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Efficiency Analysis of Commercial Banks in Tanzania: An Application of Data Envelopment Analysis (DEA) Approach: The Case study of Regional & Small Banks

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Abstract
The paper analyzes the efficiency of Regional & Small commercial banks in Tanzania from 2006-2012. It uses a non-parametric approach, the input-oriented data envelopment analysis (DEA) to analyze banks' efficiency. The findings identify four banks (57.1%) to be fully efficient in the year 2006, three banks in 2007 and 2008, one bank in 2009, 2010 and 2011 and four banks in the year 2012. The overall mean efficiency of banks is 90.4%, this means that, banks could have reduced the inputs by 9.6% without affecting the level of output. The results also show that, four banks, Dar es Salaam Community Bank (DCB), Uchumi Commercial Bank, Mbinga Community Banks and Mwanga Community Bank are the most efficiency banks.
Keywords: Bank efficiency, Banking Sector in Tanzania, Data Envelopment Analysis

1. Introduction

In Developing countries such as Tanzania, banks play a major role in financial development. This is especially true since stock and corporate bond markets are usually underdeveloped. Moreover, the development of the banking system and improving of its performance is related to higher economic growth of a country. In Tanzania commercial banks contribute to economic growth through their financial intermediation role. Better performance of commercial banks is pro foundation for product innovation, diversification and efficiency of the commercial banks (Hempell, 2002). The stability of commercial banks as whole in the economy depends on better performance and efficiency level.

Financial institutions such as banks when they are efficient allow mobilizing saving from diverse sources and allocate it to more productive activities, what benefits not only investors and beneficiaries of the investments but also the whole economy (Gulde, at el 2007). Indeed, a banking system which efficiently channels financial resources to productive use is a powerful mechanism for economic growth (Levine 1997).

Hence, bank efficiency reflects the comprehensive evaluation of all the input and output projects, including the operating achievements that can be inferred from various kinds of financial reporting and the operating outcome that cannot be taken into account in financial analysis. Bank efficiency is not only the manifestation of a bank's comprehensive competitive strength, but also, up to now, the most comprehensive evaluation index of achievements (Chen *at el 2007)*

Therefore, the efficiency analysis of commercial banks in Tanzania would benefit the managerial and administrative personnel a lot in that they could have a clear understanding of their status in the national and international banking industry and the gap between their own banks and other banks through the analysis so as to adopt the measures with a clear aim and what is more, improve management and administration and realize sustainable development.

1.1 Background of Regional & Small Banks in Tanzania

The banking sector in Tanzania has undergone substantial structural change since financial sector reform in 1991. During that period of reforms the banking sector has experienced drastic and comprehensive changes; the sector underwent major transformations and more numbers of banks were established and commercial banks constitute the largest part of the banking system in Tanzania. Commercial banks in Tanzania may be subject to the regulations of the Bank of Tanzania, as contained under the provisions of the Bank of Tanzania At of 1995. Besides, there are other laws that may govern all commercial bank transactions, including the Banking and Financial Institutions Act and the Foreign Exchange Act. These acts specify various guidelines that have to be complied with in risk asset management, and credit and exposure limits. The number of commercial banks operating in the country increased to 45 by the end of October 2011 from the 42 registered in the same period in

the year 2010, according to the Central bank of Tanzania the increase in the number of banks in the country has pushed up the number of branches by almost 8 per cent from 464 branches in 2010 to 498 branches in 2011.
In order to assist Tanzanians to have access to banking services in their localities, The Government encouraged the formation of regional & small banks and financial institutions in various parts of the country; hence in April 2003 the Banking Financial Institutions Act (BFIA) was amended to give powers to the Bank of Tanzania to prescribe lower capital threshold for establishment of regional and community banks. As of December 2010, there were eight regional/community & small banks operating in Tanzania, namely Mbinga Community Bank, Dar es Salaam Community Bank, Mwanga Community Bank, and Mufindi Community Bank. Others are Kagera Farmers Co-operative Bank, Kilimanjaro Cooperative Bank Limited, Njombe Community Bank, and Tandahimba Community Bank (Bank Tanzania, 2011). Commercial banks in Tanzania are classified into three main groups: large banks, Medium banks and Regional & Small Banks. The regional & small banks also expanded their market share of the sector's total capital from 19 percent to 26 percent and loans from 20 percent to 23 percent (Tanzania bank Survey, 2012).

The study aims at assessing the efficiency of banking sector in Tanzania focusing on Regional & Small commercial banks employing Data Envelopment Analysis (DEA) approach, in order to identify the better strategies for improving banks efficiency, so that they will be able to fully play their role of financial intermediary in Tanzania. The study will contribute to the banking literature by examining the efficiency of banking sector in Tanzania in the recent period (2006-2012).

The research questions addressed in this paper are: Are commercial banks in Tanzania efficient? Has bank efficiency increased over the years? What are the main sources of inefficiency? What are measures should be taken to improve banks efficiency? These findings may provide some important insights to both policy makers and bank managers.

The remainder of the paper is structured as follows. Next section discusses the literature review for banking efficiencies studies. In section 3 we expose the definitions of inputs, outputs, while section 4 introduces the methodology, while section 5 presents empirical results. Finally, section 6 provides conclusion

2 Literature Review

The term efficiency is related to the ability to produce a result with minimum effort or resources. It measures how close a production unit gets to its production possibility frontier, which is composed of sets of points that optimally combine inputs in order to produce one unit of output. It is one of the key concepts for financial institutions. It has been extensively studied due to its importance. Mainly, the studies making typical comparisons of bank performance can be divided into two categories: (1) those which use simple aggregate bank ratios relating cost to revenues or assets, and (2) frontier technique which measures a bank's efficiency by its distance to the efficient frontier (Laeven 1999). In this paper we will use the particular frontier technique of Data Envelopment Analysis (DEA) to analyze the efficiency of the Tanzanian banking system.
Originally, DEA was first introduced in the work of Farrell (1957) and then developed in the work of Charnes et al. (1978) where they described it as is a linear programming technique which gives a single measure for efficiency, the method has the ability to simultaneously handle multiple inputs and outputs without requiring any judgrnents on their relative importance, so it does not need a parametrically driven input and output production function.
Since, this model extensively used in different sectors of economy starting from the evaluation of fast-food restaurant chains up to the assessment of the performance of large banks in the Japanese financial sector (Harada 2005). However, DEA focuses primarily on the technological aspects of production correspondences, it can be used to estimate technical and scale efficiency without requiring estimates of input and output prices. Thus, this approach has been used extensively in the regulated sector (e.g., Banker et.al. 1986) and the non-profit sector (Lewin, Morey and Cook, 1982). Whereas, the first application of this technique into the banking context can be observed in a work of Sherman and Gold (1985); they used it to explore some operating aspects of bank branches. Despite of the huge amount of literature which applied DEA into the banking sector, most of them assessed the performance of banks in the advanced economies. Most bank efficiency studies look at the US or other developed countries; while we can mention few studies considering some African countries. Drake (2001) investigated relative efficiencies of the banking sector in UK from period1984 to 1995 employing DEA on a panel data sample and analyzed productivity change over the sample period using Malmquist productivity indices. His finding clear evidence of increasing returns to scale for smaller banks. However, most banks decrease return well before real assets reach 35 billion pound. Unlike the evidence from US banking studies, in Drake's study, scale inefficiency of UK banks appears to be more severe than X-efficiencies. Elisabetta et al

(2006) investigated the consistency of efficiency scores achieved by Stochastic Frontier Analysis and Data Envelopment Analysis based on sample of 34,192 observations for all German universal banks between 1993 and 2004. The mean efficiency estimated by SFA at 84% is significantly different from only 55% for DEA. Resti (1997) investigated the efficiency of Italian banks employed both SFA and DEA based on panel data of 270 banks from 1988-1992. The results showed that, the X-efficiency estimated by SFA is about69.6 percent; the same result was achieved when using DEA. Bhattacharyya et al (1997), employing DEA analysis on sample of 419 Indian banks for the period of 1986-1991, he found that, the average efficiency score of 80.35 percent in which Publicly owned banks achieved the highest average efficiency while Foreign-owned and privately owned banks achieved substantially lower average efficiencies. Quey-Jen Yeh (1996) made an attempt to incorporate DEA scores with the widely used bank financial ratios. By examining the performance of 6 large banks of Taiwan during 1980s he concluded that such integration of two methods is very useful for understanding the main inefficiency sources of banks. Frimpong (2010) examined the relative efficiency of the banks in Ghana during the year 2007, which investigates the efficiency and profitability linkage by employed Data envelopment analysis (DEA) approach with Intermediation Model Input-Output Specification with 3 state-owned sector banks, 8 private domestic banks and 11 foreign banks. He found only four (out of 22) banks were efficient and 18 inefficient banks had their efficiencies ranging from 33% to 89%. The average technical efficiency for the banking sector was 74% a, the Domestic private banks were the most efficient group of banks in Ghana, their average efficiency level being 87%, followed by foreign banks average of 72% and lastly, the state-owned banks with an average score of only 51%. Eman (2012) examined commercial banks efficiency in 3 North Africa countries namely Libya, Tunisia and Algeria from 2002 to 2009 using data envelopment analysis (DEA, he found that, there was striking differences in technical efficiency of the banks. Libyan banks indicated had the higher mean technical efficiency; it was 0.94 comparing with Tunisia and Algeria 0.78 and 0.47 respectively. In addition, the results showed that the technical efficiency changes grew by average 1.238 % annually for all the banks of the study. Kamau (2011) investigated the intermediation efficiency and productivity on banks in the period after liberalization of banking sector in Kenya, using Data Envelopment Analysis (DEA) approach. The results of the study indicated that, the banks were not fully efficient in all respects; however they performed fairly well during the period under study. Aikaeli (2008) examined commercial banks efficiency in Tanzania using data envelopment analysis (DEA) .The results indicated that, In terms of technical efficiency, foreign banks ranked the highest, followed by small banks and then large domestic banks; while regarding scale efficiency, small banks ranked the highest followed by international banks and then large domestic banks.

3. Defining Banking Inputs and Outputs in DEA Model

While inputs and outputs are easily identified in most businesses, that is, it is not for the case in banking sector, therefore, the specification of input and output for banks is another area, which requires critical investigation. In the literature, the issue of specification of inputs and outputs of the banks for the consideration of X-efficiencies is still the major problem and not solved.

Lack of consistency and consensus in inputs and outputs specification in the literature on the theory of banking sector leaves the definition of inputs and outputs issue unsolved in the application of various banks efficiency models. The definition and identification of inputs and outputs to be used in banks efficiency for the purpose of measuring and examining the banks efficiency cannot be defined and specified in a simple way, it needs reasonable arguments (Favero and Papi 1995). In the literature, the inputs and outputs to be used in measuring of banks efficiency can be defined by using different five approaches: intermediation approach, production approach, asset approach, user cost approach and value added approach. The first three approaches are related to some functions carried out by the banks and the other two approaches are not related to the macroeconomic functions carried out by the banks (Favero and Papi 1995). The production approach and intermediation approach are used more frequently for measurement of the banking efficiency in banking sector. Under the production approach definition and specification, bank institutions are considered as producers of deposit accounts and loan services; therefore, the outputs are measured by deposits or transactions processed, the inputs include labor and capital but do not include interest costs. Under the intermediation approach, banks are considered is the one which provide the intermediations services which transfer financial resources from surplus units to deficit units. This approach is considered to be the most relevant approach for banking sector, where most activities consist of turning large deposits and funds purchased from other financial institutions into loans and financial investments

4. Methodology

4.1 Research approach

In order to reach the objectives of this research the deductive approach was used, in view of the fact that there is much literature and theoretical framework on this topic. Additionally, this research is directed into the explanation of casual relationship between different variables on banks efficiency. The construction of the

research questions itself insist on the utilization of the deductive approach. There are several contrasting theories on this subject which complicates our analysis. Therefore, the quality of results will largely depend on correct determination of DEA model which is applicable for our case.

4.2 Data description and Sampling of the study

DEA does not account for the random error term and is being used for the performance evaluation of identical units. Oral and Yololan (1992) suggest to use DEA models for firms employing similar resources and providing the same services. Quey-Jen Yeh (1996) states that it is important to take into account the homogeneity condition during the choice of DMUs for the model. For that reason the study focused only on regional & small commercial banks in Tanzania

The study used secondary data and the data was obtained from annual reports of the banks. Data were directly taken from the banks' balance sheets, income statements and from notes to account. Time study period is 7 years from 2006 to 2012; this period was selected because of reliable and up-to-financial data were available. Tanzania has a population of 14 regional & small banks (Bank of Tanzania 2011). Among the 14 regional & small banks8 which operate in the country, we selected 7 banks according to data availability which were analyzed from 2006 to 2012, with a total of 49 pooled data.

4.3 Explanation of the model

Data Envelopment Analysis (DEA) is a non-parametric mathematical programming approach to frontier estimation. DEA is approach that is considered as an alternative method to estimate productive efficiency in the financial sector. DEA approach shows how a particular bank operates relative to other banks in the same sample. It provides a benchmark for best practice technology based on the experience of those banks in the sample. The DEA estimates are based on technological efficiency where efficient firms are those for which no other firm (or linear combination of firms) produces as much or more of output provided given inputs, or uses as little or less input to produce a given output. The efficient frontier is composed of these un-dominated firms and the piecewise linear segment that connect the set of input/output combinations of these firms yielding a convex production possibility set (Humphrey at el, 1997).

In mathematical programming parlance, this ratio, which is to be maximized, forms the objective function for the particular DMU being evaluated. (Charnes, et al., 1978) proposed the use of a set of weights that accommodates those differences. They suggested that each bank should assign weights that allow it to be shown more favorably, compared with all other banks under comparison. Thus, the respective weights for each bank should be derived using the actual observed data instead of fixing in advance (Cooper, et al., 2000). CCR introduced the following fractional programming problem to obtain values for input weights and output weights. Basic CCR formulation is

$$\max ho(u,v) = \frac{\sum_{r=1}^{s} u_r y_{ro}}{\sum_{i=1}^{n} v_i x_{io}} \qquad (1)$$

Subject to:

$$\frac{\sum_{i=1}^{n} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1 \qquad \text{j=1, 2… n} \qquad (2)$$

$$u_r \geq 0 \qquad \text{r=1, 2…s} \qquad (3)$$

$$v_i \geq 0 \qquad \text{i=1, 2…m.} \qquad (4)$$

Where x_{ij} is the observed amount of input ith of the jth DMU ($x_{ij} > 0$, I = 1, 2 …n, i= 1, 2…n) and y_{ij} = observed amount of output of the rth type for the jth DMU ($y_{ij} > 0$, r = 1, 2…3, j = 1, 2…n)

The above ratio form yields an infinite number of solutions; if (u^*, v^*) is optimal, then (αu^*, αv^*) is also optimal for $\alpha > 0$. However, the transformation developed by Charnes and Cooper for linear fractional programming

selects a representative solution [i.e., the solution (u, v) for which = 1] and yields the equivalent linear programming problem in which the change of variables from (u, v) is a result of the Charnes-Cooper transformation one can select a representative solution (u, v) for which:

$$\sum_{i}^{m} v_i x_{io} = 1 \qquad (5)$$

To obtain linear programming problem that is equivalent to linear fractional programme problem (equations 1-4). Thus, denominator in the above efficiency measure h_o is set to equal to 1 and transformed linear problem for DMU_O can be written as:

$$\max z_o = \sum_{r=1}^{s} u_r y_{ro} \qquad (6)$$

Subject to:

$$\sum_{r=i}^{s} u_r y_{rj} - \sum_{i=1}^{n} v_i x_{ij} \le 0 \qquad \text{j= 1, 2…n} \qquad (7)$$

$$\sum_{i=1}^{m} v_i x_{io} = 1 \qquad (8)$$

$$u_r \ge 0, r = 1,2...s$$

$$v_i \ge 0, i = 1,2...m$$

For which the Linear Programming dual problem is

$$Min\ z_o = \Phi$$

Subject to:

$$\sum_{j=1}^{n} \lambda_i y_{rj} \ge y_{ro} \qquad \text{r=1, 2,...s} \qquad (9)$$

$$\Phi_o x_{io} - \sum_{j=i}^{n} \lambda_i x_{ij} \ge 0 \qquad \text{j = 1, 2...n} \qquad (10)$$

Both the above linear problem yield the optimal solution ϕ which is the efficiency score (so-called technical efficiency) for the particular DMU_o and repeating them for each DMU_j, j= 1, 2…n, efficiency scores for of them are obtained. The above ϕ is always less than or equal to unity (since when tested, each particular DMU_o is constrained by its own virtual input-output combination too). DMU_s for which ϕ is less than unity are relatively inefficient and for which ϕ is equal to unity are relatively efficiency, having their virtual input-output combination points laying on the frontier. The frontier itself consists of linear facets spanned by efficient units of the data and the resulting frontier production function (obtained with the implicitly constant return to scale assumption) has no unknown parameters.

The CRS assumption is only appropriate when all DMUs are operating at an optimal scale, meaning that, one corresponding to the flat of the long run average cost (LRAC). However imperfect competitions, constraints on finance and other factors may result a DMU to be not operating at optimal scale. Banker, Charnes and Cooper (1984) suggest an extension of the CRS DEA model to account for Variable Return to Scale (VRS) situations. The use of the CRS specification when not all DMUs are operating at the optimal scale will result of TE which is confounded by scale efficiencies (SE) (Coelli, 1998). Hence, the use of the VRS specification will permit the calculation of TE devoid of these SE effects. The CRS linear programming problem can be easily modified to account for VRS by adding the convexity constraint $\sum\lambda = 1$

Since there are no constraints for the weight λ_j, other than the positivity conditions in the problem (9 – 10), it implies constant return to scale, it is necessary to add the convexity condition for the weight λ_j i.e. to include in the model (9 – 10) the constraint.

$$\sum_{j=1}^{n} \lambda_i = 1 \qquad (11)$$

The resulting DEA model that exhibits the Variable Return to Scale (VRS) is called BCC model (Banker, Charnes and Cooper 1984). The input-oriented BCC model for the DMU_o can be written formally as:

$$Min\ z_o = \Phi$$

Subject to:

$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{ro} \qquad \text{r = 1, 2…s} \qquad (12)$$

$$\Phi_o x_{io} - \sum_{j=1}^{n} \lambda_j x_{ij} \geq 0 \qquad \text{i = 1, 2…m} \qquad (13)$$

$$\sum_{j-1}^{n} \lambda_j = 1 \qquad (14)$$

$$\lambda_j \geq 0 \qquad \text{j = 1, 2…n} \qquad (15)$$

Running the above model for each DMU, the BCC efficiency scores are obtained (with similar interpretations of its values as in CCR model). These scores are also called 'Pure technical efficiency scores' since they are obtained from model that allows variable returns to scale (VRC) and hence eliminate 'the scale part' of the efficiency from analysis. Generally, for each DMU the CCR-efficiency score will not exceed the BCC efficiency score, what is intrusively clear since in the BCC-model each DMU is analysed ' locally' i.e. compared to subset of DMUs, that operate in the same region of return to scale rather than globally.

4.5 Discussion of Input-Output selection for DEA analysis

The definition of input and Output variables is another controversial issue, causing a long-standing debate in banks efficiency performance studies regarding methodology. In the literature, a production approach and an intermediation approach are two popular approaches, while a value added approach and a user cost approach are two less commonly used ones. First approach i.e. Production approach treats banks as a firm which uses capital and labor for production of different types of banking services (Heffernan 1996). Freixas and Rochet (1997) argued that, this way of evaluation is mainly applicable for the case of local branch which is "financially transparent" while the money collected directly transferred to the main branch. The second type of literature defines activities of a bank as intermediation. This approach is mainly applicable for the performance evaluation of main branch which deals with "transferring" money borrowed from depositors into the money lent to borrowers (Freixas and Rochet 1997).

The dominant role of intermediation function of banking sector in Tanzania, lead the researcher to use intermediation approach for the analysis which was originally developed by Sealey and Lindley (1977). The intermediation approach for measuring banks efficiency was used in this study. The study used 3 inputs (total deposits, number of employees and total expenses) and 2 outputs (total loans and total interest income) based on literature review, shown in the table 1

Insert table 1

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5.0 EMPIRICAL RESULTS AND ANALYSIS

The analysis of efficiency of banking sector in Tanzania was done for the period of 7 years from 2006 to 2012 using the input-oriented DEA model. Both CCR and BCC models were applied for the analysis, we applied CCR model for a comparative purpose, because the model is completely ignores the scale of operations and may results to unrealistic benchmarks.

5.1 Results of Efficiency Scores under CCR-Model

Table 2 shows the CCR efficiency scores obtained by banks which were in operational from 2006 to 2012; the results show that, in 2006 all banks are inefficiency with mean efficiency score of 81.8%. One bank, Dar es Salaam Community Bank (DCB) was identified to be fully efficiency in 2007 and by fully efficient we mean that, the bank has attained 100% efficiency score while, other banks, were inefficiency. Two banks, Dar es Salaam Community Bank (DCB) and Uchumi Commercial Bank were identified to be fully efficiency in 2008, one bank, was fully efficiency in 2009, 2010 and 2011 which indicated that, Dar es Salaam Community Bank (DCB) was fully efficiency for 2009 and 2010 while Mbinga Community Banks was efficiency in 2011. In 2012 four banks, Dar es Salaam Community Bank (DCB), Mbinga Community Banks, Mwanga Community Banks and Uchumi Commercial Bank are identified to be fully efficiency (57.1%), while other banks, Kagera Farmers - Co-operative Bank, Kilimanjaro Co-operative Bank and Mufindi Community Banks are inefficiency with efficiency scores of 61.8%, 71.8%, and 80.8% respectively. The descriptive statistics results show that, the mean efficiency scores of banks ranges from 75.5% in 2010 to 87.8% in 2012 while the overall mean efficiency for banks is 81.2%, which implies that, banks could have reduce the inputs by 18.8% without affecting the level of

output. In other words, banks have wasted 18.8% of resources in producing their levels of output. In general the results show that banks are using more resources than what they are producing. Banks were supposed to use 81.2% of resources available for them to be efficient without compromising the output level under CRS.
Insert table 2

Figure 1 shows the trend results of mean efficiency score of banks, on comparing the trends of efficiency scores for three consecutive years from 2008 to 2010, it can be clearly noticed that the efficiency of banks has decreased year after year from 82.0% in 2008 to 75.5% in 2010, however the efficiency scores slightly started to increase from 75.5% in 2010 to 87.8% in 2012.
Insert figure 2

5.2 Results of Efficiency of Banks under BCC-Model

Table 3 shows the BCC efficiency scores obtained by banks from 2006 to 2012, the results identify four banks, Kagera Farmers - Co-operative Bank, Mbinga Community Banks, Mwanga Community Banks and Uchumi Commercial Bank (57.1%) to be fully efficient in the year 2006, three banks in 2007 and 2008, one bank to be fully efficiency in 2009, 2010 and 2011 which is Dar es Salaam Community Bank (DCB) in 2009 and 2010 and Mbinga Community Banks in 2011. In 2012 four banks, Dar es Salaam Community Bank (DCB, Mbinga Community Banks, Mwanga Community Banks and Uchumi Commercial Bank are identified to be fully efficiency. The results obtained are not surprising because the scores generated through CRS are less than or equal to the corresponding VRS scores (Banker et al, 1984).
The Mean efficiency of banks under variable return to scale ranges from to 98.8% in 2006 to 81.9% in 2010 while the overall mean efficiency is 90.4%, this means that, banks could have reduced the inputs by 9.6% without affecting the level of output. In other words, banks have wasted 9.6% of resources in producing its levels of output. However the fluctuation on efficiency scores are marginally with the minimum efficiency score of 81.9% in 2010 and maximum efficiency score of 98.8% in 2006. Dar es Salaam Community Bank (DCB, Uchumi Commercial Bank, Mwanga Community Banks and Mufindi Community Bank have the mean efficiency which are higher than other banks with mean efficiency of 99.6%, 98.1%, 94.8% and 90.0% respectively. Kilimanjaro Co-operative Bank is found to be least efficient among other banks with the mean efficiency of 74.5%. Dar es Salaam Community Bank (DCB) is the most efficient bank, followed by Uchumi Commercial Bank and then Mwanga Community Bank and Mufindi Community Bank
Insert table 3

Figure 2 shows the mean efficiency scores trend of banks, on comparing the trends the results show marginally decline of efficiency score from 98.8% in 2006 to 81.9% in 2010, there after showing an increasing trend of efficiency score of 90.2% in 2012

5.3 Identification of Reference set

Table 4 shows the reference set for each bank obtained after BCC analysis. DEA approach being a widely used tool for benchmarking enables identification of efficiency DMU for inefficiency ones. This group of efficient DMUs when used for defining the operating procedures and goals for the inefficient units, in literature this group is being referred as peer group or reference set for the inefficiency DMU. The DMU which appears frequently on the reference set is considered to be a good example of efficiency performer..
The results show that, four banks, Dar es Salaam Community Bank (DCB), Uchumi Commercial Bank, Mbinga Community Banks and Mwanga Community Bank are the most efficiency banks under because are frequently appeared on the reference set.
Insert table 4

In Table 5 Shows the results of peer count summary of banks, which are obtained from table 5.3: The results show that, Dar es Salaam Community Bank (DCB), Uchumi Commercial Bank, Mbinga Community Banks and Mwanga Community Bank have the highest peer counts. This means that the above mentioned banks are benchmarked by other peers. These banks are the most efficient, which serve as the benchmark peers for inefficient banks in the sample. Therefore, inefficient banks could improve their efficiency level by benchmarking efficient banks.
Insert table 5

6. CONCLUSIONS

This paper measures the performance of commercial banks in Tanzania for the period from 2006 to 2012 using the input-oriented DEA model by utilizing case of regional & small commercial banks. Three inputs (i.e. total

deposits, number of employees and total expenses) and two outputs (i.e. total loans and total interest income) specifications were used represent efficiency in intermediation process.

The findings, under CRS assumption show that, in 2006 all banks were inefficiency with average efficiency score of 81.8%. One bank was identified to be fully efficiency in 2007 while other banks were inefficiency, two banks were fully efficiency in 2008 and one bank was fully efficiency in 2009, 2010 and 2011 and four banks (57.1%) were fully efficient in the year 2012. The results under VRS assumption identify four banks (57.1%) to be fully efficient in the year 2006, three banks in 2007 and 2008, one bank in 2009, 2010 and 2011 and four banks in the year 2012. The overall mean efficiency of banks is 90.4%, this means that, banks could have reduced the inputs by 9.6% without affecting the level of output. The findings show that, four banks, Dar es Salaam Community Bank (DCB), Uchumi Commercial Bank, Mbinga Community Banks and Mwanga Community Bank are the most efficiency banks in Tanzania, which serve as the benchmark peers for inefficient banks in the sample and comprise the best practice set or best practice frontier. Therefore, the managers of inefficiency banks should focus attention to these efficiency reference set which includes the banks against which each inefficient bank was found to be mostly directly inefficient. For these inefficiency banks to be efficiency, we recommend that, banks should minimize the use of input resources while maintaining the same level of output. By improved handling of operating expenses and by boosting banking investment operation, the less efficient banks can successfully endorse resource utilization efficiency and become efficiency one. In the general remarkable observation on regional & small commercial banks efficiency scores are that, regional & small banks in Tanzania are performing well. The overall mean efficiency score is not less than 90% at any one point these findings are similar with Aikaeli (2008).

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Notes

Table: 1 Input-Output selections for DEA analysis

Inputs	**Outputs**
1.Total deposits	1. Total loans
2. Number of employees	2. Total interest income
3. Total expense	

Table 2 Efficiency scores results – CCR Model

Banks	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Mean**
Dar es Salaam Community Bank (DCB)	0.973	1.000	1.000	1.000	1.000	0.996	1.000	0.996
Kagera Farmers - Co-operative Bank	0.686	0.728	0.767	0.785	0.664	0.634	0.618	0.697
Kilimanjaro Co-operative Bank	0.819	0.550	0.609	0.675	0.684	0.675	0.718	0.676
Mbinga Community Banks	0.798	0.576	0.819	0.494	0.443	1.000	1.000	0.733
Mufindi Community Banks	0.826	0.667	0.755	0.886	0.776	0.813	0.808	0.790
Mwanga Community Banks	0.873	0.859	0.788	0.882	0.841	0.905	1.000	0.878
Uchumi Commercial Bank	0.754	0.921	1.000	0.900	0.874	0.951	1.000	0.914
Overall Average	0.818	0.757	0.820	0.803	0.755	0.853	0.878	0.812

Source: Survey Study

Table 3 Efficiency scores results – BCC Model

Banks	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Mean**
Dar es Salaam Community Bank (DCB)	0.973	1.000	1.000	1.000	1.000	0.999	1.000	0.996
Kagera Farmers - Co-operative Bank	1.000	1.000	0.903	0.893	0.795	0.743	0.707	0.863
Kilimanjaro Co-operative Bank	0.945	0.668	0.729	0.693	0.734	0.693	0.754	0.745
Mbinga Community Bank	1.000	0.989	1.000	0.788	0.501	1.000	1.000	0.897
Mufindi Community Bank	0.994	0.862	0.893	0.979	0.856	0.858	0.855	0.900
Mwanga Community Bank	1.000	0.972	0.838	0.986	0.893	0.943	1.000	0.948
Uchumi Commercial Bank	1.000	1.000	1.000	0.951	0.952	0.961	1.000	0.981
Overall Average	0.988	0.927	0.909	0.899	0.819	0.885	0.902	0.904

Source: Survey Study

Table 4: Reference set BCC Model for the year 2006-2012

Banks	2006	2007	2008	2009	2010	2011	2012
Dar es Salaam Community Bank (DCB)	λ 2=0.02 λ4=0.31 λ28=0.19 λ49=0.47	ʎ2= 1	ʎ3= 1	ʎ4= 1	ʎ5= 1	ʎ3= 0.04 ʎ7= 0.95	ʎ7= 1
Kagera Farmers - Co-operative Bank	λ8=1	λ 9=1	λ7=0.01 λ9=0.76 λ28=0.13 λ42=0.11	λ9 =0.17 λ28=0.08 λ44=0.70 λ49=0.05	λ 8=0.16 λ28=0.06 λ36=0.14 λ44=0.51	Λ24=0.02 λ28=0.02 λ36=0.27 λ42=0.09 λ44=0.60	λ28=0.02 λ36=0.22 λ44=0.70
Kilimanjaro Co-operative Bank	λ28=0.13 λ36=0.10 λ43=0.16 λ44=0.61	λ 8=0.38 λ28=0.14 λ36=0.07 λ44=0.32	λ7=0.01 λ9=0.56 λ42=0.43	λ22=0.36 λ28=0.04 λ36=0.12 λ45=0.48	λ22=0.74 λ44=0.13 λ45=0.42	λ28=0.18 λ36=0.27 λ44=0.13 λ45=0.42	λ28=0.20 λ44=0.44 λ45=0.19 λ49=0.17
Mbinga Community Banks	λ22=1	λ8=0.05 λ22=0.76 λ24=0.13	λ24=1	λ22=0.12 λ24=0.87 λ28=0.01	λ8=0.04 λ28=0.12 λ44=0.04	λ27=1	λ28=1
Mufindi Community Banks	λ8=0.09 λ24=0.29 λ42=0.18 λ44=0.43	λ8=0.52 λ24=0.11 λ42=0.20 λ44=0.17	λ8=0.18 λ24=0.32 λ42=0.29 λ44=0.21	λ7=0.01 λ24=0.47 λ42=0.29 λ45=0.23	λ7=0.01 λ24=0.37 λ28=0.01 λ42=0.26 λ45=0.35	λ7=0.03 λ24=0.19 λ42=0.51 λ45=0.28	λ7=0.06 λ8=0.42 λ9=0.06 λ42=0.46
Mwanga Community Banks	λ36=1	λ24=0.04 λ28=0.09 λ36=0.37 λ42=0.02	λ28=0.17 λ44=0.78 λ45=0.05	λ24=0.24 λ28=0.14 λ44=0.11 λ45=0.31	λ24=0.27 λ28=0.02 λ42=0.52 λ44=0.07 λ45=0.11	λ24=0.24 λ28=0.03 λ42=0.60 λ45=0.12	λ42=1
Uchumi Commercial Bank	λ43=1	λ44=1	λ45=1	λ9=0.04 λ28=0.02 λ44=0.56 λ49=0.36	λ5=0.02 λ9=0.45 λ44=0.08 λ49=0.44	λ28=0.06 λ44=0.02 λ45=0.21 λ49=0.71	λ49=1

Source: Survey Study

Table 5: Peer Count Summary of banks for period 2006-2012

DMU	Banks	2006	2007	2008	2009	2010	2011	2012
1	Dar es Salaam Community Bank (DCB)	5	5	6	9	10	8	5
2	Kagera Farmers - Co-operative Bank	2	0	1	2	3	0	2
3	Kilimanjaro Co-operative Bank	0	0	0	0	0	0	0
4	Mbinga Community Bank	3	6	3	10	10	7	2
5	Mufindi Community Bank	0	0	0	0	0	0	0
6	Mwanga Community Bank	2	4	3	2	2	5	2
7	Uchumi Commercial Bank	4	2	3	8	10	8	4

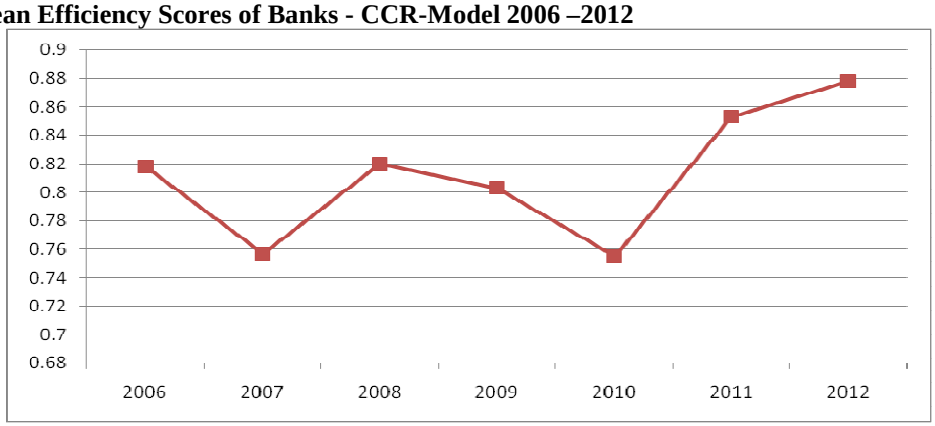
Source: Study Survey2013

Table: Reference set CCR Model for the year 2006-2012

Banks	2006	2007	2008	2009	2010	2011	2012
Dar es Salaam Community Bank (DCB)	λ4=0.25 λ28=0.17 λ49=0.68	Λ2= 1	Λ3= 1	Λ4= 1	Λ5= 1	Λ2= 0.12 Λ7= 0.94	Λ7= 1
Kagera Farmers - Co-operative Bank	λ2=0.02 λ5=0.01 λ28=0.12	λ7=0.02 λ28=0.11 λ42=0.01	λ7=0.03 λ28=0.21 λ42=0.10	λ2=0.08 λ28=0.20 λ42=0.10	λ2=0.03 λ3=0.03 λ28=0.21 λ45=0.04	λ3=0.02 λ28=0.13	λ28=0.09 λ45=0.51
Kilimanjaro Co-operative Bank	λ2=0.05 λ28=0.27 λ49=0.03	λ2=0.04 λ7=0.01 λ28=0.26	λ7=0.02 λ42=0.40	λ28=0.06 λ45=0.54	λ28=0.09 λ45=0.25	λ28=0.22 λ45=0.55	λ2=0.08 λ28=0.33 λ49=0.06
Mbinga Community Banks	λ28=0.01 λ45=0.12	λ28=0.07 λ45=0.13	λ7=0.02	λ2=0.01 λ7=0.01	λ2=0.03 λ3=0.03 λ28=0.23 λ45=0.16	λ27=1	λ28=1
Mufindi Community Banks	λ3=0.03 λ7=0.02 λ28=0.09	Λ3=0.01 λ7=0.03 λ28=0.07	λ7=0.03 λ28=0.01 λ42=0.09	λ7=0.04 λ42=0.09	λ7=0.04 λ28=0.13 λ42=0.03	λ28=0.02 λ42=0.28	λ7=0.08 λ28=0.04 λ42=0.34
Mwanga Community Banks	λ28=0.14 λ45=0.15	λ28=0.17 λ45=0.41	λ2=0.05 λ28=0.23 λ45=0.29	Λ3=0.02 λ7=0.02 λ28=0.27	λ7=0.02 λ28=0.09 λ42=0.39	λ7=0.02 λ28=0.08 λ42=0.50	λ42=1
Uchumi Commercial Bank	λ28=0.12 λ49=0.17	λ2=0.03 λ28=0.08 λ45=0.43	λ45=1	λ2=0.08 λ28=0.12 λ49=0.30	λ4=0.02 λ5=0.03 λ49=0.38	λ2=0.04 λ28=0.12 λ49=0.64	λ49=1

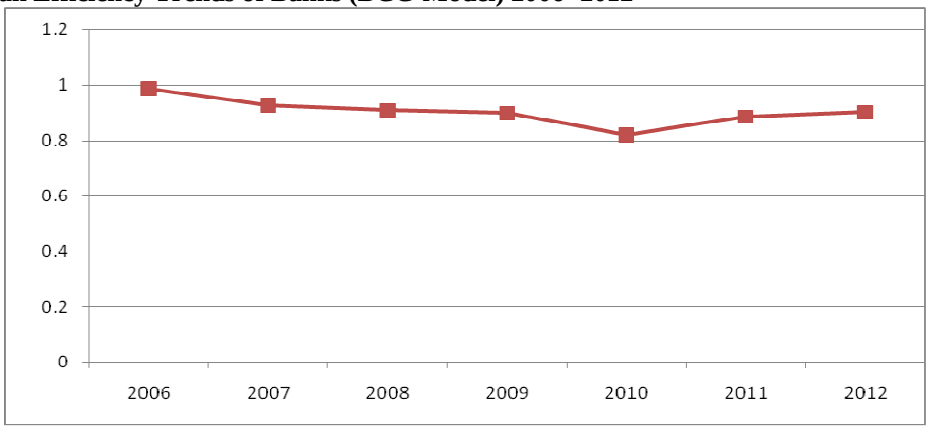
Source: Survey Study

Figure 1 Mean Efficiency Scores of Banks - CCR-Model 2006 –2012



Source: Study Survey

Figure 2 Mean Efficiency Trends of Banks (BCC-Model) 2006 -2012



Source: Study Survey2013

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