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Efficiency and Sustainability of Micro Finance Institutions in South Asia[1]

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The objective of this study has been to estimate the efficiency and sustainability of microfinance institution working in the South Asian countries such as Bangladesh, Pakistan and India. For the efficiency analysis we used non parametric Data Envelopment Analysis. We considered both inputs oriented and output oriented methods by assuming constant returns to scale and variable returns to scale technologies. While conducting DEA analysis using single country data we found that eight MFIs from Pakistan, six MFIs from Bangladesh and five MFIs from India are at the efficient frontier under variable returns to scale. The technical efficiency figures for Pakistan, Bangladesh and India are 0.395, 0.087, and 0.28, respectively, while average pure technical efficiencies for these countries respectively range between 0.713-0.823, 0.175-0.547 and 0.413-0.452. Three countries combine analysis revealed that there are two efficient MFIs under CRS and five efficient MFIs under VRS assumption in these countries. Out of these efficient MFIs three -Annesa, BARC and Grameen Bank, belong to Bangladesh, and two MFIs - Bodhana and Pushtikar, are from India. No MFI from Pakistan was found operating on the efficient frontier. The analysis further reveals that the inefficiencies of MFIs in Pakistan, India and Bangladesd are mainly of technical nature. The results have an important policy implication that in order to improve the efficiency of the MFIs there is need to enhance the managerial skills and improve technology. This could be done by imparting training. Since Grameen Bank is the leading MFIs in the world we can adopt its model according to the country specific requirements. Particularly, the lagging countries like Pakistan and India require special training programs in the field of microfinance management.

Keywords: Microfinance Institution (MFI), Efficiency, Data Envelopment Analysis, Bangladesh, Pakistan, India, South Asia

1. INTRODUCTION

Poverty is pervasive in South Asia. Rather it is on the rise in some countries of the region, which in turn further worsening the access of the poor to the economic opportunities through which they could buildup their assets and enhance income in order to come out of poverty cycle. The potential to avail such economic opportunities mainly depends on the degree of access to financial services. The commercial banking sector does not consider the poor bankable owning mainly to their inability to meet the eligibility criteria, including collateral. Thus, the poor people in most countries virtually have had no access to formal financial services [Littlefield et al. (2003)]. The informal financial alternatives such as family loans, moneylenders, and traders are usually limited in amount, often rigidly administered, and in most of the cases involve very high implicit and explicit costs forcing the destitute stuck in poverty cycle for generations. The more rational way to help the poor could be the provision of sustainable economic

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opportunities at gross root level especially provision of required financial services at competitive rates to support their investments including viable business activities.

Microfinance emerged as a noble substitute for informal credit and an effective and powerful instrument for poverty reduction among people who are economically active but financially constrained and vulnerable in various countries [Japonica Intersectoral (2003); Morduch and Haley (2002)]. It covers a broad range of financial services including loans, deposits and payment services, and insurance to the poor and low-income households and their micro-enterprises. Convincing research evidence exists showing significant role of Micro Finance Institutions (MFIs) in improving the lives of the deprived communities in various countries.[2] Persuaded with the potential role of micro financing in alleviating poverty, the South Asian countries have been actively pursuing the policy of setting up formal network of microfinance institutions. These institutions include NGOs and government sponsored programs.

Some leading MFIs, e.g. Grameen Bank, have created financial modes that serve increasing number of poor. They also lead to repayment rates positively comparable with the performance of many commercial banks. These approaches have helped many MFIs in achieving a reasonable level of sustainability, and have even produced profits without government subsidies and support from donor (Hulme, 1999). Nonetheless, some of the MFIs especially the NGOs are facing serious sustainability problems indicating lapse in their financial procedures, organizational design and governance. Moreover, most of the MFIs do not provide deposit services to their clients. In contrast, some of the successful MFIs like Grameen Bank in Bangladesh and BancoSol in Bolivia have incorporated the provision of deposit services in their operations. Appropriately managing the deposit service and micro and small savings help MFIs to reach financial self-sufficiency through generating their own internal flow of funds that in turn reduce their dependency on external sources (Bass, Henderson and WA, Inc., 2000; cited in Morduch and Haley, 2002). The MFIs exclusively dependent on external sources of funding usually are not sustainable and efficient (Rhyne, 1998).

[2] There is no dearth of literature dealing with assessment of impact of microfinancing institutions working in various countries on poverty status. A large number of empirical studies has led the policy makers and analysts to believe that the microfinance programs in various countries are playing significant role in changing the lives of the very poor people by smoothing their consumption expenditures, increasing incomes and savings, and diversify their income sources [Dichter (1999; Panjaitan-Drioadisuryo, Rositan and Cloud (1999); Remenyi and Quinones Jr., (2000); Mustafa (1996); Morduch (1998); Zaman (2000); Khandker (1998 and 2003); McKernan (2002); Simonwtz (2002); Hossain (1988)]. Some studies have also shown that these programs have significant positive effects on human resource development among the participants [Chowdhury and Bhuiya (2001); Khandker (1998); Marcus, et. al (1999); Barnes, Gaile and Kimbombo (2001); Barnes (2001); Chen and Snodgrass (2001)]. Evidence is also found in empirical literature that participation in microfinance programs positively affected the woman's empowerment and welfare [Amin et. al. (1994); Naved (1994); and Hashemi et. al. (1996)]. The studies have also shown positive effects of these programs on school enrollment and spending on schooling of children of benefiting families [Pitt and Khandker (1996); Marcus et. al. (1999); Barnes et. al. (2001); Foster (1995); and Jacoby (1994)]. The members of the participating household, particularly women and children, also benefit significantly from better nutrition, and health practices/services [MkNelly and Dunford (1999); Barnes (2001)].

The primary objective of this study is to identify the most efficient/best practice MFI(s) that would in turn help improve functioning of the other MFIs in the South Asian region, which comprises of 20% of the World poor and also the birth of the first MFI – the Grameen Bank started in 1976. Scores of studies are found on analyzing the efficiency and its determinants in commercial banking sectors of various countries.[3] The MFIs are also financial institutions with a primary objective of making credit available to that segment of the population which has been ignored by the commercial banking system for not having collateral requirements. The efficient functioning of these MFIs on sustainable basis is important also for persistent financial access of the poor segment of the society. There is dearth of literature regarding efficiency analysis of MFIs in South Asia. However, a few examples are found in literature such as Nghiem (2004) Nieto, Cinca and Molinero (2004) and Leon (2003) using data from Vietnam, Latin America and Peru, respectively.

To estimate the efficiency of MFI we used Data Envelopment Analysis (DEA) technique introduced by Farrel (1957) and extended by Charnes, et. al., (1978), Färe, et. al., (1983), Banker, et. al., (1984), and Byrens, et. al., (1984). The DEA is non parametric techniques based on mathematical programming methods to measure different efficiency measures. In the study we measure technical efficiency of MFI's which is decomposed into pure technical efficiency and scale efficiency under the assumption of variable returns to scale.

Section 2 reviews the situation of microfinance institution in South Asian countries. Next section explains different concepts of efficiency measures and detailed methodology is given in the section 4. Section 5 discusses input and output variables to be used in the analysis. Results of efficiency measures and their determinants are contained the section 6 and 7. Final section provides concluding remarks.

2. REVIEW OF MICROFINANCE IN SOUTH ASIA

The first Microfinance operation started approximately 30 years ago in South Asia. There are number of institutions, such as donor agencies, international NGOs and research institutions, which have played an important role in developing microfinance programs and institutions by financially supporting microfinance initiatives. They assisted in creating capacity building and good governance practices in microfinance programs.

The most famous MFIs established in the late 1970s are Grameen Bank and Bangladesh Rural Advancement Committee (BRAC). In the early 1980s the Grameen Bank became a private sector bank and with a limited license the BRAC became a non-government organization (NGO). These two institutions have had a global influence as there have been many successful attempts at replicating them in other developing countries (Remenyi, 1997).

There are various microfinance models currently being used by MFIs throughout the world. The most commonly known model is the Grameen model, which has emerged from the practices followed by this bank. (Hassan, et. al., 1997).

The history of microfinance activities in Pakistan starts with the launching of Orangi Pilot Project (OPP) in Kutchi Abadies of Karachi in early 1980's. Now there are more than sixteen Micro Finance Institutions working in Pakistan. The MFIs in Pakistan can be divided into different groups based on their uniqueness that separates them from other financial institutions and makes them similar in terms of the way they function. The first group consists of Financial Institutions with microfinance as a separate product line. The share of microfinance related activities of these institutions is up to 10 percent. This group includes Orix Leasing and the Bank of Khyber –both are profit making organizations and consider microfinance as a separate product line.

The second group refers to the specialized MFI's, which includes two microfinance banks - The Khushhali Bank and First Microfinance Bank Limited (FMBL) - and two NGOs - KASHF Foundation and ASASAH. All these institutions completely focus on provision of financial services and also have commercial focus as well.

Third category MFIs is related to activities of the Rural Support Programs which deals with integrated Rural Development Programs with microfinance as one of its activities. These organizations are National Rural Support Programs (NRSP), Punjab Rural Support Programs (PRSP) and Sarhad Rural Support Programs (SRSP).

The last group consists of private NGOs. These NGOs are basically integrated development organizations with microfinance as one of their activities. These include Orangi Pilot Project, Sungi Foundation, Taraqee Foundation, Development Action for Mobilization and Emancipation (TRDP), Sindh Agricultural & Forestry Workers Coordinating Organization (SAFWCO) and Development Action for Mobilization and Emancipation (DAMEN), among others.

There were less than a half million beneficiaries of the microfinance institution during the financial year 2003. They distributed more than 87 million dollars to the poor people. The Khushhali Bank remains on the top position by serving approximately 168,105 active borrowers with gross loan portfolio of about 23.54 million US dollars. The sources of finance of these MFIs include grants, loans, share capital and savings.

The organisations engaged in microfinance activities in India may be categorised as the Wholesalers, NGOs supporting Self Help Group Federations (SHGF) and NGOs directly retailing credit borrowers or groups of borrower. The wholesale agencies which provide bulk funds to the system through NGOs include the National Bank of Agriculture and Rural Development (NABARD), Rashtriya Mahila Kosh-New Delhi and the Friends of Women's World Banking in Ahmedabad. The NGOs that are supporting the SHG Federations include MYRADA in Bangalore, Self-help Women's Association (SEWA) in Ahmedabad, PRADAN in Tamilnadu and Bihar, ADITHI in Patna, SPARC in Mumbai, and the Association for Sarva Seva Farms (ASSEFA) in Madras, the Small Industries Development Bank of India (SIDBI) and the Tamil Nadu

Womens' Development Corporationetc. The NGOs that are directly enhancing credit to the borrowers include SHARE in Hyderabad, ASA in Trichy, RDO Loyalam Bank in Manipur (Tiwari and Fahad, 2004). There are perhaps 250-300 NGOs in the field of micro-finance. Currently there are more than 10 million active borrowers in India.

Table 1: Performance Indicators of MFIs in South Asia (2003)

Variables	Mean	India	Pakistan	Bangladesh
Age	16.247	11.040	10.133	21.178
Number of Personnel	714.835	139.440	192.867	1208.489
Number of Active Borrowers	156248	27097	30088	270052
Average Loan Balance per Borrower (US$)	156.859	309.960	178.333	64.644
Gross Loan Portfolio (in US$)	12069483	3022139	4480632	19625402
Total Assets (US$)	16992076	2747570	10794145	26971667
Savings (US$)	4473875	294300	411654	8149935
Total Equity (US$)	5065802	558699	4895289	7626585
Capital / Asset Ratio	0.246	0.129	0.565	0.218
Debt / Equity Ratio	10.042	16.541	1.316	9.052
Deposits to Loans	0.068	0.099	0.117	0.034
Deposits to Total Assets	0.044	0.090	0.024	0.025
Gross Loan Portfolio / Total Assets	0.843	1.115	0.671	0.750
Return on Assets (%)	0.002	-0.022	-0.068	0.035
Return on Equity (%)	-0.163	-1.091	-0.043	0.194
Operational Self-Sufficiency (%)	1.087	0.943	0.796	1.265
Financial Revenue Ratio (%)	0.187	0.197	0.122	0.200
Profit Margin (%)	-0.100	-0.112	-0.837	0.151
Total Expense Ratio (%)	0.184	0.218	0.190	0.164
Financial Expense Ratio (%)	0.050	0.083	0.033	0.038
Loan Loss Provision Expense Ratio (%)	0.011	0.013	0.017	0.009
Operating Expense Ratio (%)	0.123	0.122	0.140	0.118
Operating Expense / Loan Portfolio (%)	0.184	0.151	0.310	0.158
Cost per Borrower	17.721	16.092	44.773	9.609
Borrowers per Staff member	236.488	463.040	175.400	128.591

Players of microfinance sector in Bangladesh consists of at least 15 International NGOs, ten Government Ministries and Projects, five Commercial Banks, ten Grameen and more than 1000 other NGOs and Cooperatives. They have more than 15 million active borrowers (Rashid and Matsaert, 2005). The micro finance operation in Bangladesh starts with the establishment Grameen Bank in 1976. It has over 1000 branches spread all over Bangladesh. The Grameen Bank has borrowing groups in 28,000 villages and it has more than 3.7 million borrowers. Most of the borrowers are women. Its gross loan portfolio during 2004 was more than 337 million dollars. The most important feature is the recovery rate of loans, which is as high as 98%. Moreover

the Bank provides credit without any collateral security. Considering outreach numbers the BRAC remained at the top with 3.99 million active borrows.

Performance Indicators of microfinance institutions in the South Asian countries are given in the Table 1. These Indicators can be divided into outreach indicators, Institutional Characteristics, Financing Structure, Overall Financial Performance, Efficiency Indicators, Productivity Indicators, and Risk and Liquidity Indicators.

Average age of MFIs in the South Asia is 21 years. In this case average age of Pakistan MFI is 10 years which is less than average age of Indian (11 years) and Bangladeshi (21 years) MFIs. The average number of persons engaged in microfinance activities are highest in Bangladesh while Pakistan stands at the bottom.

All outreach indicators, as may be seen from the Table 1, show that Bangladesh is playing active role followed by India and then Pakistan. Average of outreach indicators of MFIs in India and Pakistan are well below the overall average.

If the value of total assets and total equity is considered as size of the MFI, Bangladeshi MFIs are reasonability bigger than the other countries. In case of sustainability indicators on average Indian MFIs are better than Bangladeshi MFIs. Whereas MFIs in Pakistan have negative average rate of return on assets and has less than one operational self sufficiency ratio.

Indicators of efficiency that is operating expense ratio and cost per borrower shows that Pakistani MFIs are less efficient as compared to the MFIs' of other two countries. Moreover, the value of these indicators is greater than the average of the values of the South Asian MFIs. The labour productivity is highest for Bangladeshi MFIs followed by Indian MFIs and Pakistani MFIs.

3. BEST PRACTICE FUNCTION AND THE CONCEPT OF EFFICIENCY

Efficiency in practice is a relative concept and in order to measure efficiency of firms we have to define the best practice or frontier function. Frontier function is an efficient transformation of given inputs into maximum attainable output or ability to produce a well specified output at minimum cost [Forsund (2000), Lovell (1993) and Schmidt (1985-86)]. To evaluate efficiency of firms relative to the best practice production a quantifiable standard is required. That standard can only be determined by those productive units which share a common technology. It was Farrell (1957) who first proposed an approach to estimate the productive or economic efficiency (EE) of observed units. He decomposed production efficiency into two elements: (1) technical efficiency (TE), which measures the firm's success in producing maximal output with a given set of inputs; and (2) allocative (price) efficiency (AE), which quantifies the firm's success in choosing an optimum combination of inputs.

The efficient production function a MFI that uses only two inputs, X_i and X_2, to produce a single output (Y) can be written as

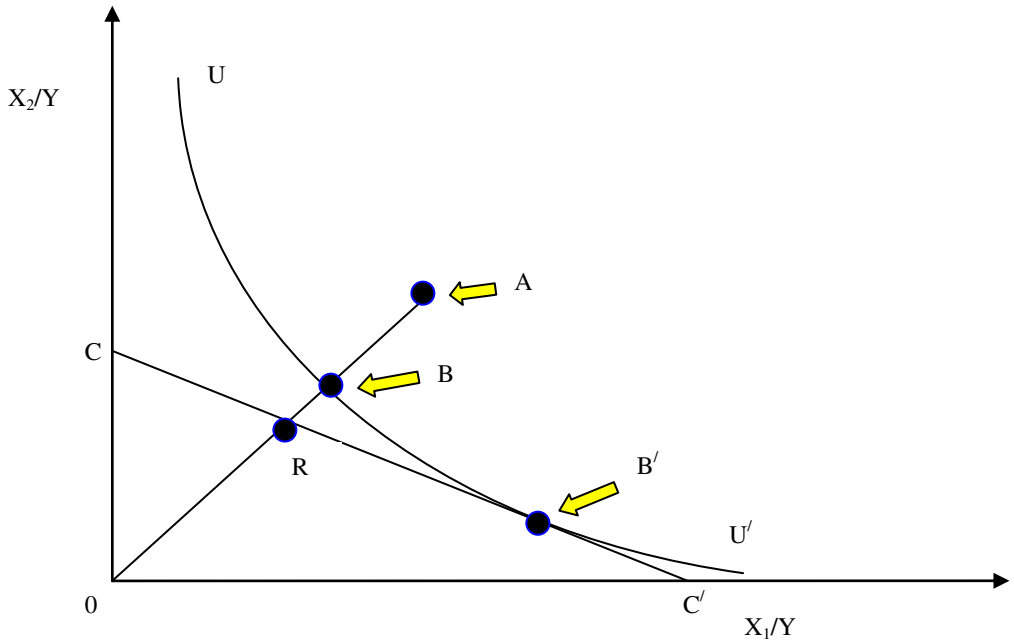
$$Y = f(X_1, X_2) \quad (1)$$

Assuming constant returns to scale, equation 1 can be expressed as[4]

$$I = f(X_1/Y, X_2/Y) \quad (2)$$

Equation 2 implies that the production frontier 1 can be depicted using the efficient unit isoquant (EUI), represented by $UU^{/}$ in Figure 1. The EUI shows the technically efficient combinations of X_1 and X_2 used to produce one unit of output Y. Point A, which lies above the unit isoquant, represents the combination of X_1 and X_2 actually used in producing Y, while point B represents a technically efficient firm using the two inputs in the same ratio as A. Point B implies that the respective firm produces the same output as A, but with less inputs. Thus the fraction OB/OA defines the TE of firm A. Hence, the technical inefficiency of 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).

Figure: Technical and Allocative Efficiencies from Input Orientation



If input prices are considered, then it is possible to examine the optimal combination of inputs which minimize the cost of producing a given level of output. This optimal combination is where the slope of $CC^{/}$, the price line, is equal to that of unit isoquant $UU^{/}$. Thus $B^{/}$ is the optimal or minimum cost point of production. Firm B is

[4]The constant returns to scale assumption allows one to represent the technology using unit isoquant. Furthermore, Farrell also discussed the extension of his method so as to accommodate more than two inputs, multiple outputs, and non-constant returns to scale.

producing at a higher cost than $B^{/}$, although both points reflect 100 percent technical efficiency. The cost of production at $B^{/}$ is only a fraction OR/OB of that at B. Farrell defines the ratio OR/OB as the allocative efficiency of B. Consequently, the allocative inefficiency of B is 1-(OR/OB), which measures the potential reduction in cost from using optimal input proportions (Schmidt, 1985-86).

If both technical and allocative efficiencies of firm A are considered, then its production or economic efficiency is given by the ratio OR/OA. Accordingly, 1 – (OR/OA) is economic or total inefficiency of that firm, which shows the overall efficiency gain of moving from point A to $B^{/}$ (Schmidt, 1985-86). Moreover, economic efficiency (OR/OB) is the product of technical (OB/OA) and allocative (OR/OB) efficiencies, i.e., EE = (OB/OA) x (OR/OB) = OR/OA (Farrell, 1957).

Farrell's original work and recent extensions made by Charnes, et. al., (1978), Fare, et. al., (1985), and Banker, et. al., (1984), among others, consisted of the estimation of efficiency without resorting to a specific functional form. For this reason these methodologies have been termed non-parametric[5]. Farrell's methodology has also been extended to parametric models based on specific functional forms. Moreover, Farrell's original idea as explained above in input/input space had an input-reducing focus, and thus is usually termed input-orientated measure. Similarly the output-oriented measures can be explained focusing on changes in output by using fixed level input. 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 return to scale prevails. The results, however, differ under increasing or decreasing returns to scale Fare and Lovell (1978).

Charnes, et. al., (1978) proposed a model which had an input orientation and assumed constant returns to scale (CRS). The CRS assumption is only appropriate when all DMU's are operating at an optimal scale. Imperfect competition, constraints on finance, etc. may cause a DMU to be not operating at optimal scale. Banker at al (1984) suggested an extension of the CRS DEA model to account for variable returns to scale (VRS) situations. The use of the CRS specification when not all DMU's are operating at the optimal scale, will result in measures of TE which includes *scale efficiencies* (SE). The use of the VRS specification permits the calculation of TE without SE effects.

The technical efficiency (CRS) can be decomposed into scale efficiency and pure (VRS) technical efficiency components. This may be done by conducting both a CRS and a VRS DEA upon the same data. If there is a difference in the two TE scores for a particular DMU, then this indicates that the DMU has scale inefficiency, and that the scale inefficiency can be calculated from the difference between the VRS TE score and the CRS TE score.

These concepts can be explained by using the Figure 3. In this figure we have one-input one-output example and have drawn the CRS and VRS DEA frontiers. Under CRS the input-orientated technical inefficiency of the point P is the distance PP_c, while

[5] Readers interested in recent advances on non-parametric models are referred to Seiford and Thrall.

under VRS the technical inefficiency would only be PP_v. The difference between these two, P_cP_v, is put down to scale inefficiency. One can also express all of this in ratio efficiency measures as:

$$TE_{ICRS} = AP_C/AP$$
$$TE_I = AP_V/AP$$
$$SE_1 = AP_C/AP_V$$

Where all of these measures will be bounded by zero and one. We also note that

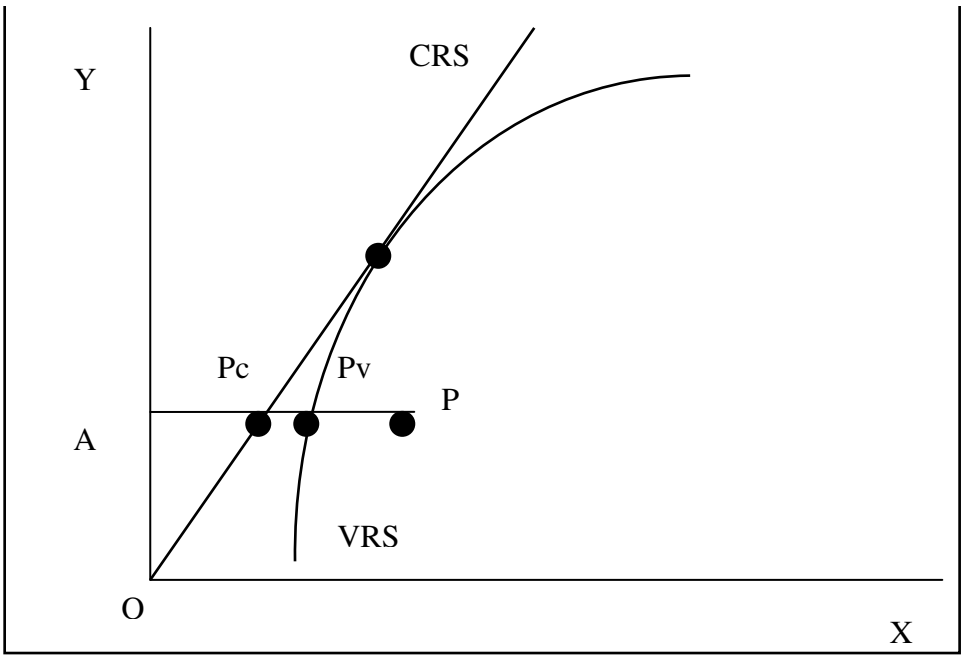
$$AP_C/AP = (AP_VAP) \times (AP_C/AP_V)$$

This is, the CRS technical efficiency measure is decomposed into pure technical efficiency and scale efficiency.

4. METHODOLOGICAL FRAMEWORK

Frontier function technique in the non parametric farm was introduced Farrell (1957) by assuming constant returns to scale (CRS). Later the assumption of CRS was relaxed and the methodology was also extended to parametric one. Now the efficiency estimation techniques can be separated into two broad categories; Econometric methods; and Mathematical programming techniques.

Figure 3: Technical Efficiency, Pure Technical Efficiency and Scale Efficiency



In econometric methods frontier is defined by primal (production) or dual (cost or profit) functions. These techniques either yield deterministic frontier or stochastic

frontier. Ordinary least squares method is used to estimate the deterministic frontier and the efficiency scores are computed from the model residuals.[6] The main drawback of the deterministic models is that they do not allow the possible effects of the factors that are not under the control of the producer. Consequently, all deviations from the frontier can be regarded as inefficiency resulting in an over estimation of this component (Meeusen and Broeck, 1977).

Aigner, Lovell and Schmidt (1977) and Meeusen and Broeck (1977) developed stochastic frontier model which is estimated using maximum likelihood methods. , which incorporates a composed error term having two components – one symmetric, capturing the effects of those factors which are not under the control of the firm and the other is one-sided representing management inefficiency. This approach was initially developed for the analysis of cross-sectional data. However, it was later expanded to analyze the panel data (e.g., Pitt and Lee, 1981; and Battese and Coelli, 1988, Battese, Coelli and Colby, 1989; and Seale, 1990).

The major advantages of this approach are its ability to incorporate and manage statistical noise and handle outliers, and that hypotheses can be statistically tested (Forstner and Isaksson, 2002). However, this methodology is not free of criticism. These models need specific functional form in order to estimate efficiency -- commonly used are Cobb-Douglas and translog functional forms, and the technology is assumed to be valid for all observations. Additionally, such models assume distributional assumptions regarding the composed error term to separate the efficiency from the statistical noise. Consequently, the econometric methodology makes the estimation of efficiency burdensome and has the tendency to produce different efficiency measures (Schmidt and Sickles, 1984).

Mathematical programming technique: Farrell's original non-parametric approach where piecewise-linear convex isoquant is constructed so as no observed point lie left or below it -- known as mathematical programming technique to form frontier (Worthington, 2000). Later, this methodology was generalized and extended by Charnes, Cooper and Rhodes (1978), Färe, Grosskopf and Lovell (1983), Banker, Charnes and Cooper (1984), and Byrens, Färe and Grosskopf (1984). This technique now is widely known as "data envelopment analysis (DEA)".[7] In contrast to econometric method, the DEA does not require any assumption about the functional form and no need to assume any specific distributional form for the error term (since there is none). Moreover, the DEA analysis is flexible and accommodates variable returns to scale (VRS) as well. A major disadvantage is of its inability to handle noisy data in a satisfactory manner (Worthington, 2000).

[6] The deterministic models were initiated by Aigner and Chu (1968) and further extended by Timmer (1970 and 1971), Afriat (1972), Richmond (1974), Schmidt (1976), and Greene (1980).

[7] More detail reviews of the methodology are presented by Seiford and Thrall (1990), Lovell (1993), Ali and Seiford (1993), Lovell (1994), Charnes, et. al., (1995) and Seiford (1996).

4.1 Analytical Model

Data envelopment analysis (DEA) has been used in study to analyze the efficiency of the microfinancing institutions (MFIs) in some selected South-Asian countries. Both input-oriented (IOM) and output-oriented (OOM) versions of the DEA methodology have been applied to the data for the sake of efficiency score comparison.

An output-oriented model implies that the efficiency is estimated by the output of the firm 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's assume that we have K decision making units (DMU)[8] 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; Shiu, 2002)

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

where y_{ik} is the quantity of the *i*th output produced by the *k*th DMU firm, x_{js} is the quantity of jth input used by the sth firm, and u_i and v_j are the output and input weights respectively. The DMU maximizes the efficiency ration, TE_k, subject to

$$\sum_{i=1}^{m} u_i y_{ik} \Big/ \sum_{j=1}^{n} v_j x_{jk} \le 1 \qquad \text{where } u_i \text{ and } v_j \ge 0)$$

The above equation indicates that efficiency measure of a firm cannot exceed 1, and the input and output weights are positive. The weights are selected in such a way that the firm maximizes its own efficiency. To select optimal weights the following mathematical programming (output-oriented) is specified (Coelli, 1998; Worthington, 1999; Shiu, 2002)

$$\text{Max } TE_k$$

$$\text{Subject to} \quad \sum_{i=1}^{m} u_i y_{ir} - x_{jr} + w \le 0 \qquad r = 1,\ldots\ldots\ldots,K$$

$$v_j x_{jr} - \sum_{j=1}^{n} u_j x_{jk} \quad \text{and ui and } v_j \ge 0$$

Input oriented linear programming methods is used in order to obtain the minimize inputs through. Therefore the following mathematical programming model is specified (Banker and Thrall, 1992; Coelli, 1998; Worthington, 1999; Shiu, 2002; Topuz et. al., 2005).

$$\text{Min } TE_k$$

$$\text{Subject to} \quad \sum_{i=1}^{m} u_i y_{ir} - y_{iF} + w \ge 0 \qquad r = 1,\ldots\ldots\ldots,K$$

[8] Hereafter MFI will be represented by DMU.

$$x_{jr} - \sum_{j=1}^{n} u_j x_{jk} \geq 0$$

and

ui and $v_j \geq 0$

The above model shows CRS if w = 0 and it changed into variable returns to scale (VRS) if w is used unconstrained. In the first case it leads to technical efficiency (TE) and in the second case we estimate pure technical efficiency (PTE).

5. SELECTION OF INPUTS AND OUTPUTS

Considering financial institutions as decision making units there are three approaches which are used to define inputs and outputs and the relationship between the input and outputs. These approaches include, i) the production approach, ii) the intermediation approach, and iii) the assets approach. Under the production approach the financial institutions are considered as the producers of deposits and loans. The number of employees and capital expenditures are important inputs in this approach. The second approach considers the financial institutions as intermediaries. As intermediaries financial institutions have the responsibility of transferring financial assets from the savors, the surplus unit to the investors, the deficit unit. In this case the inputs can be defined as labour, capital cost and interest payable on deposits. Whereas, the loans and financial investments are considered as outputs in the intermediation approach. Finally under the assets approach it is assumed that the basic function of any financial institution is the creation of credit (loan). Whereas the value of assets of financial institutions act as output in this approach.

The loans/credit is the most important financial service that MFIs provides to their customers. Therefore this study selected loans disbursed by MFI as a single output. Main inputs required to produce loans are labour and cost. We have taken two inputs that are credit officers as a proxy for labour and cost per borrower as a proxy for expenditures. Production approach suggests credit officers as input. The credit officers are relevant because they are actively engaged with loan portfolio of the MFIs.

The data for 15 Pakistani, 25 Indian and 45 Bangladeshi MFIs are taken from the Micro Finance Network, Pakistan and Mix Market Network.

6. EFFICIENCY ANALYSIS

6.1 Efficiency of MFI in Pakistan

The DEA technical efficiency is calculated by assuming both Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS) technology. While measuring the efficiency of MFIs we used both input oriented as well as output oriented methods. Results are presented in the Table 2. The results show that three MFIs are on the efficiency frontier when constant returns to scale is assumed and eight MFIs are on the efficient frontier when variable returns to scale is assumed. The MFIs that remains efficient under both CRS and VRS assumption are Kushhali Bank, Bank of Kkaber and

Kashf Foundation. Of these first two are formal financial institutions and the third Kashk Foundation is NGO fully engaged in microfinance related activities.

Table 2: Single Output-Two Inputs DEA Efficiency of MFIs in Pakistan

MFIs	INPUT ORIENTED				OUTPUT ORIENTED			
	CRS-TE	VRS-TE	SCALE		CRS-TE	VRS-TE	SCALE	
ASASAH	0.114	1.000	0.114	irs	0.114	1.000	0.114	irs
BOK	1.000	1.000	1.000		1.000	1.000	1.000	
DAMEN	0.131	0.986	0.133	irs	0.131	0.404	0.324	irs
FMFB	0.148	0.155	0.955	irs	0.148	0.522	0.283	drs
KASHF	1.000	1.000	1.000		1.000	1.000	1.000	
KHUSHHALI	1.000	1.000	1.000		1.000	1.000	1.000	
NRSP	0.400	1.000	0.400	drs	0.400	1.000	0.400	drs
ORANGI	0.220	1.000	0.220	irs	0.220	1.000	0.220	irs
ORIX LEASING	0.534	1.000	0.534	irs	0.534	1.000	0.534	irs
PRSP	0.576	0.598	0.963	irs	0.576	0.656	0.879	drs
SAFWCO	0.074	0.931	0.080	irs	0.074	0.164	0.453	irs
SRSP	0.108	0.608	0.177	irs	0.108	0.115	0.940	drs
SUNGI	0.063	1.000	0.063	irs	0.063	1.000	0.063	irs
TARAQEE	0.158	0.243	0.649	irs	0.158	0.394	0.401	drs
TRDP	0.393	0.820	0.479	irs	0.393	0.434	0.904	irs
MEAN	0.395	0.823	0.518		0.395	0.713	0.568	

The FMFB and SRSP are pure technically inefficient MFIs under both input oriented and output oriented methods. The Sungi Foundation is scale inefficient irrespective of method applied. The inefficiency of Sungi is due to the scale inefficiency rather than pure technical inefficiency. This is due to the priority of objective. It has only 30 % of activities that are related to the microfinance field.

Average input oriented technical efficiency (TE), pure technical efficiency (PTE) and scale efficiency (SE) are 39.5%, 82.3% and 51.8%, respectively. The average output oriented TE, PTE and SE are 39.5%, 71.3% and 56.8% respectively. In first case it can be conclude that 17.7 percent of inputs can be decreased without affecting the existing output level that is gross loan portfolio of MFIs. Whereas under the output oriented measures the MFIs can increase their loan portfolio by 28.7 % with the existing level of input by efficient utilization of these inputs.

The pure scale inefficiency is greater than the technical inefficiency in both measures. It implies that most of the technical inefficiency of MFIs is due to the scale inefficiency rather than the pure technical inefficiency (i.e., managerial inefficiency).

Further the results suggest that most of the MFIs in Pakistan experienced economies of scale that is 73% MFIs under input oriented measures and 47 % MFIs under output oriented measures are at the stage of increasing returns to scale. Under output oriented measures 33% MFIs are at the stage of decreasing returns to scale.

However, only one MFI is at the stage of DRS while considering input oriented measures. It implies that only these MFIs' are scale efficient

6.2 Efficiency of MFIs in Bangladesh

Table 3 provides various efficiency measures of MFIs in Bangladesh. The overall technical efficiency is measured under the assumption of constant return to scale whereas pure technical efficiency and the scale efficiency are measured by assuming VRS.

Average input oriented TE, PTE and SE measures are 8.7%, 17.5% and 66.9%, respectively. Average output oriented TE, PTE and SE are 8.7%, 54.7% and 11.3% respectively. In first case it can be conclude that 82.5% of inputs can be decreased without affecting the existing output level that is gross loan portfolio of MFIs. Whereas under the second scenario that is output oriented measures the MFIs can increase their loan portfolio by 44.3 percent with the existing level of input by efficient utilization of theses inputs.

The pure technical inefficiency is greater than the scale inefficiency under input oriented case. Whereas the scale inefficiency is greater than the pure technical inefficiency under output oriented method of measurement. It implies that most of the technical inefficiency of MFIs is due to the scale inefficiency rather than the pure technical inefficiency when output is objective and the most of the technical inefficiency of MFIs is due to the pure technical inefficiency rather than the scale inefficiency when inputs are targeted.

Further the results suggest that most of the MFIs in Bangladesh experienced economies of scale. MFIs at the stage of increasing returns to scale under input oriented measures are 40 and there are 43 MFIs at this stage under output oriented measures. As can be seen from the Table 3, there are 95 percent MFIs that are operating at the stage of increasing returns of scale. It implies that most of the MFIs in Bangladesh are enjoying the economies of scale.

The results also revealed that the Grameen Bank and the BARC are leading MFIs in Bangladesh. The first one is the only financial institution engaged in microfinance activities. It is also considered as the pioneer and premier microfinance institute in the world. The other, the BRAC is one of the largest private NGOs in Bangladesh. There are six MFIs that are pure technically efficient under both methods. All these MFIs are fully involved in microfinance related activities.

Table 3: Single Output-Two Inputs DEA Efficiency of MFI in Bangladesh Using both Constant and Variable Returns to Scale Technology

FIRM	OUTPUT ORIENTED				INPUT ORIENTED			
	CRS TE	VRS TE	SCALE		CRS TE	VRS TE	SCALE	
AF	0.031	1.000	0.031	irs	0.031	1.000	0.031	irs
Annesa	0.002	1.000	0.002	irs	0.002	1.000	0.002	irs
ASA	0.893	1.000	0.893	irs	0.893	1.000	0.893	irs
ASOD	0.007	0.012	0.622	irs	0.007	0.501	0.015	irs

Aspada	0.005	0.009	0.602	irs	0.005	0.606	0.008	irs
BARC	1.000	1.000	1.000		1.000	1.000	1.000	
BASA	0.023	0.122	0.189	irs	0.023	0.871	0.026	irs
BDS	0.002	0.003	0.818		0.002	0.346	0.006	irs
BEES	0.009	0.009	0.973		0.009	0.378	0.024	irs
BURO Tangail	0.077	0.086	0.896	irs	0.077	0.315	0.244	irs
CCDA	0.014	0.019	0.753	irs	0.014	0.402	0.036	irs
COAST Trust	0.014	0.017	0.820	irs	0.014	0.350	0.039	irs
CODEC	0.075	0.523	0.143	irs	0.075	0.946	0.079	irs
DDJ	0.007	0.012	0.645	irs	0.007	0.487	0.015	irs
DESHA	0.009	0.010	0.884	irs	0.009	0.289	0.029	irs
DIP	0.017	0.026	0.640	irs	0.017	0.497	0.033	irs
EWF	0.008	0.014	0.540	irs	0.008	0.569	0.013	irs
GJUS	0.001	0.002	0.448	irs	0.001	0.681	0.001	irs
Grameen Bank	1.000	1.000	1.000		1.000	1.000	1.000	
HEED	0.018	0.021	0.852	irs	0.018	0.324	0.055	irs
HFSKS	0.010	0.016	0.624	irs	0.010	0.502	0.020	irs
ICDA	0.002	0.004	0.559	irs	0.002	0.687	0.003	irs
IDF	0.025	0.032	0.778	irs	0.025	0.397	0.062	irs
JCF	0.047	0.062	0.756	irs	0.047	0.421	0.111	irs
NGF	0.013	0.017	0.744	irs	0.013	0.406	0.032	irs
NUSA	0.002	0.002	0.848		0.002	0.395	0.005	irs
PBK	0.009	0.011	0.775	irs	0.009	0.386	0.022	irs
PDIM	0.006	0.014	0.417	irs	0.006	0.720	0.008	irs
PMK	0.038	0.053	0.717	irs	0.038	0.454	0.083	irs
PMUK	0.053	0.081	0.655	irs	0.053	0.504	0.105	irs
POPI	0.006	0.008	0.746	irs	0.006	0.407	0.015	irs
PPSS	0.011	0.014	0.750	irs	0.011	0.401	0.027	irs
RDRS	0.120	0.228	0.528	irs	0.120	0.654	0.184	irs
RIC	0.012	0.014	0.913	irs	0.012	0.270	0.046	irs
RRF	0.024	0.028	0.847	irs	0.024	0.337	0.071	irs
SBD	0.010	1.000	0.010	irs	0.010	1.000	0.010	irs
SDC	0.011	0.017	0.645	irs	0.011	0.490	0.023	irs
SDS	0.004	0.006	0.671	irs	0.004	0.588	0.007	irs
SSS	0.036	0.039	0.922	irs	0.036	0.271	0.133	irs
ST	0.006	0.008	0.737	irs	0.006	0.486	0.013	irs
TMSS	0.190	0.235	0.812	irs	0.190	0.472	0.403	irs
UDDIPAN	0.031	0.042	0.740	irs	0.031	0.436	0.071	irs
UDPS	0.008	0.008	0.913	irs	0.008	0.266	0.029	irs
VARD	0.006	0.015	0.413	irs	0.006	0.738	0.008	irs
Wave	0.017	0.021	0.817	irs	0.017	0.358	0.048	irs
MEAN	0.087	0.175	0.669		0.087	0.547	0.113	

6.3 Efficiency of MFIs in India

Various efficiency measures of MFIs in India are presented in the Table 4. The overall technical efficiency is measured assuming constant return to scale whereas pure technical efficiency and the scale efficiency are measured by assuming VRS.

Average input oriented TE, PTE and SE measures are 28.0%, 45.2% and 61.2%, respectively. Average output oriented TE, PTE and SE are 28.0%, 41.3% and 71.1% respectively. The pure technical inefficiency is greater than the scale inefficiency under both input and output oriented cases. It implies that most of the technical inefficiency of MFIs is due to the pure technical inefficiency rather than the scale inefficiency in both cases. In first case it can be conclude that 54.8 % of inputs can be decreased without affecting the existing output level that is gross loan portfolio of MFIs. Whereas under the second scenario -the output oriented measures - the MFIs can increase their loan portfolio by 58.7 percent with the existing level of input by efficient utilization of resources.

The stages of production technology of firms - IRS, CRS and VRS – have important policy implications (Fare, et. al., 1985). Table 4 indicates that 76% of the MFIs in India are enjoying economies of scale. However, 16% of the MFIs experience IRS under the output oriented measure.

The analysis reveals that Pushtikar and Sanghamitra are the most efficient (the best practice) MFIs assuming CRS. When variable returns to scale is considered BASIX, Bodhana, Sarvodaya Nano Finance and Satin Credit Care joins Pushtikar and Sanghamitra as the best practice MFIs of India.

Table 4: Single Output-Two Inputs DEA Efficiency of MFI in India Using both Constant and Variable Returns to Scale Technology

MFIs	INPUT				OUTPUT			
	CRSTE	VRSTE	SCALE		CRSTE	VRSTE	SCALE	
AMMACTS	0.400	0.408	0.981	irs	0.400	0.657	0.609	drs
Bandhan	0.103	0.139	0.735	irs	0.103	0.291	0.352	drs
BASIX	0.267	1.000	0.267	drs	0.267	1.000	0.267	drs
BIRDS	0.122	0.221	0.551	irs	0.122	0.138	0.886	drs
BISWA	0.108	0.291	0.371	irs	0.108	0.174	0.622	drs
Bodhana	0.366	1.000	0.366	irs	0.366	1.000	0.366	irs
BWDA	0.120	0.148	0.810	irs	0.120	0.205	0.585	drs
Coshpor MC	0.127	0.344	0.370	drs	0.127	0.488	0.261	drs
Guide	0.181	0.556	0.325	irs	0.181	0.206	0.878	irs
IASC	0.377	0.388	0.971	irs	0.377	0.412	0.914	drs
Janodaya	0.150	0.508	0.294	irs	0.150	0.171	0.877	irs
KBSLAB	0.198	0.209	0.948	irs	0.198	0.235	0.843	drs
Kotalipara	0.050	0.144	0.344	irs	0.050	0.056	0.891	drs
LEAD	0.076	0.351	0.217	irs	0.076	0.093	0.820	drs
Mahasemam	0.113	0.119	0.952	irs	0.113	0.303	0.374	drs
Pushtikar	1.000	1.000	1.000		1.000	1.000	1.000	
PWMACS	0.043	0.238	0.180	irs	0.043	0.046	0.924	drs
RGVN	0.128	0.294	0.437	irs	0.128	0.193	0.664	drs
Sanghamitra	1.000	1.000	1.000		1.000	1.000	1.000	

Sarvodaya Nano Finance	0.783	1.000	0.783	drs	0.783	1.000	0.783	drs
Satin Creditcare	0.863	1.000	0.863	drs	0.863	1.000	0.863	drs
SEVA Micro foundation	0.057	0.500	0.114	irs	0.057	0.061	0.930	irs
TCT	0.085	0.114	0.748	irs	0.085	0.121	0.706	drs
VSKSU	0.106	0.141	0.756	irs	0.106	0.121	0.878	drs
VWS	0.173	0.187	0.925	irs	0.173	0.351	0.492	drs
Mean	0.280	0.452	0.612		0.280	0.413	0.711	

6.4 Efficiency of MFIs in South Asia

The efficiency analysis has also performed by combining all MFIs from Pakistan, Bangladesh and India and the results are presented in Table 5. The overall technical efficiency is measured under the assumption of CRS whereas pure technical efficiency and the scale efficiency are measured assuming VRS.

Average input oriented TE, PTE and SE measures are 6.5%, 22.6% and 20.7%, respectively. The average output oriented TE, PTE and SE measures are 6.5%, 10.0% and 85.7% respectively. Table 5 shows that average MFI can become efficient by reducing the inputs 93.5 percent of their current level under CRS technology. The pure technical inefficiency is less than the scale inefficiency under input oriented case, while the scale inefficiency is less than the pure technical inefficiency under output oriented method of measurement. It implies that most of the technical inefficiency of MFIs is due to the scale inefficiency rather than the pure technical inefficiency when output is objective and the most of the technical inefficiency of MFIs is due to the pure technical inefficiency rather than the scale inefficiency when inputs are targeted.

In first case it can be conclude that 77.4% of inputs can be decreased without affecting the existing output level that is gross loan portfolio of MFIs. Whereas under the second scenario that is output oriented measures the MFIs can increase their loan portfolio by 90 percent with the existing level of inputs by efficient utilization.

The results show that 53 MFIs (i.e., 60%) out of 85 are operating at increasing returns to scale. The results further suggest that most of the MFIs experiencing IRS are in Bangladesh. Seven MFIs operate under decreasing returns to scale comprising five from Pakistan and two from India.

The Grameen Bank and the BRAC of Bnagladesh are the most efficient MFIs in three countries assuming constant return to scale. However the efficiency analysis under the variable returns to scale reveals that five institutions lie on the frontier. These best practice MFIs in include Annesa, BRAC and Grameen Bank from Bangladesh and Bodhana and Pushtikar from India. Howeve,r there is no institution in Pakistan that can be considered efficient in overall scenario.

Table 5: Single Output-Two Inputs DEA Efficiency of MFI in South Asia

MFIs	Input				Output			
	Crste	Vrste	Scale		Crste	Vrste	Scale	
PAKISTAN								
Asasah	0.005	0.108	0.043	irs	0.005	0.005	0.962	
BOK	0.084	0.238	0.352	irs	0.084	0.090	0.927	irs
DAMEN	0.004	0.070	0.054	irs	0.004	0.004	0.983	
FMFB	0.012	0.039	0.317	irs	0.012	0.015	0.841	drs
Kashf	0.042	0.096	0.435	irs	0.042	0.042	0.987	irs
Khushhali	0.049	0.069	0.706	irs	0.049	0.094	0.521	drs
NRSP	0.014	0.023	0.630	irs	0.014	0.058	0.246	drs
Orangi	0.015	0.183	0.082	irs	0.015	0.016	0.927	irs
Orix Leasing	0.045	0.418	0.107	irs	0.045	0.058	0.769	irs
PRSP	0.015	0.042	0.365	irs	0.015	0.025	0.612	drs
SAFWCO	0.004	0.138	0.030	irs	0.004	0.004	0.948	
SRSP	0.009	0.161	0.056	irs	0.009	0.010	0.933	irs
Sungi	0.005	0.502	0.010	irs	0.005	0.007	0.706	irs
Taraqee	0.010	0.042	0.231	irs	0.010	0.011	0.920	drs
TRDP	0.033	0.242	0.136	irs	0.033	0.037	0.895	irs
BANGLADESH								
AF	0.031	0.342	0.092	irs	0.031	0.041	0.769	irs
Annesa	0.002	1.000	0.002	irs	0.002	1.000	0.002	irs
ASA	0.893	0.960	0.930	irs	0.893	0.952	0.938	irs
ASOD	0.007	0.128	0.058	irs	0.007	0.008	0.920	irs
Aspada	0.005	0.099	0.052	irs	0.005	0.005	0.947	
BARC	1.000	1.000	1.000		1.000	1.000	1.000	
BASA	0.023	0.255	0.090	irs	0.023	0.028	0.816	irs
BDS	0.002	0.091	0.023	irs	0.002	0.002	0.957	
BEES	0.009	0.132	0.069	irs	0.009	0.009	0.984	
BURO Tangail	0.077	0.140	0.550	irs	0.077	0.079	0.975	irs
CCDA	0.014	0.110	0.131	irs	0.014	0.015	0.946	irs
COAST Trust	0.014	0.098	0.141	irs	0.014	0.014	0.957	irs
CODEC	0.075	0.297	0.252	irs	0.075	0.092	0.810	irs
DDJ	0.007	0.126	0.059	irs	0.007	0.008	0.922	irs
DESHA	0.009	0.077	0.110	irs	0.009	0.009	0.974	
DIP	0.017	0.135	0.122	irs	0.017	0.018	0.921	irs
EWF	0.008	0.145	0.052	irs	0.008	0.008	0.902	irs
GJUS	0.001	0.111	0.008	irs	0.001	0.001	0.939	
Grameen Bank	1.000	1.000	1.000		1.000	1.000	1.000	
HEED	0.018	0.094	0.189	irs	0.018	0.018	0.965	irs
HFSKS	0.010	0.130	0.075	irs	0.010	0.011	0.920	irs
ICDA	0.002	0.127	0.016	irs	0.002	0.002	0.923	
IDF	0.025	0.117	0.209	irs	0.025	0.026	0.948	irs
JCF	0.047	0.143	0.326	irs	0.047	0.049	0.942	irs
NGF	0.013	0.109	0.118	irs	0.013	0.014	0.945	irs
NUSA	0.002	0.077	0.024	irs	0.002	0.002	0.968	

PBK	0.009	0.102	0.083	irs	0.009	0.009	0.947	
PDIM	0.006	0.114	0.050	irs	0.006	0.006	0.930	
PMK	0.038	0.141	0.267	irs	0.038	0.040	0.936	irs
PMUK	0.053	0.171	0.308	irs	0.053	0.057	0.918	irs
POPI	0.006	0.112	0.053	irs	0.006	0.006	0.939	
PPSS	0.011	0.107	0.100	irs	0.011	0.011	0.946	irs
RDRS	0.120	0.264	0.456	irs	0.120	0.136	0.888	irs
RIC	0.012	0.076	0.164	irs	0.012	0.013	0.979	
RRF	0.024	0.102	0.235	irs	0.024	0.025	0.964	irs
SBD	0.010	0.252	0.041	irs	0.010	0.013	0.793	irs
SDC	0.011	0.129	0.086	irs	0.011	0.012	0.922	irs
SDS	0.004	0.101	0.041	irs	0.004	0.004	0.947	
SSS	0.036	0.096	0.377	irs	0.036	0.037	0.982	irs
ST	0.006	0.103	0.060	irs	0.006	0.007	0.944	
TMSS	0.190	0.266	0.715	irs	0.190	0.199	0.955	irs
UDDIPAN	0.031	0.132	0.233	irs	0.031	0.033	0.938	irs
UDPS	0.008	0.071	0.108	irs	0.008	0.008	0.979	
VARD	0.006	0.168	0.037	irs	0.006	0.007	0.877	irs
Wave	0.017	0.102	0.169	irs	0.017	0.018	0.956	irs
INDIA								
AMMACTS	0.045	0.204	0.220	irs	0.045	0.051	0.878	irs
Bandhan	0.016	0.102	0.154	irs	0.016	0.016	0.955	irs
BASIX	0.041	0.073	0.559	irs	0.041	0.053	0.775	drs
BIRDS	0.010	0.204	0.050	irs	0.010	0.012	0.843	irs
BISWA	0.016	0.253	0.064	irs	0.016	0.020	0.802	irs
Bodhana	0.023	1.000	0.023	irs	0.023	1.000	0.023	irs
BWDA	0.010	0.098	0.098	irs	0.010	0.010	0.954	
Coshpor MC	0.019	0.051	0.369	irs	0.019	0.025	0.751	drs
Guide	0.021	0.540	0.039	irs	0.021	0.039	0.534	irs
IASC	0.064	0.212	0.302	irs	0.064	0.069	0.930	irs
Janodaya	0.012	0.501	0.025	irs	0.012	0.023	0.537	irs
KBSLAB	0.023	0.094	0.240	irs	0.023	0.023	0.980	
Kotalipara	0.003	0.143	0.023	irs	0.003	0.004	0.900	
LEAD	0.011	0.335	0.031	irs	0.011	0.014	0.744	irs
Mahasemam	0.012	0.065	0.187	irs	0.012	0.012	0.990	
Pushtikar	0.518	1.000	0.518	irs	0.518	1.000	0.518	irs
PWMACS	0.009	0.217	0.042	irs	0.009	0.010	0.900	irs
RGVN	0.018	0.257	0.068	irs	0.018	0.022	0.795	irs
Sanghamitra	0.154	0.625	0.246	irs	0.154	0.281	0.546	irs
Sarvodaya Nano Finance	0.097	0.287	0.339	irs	0.097	0.116	0.841	irs
Satin Creditcare	0.146	0.190	0.769	irs	0.146	0.148	0.984	irs
SEVA Microfoundation	0.006	0.500	0.012	irs	0.006	0.011	0.540	irs
TCT	0.006	0.066	0.091	irs	0.006	0.006	0.988	
VSKSU	0.010	0.102	0.098	irs	0.010	0.010	0.971	
VWS	0.017	0.104	0.163	irs	0.017	0.018	0.954	Irs

MEAN	0.065	0.226	0.207		0.065	0.100	0.857	

7. ANALYSIS OF EFFICIENCY DETERMINANTS

This section investigates the possible determinants of efficiency of MFIs in South Asian countries. We propose different variables that can explain the efficiency of MFIs. These variables can be divided into different groups based on location, basic characteristics, financial management and performance. We used both correlation and the regression analysis in this section.

First variable that we considered is the location of the MFI. While dealing with three countries in South Asia, we used three location dummies as PAK, BAN and IND for Pakistan, Bangladesh and India, respectively.

The second category relates to the characteristics of MFIs including age and size. The age represents the experience of MFI. To capture the effect of the size of MFI we used total value of assets (TA). We hypothesize large with more experience firms may perform better than those having less experience and with smaller size.

The variable that represents the financial management of MFIs is Debt-Equity ratio. It is expected that higher debt-equity ratio reduces firms' efficiency. The last set of variables represents the overall performance of the MFI: the first is operational self sufficiency (OSS) ratio representing the financial ability of MFI that may lead to efficiency of MFI; and the second variable is the rate of return on assets (RONA), which is expected to have positive association with firm efficiency.

7.1 Correlation Analysis

We have calculated the correlation coefficients between different efficiency measures and the variables defined above. The correlation coefficients are presented in Table 6. The results show that the value of total assets has significant positive correlation with TE and PTE and correlation coefficient OSS with TE and SE significant. The age of MIF are positively correlated with all scale efficiency measure. However the debt/ equity ratio is negatively related to TE and PTE.

Table 6: Correlation Coefficients between Different Efficiency Measures and Variable

Variables	TE	PTE	SE
Total Assets (TA)	0.90*	0.64*	0.09
Operational Self-Sufficiency (OSS)	0.26*	0.17	0.20**
Return on Assets (RONA)	0.17	0.16	0.11
Debt / Equity Ratio (DER)	-0.13	-0.11	0.05
Age (YEAR)	0.15	0.01	0.26*
PAKISTAN	-0.11	-0.13	-0.11
INDIA	-0.05	0.04	-0.23*
BANGLADESH	0.13	0.06	0.29*

Note: * shows significant at 5% level of and ** shows significant at 10%

In case of location, the Bangladesh MFIs have positive correlation with measures of scale efficiency, whereas Indian MFIs have negative correlation with SE.

7.2 Regression Analysis

In order to determine the possible determinant of different measures of efficiency we also used regression analysis[9]. The results of regression analysis are presented in Table 7. The value of adjusted R^2 shows that 82% of variation in the technical efficiency is explained by the variables included in the model. In case of pure technical efficiency this variation is 37%, while for scale efficiency model the included variable explains only 15% the variations.

Table 7: Determinants of Efficiency of MFIs in South Asian

Variable	SCALE		CRSTE		VRSTE	
	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
C	**0.579791**	**2.952001**	-0.115574	-1.359680	0.261355	1.203746
IND	-0.843392	-1.189563	-0.448967	-1.411885	0.573489	0.706055
PAK	0.340054	0.635435	0.180818	0.754976	-0.206093	-0.336887
TA	-2.70E-11	-0.050776	**2.37E-09**	**17.50433**	**2.46E-09**	**7.091572**
TA*PAK	**-7.35E-09**	**-2.033375**	-2.29E-09	-1.422523	-1.65E-09	-0.399857
TA*IND	1.03E-08	0.740815	-1.49E-09	-0.240141	-7.97E-09	-0.501170
YEAR	0.001378	0.686555	0.000850	0.950124	-0.000190	-0.083020
YEAR*IND	0.005031	0.646675	-0.000780	-0.222992	-0.013417	-1.501910
YEAR*PAK	-0.019365	-1.255799	-0.002079	-0.299791	0.000366	0.020672
DER	-0.000607	-0.342352	-0.000156	-0.195498	0.000377	0.185079
DER*IND	**0.006358**	**1.690582**	-0.001149	-0.679466	-0.001921	-0.444713
DER*PAK	-0.008718	-0.197350	-0.006151	-0.309534	-0.004448	-0.087634
RONA	**-2.660132**	**-1.604597**	-0.419734	-0.565193	2.941773	1.550818
RONA*IND	1.172965	0.374514	-1.538681	-1.093487	-0.960147	-0.267135
RONA*PAK	1.917745	0.729393	0.580596	0.491739	-2.733543	-0.906389
OSS	**0.315802**	**1.633975**	0.107905	1.276228	**-0.251805**	**-1.165956**
OSS*IND	0.545534	0.774701	**0.517782**	**1.638069**	-0.247148	-0.306106
OSS*PAK	-0.152946	-0.368604	-0.124190	-0.669355	0.228846	0.482881
R-squared		0.343566		0.860130		0.507046
Adjusted R-squared		0.151163		0.819828		0.365008
Log likelihood		31.85199		93.63657		21.42777
F-statistic		1.785659		21.34233		3.569800
Prob(F-statistic)		0.052671		0.000000		0.000140

The parameter estimate of the size variable represented by the total value of assets (TA) is significant having positive sign in the TE and PTE regression implying that the size of the MFI is important in determining efficiencies (i.e., TE and PTE). Operating self sufficiency is another important variable that is contributing to the SE and TE.

The MFIs of different countries have different level of efficiency and size. Therefore there is a possibility of different slope effect on efficiency of MFI's of different countries. This differential slope is measured by the introduction of interaction variable in the model. As can be seen from the Table 7, the size of MFI is important determinant of TE and PTE related to Bangladesh. However, size of MFIs' in Pakistan is important in the determination SE.

[9] In DEA process efficiency is measured by imposing unity constraint. The value of unity of efficiency measure is in the nature of censored data. Therefore, it may produce inconsistency of OLS.

For validation of the results of efficiency analysis we divide MFIs into two groups. First group consists of those MFIs which lie on the efficiency frontier and the second group contains the inefficient firms- below the frontier. For this purpose we considered a number of variables that discussed in the section 3 and that are also included in the regression analysis. The results are presented in the Table 8. Following points emerged.

Average experience of the efficient MFIs is 27 years. The experience of MFI based in Pakistan and India is relatively less than that of MFIs in Bangladesh.

1. Efficient MFIs and those of Bangadesh have positive rate of return on assets, returns on equity and profit margin. However, these are negative in cases of India and Pakistan
2. Furthermore the operating expense ratio and the cost of per borrower, the indicators of efficiency, are on high side in case of Pakistan followed by India and Bangladesh.
3. Moreover the productivity of MFI in Pakistan measured as cost per borrower is also less.

The results from the correlation and regression analysis lead to conclude that size of MFI is important in the determination efficiency of MFIs.

Table 8: Performance Indicators of MFIs in South Asia

Variables	Mean	Efficient	Inefficient	India	Pakistan	Bangladesh
Age	16.257	27.5	15.97	11.040	10.133	21.178
Number of Personnel	714.835	15376.5	361.5422	139.440	192.867	1208.489
Number of Active Borrowers	156248	3846762.5	67320.77	27097	30088	270052
Average Loan Balance per Borrower (US$)	156.859	76	158.8072	309.960	178.333	64.644
Gross Loan Portfolio (in US$)	12069483	290423571	5362156	3022139	4480632	19625402
Total Assets (in US$)	16992076	401233968.5	7733235	2747570	1079414 5	26971667
Capital / Asset Ratio	0.246	0.23235	0.246768	0.129	0.565	0.218
Debt / Equity Ratio	10.042	3.86125	10.20005	16.541	1.316	9.052
Deposits to Loans	0.068	0.48555	0.05772	0.099	0.117	0.034
Deposits to Total Assets	0.044	0.31855	0.037228	0.090	0.024	0.025
Gross Loan Portfolio / Total Assets	0.843	0.75055	0.845451	1.115	0.671	0.750

Return on Assets (%)	0.002	0.0174	0.002096	-0.022	-0.068	0.035
Return on Equity (%)	-0.163	0.0571	-0.16878	-1.091	-0.043	0.194
Operational Self-Sufficiency (%)	1.087	1.08975	1.087231	0.943	0.796	1.265
Financial Revenue Ratio (%)	0.187	0.1905	0.186418	0.197	0.122	0.200
Profit Margin (%)	-0.100	0.0777	-0.10468	-0.112	-0.837	0.151
Total Expense Ratio (%)	0.184	0.1731	0.184046	0.218	0.190	0.164
Financial Expense Ratio (%)	0.050	0.0543	0.049819	0.083	0.033	0.038
Operating Expense Ratio (%)	0.123	0.08765	0.12353	0.122	0.140	0.118
Operating Expense / Loan Portfolio (%)	0.184	0.11515	0.185258	0.151	0.310	0.158
Cost per Borrower	17.721	8.4	17.94578	16.092	44.773	9.609
Borrowers per Staff member	236.488	261.5522986	236.7952	463.040	175.400	128.591
TE	0.065	1	0.042916	0.052	0.023	0.087
PTE	0.100	1	0.078566	0.120	0.032	0.112
SE	**0.857**	**1**	**0.853494**	**0.785**	**0.812**	0.912

8. CONCLUDING REMARKS

The objective of this study has been to estimate the efficiency and sustainability of microfinance institution working in the South Asian countries such as Bangladesh, Pakistan and India. For the efficiency analysis we used non parametric Data Envelopment Analysis. We considered both inputs oriented and output oriented method by assuming constant returns to scale and variable returns to scale technology.

While conducting DEA analysis on single country data it is found that there are eight MFIs in Pakistan, six MFIs in Bangladesh and five MFIs in India are at the efficient frontier under variable returns to scale. The technical efficiency figure for Pakistan, Bangladesh and India is 0.395, 0.087, and 0.28, respectively. The average pure technical efficiency for these countries respectively ranges between 0.713-0.823, 0.175-0.547 and 0.413-0.452.

Full three countries combine analysis revealed that there are two efficient MFIs under CRS and five efficient MFIs under VRS assumption in these countries. Out of these efficient MFIs three (that is Annesa, BARC and Grameen Bank) belongs to Bangladesh and two MFIs (ie., the Bodhana and the Pushtikar) are from India. It is found

that there is no MFI from Pakistan that fall on the efficient frontier. Moreover variation in the TE and SE measures is less for Bangladesh and highest for Pakistan.

The analysis revealed that the inefficiencies of MFIs in Pakistan, India and Bangladesd are mainly due to technical nature. The result has very important policy implication, that is in order to improve the efficiency of the MFIs we need to improve managerial skills and technology. This could be done by imparting training. Since Grameen Bank is the leading MFIs in the world we can adopt its model according to the country specific requirement. Particularly, the lagging countries like Pakistan and India require special training programmes in the field of microfinance

Table A: List of Microfinance Institutions (MFI) Included in the Study

NAME	
PAKISTAN	
ASASAH	ASASAH
The Bank of Khyber	BOK
Development Action for Mobilization and Emancipation	DAMEN
First Micro Finance Bank Limited	FMFB
KASHF Foundation	KASHF
The Khushhali Bank Limited	KHUSHHALI
National Rural Support Programme	NRSP
Orangi Pilot Project	Orangi
Orix Leasing Pakistan Limited	ORIX LEASING
Punjab Rural Support Programme	PRSP
Sindh Agricultural & Forestry Workers Coordinating Organization	SAFWCO
Sarhad Rural Support Programme	SRSP
Sungi Development Foundation	SUNGI
Taraqee Foundation	TARAQEE
Thardeep Rural Development Programme	TRDP
INDIA	
Amber Ashrayee Mahila Benefit Association	AAMBA
ADARSA	ADARSA
Asmita Institute for Development	AID
Acts Mahila Mutually Aided Coop Thrift Society	AMMACTS
A Society for Integrated Rural Development	ASSIST
Bandhan	Bandhan
Bhartiya Samruddhi Finance Limited	BASIX
Balaji Educational Society	BES
Bharti Integrated Rural Development Society	BIRDS
Bharat Integrated Social Welfare Agency	BISWA
Bodhana Trirvalla social Services Society	Bodhana
Bullock-Cart Workers Development Association	BWDA
Coshpor Micro Credit	Coshpor MC
Grameen Koota	GK
Guide	Guide
Grama Vidiyal	GV
Indian Association for Savings and Credit	IASC
IMED	IMED
Janodaya public Trust	Janodaya
Krishna Bhima Samruddhi Local Area Bank Limited	KBSLAB
Kotalipara Development Society	Kotalipara

KRUSHI	KRUSHI
League for Education and Development	LEAD
Mahasemam	Mahasemam
Pragathi Sewa Samiti	PSS
Pushtikar Laghu VPBSSS Ltd	Pushtikar
Payakaraopeta Women's Mutually Aided Co-operative Thrift and Credit Society	PWMACS
Rashtriya Gramin Vikas Nidhi	RGVN
Sanghamitra Rural Financial Services	Sanghamitra
Sarvodaya Nano Finance Limited	Sarvodaya
Satin Creditcare Network Limited	Satin Creditcare
SEVA Microfoundation	SEVA
Star Youth Association	SYA
Thirumalai Charity Trust	TCT
Vikas Center For Development	VCD
Vivekananda Seva Kendra-o- Sishu Uddyan	VSKSU
Village Welfare Society	VWS
BANGLADESH	
Annesha Foundation	AF
Annesa Somaj Unnayan Songstha	Annesa
Association for Social Advancement	ASA
Association for Sanitation and Economic Development	ASED
Assistance for Social Organization and Development	ASOD
Agroforestry Seed Production Development and Association	ASPADA
BASA	BASA
Bangladesh Development Society	BDS
Bangladesh Extension Education Services	BEES
Bangladesh Rural Advancement Committee	BRAC
BURO Tangail	BURO Tangail
Centre for Community Development Assistance	CCDA
Coastal Association for Social Transformation Trust	COAST Trust
Community Development Centre	CODEC
Christian Service Society	CSS
Dak Diye Jai	DDJ
DESHA	DESHA
Center for Development Innovation and Practices	DIP
Eskander Welfare Foundation	EWF
Grameen Jano Unnayan Sangstha)	GJUS
Grameen Bank	Grameen Bank
Gono Unnayan Prochesta	GUP

HEED Bangladesh	HEED
Hilful Fuzul Samaj Kallyan Sangstha	HFSKS
Integrated Community Development Association	ICDA
Integrated Development Foundation	IDF
Jagorani Chakra Foundation	JCF
Nowabenki Gonomukhi Foundation	NGF
Naria Unnayan Samity	NUSA
Pally Bikash Kendra	PBK
Participatory Development Initiatives of the Masses	PDIM
Palli Mongal Karmosuchi	PMK
Padakhep Manabik Unnayan Kendra	PMUK
People's Oriented Program Implementation	POPI
Palli Progoti Shahayak Samity	PPSS
PROSHIKA	PROSHIKA
RDRS Bangladesh	RDRS
Resource Integration Centre	RIC
Rural Reconstruction Foundation, Jessore	RRF
Saint Bangladesh	Saint
Swanirvar Bangladesh	SBD
Society Development Committee	SDC
Shariatpur Development Society	SDS
Society for Social Services	SSS
Sangkalpa Trust	ST
Thengamara Mohila Sabuj Sangha	TMSS
United Development Initiatives for Programmed Actions	UDDIPAN
Uttara Development Program Society	UDPS
Voluntary Association for Rural Development	VARD
Wave Foundation	Wave

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