International Journal of Economics, Commerce and Management
United Kingdom Vol. IV, Issue 1, January 2016
http://ijecm.co.uk/ ISSN 2348 0386

EVALUATION OF EFFICIENCY OF MICROFINANCE INSTITUTIONS IN KENYA: AN APPLICATION OF DATA ENVELOPMENT ANALYSIS

Phares Ochola
Kenya School of Monetary Studies, Kenya
ocholap@ksms.or.ke

Abstract

The study applies Data Envelopment Analysis (DEA) to evaluate relative technical efficiency of MFI which are not only registered by AMFI but also those that have reported complete data in the MixMarket database. The inputs are total operating expenses and total assets while the outputs are financial revenue and gross loan portfolio. In order to comply with the requirement of DEA that the some of the output variables must be equal to one third of the nine (9) DMUs studied, the evaluation is undertaken by using each of the output variables separately. Both reference sets (benchmarks) for inefficient MFIs and their improvement potential is also computed. Results show that an average efficiency of 50.6% under both the financial revenue and gross loan portfolio output scenarios with only 89% and 78% of the MFIs being efficient under each scenarios respectively. A t-test shows that there are no statistically significant differences between the two sets of efficiencies. On references sets and as expected, all the inefficient MFISs have the same benchmarking peers under each scenario Findings on inefficient MFIs' improvement potentials shows that there is no significant difference between the target values for each input under both his financial revenue and gross loan portfolio scenario. This result shows that changing the output variable while keeping the input variables the same does not produce a significantly different efficiency level and hence target values.

Keywords: Data Envelopment Analysis, Microfinance Institutions, Slacks, Target Values, Improvement Potential

INTRODUCTION

According to Ferdousi (2013), the practice of Microcredit of rendering service to the poor segments of society who are usually underserved by commercial banks can be traced back to the 70s and 80s in Bangladesh's Grameen Bank. Over the years, this financial innovation has been replicated especially in a number of developing economies. Developments in the sector have seen a move from the narrowly defined microcredit function to all encompassing microphones with its commercialization objective. Like in Bangladesh, the emergence of Microfinance Institutions (MFIs) in developing countries arose from the need to provide alternative sources of finance for the majority of the largely poor segments of the population, thus enhancing these countries' financial inclusion agenda (Robinson, 2003 and CGAP, 2009).. There is little doubt that since inception, MFIs has played the critical role with marked successes. There is indisputable evidence that through the MFIs, the poor have been enabled to gradually build their assets, develop their enterprises and enhance their earning capacity among

In the East African region, the emergence of MFIs was a consequence of financial sector reforms in the 1990's whose aim was to develop sustainable, efficient and effective financial systems with the capacity to serve the low-income segment of the society and thereby contribute to economic growth and reduce poverty. Since then, the institutions have seen significant growth. For example, the growth of MFIs has been more significant in Kenya and Rwanda with 22 MFIs 1.3 million having loaned 1.9 billion in 2012 the figure for Rwanda being 24 MFIs 0.8 million having loaned 0.87 billion (Market Information Exchange, (2012) Still in Kenya, according to AMFI Annual report (2013), the total asset of the sector reached the 298.4bn as of December, 2012, this being dominated by banks which represented 72% of the total. The relative market share consisted of 4 banks, 7 DTMs and 21 credit only MFIs representing 85%, 11% and 4% respectively. This scenario succinctly illustrates the significant position of MFIs in the Country's economy. Questions however have persisted on their efficiency especially given that MFI target the small and medium enterprises. Literature is littered with a number of theoretical models that have widely been used to assess efficiency levels of users of inputs to producer of output with the most prominent methodology being the non-parametric data envelopment analysis (DEA)

Data Envelopment Analysis (DEA) is a relatively new data-oriented approach for evaluating the technical efficiency of a set of peer entities called Decision Making Units (DMUs). DEA provides a single measure and easily deals with multiple inputs and multiple outputs. Since the DEA technique was first developed, it has been widely applied to industries as diverse as health care (Bhat, Verma, & Reuben, 2001; Jacobs, Smith, & Street, 2006), Banking (Hassan &

Sanchez, 2007), and transportation (Pathomsiri, 2006) and many other industries and organizations. Further, DEA-approach has proved especially valuable in cases where there are non-marketed inputs or outputs and/or cannot be derived or agreed upon among different DMUs. In this study, DEA is used to assess the efficiencies of the MFIs in Kenya

This paper is organized as follows: sub-Section 1.1 gives study problem, section 1.2 purpose and objectives of the study, section 2 gives a brief review of related literature section 3: methodology: model specification, section 4 gives Data and specification of inputs and outputs, section 5: findings and discussion and finally section 6: conclusion, limitation and recommendations.

Study Problem

The phenomenon growth of the sector in Kenya just as in majority of the developing economies has continued to elicit debate on whether this performance is accompanied with efficient use of scarce resource to produce the much need output. As pointed by Ferdousi (2013), MFI development, hitherto dependent on donor funding, has increasingly become dependent on internally generated funds and other inputs. The paradigm shift has exerted more pressure on the institutions to employ resources (input) more efficiently to realize desired results (outputs) and hence the efficiency question. There are very limited studies in the efficiency of MFIs, especially in the poor and developing countries such as in Sub-Saharan Africa region. Hence, the study on efficiency in Kenya is significant as it will contribute to the body of knowledge: theoretically and practically.

This study contributes to the existence empirical literature in two key ways. First, contrary to the previous studies which does not test for efficiency measurement on various output scenarios, our study determines if changing output variables while keeping input variables have a significant effect on efficiency levels and hence the improvement potentials for inefficient DMUs. The objectives of this study are therefore twofold: a) assess the efficiency levels of selected microfinance institutions under selected output scenarios and b) assess the improvement potential of inefficient MFIs under the selected output scenarios.

REVIEW OF RELATED LITERATURE

MFI efficiency refers to efficient conversion of inputs to outputs to meet the desired social and economic objectives. Efficiency in Microfinance institutions can be divided into two components in order to capture the double bottom line mission of the institution, the financial efficiency and social efficiency. A number of approaches have been used to study MFI efficiency globally. Balkenhol (2007) asserts that like in majority of conventional financial sector institutions, MFI

productivity and efficiency has traditionally been measured by conventional financial ratios or indicators. This notwithstanding, majority of recent studies have increasingly used new methodologies such as data envelopment analysis (DEA) or stochastic frontier analysis (SFA) to assess MFI efficiency

Guitierrez-Nieto, et al (2007) investigated efficiency of MFIs in Latin American MFIs using the non-parametric data envelopment analysis approach. The study used total Assets, operating costs and number of employees as inputs with number of active female borrowers, average loan balance per borrower per Gross National Index and gross loan portfolio and financial revenue as output variables. The study found that Non-Governmental Organizations (NGOs) and non-bank financial institution were the most efficient.

Using DEA methodology, Abdelkader (2012) assessed the efficiency of microfinance institutions in the MENA region over the period 2006-2009. The inputs selected in this study were: total assets, operating expenses, and number of employee, while the outputs used were of two types: financial revenue (and benefit to the poorest. The result showed that average efficiency of most countries of the region had decreased over the period under study. The results further revealed that efficiency significantly differs by legal status among other factors.

A study by Ferdousi (2013) attempted to investigate the comparative performance of microfinance institutions (MFIs) in three Asian countries namely Bangladesh, India and China. Using data envelopment analysis, the study identified best practice MFIs and their efficiency determinants using tobit regression analysis. Findings revealed that MFIs in China and India performs more efficiently than those of Bangladesh under constant return to scale technology but under variable return to scale technology MFIs in Bangladesh perform more efficiently than others. Tobit regression analysis further 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.

Hassan & Sanchez, (2009) used DEA methodology under two approaches, the intermediation and the production approach, to undertake a comparative study on MFI efficiencies in North Africa, Latin America and Middle East. The study used operating expenses, total financial expenses and labour inputs and gross loan portfolio, total funds and financial revenues outputs under the intermediation approach. Regarding the production approach, the study used operating expenses and labour and number of active borrowers as the only output. The study found that banks and credit unions MFIs) had a higher technical efficiency than non-profit and non-financial institutions.

Haq, et.al., (2010) using the production approach of non-parametric data envelopment analysis. Examined cost efficiency of 39 MFIs in three continents, Asia, Latin America and

Africa. Regarding input variable selection, while under the production approach the study used Labor, Cost per borrower and cost per saver the study used Total number of staffs/personnel and Operating/administrative expense under the intermediary approach. On the output side, Number of borrowers per staff member and number of savers per staff member were used under the production approach while gross loan portfolio and Total savings employed under the intermediary approach. Results showed that non-governmental microfinance institutions were the most efficient as compared to bank-microfinance institutions which were more efficient under intermediation approach.

Nawaz (2010) study on the role played by subsidy on MFIs efficiency and productivity analysis used inputs such as positive subsidy, total assets, operating expenses, and number of employee, while the outputs used were of two types: financial revenue (for financial performance and benefit to the poorest (for social performance). The study used a 3 stage approach of by fist finding technical and pure efficiency scores through DEA followed by deriving DEA-Malmquist indices for internal productivity and finally undertaking Tobit Regression analysis to test a series of hypotheses concerning the relationship between financial efficiency and MFIs productivity, organization, outreach, sustainability and social impact.

A study by Ahmad (2011) undertook to estimate the efficiency of MFIs in Pakistan using Data Envelopment analysis methodology under both the input oriented and output oriented constant return to scale (CRS) and variable return to scale (VRS) assumptions. The output variable set used in this study were gross loan portfolio and number of active borrowers while selected input set was total assets and number of personnel . The study found that inefficiencies in Pakistan were majorly technical in nature and that improvements in managerial skills and technology were the most needed interventions to making inefficient MFIs realize efficiency status.

In East Africa a study by Kipesha, (2012) evaluated the efficiency of Microfinance institutions operating using non parametric approach (Data Envelopment Analysis). The study used production approach to estimate efficiency scores of 35 MFIs under both constant and variable returns to scale. The study found that MFIs in East Africa have higher efficiency scores in average. It was further found that on average the banks and non-bank financial Institutions were more relatively efficient compared to NGOs and Cooperatives and that inefficiency was mainly caused by technical inefficiency. NGOs and Cooperatives are recommended to consider the market structure changes, technology and increased competition as improvement strategies.

METHODOLOGY

Decision Making Units (DMUs) and Variable Selection

Data used in this study was drawn from Mix Market database and only for MFIs reporting complete information on the target variable. As mentioned earlier, regarding variable selection, various studies have used various input and output in the evaluation of MFI efficiency. In this study, given data availability, we use 5 input variables and 3 output variables in this study (Table 1)

Table 1: Selected Input and Output Variables

Variable	Name (Notation)	Definition	Measurement Unit
Input	Total assets (TA)	Total of all account assets	Ksh.
Input	Total Expenses (OC)	Total expenses including personnel and Administrative expenses,	Ksh.
Output	Financial Revenue (FR)	Revenue generated from the gross loan portfolio and from investments plus other operating revenue	Ksh.
Output	Gross loan Portfolio (GL)	Outstanding principal balance of all of the MFI's outstanding loans	Ksh.

To ensure meaningful efficiency scores, the number of MFIs (DMUs) must be large enough relative to the number of input and output variables. A rule of thumb is given by Banker, Charnes and Cooper (1984) as [s+m ≤ n/3], where s is the number of output variables, m the number of input variables, and n the number of DMUs. In this research, the number of input and output variables is (2+3), which is less than one-third of the number of DMUs. This is the rule that has been used in this study. In compliance with this rule and to test whether there is a significant difference between the DMU efficiencies derived from different output variables scenarios as follows;

Scenario 1: One output variable (Financial Revenue) and two input variables Total Assets and Total Expenses)

Scenario 2: One output variable (Gross Loan portfolio) and two input variables Total Assets and Total Expenses)

Data Collection

Secondary data (Table 1) for the 2014 period on the selected input and output variables were obtained from the Mix-Market database

Table 1: Input and Output Variable Data

	Inputs (Millions of Kenya Shillings)		Outputs(Millions of Kenya Shillings)	
	Financial Revenue	Gross Loan Portfolio	Total Assets	Total Expenses
AAR Credit Services	2.734	5.741	7.784	2.397
Faulu MFB	34.103	102.561	143.833	30.521
KWFT MFB	74.656	297.748	297.748	70.358
Musoni	2.838	5.357	8.916	3.384
Platinum Credit	12.635	18.919	21.343	7.272
Rafiki MFB	12.876	38.534	65.929	12.619
SISDO	1.307	3.224	7.198	1.425
SMEP MFB	6.882	20.773	26.925	6.901
VISION FUND KENYA	232.606	506.153	10.528	3.325

Source: Mix Market database (2015)

DEA Model Specification

In this study we use the DEA method to assess the level of performance of MFIs efficiency in Kenya. Due to the fact that in MFIs, it is easier to control inputs rather than outputs, the DEA BCC input oriented model with variable return to scale (VRS) is used to compute MFI efficiencies.

Data Envelopment Analysis (DEA) methodology, was first introduced by Charnes, Cooper and Rhodes (1978) measures the relative efficiency of s Decision Making Unit , DMU_0 in comparison with a set of ‘‘n’’ DMUs in a given sample. Commonly know as CCR model after the names of the authors, DEA is a generalization of efficiency model proposed by Farrell (1957). The CCR model measures relative efficiency of a number of entities commonly referred to as Decision Making Units (DMUs) using a set of multiple inputs to generate a set multiple outputs.

DEA’s key objective is to establish a level of relative efficiency ($1 \leq \theta \leq 1$) for each DMU by comparing its quantities of inputs and outputs with other DMUs. Regarding the BCC input oriented model.

By defining effeminacy as the weighted sum of outputs over the weighted sum of inputs, the following equation is developed:

$$h_0(u,v) = \sum_r u_r y_r / \sum_r v_j x_{j0} \quad \text{(i)}$$

Using the inputs and outputs of this research the equation cam be written as follows

$$h_o(u,v) = \frac{u_1(O_i)}{v_1(TA) + v_2(TE)} \quad \text{(ii)}$$

Where:

h_o: Relative efficiency of the MFI

O_i Either Financial Revenue (FR) or Gross loan Portfolio (GL)

TA: Total Asset

TE: Total Expenses

u_r: Weight given to output r=1

v_j: Weight given to inputs j=1,2

$$\min \in \vartheta - \in (\sum_{j=1}^{4} s_j^{-} + \sum_{r=1}^{3} s_r^{+}) \quad \text{(iii)}$$

Subject to:

$$\sum_{j=1}^{9} x_{ij} \lambda_j + s_i^{-} \geq \theta x_{io} \quad i = 1,2, \quad \text{(iv)}$$

$$\sum_{j=1}^{9} y_{rj} \lambda_j - s_i + \geq \theta y_{io} \quad i = 1 \quad \text{(v)}$$

$$\lambda_j \geq 0 \quad \text{and} \quad j = 1,2,3,4....9$$

For the BCC model, the following constract is added

$$\sum_{j=1}^{9} \lambda_j = 1$$

Where

λ_j : is a matrix of intensity factos that defines the hypothetical DMUto which DMU_{jo} is compared

Θ : a radial (input reducing measure of technical Technical Efficiency

S_i^{-} and S_r^{+} are slack variables used to convert the inequalities to equalities

$\in > 0$: An Archimedian element defined to be smaller than say a postive real number

DEAP software version 2.1 is used in this study to measure the technical efficiency of the MFIs based on BCC input oriented model. It is also used to find the needed improvements of the inefficient MFIs in order to make them 100% efficient.

EMPIRICAL FINDINGS AND DISCUSSION

BCC Efficiency Results

This section gives that results that were obtained by making the variable returns to scale (VRS) assumption. The efficiency scores shows which of the nine (9) microfinance institutions are found to be attain some level of efficiency relative to the most efficient frontier. Table 2 shows

the DEA efficiency scores and reference sets for each MFIs under the two output scenarios of financial revenue and gross loan portfolio while keeping the input variables unchanged.

Table 2: Variable Return to Scale DEA Efficiency and Reference sets

		Financial Revenue output dependent		Gross Loan portfolio output dependent	
No	**MFIs**	Technical Efficiency	Reference Sets	Technical Efficiency	Reference Sets
1	AAR Credit Services	0.927	9 7	0.927	9 7
2	Faulu MFB	0.056	9 7	0.059	9 7
3	KWFT MFB	0.029	9 7	0.031	9 7
4	Musoni	0.810	7 9	0.809	7 9
5	Platinum Credit	0.345	7 9	0.342	7 9
6	Rafiki MFB	0.120	9 7	0.124	9 7
7	SISDO	0.767	7	1.000	7
8	SMEP MFB	0.270	9 7	0.272	7 9
9	VISION FUND KENYA	1.000	9	1.000	9
	Mean	0.506		0.506	

Firstly, the average efficiency under both financial revenue output and gross loan portfolio scenarios is 0.506 even though there are some differences between corresponding efficiency values. For example, one MF is efficient under financial revenue output scenario while two are efficient under the gross loan portfolio output case. We then proceeded to test whether there is a significant difference between the two sets of technical efficiency values. By defining μ_{FR} and μ_{GRL} as the mean efficiency derived using financial revenue and gross loan portfolio outputs respectively, the following hypotheses were designed

$H_0 : \mu_{FR} = \mu_{GRL}$.

$H_0 : \mu_{FR} \neq \mu_{GRL}$

A student t-test at 5% level of significance produced a p-value of 0.44 which is greater than the level of significance 0.05. This result is confirmed by a correlation result of 0.98 which implies that either of the two output variables can be used to measure the DMUs technical efficiency. From these findings, it is concluded that there is no sufficient evidence from the sample to show that changing output variables would lead to a significant change in DMU efficiency on average. Regarding reference sets, it is noted as expected that all inefficient MFIs have the same (reference sets) benchmarks. The inefficient DMUs can improve their performance by using the best practices (production plans) from their peers to efficiently transform their inputs to outputs. Specifically inefficient MFIs should adopt their peers benchmark policies and techniques in the

production of services. Interestingly in this study all the inefficient MFIs can benchmark on two DMUs: 7=SISDO and 9=Vision fund.

Assessment of Improvement Potential

As alluded to earlier, Data Envelopment Analysis models derive input and output weights through optimization. Based on that, units can be classified into efficient and inefficient. In inefficient units, DEA indicates target values of inputs and outputs which would lead to efficiency that is potential for improvement. DEA target value is the amounts by which an inefficient MFI should decrease/increase its inputs/output to become efficient. Target input and output levels are the results of respective slack values added to proportional reduction amounts. For the inefficient DMUs, the targets for input variables comprise proportional reduction in the input variables value. Regarding outputs however, these are obtained by multiplying efficiency scores by the outputs and then adding the slack values to the result. Table 3 shows the target values of all the inputs and outputs in the context of financial revenue and gross loan portfolio efficiency scenarios.

Table 3: DMUs Target Values

		Target Values (Millions of Kenya Shillings)					
No	**Microfinance institution (MFI)**	**Financial Revenue output dependent**			**Gross Loan portfolio output dependent**		
		Financial Revenue	**Total Assets**	**Financial Expenses**	**Gross Loan portfolio**	**Total Assets**	**Financial Expenses**
1	AAR Credit	2.73	7.22	1.44	5.74	7.22	1.43
2	Faulu MFB	34.10	7.67	1.69	-	7.86	1.80
3	KWFT MFB	74.66	8.25	2.03	-	8.58	2.21
4	Musoni	2.84	7.22	1.44	5.36	7.21	1.43
5	Platinum Credit	12.64	7.36	1.52	18.92	7.30	1.48
6	Rafiki MFB	12.88	7.36	1.52	38.53	7.43	1.56
7	SISDO	1.31	7.20	1.43	3.22	7.20	1.43
8	SMEP MFB	6.88	7.28	1.47	20.77	7.31	1.49
9	Vision Fund	-	10.53	3.32	-	10.53	3.32

Figures 1 and 2 respectively illustrate the relationship between actual and target values for total asset and financial expenses under the gross loan portfolio output scenario

Figure 1: Total Asset Actual and Target Values (Millions Kenya Shillings)

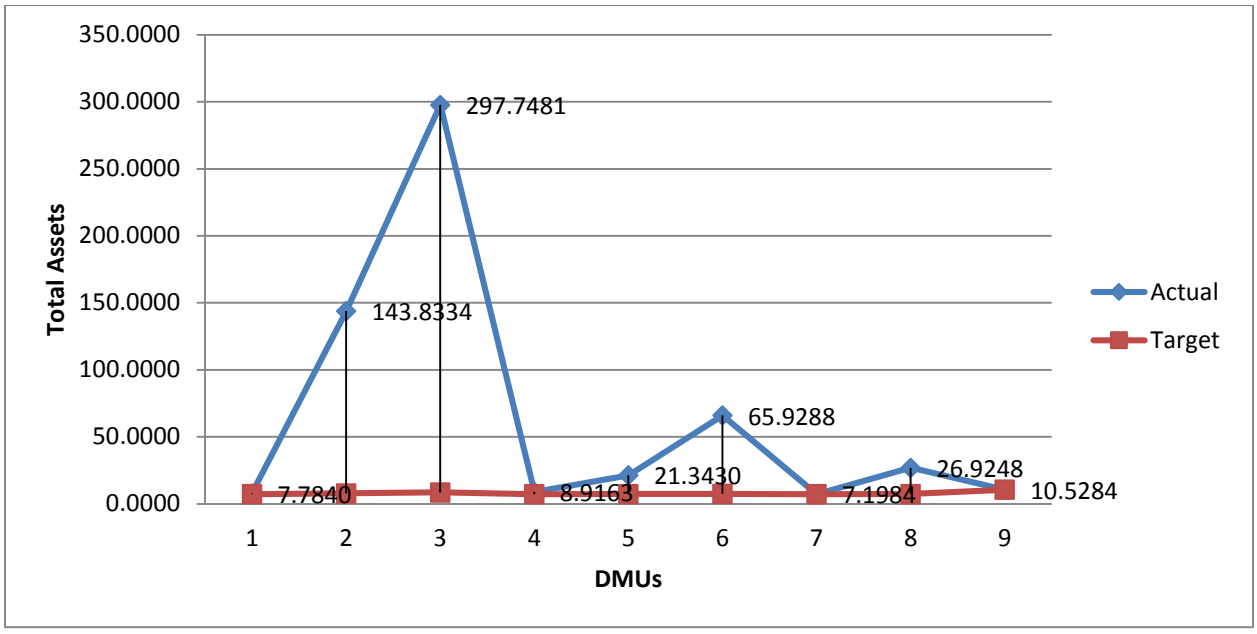
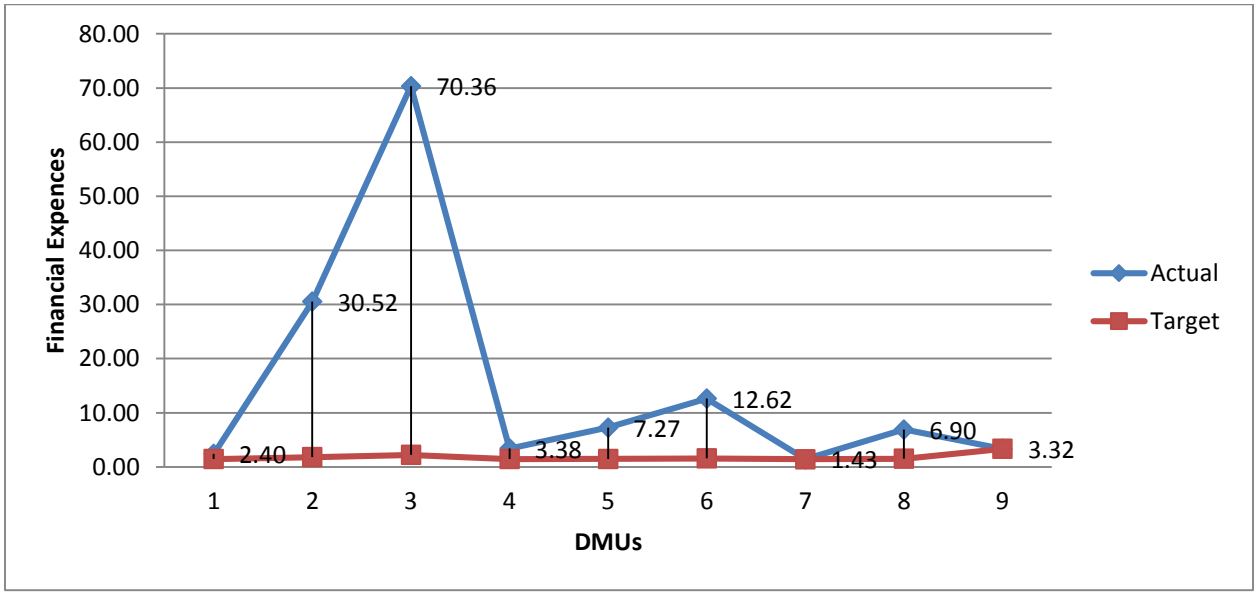


Figure 2: Financial Expenses Actual and Target Values (Millions Kenya Shillings)



Clearly, the two inputs exhibit surprisingly the same trend, this a part from the fact that as expected, target values are equal for efficient DMUs are equal. Similar results were realized under the financial revenue scenario. Further, we proceeded to perform a t-test at 5% level to determine if there is a significant difference between the mean target values under the financial

revenues and gross loan portfolio output scenarios. A p-value of 0.45 was obtained, once again, implying that changing the output variable invariably has no effect on the inputs target values.

CONCLUSIONS AND RECOMMENDATIONS

In this research we used the input minimizing Data Envelopment Analysis approach with variable return to scale to measure the technical efficiency of selected nine microfinance institutions in Kenya.

The objectives of the study were twofold: a) assess MFI efficiency levels under two output scenarios: financial revenue and gross loan portfolio; and b) assess the improvement potential of inefficient MFIs under the same output scenarios.

Under both scenarios, an average technical efficiency score of 0.506 was obtained showing that changing the output variable while keeping the inputs variables the same does not affect the average technical efficiency score. A t- test of differences between the mean scores confirmed this result. Analysis of correction between the MFIs technical efficiencies under for the two cases produced the same evidence.

Regarding improvement potential for each inefficient MFIs, the results show that the six inefficient DMUs under both scenarios can improve their performance by learning from SISDO and Vision Fund Kenya as benchmarking institutions. Similarly, on input target values, it was found that efficient MFI had their target values equal to the actual value and that when compared under the two scenarios, the emerging actual and target values trends were the same A t-test at 5% level of significance further showed that there was no statistically significant difference between the mean target value under the financial revenue and gross loan portfolio output scenarios.

From the findings, it is recommended that MFIs in Kenya should improve their efficiency by better use of resources and reducing the amount of waste with respect to inputs. It is further, recommended that in order to provide a more detailed insight on MFIs efficiency, an empirical assessment of their technical efficiency should be undertaken overtime by categorizing the MFIs in terms of their legal status including regulation. In addition, to bit regressions analysis should follow to determine which of the selected input and output factors have the most statistically significant effect on efficiency.

LIMITATIONS

The key limitation in this study is that it used deterministic and non-parametric data envelopment analysis methodology. Further, in light of availability of complete data in Mix Market database, only a limited number of MFIs were used leading to the use of a small number

of input and output variables. Further, it would have been appropriate to compare regulated and non-regulated MFIs with availability of complete data for both cases. However, due to data limitation, this was not possible.

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