CENTRAL EUROPEAN REVIEW
OF ECONOMICS AND MANAGEMENT

ISSN 2543-9472; eISSN 2544-0365

Vol. 1, No. 4, 87-115, December 2017

www.cerem-review.eu
www.ojs.wsb.wroclaw.pl

Efficiency determinants of microfinance Institutions in India: two stage DEA analysis

Santa Kar, Joyeeta Deb

Assam University, Silchar, India

Abstract:

Aim: In India, Microfinance Institutions (MFIs) emerged as major player in providing microfinance services and therefore such institutions need to be financially sustainable in order to achieve their double bottom-line objective. Besides, Indian MFIs cannot protect themselves from the curse of loan non-repayment. Therefore, this study aims to measure performance of the Indian MFIs and examine whether sustainability has any significant impact on the efficiency of the MFIs.

Design / Research methods: In order to gauge the performance of the Indian MFIs, non parametric Data Envelopment Analysis (DEA) is adopted. Two models of DEA (BCC Model-input oriented and Undesirable Measure Model-output oriented) are applied used for better analysis. Further, to examine the factors influencing efficiency of the MFIs and particularly to answer whether Sustainability has any significant impact on efficiency, Tobit regression is applied in the study. Data of thirty-one Indian MFIs for seven years (2009-2015) are collected from MiX Market for the study.

Conclusions / findings: Result of the study shows that average technical efficiency of the MFIs is estimated to be 79 percent under BCC model and 98 percent under Undesirable Measure Model. Indian MFIs can attain production frontier if they can trim their bad output (proxied by Portfolio at Risk 30) to an extent of around 14 percent. Further, the study validates that sustainability (proxied by Operational Self Sufficiency) has positive impact on efficiency.

Originality / value of the article: Studies made so far on Indian MFIs have not addressed how the MFIs could become efficient by reducing their undesirable/bad output. Besides, no study so far has analysed the impact of sustainability on efficiency of the Indian MFIs. Therefore, this research tries to fill the existing research gap.

Implications of the research: The result of the study can be useful to the Indian Microfinance Industry in improving their performance. The result can further be used by Reserve Bank of India (RBI) to frame yardstick for the clients of the MFIs in connection with borrowing loans from MFIs.

Keywords: Microfinance Institutions, Sustainability, Data Envelopment Analysis

JEL: G21, C67, C33

Correspondence address: Santa Kar, Assam University Silchar - 788 011, Assam, India. E-mail: kar.santa5@gmail.com
Received: 23-08-2017, Revised: 14-11-2017; 16-11-2017, Accepted: 21-11-2017
doi: http://dx.doi.org/10.29015/cerem.528

1. Introduction

Microfinance is considered to be an imperative tool for sustainable growth in a developing nation. Initially Microfinance Institutions (MFIs) originated with a social mission which is poverty reduction. However, last two decades witnessed a shift in the operation of the MFIs from being social oriented to commercialization (Sriram, 2010; Rauf, Mahamood 2009). MFI's major objective is to provide banking services to the financially excluded people, particularly to provide small credits to the borrowers (Mersland, Strom 2009). Therefore, MFIs should be sustainable in order to continue their services. For attaining sustainability MFIs charges high interest rates, which is even higher than the interest charged by commercial banks (Ahmed, 2002; Diop et al. 2007; Obaidullah 2008). Tulchin (2003) & Hartarska (2005) stated that MFIs face unique challenge because of their double bottom line objective of outreach and sustainability. In the process of attaining self-sufficiency, the MFIs started to become commercial institutions. Crabb & Keller (2006) stated that like commercial banks and other lending institutions, MFIs must manage their repayment risk. Interestingly, MFIN Report (2017) highlights that Indian MFIs suffers from repayment issue as average Portfolio at Risk more than 30 days (PAR30) is estimated to be 7.46 percent which implies that the Indian MFIs cannot guard themselves from the curse of non-repayment.

The drift of the MFIs from their prime objective to commercialization deemed the traditional technique of gauging the performance of the MFIs unfit. Considering the importance of cost trimming in the sector vital, there is felt a need to add fresh dimension of performance measurement incorporating both social and commercial aspect.

The present study proposes relative efficiency as a technique to measure social and financial aspect of MFI performance (Ferdousi 2013). The study proposes to use a non-parametric DEA approach to estimate efficiency. Besides, the study proposes to address the bad output produced by the MFIs in the form of PAR30 by using Undesirable Measure Model. Thereafter, the study tries to answer whether sustainability of MFIs has any significant impact on efficiency of MFIs.

The rest of the paper is organized as: Background of microfinance vis-a-vis genesis of Indian microfinance is explained in the second section followed by Sustainability and its measures in the third section. Technique for estimating efficiency, particularly DEA, is discussed in the fourth section. The fifth section focuses on reviewing of other related studies in and around the area. The sixth section highlights the research design as well as specification of model to be used in the study followed by the result of efficiency estimation in the seventh section and result of Tobit regression in the eighth section. Finally the summary of findings, scope for future research and conclusion of the study is mentioned in the ninth section.

2. Microfinance

Microfinance refers to the provision of small loans without collateral security, to the poor and low-income households, whose access to the commercial bank is limited. Microfinance, thus bridges the gap between the financially excluded group of people and their financial crisis. According to Robinson (2001), microfinance refers to 'small-scale financial services–primarily credit and savings–provided to people who farm or fish or herd; who operate small enterprises or microenterprises where goods are produced, recycled, repaired, or sold; who provide services; who work for wages or commissions; who gain income from renting out small amounts of land, vehicles, draft animals, or machinery and tools; and to other individuals and groups at the local levels of developing countries, both rural and urban'. Besides granting credit, Microfinance provides other services such as savings, insurance, pension and payment services (Oikocredit 2005). In India microfinance started through loaning miniaturized scale credit amid the 60s' picked up force amid the 90s when Government intervention was made and banks began connecting up with SHG programs. Micro Finance Institutions (MFIs), some private foundations, came forward, whose prior goal was to give microfinance services, such as providing advances, protection of clients' interest and currency exchange. Despite the fact that these MFIs experiences absence of benefactor steadiness that brings up the issue of

their manageability, however such organizations are as yet perceived as effective apparatus for battling neediness and equipping comprehensive development. Following paragraphs depicts brief picture of the evolution of microfinance.

2.1 History of microfinance

Microfinance initiated under the plan of budgetary consideration which expected to bring poor people and denied area of the populace under the scope of money related administrations. Notwithstanding, microfinance commenced hundreds of years prior when casual investment funds and credit bunches began working for poor people. The evolution of microfinance as narrated by Robinson (2001), the incorporation of the “susus” of Ghana, “chit funds” in India, “tandas” in Mexico, “arisan” in Indonesia, “cheetu” in Sri Lanka, “tontines” in West Africa and “pasanaku” in Bolivia started the voyage of microfinance. In 1700s, the Irish creator Jonathan Swift started the most punctual type of present day MFIs: the Irish credit subsidize framework. The Irish credit support framework was intended to give little uncollateralized advances to country poor. Scholar Lysander Spooner composed over the advantages from little credits to the business visionaries and agriculturists as a wellspring of inspiring the job of the poor amid the 1800s and different other formal organizations started to rise in Europe in the types of individuals' banks, credit unions and reserve funds and credit co agents. Of these, the credit unions created by Friedrich Wilhelm, Raiffeisen increased wide recognition in Europe and other North American States, in mitigating the rustic poor from the grip of usurious moneylenders. In 1895 individuals' banks ended up plainly prevalent in Indonesia, and in 1900 the thought spread to Latin America. By the year 1901 the bank achieved two million provincial ranchers. Between the period 1900 to 1906 the caisse populaire development grounded by Alphone and Dormene Desjardians in Quebec established the principal caisse, they passed a law representing them in the Quebec get together. However the unrest in the zone of microfinance occurred in 1970s when Professor Mohammad Yunus helped by his understudy Akhtar Hameed Khan spearheaded the Grameen Bank Model in Bangladesh. Close by Shorebank was framed in 1974 which was the principal microfinance and group improvement bank established in Chicago. Going to the 21st century, the year 2005 was

broadcasted as the global year of microcredit by the Economic and Social Council of the United Nations in a require the money related and assembling division to "fuel" the solid entrepreneurial soul of the needy individuals around the globe. In the year 2006 Professor Mohammad Yunus, the organizer of Grameen Bank was granted the Nobel Prize for his endeavours. Regardless of the possibilities of microfinance, think about made by Deutsch Bank in 2007 featured that as indicated by a few gauges just 1-2 percent of all Microfinance Institutions on the planet are fiscally maintainable, which means in this manner a large portion of the Microfinance Institutions need to rely upon outside endowments.

2.2 History of microfinance in India

In India the journey of Microfinance began with the starting of a NGO named Mysore Rehabilitation and Development Agency (MYRADA) in Karnataka, 1968 to encourage a procedure of continuous change for the country poor. Later amid 1984-85 MYRADA accomplished its goals, that is, to help the poor to help themselves by framing Self Help Groups (SHGs) and through association with NGOs and different associations. Close by, in 1974 Shri Mahila SEWA (Self Employed Women's Association) Sahakari Bank was shaped for giving saving money administrations to the poor ladies utilized in the disorderly segment in Ahmadabad, Gujrat. Be that as it may, the microfinance development in India picked up energy with the impedance of NABARD (National Bank for Rural Development) in 1992. It was amid the late 1990s' and mid 2000s' few studies were made with respect to the credit accessibility got by the denied area which featured the possibilities of the miniaturized scale credit which brought about the ascending of different pinnacle establishments like NABARD, SIDBI and Rashtriya Mahila Kosh (RMK) for giving microfinance benefit, Commercial Banks, Regional Rural Banks and Cooperatives likewise give microfinance administrations. Private Institutions named Microfinance Institutions (MFIs) were built up that embraced microfinance benefits as their primary action. Moreover, couple of NGOs began giving direct credit to the borrowers, for example, SHARE in Hyderabad, ASA in Trichy, RDO LOYALAM Bank in Manipur (Tiwari 2004). Once more, couple of NGOs like MYRADA in Bangalore, SEWA in

Ahmadabad, PRADHAN in Tamil Nadu and Bihar, ADITHI in Patna, SAARC in Mumbai are a portion of the NGOs that help the SHGs.

Assocham Report, 2016 categorised the evolution of Microfinance sector into four periods: Initial Period, Change Period, Growth and Crisis and Consolidation and Maturity.

Commencement of Sewa Bank in 1974 and linking of NABARD with SHGs in 1984 was clustered as "Initial Period". Beginning of SHG Loans on par with secured Loans on 2002, MFI lending treated as Public Sector Lending on 2004 and the Krishna crisis in Andhra Pradesh on 2006 was tagged as "Change Period". Entry of Private Equity in Microfinance Industry in 2007, introduction to MicroFinance Institution Network in 2009 and starting of SKS Microfinance offering IPO, Andhra Crisis in the year 2010 was clubbed as "Growth and Crisis Period". Finally, Malegam Committee Report and RBI guidelines on the regulation of MFIs in 2011, grant of banking license to Bandhan in 2014 and launching of MUDRA bank and 8 MFIs granted SFB license in 2015 was grouped as "Consolidation and Maturity Period".

The year 2011 marked an important phase in the Indian microfinance history. Gradual materialization of the MFIs leads to bulk indebtedness among the poor farmers of Andhra Pradesh. However, Beginning of the Andhra Pradesh Microfinance emergency can be followed back in the year March, 2006 when Krishna region government shutdown 57 branches of two biggest MFIs (SHARE and Spandana) and in addition those of couple of littler MFIs. Choice to shut down of these MFIs came in view of the affirmations of dishonest accumulations, unlawful operational practices, (for example, taking reserve funds), poor administration, usurious loan costs, and profiteering (CGAP 2010). There was even an affirmation that 10 borrowers of MFIs in Krishna region conferred suicide since they were not able reimburse the credits taken from MFIs (Shylendra 2006). Quick extension of bank credit as encouraged by activities like ICICI organization model and accessibility of shabby credit in type of "Pavala Vaddi" plot, spurred by political thought, heightened the crisis. As analyzed by Shylendra (2006) clash between States bolstered SHGs and Civil society activities in type of MFIs as the significant purpose for the emission of emergency.

3. Sustainability of MFIs

According to Pissarides et al. (2004), MFI can be proclaimed to be self-sustainable if resources can profitably provide finance to poor on an acceptable scale without using of subsidies, grants or other concession. Sustainable MFIs have repeatable operations and they are able to serve their target clients regularly. Notably, self sufficient MFIs might be financially sustainable but they cannot be claimed to be self financially sustainable unless they are privately profitable. Committee of Donor Agencies (CDA) explains sustainability of MFIs into two degrees: Operational Self Sufficiency and Financial Self Sufficiency. McGuire & Ors (1998) define Operational Self Sufficiency as "require MFIs to cover all administrative costs and loan losses from operating income". Financial Self Sufficiency is defined as the capacity of MFIs to cover all administrative costs as well as loan losses from operating income, after adjusting inflation and subsidies and treating all funding as it had a commercial cost (McGuire, Ors 1998). However, it is believed that small credits are costly and the operation of MFIs cannot generate sufficient income to ensure profitable business. Studies of Brau & Woller (2004) highlighted that unlike formal financial institutions, MFIs cannot be financially sustainable and therefore, they have to rely upon donor subsidies. However, there has been observed a gradual shift in the microfinance industry from subsidized credit delivery program to self sufficient financial institution through which the MFIs can achieve social outreach and financially sustainability without any sort of subsidy-requirement (Robinson 2001).

Marakkath (2014) stated that financial sustainability is denoted by three major metrics: Operational Self Sustainability Ratio, Financial Self Sustainability Ratio and Subsidy Dependence Index. Amongst these the most basic measure of financial sustainability of an MFI is Operational Self Sustainability (OSS). MFI with higher OSS ratio is likely to earn adequate revenue to cover its financing and operating costs as well as loan loss provision and gradually attain the status of FSS without any kind of subsidy-dependence (Meyer 2002; Ledgerwood 1999; Rosenberg 2009). Subsidy Dependence Index indicates the percentage increase required in on-lending interest rates to completely eliminate all subsidies received by an MFI (Yaron 1992).

Another commonly used indicator for estimating institutional scale is Adjusted Return on Assets (Zerai, Rani 2011). Sustainability is also measured by Return on Assets (ROA) and Returns on Equity (ROE) (Olivares 2005). ROA is indicative of a MFI's ability to generate returns using the institution's total assets.

In the present study Operational Self Sustainability (OSS) is taken as an indicator of sustainability of the MFIs. OSS measures how efficiently the MFI can manage its costs with the help of operating income and therefore is considered to be a superior measure of sustainability. Hartarska (2004) has also used Return on Assets (ROA) and Operational Self Sustainability (OSS) in his study to measure sustainability of MFIs. OSS is believed to be a better measure because the value of donation, subsidies and inflation is not recorded in ROA (Hartarska 2004).

The mathematical explanation of Operational Self Sustainability as defined by MIX Market is:

$$OSS = \frac{\text{Operating Income (Loans + Investment)}}{\text{Operating Costs + Loan Loss Provisions + Financing Costs}}$$

4. Techniques for estimating performance of MFIs

Traditional financial ratios are not adequate to evaluate microfinance performance because of its social mission, functioning of MFI is not only constrained to profit-earning but its capacity "to work in long haul without risk of liquidation" (Nanayakkara 2012). Some MFIs purposely concentrate on profit-making to achieve sustainability (e.g. bank-MFI). There exist different MFIs where profitability is not a prior concentration and such MFIs have to sustain by means of donations and grants from donors, e.g. non-governmental organization based MFI (NGO-MFI). Using traditional ratio approach to gauge MFI performance can be vague: an MFI can excel in one aspect however fail in others, consequently causing problem in general benchmarking (Bogetoft, Otto 2011).

Efficiency is therefore proposed in this study to gauge the performance of the MFIs because of its ability to cover both diverse aspects of microfinance and to be connected to both business and not-revenue driven MFIs (Balkenhol 2007).

Efficiency relates utilization of inputs to create output (Cooper et al. 2000). Subsequently, efficiency approach which is capable of estimating efficiency taking multiple inputs and multiple outputs in order to benchmark the performance of MFIs is Data Envelopment Analysis (DEA), explained below.

DEA was first propounded by Charnes, Cooper & Rhodes (1978), broadly known as the CCR, as an extension of single input-output productive efficiency model proposed by Farrell (1957). Using linear programming, it frames a "drifting" piecewise linear production frontier on top of all data as best-practice benchmark set against which each DMU is evaluated, thus it is called "envelopment" (Cook, Zhu 2005; Emrouznejad, Anouze 2010; Fluckiger, Vassiliev 2007). Technical Efficiency is calculated as distance of DMU to reference set, making relative productivity measure for all Decision Making Units (DMUs) (Cook, Zhu 2005; Cooper et al. 2004; Emrouznejad, Anouze 2009). Since its inception, DEA has been widely applied in efficiency estimation of various financial and non-financial organisations.

Two essential DEA models are CCR model of Charnes et al. (1978) and BCC model of Banker et al. (1984). CCR demonstrate technical efficiency under Constant Return to Scale (CRS) condition and states that multiple inputs and outputs for a given DMU are linearly aggregated into single 'virtual' input and output (Widiarto, Emrouznejad 2015). On the other hand, BCC model in Banker et al. (1984) modifies CCR model by applying a more realistic assumption of Variable Returns to Scale (VRS) wherein each DMU is allowed to exhibit different returns to scale due to different environment, hence named VRS model (Widiarto, Emrouznejad 2015).

Two approaches in basic DEA models are input-oriented and output-oriented. In input oriented model, the input reduction is proportionally maximized, keeping output constant while in output-oriented model, the output is proportionally maximized holding inputs constant, the following equation 1 and equation 2 explains input-oriented and output-oriented models respectively.

Θ = Min Θ	$\emptyset$= Max $\emptyset$
Subject to	Subject to
$\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{r0}$, r=1,2,...,s;	$\sum_{j=1}^{n} \lambda_j y_{rj} \geq \emptyset\, y_{r0}$, r=1,2,...,s;
$\sum_{j=1}^{n} \lambda_j x_{ij} \leq \Theta x_{i0}$, i=1,2,...,m;	$\sum_{j=1}^{n} \lambda_j x_{ij} \leq x_{i0}$, i=1,2,...,m;
$\sum_{j=1}^{n} \lambda_j = 1$ (eq 1)	$\sum_{j=1}^{n} \lambda_j = 1$ (eq 2)
$\lambda_j \geq 0$, j=1,2,...,n.	$\lambda_j \geq 0$, j=1,2,...,n.

Banker added $\sum_{j=1}^{n} \lambda_j = 1$ in the constraint set to represent convexity constraint for λ *k* in VRS condition; ensuring a DMU to be compared only to similarly-sized DMUs with similar return to scale. Pure technical efficiency scores from BCC model is thereby greater or equal to global technical efficiency scores from CCR model as DMU is measured relative to smaller number of DMUs (Thanassoulis 2001).

Most of the industries, besides producing desirable outputs, produce certain undesirable outputs too. Pollution produced in manufacturing industry, NPA in banking industry are example of undesirable output. Koopmans (1951) suggested the ADD approach where f (U) = -U through which the undesirable output or input could be transformed to desirable output or input. However, Liu & Sharp (1999) stated that one may regard an undesirable input as a desirable output and an undesirable output as a desirable input. This approach signifies that efficient DMUs wish to maximise desirable output and undesirable inputs. Fare et al. (1989) developed a non linear program for treating undesirable outputs: Max Θ, subject to $\Theta\, y_g \leq Y_G$, $\Theta^{-1} y_b = Y_B$ and $x \geq X$, Technical Efficiency = $1/\Theta$.

5. Review of literature

Microfinance Institutions are the budding financial institutions in developing nations, and are considered as an important area of research. Good number of studies is conducted across the globe in different aspects of Microfinance Institutions; however, here we are concentrating only on those studies which are related to estimation of the efficiency of the Microfinance Institutions. Ratio Analysis is considered to be traditional technique of gauging financial performance; however, Thanassoulis et al. (1996) made a study to compare the traditional ratio

analysis technique with Data Envelopment Analysis in assessing the performance of District Health Authorities of England. Result highlighted that though both the methods agree reasonably on the performance of the unit as a whole but ratio analysis, unlike DEA is not found to be suitable for setting targets. Again, for estimating efficiency of financial institutions Stochastic Frontier Approach (SFA) has been widely used, to cite a few: Worthington (1998) used SFA to estimate the efficiency of Credit Unions in Australia. Study was made over 150 Australian credit unions and later used limited variable regression technique to relate credit unions' efficiency scores to structural and institutional consideration. Result of the study implies noncore commercial activities are not a significant influence on the level of cost inefficiency. Quayes (2012) used SFA to present an empirical analysis of the cost efficiency of MFIs in Bangladesh and his results shows that larger MFIs are more efficient with some evidence of a trade-off between efficiency and outreach.

Considering the present study, comprehensive review of the studies relating to the use of Data Envelopment Analysis in gauging the efficiency of financial institutions and more particularly that of Micro Finance Institutions across the globe is made which is presented in the following paragraph.

Soterou & Zenios (1997) and Canhoto & Dermine (2003) both conducted an empirical study to measure efficiency of banking industry, the former took 144 branches of major commercial banks in Cyprus as samples and the later took 20 banking institutions including new and old commercial banks in old Portugal. Efficiency of the samples in both the studies was measured through Data Envelop Analysis model. The major findings of the former study were: superior insights can be obtained by analyzing simultaneously operations, service quality and profitability whereas the later findings implies improvement in efficiency for the overall samples and the new banks dominate the old ones in terms of efficiency. Good number of studies has been made so far on estimating the efficiency of MFIs using Data Envelopment Analysis, to cite a few: Conhoto & Dermine (2002), Neito et al. (2005), Haq et al. (2010), Neito et al. (2009), Kripesha (2013) studied the estimation of efficiency of MFIs using Data Envelopment Analysis. Neito et al. (2005) made a study in order to measure the efficiency of MFIs. Secondary data were collected for 30 Latin American MFIs (Bolivia, Colombia, Dominican Republic, Ecuador,

Mexico, Nicaragua, Peru and Salvador) for one year. Result of the study implies that there are country effects on efficiency; and effects that depend on non-governmental organization (NGO)/non-NGO status of the MFI but Haq et al. (2010) made a study to examine the cost efficiency of 39 MFIs across Africa, Asia and Latin America. Data Envelopment Analysis was used for the said study and findings of the study shows that non government MFIs were the most efficient; under intermediation approach, bank MFIs also outperform in the measure of efficiency. Neito et al., (2009) made a study to estimate the efficiency of MFIs in relation to financial and social outputs. Impact on women and poverty reach index has been taken as social performance indicators. The study was made on 89 MFIs and results reveal the importance of social efficiency index. Kripesha (2013) studied the technical efficiency of Microfinance Institutions operating in Tanzania, 29 MFIs were selected for the study and relevant data were collected during the period 2009-2012 through secondary sources and were evaluated using Data Envelop Analysis model. The major findings of the study were: Higher average technical efficiency was observed under production efficiency and most of inefficiency in MFIs was result of inappropriate scale. In India, Singh (2014) conducted a study to examine the efficiency of Indian MFIs over thirty MFIs and a modified form of Data Envelopment Analysis was used, results of the study indicated the inefficiencies of the microfinance sector.

Few studies on estimating performance of MFIs extended to identification of the determinants of efficiency, to cite a few: Nghiem et al. (2006) investigated the efficiency of the microfinance industry in Vietnam. The study was conducted with 46 schemes in the north and central regions. DEA was used to gauge the efficiency of the schemes and later used Tobit regression was used to identify the determinants of efficiency. Result of the study shows that average technical efficiency of the schemes is estimated to be 80 percent and age and location of the schemes are found to be significantly influencing the efficiency. Nawaz (2010) measured the financial efficiency and productivity of the MFIs worldwide considering the subsidies received by the MFIs using DEA. A three stage analysis was adopted for the study where firstly the efficiency of the MFIs is estimated followed by analysing the productivity changes using Malmquist indices and lastly tobit regression is used to

identify the determinants of efficiency. Result of the study highlighted substitution between outreach to the poor and financial efficiency, lending to women is efficient only in the presence of subsidies and MFIs in South Asia and Middle East and North Africa tend to be less efficient than others. Abayieet et al. (2011) investigated the economic efficiency of MFIs in Ghana using parametric Stochastic Frontier Approach followed by the use of Tobit regression to identify the determinants of efficiency. The study was conducted on 135 MFIs over a period of four years. Result of the study presented the overall average economic efficiency to the extent of 56.29 percent; age, savings and cost per borrowers were the significant determinants of efficiency. Singh et al. (2013) estimated efficiency of 41 MFIs in India using non parametric DEA where both input oriented and output oriented approaches were used. Later the study used Tobit regression to identify the determinants of efficiency. The findings of the study highlighted that output of the MFIs could be increased to the extent of 59.4 percent; 25 MFIs experienced economies of scale under input oriented approach and 10 MFIs under output oriented approach and MFIs operating in southern part of India are found more efficient. Wijesiri et al. (2015) examined the technical efficiency of 36 MFIs in Sri Lanka using two-stage DEA approach. Bootstrap DEA was used to estimate efficiency followed by the use of double bootstrap truncated regression approach. Result of the study highlighted that most of the MFIs in Sri Lanka were financially and socially inefficient and age and capital-to-asset ratio were crucial determinants of efficiency.

Reviewing the aforementioned studies exhibit that scanty of studies are made to estimate the efficiency of Indian MFIs. Moreover, no study till date has been made to estimate the efficiency of the Indian MFIs to address the bad output, which is an important aspect of the microfinance industry. Besides, the researcher has not come across any study that verifies whether sustainability has any impact over efficiency. Therefore the present study tries to fill this research gap by framing the following objectives of the study:

- Estimate efficiency of the selected MFIs using BCC model and Undesirable Output Model.
- Identify determinants of efficiency, specifically to check whether sustainability has any impact on efficiency.

6. Research design and model specification

Sample Size and Data Source: Secondary data is collected for thirty-one Indian MFIs for six years (2009-2015) from MixMarket.

Selection of Models for Efficiency Estimation and Selection of Inputs and Outputs: The study used production approach to access the performance of MFIs considering the fact that most of the Indian MFIs do not collect deposit (Fluckiger, Vassiliev 2007; Neito et al. 2009; Neito et al. 2007; Haq et al. 2010; Kripesha 2012). The study employs input oriented-BCC model to estimate technical efficiency. Since the MFIs differ in their operational size, therefore such difference in their operational size is likely to affect efficiency. Hence BCC model using VRS assumption is naturally more appropriate in estimating the performance of MFIs (Emrouznejad, Widiarto 2015). Beside BCC model, the study also computes the efficiency of the MFIs using output oriented-Undesirable Measure Model (UMM). The study uses UMM considering the fact that the Microfinance industry produces certain undesirable outputs which cannot be ignored. The selection of inputs and outputs used in the study is on the basis of their repetition in the studies relating to efficiency of Microfinance Industry. Table 1 exhibits the definition of selected inputs and outputs along with their use in other studies.

Table 1. Details of Inputs and Outputs used in the study

Specification (Model)	Variable	Definition	Usage in literature	Unit	MFI Objective Represented
Input (BCC & UMM)	Operating Expenses	Operating expense as a percentage of gross loan portfolio	Gonzoalex (2008), Neito et al. (2005), Tahir, Tahrim (2013), Gebremichael, Rani (2012), Ferdousi (2013)	₹	Financial Efficiency
Input (BCC & UMM)	Employees	The number of individuals who are actively employed by an entity. This number includes contract employees or advisors who dedicate a substantial portion of their time to the entity, even if they are not on the entity's employee's roster.	Gonzoalex (2008), Neito et al. (2005), Tahir, Tahrim (2013), Gebremichael, Rani (2012), Ferdousi (2013)	Number	Social Efficiency
Output (BCC & UMM)	Gross Loan Portfolio	All outstanding principals due for all outstanding client loans. This includes current, delinquent, and renegotiated loans, but not loans that have been written off.	Nawaz (2010), Gonzalez (2008), Singh et al. (2013), Tahir, Tahrim (2013), Ferdousi (2013)	₹	Financial Efficiency

Table 1. Continuation

Specification (Model)	Variable	Definition	Usage in literature	Unit	MFI Objective Represented
Output (BCC & UMM)	Number of Active Borrowers	The numbers of individuals or entities who currently have an outstanding loan balance with the MFI or are primarily responsible for repaying any portion of the Loan Portfolio, Gross.	Annim (2012), Gonzalez (2008), Tahir, Tahrim (2013), Ferdousi (2013)	Number	Social Efficiency
Output (UMM)	Portfolio at Risk more than 30days (PAR30)	Represents the portion of loans greater than 30 days past due, including the value of all renegotiated loans (restructured, rescheduled, refinanced and any other revised loans) compared to gross loan portfolio. The most accepted measure of a financial institution's portfolio quality.	Not been used as output in any DEA-microfinance literature	Percentage	

Source: Literature Survey
NB: Description of the variables as per MIX Glossary

The study follows the widely used practice by the micro economic researchers on efficiency. The estimated efficiency score of the BCC Model and Undesirable Measure Model is to be regressed on sustainability, other control and firm-specific variables in order to identify the factors that influence efficiency. Identification of such factors will help the new and existing MFIs to increase their efficiency level

(Elyasiani, Mehdian 1990; Casu, Molyneux 2000; Isik, Hassan 2003; Masood, Ahmad 2010). Equation I and equation II presents the two regression models using the efficiency scores of BCC and UMM respectively.

Y_{BCC} = f (GLP, DE, ROA, ROE, NAB, OSS, S) .....(I)

Y_{UMM} = f (GLP, DE, ROA, ROE, NAB, OSS, S) .....(II)

Y_{BCC} and Y_{UMM} represents the efficiency scores of BCC and UMM respectively. GLP (Gross Loan Portfolio) represents all outstanding principle due for all outstanding client loans. DE (Debt-Equity Ratio) represents total liabilities of the firm compared to equity. ROA (Return on Asset) represent net operating income (less taxes) compared to average assets. NAB (Number of Active Borrowers) represents the number of individuals or entities who have an outstanding loan balance with the firm. OSS (Operational Self Sufficiency) measures the firm's ability to cover its cost through operating incomes. S (Scale) signifies the proportion of Gross Loan Portfolio sanctioned by the firms. The detailed description of the explanatory variables is highlighted in table 2.

Table 2. Explanation of the independent variables

Variables	Computation	Expected Sign
GLP	Total Loans of MFIs	+
DE	Debt/Equity	-
ROA	Net Profit/Total Asset	+
ROE	Net Profit/Share Capital	+
NAB	The total active borrowers of MFIs	+
OSS	Operating Income/(Operating Cost + Financing Cost + Loan Loss Provision)	+
S	Proportion of Gross Loan Portfolio sanctioned by MFIs (Large = GLP more than ₹52.31 crore, Medium = ₹13.07 crore to ₹52.31 crore and Small= GLP less than ₹13.07 crore) (Vector of Dummy Variable) 1=Small, 2= Medium, 3= Large	+

Source: Literature Survey
NB: Classification of the variable "Scale" as per MIX Glossary

7. Result of first-stage DEA

Table 3 highlights the Overall Technical Efficiency of the sample MFIs over the study period, i.e., from 2009 to 2015 and also shows the decomposition of the overall technical efficiency into Pure Technical Efficiency and Scale Efficiency. From the table it can be stated that for the average technical inefficiency of 20 percent (1-0.80) is explained by Pure Technical Inefficiency estimates of 23 percent (1-0.77), that is due to managerial inefficiency in miss utilization of resources resulting into wastages and the rest explained by Scale Inefficiency to the extent of 11 percent (1-0.89) due to the MFIs' operating at sub optimal scale of operation.

Table 3 also presents the technical efficiency scores of the MFIs under both BCC Model-Input oriented as well Undesirable Measure Model-Output oriented; the table shows average TE score under BCC model is 0.79 which implies Technical Inefficiency to the extent of (1-0.79) 21 percent. This indicates that the sample MFIs can reduce cost to the extent of 21 percent and still produce the same output whereas, the average TE score under UMM is estimated to be 0.98, implying the Technical Inefficiency to the extent of (1-0.984) 2 percent which implies that with reducing cost to the extent of just 2 percent the sample MFIs can produce the same output.. The average TE scores range between 0.70 and 0.87 in case of BCC Model and between 0.98 and around 1.00 in case of Undesirable Measure Model. Overall, the MFIs exhibit a consistent trend in the TE scores in case of both the models as evident by a lower standard deviation.

Table 4 represents how the relatively inefficient MFIs can reach the production frontier by altering their bad output. The result of the study highlights that during the study period, 2010 was marked to be the year when the average efficiency score of the MFIs was lowest. However, few MFIs, such as Asirvad, Belghoria, BSS, Chaitanya, Mahasemam, Sanghamithra, SKDRDP, SKS, Smile, Sonata and Spandana, remained efficient throughout the study period. The table also natters that on average, the MFIs require to trim their bad output (PAR30) to an extent of 14 percent. Table 4 exhibit in details the quantity of PAR30 the inefficient MFIs need to trim in order to become efficient.

Table 3. Technical efficiency scores under BCC and UM model (2009-2015)

YEAR	TE and Decomposition under BCC Model			Technical Efficiency Scores under Undesirable Measure Model (Output oriented)
	Overall Efficiency	Pure Technical Efficiency	Scale Technical Efficiency	
2009 (N=31)	0.819	0.819	0.933	0.988
2010(N=31)	0.868	0.868	0.964	0.987
2011(N=31)	0.855	0.855	0.935	0.976
2012(N=31)	0.740	0.740	0.925	0.986
2013(N=31)	0.770	0.770	0.888	0.991
2014(N=31)	0.781	0.781	0.875	0.991
2015(N=30)	0.699	0.537	0.699	0.986
$\bar{X}$	0.790	0.767	0.889	0.986
STDEV	0.061	0.111	0.089	0.005
MAX	0.868	0.868	0.964	0.991
MIN	0.699	0.537	0.6994	0.976

Source: Own calculation using DEA Frontier and DEAP
Note: STDEV= Standard Deviation
MAX= Maximum
MIN= Minimum

Figure 1 exhibits the distribution of MFIs in Efficiency Range estimated through BCC model-Input oriented model. Result highlights that under Input oriented-BCC Model, most of the MFIs' efficiency score ranges between 0.71 and 0.99, indicating that on an average the sample MFIs display cost savings potentiality to the extent of 1percent to 29 percent. The figure also portrays that two MFIs (Sanghamithra and Spandana) under BCC- input oriented model were highly efficient.

However, in Output oriented-Undesirable Measure Model most of the MFIs efficiency score ranges between 0.9 and 1.00 meaning thereby on an average the MFIs have potentiality of around 1 percent to reduce the undesirable output and reach efficiency frontier.

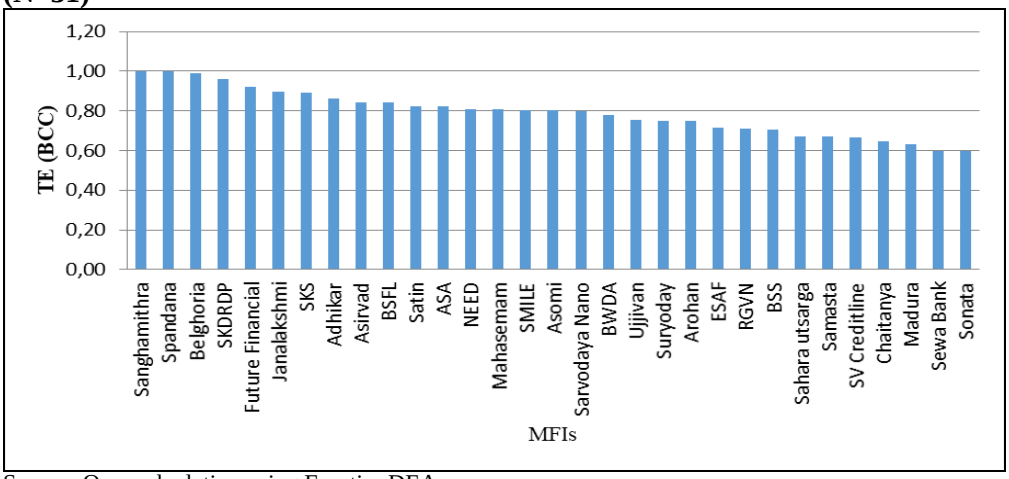
Table 4. Volume of PAR30 inefficient MFIs need to Adjust

MFIs	2010	2011	2012	2013	2014	2015	$\bar{X}$
Adhikar						0.072	0.072
Arohan		0.719					0.719
ASA	1.885						1.885
Asomi	2.289	1.339					1.814
BSFL	37.761		66.681		20.569		41.670
BWDA	5.936	373.171					189.554
ESAF		1.229					1.229
Future Financial		21.344	18.404	8.918	4.539		13.301
Janalakshmi	1.628						1.628
Madura	2.088						2.088
NEED	0.749						0.749
RGVN	3.579						3.579
Sahara utsarga	2.537				1.354	1.377	1.756
Samasta	1.309					0.214	0.762
Sarvodaya Nano	8.622				2.309	0.507	3.813
Satin			0.799				0.799
Sewa Bank	12.802	11.412	21.706		12.369	12.353	14.128
Suryoday	5.019						5.019
SV Creditline	0.669					0.246	0.458
Ujjivan		1.199	0.199				0.699
$\bar{X}$	6.205	58.630	21.558	8.918	8.228	2.461	

Source: Own calculation using DEA Frontier
N.B: Volume of PAR30 to be adjusted = Actual Output- Targeted Output

Table 5 exhibits the ranking of MFIs under both BCC and Undesirable Measure Models as per their technical efficiency, to estimate the correlation between the ranks obtained under the two models Spearman's Rank Correlation is estimated, which shows a value of 0.43 indicating a high positive correlation between ranks of both the models. This is also evident from the fact that Sanghamithra and Spandana are the MFIs which are ranked first under both the Models.

Figure 1. Distribution of MFIs in efficiency range (BCC Model-Input oriented) (N=31)



Source: Own calculation using Frontier DEA

Table 5. Spearman's Rank Correlation of the MFIs between their Efficiency scores calculated under BCC Model and Undesirable Measure Model (n=31)

DMU	BCC	UMM	DMU	BCC	UMM
Adhikar	8	19	NEED	13	16
Arohan	21	17	RGVN	23	26
ASA	12	23	Sahara utsarga	25	25
Asirvad	9	7	Samasta	26	15
Asomi	16	11	Sanghamithra	1	1
Belghoria	3	1	Sarvodaya Nano	17	27
BSFL	10	30	Satin	11	21
BSS	24	13	Sewa Bank	30	31
BWDA	18	29	SKDRDP	4	1
Chaitanya	28	8	SKS	7	12
ESAF	22	22	SMILE	15	5
Future Financial	5	28	Sonata	31	20
Janalakshmi	6	9	Spandana	1	1
Madura	29	24	Suryoday	20	18
Mahasemam	14	6	SV Creditline	27	14
			Ujjivan	19	10
Spearman's Rank Correlation			0.434		

Source: Own calculation using MS Excel

8. Result of second-stage: Tobit Regression

Table 6 exhibits the result of the Tobit regression under both BCC and Undesirable Measure Model. Result of Tobit regression reflect that in case of BCC model the coefficient of Operational Self Sufficiency (OSS), showed positive impact on efficiency, which is as per the researcher's expected sign, however, the result showed coefficient value of OSS 0.001 unit, Singh et al. (2015), Masood and Ahmad (2010) and Gonzalez (2007) also support the finding. The coefficient of Gross Loan Portfolio showed positive impact upon the efficiency of the MFIs which is as per the expectation of the study. Meaning thereby that with one unit increase in GLP, efficiency will increase to the extent of 1.30 units and the finding is supported by Masood and Ahmad (2010). Debt Equity Ratio and Return on Asset accounted to be significantly insignificant.

Table 6. Results of Tobit Regression (Model 1 and Model 2)

E		Coef.		P>|t|		[95% Conf. Interval]			
		Model 1	Model 2	Model 1	Model 2	Model 1	Model 1	Model 2	Model 2
GLP		1.30	7.31	0.023	0.645	1.83	2.43	-2.39	3.85
DE		-0.00	-0.00	0.89	0.64	-0.00	0.00	-0.00	0.00
ROA		-0.01	0.001	0.300	0.68	-0.023	0.01	-0.00	0.01
ROE		-0.001	-0.00	0.04	0.44	-0.00	-0.00	-0.00	-0.00
NAB		4.08	3.23	0.004	0.41	1.31	6.85	-4.46	1.90
OSS		0.001	0.00	0.002	0.70	-0.001	-0.00	-0.00	0.00
S		0.06	0.01	0.01	0.12	0.02	0.10	-0.002	0.02
-cons		0.70	0.97	0.00	0.00	0.64	0.76	0.96	0.99
/sigma		0.16	0.04			0.14	0.17	0.90	0.49

Source: Own calculation using STRATA11

Coefficient of Return on Equity also upholds the researcher's expected sign against this variable indicating one unit increase in Return on Equity will reduce the efficiency by 0.001 unit, the finding is supported by the studies of Singh, et al. (2015) and Masood and Ahmad (2010). The coefficient of Debt Equity ratio is negative which is as per the expectation of the study and is in line with other studies made by Singh et al. (2015), Masood and Ahmad (2010) and Gonzalez (2007). The

coefficient of Number of Active borrowers showed positive effect upon efficiency which is as per our assumption, reflecting that one unit of increase in number of active borrowers will increase efficiency to the extent of 3.23 units. Size of the MFIs measured in terms of Scale of operation showed positive impact on the efficiency of the MFI to the extent of 5.7 percent.

Tobit result in case of Undesirable Measure model shows insignificant result in case of all the variables.

9. Conclusion and direction for future research

The present study made an attempt to estimate the Technical Efficiency of selected Indian MFIs over seven years (2009-2015) and thereafter to identify the determinants of efficiency and more particularly to answer whether Sustainability has significant impact on Technical Efficiency. The study used non parametric DEA technique and efficiency is estimated under two models: BCC Model and Undesirable Measure Model, result shows that average TE score under both the models lies between 0.71 and 0.99 implying Technical Inefficiency to the extent of 29 to 1 percent Thereafter the MFIs are ranked as per their Efficiency scores under the two models (BCC and UMM) which shows that Sanghamitra and Spandana are the MFIs which are ranked first under both the Models; when Spearman's Rank Correlation is estimated, result highlights a value of 0.43 indicating a positive correlation between ranks of both the models. Subsequently determinants of Technical Efficiency (under both the models) is identified where it is found that sustainability measured in terms of OSS ratio is found to be having a significant positive impact on TE under BCC model. Besides, it has also been found that in case of Model 1 (BCC Model) Gross Loan Portfolio, Return on Equity, Number of Active Borrowers and Scale of Operation of the MFI are statistically significant at 5 percent level of significance.

As the empirical results indicate that there exist cost savings potentialities on the part of sample MFIs under both the models, therefore there is a need for cost trimming following the best practice. The managers should devote their attention in

optimizing the output and reducing the cost. Special care should be taken to vigil timely loan repayment so that rate of PAR30 could be pulled back. At the same time, since sustainability is found to be having a positive significant impact on technical efficiency, therefore, the MFIs should target on maximizing their revenues so as to absorb the costs sufficiently, as it can be comprehended from the analysis that a sustainable MFI is an efficient MFI.

References

Abayie E.F.O., Amanor K., Frimpong M. (2011), The Measurement and determinants of economic efficiency of microfinance institutions in Ghana. A Stochastic frontier approach, „African Review of Economics and Finance", vol. 2 no. 2, pp. 149-166.

Ahmed H. (2002), Financing microfinances. An Analytical study of Islamic microfinance institutions, „Islamic Economic Studies" vol. 9 no. 2, pp. 27-64.

Annim S.K. (2012), Microfinance efficiency trade-offs and complementarities between the objectives of microfinance institutions and their performance perspectives, „European Journal of Development Research", vol. 24 no. 5, pp. 788-807.

ASSOCHAM INDIA (2016), Evolving landscape of microfinance institutions in India, http://www.ey.com/Publication/vwLUAssets/ey-evolving-landscape-of-microfinance-institutions-in-india/$FILE/ey-evolving-landscape-of-microfinance-institutions-in-india.pdf [6.12.2017].

Balkenhol B. (2007), Efficiency and sustainability in microfinance, in: Microfinance and public policy. Outreach, performance and efficiency, ed. Balkenhol B., Palgrave Macmillan, Basingstoke, pp. 3-23.

Banker R.D., Charnes A., Cooper W.W. (1984), Some models for estimating technical and scale inefficiencies in data envelopment analysis, „Management Science", vol. 30 no. 9, pp. 1078-1092.

Bogetoft P., Otto L. (2011), Benchmarking with DEA, SFA, and R, Springer Science + Business Media, London.

Brau J.C., Woller G.M. (2004), Microfinance. A Comprehensive review of the existing literature, „Journal of Entrepreneurial Finance and Business Venture", vol. 9 no. 1, pp. 1-28.

Canhoto A., Dermine J. (2003), A note on banking efficiency in Portugal. New vs. old banks, „Journal of Banking & Finance", vol. 27 no. 11, pp. 2087-2098.

Casu B., Molynuex P.A. (2003), A Comparative study of efficiency in European banking, „Applied Economics", vol. 35, pp. 1865-1876.

Charnes A., Cooper W.W., Rhodes E. (1978), Measuring the efficiency of decision making units, „European Journal of Operational Research", vol. 2 no. 6, pp. 429-444.

Consultative Group to Assist the Poor (2010), Annual report, http://www.cgap.org/publications/cgap-annual-report-2010 [6.12.2017].

Cook W.D., Zhu J. (2005), Modeling performance measurement, Applications and implementation issues in DEA, Springer Science + Business Media, New York.

Cooper W.W., Seiford L.M., Tone K. (2000), Data envelopment analysis. A Comprehensive text with models, applications, references and DEA-solver software, Kluwer Academic, Dordrecht.

Cooper W.W., Seiford L.M., Zhu J. (2004), Data envelopment analysis. History, models and interpretations, in: Handbook on data envelopment analysis, ed. Cooper W.W., Seiford L.M., Zhu J., Kluwer Academic, Dordrecht pp. 1-39.

Crabb P.R., Timothy K. (2006), A Test of portfolio risk in microfinance institutions, „Faith & Economics", vol. 48, pp. 25-39.

Diop A., Hillenkamp I., Servet J.-M. (2007), Poverty versus inequality, in: Microfinance and public policy. Outreach, performance and efficiency, ed. Balkenhol B., Palgrave Macmillan, Basingstoke, pp. 27-46.

Elyasiani E., Mehdian S.M. (1990), A nonparametric approach to measurement of efficiency and technological change. The case of large U.S. commercial banks, „Journal of Financial Services Research", vol. 4, pp. 157-168.

Emrouznejad A., Anouze A.L. (2009), A note on the modeling the efficiency of top Arab banks, „Expert Systems with Applications", vol. 36 no. 3, pp. 5741-5744.

Emrouznejad A., Anouze A.L. (2010), Data envelopment analysis with classification and regression tree – a case of banking efficiency, „Expert Systems", vol. 27 no. 4, pp. 231-246.

Fare R., Grosskopf S., Lovell C.A.K., Pasurka C. (1989), Multilateral productivity comparisons when some outputs are undesirable. A Non-parametric approach, „Review of Economics and Statistics", vol. 71 no. 1, pp. 90-98.

Farrell M.J. (1957), The Measurement of productive efficiency, „Journal of the Royal Statistical Society. Series A (General)", vol. 120 no. 3, pp. 253-290.

Ferdousi F. (2013). Performance of microfinance institutions in Asia. DEA based efficiency analysis, International Conference on the Modern Development of the Humanities and Social Sciences, Atlantis Press, Paris, pp. 91-94.

Fluckiger Y., Vassiliev A. (2007), Efficiency in microfinance institutions. An Application of data envelopment analysis to MFIs in Peru, in: Microfinance and public policy. Outreach, performance and efficiency, ed. Balkenhol B., Palgrave Macmillan, Basingstoke, pp. 89-110.

Gebremichael B.Z., Rani D.L. (2012), Total factor productivity change of Ethiopian Microfinance Institutions (MFIs). A Malmquist Productivity Index Approach (MPI), „European Journal of Business and Management" vol. 4 no. 3, pp. 105-114.

Gutiérrez-Nieto B., Serrano-Cinca C., Mar Molinero C. (2007), Microfinance institutions and efficiency, „Omega", vol. 35 no. 2, pp. 131-142.

Gutiérrez-Nieto B., Serrano-Cinca C., Mar Molinero C. (2009), Social efficiency in microfinance institutions, „Journal of the Operational Research Society", vol. 60 no. 1, pp. 104-119.

Haq M., Skully M., Pathan S. (2010), Efficiency of microfinance institutions. A Data envelopment analysis, „Asia-Pacific Financial Markets", vol. 17 no. 1, pp. 63-97.

Hartarska V. (2004), Governance and performance of microfinance institutions in Central and Eastern Europe and the newly independent states (unpublished work).

Hartarska V. (2005), Governance and performance of microfinance institutions in Central and Eastern Europe and the newly independent states, „World Development" vol. 33, pp. 1627-1648.

Hassan M.K., Sanchez B. (2009), Efficiency analysis of microfinance institutions in developing countries, Network Financial Institute Working Paper No. 2009-WP-12, Indiana State University, http://indstate.edu/business/NFI/leadership/papers/2009-WP-12_Sanchez_Hassan.pdf [6.12.2017].

Isik I., Hassan M.K. (2003), Financial deregulation and total factor productivity change. An Empirical study of Turkish commercial banks, „Journal of Banking and Finance", vol. 27, pp. 1455-1485.

Kipesha E.F. (2012), Efficiency of microfinance institutions in East Africa. A Data envelopment analysis, „European Journal of Business and Management", vol. 4 no. 17, pp. 77-88.

Ledgerwood J. (1999), Microfinance handbook. An Institutional and financial perspective, The World Bank: Sustainable Banking with the Poor, Washington DC.

Liu W.B., Sharp J. (1999), DEA models via goal programming, in: Data Envelopment Analysis in the Public and Private Sector, ed. Westerman G., Deutscher Universtats-Verlag, Wiesbaden.

Malegam Committee Report (2011), Reserve Bank of India, www.rbi.org.in/SCRIPTS/PublicationReportDetails.aspx?UrlPage=&ID=608#L2 [6.12.2017].

Marakkath N. (2014), Sustainability of Indian microfinance institutions. A Mixed model approach, Springer, Dordrecht.

Martínez-González A. (2008), Technical efficiency of microfinance institutions. Evidence from Mexico. Thesis submitted to the Ohio State University.

Massod T., Ahmad I. (2010), Technical efficiency of microfinance institutions in India. A Stochastic frontier approach, http://ssrn.com/abstract=11689645 [6.12.2017].

McGuire P.B. et al. (1998), Getting the framework right. Policy and regulation for microfinance in Asia, http://www.bwtp.org/publications/pub/Chapter2.htm.

Mersland R., Strom R.O. (2009), Performance and governance in microfinance institutions, „Journal of Banking and Finance" vol. 33 no. 4, pp. 662-669.

Meyer R.L. (2002), Track record of financial institutions in assisting the poor in Asia, Working Paper, Asian Development Bank Institute (ADB), https://www.microfinancegateway.org/sites/default/files/mfg-en-paper-track-record-of-financial-institutions-in-assisting-the-poor-in-asia-dec-2002.pdf [6.12.2017].

Micrometer. (2017). Microfinance Institutions Network. Retrieved from http://mfinindia.org/latest-news/micrometer-issue-21-fy-16-17/
MiX Glossary. Retrived from www.themix.org/glossary#GlossaryTable on 5-2-2017.

Nanayakkara G. (2012), Measuring the performance of microfinancing institutions. A New approach, „South Asia Economic Journal", vol. 13 no. 1, pp. 85-104.

Nawaz A. (2010), Efficiency and productivity of microfinance. Incorporating the role of subsidies, „CEB Working Paper" no. 10.

Nghiem H.S., Coelli T., Rao P. (2006), The Efficiency of microfinance in Vietnam. Evidence from NGO schemes in the North and the Central Region, „International Journal of Environmental, Cultural, Economic and Social Sustainability", vol. 25, pp. 71-78.

Obaidullah M. (2008), Introduction to Islamic microfinance, IBF Net (P) Limited, New Dehli.

Oikocredit (2005), Social performance report, www.oikocredit.coop/publications/social-and-environmental-performance-reports [6.12.2017].

Olivares Polanco F. (2005), Commercializing microfinance and developing outreach? Empirical evidence from Latin America, „Journal of Microfinance", vol. 7 no. 2, pp. 38-40.

Pal D. (2010), Measuring technical efficiency of microfinance institutions in India, „Indian Journal of Agricultutral Economics", vol. 65 no. 4, pp. 639-657.

Pissarides F., Nussmbaumer M., Gray C. (2004), Sustainability of microfinance banks. The Ultimate goal. Working Paper, „Law in Transition on-line".

Quayes S. (2012), Depth of outreach and financial sustainability of microfinance institutions, „Applied Economics", vol. 44 no. 26, pp. 3421-3433.

Rauf S.A., Mahamood T. (2009), Growth and performance of microfinance in Pakistan, „Pakistan Economic and Social Review", vol. 47 no. 1, pp. 99-122.

Robinson M. (2001), The Microfinance revolution. Sustainable finance for the poor. The International Bank for Reconstruction and Development, The World Bank, Washington DC, http://people.virginia.edu/~sj8n/research/microfinJELreview.pdf [6.12.2017].

Rosenberg R. (2009), Measuring results of microfinance institutions. Minimum Indicators That Donors and Investors Should Track. Technical guide, The World Bank, Washington DC, https://www.cgap.org/sites/default/files/CGAP-Technical-Guide-Measuring-Results-of-Microfinance-Institutions-Minimum-Indicators-That-Donors-and-Investors-Should-Track-Jul-2009.pdf [6.12.2017].

Shylendra H.S. (2006), Microfinance institutions in Andhra Pradesh. Crisis and diagnosis, „Economic and Political Weekly", vol. 41 no. 20.

Singh S., Goyal S.K., Sharma S.K. (2013), Technical efficiency and its determinants in microfinance institutions in India. A Firm level analysis, „Journal of Innovation Economics", vol. 1 no. 11, pp. 15-31.

Soteriou A.C., Zenios S.A. (1997), Efficiency, profitability and quality in the provision of financial services, Working Paper no 97-13, Department of Public and Business Administration University of Cyprus, Nicosia.

Sriram M.S. (2010), Commercialisation of microfinance in India. A Discussion of the emperor's apparel, „Economic and Political Weekly", no. 24, pp. 65-74.

Tahir I.M., Tahrim S.N.C. (2013), Efficiency analysis of microfinance institutions in ASEAN. A DEA approach, „Business Management Dynamics", vol. 3 no. 4, pp. 13-23.

Thanassoulis E. (2001), Introduction to the theory and application of data envelopment analysis, Kluwer Academic, Dordrecht.

Thanassoulis E., Boussofiane A., Dyson R.G. (1996), A Comparison of data envelopment analysis and ratio analysis as tool for performance assessment, „Omega", vol. 24, pp. 229-244.

Tulchin D. (2003), Microfinance's double bottom line, MicroCapital Institute, Boston, www.micro capital.org [6.12.2017].

Widiarto. I., Emrouznejad. A. (2015), Social and financial efficiency of Islamic microfinance instiitutions. A Data envelopment analysis application, „Socio-Economic Planning Science", vol. 50, pp. 1-17.

Wijesiri M., Vigano L., Meoli M. (2015), Efficiency of microfinance institutions in Sri Lanka. A Two-stage double bootstrap DEA approach, „Economic Modelling", vol. 47, pp. 74-83.

Worthington A.C. (1998), The Determinants of non-bank financial institution efficiency. A Stochastic cost frontier approach, „Applied Financial Economics", vol. 8 no. 3, pp. 279-289.

Yaron J. (1994), Successful rural financial institutions, „The World Bank Research Observer", vol. 9 no. 1, pp. 49-70.

Zerai B., Rani L. (2011), Is there a trade-off between outreach and sustainability of microfinance institutions? Evidence from Indian Microfinance Institutions, „Research Journal of Finance and Accounting", vol. 2 no. 11, pp. 2222-2847.

Determinanty wydajności instytucji mikrofinansowych w Indiach: dwuetapowa analiza DEA

Streszczenie

Cel: Instytucje mikrofinansowe (ang.: *Microfinance Institutions* (MFIs)) wyłoniły się w Indiach jako główny gracz z punktu widzenia świadczenia usług mikrofinansowych. Z tego względu instytucje te muszą być stabilne finansowo, aby osiągnąć założony cel w postaci podwójnych zysków (ang.: *double bottom-line*). Poza tym, indyjskie MFIs nie mogą się ochronić przed klątwą niespłacania pożyczek. Dlatego też celem niniejszego artykuły jest pomiar kondycji indyjskich MFIs oraz określenie, czy podtrzymywalność ma znaczący wpływ na wydajność MFIs.

Metodyka badań: Aby zdiagnozować kondycję indyjskich MFIs, wykorzystano nieparametryczną metodę obwiedni danych (ang. Data Envelopment Analysis (DEA)). Dla bardziej dogłębnej analizy zastosowano dwa modele DEA (zorientowany na nakłady model BCC oraz zorientowany na wyniki Undesirable Measure Model). Następnie użyto w badaniach regresji Tobita w celu określenia czynników oddziałujących na wydajność MFIs, a w szczególności w celu odpowiedzi na pytanie, czy podtrzymywalność ma znaczący wpływ na wydajność. W badaniach wykorzystano uzyskane z MiX Market dane dotyczące 31 indyjskich MFIs w latach 2009-2015.

Wnioski: Wyniki badań wskazują, że techniczną wydajność MFIs można oszacować na poziomie 79% w modelu BCC oraz 98% w *Undesirable Measure Model*. Indyjskie MFIs mogą osiągnąć granicę produkcji, jeśli zdołają obniżyć złe wyniki (określone przy portfelu ryzyka 30) do poziomu około 14%. Ponadto badania potwierdziły, że podtrzymywalność (określona przez samowystarczalność operacyjną) ma pozytywny wpływ na wydajność.

Wartość artykułu: Dotychczasowe badania indyjskich MFIs nie koncentrowały się na tym, jak MFIs mogą stać się wydajne poprzez redukcję niepożądanych / złych wyników. Ponadto żadne dotychczasowe badanie nie analizowało wpływu podtrzymywalności na wydajność indyjskich MFIs. Z tego względu niniejszy artykuł stara się wypełnić istniejącą lukę badawczą.

Implikacje: Wyniki badań mogą być przydatne dla indyjskiego przemysłu mikrofinansowego w celu poprawy jego wydajności. Wyniki mogą być też wykorzystane przez Indyjski Bank rezerw (ang. *Reserve Bank of India*, aby stworzyć wspólną miarę dla klientów MFIs w połączeniu z zaciąganiem pożyczek w MFIs.

Słowa kluczowe: instytucje mikrofinansowe, podtrzymywalność, metoda obwiedni danych (DEA)

JEL: G21, C67, C33