A REVIEW OF EARLIER STUDIES ON EFFICIENCY ANALYSIS OF MFIS USING NON PARAMETRIC DEA AND PARAMETRIC SFA

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Introduction

There were limited studies available on the efficiency analysis of MFIs. Across the world there were enough number of studies carried out to know the efficiency of banking sector. The survey made by Berger& Humphrey (1997) substantiated this fact. The survey made by them revealed frontier techniques were used in more than 130 studies so as to analyze the efficiency of banks in different countries across the world.

Cummins and Weiss (2000) conducted a survey with the objective of analyzing the insurance companies' efficiency in the insurance industry and it was found that there were about 21 studies in which researchers used frontier techniques.

Luhen (2009) has conducted a recent survey and found that there were more than 93 studies that used frontier techniques for measurement of efficiency in insurance industry.

But the studies of (Nghiem 2004; Gutierrez-Nieto et al., 2005; Gutierrez-Nieto et al., 2009; Hassan and Tuffe, 2001; Qayyum and Ahmed, 2006; Haq et al., 2007; Sufian, 2006; Bassem, 2008; Hermes et al., 2009; Hassan and Benito, 2009; Nawaz, 2009; Masood and Ahmed, 2010,Oteng-Abayie et al., 2011, Bereket Zerai ,2012) were only available on the efficiency of microfinance institutions. The findings of these empirical studies are discussed hereunder.

Empirical works on efficiency analysis of MFIs

Guitierrez-Nieto et al (2005) have applied DEA to analyze the efficiency of about 30 MFIs in Latin America. Efforts were made to explore the results of multivariate analysis of DEA by developing about 21 specifications using 2 inputs and 3 outputs for the efficiency analysis. It was observed that an NGO and an NBFI were identified to be the most efficient among different forms and group of MFIs.

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Bassem (2008) in his study conducted on 35 MFIs in the Mediterranean zone for evaluating the efficiency of MFIs during the period 2004-05 using DEA. About 8 out of 35 MFIs in the Mediterranean zone were efficient. Further the study revealed that size of the MFIs does have a negative impact on efficiency of MFIs.

Bereket Zerai (2012) used both DEA and SFA to evaluate the efficiency of 19 MFIs in Ethiopia for evaluating the efficiency of MFIs during the period 2005-09.Scale inefficiency is present in Ethiopian microfinance industry (that is, majority of the MFIs exhibit increasing returns to scale) under both the SFA and DEA approaches. Further the results of the two-stage DEA reveal that size, age, ownership and financial sustainability have significant impact on MFIs technical efficiency. Meanwhile, the results of the SFA show that size, age, financial sustainability, women and time have significant impact on MFIs technical efficiency. The application of SFA seems to confirm the two-stage DEA as the three factors (size, age and financial sustainability) appeared to be significant. Therefore, there is strong evidence from both the estimation approaches that size, sustainability, and age (experience) are found to be the main factors that influence efficiency of the Ethiopian MFIs. The DEA Malmquist Total Factor Productivity index was used and observed that the Ethiopian MFIs have experienced moderate productivity growth during the period. And the main source of growth in total factor productivity of Ethiopian MF industry is due to technical efficiency change. It was observed that the industry as a whole has exhibited a decline in technological change. This implies that there has been deterioration in the performance of the best practicing micro finance institutions.

Hassan and Sanchez (2009) employed DEA under both production and intermediation approaches to analyze the efficiency of MFIs in 3 regions viz Latin American countries (141MFIs), Middle East and North African (26 MFIs) and South Asian countries (47 MFIs) in 2005.The sample of the study covers NGO MFIs followed by NBFI MFIs (for profit MFIs). The study revealed that technical efficiency of banks and credit unions was higher than non formal MFIs i.e. nonprofit organizations and non financial institutions. Further high technical efficiency was observed in South Asian MFIs when compared to Latin American and MENA MFIs. Inefficiency of MFIs in three regions was observed and the source of inefficiency for MFIs in 3 regions was mainly pure technical efficiency. The results infer that MFIs were either not utilizing the resources properly to the fullest extent leading to wastage or they were not able to produce enough outputs at given level of inputs (i.e. extending sufficient number of loans, raising funds and getting more outreach).

Kablan (2012) in his study to observe the impact of reforms on the industry used DEA (CRS and VRS assumptions) to measure the efficiency of 104 MFIs in West African Economic and Monetary Union (WAEMU). Non parametric DEA was used to measure the efficiency; both financial and social by taking financial expenditure, capital and number of personnel as inputs; while gross loan portfolio was taken as an output. The study takes in to account number of active borrowers, poverty index and percentage of female borrowers as outputs. Efforts were made to determine the factors influencing efficiency. It was found that sustainability is prevalent in the industry. It was observed that increase in the financial efficiency resulted in the decrease of social efficiency. The MFIs focusing more on outreach tend to be less efficient. There is a positive impact of reforms on financial efficiency while there is a negative impact of reforms on social efficiency.

Masood and Ahmed (2010) in their study used SFA to investigate the efficiency of 40 MFIs in India for the period between 2005 and 2008. Even though mean efficiency of MFIs was found to be 34% there is an increasing trend of efficiency over the period of the study. The study shows that age of MFIs positively influences efficiency and regulated MFIs are less efficient when compared to non regulated MFIs.

Haq et al (2009) used DEA, a non parametric technique in their study, for analyzing the efficiency of 39 MFIs in Africa, Asia and Latin America. Out of 39 MFIs selected as sample, 13 are bank MFIs, 8 belong to NBFI-MFIs category, 6 belong to cooperative/credit union MFIs, 11 belong to NGO-MFIs category and one belong to other non classified MFIs category. Input and Output oriented models using both production and intermediation approaches under CRS and VRS assumptions were employed. NGO MFIs were found to be more efficient under production approach, whereas under intermediation approach bank-MFIs were efficient. Further the results reveal that it may be possible that bank-MFIs may outperform the NGO-MFIs in the long run period.

Servin et al (2012) in their study in order to analyze the efficiency of different types of MFIs in Latin America applied stochastic frontier analysis (SFA). A sample of 315 MFIs was taken in about 18 Latin American countries for the period between 2003 and 2009. . NBFIs and Banks were found to have more inter firm and intra firm technical efficiency than NGOs and Cooperatives/credit unions. It was suggested that more regulation and competition will be required to reduce inefficiency of NGO and Cooperative /credit unions.

Abdul Qayyum and Ahmad (2006) in their study made efforts to analyze the efficiency of 85 MFIs in 3 countries of South Asia (India (25), Pakistan (15) and Bangladesh (45)). The study revealed that MFIs in the 3 countries suffers with technical inefficiency and suggested that the MFIs have to improve their technological capabilities, managerial expertise and efficiency.

Nghiem et al (2004) in their study have conducted a survey of 46 schemes existing in the north and central regions of Vietnam to analyze the efficiency of MFIs. DEA was applied and it was observed that the average technical efficiency score found to be 80%. The age of MFI and location in which MFI is operating has positive influence on performance of the schemes.

Hassan and Tufte (2001) by using branch level cost data over the period between 1988 and 1991 studied cost inefficiency and determinants of the Grameen Bank. They applied stochastic frontier analysis, a parametric technique and found that the branches of Grameen Bank which are employed with female employees are performing much more efficiently when compared to their counter parts which are having male staff members.

Gregonia and Ramirez (2004) in their study of efficiency analysis of MFIs in Peru during 1999 and 2003 using SFA observed that MFIs having more assets tend to record highest efficiency levels and the MFIs which are operating in less concentrated markets tend to record high efficiency. Average loan size, financial leverage, proportion of net assets, financial sufficiency, business experience and proportion of farm loans effect the cost efficiency of MFIs.

Sufian (2006) in his study of efficiency analysis of 80 NBFIs between 2000 and 2004 in Malaysia used DEA, a non parametric technique. It was observed that the size of the MFIs   and part of the market have a negative impact on efficiency.

Martinez-Gonzalez (2008), used DEA for analyzing the efficiency of a sample of MFIs in Mexico. The results showed that most of the MFIs were successful in achieving the sustainability related efficiency rather than outreach. Average loan size, scale of operations, proportion of assets used as performing portfolio, ratio of payroll to expenses, age, structure of the board, and for-profit status of the MFI have significant influence on efficiency of Micro Finance Institutions.

Hermes et al (2008) tried to investigate the efficiency of 435 MFIs and put efforts to examine whether there is trade-off between outreach and efficiency. SFA was used to measure efficiency as SFA controls measurement errors and random effects. SFA Battese and Coelli 1995 model was used to estimate the cost frontier as well as the coefficients of variables of efficiency. It was found that those MFIs which are concentrating more on female borrowers and having low average loan balances are found to be less efficient and hence found that there is negative correlation between outreach and efficiency of MFIs. The efficiency of MFIs is found to be higher if they concentrate less on poor and reduce the number of women borrowers.

Islam et al (2011), in their study used DEA to assess the technical, economic and allocative efficiency of borrowers of agricultural MFIs and non borrowers in rice farming in Bangladesh. It was found that under VRS assumption the mean technical, economic and allocative efficiencies were found to be 72%, 47% and 66% respectively. Further the results revealed that there was a significant difference between efficiency scores of Microfinance borrowers and non borrower's institutions.

Kipesha (2010), in his study on MFIs in East Africa applied non parametric DEA for evaluating the efficiency. The variables selected for the study were based on production approach and efficiency scores are estimated for the selected sample of MFIs (35) under both CRS and VRS assumptions. The East African MFIs recorded higher efficiency scores on average. On an average the NBFIs and banks were found to be more efficient when compared to Cooperatives and NGOs. The efficiency averages show that, under CRS assumption Kenya and Rwanda were found to have high average scores of efficiency for three years while under variable return to scale assumption Tanzania and Uganda have higher average efficiency scores. Further it is recommended that NGOs and Cooperatives should consider the market structure changes, technology and increased competition for their survival. So as to improve the efficiency, the MFIs were recommended to go for better allocation of resources and to minimize the wastage, since inefficiency of most of the MFIs   was identified to be technical in nature.

Kipesha (2013) in his recent studies, also concluded that the MFIs in Tanzania are efficient as producer and inefficient as intermediary, indicating better input resources allocation in the production of outputs. The recent studies by the researcher have contradictory results when compared to earlier studies which reported inefficiency of MFIs under both production and intermediation approach and non-banks were found to have recorded lesser efficiency than

commercial banks and pure MFIs. Further it is recommended that MFIs should strive to to improve scale efficiency and also for better resource allocations.

Nawaz (2010), used DEA to measure the financial efficiency and productivity analysis of MFIs across the world taking in to consideration the subsidies received by MFI. 3 stage analysis was conducted to carry out the study. In the first stage, technical and pure technical efficiencies are calculated; in the second stage so as to analyze the productivity change DEA based Malmquist Indices are calculated. In the third stage, Tobit regression analysis was carried out to observe the relationship between financial efficiency and other indicators related to the productivity of MFIs; the indicators being organization, outreach, sustainability and social impact and to test the hypothesis concerning that. It was found that MFIs with poor borrowers are less efficient than with borrowers who are relatively well off. It was observed that lending to women borrowers is efficient only in the presence of subsidies. Further the results of the study reveal that South Asia and Middle East &North African (MENA) MFIs tend to be less efficient than others.

Ahmad (2011) used DEA to analyse the efficiency of Pakistan MFIs for the years 2003 and 2009 respectively. Under the 2 assumptions CRS and VRS, the researcher considered input oriented and output oriented DEA methods. The inputs selected for the study include total assets and number of personnel while the outputs are gross loan portfolio and number of active borrowers. It was observed that under CRS and VRS assumptions, 3 MFIs are on efficiency frontier in the year 2003. 3 MFIs are efficient under CRS assumption and 4 MFIs are efficient under VRS assumption. For the year 2009, out of 19, 4 MFIs are efficient under CRS and 9 are efficient under VRS assumption. There are 4 MFIs that are efficient under both CRS and VRS. 2 efficient MFIs in 2003 do not exist in 2009 anymore. It was found that there is a decline in efficiency of most of the MFIs in 2009 as compared to 2003. Inefficiencies in Pakistan MFIs are mainly technical in nature. Improvements in managerial skills and technology are hence needed. Funding gap is identified which may be closed by uplifting the prohibition of microfinance banks from pledging security or sourcing foreign currency loans.

Jayamaha (2012) estimated the efficiency of small financial institutions (SFIs) in Sri Lanka during the period between 2005 and 2010 by taking all 1,933 CRBs operating in 2010. DEA is used to measure Technical Efficiency, Pure Technical Efficiency and Scale Efficiency under both CRS and VRS models. The input variables   for the study include deposits, number of deposit accounts and number of branches while outputs being loans and advances, number of loans and advances accounts. The efficiency was analysed based on size and location. Decline in efficiency was observed during the period 2005-2010. There appears a significant difference in the CRBs' efficiency by geographical locations. The efficient banks are also found closely associated with size of the banks.

Oteng_Abayie et al (2011) applied Cobb-Douglas stochastic frontier model to estimate the economic efficiency of 137 MFIs in Ghana for the period between 2007 and 2010. The MFIs in Ghana experienced an overall average economic efficiency of 56.29%. It was found that the MFIs are operating at constant cost to size, the study also reveal that the inefficiency of MFIs in Ghana was mainly due to improper management practices and differences in technical capacities in terms of training and portfolio quality. Further the results reveal that the age, savings, outreach and productivity and cost per borrower are found to be   highly significant.

Izah Mohd Tahir & Siti Nur Zahira Che Tahrim (2013) quotes the work of Abdelkader, Jemaa, & Mekki (2012) which says that the researchers in their study attempted to evaluate the performance of MFIs using input oriented DEA in the MENA region over the period 2006-2009.Unbalanced data of 61 MFIs from MENA region (Egypt, Iraq, Jordan, Lebanon, Morocco, Palestine, Sudan, Syria, Tunisia and Yemen) constitutes the sample for the study. The MFIs of these countries are categorized as NGO (46), non-bank financial institutions – NBFIs (10), bank (1) and others (4). Total assets, operating expenses and number of employees are selected as inputs and the variables indicator of benefit to the poorest (POV) and financial revenue were selected as outputs. Necessary measures were adopted to solve problems that arise with non-parametric DEA technique. In order to test the nature of return to scale of the different MFIs, Simar and Wilson (2002) bootstrap-based approach is used initially. Subsequently, to detect outliers of non-parametric estimators of frontiers, a combination of the methods; peer-count index (Charnes and al. 1985), the super-efficiency approach (Anderson and Petersen, 1993) and Wilson approach (Wilson, 1993) is used. Only after clearing the data from outliers, a DEA-Bootstrapping methodology is applied, following Simar and Wilson (1998, 2000) to drift appropriate measures of DEA efficiency scores and to construct confidence intervals. The results of the analysis show that average efficiency of the most countries of the region has declined over the period of study. Another important finding is that the efficiency scores of NGOs are significantly greater than those of the NBFIs.

Journal articles and Conference papers

The study done by Annim (2010) focus on efficiency of MFIs using a panel data of 164 MFIs during the period 2004-2008.MIX Market Database formed basis for collecting the data for the study. Both parametric SFA and non-parametric DEA approaches were employed for analyzing the efficiency. Three-stage analysis was done: 1) Firstly, DEA technique using CRS and VRS assumptions to distinguish technical efficiency from scale efficiency; 2) Secondly to correct bias with second stage truncated regression, parametric Bootstrap was applied and 3) Thirdly Translog cost frontier was applied. This study is done covering the scope of microfinance (financial and operational) and MFIs' objectives (outreach and sustainability). The variables selected for the study include operating expenses, financial revenue, women borrowers, gross loan portfolio, personnel, cost per staff and cost per loan. From the study, it was observed that social efficiency was found to be positively related with outreach. Another observation is that there were bureaucracies in registration of properties and lack of credit information negatively influences social efficiency.

Izah Mohd Tahir & Siti Nur Zahira Che Tahrim (2013) refers to the work of Sedzro & Keita (2009) in which the researchers tried to examine the efficiency of MFIs in seven countries of the West African Economic and Monetary Union (WAEMU) namely Benin, Mali, Burkina-Faso, Niger, Senegal, Ivory-Coast and Togo during the period from 2000 to 2002. Output oriented DEA was used and efficiency was analysed under both CRS and VRS assumptions. Unbalanced data with 539 observations, representing 161 in 2000, 210 in 2001 and 168 in 2002 was collected for the purpose of the study. Under production approach, the MFIs were found to be most efficient in the year 2000 followed by 2001 and 2002. While under intermediation approach, the MFIs were found to be most efficient in the year 2000, followed by 2002 and 2001. It was evident from the results that most of the MFIs' performances are due to their country

environment in 2000 and 2001. No significant difference was observed in the MFIs performance in the year 2002 suggest that the WAEMU countries are more convergent at least regarding their MFI policies. Truly, the talk on common policies in 2001 regarding supervision of MFIs in the WAEMU countries has begun and adopted in the year 2003.

Komlan Sedzro, Mariam Keita and Tov Assogbavi (2010) in their study to measure relative efficiency of different legal forms of Microfinance Institutions (MFI): Banks, Non Governmental Organizations (NGOs) and Non Bank Financial Institutions (NBFIs) and cooperatives in three regions which include Africa, South Asia and East and Latin America applied non parametric Data Envelopment Analysis and results of the study reveal that MFIs that operate as NGOs are more technically efficient than bank MFIs. For the same inputs (labor, physical and financial asset), NGOs serve more clients (number of borrowers or depositors) than Bank MFIs.

Debdatta Pal (2010) in his study for analyzing the efficiency of 39 MFIs covering 3 regions of India: Eastern India, Southern India and North and Western India applied DEA, a non parametric technique and observed that 2 MFIs were technically efficient under CRS assumption. 6 MFIs were technically efficient under VRS assumption. Further the results show that borrowers per staff, age, return on assets, value of total assets, return on equity, level of operational self sufficiency, and yield on gross portfolio of MFI are positively correlated with all technical efficiency measures. The variables debt equity ratio and financial expenses per asset are negatively related with Technical Efficiency and Pure Technical Efficiency. MFIs from South Indian states were positively correlated with all technical efficiency measures. In order to determine the variability of efficiency measures multiple regression analysis was applied and the value of R^2 revealed that 81 percent variation in technical efficiency is explained by the independent variables included in the model. This variation is found to be 68 percent in case of pure technical efficiency. The statistical significance of variables business per staff and log (total assets) indicate the need of scaling up of MFIs to become efficient.

Surender Singh et al (2013) in their study used DEA for estimating efficiency of 41 MFIs in India using input- oriented and output-oriented approaches. Both production and intermediation approaches were employed in the study. Correlation and Tobit regression analysis were performed to determine the factors influencing efficiency. The variables selected for the study falls under the categories of basic characteristics, governance, financial management, performance and geographical location. The study reveals that there is considerable scope for the sample MFIs to improve the output or to reduce inputs. Wide regional disparities are observed across India and MFIs operating in the south India were found to be more efficient. The result of the regression show expected sign for all selected variables except return on assets (ROA) and age of MFIs. The variables age and return on assets (ROA) does not found to have significant relationship with efficiency of MFIs. The policy implication is that can be made from the study include that new firms by having strong fundamentals can also achieve higher level of efficiency, rational policy and management. The MFIs should focus more on increasing the customer base rather than higher staffing that matters a lot in achieving greater efficiency levels. Further the results reveal that there is a huge scope for MFIs to increase their operations in north India as there is potential to increase the efficiency level of their operations as compared to MFIs operating in southern India.

Izah Mohd Tahiri and Siti Nurzahira Che Tahri (2013), in their study applied DEA with production approach and compared the efficiency levels of five countries (Indonesia, the Phillipines, Vietnam, Cambodia and Laos in ASEAN during the period from 2008 to 2010. While MFIs in Laos are least efficient, the MFIs belonging to Vietnam are found to be more efficient than their counterparts. Pure Technical Efficiency scores were low when compared to scale efficiency for Indonesia, Cambodia, Phillipines and Vietnam, which implies that the MFIs are inefficient in terms of controlling their cost of operations rather than operating at the less than optimum scale. PTE is higher in Laos when compared to scale efficiency indicating that MFIs in Laos are not operating at the optimum scale of operation rather than producing below the production frontier. The results imply that there is a need for the MFIs to improve their performance by minimising the over usage of inputs.

Farhana Ferdousi (2013), tried to investigate the performance of MFIs in three Asian countries namely Bangladesh, India and China using data envelopment analysis and best practice MFIs have been identified and used Tobit regression analysis to identify their respective efficiency determinants. Findings of the study revealed that Bangladesh MFIs perform much better than other regions' MFIs under variable returns to scale assumption, while MFIs in India and China performs more efficiently than that of Bangladesh MFIs under constant return to scale assumption. Further, regression analysis confirms that, the performance of MFIs in terms of total assets and financial performance in terms of profitability is critical for sustainable and efficient development of MFIs (retrieved from www.atlantis-press.com)

Francis Awuku Darko (2013), estimated the efficiency of MFIs in SSA countries for the period 2005 – 2011 applying DEA, a non parametric technique. Further in order to examine the impact of commercialization on efficiency of MFIs, truncated regression model was employed. The recent global financial crisis and its impact on the observed efficiency of the institutions in the region was investigated. The results of the analysis suggests that most (about 30.79%) of the overall technical inefficiencies (37.12%) observed within SSA microfinance industry is mainly due to managerial inefficiency along with little source of scale inefficiency. Furthermore, the results show that compared to non-commercial MFIs, scale inefficiency is found to be high among commercial MFIs while managerial inefficiency is high among non-commercial MFIs. Regarding the factors influencing efficiency, a strong positive impact of commercialization and age of MFIs (a measure of experience) on both Overall Technical Efficiency and Pure Technical Efficiency was observed, it seems that urbanization and the recent global financial crisis led to the worsening of the efficiency of the sample microfinance institutions.

Varman & Mahendra(2008) in their study used parametric Stochastic Production Frontier Approach to benchmark the best practice MFIs in India. Accordingly 26 MFIs in India for which information is available were selected as sample and the period of the study was from 2005 to 2007. The sample MFIs consists of a mix of NGOs, NBFCs and Credit Cooperative. Accordingly Satin Credit Care and IASC were identified as the Benchmark MFIs. Regression analysis is employed to assess the determinants of efficiency. The results reveal that the size of MFI, the Legal status and Number of years of experience are the important factors that determine the efficiency of MFIs

Syedah Shan E Ahmadi et al, in their study examined the efficiency of 170 MFIs in South Asian region during the period of 2008-2009, using data envelopment analysis (DEA) methodology; a non parametric technique with all limitations where error can ground for the significant problems. The results reveal that 49 institutions are relatively efficient, and the the size of the MFIs has a negative impact on the efficiency. MFIs having modest size are found to be more efficient. The results reveal that the ability of the microfinance institutions to develop a trusty relationship with credit borrowers (as a result of their average size), and also maintaining the contact in the long run are the two things which arise due to financial stability. The increasing trend of expanding outreach by having more and more number of women borrowers increases the financial return. Out of 16 efficient MFIs for which sustainability is measured, 7 proved to be sustainable.

Ritika Singh et al in their study employed Output oriented Constant Returns to Scale based DEA model to assess the efficiency score of twenty (20) MFIs by considering the input and output variables as performance attributes. It is evident from the analysis that the 3 MFIs namely Bandhan, EMFPL and FFSL (DMUs 5, 17 and 19 respectively) are efficient Decision Making Units. The remaining 17 MFIs are inefficient. The results of the study clearly indicate that DEA not only categorizes the DMUs into efficient and inefficient DMUs but also benchmark the inefficient DMUs by making peer groups. As interest and fee income is sustainability measure, the results shows that Adhikar having enough outreach should increase its sustainability by increasing its revenue. Thus this analysis will help the MFIs which are inefficient to trade-off between sustainability and outreach.

Ines Ben Abdelkader & Asma Ben Salem (2013) in their study on Islamic microfinance sector in MENA region for the period between 2005 and 2010 have attempted to examine how the Islamic MFIs compare with conventional institutions in terms of technical efficiency. The study applied non parametric DEA model, the study shows no significant differences between conventional and microfinance institutions in the efficiency of the two groups in the region. The research conclusion is that the religion and more specifically the use of Sharia-compliant products does not have influence on the efficiency of MFIs in the MENA region.

Poramate Asawaruangpipop & Opal Suwunnamek (2014) in their study on 732 Savings and Credit Cooperatives (SCCs) in Thailand made efforts to analyse the efficiency by using DEA. The study was carried out by using the databases of Cooperative Auditing Department, Ministry of Agriculture and Cooperatives of Thailand. The technical efficiencies of SCCs in Thailand are measured under both on production and intermediation approaches. It was found that state enterprise cooperatives had maximum number of efficient cooperatives and average efficiency score. Further it was also found that private cooperatives had maximum efficiency in terms of cooperative quantity and efficiency score.

V. Umasri & Dr.Chitra Sivasubramanian (2014) in their study used non parametric technique DEA to measure the efficiency of Indian MFIs during the period 2008 to 2010. The panel dataset of 765 observations are used from 51 Indian MFIs over the period of 2008-10 to measure the Malmquist productivity index. Output oriented model is applied under the technique of Malmquist DEA analysis. During the period 2008-09, it may be observed from the study that the total factor productivity (TFP) is greater than 1, which indicates progress in efficiency. While in

the next period (2009-10), the TFP value was found to be less than 1 which indicates a regress. On the whole, the average productivity change is 3.3% per year. The annual rate of technological change is 9.7% and the technical change is in negative value of (- 0.58%). The study revealed the poor performance of MFIs and suggested need for improvement of performance. On the whole the MFIs are found to be better in terms of average scale efficiency change rather than the pure technical efficiency. So as to improve sustainability the Indian MFIs should improve their management practices. The Indian MFIs must improve their efficiency at a greater level for achieving more outreach and sustainability is the conclusion derived from the study.

Musa A. Olasupo et al (2014), in their paper attempted to measure the changes in performance and productivity of MFBs from the period 2006 to 2010 in South-West Nigeria, the country had its microfinance policy launched in the year 2005.It was revealed from the study that in 2006, only about 16.28% of the sampled Microfinance Banks were successful in reaching the recommended maximum Portfolio At Risk value of 5% and that percentage was found to be the highest over the entire period of the study. About 31.14% of the sampled MFBs have registered a debt/equity ratio of more than the recommended value of 2 in the year 2006, while 32.56% of the sample MFBs had gearing of over 2 in the year 2010. The sample Microfinance Banks in South-West Nigeria have experienced a fluctuating trend in performances in terms of their productivity changes, while improvement in pure technical efficiency was observed in the years 2007 and 2009. However, the MFBs suffered technological decline throughout the period of the study. Overall, an improvement in Total Factor Productivity was observed in 2007 for the South-West Nigerian MFBs, while productivity decline was observed in the years 2008, 2009 and 2010.

Master Theses

 Ariadna Martínez-González (2008),in their study tried used DEA to investigate the relative technical efficiency of a sample of microfinance institutions (MFIs) in Mexico and used Tobit regression to identify determinants of the efficiency. The inputs and outputs are chosen based on intermediation and production approaches and it was found that most MFIs have been more efficient in pursuing sustainability rather than breadth of outreach or have not met either goals successfully, but there is a reverse trend observed in the year 2007. The determinants of differences in efficiency found to be significant are; the proportion of assets used as performing portfolio, ratio of payroll to expenses average loan size, percentage of FINAFIM funds, structure of the board, scale of operations, age of MFI, and for-profit status of the MFI. The results indicate an incipient market, where public funding does not necessarily lead to efficiency.

Arturs Kravcenko (2011) in his research study' Governance and   Efficiency of Microfinance Institutions: An application of Data Envelopment Analysis, Stockholm' assessed the efficiency levels of MFIs by the legal status i.e. NGO and Non NGO MFIs. The study was carried out with the objective   to see if these microfinance institutions are able to manage their funds and serve social mission. Non parametric DEA (CCR model) is employed to calculate the technical efficiencies under production approach. The DEA technique was applied using mean normalization and narrowing to the sample without MFIs with any missing numbers after removing the outliers from the data. The results reveal that Non-NGO MFIs were financially driven and achieved high efficiency results in overall.

Joseph John Magali and Dickson Pastory in their study, to examine the technical efficiency of rural SACCOS in Tanzania employed DEA. The efficiency estimates for Morogoro, Dodoma and Kilimanjaro regions were found to be 0.61999, 0.6028724 and 0.4649 respectively. It was observed that the technical efficiency of SACCOS varies across and within the regions. The prime cause of inefficiency in rural SACCOS was found to be higher costs of operations. It was suggested that by effectively utilizing savings, deposits and expenses the   rural SACCOS in Tanzania should strive to improve their efficiencies.

Empirical works using frontier approaches (DEA and SFA) for efficiency analysis of MFIs

Author	Data description	Approach
Hassan and Sanchez(2009)	215 MFIs in the world	DEA
Gutierrez-Nieto et al. (2007)	21 MFIs in Latin America DEA	DEA
Hamiza Haq et al. (2007)	39 MFIs from the world	DEA
Abdul Qayyum and Munir Ahmed (2006)	85 MFIs from India, Pakistan and Bangladesh	DEA
Nghiem (2004)	46 MFIs in Vietnam	DEA and SFA
Ahmed Nawaz (2009)	204 MFIs around the world	DEA
Bassem(2008)	35 MFIs in Mediterranean	DEA
Hassan and Tufte (2001)	Grameen Bank branch level over the 1988-1991 period	SFA
Hermes et al. (2009)	435 MFIs in the world for the period 1997-2007	SFA
Oteng-Abayie et al. (2011)	Ghana MFIs for the period from 2007-2010	SFA
Masood and Ahmed (2010)	40 Indian MFIs for the period 2005-2008	SFA
Gregorio and Ramirez (2004)	Peru MFIs for the period of 1999-2003	SFA
Martinez-Gonzalez (2008)	Sample MFIs in Mexico	DEA
Ahmed (2011)	MFIs in Pakistan	DEA
Servin et al. (2012)	315 MFIs from Latin America	SFA
Islam et al(2011)	Agricultural MFI borrowers and non borrowers in ricefarming in Bangladesh	DEA
Kipesha(2010)	35 MFIs from East Africa	DEA
Bereket Zerai Gabriel(2012)	19 MFIs from Ethiopia during the period 2005-2009	DEA & SFA
Debdatta Pal(2010)	39 MFIs in India in 3 locations(Eastern India,Southern India and North&Western India	DEA
Surender Singh etal(2013)	41 MFIs in India	DEA
Izah Mohd Tahiri & Siti Nurzahira Che Tahiri(2013)	5 countries of ASEAN from 2008-2010	DEA
Farhana Ferdousi(2013)	Performance of MFIs in Bangladesh,India and China	DEA
Francis Awuku Darko(2013)	Efficiency of MFIs in SSA countries from 2005-2011	DEA
Varman & Mahendra(2008)	26 MFIs in India from 2005 -2007	SFA
Syedah Shan E Ahmad, Waqar Akram & Syed Umer Abdi	170 MFIs in South Asian region during 2008-09	DEA
Ines Ben Abdelkader& Asma Ben Salem (2013)	Islamic microfinance sector in MENA region	DEA
Arturs Kravcenko(2011)	Efficiency of MFIs by legal status(Sweden)	DEA

Source: Author's compilation

Conclusion

By extensive literature review it was found that the studies on measurement of performance of microfinance institutions employing frontier techniques (DEA and SFA) were limited and there is a lot of scope to carry out wide research in this area of study.

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