moreover, the institutions are required to deploy sufficient effort to transform their custom practices in line with rapid changes in the technology and techniques of modern financial service provisions. The transformation enables institutions to bring idle economic resources (assets) and labor forces to productive operations and minimizes a portion of the total costs incurred due to underperformance.

6. Policy implications and future research directions

Our study result reveals that MFIs operating in SSA countries are highly cost inefficient. We believe in installing institutional policies that could improve the efficiency of the institutions, particularly on the following aspects. First, cost and resources management reforms should be implemented in those MFIs realizing high cost inefficiency. Second, fast and productive human resource policy, new operating techniques and updated self-adaptation to innovative financial technology should be considered in the financial institutions. Third, regular performance evaluation and self-assessment shall be held on labor productivity, assets management, interest rate management, and gender diversity in the governance and labor force pillars of MFIs in SSA. On other hand, we set suggestion for future research to focus on the effects of country specific dimensions and labor productivity of MFIs on cost as well as profit efficiencies of the institutions operating in SSA countries.

Notes

1. CGAP is a dynamic organization established in 1995 as the Consultative Group to Assist the Poor (CGAP) by creating inclusive financial ecosystem (for more see <https://www.cgap.org/about>).
2. The Microfinance Information Exchange, Inc. (MIX – market) is a free, global web-based platform designed to increase the flow of information, ensure transparency and improve communication for the microfinance sector (<https://www.devex.com/organizations/the-mix-market-44420>). MIX Market provides dataset using the World Bank's Data Catalog that allows users to combine the data with other global finance and development data for richer insights (<https://www.findevgateway.org/node/156926>).

Disclosure statement

The authors report there are no competing interests to declare.

About the authors

Tarekegn Tariku Ebissa is PhD scholar in finance stream at Jimma University, Ethiopia. He has more than ten year work experience in teaching, advising and conducting research works and offering community services. His major research interest includes financial system, financial institutions efficiency and financial technology.

Arega Seyoum Asfaw (PhD) is associate professor of finance at Jimma University, Ethiopia. He has research works published on journals with major focus on financial institutions performance, capital structure and contemporary issues in finance. In addition, he is engaged on advising and supervising PhD courses and dissertation works.

Deresse Mersha Lakew (PhD) is associate professor of finance at Ethiopian Civil Service University, Ethiopia. His major interest research areas are corporate governance and strategy, financial efficiency, and contemporary issues in finance like financial technology. In addition, he is engaged on advising and supervising PhD courses and dissertation works.

ORCID

Tarekegn Tariku Ebissa  <http://orcid.org/0000-0002-0470-6268>

Data availability statement

We used data available on MIX-market database accessed through <https://databank.worldbank.org/source/mix-market#>.

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Appendix

Table 1. Variable definition and measurement.

	Measurement	Definition
<i>Panel A: Dependent variable</i>		
TC: total cost	Administrative expense + interest expense + Other financial expense + Operating expense + other operating expense + Non – operating expense + Personnel expense (Abdulai & Tewari 2016; MIX, 2021; Srairi 2010)	Interest expense = interest expense on deposits + interest expense on borrowings
<i>Panel B: Independent variables</i>		
<i>Input prices</i>		
Labor: Price of labor	Personnel expenses divided by total number of personnel (MIX, 2021; Lu et al., 2018)	Cost paid as a salary or wage to mobilize employees' effort
Fund: Price of fund	Interest expenses (interest paid) divided by total deposits and borrowings (MIX, 2021; Lu et al., 2018)	Interest expense = interest expense on deposits + interest expense on borrowings
PPC: Price of physical capital	Operating expense divided by net fixed assets	Operating expense includes expenses not related to personnel expenses, depreciation, amortization and administrative expenses & Net fixed assets are tangible assets net of accumulated depreciation (MIX, 2021).
<i>Output quantities</i>		
Loan: Net loan portfolio	Value of loan portfolio net of impairment loss allowance and unearned income and discount (when applicable) (MIX, 2021; Lu et al., 2018).	Describes efficiency of MFI in minimizing adverse outcomes
OEA : Other earning Assets	Total of all other assets	Includes receivables, long-term investment, inventories, intangible assets (MIX, 2021).
<i>Panel C: Determinants of cost inefficiency</i>		
<i>Firm-specific variables</i>		
firmsize: Firm size	Natural logarithm of total assets (Lu et al., 2018)	Total assets (MIX, 2021)
ROA: Profitability	ROA (Abdulai & Tewari, 2016; Srairi, 2010)	Return on asset ratio (MIX, 2021)
Boardg: Broad gender diversity	Percentage of female as board members (MIX, 2021; Mori et al., 2015)	Gender diversity in corporate governance
Mgmtg: Management gender diversity	Percentage of female in management (MIX, 2021; Mori et al., 2015)	
Femaleb: Female borrower	Percent of female as active borrowers (Abdulai & Tewari 2016; Tadesse Abate et al., 2014)	Efficiency in outreach (depth of outreach)
Femalestaf: female personnel	Number of female in personnel (MIX, 2021)	Female employees acting as regular personnel in microfinance institution.
Femaleof: Female loan official	Percentage of female loan officer (MIX, 2021)	Female employees acting as loan officer in microfinance institution
<i>Panel D: Controlling and additional variables</i>		
Time trend in year (T)	Labeled as "1" if 2009, "2" if 2010, "3" if 2011 ... and "10" if 2018.	Added as dummy variable (Lu et al., 2018)
Income: Income category	1 = Upper middle income 2 = Lower middle income 3 = Low income	MFI's country income category (dummy variable) (World Bank, 2022).
Type: Type of MFIs	1 = NBFi, 2 = Bank, 3 = NGO, 4 = Credit union/ cooperative (Tilahun, 2021)	Legal status of MFI (MIX, 2021)

Table 2. Summary statistic for cost efficiency scores.

	Cost efficiency scores (%)	
	Mean	Std.Dev
<i>Panel A: Types of MFI</i>		
NBFI	14.22	0.131
Bank	9.40	0.065
NGO	14.81	0.092
Credit union/cooperative	11.66	0.069
Overall efficiency	13.07	0.099
<i>Panel B: Income category of MFI's country</i>		
Upper-middle income	9.56	0.043
Lower-middle income	13.62	0.110
Low income	12.46	0.083
Overall efficiency	13.07	0.099
<i>Panel C: Time trend (2009–2018)</i>		
2009	12.50	0.109
2010	12.70	0.105
2011	13.25	0.106
2012	12.77	0.068
2013	12.96	0.098
2014	13.31	0.105
2015	13.29	0.104
2016	13.37	0.111
2017	13.15	0.083
2018	13.59	0.089
Overall efficiency	13.07	0.099
<i>Panel D: Top Three Countries with most cost efficient MFIs</i>		
	Score (%)	Rank
Angola	87%	1
Mali	24%	2
Congo Republic	17%	3
Egypt	17%	3
<i>Panel E: Countries with smallest cost efficient MFIs</i>		
Uganda	8%	3
Malawi	7%	2
Sudan *	2%	1

Source: Authors' computation.

*MFIs operating in Sudan have scored the smallest cost efficiency result, which means that they are efficient only for 2%.

Table 3. Stochastic frontier regression results.

Dependent variable – total cost			
Panel A: Input, Outputs and Cross terms		Cost inefficiency	
Notation	Parameter	Coef	z-value
ln(Labor/PPC)	α_1	0.5622	3.17***
ln(Fund/PPC)	α_2	15.1082	2.55**
ln(Loan)	α_3	0.2265	2.01**
ln(OEA)	α_4	0.0108	0.11
$\frac{1}{2} \ln(\text{Labor/PPC})^2$	α_5	0.1024	11.82***
$\frac{1}{2} \ln(\text{Fund/PPC})^2$	α_6	−20.2819	−2.97***
$\frac{1}{2} \ln(\text{Loan})^2$	α_7	0.0514	11.81***
$\frac{1}{2} \ln(\text{OEA})^2$	α_8	0.0079	1.55
ln(Labor/PPC)* ln(Fund/PPC)	α_9	−2.3964	−7.73***
ln(Labor/PPC)* ln(Loan)	α_{10}	−0.0523	−4.17***
ln(Labor/PPC)* ln(OEA)	α_{11}	0.0052	0.64
ln(Fund/PPC)* ln(Loan)	α_{12}	−0.0601	−0.14
ln(Fund/PPC)* ln(OEA)	α_{13}	0.7328	2.84***
ln(Loan)* ln(OEA)	α_{14}	−0.0082	−1.24
ln(Labor/PPC)*T	α_{15}	0.0135	3.34***
ln(Fund/PPC)*T	α_{16}	0.2304	1.60
ln(Loan)*T	α_{17}	−0.0058	−1.35
ln(OEA)*T	α_{18}	0.0007	0.20
$\frac{1}{2}(T)^2$	α_{19}	−0.0018	−0.50
T	α_{20}	0.0904	1.70*
Constant	α_0	0.4095	0.27
Wald Chi-square	2043.13		000***
Sigma squared	0.4216		8.03***
Gamma (γ)	0.7694		24.54***
Eta (η)	0.0337		000***
Log-likelihood function	−456.7440		
Number of observation	930		
Number of group	128		

*** $p < 1\%$, ** $p < 5\%$, * $p < 10\%$.

Source: Authors' regression model outputs.

Table 4. Factors affecting cost inefficiency of MFIs in SSA.

Dependent variable: Cost inefficiency		Model 1		Model 2		Model 3	
Independent variable	Parameter	Coef	t-value	Coef	t-value	Coef	t-value
Infirmsize	β_1	0.066	7.12***	0.085	9.79***		
InROA	β_2	0.030	0.81	0.040	1.06		
InCostperbor	β_3	0.057	3.70***	0.056	3.64***		
Boardg	β_4	-0.171	-2.73***			-0.223	-3.28***
Mgmtg	β_5	0.079	1.16			0.168	2.32**
Femalebr	β_6	0.030	0.42			-0.329	-4.83***
InFemalestaff	β_7	0.063	5.70***			0.098	8.64***
Femaleof	β_8	-0.212	-2.81***			-0.252	-3.16***
Upper_middle_income	β_9	-0.072	-0.57	0.006	0.05		
Lower_middle_income	β_9	-0.179	-5.41***	-0.151	-4.60***		
NBFI	β_{10}	-0.241	-5.19***	-0.233	-4.95***		
Bank	β_{10}	0.002	0.04	0.003	0.06		
NGO	β_{10}	-0.229	-4.83***	-0.220	-4.75***		
Constant	β_0	1.051	4.36***	0.912	3.90***	2.37	21.28***
Number of obs.		930		930		930	
Chi-square		313.66***		253.64***		121.89***	
LR test of the one-sided error		3.68**		11.64 ***		1.66 *	
Log likelihood function		-601.44		-622.95		-683.05	

*** $p < 1\%$, ** $p < 5\%$, * $p < 10\%$.

Source: Authors' regression model outputs.