# Impact of governance and gender on microfinance efficiency – A stochastic frontier analysis

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## Abstract

Microfinance institutions (MFIs) have become central players in socio-economic development especially in developing countries. This paper investigates empirically the inefficiency factors of South Asian MFIs using stochastic frontier analysis (SFA). A total of 392 MFIs were sampled for the period from 2003-2013. The underpinning assumption is that governance i.e. ownership, regulatory structures of MFIs and women in several roles as a buyer, lender and board member are important efficiency indicators of microfinance business. The estimated results suggest that presence of female loan officers have a positive effect while female board members and female borrowers show a significant negative impact on financial and social efficiency of MFIs. A strong positive association is found between the governance of an MFI and its efficiency. Cost efficiency estimates show that, on average, South Asian MFIs are operating at similar financial and social efficiency levels. It is therefore not suggested any trade-off between dual role of MFIs.

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## 1. Introduction

Microfinance is a well-known terminology used for providing financial services to financially deprived community. Both profit-oriented and non-profit-oriented microfinance institutions (MFIs) have been providing these services through formal, informal and semi-formal ways. However, microfinance is a costly business due to high expenditure in processing the small loans and high risk of recovery, hence, expected efficiency is less than their potential. MFI governance is another challenge to the development of the microfinance industry (CSFI, 2008) and donors, governments, and investors are looking for effective mechanisms of control to ensure that MFIs make the best use of scarce resources.

Another aspect of analysis in this study is impact of gender on MFIs' efficiency. Microfinance is to a large extent a woman's business as female borrowers are the MFIs' largest market, and lending to woman is considered one of the main reasons for microfinance's success (Armendariz & Morduch, 2010). The female proportion of top executives and directors in MFIs is high. In our South Asian sample, the ratio of female board members (PFMs) is almost 33% of the total board, the percentage of female loan officers (PFOs) is 35% of the total loan officers, and about 83% of the total borrowers are women.

While previous studies have estimated the impact of MFI governance mechanisms separately along either financial or social dimensions (Hartarska, 2005; Mersland & Strom, 2009), this paper takes simultaneously into account both objectives of MFIs in evaluating the effectiveness of various governance mechanisms like Hartarska & Mersland (2012). But our study is distinctive in following aspects. First, we have extended the data period up to 2013. Second, we estimate cost efficiency and technical efficiency using SFA, a method that has not been widely applied in microfinance. The cost and technical efficiency scores are further

used for comparing efficient use of available resources by ownership type and organizational regulatory structure. Finally, in context of dual objectives of MFIs, we adopted the methodology of Hartarska, Shen, & Mersland (2013) and Hermes Lensink & Meesters (2011) who not only focus on cost efficiency but further regress the inefficiency scores on some variables. We use our inefficiency scores to regress on governance and gender variables.

Following research questions are addressed in present paper. Firstly, how efficient are MFIs operations in South Asian countries, and what factors explain the variation in microfinance efficiency? Secondly, as suggested by Strøm, D'Espallier, & Mersland (2014) for future research, we explore whether governance and the involvement of women could be key determinants of MFIs' efficiency. We believe our research is useful for policy intervention, as microfinance institutions in South Asia are promoted to expand financial services to the unbanked poor: failure to achieve wider breadth and deeper outreach in the pursuit of financial sustainability can thus have a policy concern.

We have adopted an approach that is widely used to study efficiency in banks and modify it to capture the duality of MFIs (as suggessted by Berger, DeYoung, & Udell, 2001). This approach captures the cost minimization objective of MFIs by using efficiency coefficients obtained from a stochastic frontier. In a second step, the (predicted) individual efficiency coefficients from the cost function estimation are modelled as a function of measurable internal and external governance and gender variables. The internal governance factors are those related to differences in regulation, board that is representations by various stakeholders and managerial capture. The external factors account for the weak market-disciplining mechanisms in an economy, such as political stability and absence of violence and terrorism. Gender variables include female loan officers, borrowers and board members.

Our cost efficiency estimates suggest that MFIs are operating at a similar level in both a financial and social context, but institutional and country differences matter more for financial efficiency than for social efficiency. The results also show that the average MFIs exhibit increasing returns to scale in financial sustainability, but these institutions are not enjoying economies of scale when social objectives are measured. In order to identify the key efficiency determinants, we explore the female contribution and governance. The findings suggest that governance and gender are important efficiency determinants of MFIs.

The rest of the paper is organized as follows: In the next section, we review previous research. Section 3 presents the analytical approach followed to estimate and correlate the cost efficiency with outreach and financial sustainability indicators. Section 4 describes the data, summary statistics and definition of variables. The results discussion is presented in Section 5 and last section concludes by summarizing the main findings.

## 2. Prior research

In this section, we briefly review some related literature and describe the expected findings of our research questions. The literature has identified various links between MFIs performance and its governance topics such as existing corporate structure, banking, non-profit-oriented or for-profit-oriented organisations. Therefore, a brief review of the existing literature on these topics is used to identify the relevant governance mechanisms for MFIs.

The first empirical study of this topic is Hartarska (2005), who uses a small sample of MFIs in Eastern Europe and Central Asia (ECA) to study how managerial compensation, board size, prudential regulations, external rating, and auditing affect financial performance. The study finds that board independence, improve performance, while some traditional control mechanisms, such as performance-based compensation, are ineffective. This study does not

find consistent evidence that board size, regulation, audits, or ratings affect MFI outreach or sustainability. Similarly, Mersland and Strøm (2009) studied effect of the CEO/chairman duality, female CEOs, international directors, board size, and external factors on financial performance and outreach. They also verified the findings of Hartarska (2005) and stated that there is no evidence that typical governance mechanisms work, but their results may also be affected by not measuring simultaneously the dual objective.

Other studies using SFA approach have discussed various performance determinants. For example, Cull et al. (2007) use SFA to examine the microfinance promise of reducing poverty by employing profit-making banking practices in low-income communities. They find that although many MFIs manage to secure high loan repayment rates, relatively few earn profits so far. Another study using SFA methodology is conducted by Hermes, Lensink, & Meesters (2011) find that outreach is negatively related to the financial efficiency of MFIs; specifically those institutions that have lower average loan balances and a greater proportion of female borrowers are less efficient in terms of financial performance.

Oteng-Abayie, Amanor & Frimpong (2011) using SFA investigate the economic efficiency of 135 MFIs in Ghana, for the period from 2007 to 2010. They find a high degree of inefficiency (56.29% economic efficiency on average) in the microfinance industry. They recommend that microfinance practitioners can help to improve MFIs' performance by enhancing their technical training programs, by operating diversified savings products to improve their portfolio quality, and by heightening the extent of social commitment to both staff and clients. Abate, Borzaga & Getnet (2013) using SFA investigate whether the way ownership is organized and practiced affects the cost of microfinance delivery. They find that

financial cooperatives are better at cost containment, compared with specialized MFIs owned by shareholders.

We address both[1] internal governance mechanisms, i.e. the ownership, regulatory structure, women board members, and external governance mechanisms or institutional quality variables, i.e., political stability and the control of corruption. The non-profit-oriented MFIs such as NGOs and credit unions are mainly built on the social objectives of serving the poor, while profit-oriented MFIs such as microfinance banks are working to serve both outreach and financial sustainability objectives. Because both profit-oriented and non-profit-oriented MFIs are working as MFIs, we expect that the profit-oriented MFIs should concentrate more on financial efficiency, and the non-profit-oriented MFIs concentrate more on social efficiency. We also expect that relative efficiency levels vary according to the different types of MFIs, and that internal governance to be positive efficiency indicators for MFIs. Overall, we expect internal and external governance to be positive efficiency indicators for MFIs.

Some prior studies have used SFA to explore the relationship between efficiency measures and governance. For example, Hartarska (2005) measures the impact of governance on outreach and sustainability of MFIs in Central and Eastern Europe and the newly independent states. She finds a trade-off between the MFI outreach and sustainability objectives, depending on stakeholders' representation on the board and also suggests that external governance mechanisms play a limited role. Hartarska & Nadolnyak (2007) find that regulatory involvement does not directly affect performance in terms of either operational self-sustainability or outreach. However, they also find some indirect benefits of regulations

[1] Governance indicators are mainly categorised as internal and external governance mechanisms in microfinance literature (Caudill, Gropper, & Hartarska, 2009; Hartarska & Nadolnyak, 2007). The main difference between internal and external mechanisms is that the former can be chosen by an institution, while the latter is more or less determined by external factors - the market and the supervisory environment (Mersland, 2007).

on those MFIs who collect savings, as they appear to reach more borrowers after regulation is introduced. Kyereboah-Coleman & Osei (2008) examine the impact of governance on performance measures of outreach and profitability in MFIs, and find that governance plays a critical role in the performance of MFIs.

Mersland & Strom (2009) study the relationship between firm performance and corporate governance in MFIs. They find no difference between non-profit organisations and shareholder firms in financial performance and outreach, and also find no impact of regulation on MFIs performance. Mersland (2009) compares the cost of different ownership structures of MFIs, and concludes that the coexistence of ownership types is essential to best serve the customers. Cull, Demirguc-Kunt, & Morduch (2011) conclude that profit-oriented MFIs in trying to maintain profit curtail outreach to women and customers that are costly to reach, while MFIs with a weaker commercial focus tend to reduce profitability but maintain outreach.

Some microfinance studies investigate the role of women and performance of MFIs. Key studies in this area include Mersland & Strøm (2009) Armendariz & Morduch (2010), Guérin, & Mersland (2011). Mersland & Strøm (2009) find that the MFIs with female CEOs achieve higher financial performance due to their better understanding of the market in which the MFI operates. Armendariz & Morduch (2010) argue that financial sustainability and female targeting are perfectly compatible, reflecting higher repayment rates among female borrowers.

The study of Bert, Guérin, & Mersland (2011) confirm that the targeting of women leads to higher repayment rates in MFIs. Strøm et al. (2014) investigate the relationships between

female leadership, firm performance, and corporate governance in a global panel of 329 MFIs in 73 countries covering the years 1998–2008. They find female leadership to be significantly associated with larger boards, younger firms, a non-commercial legal status, and more female clientele. They also note that having female board members is positively related to MFIs' performance. We use gender variables to see the overall impact of females on the efficiency level of MFIs. Many MFIs dealt with mainly women so we expect that females on boards, as officers and as clients will positively impact the financial and social efficiency level of MFIs.

## 3. Methodology

Widely used approaches to estimate a production frontier are non-parametric DEA and parametric SFA. We use DEA approach using same data set in Bibi, Balli, Matthews, & Tripe (2016) but in this paper we use SFA. Parametric approach has advantages over nonparametric approaches. For example, nonparametric methods assume that all variations in firm performance are attributable to inefficiency, which is problematic as it ignores exogenous shocks in measurement, omitted variables and measurement errors. While parametric methods impose a functional form on the data, whereas accurate efficiency measurement dependents on a functional form that correctly represent the true model (Coelli, Rao, O'Donnell, & Battese, 2005).

### 3.1. Translog (Transcendental Logarithmic) Cost Function

To determine cost efficiency, commonly used models in the literature are Translog and the Cobb-Douglas. Gregoire, and Tuya (2006) use a Likelihood Ratio test to determine the best among these models and prove that the Translog model has better specification specifically for MFIs cost function. Therefore, we use the SFA-BC model suggested by Battese and Coelli (1995). This a one-step approach to investigate a common cost frontier and the

determinants of the inefficiency of individual MFIs as it estimates the cost frontier and the coefficients of the explanatory variables simultaneously (Hermes et al., 2011).

Moreover, the structural approach to determine the optimal scale of efficiency in financial institutions involves estimating a cost or profit function; the former refers to cost minimisation and the latter to profit maximisation. For the microfinance industry, cost functions are more commonly used as they assume exogenous output, whereas the profit function uses input and output prices, which is problematic for a study on MFIs (Abate, Borzaga, & Getnet, 2014). Although some MFIs operate as profit-oriented institutions, the majority remain non-profit-oriented; however, even then, all MFIs strive to minimize costs and maximize profit. Therefore, we estimate a typical Translog cost function.

Cost-efficiency is measured in terms of how close an MFI's cost lies to the efficient cost frontier for a given technology. Our stochastic cost frontier approach illustrated by Battese and Coelli (1995) that estimates the cost frontier and inefficiency simultaneously, is presented in Equation 1.

$$log(TC_{i,t}) = \beta_0 + \beta_1 log(Y_{i,t}) + \beta_2 log(CPL_{i,t}) + \beta_3 log(COB_{i,t}) + 0.5\,[\,\beta_4 log(Y_{i,t})^2 + \beta_5 log(CPL_{i,t})^2 + \beta_6 log(COB_{i,t})^2 + \beta_7 log(CPL_{i,t})\, log(Y_{i,t}) + \beta_8 log(COB_{i,t}) log(Y_{i,t}) + \beta_9 log(CPL_{i,t}) log(COB_{i,t})] + \beta_{10}\,(year_{i,t}) + 0.5\,[\,\beta_{11}\,(year_{i,t})^2 + \beta_{12}(year_{i,t})\; log(CPL_{i,t}) + \beta_{13}\,(year_{i,t}) log(COB_{i,t})] + \beta_{14}\, other\ factors_{i,t} + u_{i,t} + v_{i,t}$$

(Equation 1)

TC is total cost. Y is equal to the outputs for every $i^{th}$ firm. These outputs include gross loan portfolios (GLP) for financial performance and the number of active borrowers (NAB) for social performance. Input variables are cost of labor (CPL) and cost of borrowing (COB). CPL is equal to personnel operating expenses[2] divided by the number of employees, and

[2] Data for TC, CPL and COC are not directly available from the dataset we have used for this study (Mix Market; see data section for further description of this source). Instead, information in terms of ratios, such as

COB is equal to interest expenses divided by the total borrowings. Cost of physical capital (COC) is the price input that is used to adjust the total cost, CPL and COB. COC is equal to non-personnel operating expenses divided by total liabilities. The specification of our cost function takes into account the individual input and output variables, the square of these variables (quadratic terms), as well as combinations of these variables (interaction terms).

We add 'time' to capture the effects of technological change or unobserved heterogeneity over time that runs from 1 to 16 (year dummy). We also include control variables (other factors) for risk coverage (a financial ratio), type of MFIs (dummies for profit-oriented MFIs and regulated MFIs) and country dummies (Bangladesh, India, Nepal and Pakistan). $\beta$ is the vector of coefficients, $u_{i,t}$ is a variable representing the cost or technical inefficiency and $v_{i,t}$ is a random variable representing noise. The error term is a composite expression of cost inefficiency and random error terms with the expected value of the inefficiency term conditional on the estimated values of the residuals. Hartarska et al. (2013) note that homogeneity in input price variables requires the following restrictions:

$$\beta_2 \; and \; \beta_3 \; = 1$$
$$\sum_{i=5}^{9} \beta_i = 0$$
$$\beta_{12} \, , \beta_{13} \; and \; \beta_{14} \; = 0$$

We impose these restrictions in the estimation by normalizing (dividing) all input prices and the total cost of cost function by COC. We also account for country differences in our model

total expenses to total assets is only given. This is why we have multiplied this ratio with total assets to obtain data for TC. Thus, TC is measured as the total expenses to total assets ratio times total assets in US dollars. CPL is available but it is further divided by gross national income (GNI per capita), so we multiply the ratio with GNI per capita. This, CPL is measured as the operating expenses of total personnel divided by GNI per capital times GNI per capita. Thirdly, for COC, we subtract personnel expenses from total operating expenses to get non-personnel operating expenses that are used as a numerator for COC; for a denominator that is total liabilities, we multiplied equity with debt to equity ratio.

(Bolli & Thi, 2014; Chaffai, Dietsch, & Lozano-Vivas, 2001; Kumbhakar, Lozano-Vivas, Lovell, & Hasan, 2001). Furthermore, we also control for the level of risk using risk coverage ratio, which is a standard ratio used by MFIs to measure the risk level of their loan portfolio. As suggested by Hughes & Mester (2008) omitting this determinant in cost function may produce misleading results.

The central aim of this analysis is to investigate the impact of governance and gender variables on the efficiency of MFIs. In this framework, we calculate an inefficiency measure for an MFI. To analyze this relationship between efficiency, governance and gender, we specify an empirical model where the inefficiency variable is the dependent variable and in which we have governance and gender variables. The general specification of the inefficiency equations we estimate as suggested by Hermes et al. (2011) is as follows:

$$u_{i.t} = \delta_0 + \delta_1 \mathrm{PFOs}_{i,t} + \delta_2 \mathrm{PFBs}_{i,t} + \delta_3 \mathrm{PFMs}_{i,t} + \delta_4 \mathrm{STAB}_{i,t} + \delta_5 \text{other factors} + \text{error term} \quad \text{(Equation 2)}$$

In equation 2, $u_{i.t}$ stands for the first moment of the technical inefficiency distribution for MFI *i*, at time *t*, calculated from the cost function (Equation 1). Gender variables include percentage of female loan officers (PFOs), percentage of female borrowers (PFBs) and percentage of female board members (PFMs). The external governance indicator is STAB (political stability). The control variables (other factors) include age (dummy of mature MFIs), size of MFIs (log of total assets) and size of sample economies (real GDP of sample countries). $\delta$ is the vector of coefficients. We use STATA software to run the frontier estimation as suggested by Belotti, Daidone, Ilardi & Atella (2012).

## 4. The dataset

MIX market and World Bank development indicators are the data sources for this study. The variables used are shown in Table 1, their descriptive statistics in Table 2 and the correlation among variables in Table 3. We have unbalanced panel data for 392 MFIs for 16 years from 1998 to 2013 but only small numbers of observations are found in earlier years. When we run the model, it therefore reduces to eleven years for 2003 to 2013. The distribution of observations in the sample countries is 51% of MFIs from India, 21% from Bangladesh, 12% from Nepal, 9% from Pakistan and only 7% from Sri Lanka. We split our data sample into non-profit-oriented and profit-oriented MFIs, comprising 72% and 28% of our sample respectively; 66% are regulated and 34% are non-regulated MFIs in our sample.

**[INSERT TABLE 1 ABOUT HERE]**

**[INSERT TABLE 2 ABOUT HERE]**

Table 2 provides the descriptive statistics for the variables used. The average values of female data show that South Asian MFIs have higher proportion of PFBs (83%) in comparison to PFMs and PFOs (33% and 29% respectively). The external governance indicator shows the weak political stability of South Asian countries (with negative mean values), lower real GDP level (3,467 USD on average) and high inflation rate (8% on average). 76% of our sample institutions are mature, defined as operating for 8 years or more.

**[INSERT TABLE 3 ABOUT HERE]**

Table 3 shows the correlation matrix for our data set. This shows the basic relationships between all the variables and shows no identification of potential multi-collinearity problem.

## 5. Discussion of the results

In this section, social and financial efficiency estimates are presented using SFA with the findings of baseline model (Equation 1). Using this methodology, we get economies of scale,

technological progress and cost efficiency estimates, reported in Figures 1, 2 and 3. We also report technical inefficiency scores from using the SFA-BC model that we use in second stage to explore efficiency determinants.

### 5.1. Baseline Model Results

The procedure we have used to generate these results is as follows. The cost frontier and inefficiency equations are estimated simultaneously (see Battese & Coelli, 1995) using outputs of GLP (for financial efficiency) and NAB (for social efficiency). Table 4 provides the cost frontier estimates and regression estimation results with respect to governance and gender variables in Panel A and Panel B, respectively. Column one (I) of Table 4 presents a basic model of inputs and outputs (with quadratic and interaction terms) and with control variables, the second column (II) adds the year dummy with its quadratic and interaction terms and, in the third column (III), we control the country heterogeneity by including the dummy variables for four countries. The same is repeated for specifications in columns IV to VI where output is measured by NAB. These six specifications are those on which our analysis is primarily focused. Since our data has a panel structure, all estimations are carried out using pooled regressions.

**[INSERT TABLE 4 ABOUT HERE]**

Panel A of Table 4 reports to the estimation results of the cost frontier. We find increasing returns to scale when looking at the output coefficient alone as it is greater than one in all specifications. A positive and greater than one coefficient imply an outward shift of the cost function or higher cost. The estimation results for the cost function appear to be as expected in most cases. In all model specifications, almost all core variables—input prices, outputs and their derivatives—have the expected signs and are statistically significant at the 5% level or better (except for one input of COB whose quadratic and interacting terms are usually negative but, generally significant only at the 10% level). The variables with unexpected

signs are statistically insignificant. The coefficients for COB, GLP and NAB are always significant and positive, while the coefficient for CPL is negative but significant only at the 10% level in one of each specification of both output regressions, not as expected. However, as CPL is highly significant and positive in quadratic terms, this leads us to conclude that our specification of the cost frontier fits the theory reasonably well.

Furthermore, the panel nature of the data allows us to study the role of technical progress in microfinance and answer questions such as whether costs decrease with time. Unfortunately, the majority of time variables are statistically insignificant and, hence, we cannot conclude that MFIs' costs decrease or increase over time. The results, including country controls, are presented in columns III and VI. All dummy variables for countries and for the type of MFIs are statistically significant in almost all specifications in the financial efficiency regressions, but not (mostly) in social efficiency regressions, indicating that the type of MFI and different economies affect the cost frontier for financial efficiency more. This confirms our expectations that the relative efficiency level varies according to different types of MFIs. In addition, the risk ratio is statistically insignificant in financial regressions, but negative and significant in social efficiency regressions, indicating that high risk is not associated with high cost, contrary to what is expected.

On average, the financial and social cost efficiency scores of MFI is 0.80, suggesting that the average MFI needs to reduce its actual cost by 20% to become cost efficient. This overall cost efficiency level is similar and comparable to the results in recent microfinance studies, such as Gregoire & Tuya (2006), who analyse the efficiency of MFIs in Peru between 1999 to 2003 using SFA.

### 5.2. Inefficiency Regressions

It was mentioned above that along with specification of the cost frontier estimates, we also focus on the specification of the inefficiency equation and the impact of gender on the efficiency levels of these MFIs. From the stochastic frontier analysis, we generated a technical inefficiency score that shows the level of inefficiency of a particular MFI. The score is non-negative; it is equal to zero if the MFI is perfectly efficient. Before commenting on the results, we want to mention that the baseline model measures the extent to which an MFI is considered to be inefficient. This means that we expect that the coefficient for the gender variables (high proportion of females) should be significantly negative in social efficiency and significantly positive in financial efficiency.

Panel B of Table 4 shows the results from estimating the inefficiency equation. The results in columns I to VI suggest that gender is a strong efficiency indicator for MFIs, especially PFBs and PFOs, although the PFMs variable remains insignificant in all regressions. In all equations, the coefficient for PFOs is positive and highly significant and, as expected, the coefficient of PFBs is positive in financial efficiency and negative in social efficiency. This result confirms our expectations that as MFIs are mainly focused on women, female involvement should be associated with greater efficiency, but this is only confirmed for PFOs and PFBs coefficients. We could not find any impact of PFMs on MFI efficiency, in contrast to Mersland and Strom (2009), who find it as a positive indicator of MFI efficiency. Our findings might suggest that MFIs that focus more on lending to females are less financially efficient but more socially efficient.

In addition, the results also indicate that PFOs negatively impact the efficiency level of MFIs since the coefficient for PFOs is positive and significant, with these results not changing

when we include different sets of control variables. The coefficient for PFOs remains negative and highly significant in all specifications, although the coefficient of PFBs became significant after adding the control variables in regressions. We find political stability (an external governance indicator) positively impacting financial efficiency and negatively impacting social efficiency. These findings are partially according to our expectation that external governance should be a positive efficiency indicator for MFIs.

With respect to the control variables, panel B of Table 4 shows that the coefficient for the variable *DMATURE* is positive and significant, indicating that older MFIs are less efficient. This supports the view that more recently established institutions benefit from knowledge of microfinance practices that has been built up during past decades. Based on existing knowledge, these new MFIs may leapfrog older institutions in terms of the efficiency of their activities. As a robustness test, we apply different output variables, such as average loan balance portfolios GNI per capita for social efficiency and OSS for financial efficiency, but the findings are similar to those presented in Table 4. Further research is needed to look into this issue more carefully.

## 6. Conclusion

To examine the cost efficiency level and technical inefficiency of South Asian MFIs, we use a sample of 392 MFIs for a sample period of 16 years from 1998 to 2013. The cost efficiency estimates show that MFIs are operating at a similar level in both a financial and social context but institutional and country differences matter more for financial efficiency than for social efficiency. In looking for important efficiency indicators, we assess some gender and governance variables. MFIs are remarkable in that they elect more female chairs and female directors than firms in most of the advanced countries do, so we also see linkages of their

efficiency levels with governance and gender variables. We investigate the roles of females in achieving the social and financial objective of MFIs and their relationships with financial and social performance of MFIs, as found in Mersland & Strom (2014). The findings suggest that governance and gender are important efficiency determinants of MFIs.

The sample size in this study is restricted by data availability, the choice of statistical analysis, time and MFIs covered so results must be carefully considered since many specific (other) factors can affect MFIs' working process. For future research, we suggest that inclusion of other corporate governance and gender variables would also merit further considerations. As we believe that the mostly conflicting governance and performance results are because MFIs are young firms, and the optimal governance form has perhaps not been finalized. MFIs in South Asia might face difficult challenges that may be outside the control of these institutions and our approach might not capture all potential strategic management decisions.

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## Table 1: Variables explanation for efficiency evaluation using SFA

| Variable | Name | Calculated as | Explanation | Data source |
|---|---|---|---|---|
| Outputs | Total cost | Total expense to total assets ratio times total assets | Total cost includes all types of cost. | MIX market |
| | Logarithm of number of active borrowers (LNAB) | Total borrowers and clients of MFIs | The number of credit clients at the end of each period are used as social performance output | |
| | Gross loan portfolio (GLP) | Gross value of all outstanding bills | All outstanding bills due for all outstanding client loans. This includes current, delinquent, and renegotiated loans, but not loans that have been written off. It does not include interest receivable. | |
| Inputs | Cost of labour (COL) | Operating expenses divided by number of employees | Operating expenses include those administrative expenses that exclude interest expenses. | |
| | Cost of borrowings (COB) | Financial expenses divided by total liabilities | Financial expenses are classified by associated liability and are also broken down by type of expense (interest, fee) for each associated financial liability. | |
| | Cost of physical capital (COC) | Non-personnel operating expenses divided by total liabilities | Non-personnel operating expenses are all expenses that are categorised other than personnel operating expenses. Total liabilities are total amount of obligations raised from past transactions. | |
| Control variables | Risk coverage ratio (%) (RSKC) | Impairment Loss Allowance divided by PAR greater than 30 days | The non-cash expense is used to create or increase the impairment loss allowance and is calculated as a percentage of the value of the loan portfolio that is at risk of default. PAR30 is value of all loans outstanding that have one or more instalments of principal past due more than 30 days. This includes the entire unpaid principal balance, including both the past due and future instalments, but not accrued interest and rescheduled loans. | |
| | Dummy of mature institutions (DMATURE) | Mature MFIs in data sample | Dummy of young (less than 8 years old) and dummy of mature (equals to or greater than 8years old) dummies are created for age and dummy of young is chosen as base dummy. | |
| | Assets (LAST) | Logarithmic value of total assets | Total assets used as proxy of size measure | |
| | Real GDP (LREALGDP) | Logarithmic value of real GDP | Proxy to measure the country size. | World development indicato |
| | Inflation (INFL) | Inflation, consumer prices (annual %) | Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. | |
| Governance variables | Internal governance indicator | Percentage of female board members (%) (PFMs) | Number of women board members divided by total board members | MIX market |
| | | Dummy of non-profit-oriented MFIs | This is a dummy variable that is equal to one if the MFI is a non-profit-oriented institution and zero, if otherwise | |
| | | Dummy of regulated | This is a dummy variable that is equal to one if the MFI is listed as regulated institution and zero, if otherwise | |

| | | | | |
|---|---|---|---|---|
| | External governance indicator | Political stability and absence of violence and terrorism | Reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. Estimate of governance (ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance). | |
| Gender variables | Gender | Percentage of female loan officers (%) (PFOs) | Number of women loan officers divided by total loan officers | |
| | | Percentage of female borrowers (%) (PFBs) | Number of women active borrowers divided by number of active borrowers | |

Notes: Variables are explained as defined in their respective data sources.

## Table 2: Descriptive statistics for efficiency evaluation using SFA

| Variable | Mean | Min. | Max. | Std. | Obs. |
|---|---|---|---|---|---|
| Total cost (TC) | 8,171,288 | 1,690 | 305,000,000 | 27,100,000 | 565 |
| Total cost adjusted-TC/COC | 300,000,000 | 46,380 | 12,500,000,000 | 1,280,000,000 | 563 |
| Gross loan portfolios | 31,900,000 | 13,169 | 1,010,000,000 | 101,000,000 | 632 |
| Number of active borrowers | 244,912 | 94.00 | 6,710,000 | 798,139 | 629 |
| Operating expenses | 3,669,222 | 553.00 | 117,000,000 | 11,200,000 | 565 |
| Number of Personnel | 2,270 | 1.00 | 263,300 | 17,902 | 627 |
| Total borrowings | 20,800,000 | 10,747 | 501,000,000 | 55,300,000 | 465 |
| Non-personnel operating expenses | 1,386,005 | 553.00 | 49,200,000 | 3,972,737 | 565 |
| Liabilities | 34,500,000 | 12,936 | 1,790,000,000 | 134,000,000 | 626 |
| Input1 - CPL | 2,288 | 89.00 | 9,583 | 1,309 | 436 |
| Input1 adjusted-CPL/COC | 71,527 | 491.00 | 1,099,636 | 92,039 | 435 |
| Input2-COB | 23.71 | 1.00 | 486.00 | 36.67 | 561 |
| Input2 adjusted –COB/COC | 509.00 | 3.86 | 6076.83 | 720.25 | 553 |
| Input3-COC | 0.10 | 0.01 | 3.55 | 0.26 | 563 |
| Risk coverage ratio (%) | 50.30 | 01.00 | 99.80 | 29.80 | 632 |
| Dummy of mature MFIs | 0.76 | 0.00 | 1.00 | 0.43 | 612 |
| Total assets | 41,300,000 | 19,011 | 1,900,000,000 | 149,000,000 | 629 |
| Regulated MFIs | 0.69 | 0.00 | 1.00 | 0.46 | 612 |
| Non-profit-oriented MFIs | 0.57 | 0.00 | 1.00 | 0.49 | 612 |
| Real GDP | 3466.66 | 1293.45 | 8855.50 | 1,612.76 | 612 |
| Inflation (%) | 7.93 | 2.01 | 22.56 | 3.16 | 612 |
| Dummy of Bangladesh | 0.27 | 0.00 | 1.00 | 0.44 | 632 |
| Dummy of India | 0.42 | 0.00 | 1.00 | 0.49 | 632 |
| Dummy of Nepal | 0.11 | 0.00 | 1.00 | 0.32 | 632 |
| Dummy of Pakistan | 0.09 | 0.00 | 1.00 | 0.29 | 632 |
| Percentage of female board members (%) | 32.90 | 6.70 | 100.00 | 19.80 | 407 |
| Percentage of female loan officers (%) | 28.50 | 0.20 | 118.20 | 28.20 | 458 |
| Percentage of female borrowers (%) | 82.90 | 2.60 | 103.10 | 25.50 | 632 |
| Political stability | -1.43 | -2.81 | -0.45 | 0.40 | 620 |

Note: Variables are defined in Table 1. We adjusted all inputs, outputs and total cost by dividing them with COC (cost of capital). For detail, we add descriptive statistics of both not adjusted and adjusted variables. Input1-CPL is calculated by dividing the operating expense dividing by number of employees, input2-COB is calculated by dividing the financial expenses with total liabilities and input3-COC is calculated by dividing the non-personnel operating expenses with total liabilities. For detail, we add descriptive statistics of both individual variables and inputs that created after dividing them.

## Table 3: Correlation among variables for efficiency evaluation using SFA

| | Input1-CPL | input2-COB | input3-COC | RSKC | DMATUR | LAST | RGLTD | NPRO | LGDP | DBANG | DIND | DNEPAL | DPAK | PFMs | PFOs | PFBs | STAB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| input1-CPL | 1.000 | | | | | | | | | | | | | | | | |
| input2-COB | 0.373 | 1.000 | | | | | | | | | | | | | | | |
| input3-COC | 0.108** | 0.375** | 1.000 | | | | | | | | | | | | | | |
| RSKC | -0.003 | 0.075** | 0.027 | 1.000 | | | | | | | | | | | | | |
| DMATUR | -0.224 | -0.252 | -0.191 | 0.027** | 1.000 | | | | | | | | | | | | |
| LAST | 0.150 | -0.133 | -0.167 | -0.107* | 0.164 | 1.000 | | | | | | | | | | | |
| RGLTD | 0.108* | 0.102 | 0.078 | -0.095** | -0.155 | 0.037 | 1.000 | | | | | | | | | | |
| NPRO | -0.245 | -0.079 | -0.060 | 0.271** | 0.220 | -0.217** | -0.486 | 1.000 | | | | | | | | | |
| LGDP | 0.209 | 0.079 | 0.056 | -0.392 | -0.191 | 0.017 | 0.013 | -0.347 | 1.000 | | | | | | | | |
| DBANG | 0.089** | -0.005 | -0.010* | -0.088* | 0.031* | 0.081* | 0.026 | -0.075 | 0.274** | 1.000 | | | | | | | |
| DIND | -0.227 | -0.095 | -0.054 | 0.319 | 0.278 | 0.161 | -0.086 | 0.491 | -0.729** | -0.166 | 1.000 | | | | | | |
| DNEPAL | 0.025 | -0.151 | 0.011* | -0.395 | -0.189 | 0.051 | -0.125 | -0.287 | 0.561 | 0.042** | -0.578 | 1.000 | | | | | |
| DPAK | 0.070 | -0.029 | -0.071** | 0.206 | 0.008 | -0.157 | 0.160** | -0.146 | -0.424 | -0.012 | -0.161 | -0.289 | 1.000 | | | | |
| PFMs | 0.184* | 0.373* | 0.127** | 0.139 | -0.099 | -0.277 | 0.124* | 0.046 | 0.119* | 0.087** | -0.202** | -0.361 | -0.101* | 1.000 | | | |
| PFOs | 0.088 | 0.077 | 0.135* | 0.028* | 0.014 | -0.131 | 0.029 | 0.164 | -0.049* | -0.001* | 0.066** | -0.007 | -0.090 | 0.146 | 1.000 | | |
| PFBs | -0.189* | -0.055 | -0.036* | -0.072 | 0.121* | -0.193* | 0.077 | 0.013 | 0.075 | -0.022** | -0.058 | -0.096** | -0.015* | 0.133* | 0.069* | 1.000 | |
| STAB | -0.163 | -0.341 | -0.074 | 0.024 | -0.034 | 0.075* | -0.141 | 0.093 | -0.105 | -0.081 | 0.126 | 0.329 | -0.027** | -0.524 | 0.025* | 0.040 | 1.000 |

Note: ***, **, * denote significance at the 1%, 5% and 10% levels respectively. Correlation of cost efficiency and inefficiency regressors are presented. Input1-CPL = first input cost of labour, input2 - COB = second input cost of borrowers,input3 - COC = third input cost of capital, RSKC = risk coverage ratios, DMATUR = dummy of mature (greater than or equal to 8years) MFIs, LAST = logarithm of assets, RGLTD = dummy of regulated MFIs, NPRO = dummy of non-profit-oriented MFIs, LGDP = logarithmic value of real GDP, DBANG = dummy of Bangladesh, DIND = dummy of India, DNEPAL = dummy of Nepal, DPAK = dummy of Pakistan, PFMs = Percentage of female board members, PFOs = Percentage of female loan officers, PFBs = percentage of female borrowers, STAB = political stability, see Table 1 for more details.

## Table 4: Regression results for SFA approach

| | Output: GLP | | | Output: NAB | | |
|---|---|---|---|---|---|---|
| | **I** | **II** | **III** | **IV** | **V** | **VI** |
| Panel A – Cost frontier estimates | | | | | | |
| Log (Y) | 1.208*** | 1.128*** | 1.024*** | 1.072*** | 1.106*** | 1.036*** |
| | (6.79) | (6.37) | (5.88) | (9.04) | (9.43) | (8.85) |
| Log(CPL) | -0.375 | -0.511 | -0.541* | -0.391* | -0.369 | -0.252 |
| | (-1.14) | (-1.49) | (-1.63) | (-1.71) | (-1.44) | (-1.00) |
| Log (COB) | 1.563** | 1.494** | 1.541*** | 1.649*** | 1.386*** | 1.151*** |
| | (4.25) | (3.63) | (3.82) | (6.93) | (4.88) | (3.94) |
| Log $(Y)^2$ | 0.015 | 0.018 | 0.020* | 0.016* | 0.015* | 0.019** |
| | (1.32) | (1.54) | (1.78) | (1.83) | (1.70) | (2.15) |
| Log $(CPL)^2$ | 0.076 | 0.071 | 0.116** | 0.182*** | 0.185*** | 0.167*** |
| | (1.39) | (1.32) | (2.18) | (4.16) | (4.38) | (3.97) |
| Log $(COB)^2$ | -0.122* | -0.122* | -0.128* | 0.137** | 0.223*** | 0.214*** |
| | (-1.88) | (-1.84) | (-1.95) | (2.31) | (3.53) | (3.39) |
| Log(CPL)* log (COB) | 0.055 | 0.056 | -0.020 | -0.326*** | -0.397*** | -0.361*** |
| | (0.49) | (0.50) | (-0.18) | (-3.20) | (-4.00) | (-3.60) |
| Log(CPL)* Iog (Y) | -0.022 | -0.030 | -0.052 | -0.056 | -0.053 | -0.056 |
| | (-0.51) | (-0.68) | (-1.22) | (-1.56) | (-1.50) | (-1.62) |
| Log (COB)* Iog (Y) | -0.113** | -0.085* | -0.028 | 0.018 | 0.007 | 0.025 |
| | (-2.33) | (-1.73) | (-0.57) | (0.40) | (0.16) | (0.59) |
| Risk coverage ratio | 0.066 | 0.069 | 0.020 | -0.191*** | -0.180*** | -0.098* |
| | (1.06) | (1.12) | (0.31) | (-3.90) | (-3.76) | (-1.94) |
| Regulated MFIs | -0.084 | -0.075 | -0.104** | -0.056 | -0.059* | -0.030 |
| | (-1.77) | (-1.59) | (-2.20) | (-1.62) | (-1.74) | (-0.83) |
| Non-profit-oriented MFIs | 0.148*** | 0.171*** | 0.091** | 0.001 | -0.028 | 0.033 |
| | (3.36) | (3.83) | (1.98) | (0.04) | (-0.88) | (0.92) |
| Year | | -0.089 | -0.016 | | -0.145* | -0.140* |
| | | (-0.87) | (-0.16) | | (-1.89) | (-1.76) |
| $Year^2$ | | -0.008 | -0.010 | | -0.005 | -0.004 |
| | | (-1.21) | (-1.54) | | (-1.02) | (-0.74) |
| Year * log(CPL) | | 0.043* | 0.038 | | 0.023 | 0.012 |
| | | (1.74) | (1.53) | | (1.23) | (0.62) |
| Year * log (COB) | | -0.027 | -0.035 | | 0.033 | 0.045** |
| | | (-0.95) | (-1.22) | | (1.56) | (2.13) |
| Dummy of Bangladesh | | | 0.505*** | | | -0.103 |
| | | | (6.23) | | | (-1.52) |
| Dummy of India | | | 0.348*** | | | 0.107** |
| | | | (5.12) | | | (1.97) |
| Dummy of Nepal | | | 0.327*** | | | 0.012 |
| | | | (3.30) | | | (0.14) |
| Dummy of Pakistan | | | 0.299*** | | | -0.043 |
| | | | (3.49) | | | (-0.62) |
| Observations | 416 | 416 | 416 | 416 | 416 | 416 |
| Wald test (P-values) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Panel B - The inefficiency equations | | | | | | |
| DMATURE | 0.030 | 0.035* | 0.041* | 0.114*** | 0.098*** | 0.096*** |
| | (1.44) | (1.67) | (1.73) | (3.81) | (3.40) | (3.54) |
| Size of MFIs | 0.005 | 0.004 | 0.006 | 0.009 | 0.010 | 0.011 |
| | (0.99) | (0.79) | (0.99) | (1.09) | (1.29) | (1.61) |
| Log of real GDP | -0.01 | 0.004 | 0.062** | 0.137*** | 0.122*** | 0.088*** |
| | (-0.71) | (0.19) | (2.66) | (4.63) | (4.25) | (3.29) |
| Percentage of female loan officers (PFOs) | 0.162*** | 0.155*** | 0.197*** | 0.144*** | 0.144*** | 0.156*** |
| | (5.88) | (5.57) | (6.18) | (3.59) | (3.69) | (4.28) |
| Percentage of female borrowers (PFBs) | 0.055 | 0.068* | 0.072* | -0.799 | -0.079 | -0.094** |
| | (1.59) | (1.95) | (1.80) | (-1.58) | (-1.61) | (-2.05) |
| Percentage of female board members (PFMs) | 0.0001 | -0.006 | -0.018 | -0.025 | -0.062 | -0.082 |
| | (0.00) | (-0.15) | (-0.39) | (-0.42) | (-1.06) | (-1.50) |
| Political stability | -0.011 | -0.021 | -0.049* | 0.057* | 0.043 | 0.022 |
| | (-0.49) | (-0.89) | (-1.82) | (1.67) | (1.29) | (0.71) |
| Observations | 295 | 295 | 295 | 295 | 295 | 295 |
| Significance level of F-statistics of likelihood ratio | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 |

Note: T-statistics are in parentheses, *, ** and *** denotes significance at levels 10%, 5%, 1%, respectively. Log (Y) = logarithm value of output that is GLP for financial performance and NAB for social performance. CPL = logarithm value of first input cost of labour and COB = logarithm value of second input cost of borrowers. TC is dependent variables for Panel A, and its residuals are used as dependent variables for Panel B. We include the constant in both panels, but these are not reported to save space.