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Measuring Technical Efficiency of Microfinance Institutions in India

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I

INTRODUCTION

The last three decades have witnessed an expansion in the domain and scope of microfinance activities shaping policy discussions as well as social delivery systems within and across many national contexts. The modern microfinance movement dates back to the 1970s when the experimental programmes in India, Bangladesh, Brazil, and a few other countries began to extend tiny loans to groups of poor women to invest in microenterprises. It has been argued for long that commercial banks have not met the credit needs of financially challenged people who are not able to offer collaterals but who have feasible and promising investment ideas that can turn into profitable initiatives (Hollis and Sweetman, 1998). The incidence of such exclusion had also been highlighted by Littlefield *et al.* (2003) stating that the commercial banking sector does not consider the poor bankable owing to their inability to meet the eligibility criteria, including collateral. This had limited the accessibility and provision of timely and adequate credit from formal financial institutions for the resource starved section of the society. Further, Fisher and Sriram (2002) argued that the mismatch between the hierarchy of credit needs and availability from formal financial institutions results in 'adverse usage'.

To cover the unmet credit requirement of the poor, a set of new financial institutions have come up that are in touch with the local community, that can obtain information about the loan taker at a low cost, and that often are not only interested in profit but also on the creation of income generating activity and empowerment. These new financial intermediaries, the Microfinance Institutions (MFIs), provide small loans to poor people, who can offer little or no collateral.

The role of MFIs in India in bridging the gap between the demand and supply of financial services among credit thirsty people had been noted by Sinha (2003) that over the past two decades, while organisations such as SEWA Bank, Ahmedabad and Working Women's Forum, Chennai have taken a pioneering effort to meet the vacuum in financial services, the more vigorous attempt has started during the 1990s, with the initiation of the microfinance programme by several NGOs.

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Two broad approaches characterise the microfinance sector in India – groups formed by NGOs and linked to banks (SHG Bank Linkage Program - SBLP) and NGOs/non-banking financial companies (NBFCs) form groups and perform financial intermediation role as a lender to groups after sourcing loans from banks, other financial institutions (MFI Bank Linkage Model). The *Status of Microfinance in India 2008-09* (NABARD, 2009) has highlighted that as on 31 March 2009, the outstanding bank loan to 1915 MFIs was INR 50.09 billion.

As microfinance emerge as a new approach to fight poverty, the question that arises is whether the MFIs are efficient in their operations. Yaron (1994) suggested a framework, based on the outreach and sustainability to assess the performance of an MFI. The outreach is about the number of clients of the MFI and the product quality. Sustainability implies the capability of the institution to generate enough income to at least repay the opportunity cost of all inputs as well as assets (Chaves and González-Vega, 1996). It is difficult for an MFI with poor financial management to become sustainable (Johnson and Rogaly, 1997). Ledgerhood (1999) identified four main areas of risk that are specific to MFIs: portfolio risk, ownership and governance, management and 'new industry'.

Against this backdrop, the study attempts to identify the most technically efficient/best practice MFI(s), by using the Data Envelopment Analysis approach, which would in turn help to improve the functioning of other MFIs in India. The study also aims to identify and analyse the possible determinants of technical efficiency of MFIs in India. As the goal of MFIs as a development organisation revolves around servicing the financial needs of the unserved and/or under-served markets as a means of meeting the development objective, the efficient functioning of these MFIs on a sustainable basis is also important for the persistent financial access of the credit thirsty segment of the society.

II

FRONTIER FUNCTIONS OF EFFICIENCY

The economists use the term 'efficiency' to narrate how well an organisational unit is performing in utilising resources for generating outputs or outcomes. Farrell (1957) first proposed an approach to estimate the efficiency (E) of observed units and decomposed efficiency into two elements: (a) technical efficiency (TE), which measures the firm's success in producing maximal output with a given set of inputs; and (b) allocative (price) efficiency (AE), which estimates the firm's success in choosing an optimum combination of inputs, given their respective prices. This is illustrated in Figure 1, where it is assumed that output is produced by two inputs X_1 and X_2, with the curve UU′ being an output isoquant. The line PP′ represents the cost minimization plane and given this, the overall efficiency of unit A is measured by OD/OA, while the technical efficiency measured as OB/OA and allocative efficiency measured as OD/OB.

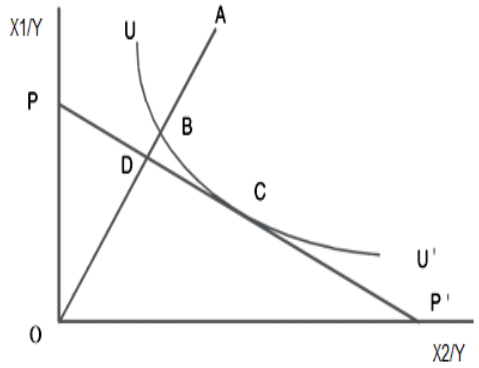

Figure 1. Technical and Allocative Efficiencies from Input-Orientation

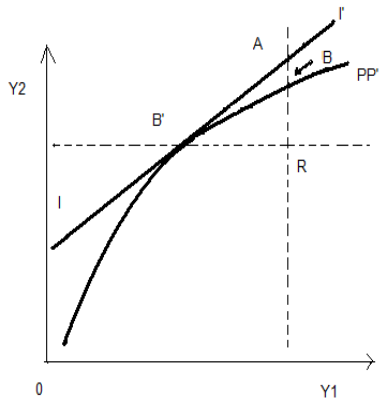

Figure 2. Technical and Allocative Efficiencies from Output-Orientation

Thus the efficiency can be computed as E = OD/OA = OB/OA × OD/OB = TE × AE. Hence, the technical inefficiency of a firm A is 1- OB/OA, which shows the proportion by which the inputs could be reduced, holding the input ratio (X_1/X_2) constant, without any reduction in output. In other words, firm A should have produced OA/OB times more output with the same input quantities (Farrell, 1957).

If input prices are considered, then it is possible to examine the optimal combination of inputs which minimise the cost of producing a given level of output. This optimal combination is where the slope of PP′, the price line, is equal to that of isoquant UU′. Thus C is the optimal or minimum cost point of production. Firm B is producing at a higher cost than C, although both points reflect 100 per cent technical efficiency. The cost of production at C is only a fraction OD/OB of that at B. The ratio OD/OB is the allocative efficiency of B. Consequently, the allocative inefficiency of B is 1-(OD/OB), which measures the potential reduction in cost from using optimal input proportions (Schmidt, 1985-86).

Similarly the output-oriented measures could be explained focusing on changes in output by using fixed level inputs. Figure 2 shows single output, Y, production function. In Figure 2, PP` is a production function. The PP` reflects a technically efficient practice and thus all firms operating at PP` are 100 per cent technically efficient. A firm is observed to be operating at R using the same amount of input as being used by an efficient firm operating at B. The technical efficiency of the observed firm is defined as the ratio of the distance OR to OB (TE = OR/OB).

To compute allocative efficiency, an iso-profit (II`) line is drawn passing through points A and B` - the latter is a tangency point between PP` and iso-profit line. The firm operating at point B` is producing the optimal combination of the output. The

firm operating at B is not optimal since profit can be increased by producing a higher level of output, B-A, using the same input level. Allocative efficiency in output is the ratio between OB and OA (AE = OB/OA). Efficiency is the product of technical efficiency and allocative efficiency, which can be written as: E = (OR/OB) (OB/OA) = OR/OA.

The results of the technical efficiency measures would be the same irrespective of the output-oriented or input-oriented method is used if the constant returns to scale exists. The results differ under increasing or decreasing returns to scale (Fare and Lovell, 1978).

Farrell's original work and further extensions made by Charnes *et al.* (1978), and Banker *et al.* (1984), among others, consisted of the estimation of efficiency without assuming a specific functional form. For this reason these methodologies have been termed as non-parametric. Subsequently, Charnes and Cooper (1985) provided their formal definition of efficiency:

'100 per cent efficiency is attained for (a unit) when:

(a) None of its outputs can be increased without either (i) increasing one or more of its inputs, or (ii) decreasing some of its other outputs;
(b) None of its inputs can be decreased without either (i) decreasing some of its outputs, or (ii) increasing some of its other inputs'.

This mathematical programming technique is widely known as 'Data Envelopment Analysis' (DEA). DEA calculates the relative efficiency scores of various Decision Making Units (DMUs) in a particular sample. The DMUs could be banks or branches of banks in case of studying financial institutions or, individual MFI in this study. The DEA measure compares each of the MFIs in this sample with the best MFI in the sample depicting the most efficient DMU(s) in the sample. One advantage of DEA (non-parametric) over parametric approaches to measure efficiency is that this technique can be used when the conventional cost and production functions cannot be justified (Berger and Mester, 1997). Moreover, the DEA analysis is flexible and accommodates variable returns to scale (VRS) as well.

III

ANALYTICAL METHOD

Data Envelopment Analysis (DEA) has been used in this study to analyse the technical efficiency, i.e., an unit's ability to obtain maximum output from a given set of inputs of the select MFIs in India. As allocative (price) efficiency estimates the unit's success in choosing an optimum combination of inputs, given their respective prices, the study restricts itself in analysing technical efficiency only, due to unavailability of price information of the inputs. Both input-oriented (IOM) and

output-oriented (OOM) versions of the DEA technical efficiency measurement methodology have been applied to the data. Each MFI is a DMU in the study.

An output-oriented model implies that technical efficiency is estimated by output of the firm (in this case MFI) relative to the best-practice level of output for a given level of inputs. In order to specify the mathematical formulation of the OOM, let us assume that we have K decision making units (DMU) using N inputs to produce M outputs. Inputs are denoted by x_{jk} (j=1,..,n) and the outputs are represented by y_{ik} (i=1,...,m) for each MFI k (k=1,...,K). The efficiency of the DMU can be measured as (Coelli, 1998; Worthington, 1999):

$$TE_k = \sum_{i=1}^{m} u_i y_{ik} / \sum_{j=1}^{n} v_j x_{jk}$$

where, y_{ik} is the quantity of the i-th output produced by the k-th DMU, x_{jk} is the quantity of j-th input used by the k-th DMU, and u_i and v_j are the output and input weights respectively. The DMU maximises the technical efficiency, TE_k, subject to

$$TE_k = \sum_{i=1}^{m} u_i y_{ik} / \sum_{j=1}^{n} v_j x_{jk} \leq 1 \text{ where, } u_i \text{ and } v_j \geq 0$$

The above equation indicates that the technical efficiency measure of a DMU cannot exceed 1, and the input and output weights are positive. The weights are selected in such a way that the DMU maximises its own technical efficiency which is executed separately for each of the three regions for which MFIs are chosen for the application of DEA. To select optimal weights the following linear programming (output-oriented) is specified (Coelli, 1998; Worthington, 1999):

Max TE_k

Subject to

$$\sum_{i=1}^{m} u_i y_{ik} - x_{jk} + w \leq 0 \text{ where, } k = 1, \ldots\ldots\ldots, K$$

$$v_j x_{jk} - \sum_{j=1}^{n} u_j x_{jk} \geq 0 \text{ , and } u_i \text{ and } v_j \geq 0$$

Input oriented linear programming method is used in order to obtain the given level of output by input minimisation. Therefore the following mathematical programming model is specified (Coelli, 1998; Worthington, 1999):

Min TE_k

Subject to

$$\sum_{i=1}^{m} u_i y_{ik} - y_{jk} + w \geq 0 \text{ where, } k = 1, \ldots\ldots\ldots, K$$

$$x_{jk} - \sum_{j=1}^{n} u_j x_{jk} \geq 0 \text{ , and } u_i \text{ and } v_j \geq 0$$

The above model shows TE under CRS assumption if w = 0 and it changes into VRS if w is used unconstrained. In the first case it leads to technical efficiency (TE) and in the second case pure technical efficiency (PTE) is estimated.

As the CRS assumption holds good only when all DMUs are operating at an optimum scale while imperfect competition, accessibility to fund etc. may not allow all DMUs to operate at optimal scale (Coelli, 1998), considering the suggestion by Banker *et al.* (1984) the CRS DEA technical efficiency (TE_{CRS}) been decomposed into two components, technical efficiency under VRS assumption (TE_{VRS}) and scale efficiency (SE), where, $TE_{CRS} = TE_{VRS} \times SE$. This can be alternatively stated as TE = PTE x SE (Coelli, 1998).

As the value of scale efficiency does not indicate the nature of the scale efficiencies, i.e., whether the DMU is operating in an area of increasing or decreasing returns to scale, this may be determined by running an additional DEA problem with non-increasing returns to scale (NIRS) imposed. The nature of the scale efficiencies for a particular DMU can be identified by observing whether the TE_{NIRS} score is equal to the TE_{VRS} score. While the unequal scores would indicate the existence of increasing returns to scale for the particular DMU, the equal scores would indicate decreasing returns to scale. The results given in the paper have been calculated in the Data Envelopment Analysis (Computer) Program (DEAP).

IV

SELECTION OF INPUTS AND OUTPUTS

For the purpose of this paper, it will be useful to make a distinction between the model and specification in a DEA context. Different philosophical approaches as to what a financial institution does, and what is meant by efficiency leads to different models (Berger and Mester, 1997). Two basic models are prevalent in the literature: intermediation and production (Athanassoupoulos, 1997). Under the production approach financial institutions are considered as the producers of deposits and loans while the number of employees and capital expenditures are considered as inputs in this approach. The second approach considers the financial institutions as intermediaries where they perform the responsibility of transferring financial assets from the surplus unit to the deficit unit. While labour, capital cost and interest payable on deposits are taken as inputs, the loans and financial investments are considered as outputs in this approach.

In India MFIs which are registered as a society or trust or a Section 25 company with non-profit motive and operating as an NGO, are not permitted to offer deposit service to the client group, they offer credit product to their clients. MFIs which have transformed to non-banking financial companies (NBFCs) are holding non-deposit taking NBFC licenses from the Reserve Bank of India. Only MFIs operating as Local Area Bank (LAB) or co-operatives are permitted to mobilise deposits. As the credit remains the most important financial service that MFIs provide to their customers, loan or portfolio outstanding as on a particular date could be an indicator for the level of outreach. In the present study, three year average portfolio outstanding for financial years ending 2007, 2008 and 2009 has been taken as output variable. The average portfolio outstanding to average total asset during the corresponding period ranges between 68.30 to 90.21 per cent, 77.70 to 96.32 per cent, 85.08 to 93.49 per cent for East, South and North and West region respectively. It is also to be noted that across the three regions borrowing from banks and other financial institutions by the MFIs to total liability is comparable in the range of loans outstanding to total asset during the same period. Further empirical studies suggest that the primary inputs required to produce loans are labour and expenditure (Norman and Stocker, 1991). This study has considered two inputs that are the number of credit officers involved in the MFI as a proxy for labour and the cost per borrower as a proxy for expenditure. As credit officers are actively engaged with the development of the loan portfolio as well as maintenance of its quality, it has been included as a proxy of labour. The cost per borrower indicates operating expenses (i.e., expenses related to operations, including all personnel expenses, depreciation and amortisation, and administrative expense) per active borrower.

The data source for the study is the Mix Market Network (www.mixmarket.org). As the study intended to take the average data for three consecutive years (i.e., 2007, 2008 and 2009) for its analysis, it faced a problem of missing data in the panel setting. The way to handle the problem would be either to impute the missing data or to limit the study with the DMUs having complete information throughout the panel. The study embarks on the latter approach. The researcher could plead only the need to spare effort. Thirty nine Indian MFIs which have been included in the study met this stated criterion. Out of them, 10 have major operations in eastern India, 6 in north and western India and the rest in the southern part of India.

V

TECHNICAL EFFICIENCY ANALYSIS

Technical Efficiency of MFIs in Eastern India

The DEA technical efficiency for 10 MFIs is calculated by assuming both Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS) technology. While measuring the technical efficiency of MFIs, both input oriented as well as output oriented methods have been used. The results are presented in Table 1.

TABLE 1. SINGLE OUTPUT-TWO INPUTS DEA TECHNICAL EFFICIENCY OF MFIs IN EASTERN INDIA

	Input oriented				Output oriented			
MFIs	TE	PTE	SE		TE	PTE	SE	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ABCRDM	0.268	1.000	0.268	irs	0.268	1.000	0.268	irs
ADHIKAR	0.583	0.804	0.725	irs	0.583	0.584	0.997	irs
ASOMI	0.535	0.682	0.784	irs	0.535	0.570	0.939	irs
BANDHAN	1.000	1.000	1.000	-	1.000	1.000	1.000	-
BISWA	0.672	1.000	0.672	irs	0.672	1.000	0.672	irs
GU	1.000	1.000	1.000	-	1.000	1.000	1.000	-
NBJK	0.564	1.000	0.564	irs	0.564	1.000	0.564	irs
RGVN	0.666	0.717	0.928	irs	0.666	0.681	0.977	drs
SU	0.551	0.913	0.603	irs	0.551	0.569	0.968	irs
VFS	0.761	0.828	0.919	irs	0.761	0.785	0.969	irs
MEAN	0.660	0.894	0.746		0.660	0.819	0.835	

The results show that two MFIs are on the technical efficiency frontier when constant returns to scale is assumed, while five MFIs are on the efficient frontier in the case when variable returns to scale is assumed. The MFIs that remains technically efficient under both CRS and VRS assumption are Bandhan and Gram-Utthan. Both are fully engaged in microfinance related activities.

The average input-oriented technical efficiency (TE), pure technical efficiency (PTE) and scale efficiency (SE) are 66.0 per cent, 89.4 per cent and 74.6 per cent, respectively. The average output-oriented TE, PTE and SE are 66.0 per cent, 81.9 per cent and 83.5 per cent respectively.

In the first case it can be concluded that 10.6 per cent of inputs can be decreased without affecting the existing output level that is the gross loan portfolio of MFIs. Whereas, under the output oriented measures the MFIs can increase their loan portfolio by 18.1 per cent with the existing level of input by efficient utilisation of the inputs, namely, the number of credit officers and cost per borrower.

The results also revealed that most of the MFIs in eastern India experienced economies of scale, i.e., 80 per cent MFIs under input oriented measures and 70 per cent MFIs under output oriented measures are at the phase of increasing returns to scale. Under output oriented measures only one out of ten MFIs is at the stage of decreasing returns to scale.

Technical Efficiency of MFIs in Southern India

The DEA technical efficiency for 23 MFIs with a major presence in the southern part of India is calculated by assuming both the CRS and VRS assumption. Both input oriented as well as output oriented methods have been used while measuring the technical efficiency of MFIs. The results are presented in Table 2.

TABLE 2. SINGLE OUTPUT-TWO INPUTS DEA EFFICIENCY OF MFIS IN SOUTHERN INDIA

	Input oriented				Output oriented			
MFIs	TE	PTE	SE		TE	PTE	SE	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
AML	0.787	0.919	0.856	drs	0.787	0.924	0.851	drs
AMMACTS	0.544	0.660	0.824	drs	0.544	0.758	0.718	drs
AWS	0.884	1.000	0.884	irs	0.884	1.000	0.884	irs
BASIX	0.347	0.473	0.733	drs	0.347	0.504	0.688	drs
BFL	0.654	0.743	0.880	drs	0.654	0.808	0.809	drs
BSS	0.453	0.702	0.645	drs	0.453	0.786	0.577	drs
CRESA	0.321	0.636	0.504	irs	0.321	0.325	0.988	drs
ESAP	0.197	0.197	1.000	-	0.197	0.303	0.651	drs
GFSPL	0.306	0.489	0.625	drs	0.306	0.591	0.517	drs
KBSLAB	0.357	0.368	0.970	drs	0.357	0.577	0.619	drs
KRUSHI	0.634	0.840	0.756	irs	0.634	0.649	0.978	irs
MFI	0.427	0.995	0.429	irs	0.427	0.978	0.436	irs
RASS	0.707	0.885	0.799	irs	0.707	0.707	1.000	-
SAADHANA	0.375	0.390	0.962	irs	0.375	0.549	0.684	drs
SANGHAMITRA	1.000	1.000	1.000	-	1.000	1.000	1.000	-
SARVODAYA	0.335	1.000	0.335	irs	0.335	1.000	0.335	irs
SHARE	0.903	0.977	0.924	drs	0.903	0.978	0.923	drs
SKDRP	0.837	0.858	0.976	drs	0.837	0.867	0.966	drs
SKS	0.593	1.000	0.593	drs	0.593	1.000	0.593	drs
SMSS	0.341	0.649	0.525	irs	0.341	0.341	1.000	-
SPANDANA	1.000	1.000	1.000	-	1.000	1.000	1.000	-
SWAWS	0.340	0.341	0.996	irs	0.340	0.550	0.618	drs
UJJIVAN	0.170	0.242	0.702	drs	0.170	0.352	0.484	drs
MEAN	0.544	0.712	0.779		0.544	0.719	0.753	

The results indicate that two MFIs are on the technical efficiency frontier when constant returns to scale is assumed while five MFIs are on the technical efficiency frontier in case when variable returns to scale is assumed. The MFIs that remains technically efficient under both the CRS and VRS assumption are the Sanghamithra Rural Financial Services (SRFS) and the Spandana Sphoorty Financial Limited (SSFL). SRFS is a not-for-profit micro-financing institution, while SSFL is registered as NBFC with the Reserve Bank of India and both are fully engaged in microfinance activities.

The average input oriented TE, PTE and SE are 54.4 per cent, 71.2 per cent and 77.9 per cent, respectively. The average output oriented TE, PTE and SE are 54.4 per cent, 71.9 per cent and 75.3 per cent respectively. In the first case, it can be concluded that 28.8 per cent of inputs can be reduced without affecting the existing output level that is the gross loan portfolio of MFIs. Whereas under the output oriented measures the MFIs can increase their loan portfolio by 28.1 per cent with the existing level of input by the efficient utilisation of inputs namely the number of credit officers and cost per borrower.

The results also suggest that 39.1 per cent of the MFIs in southern India experienced economies of scale under input oriented measures. But under the output oriented measures majority (65.2 per cent) of MFIs are at the stage of decreasing returns to scale while only 4 out of 23 (17.4 per cent) of MFIs included in the study have attained the phase of increasing returns to scale.

Technical Efficiency of MFIs in Northern and Western India

The DEA technical efficiency for six MFIs concentrated in the northern and western part of India is calculated by assuming both CRS and VRS assumption. Both input oriented as well as output oriented methods have been used while measuring the efficiency of MFIs. The results are presented in Table 3.

TABLE 3. SINGLE OUTPUT-TWO INPUTS DEA TECHNICAL EFFICIENCY OF MFIs IN NORTHERN AND WESTERN INDIA

	Input oriented				Output oriented			
MFIs	TE	PTE	SE		TE	PTE	SE	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CASPHOR MC	1.000	1.000	1.000	-	1.000	1.000	1.000	-
NEED	0.707	1.000	0.707	irs	0.707	1.000	0.707	irs
SCNL	0.788	0.794	0.993	irs	0.788	0.847	0.930	drs
SEWA BANK	1.000	1.000	1.000	-	1.000	1.000	1.000	-
SFPL	0.129	0.958	0.134	irs	0.129	0.225	0.571	irs
SONATA	0.557	0.650	0.856	irs	0.557	0.596	0.934	irs
MEAN	0.697	0.900	0.782		0.697	0.778	0.857	

The results indicate that two MFIs, namely, Casphor MC and SEWA Bank are on a technical efficiency frontier both under constant as well as variable returns to scale. While Casphor MC operates as NBFC, the legal status of SEWA Bank is co-operative.

The average input oriented TE, PTE and SE are 69.7 per cent, 90.0 per cent and 78.2 per cent, respectively. The average output oriented TE, PTE and SE are 69.7 per cent, 77.8 per cent and 85.7 per cent respectively. In the first case it can be concluded that 10.0 per cent of inputs can be decreased without affecting the existing output level that is the gross loan portfolio of MFIs. Whereas under the output oriented measures the MFIs can increase their loan portfolio by 22.2 per cent with the existing level of input through efficient utilisation of inputs, i.e., number of credit officers and costs per borrower.

The results also show that 66.7 per cent of the MFIs in the northern and western India experienced economies of scale under input oriented measures. But under output oriented measures 50.0 per cent of MFIs are at the stage of increasing returns to scale while one out of six MFIs included in the study are at decreasing returns to scale.

Technical Efficiency of MFIs in India

The technical efficiency analysis has also been undertaken by combining all the MFIs from the eastern, southern, northern and western part of India and for 39 MFIs. The results are presented in Table 4. Both input oriented as well as output oriented methods have been used while measuring the efficiency of MFIs. The results indicate that two MFIs are on the efficiency frontier when CRS is assumed, whereas six MFIs are on the efficient frontier in case when VRS is assumed. The MFIs that remains efficient under both the CRS and VRS assumption are the Sanghamithra Rural Financial Services and the Spandana Sphoorty Financial Limited. Both were also efficient under both CRS and VRS during the analysis on a regional basis.

The average input oriented TE, PTE and SE are 41.7 per cent, 62.4 per cent and 67.8 per cent, respectively. The average output oriented TE, PTE and SE are 41.7 per cent, 57.4 per cent and 74.1 per cent respectively. In the first case, it is identified that 37.6 per cent of inputs can be decreased without affecting the existing output level that is the gross loan portfolio of MFIs. Whereas, under the output oriented measures the MFIs can increase their loan portfolio by 42.6 per cent with the existing level of input by efficient utilisation of the inputs.

It is also evident from the results that 61.5 per cent of the MFIs been studied experienced economies of scale under input oriented measures. But under output oriented measures 17.9 per cent of MFIs are at the stage of increasing returns to scale while 69.2 per cent of MFIs included in the study are at decreasing returns to scale.

VI

ANALYSIS OF TECHNICAL EFFICIENCY DETERMINANTS

In this section, the study aims to identify and analyse the possible determinants of technical efficiency of MFIs in India. Different variables expected to explain the efficiency of MFIs have been proposed. Care has been taken to group the variables under four wide categories namely location, governance, presence and outreach and financial management and performance.

Location has been considered as a variable due to the wide geographical spread of the Indian sub-continent, there lies a deep variation in culture, dialect, thrift and borrowing habit, livelihood etc. Hence, the whole of India has been divided into three parts as East, South and, North and West. The study considers ‘East’ and ‘South’ as dummy variable while ‘North and West’ are omitted variables as the proposed regression model consists of intercept. As the qualitative variable ‘location’ has three categories, the model includes only two dummy variables to avoid the dummy variable trap, i.e., the situation of perfect collinearity.

TABLE 4. SINGLE OUTPUT-TWO INPUTS DEA TECHNICAL EFFICIENCY OF MFIs IN INDIA

MFIs (abbreviated form)	Region	Input oriented				Output oriented			
		TE	PTE	SE		TE	PTE	SE	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ABCRDM	East	0.112	0.587	0.191	irs	0.112	0.131	0.861	drs
ADHIKAR	East	0.194	0.420	0.463	irs	0.194	0.284	0.685	drs
ASOMI	East	0.178	0.446	0.400	irs	0.178	0.226	0.791	drs
BANDHAN	East	0.526	0.623	0.844	irs	0.526	0.536	0.983	drs
BISWA	East	0.269	0.775	0.347	irs	0.269	0.421	0.637	irs
GU	East	0.343	0.476	0.722	irs	0.343	0.491	0.700	drs
NBJK	East	0.188	1.000	0.188	irs	0.188	1.000	0.188	irs
RGVN	East	0.222	0.379	0.586	irs	0.222	0.336	0.661	drs
SU	East	0.184	0.489	0.376	irs	0.184	0.249	0.737	drs
VFS	East	0.254	0.464	0.547	irs	0.254	0.345	0.735	drs
AML	South	0.787	0.919	0.856	drs	0.787	0.924	0.851	drs
AMMACTS	South	0.544	0.660	0.824	drs	0.544	0.758	0.718	drs
AWS	South	0.884	1.000	0.884	irs	0.884	1.000	0.884	irs
BASIX	South	0.347	0.473	0.733	drs	0.347	0.504	0.688	drs
BFL	South	0.654	0.743	0.880	drs	0.654	0.808	0.809	drs
BSS	South	0.453	0.702	0.645	drs	0.453	0.786	0.577	drs
CRESA	South	0.321	0.598	0.537	irs	0.321	0.325	0.988	drs
ESAP	South	0.197	0.197	1.000	-	0.197	0.303	0.651	drs
GFSPL	South	0.306	0.489	0.625	drs	0.306	0.591	0.517	drs
KBSLAB	South	0.357	0.368	0.970	drs	0.357	0.577	0.619	drs
KRUSHI	South	0.634	0.840	0.756	irs	0.634	0.649	0.978	irs
MFI	South	0.427	0.995	0.429	irs	0.427	0.978	0.436	irs
RASS	South	0.707	0.885	0.799	irs	0.707	0.707	1.000	-
SAADHANA	South	0.375	0.390	0.962	irs	0.375	0.549	0.684	drs
SANGHAMITRA	South	1.000	1.000	1.000	-	1.000	1.000	1.000	-
SARVODAYA	South	0.335	1.000	0.335	irs	0.335	1.000	0.335	irs
SHARE	South	0.903	0.977	0.924	drs	0.903	0.978	0.923	drs
SKDRP	South	0.837	0.858	0.976	drs	0.837	0.867	0.966	drs
SKS	South	0.593	1.000	0.593	drs	0.593	1.000	0.593	drs
SMSS	South	0.341	0.603	0.566	irs	0.341	0.341	1.000	-
SPANDANA	South	1.000	1.000	1.000	-	1.000	1.000	1.000	-
SWAWS	South	0.340	0.341	0.996	irs	0.340	0.550	0.618	drs
UJJIVAN	South	0.170	0.242	0.702	drs	0.170	0.352	0.484	drs
CASPHORMC	North and West	0.305	0.340	0.898	drs	0.305	0.400	0.762	drs
NEED	North and West	0.203	0.622	0.327	irs	0.203	0.206	0.986	irs
SCNL	North and West	0.218	0.221	0.988	irs	0.218	0.396	0.550	drs
SEWA BANK	North and West	0.380	0.401	0.948	irs	0.380	0.538	0.706	drs
SFPL	North and West	0.049	0.568	0.086	irs	0.049	0.049	0.995	-
SONATA	North and West	0.124	0.229	0.542	irs	0.124	0.212	0.586	drs
MEAN		0.417	0.624	0.678		0.417	0.574	0.741	

Rock *et al.* (1998) defined governance of MFI as the process by which the board of directors through management provide guidance to an institution to meet its mission and to protect its assets without diluting the quality. As foremost consideration of an MFI is the livelihood promotion by meeting the unmet credit demand of the economically challenged section of the society, borrower per staff (BPS) has been considered as a proxy for the coverage by an MFI within the given set of resources to meet the credit need of the target group. Further, the degree of asset quality has been captured by portfolio at risk (PAR 30 days) of individual MFI.

Under the third category of presence and outreach, the study considers 'age', i.e., how old is the microfinance operation and size of the MFIs. As MFI becomes older it would approach technical efficiency from learning and experience. To capture the effect of the size of MFI, the average value of assets (TA) for financial years ending 2007, 2008 and 2009 have been considered. It has been hypothesised that large MFIs with more number of years in the sector may perform better than newer entrants and with relatively smaller size.

Financial and economic viability of an MFI stands important to keep the microfinance operation viable from an organisational point of view (Hulme and Mosley, 1996). Financial ratios as debt-equity ratio (DER), return on assets (ROA), return on equity (ROE), operational self-sufficiency (OSS), yield on gross portfolio (YOGP) and financial expenses per asset (FEPA) have been included under the category of financial management and performance. It is expected that higher debt-equity ratio reduces firms' technical efficiency as it reflects the higher financial dependence of the MFI on outside sources/borrowing. On the other hand both the ROA and ROE are expected to have a positive effect on the technical efficiency of MFI. OSS represents the ability of MFIs to meet their operating costs from their income. It indicates whether enough revenue is earned to cover the organisation's costs which includes financial expense, operating expense as well as impairment loss. This study hypothesises that an increasing OSS representing the financial viability of MFI would lead to its technical efficiency. YOGP and FEPA stand as proxies for interest rate charged by the MFI to its borrowers and the cost of borrowing for the respective MFI. As total assets primarily include loan portfolio, FEPA explains the financial expenses incurred to build a unit of asset. As a higher spread, i.e., higher the difference between the income and expense of an MFI, greater the possibility of becoming financially self-sustainable, it is hypothesised that while YOGP is positively related to technical efficiency, FEPA holds a negative relation with technical efficiency. The description of the variables labelled as PAR, DER, ROA, ROE, OSS, YOGP and FEPA are given in the Annexure.

Correlation analysis has been undertaken to know whether and how strongly pairs of variables are related and their direction of relationship. As we understand that more loans could be disbursed with increased credit officers, alongside to offer credit plus services and doorstep banking transaction cost as well as overall cost per borrower would also increase. As there lies every possibility for an increase in

portfolio outstanding with enhanced coverage by more number of credit officers as well as by added service at the same price, technical efficiency measures with output orientation have been used as dependent variable.

Further, the study attempts to build up a multiple regression model to identify the independent variables to predict the dependent variable i.e. the individual efficiency measures of MFIs.

Correlation Analysis

Correlation coefficients between different technical efficiency measures and the variables defined above have been undertaken. The results of correlation coefficients have been tabulated in Table 5. The results indicate that the borrower per staff, age, value of total assets, returns on assets, return on equity, level of operational self sufficiency and yield on gross portfolio of MFI are positively correlated with all technical efficiency measures. However, the debt equity ratio and financial expenses per asset is negatively correlated to TE and PTE, as expected. In case of location, the MFIs from the southern states have a positive correlation with all three measures of technical efficiency, whereas MFIs from eastern India show a negative correlation with all three measures of technical efficiency.

TABLE 5. CORRELATION COEFFICIENTS BETWEEN THE DIFFERENT TECHNICAL EFFICIENCY MEASURES AND THE VARIABLES DEFINED

Variables	TE	PTE	SE
(1)	(2)	(3)	(4)
East	-0.388	-0.348	-0.125
South	0.593	0.603	0.074
BPS	0.706	0.494	0.398
PAR (30 days)	0.048	0.117	-0.174
AGE	0.219	0.253	-0.056
LOG (TA)	0.585	0.563	0.010
LOG (DER)	-0.130	-0.419	0.403
ROA	0.254	0.301	0.154
ROE	0.185	0.201	0.134
LOG(OSS)	0.291	0.338	0.103
YOGP	0.010	0.029	0.052
FEPA	-0.063	-0.105	-0.130

The results from the correlation coefficients lead to conclude that governance and size of MFIs are important in determining the technical efficiency of MFIs. Secondly, as the MFI becomes older the experience of the personnel leads to a higher technical efficiency which has been depicted by positive correlation between age and all three technical efficiency measures. Further, the over dependence on outside or borrowed funds shows an adverse effect on efficiency. As we understand the MFIs taken in the study, act as an intermediary where major source of funds have been borrowed from formal financial institutions to lend to target beneficiaries, the operations should have

been internal cash accrual to rotate the fund as well as build up the reserve to render the MFI strong financial base having debt equity ratio within the maximum permissible limit.

Regression Analysis

A multiple regression model is specified to find out the major determinants of individual technical efficiency measures of MFI.

$$Y = \alpha + \beta_1(DUM_1) + \beta_2(DUM_2) + \beta_3(BPS) + \beta_4(PAR) + \beta_5(AGE) + \beta_6(logTA) + \beta_7(logDER) + \beta_8(ROA) + \beta_9(ROE) + \beta_{10}(logOSS) + \beta_{11}(YOGP) + \beta_{12}(FEPA) + u$$

where,

Y = Individual technical efficiency measures of MFI, i.e., TE, PTE and SE
DUM_1 = 1 if the MFI has its operation predominantly in Eastern states in India
= 0 otherwise (i.e., in other regions of the country)
DUM_2 = 1 if the MFI has its operation predominantly in Southern states in India
= 0 otherwise (i.e., in other regions of the country)
BPS = Borrower per staff
PAR = Portfolio at risk (30 days) (in percentage)
AGE = Age of the MFI in years of operation in microcredit services
TA = Total asset (amount in US $)
DER = Debt equity ratio
ROA = Return on asset (in percentage)
ROE = Return on equity (in percentage)
OSS = Operational self sufficiency (in percentage)
YOGP = Yield on gross portfolio (in percentage)
FEPA = Financial expenses/assets (in percentage)
u = Error term in the model

All the independent variables are the averages of data pertaining to financial years ending 2007, 2008 and 2009. The results of regression analysis are presented in Table 6. The value of R^2 shows that 81 per cent of variation in the technical efficiency is explained by the independent variables included in the model. In the case of pure technical efficiency, this variation is 68 per cent, while for the scale efficiency model, the included variables explain only 55 per cent of the variations.

The regression estimates for TE as a dependent variable show expected signs for all except two variables, i.e., ROA and ROE. The estimate of BPS shows that with other independent variables held constant, a one per cent increase in BPS leads to a 0.001 per cent increase in TE. Contrary results have been observed in the case of

TABLE 6. DETERMINANTS OF EFFICIENCY OF MFIS IN INDIA

Independent Variables	Dependent Variable: Technical Efficiency		Dependent Variable: Pure Technical Efficiency		Dependent Variable: Scale Efficiency	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	-1.174***	-3.528	-0.831	-1.718	0.424	1.069
DUM_1	-0.119	-1.267	0.100	0.733	-0.249**	-2.232
DUM_2	0.037	0.416	0.240*	1.859	-0.168	-1.584
BPS	0.001***	6.168	0.000**	2.331	0.001***	3.616
PAR (30 days)	-0.011	-0.011	1.494	0.979	-1.936	-1.547
Age	0.005	1.064	0.005	0.765	0.003	0.486
Log (TA)	0.159***	3.275	0.137*	1.943	0.016	0.276
Log (DER)	0.055	1.002	-0.174**	-2.173	0.239***	3.645
ROA	-0.334	-0.365	-1.219	-0.918	0.260	0.239
ROE	-0.038	-0.700	0.006	0.071	-0.056	-0.874
Log(OSS)	0.814	1.541	1.146	1.493	0.330	0.524
YOGP	0.436	1.056	0.328	0.548	0.386	0.785
FEPA	-0.134	-0.105	1.223	0.662	-1.706	-1.126
R-squared	0.810		0.686		0.558	
Adj R-squared	0.723		0.541		0.354	
F-statistic	9.262		4.736		2.734	
D-W statistic	2.411		2.025		2.586	

***, ** and * indicate coefficient is significant at 1, 5 and 10 per cent level, respectively.

ROA and ROE against the expectation that a higher return on asset as well as equity would lead towards the long run sustainability of the microcredit operation by reinvesting the surplus into the operation. In this model BPS and log(TA) is significant at 1 per cent level.

As the estimated F statistics exceeds the tabulated $F_{0.01(12,26)}$, we reject the following null hypothesis, H_0: $\beta_1 = \beta_2 = \ldots\ldots = \beta_{12} = 0$. Thus, the result of the F test besides measuring the overall significance of the estimated regression also supports that the categorisation in qualitative variable location in two dummy variables (as the model includes intercept) is relevant.

In the regression estimates for PTE, as dependent variable BPS and log(DER) are significant at 5 per cent level, while in the third model, BPS and log(DER) are significant at 1 per cent level.

VII

CONCLUDING REMARKS AND FURTHER RESEARCH

While conducting the DEA analysis using individual location data, it has been observed that two from each of the three locations are at the technically efficient frontier under both constant returns to scale and variable returns to scale. The technical efficiency figures for East, South and, North and West are 0.66, 0.544, and

0.697, respectively, while the average pure technical efficiencies for these locations respectively range between 0.819-0.894, 0.712-0.719 and 0.778-0.9. Similarly, the average scale efficiencies for these locations respectively range between 0.746 – 0.835, 0.753 – 0.779 and 0.782 – 0.857.

The analysis of the whole of India, combining all three locations indicated that there are two technically efficient MFIs under CRS assumption and six technically efficient MFIs under VRS assumption among the 39 MFIs been studied throughout India. The MFIs that remain technically efficient under both CRS and VRS assumption are the Sanghamithra Rural Financial Services and the Spandana Sphoorty Financial Limited, both have major operations in south India. Both the MFIs were found to be efficient under both the CRS and VRS during the analysis on regional basis.

The study attempted to identify and analyse the possible determinants of the technical efficiency of MFIs in India. The variables were grouped under four categories, namely, location, governance, presence and outreach and financial management and performance. The results indicate that borrower per staff, age, value of total assets, return on assets, return on equity level of operational self-sufficiency and yield on gross portfolio of MFI are positively correlated with all technical efficiency measures. As expected debt equity ratio and financial expenses per asset are negatively related with TE and PTE. In the case of location only the MFIs from southern Indian states have positive correlation with all three measures of technical efficiency. This may be a result of early intervention of MFIs in southern states as well as conducive atmosphere as well as Government support and policy of promoting microfinance as a poverty alleviation tool for a long time.

The study also aimed to build a multiple regression model to explain the variability of individual efficiency measures. The value of R^2 shows that 81 per cent of variation in the technical efficiency is explained by the independent variables included in the model. In case of pure technical efficiency this variation is 68 per cent. The statistical significance of business per staff and log(total asset) indicate need of scaling up of MFIs to become efficient.

As the present study has dealt with the average data of three consecutive years for a single output and two inputs to measure the technical efficiency of MFIs, there is further scope for research on comparing the technical efficiency of individual MFIs as well as the group as a whole on a longer panel data set which would show the direction of technical efficiency of MFIs in the Indian context. The non-availability of the borrower's side secondary data as a utilisation of the borrowing fund, microeconomic activities undertaken, average duration of loans and loan instalments may have limited the efficiency of the multiple regression models. Further the MFIs could be sub-divided among their legal status as a society/trust/section 25 companies, cooperative/credit union and NBFC/LAB to study the variation in technical efficiency across the status if any.

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ANNEXURE

DESCRIPTION OF FINANCIAL INDICATORS

Portfolio at Risk > [KK] days
The value of all loans outstanding that have one or more principal installments past due for more than [KK] days. This includes the entire unpaid principal balance, including both the past due and future installments, but not accrued interest. It also includes restructured or rescheduled loans.

Debt/Equity Ratio
Liabilities/Equity

Return on Assets (%)
(Net Operating Income, less Taxes)/Assets

Return on Equity (%)
(Net Operating Income, less Taxes)/Equity

Operational Self-Sufficiency (%)
Financial Revenue/(Financial Expense + Impairment Loss + Operating Expense)

Yield on Gross Portfolio (%)
Interest and fees on gross loan portfolio/gross loan portfolio

Financial expenses/assets (%)
(Cumulative expense in form of interest, fees and commissions incurred by the MFI on all liabilities, which includes borrowings, subordinated debt, deposit accounts of clients held by the MFI, and other liabilities)/total asset.