Efficiency of microfinance institutions of South Asia: a bootstrap DEA approach

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Abstract: The microfinance institutions (MFIs) operate with the dual goals; financial sustainability and social outreach. Therefore, the present paper aims to assess the twin objectives of MFIs operating in the selected four South Asian countries (i.e., Bangladesh, India, Nepal and Pakistan) during the financial year 2010 to 2015. First, we remove the outliers from the dataset by following Banker and Gifford (1988) and Banker and Chang (2006) guidelines. Thereafter, the study use bootstrap data envelopment analysis (DEA) by designing two separate models to measure bias-corrected financial and social efficiency estimates. The empirical results confirm that the South Asian MFIs remain more financially efficient than socially during the study period. Further, the Indian MFIs outperform in terms of both the aspects followed by Nepali and Bangladeshi MFIs, respectively. However, the Pakistani MFIs are the least performers in terms of both social outreach and financial sustainability.

Keywords: bias-corrected efficiency; financial efficiency; social efficiency; bootstrap data envelopment analysis; DEA; bootstrap DEA; microfinance institutions; MFIs; microfinance; South Asia.

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1 Introduction

Over three billions people (i.e., close to half of the world population) live on less than US$ 2.50 a day (Ravallion et al., 2009). In addition, they are not considered bankable in the conventional banking system due to lack of acceptable collateral, frequent and small credit demand and absence of credit history etc. Consequently, they remain excluded from the conventional financial system and continued in the vicious cycle of poverty (Hermes and Lensik, 2007). Therefore, the microfinance emerged which offers a range of financial services such as small loans, deposit facilities, micro insurance, transfer and payments services, etc. and enable them to come out of poverty (Shaw, 2004). The microfinance has been considered as one of the significant devices used in the global poverty alleviation programmes (Widiarto and Emrouznejad, 2015). The microfinance programme was started in South Asia with microcredit by Nobel Laureate, Prof. Mohammad Yunus in rural Bangladesh during the mid-1970s. South Asia is considered as the largest microfinance market in terms of client outreach (Bibi et al., 2017). In addition, these MFIs are serving the poorest of the poor which is evident by smaller average loan size of South Asian MFIs. The smaller loan size usually associated with higher transaction cost which could affect the financial performance of MFIs. In addition, the government has reduced the subsidies in the MFIs operating in the South Asian countries to make the MFIs self-sustainable. Given this background, the following questions arise in the author’s mind:

1 How the South Asian MFIs are sustaining financially?
2 What is their social outreach level?
3 Whether they able to attain dual goals of microfinance simultaneously; financial sustainability and social outreach.

To seek answers of the above questions, the present paper aims to assess the efficiency levels of MFIs on the attainment of dual mission of social outreach and financial sustainability in South Asia region, and to see whether there exists significant difference (or trade-off) in achieving efficiency in pursuing dual mission across South Asian countries. In particular, we employed data envelopment analysis (DEA) model to measure the financial and social efficiency scores of individual MFIs operating in the four selected South Asian countries during the year 2010–2015. The conventional DEA models do not follow any statistical properties and consequently obtain biased efficiency estimates (Simar and Wilson, 2007; Wijesiri et al., 2015; Khan and Gulati, 2019). Therefore, we incorporated the bootstrap procedure in the DEA model to obtain bias-corrected efficiency scores. In addition, we employed the super-efficiency based outlier’s detection procedure suggested by Banker and Gifford (1988) and Banker and Chang (2006) to detect and removed possible outliers from the dataset. Then, we carry
our analysis based on remaining observation after removing the outliers. To examine the
dual goals performance, we designed two DEA models separately; Financial and Social.
We deployed the homogenous bootstrap procedure in the output-oriented constant return
to scale DEA framework suggested by Simar and Wilson (1998, 2000) to obtain
bias-corrected efficiency estimates of individual MFIs.

The study contributes to the embryonic empirical literature of MFIs efficiency in the
following ways. First, to the best of author’s knowledge this the first attempt to estimate
the financial and social bias-corrected efficiency scores of South Asian MFIs. In
particular, to examine how the MFIs are balancing their dual mission, we designed two
DEA models, to estimate the financial and social efficiency separately. This is the first
study to examine the dual goal performance of South Asian MFIs at the country level.
Second, from the methodological point of view, using the bootstrap procedure in the
DEA framework is also the major contribution in the literature. Third, the study uses
super-efficiency based Banker and Gifford (1988) guidelines to remove the outliers from
the dataset and estimate the accurate efficiency frontier. Banker and Chang (2006) argued
that the super-efficiency procedure is more effective in detecting the outliers when the
noise in the data in high. Abdelkader et al. (2014) also used super-efficiency based outlier
detection procedure followed by Andersen and Petersen (1993) which is also based on
Banker and Gifford (1988) procedure.2 Fourth, we have compared the bias-corrected
efficiency estimates with the original CCR-based DEA efficiency scores. Fifth, the
empirical results are based on the recent dataset from the year 2010 to 2015; therefore,
the study may capture the impact of the latest technological advancement and regulatory
transformation of South Asian MFIs industry. We believe that the empirical results of the
study will provide significant inputs to policymakers, regulators, and researchers who are
interested in the performance of South Asian MFIs.

Rest of the paper is structured as follow: Next Section 2 reviews the existing
efficiency literature on microfinance. Section 3 describes the brief of South Asian MFIs
industry. The methodological Section 4, explains the description of inputs-outputs,
database and procedure to estimate the bias-corrected efficiency scores. The empirical
results are presented in Section 5, and finally, Section 6 concludes the study.

2 Literature review

The academicians and researchers have shown interest in assessing MFIs efficiency and
productivity over the last decade (Gutiérrez-Nieto and Serrano-Cinca, 2019). Both the
parametric, i.e., data envelopment analysis (DEA) and non-parametric, i.e., stochastic
frontier analysis (SFA) has been frequently used over the last decade in microfinance
efficiency literature (Fall et al., 2018). Although, both the techniques have their own pros
and cons, still authors are using them as per the nature of data available and objectives of
the study (Berger and Humphrey, 1997). Many authors have contributed in the
microfinance empirical efficiency literature e.g., Gutiérrez-Nieto et al. (2007, 2009), Haq
et al. (2010), Hermes et al. (2011), Masood and Ahmud (2012), Abdelkader et al. (2014),
(2015), Lebovics et al. (2016), Bibi et al. (2017), Abdelkader and Mansouri (2019) and
Khan and Gulati (2019). Though research on MFIs efficiency attracting the
academicians, however, there is lack of quality research work. Therefore, the MFIs
literature requires more quality research to flourish further.
Gutiérrez-Nieto et al. (2007) were the first to contribute in the MFIs empirical literature. They employed the constant returns to scale output-oriented DEA model to examine the 30 Latin American MFIs. They classified the MFIs into NGO and non-NGOs and carry the analysis with different input and output combinations. Their empirical results suggest that the level of efficiency depends upon the input-output specification used in the DEA model. Further they conclude that NGO MFIs offer a larger number of loans to make the service cost down and become cost-efficient. Further, the authors were keen to know how the MFIs are managing their dual mission of financial sustainability and social outreach. Therefore, Gutiérrez-Nieto et al. (2009) examined the dual mission of MFIs; financial and social performance. They analyse financial and social efficiency of 89 MFIs operating in Africa, Asia, Latin America and Eastern Europe during the year 2003. They designed two separate output-oriented DEA models based on constant returns to scale assumption with different input and output combinations. They found that MFIs are able to attain both sustainability and social outreach, simultaneously. In addition, they found NGOs are more socially efficient relatively. Further, their analysis suggests that geographical location is the most important determinants of efficiency level. Further, using the data of 39 MFIs of Africa, Asia and Latin America operating in the year 2004, Haq et al. (2010) examined the cost efficiency of individual MFIs. They have also applied the constant return to scale output-oriented DEA model and measure the cost efficiency under both production and intermediation approaches. They found NGOs are most cost-efficient under production approach and bank MFIs are efficient under intermediation approach. They also corroborated the findings of Gutiérrez-Nieto et al. (2009) that there is no trade-off between sustainability and outreach. Further, this dual goals mission was also examined by Piot-Lepetit and Nzongang in the year 2014. They used multi-DEA approach to measure the financial and social efficiency level of 52 MFIs operating in the Cameroon during the financial year 2009. They found that trade-off exists only for 15% MFIs, 46% MFIs are able to manage their dual mission performance, and rest 39% MFIs neither financially nor socially efficiency. In the same financial year, Abdelkader et al. (2014) use the upgraded methodology to assess the efficiency of 61 MFIs operating in the MENA region during the year 2006 to 2009. They have incorporated the bootstrap procedure in a DEA framework to assess the bias-corrected efficiency scores. They first identified and removed the outliers from the dataset by employing three different methods (i.e., peer count method, super-efficiency methods and Wilson method) and carry the analysis on reaming observations. They found the average efficiency level has declined over the study period. Further, they conclude that efficiency significantly varies across the different legal status of MFIs.

The decision-making units (DMUs) operating with similar environment must be grouped together to form the efficiency frontier in the DEA framework (Gulati and Kumar, 2016). In the MFIs efficiency literature, Widiarto and Emrouznejad (2015) employed the DEA based meta-frontier approach to compare the efficiency of 231 Islamic and conventional MFIs operating in MENA, East Asia-Pacific and South Asia regions during the financial year 2009–2010. They deployed the output-oriented variable returns to scale DEA model to assess the financial, social and overall efficiency scores of individual MFIs. Their results confirmed that conventional MFIs were outperforming in the MENA region in term of overall performance. However, Islamic MFIs were to be more socially efficient. Further, they employed regression analysis, and mature MFIs
have higher social efficiency; however, their results are not statistically significant. Similar observations were obtained by Wijesiri et al. (2015). However, their findings were statistically significant that age is the major determinant of social performance. They incorporated the bootstrap procedure in a DEA framework to assess the bias-corrected efficiency scores of 36 Sri Lankan MFIs. They also identified the efficiency determinants by employing the second-stage bootstrap truncated regression analysis. Their finding suggests that NGOs MFIs are more socially efficient. Further, they found age and capital have a positive association with financial efficiency. However, ROA, legal status and age have a significant impact on social efficiency.

In the empirical literature, the debate on financial and social goals mutuality is still unresolved; few authors have again tried to examine this debate in different countries. Recently, Lebovics et al. (2016) deployed the input-oriented constant return to scale DEA model to measure the financial and social efficiency of 28 Vietnamese MFIs operating during the year 2011. They examine the trade-off debate between the dual goals of sampled MFIs. However, they did not find any supportive evidence of trade-off. Similar findings were also observed by Khan and Gulati (2019) in case of Indian MFIs. They have also incorporated the bootstrap procedure in the DEA model to measure the bias-adjusted social, financial and overall efficiency scores of 82 Indian MFIs operating during the financial year 2015–2016. They found that Indian MFIs were more financially efficient than socially. They argued that Indian MFIs are able to manage the dual goal performance. Their empirical results confirmed that financial sustainability and social outreach goals of MFIs are complementary in nature and could be achieved simultaneously. Following the Simar and Wilson (2007) approach, Bibi et al. (2017) also identified the performance determinants of South Asian MFIs operating during the year 2005–2015. They employed the input-oriented bootstrapped DEA model to assess the bias-corrected efficiency scores. Their empirical results confirmed that gender and governance are the significant determinants of the efficiency of South Asian MFIs. More recently, Abdelkader and Mansouri (2019) have assessed the bias-corrected MFIs of 72 MFIs operating the MENA region during the year 2002–2012. They have also applied the parametric and non-parametric test to compare the performance and identify the factors which affect the efficiency of Arab MFIs. Their results confirmed that efficiency differences were due to variation in the age and regulation in different countries. Their results also confirmed that MFIs in the MENA region are able to achieve the dual goals; financial sustainability and social outreach.

After a thorough review of MFIs empirical literature based on frontier analysis, we made the following observations. First, most of the studies (e.g., Gutiérrez-Nieto et al., 2007, 2009; Haq et al., 2010; Piot-Lepetit and Nzongang, 2014; Widiarto and Emrouznejad, 2015; Lebovics et al., 2016) are based on conventional DEA models. A simple DEA framework does not account for the bias in the efficiency estimation (Wijesiri et al., 2015). In addition, the conventional DEA models have no statistical properties; consequently, one may obtain biased efficiency estimates (Simar and Wilson, 2007; Khan and Gulati, 2019). Second, there is only few studies i.e., Abdelkade et al. (2014), Wijesiri et al. (2015), Bibi et al. (2017), Abdelkader and Mansouri (2019), Khan and Gulati (2019) in the entire MFIs efficiency literature which used bootstrap procedure in the DEA framework to measure bias-adjusted efficiency estimates. Third, only Bibi et al. (2017) have assessed the efficiency level of South Asian MFIs during the period 2005 to 2012. Apart from that, there is no single study in the empirical efficiency literature on the South Asian MFIs.
To bridge the above-mentioned gap and enrich the MFIs empirical literature, the present study attempts to scrutinise both financial and social efficiency prospects of South Asian MFIs operating during the year 2010–2015. In particular, first, we employed the super-efficiency based outlier’s detection procedure suggested by Banker and Gifford (1988) and Banker and Chang (2006) to detect and removed possible outliers from the dataset. Then, we carry our analysis based on remaining observation after removing the outliers. We deployed the homogenous bootstrap procedure in the output-oriented constant return to scale DEA framework suggested by Simar and Wilson (1998, 2000) to estimate bias-corrected efficiency scores of individual MFIs. Further, the MFIs operate to achieve their dual goals performance finance and social, therefore, they need to be assessed on both the aspects (Koveos and Randhawa 2004; Gutiérrez-Nieto et al., 2009). Therefore, we design the two DEA models separately; financial and social, to examine the dual goals performance of South Asian MFIs.

3 An overview of the microfinance industry of South Asia

Microfinance services have been benefited the 116.6 millions of clients with the US$ 92.4 billion of credit to the poor around the World (MIX market, 2015). In particular, the South Asian MFIs are reaching to the largest number of poor among the other continents. This is evidence that this continent is solely serving the 66.93 millions of poor, which are 57% of total clients of microfinance all over the World. Additionally, these MFIs have a greater focus on empowering women. As per the global outreach and financial performance benchmark report 2015, the client portfolio of South Asian MFIs consists of 92% of women. Besides, the average loan balance per borrower is US$ 346, i.e., lowest among all MFIs industry. This reflects that South Asian MFIs are doing well in terms of the original mission of microfinance, i.e., empowering the poor and women borrowers.

Table 1  Summary of basic operational metrics of South Asian MFIs (fiscal year 2015)

<table>
<thead>
<tr>
<th>Country</th>
<th>No. of MFIs</th>
<th>Active borrowers</th>
<th>Female borrowers (percent)</th>
<th>Gross loan portfolio(US$) millions</th>
<th>Average loan balance per borrower (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>6</td>
<td>148,600</td>
<td>34</td>
<td>113.1</td>
<td>761</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>34</td>
<td>23,977,700</td>
<td>90</td>
<td>5,753.7</td>
<td>240</td>
</tr>
<tr>
<td>India</td>
<td>103</td>
<td>38,097,600</td>
<td>97</td>
<td>11,640.8</td>
<td>244</td>
</tr>
<tr>
<td>Nepal</td>
<td>12</td>
<td>1,009,700</td>
<td>99</td>
<td>369.6</td>
<td>366</td>
</tr>
<tr>
<td>Pakistan</td>
<td>39</td>
<td>3,549,500</td>
<td>53</td>
<td>884.9</td>
<td>247</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>2</td>
<td>146,200</td>
<td>90</td>
<td>23.0</td>
<td>219</td>
</tr>
<tr>
<td>Total</td>
<td>196</td>
<td>6,69,29,300</td>
<td>77.17</td>
<td>18,785.1</td>
<td>346.17</td>
</tr>
</tbody>
</table>

Note: aData includes for the MFIs which reports to the MIX market only.


Further, we noted from the MIX report 2015, the portfolio at risk greater than 30 days was only 2.6% among South Asian MFIs, which reflects they are getting their loan payback timely. On the whole, we may conclude that these MFIs are outperforming among the peer regions. As per the global outreach and financial performance benchmark
report – 2015, the client outreach of South Asian MFIs is the largest one among the other regions. Particularly, Indian and followed by the Bangladeshi MFIs are catering to the financial needs of 38 million and 23 million poor, respectively. Though the South Asian MFIs are catering to the largest number of borrowers, the disparities among counties are quite large. The variation in the regulatory environment, financial status, history and scale of microfinance operation in the Asian countries are responsible for the microfinance outreach in their respective region. Therefore, the authors are motivated to examine the financial and social performance of the MFIs operating in South Asia.

4 Data and methodology

We incorporated the homogeneous bootstrap procedure suggested by Simar and Wilson (1998, 2000) in the data envelopment analysis (DEA) model. The conventional DEA models do not follow the statistical properties consequently may lead to biased efficiency estimates. The bias-corrected efficiency estimates are a true measure of efficiency level. Further, in the case of small sample size, the bootstrap DEA models offer valid and reliable efficiency. Therefore, in the present paper, we employed output-oriented constant return to scale bootstrap DEA model to estimate the bias-corrected financial and social efficiency scores of individual MFIs.

4.1 CCR-based DEA model

Charnes, Cooper and Rhodes (1978) have developed the first CCR-based DEA model based on the seminal work done by Farrell (1957) to measure the relative efficiency scores of decision-making units (DMUs). The CCR model has been further developed into the BCC model by Banker et al. (1984). The DEA models (non-parametric) have certain advantages over stochastic frontier analysis-SFA (parametric) models, for instance, it can accommodate the multiple inputs and outputs and provide a comparable scalar value of efficiency scores for the individual DMUs in the reference set. Further, the objectives of MFIs are to maximise the revenue and social outreach with the given level of input resources, therefore, the study uses the simple CCR-based output-oriented DEA model (Charnes et al., 1978) to estimate original efficiency scores ($\hat{\theta}^o$) of individual MFI and compared with the bootstrapped DEA model (Simar and Wilson 1998, 2000).

Let’s assume there are $n$ MFIs (i.e., $j = 1, 2, \ldots, n$) where each MFIs produce $s$ outputs vector ($y_{ij}$) using $m$ inputs vector ($x_{ij}$), then the efficiency of MFI $o$ is calculated by solving the following linear programming:

$$
\begin{align*}
\max_{\lambda, \mu} \hat{\theta}^o = & \phi + \epsilon \left( \sum_{i=1}^{m} \lambda_i x_{ij} + \mu \sum_{j=1}^{s} s_j^o \right) \\
\text{s.t.} \quad & \sum_{j=1}^{s} \lambda_i x_{ij} + s_j^o = x_{io}; \sum_{j=1}^{s} \lambda_j y_{ij} - s_j^o = \phi y_{io} \\
& r = 1, 2, \ldots, s; i = 1, 2, \ldots, m; s_j^o, s_j^o \geq 0; \lambda_j \geq 0; j = 1, 2, \ldots, n
\end{align*}
$$

where $\hat{\theta}^o$ represent the original efficiency estimate of the MFI $o$ which vary between zero to unity, and $\phi$ represents the proportion by which MFI $o$ can increase its outputs for...
a given level of inputs to become as efficient. The $\lambda_j$ shows the share of MFI $j$ in defining an efficient target for the MFI $o$. The variables $s^-_i$ and $s^+_r$ indicate input slack (possible input reduction) and output slack (possible output augmentation), respectively. The parameter $\varepsilon$ is a non-Archimedean infinitesimal. Further, $1-\hat{\theta}^n$ represents the maximum proportional expansion in the output produced at the given level input resources. For the efficient MFIs, $\hat{\theta}^n = 1$ and if $\hat{\theta}^n < 1$ then the MFI is considered to be inefficient.

4.2 Bootstrap DEA procedure

The conventional DEA models do not have the statistical properties. Therefore, they provide biased efficiency scores (Wijesiri et al., 2015). To overcome this issue, we follow the concept of bootstrap, which repeatedly simulates the data generated process to obtain the new estimates from each simulation (Efron, 1997; Efron and Tibshirani, 1993). In addition, the distribution of re-sampled estimates may be used to obtain the bootstrapped confidence intervals to confirm whether efficiency estimates are statistically significant (Fuentes, 2011). To separate the bias from the estimated efficiency scores by using equation (1), we used the following bias-corrected algorithm suggested by Simar and Wilson (1998, 2000) to estimate the bias-corrected efficiency estimates $(\tilde{\theta}^n)$.

The procedure of bootstrap bias-adjusted DEA estimates

1. Calculate the original efficiency estimate $\hat{\theta}^n$ using the equation (1)

2. Then we smooth homogeneous bootstrapping to generate bootstrap sample $\hat{\theta}^1, ..., \hat{\theta}^n$ to obtain a bootstrap replica of $\hat{\theta}^1, ..., \hat{\theta}^n$ and follow the step 2.1 to 2.4

2.1 Bootstrap, sample with replacement from $\hat{\theta}^1, ..., \hat{\theta}^n$ and call the results $\beta^1, ..., \beta^n$.

2.2 Simulate standard normal independent random variables $\epsilon^1, ..., \epsilon^K$.

2.3 Calculate $\tilde{\theta}^n = \begin{cases} \beta^n + h\varepsilon^n & \text{if } \beta^n + h\varepsilon^n \leq 1 \\ 2 - \beta^n - h\varepsilon^n & \text{otherwise} \end{cases}$

2.4 adjust $\tilde{\theta}^K$ to obtain parameter with asymptotically correct variance, and then estimate the variance $\sigma^2 = \frac{1}{K} \sum_{i=1}^{n} (\tilde{\theta}^n - \bar{\beta})^2$ and calculate $\tilde{\theta}^n = \bar{\beta} + \frac{1}{\sqrt{1 + h^2/\sigma^2}} (\tilde{\theta}^n - \bar{\beta})$

where $\bar{\beta} = \frac{1}{K} \sum_{i=1}^{n} \beta^n$.

3. Using the formula $Y^{nb} = \tilde{\theta}^n \bar{\theta}^n Y^n$, we obtain output-oriented bootstrapped efficiency estimates.

4. Calculate $\theta^{eb}$ by solving the DEA program
A. Khan and R. Gulati

\[
\theta^{ob} = \max \left\{ \theta \leq 0 \mid X^a \geq \sum_{j=1}^{K} \lambda_j X_j, \theta Y^a \leq \sum_{j=1}^{K} \lambda_j Y_j; \lambda_j \geq 0, \sum_{j=1}^{K} \lambda_j = 1 \right\} (n = 1, ..., K)
\]

5 To obtain the bootstrap estimates (\(\theta^{ob}, ..., \theta^{ob}\)) where \((b = 1, ..., B)\), repeat the step from 2–4.

6 Calculate the mean and variance of \((\theta^{ob}, ..., \theta^{ob})\) to get the bootstrap estimate \(\theta^{*b}\), the bias-corrected estimate \(\theta^{b}\) and the variance.

We used 2,000 bootstrap samples to calculate the confidence intervals of the data set following the Simar and Wilson (1998, 2000) guidelines. The interested researchers may visit Simar and Wilson (2007) and Bogetoft and Otto (2010) for a more detailed discussion on bootstrapping procedure.

4.3 Database

The study used secondary data extracted from MixMarket (http://www.themix.org). The MFIs around the World voluntarily report the audited balance sheets and financial statements to the MixMarket. It contains the reliable and standardised data of financial and social performance indicators of 1,033 financial service providers (FSPs) operating worldwide.\(^4\)

We have included the four selected countries of South Asia, i.e., Bangladesh, India, Nepal and Pakistan only. Other countries of the region, i.e., Afghanistan, Bhutan, Maldives and Sri Lanka remain excluded from the sample due to missing information or unreported data of selected input and output variables. We have extracted the data for the fiscal year 2010 to 2015. During this period, the South Asian MFIs industry has gone under various regulatory transformations and shifted to a new paradigm of financial sustainability. Table 3 reports the details of the sample drawn from each selected country after removing the possible outliers.\(^5\)

4.4 Selection of inputs-outputs

In the bank efficiency literature, two orientations namely; intermediation and production approaches are being commonly used to select the inputs and outputs (Athanasopoulos, 1997; Berger and Humphrey, 1997; Kumar and Gulati, 2014).\(^6\) The MFIs’ operating styles are heterogeneous around the World, and they have dual goals to achieve. Therefore, a mix of two production and intermediation approaches is suitable (Gutiérrez-Nieto et al., 2007), also quoted by Mia and Soltane (2016) and Khan and Gulati (2019).

The study used three inputs and three outputs to measure the efficiency score using the output-oriented DEA framework. After a thorough review of the literature, we choose an input combination of

1 total assets
2 operating expenses
3 labour as frequently used in the efficiency studies (Gutiérrez-Nieto et al., 2009; Widiarto and Emrouznejad, 2015; Kumar and Sensarma, 2017; Khan and Gulati, 2019).
Our outputs consist of
1. financial revenue
2. gross loan portfolio
3. number of active borrowers.

We assess the financial performance of MFIs by incorporating gross loan portfolio, i.e., represent how MFIs are efficient in placing the credit (Gutiérrez-Nieto et al., 2009) and financial revenue as a proxy to evaluate how MFIs are efficient in collecting the revenue (Khan and Gulati, 2019). We relied on client outreach to evaluate the social efficiency, although there are various other proxies to measure the social performance, i.e., the number of women borrowers (depth of outreach), average loan balance per borrower (depth of outreach) as suggested by Schreiner (2002). The number of active borrowers is the widely used proxy to estimates the social outreach (breadth) (Widiarto and Emrouznejad, 2015; Wijesiri and Meoli, 2015; Kaur, 2016; Khan and Gulati, 2019). The definition of inputs and outputs and description of DEA models have been given in Table 2.

Table 2  Definition of input-output variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unit</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inputs for model A and B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Total assets (A)</td>
<td>US$</td>
<td>Total of all net assets</td>
</tr>
<tr>
<td>2 Operating expenses (O)</td>
<td>US$</td>
<td>It includes all expenses associated with personnel, depreciation &amp; amortisation and administration</td>
</tr>
<tr>
<td>3 Labour (L)</td>
<td>Number</td>
<td>Number of employees working on MFIs payroll</td>
</tr>
<tr>
<td>Outputs Model A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Financial revenue (F)</td>
<td>US$</td>
<td>Revenue collected from loan portfolio, interest and fee, and from other financial assets</td>
</tr>
<tr>
<td>2 Gross loan portfolio (G)</td>
<td>US$</td>
<td>Total amount of loans outstanding with the borrowers at the end of the financial year</td>
</tr>
<tr>
<td>Outputs Model B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Borrowers (B)</td>
<td>Numbers</td>
<td>Total number of active borrowers</td>
</tr>
</tbody>
</table>

Source: Variable definitions have been taken from Mix Market, accessed in October 2017 https://www.themix.org/sites/default/files/publications/global_benchmark_report_fy2015_0.pdf

The variable labour and active borrowers are in the actual numbers, and all other monetary data are in the US Dollar. Since the large variations were noted among some inputs and outputs data, therefore, all the momentary data are mean normalised to avoid possible ‘scaling issues’ by following the Sarkis (2007) guidelines. In addition, this mean-normalisation process also used by Widiarto and Emrouznejad (2015) and Khan and Gulati (2019) in the microfinance efficiency literature. We use the following equation to prepare the data to use in the DEA framework.

\[ X_{\text{Norm}} = X_{\text{io}} + \left( \frac{N}{N} \sum_{i=1}^{N} X_{\text{io}} \right) / N \]  

(2)
where $X_{io}$ is the value for $i^{th}$ variable of $MFI_o$, $N$ stands for total number of sampled MFIs, and $X_{normio}$ is the mean normalised value of $i^{th}$ variable of $MFI_o$.

Table 3  
Input-output data available for the number of MFI (after removing the outliers)

<table>
<thead>
<tr>
<th>Country</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>34</td>
<td>31</td>
<td>23</td>
<td>32</td>
<td>35</td>
<td>5</td>
<td>160</td>
</tr>
<tr>
<td>India</td>
<td>97</td>
<td>104</td>
<td>87</td>
<td>83</td>
<td>95</td>
<td>93</td>
<td>552</td>
</tr>
<tr>
<td>Nepal</td>
<td>29</td>
<td>34</td>
<td>23</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>115</td>
</tr>
<tr>
<td>Pakistan</td>
<td>26</td>
<td>26</td>
<td>23</td>
<td>35</td>
<td>13</td>
<td>13</td>
<td>160</td>
</tr>
<tr>
<td>Total</td>
<td>189</td>
<td>198</td>
<td>158</td>
<td>172</td>
<td>122</td>
<td>122</td>
<td>997</td>
</tr>
</tbody>
</table>

Source: Author’s own calculations from MIX market database

Table 4  
Details of outlier detected and removed from the extracted dataset

<table>
<thead>
<tr>
<th>Year</th>
<th>Model 1. Financial</th>
<th>Model 2. Social</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Name-Country</td>
</tr>
<tr>
<td>2010</td>
<td>1</td>
<td>Pustikar-India</td>
</tr>
<tr>
<td>2011</td>
<td>2</td>
<td>Annapurna Microfinance, Pustikar-India</td>
</tr>
<tr>
<td>2012</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>2013</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>2014</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>2015</td>
<td>2</td>
<td>Muthoot Microfin, Gramalaya Microfin-India</td>
</tr>
</tbody>
</table>

Source: Author’s own calculations using Banker and Gifford (1988) and Banker and Chang (2006) guidelines

4.5 Detection of outliers

The observations which are inconsistent with others in the data set are possible candidates to be the outliers (Barnett and Lewis, 1994). The outliers, if not detected and removed from the dataset, may shift the upward (or downward) the entire efficiency frontier (Bogetoft and Otto 2010). Consequently, other DMUs become more inefficient (or efficient) than they truly are (Banker and Chang, 2006; Banker et al., 2017). Banker and Gifford (1988) and Andersen and Petersen (1993) used the super-efficiency procedure in the DEA model to eliminate the over influential points in the production frontier. The outlier detection method based on the super-efficiency concept is recommended by Banker and Gifford (1988) (thereafter BG procedure) and Wilson (1993). Banker et al. (1989) employed BG procedure for outlier detection. To estimate the true production frontier, we first detected the outliers by using the procedure
suggested by Banker and Gifford (1988). We define an arbitrary decision rule and set the screen level at 1.6 by following the Banker and Chang (2006). If the $\theta^{\sup} \geq 1.6$ for any DMU we declare that unit as an outlier and removed from the sampled MFIs and carry the analysis on rest of the observations. We detected and removed the outliers for each model financial and social separately, which are reported in Table 4.

5 Empirical results

5.1 Estimation strategy

We identify and remove the possible outliers from the dataset by deploying the super-efficiency concept suggested by Banker and Gifford (1988) and following the screen level of 1.6 as recommended by Banker and Chang (2006). We constructed the separate annual efficiency frontier for each year despite a single multi-year frontier to account technological advancement in the DEA model. We estimated annual efficiency frontiers of original DEA efficiency ($\hat{\theta}$) using the equation two and the bias-corrected efficiency ($\hat{\theta}^\ast$) using the procedure given section 4.2. In addition, we estimated lower bound (LB), and upper bound (UB) with the 95% confidence interval (CI), and corresponding bootstrapped bias was also reported by authors.

5.2 Efficiency in attaining dual mission by MFIs in South Asia

The MFIs original mission is to empower the women and poor people by serving them with microfinance. However, they need to be financially self-sustain in the long-run to operate without any external financial aid. Therefore, MFIs need to achieve dual objectives simultaneously; financial sustainability and poverty outreach.

5.2.1 Efficiency in achieving financial sustainability

For measuring the efficiency performance of microfinance institutions on achieving financial sustainability, we estimated financial efficiency scores of each MFI in South Asian region using the input-output specification defined for model A. The estimated scores are reported in Table 5. From the empirical results, we noticed that the means of original DEA estimates are higher than the means of bias-adjusted efficiency estimates of each country over the study period. It reflects that the CCR-based DEA model overestimates the efficiency scores relatively. The true efficiency estimates vary between the lower and upper bound of the confidence interval. Further, we observed that the original efficiency and bias-adjusted efficiency have decreased over the study period for all the selected countries (see Figure 1). It reflects their inefficiency in allocating the input resources. The low average loan size of South Asian MFIs, which usually incurred the higher transaction cost, might have affected their financial performance. However, a smaller loan size is the proxy of deeper financial inclusion. This might be the positive side of the industry. The efficiency level of MFIs operating South Asia was expected to be the same since the MFIs are operating in a similar economic environment (Bibi et al.,
However, we found the variations in the efficiency level of MFIs. The similar results were also confirmed by Bibi et al. (2017). Further, we found only a few MFIs operating on the efficient-frontier based on the original-DEA estimates (see Table 5), however, non-of the MFIs were found to be efficient while looking at bias-adjusted efficiency frontier. In addition, we found a common decreasing trend in the financial efficiency of the entire South Asian MFIs during the study period (Figure 1). In particular, we observed that on an average, the financial efficiency of selected South Asian MFIs has decreased from 0.692 to 0.517 over the study period. Even though the South Asian microfinance policy has been improved much over time, still the government interventions which prevail in the entire region hinder the growth of this sector. Regulators in South Asian countries put a ceiling on the interest rate which restricts the MFIs to keep the interest rate low. Consequently, some MFIs are not able to cover the cost associated with smaller loan size. Therefore the financial efficiency level has not improved much over the study period.

We found the average of the bias-corrected efficiency of Bangladeshi MFIs have dropped from 0.747 to 0.439 over the study period. It is worth mentioning here that the reported MFIs in Bangladesh also decreased from 34 (in the year 2010) to 5 (in the year 2015) which could be the possible reason to decline the average efficiency level of Bangladeshi MFIs industry. In the year 2015, Indian and Bangladeshi MFIs were found to be the most and the least efficient, respectively, among the peer’s South Asian MFIs in terms of financial prospects. However, the least biases were reported in the original financial efficiency estimates of Bangladeshi MFIs. Over the study period, the Indian MFIs outperformed, though, more biasness was reported, when the study estimates the true efficiency score. However, the bias-corrected financial efficiency estimates of Indian MFIs were higher among the peer MFIs of the South Asian region. Further, the majority of Indian MFIs are non-banking financial companies (NBFCs), which are governed by the Reserve Bank of India (RBI). It clearly reflects the reforms in terms of regulation in the Indian MFI industry would have enabled the MFIs to optimise their resources. In addition, The Indian MFIs are better utilising the technology to reduce the transaction cost per dollar lent. The MFIs operating in the other peer nations must adopt the operating style of Indian MFIs to become financially sustainable.
Table 5  Annual averages and summary of original and bias-corrected efficiency scores

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>$\tilde{\theta}^*$</th>
<th>$\tilde{\theta}^c$</th>
<th>Bias</th>
<th>95% confidence interval</th>
<th>No. of efficient units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>2010</td>
<td>0.777</td>
<td>0.747</td>
<td>0.030</td>
<td>0.725 - 0.776</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>0.754</td>
<td>0.729</td>
<td>0.026</td>
<td>0.711 - 0.752</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>0.688</td>
<td>0.638</td>
<td>0.051</td>
<td>0.612 - 0.671</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>0.694</td>
<td>0.657</td>
<td>0.037</td>
<td>0.634 - 0.687</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>0.581</td>
<td>0.525</td>
<td>0.056</td>
<td>0.483 - 0.596</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>0.520</td>
<td>0.439</td>
<td>0.081</td>
<td>0.394 - 0.493</td>
<td>0</td>
</tr>
<tr>
<td>Grand mean</td>
<td></td>
<td>0.663</td>
<td>0.623</td>
<td>0.047</td>
<td>0.593 - 0.663</td>
<td>-</td>
</tr>
<tr>
<td>India</td>
<td>2010</td>
<td>0.800</td>
<td>0.737</td>
<td>0.063</td>
<td>0.687 - 0.798</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>0.838</td>
<td>0.782</td>
<td>0.056</td>
<td>0.738 - 0.838</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>0.766</td>
<td>0.685</td>
<td>0.082</td>
<td>0.631 - 0.748</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>0.822</td>
<td>0.744</td>
<td>0.078</td>
<td>0.683 - 0.821</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>0.735</td>
<td>0.634</td>
<td>0.101</td>
<td>0.555 - 0.724</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>0.716</td>
<td>0.588</td>
<td>0.128</td>
<td>0.514 - 0.678</td>
<td>8</td>
</tr>
<tr>
<td>Grand mean</td>
<td></td>
<td>0.780</td>
<td>0.695</td>
<td>0.085</td>
<td>0.635 - 0.768</td>
<td>-</td>
</tr>
<tr>
<td>Nepal</td>
<td>2010</td>
<td>0.755</td>
<td>0.700</td>
<td>0.054</td>
<td>0.657 - 0.755</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>0.826</td>
<td>0.761</td>
<td>0.065</td>
<td>0.707 - 0.834</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>0.802</td>
<td>0.702</td>
<td>0.100</td>
<td>0.632 - 0.787</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>0.777</td>
<td>0.731</td>
<td>0.046</td>
<td>0.701 - 0.772</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>0.711</td>
<td>0.625</td>
<td>0.087</td>
<td>0.559 - 0.703</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>0.675</td>
<td>0.570</td>
<td>0.105</td>
<td>0.515 - 0.633</td>
<td>0</td>
</tr>
<tr>
<td>Grand mean</td>
<td></td>
<td>0.758</td>
<td>0.682</td>
<td>0.076</td>
<td>0.629 - 0.747</td>
<td>-</td>
</tr>
<tr>
<td>Pakistan</td>
<td>2010</td>
<td>0.621</td>
<td>0.583</td>
<td>0.038</td>
<td>0.554 - 0.621</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>0.678</td>
<td>0.635</td>
<td>0.042</td>
<td>0.603 - 0.680</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>0.774</td>
<td>0.704</td>
<td>0.070</td>
<td>0.661 - 0.756</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>0.686</td>
<td>0.632</td>
<td>0.055</td>
<td>0.591 - 0.680</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>0.629</td>
<td>0.571</td>
<td>0.058</td>
<td>0.529 - 0.620</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>0.564</td>
<td>0.472</td>
<td>0.092</td>
<td>0.421 - 0.538</td>
<td>2</td>
</tr>
<tr>
<td>Grand mean</td>
<td></td>
<td>0.659</td>
<td>0.600</td>
<td>0.059</td>
<td>0.560 - 0.649</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: We used 2,000 bootstrap iterations.
Source: Author’s own calculations

5.2.2 Efficiency in poverty outreach

For measuring the level of outreach to poor borrowers by MFIs in South Asia, we estimated the social efficiency of MFIs using input-output specification as discussed in model B. Original DEA estimates ($\tilde{\theta}^*$) and bias-adjusted efficiency estimates ($\tilde{\theta}^c$) with upper bound (UB) and lower bound (LB) of bootstrap confidence intervals (CI) are
reported in Table 6. In the last column, we reported the number of efficient MFIs based on the original social efficiency estimates (CCR-DEA results). From the empirical results, we observed that among the peer nations MFIs, the India MFIs again outperformed in terms of social outreach followed by Bangladeshi MFIs. In contrast, the Pakistani MFIs were found to be the least performers in terms of social outreach. This reflects that the MFIs operating in Pakistan were neither financially efficient nor socially efficient. Though, the least biases were reported in original social efficiency estimates of Pakistani MFIs. Further, we noted that the social performance of MFIs in each particular country has decreased over the study period except Indian MFIs. In the year 2015, we found that 7 MFIs (i.e., from India) were operating at the best-practice frontier in social prospect. Non-of the MFIs operating in Nepal were found to be efficient over the study period.

From Figure 2, we apparently observed that the bias-corrected social efficiency of MFIs operating in South Asia was moved in the same directions over the period. In the year 2013, the social efficiency of the entire region came down and slowly picked up in the year 2014 and 2015. We noted that after the year 2013, the Bangladeshi MFIs had reported faster recovery in client outreach than other peer nations except India. The MFIs of the entire region may increase the financial and social performance by 48.3% and 64.5%, respectively, without a further increment in the input level. Among the peer nations, India MFIs outperformed both in generating the financial revenue and reach out to the more poor clients throughout the study period, except in the year 2012, in the particular year, the Pakistani MFIs outperform in terms of generating the financial revenue and placing the loans. Additionally, we found that social efficiency has also decreased from 0.382 in the year 2010 to 0.365 in the year 2015. The smaller size of loans of South Asian MFIs (i.e., US$ 346 lowest among all continent) incurred high transaction cost per dollar lent, in result, the MFIs have started to serve less poor clients with higher average loan size to become more financially efficient. Consequently, the social outreach of MFIs has decreased over the period.

On the whole, we observed the high of level corruption, gradual shrinkage in the government subsidy, absence of adequate regulatory framework, professional manpower, limited use of technology and the lack of financial literacy limit the MFIs sector growth in South Asia continent.

**Figure 2** Trends of annual averages of bias-corrected social efficiency scores (see online version for colours)
Table 6  Annual averages and summary of bootstrap efficiency scores and original efficiency scores

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>θ₀</th>
<th>θ₀</th>
<th>Bias</th>
<th>LB</th>
<th>UB</th>
<th>No. of efficient units CCR-based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>2010</td>
<td>0.502</td>
<td>0.475</td>
<td>0.027</td>
<td>0.451</td>
<td>0.522</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>0.530</td>
<td>0.463</td>
<td>0.067</td>
<td>0.426</td>
<td>0.515</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>0.499</td>
<td>0.462</td>
<td>0.036</td>
<td>0.435</td>
<td>0.505</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>0.234</td>
<td>0.194</td>
<td>0.041</td>
<td>0.162</td>
<td>0.245</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>0.345</td>
<td>0.306</td>
<td>0.039</td>
<td>0.273</td>
<td>0.354</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>0.451</td>
<td>0.406</td>
<td>0.045</td>
<td>0.375</td>
<td>0.455</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Grand mean</td>
<td></td>
<td>0.427</td>
<td>0.384</td>
<td>0.043</td>
<td>0.354</td>
<td>0.433</td>
<td>-</td>
</tr>
<tr>
<td>India</td>
<td>2010</td>
<td>0.458</td>
<td>0.403</td>
<td>0.055</td>
<td>0.356</td>
<td>0.475</td>
<td>2</td>
</tr>
<tr>
<td>2011</td>
<td>0.584</td>
<td>0.505</td>
<td>0.079</td>
<td>0.460</td>
<td>0.567</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>0.608</td>
<td>0.536</td>
<td>0.072</td>
<td>0.480</td>
<td>0.609</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>0.420</td>
<td>0.342</td>
<td>0.078</td>
<td>0.282</td>
<td>0.430</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>0.586</td>
<td>0.503</td>
<td>0.082</td>
<td>0.437</td>
<td>0.591</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>0.593</td>
<td>0.508</td>
<td>0.085</td>
<td>0.411</td>
<td>0.603</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Grand mean</td>
<td></td>
<td>0.542</td>
<td>0.466</td>
<td>0.075</td>
<td>0.404</td>
<td>0.546</td>
<td>-</td>
</tr>
<tr>
<td>Nepal</td>
<td>2010</td>
<td>0.382</td>
<td>0.330</td>
<td>0.053</td>
<td>0.284</td>
<td>0.397</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>0.388</td>
<td>0.327</td>
<td>0.061</td>
<td>0.288</td>
<td>0.380</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>0.353</td>
<td>0.313</td>
<td>0.039</td>
<td>0.282</td>
<td>0.355</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>0.279</td>
<td>0.236</td>
<td>0.043</td>
<td>0.203</td>
<td>0.290</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>0.394</td>
<td>0.343</td>
<td>0.051</td>
<td>0.301</td>
<td>0.398</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>0.350</td>
<td>0.312</td>
<td>0.038</td>
<td>0.284</td>
<td>0.354</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Grand mean</td>
<td></td>
<td>0.358</td>
<td>0.310</td>
<td>0.048</td>
<td>0.274</td>
<td>0.362</td>
<td>-</td>
</tr>
<tr>
<td>Pakistan</td>
<td>2010</td>
<td>0.341</td>
<td>0.319</td>
<td>0.022</td>
<td>0.300</td>
<td>0.355</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>0.384</td>
<td>0.399</td>
<td>0.045</td>
<td>0.315</td>
<td>0.376</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>0.442</td>
<td>0.404</td>
<td>0.038</td>
<td>0.373</td>
<td>0.451</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>0.256</td>
<td>0.202</td>
<td>0.054</td>
<td>0.159</td>
<td>0.261</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>0.301</td>
<td>0.263</td>
<td>0.038</td>
<td>0.231</td>
<td>0.311</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>0.264</td>
<td>0.233</td>
<td>0.031</td>
<td>0.210</td>
<td>0.268</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Grand mean</td>
<td></td>
<td>0.331</td>
<td>0.303</td>
<td>0.038</td>
<td>0.265</td>
<td>0.337</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: We used 2,000 bootstrap iterations.
Source: Author’s own calculations

6 Conclusions and policy implications

In the present study, we examined the bias-corrected financial and social efficiency estimates of individual MFIs operating during the year 2010 to 2015 in the selected four
South Asian countries (i.e., Bangladesh, India, Nepal and Pakistan). We removed the outliers from the dataset by using the procedure suggested by Banker and Gifford (1988) based on the ‘super-efficiency’ concept. Then, on the remaining observations, we applied the homogenous bootstrap procedure with 2000 replication as suggested by (Simar and Wilson, 1998) to measure the bias-adjusted financial and social efficiency scores of individual MFIs. We designed two DEA models (i.e., model A – financial and model B – social) to investigate dual missions of microfinance among the South Asian MFIs.

The empirical results of our analysis revealed that original efficiency scores were higher than the bias-adjusted efficiency estimates. Notably, more biases were reported in the financial model than social. The results confirmed that on an average, the South Asian MFIs are more financially efficient than socially. This reflects that the entire South Asian MFIs industry is prioritising financial sustainability to sustain in the long run by serving a large number of poor borrowers. Though, the South Asian MFIs operate in a similar economic environment. However, the results found statistically significant variations in the efficiency level of MFIs. Further, the author found that Indian MFIs outperformed among the peer nations’ MFIs in terms of both financial sustainability and social outreach followed by Nepal in the financial and Bangladeshi MFIs in the social perspective, respectively. Besides, the Pakistani MFIs were found to be the least performers in both the aspects; financial and social. These MFIs need to redesign their operating strategies to become efficient to achieve at least one of the objectives. It is worth mentioning here that none of the sampled MFIs from entire South Asia region were found to be operating at the best-practice frontier of bias-corrected efficiency estimates. However, in original DEA estimates, we found few MFI from India operating at efficient-frontier. Further, we noticed that both the financial and social efficiency of South Asian MFIs had not improved much over the study period. The managers were unable to allocate the resources to generate the maximum level of output from the existing level of inputs.

Even though the South Asian microfinance policy has been improved much over the last decade, still the government interventions which prevail in the entire region hinder the growth of this sector. Regulators in South Asian countries put a ceiling on the interest rate which restricts the MFIs to keep the interest rate low. Consequently, some MFIs are not able to cover the cost associated with smaller loan size. The policymakers and regulators of South Asian MFIs industry must understand the basic characteristics of MFIs in their respective countries and formulate the suitable for MFIs and borrowers friendly policy. The development of microfinance by setting up the proper regulatory framework for MFIs will be beneficial for South Asia in poverty alleviation and enhance the economic prosperity

6.1 Limitations and future directions for research

Although, to enrich the MFIs empirical literature, we assessed dual goals performance of South Asian MFIs; financial sustainability and social outreach. However, the researchers can extend our work by identifying the possible determinants of the efficiency level of South Asian MFIs industry. We have considered the breadth of outreach (number of borrowers) to assess the social performance of MFIs. Authors may opt for the depth of outreach by taking other proxies for social aspects, e.g., women borrowers or average loan balance per borrower etc.
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References


Notes

1 Prof. Mohammad Yunus was the Professor of economics at Chittagong University, Bangladesh in 1970s. In the year 1976, he started his Grameen project with the US$27 collateral-free small loan to the poor women. He expanded the microcredit programme and successfully established the Grameen Bank in the year 1983. In the year 2006, The Norwegian Nobel Committee gave Novel Peace Prize to him and Grameen Bank for the outstanding contribution in microfinance.

2 Abdelkader et al. (2014) used three methods to detect the possible outliers in the dataset namely:

1 Super-efficiency based Andersen and Petersen (1993) approach
2 Peer-count index suggested by Charnes and al. (1985)

Further, Andersen and Petersen (1993) used the super efficiency to rank the efficient units not to detect the outliers. Banker and Chang (2006) found that super-efficiency based procedure is more effective to identify the outliers, not to rank the efficient units.
Decision-making units (MUs) are homogeneous and independent units which convert the inputs into outputs by the production process, and they are the subject of interest in DEA framework. As per the Global Outreach and Financial Performance Benchmark Report – 2015, MIX Market (http://www.themix.org).

The number of MFIs mentioned in Table 3 may vary from the actual number of MFIs operating the particular country. The study has extracted the selected data of MFIs, which reports to the MIX market. The study also excluded the MFIs which have missing information for the particular required variable.

Authors who seek more details on production approach see Benston (1965), and for intermediation approach see Sealey and Lindley (1977).

The super-efficiency DEA model varies from conventional models. It excludes the observation under evaluation from the reference set while determining the efficiency frontier. The efficiency scores in case of super-efficiency may exceed one.

Banker and Chang (2006) suggest super-efficiency based screen levels 1.0, 1.2, 1.6 and 2.0 to detect of outliers and recommend 1.6 screen level is the optimum choice.