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AN ENVELOPMENT ANALYSIS APPROACH TO MEASURING THE EFFICIENCY AND EFFECTIVENESS OF COMMERCIAL BANKS IN EAST AFRICA

Muroki F. Mwaura[1*] Solomon Yaanga[2] , Peter Ruto[3]

[1,2] William Paterson University
[3]Dedan Kimathi University

ABSTRACT

The purpose of this paper was to analyse the efficiency, effectiveness, and performance of 63 commercial banks operating in the East African Community States using a two-stage performance evaluation model. This paper is perhaps the first to evaluate the performance of East African commercial banks by considering simultaneously the aspects of efficiency and effectiveness. Using cross-sectional data for the financial years 2006-2011, the technique of data envelopment analysis was used for computing the efficiency and effectiveness scores for individual commercial banks in the East African Community (EAC). The overall performance scores have been derived by taking the product of efficiency and effectiveness scores. The empirical results reveal that high efficiency does not imply high effectiveness in the East African banking industry. A positive and strong correlation between effectiveness and performance measures has been noted. Large banks score better than small banks in efficiency, effectiveness and overall performance.

***Keywords**: Organizational effectiveness, Performance measures, Public sector organizations, Data analysis, Banks, East Africa*

[*] Corresponding author email: mwauram@wpunj.edu

Introduction

The European Central Bank (2010) defines bank performance as the capacity to generate sustainable profitability. Profitability refers to the net gains after deducting all costs and is essential for ongoing activities as well as for its investors to obtain fair returns. A bank refers to a licensed institution which accepts deposits, makes business loans, and offers related services. Commercial banks also allow for a variety of deposit accounts, such as checking, savings, and time deposit. Kumar and Gulati (2010) define performance in both profit and non-profit organizations as an appropriate combination of efficiency and effectiveness.

The study by Diamond and Rajan (2001) highlights the strength of the banking system as an essential requirement to ensure the economic stability and growth. Banks are the main part of the financial sector in any economy performing valuable activities on both sides of the balance sheet. On the asset side, they enhance the flow of funds by lending to the cash starved users of funds, whereas they provide liquidity to savers on the liability side. Banks also facilitate the payments and settlement systems and support the smooth transfer of goods and services. They ensure productive investment of capital to stimulate the economic growth.

A performance measurement framework as noted by Bigliardi and Bottani (2010) assists in the process of performance measures building, by clarifying measurement boundaries, specifying performance measurement dimensions or views and may also provide initial intuitions into relationships among the dimensions. There are a multitude of measures used to assess bank performance with each group of stakeholders having its own focus of interest. (Rouse and Putterill, 2003)

The ECB (2010) supports the above notion and classifies the large set of performance measures for banks used by academics and practitioners alike, into traditional, economic and market-based measures of performance. The Traditional measures of performance measures include return on assets (ROA), return on equity (ROE) or cost-to-income ratio and net interest margin (NIM). The economic measures of performance take into account the development of shareholder value creation and aim at assessing, for any given fiscal year, the economic results generated by a company from its economic assets (as part of its balance sheet). These measures mainly focus on efficiency as a central element of performance, but generally have high levels of information requirements. Lastly, the Market-based measures of performance characterize the way the capital markets value the activity of any given company, compared with its estimated accounting or economic value. The most commonly used metrics include: the “total share return” (TSR), the “price-earnings ratio” (P/E), the “price-to-book value” (P/B), which relates the market value of stockholders’ equity to its book value; the “credit default swap” (CDS), which is the cost of insuring an unsecured bond of the institution for a given time period.

Productivity theory as reported by Chatzoglou *et al.,* (2010) is a well-developed branch of analysis (and theory) with three commonly used methods: Stochastic Frontier Analysis (SFA), total factor productivity (TFP) and Data Envelopment Analysis (DEA). Productivity growth is defined by Al-Muharrami (2007) as the change in output due to technical efficiency change and technical change over time. A further more recent branch that provides for performance to be decomposed further into technological change and efficiency

change is provided by Malmquist (1953) techniques.

Rouse and Putterill (2003) mention other methods commonly used for performance analysis which include statistical regression, data mining, factor analysis, structural equation modelling, expert systems/ geographic information systems, and ratio analysis.

Previous studies (Gitau and Gor, 2011;Chatzoglou *et al.*, 2010; Figueria *et al.*,2009; Kamau, 2009; Al-Muharrami, 2007; Aikaeli, 2006) have analysed bank performance measures in terms of efficiency, profitability and productivity. According to Kumar and Gulati (2010), efficiency and effectiveness are central terms in assessing and measuring the performance of organizations. Drucker (1977) distinguished efficiency and effectiveness by associating efficiency to 'doing things right' and effectiveness to 'doing the right things'. A measure of efficiency assesses the ability of an organization to attain the output(s) with the minimum level of inputs.

While commenting on effectiveness, Keh *et al.*, (2006) observed that a measure of effectiveness assesses the ability of an organization to attain its pre-determined goals and objectives. This indicates that there is no consensus on a single measure that can be applied to measure bank performance. This study seeks to identify a single measure of bank performance that can be applied by commercial banks in the East African Community (EAC).

The East African Community

The first attempt, as reported by the EAC (2011), at integrating the countries in the East Africa region was signed in 1967 by Kenya, Uganda and Tanzania and subsequently the Permanent Tripartite Commission formed. However, the union collapsed in 1977 due to political differences amongst the member countries. The second attempt at integration resulted in the signing of the Treaty for the Establishment of the East African Community which was signed in Arusha, Tanzania, on 30 November 1999. The Treaty entered into force on 7 July 2000 following the conclusion of the process of its ratification and deposit of the Instruments of Ratification with the Secretary General by all the three Partner States. The EAC was inaugurated in January 2001 and as at December 2011 comprises of the following countries; Kenya, Uganda, Tanzania, Rwanda and Burundi.

The banking sectors in the EAC countries as noted by Cihak and Podpiera (2005) consist of three main segments – large domestic banks, subsidiary banks or branches of international banks and small (domestic and foreign) banks. Other segments include mortgages, deposit taking microfinance institutions, representative offices of foreign banks, foreign exchange bureaus and credit reference bureaus. The International banks play a key role in each of the countries. The East African community countries have a total of 127 commercial banks comprising Kenya 43; Tanzania 32; Uganda 25; Rwanda 14 and Burundi 13 as at 31 December 2011.

The process for the establishment of the East African Monetary Union is underpinned by Articles 5 and 82 of the Treaty for the establishment of the EAC. The primary rationale for the monetary union is to reduce the costs and risks of transacting business across the national boundaries of the countries comprising the union.

Literature Review

The worldwide financial crisis in 2008/2009 as highlighted in the Global Financial Development Report (2013) has

starkly highlighted the importance of transparency in financial systems and their role in supporting economic development, ensuring stability and reducing poverty. The evaluation of bank performance according to Mehrabad *et al.,* (2012), has been an area of concern for managers of production systems for a long time. In practice, company strategies need to be coupled with appropriate and consistent performance metrics. The 2008/2009 financial crisis which resulted in massive bank failures and has brought into focus the need for stringent and effective performance measures intended to counteract the repeat of the financial crisis.

The significant changes in the financial sector of economies, as observed by Casu *et al.,* (2006) have increased the importance of performance analysis for modern banks. The operating environment is characterized by more intense competition and a movement towards increasingly market-oriented banking systems.

Commercial banking as observed by Berger and Humphrey (1992) is a very difficult service industry in which to measure output, technical change, or productivity growth. Similarly, Chatzoglou *et al.,* (2010) highlights the problem of measuring banking productivity in that it is difficult to define, as there are many factors that should be estimated; it can be measured by outputs, costs, efficiency and performance. Further, Chatzoglou *et al.,* (2010) notes that the changing nature of the banking industry has further made evaluations even more difficult, triggering the need for more flexible alternative forms of performance analysis.

According to Aarma *et al.,* (2004), different versions of financial ratio analysis are used for the bank performance analysis using financial statement items as initial data sources. To study results of financial sector reform and restructuring, a rigorous performance analysis is needed. The traditional financial ratio analysis is mainly used for this bank performance analysis. However, Yeh (1996) observes that there is no clear-cut rationale which would allow one to acquire a composite score on the overall financial soundness of a bank.

The focus of financial analysis for the management of any bank as noted by Aarma *et al.,* (2004) should be on the efficiency of performance of the bank measured from the viewpoint of investors/owners income maximization. It is argued that internationalization, adoption of new banking technologies, deregulation, banking market consolidation and other recent trends in financial intermediation should result in increasing efficiency. On the other hand, since banks are no longer monopoly suppliers of financial services and products, and markets are more contestable (increased competition between banks and new competition from non-bank financial institutions and markets), intermediation margins, net interest income, and other income should result in decreasing profitability and efficiency.

The findings by Papadopoulos and Karagiannis, (2009) suggest that the largest sized banks are generally the least efficient banks and the smallest sized institutions appear to be the most efficient throughout the period 1999-2004. Therefore, inefficiency seems to be increasing with the bank size although only marginally. This seems to contradict the current consolidation of banks around the world in recent years and is intensifying public policy debates on the influences of market structure on overall the performance of banks.

The question, as posed by Akhtar (2011) whether small banks are more productive and efficient when compared with large banks, remains unanswered.

Past studies in the East African countries banking sector have concentrated on capital adequacy, interest rate, exchange rate, inflation and reserves, efficiency (Ndung'u 1993; Kamau *et al.*, 2004; Ngugi, 2004; Aikaeli, 2006; Mugume 2008; Kamau, 2009). Nonetheless, as highlighted by Kumar and Gulati (2010), the common feature of all the aforementioned research investigations is that the concept of efficiency has been incorrectly dubbed as performance. It is well established in the literature on performance evaluation that the performance of banks should be appraised simultaneously, both in terms of its efficient resource utilization and productivity which refers to effectiveness in realizing the pre-determined goals. (Kumar and Gulati, 2010). Surprisingly, these measures are not used in practice in EAC countries and this raises the question of which measure should be applied especially as East African economies move towards economic integration.

Conceptual Framework

The two-stage performance evaluation model was applied to develop a single measure which will be a product of efficiency and effectiveness. In stage 1, the efficiency scores for individual banks will be computed. As noted by Kumar and Gulati (2010), there is no consensus on what constitutes the inputs and outputs of banks. Data Envelopment Analysis (DEA) was applied to compute the efficiency scores and effectiveness score for individual banks.

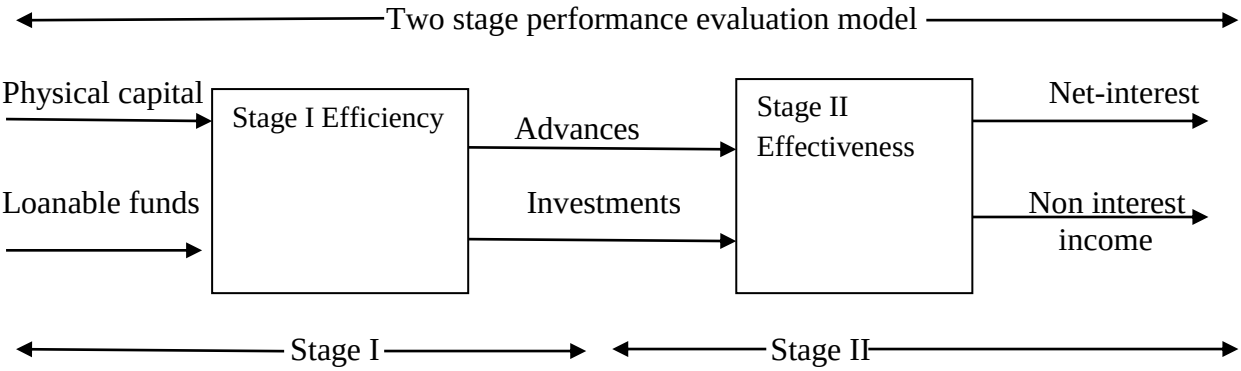

Figure 1.2 Performance evaluation model

Source: Kumar and Gulati (2010)

The selected output variables are advances and investments while input variables are physical capital (measured by the value of fixed assets); and loanable funds (measured as the sum of deposits and borrowings).

Performance of EAC banks was evaluated using the Cooper Charnes Rhodes (CCR) revised model as proposed by Cooper et al., (2000). The use of DEA was preferred over other frontier efficiency measurement techniques of banking efficiency because it has a number of advantages. First, it can simultaneously use several inputs and outputs, which is an attractive feature because production in the banking industry often involves multiple inputs and multiple outputs. Second, it does not require any assumptions about the functional form of the production function. Third, it calculates a maximal performance measure for each bank relative to all other banks in the sample with the sole condition that each bank lies on or below the efficient frontier. Fourth, it is particularly suitable for small sample studies like ours[4]. Fifth, DEA uses exclusively quantity information and, thus, demands neither problematic price information nor a restrictive

behavioural assumption in its calculation (Kumar and Gulati, 2010)

.Several different mathematical programming models have been proposed in the literature (see Charnes et al., 1994; Coelli et al., 1999; Thanassoulis, 2001; Cooper et al., 2004, 2007 for details on various models). Essentially, these models seek to establish which of n DMUs determine the envelopment surface. The geometry of the surface is prescribed by the specific DEA model employed. In the present study, we made use of output-oriented Charnes-Cooper-Rhodes (CCR) model, named after its developers Charnes et al. (1978) to obtain a scalar measure of efficiency and effectiveness for individual PSBs. CCR model imposes three restriction on the frontier technology: constant returns-to-scale, convexity of the set of feasible input-output combinations,

and strong disposability of inputs and outputs (Murillo-Zamorano, 2004).

Maximize $\frac{u^T y_0}{v^T x_0}$

(u,v)

Subject to: $\frac{u^T y_j}{v^T x_j} \le 1 \qquad j = 1.....n, \quad u,v \ge 0$ ……..(1)

where u is the (s x 1) vector of output weights and v is the (m x 1) vector of input weights. "T" denotes the matrix transpose operator. Thus, u and v are chosen to maximize the efficiency measure of the DMU subject to the constraints that the efficiency levels of all units must be less than or equal to 1. The above problem has an infinite number of solutions. To generate a unique solution, the following constraint is imposed: $u^T y_0 = 1$. The maximization problem then becomes:

Minimize $v^T x_0$

(u,v)

Subject to: $u^T y_0 = 1, u^T y_j - v^T x_j = 1,$
$j = 1.....n, \qquad u,v \ge 0$
……..(2)

To illustrate the CCR model, consider n DMUs, $j = 1.....n$: The units are homogeneous with the same types of inputs and outputs. Assume there are m inputs and s outputs. Let x_j and y_j denote, respectively, the input and output vectors for the j th DMU. Thus, x_j is a $(mx1)$ column vector and y_j is a $(sx1)$ column vector.

Moreover, $X = x_1 + x_2 + ...x_n$ is a $m\,x\,n$ is input matrix and $Y = y_1 + y_2 + ...y_n$ is the $s\,x\,n$ output matrix. The CCR model assigns weights to each input and output, and then assesses the efficiency of a given DMU by the ratio of the aggregate weighted output to the aggregate weighted input. The weights assigned must be non-negative.

The model is demonstrated below:

The duality problem to equation (2) can be written as follows:

Maximize ϕ_0

(ϕ_0, λ)

Subject to: $\phi_0, y_0\,\lambda \le \lambda^T Y, \quad x_0 \le \lambda^T X \quad ,$
$\lambda \ge 0$ ……..(3)

Where λ is a $(nx1)$ column vector and ϕ_0 is a scalar. In other words, we search for all linear combinations of input vectors in current practices that can be provided by the input vector of the o unit. We then compute the maximal proportional output vector that can be produced by these linear combinations. Let ϕ^*_0 denote the optimal solution to equation

(3). Hence, $\phi^*_0 > 1$, if $\phi^*_0 = 1$, then the DMU o is efficient, otherwise $\phi^*_0 > 1$ and DMU o is inefficient. Later, we also denote $1/\phi^*_0$ by E_0, the efficiency score for DMU o. Note that the LPP equation (3) must be solved n times, once for each DMU in the sample. It is important to note here that the implementation of equation (3) with the input and output vectors of the Stages I and II yields the efficiency and effectiveness scores, respectively.

The efficiency scores computed in stage 1 capture the ability of banks to generate advances and investments using the inputs of physical capital and loanable funds. In stage 2, the effectiveness scores are derived using the outputs from stage 1 (advances and investments) as inputs and net interest income and non-interest income as outputs. Net interest income is obtained by taking the difference between interest earned from loans and interest paid on deposits. Non-interest income comprises off-balance sheet items and will include commissions, exchange and brokerage fees and dividend income.

DEA models have two orientations as highlighted by Sreekumar and Mahapatra (2011) namely input orientation and output orientation. Input orientation means by how much inputs can be reduced while maintaining the same level of output while output orientation analyses how much output can be increased while keeping the level of inputs constant. The latter has been applied as it is more relevant for banks whose objective is to maximize the output maintaining the same levels of inputs.

The overall performance measure was derived as the product of efficiency and effectiveness measures which provided a complete picture of the true performance of an organization.

In deriving the single measure, the method by Berger and Humphrey (1997) was applied and used the intermediary approach which lays emphasis on the financial intermediation function of banks. The intermediary approach views banks as financial intermediaries where deposits are treated as an input because a bank's main business is to borrow funds from deposits and lend to others. In accordance with this approach, two outputs which were identified as the main activities are interest income and non-interest income. The input factors are identified as deposits and capital which corresponds to the intermediation function.

Therefore, following Berger and Humphrey (1997) and Kumar and Gulati (2008), the modified version of intermediation approach was adopted as opposed to the production approach for selecting input and output variables.

The output vector contained two output variables: interest spread and non-interest income. The output variable "interest spread" is also known as "net-interest income" and was computed by subtracting "interest expenses" from "interest income". This variable as pointed out by Kumar and Gulati (2008), connotes net income received by the banks from their traditional activities like advancing of loans and investments in government and other approved securities. The output variable "non-interest income" accounts for income from off-balance sheet items such as commission, exchange and brokerage, among others. The inclusion of "non-interest income" enables us to capture the recent changes in the production of services as Indian banks are increasingly engaging in non-traditional banking activities.

Methodology

The data set utilized in this research consists of secondary data. Secondary data was obtained from the bank's annual reports, central banks of member countries and the banking surveys. Secondary data comprise data from 63 commercial banks operating in the EAC region and covered the period 2011.

The empirical work in this study involved the computation of efficiency and effectiveness scores for individual commercial banks using data envelopment analysis (DEA) to develop a single measure. DEA introduced by Charnes *et al.,* (1978) based on Farrell's (1957) pioneering work, is a linear programming based non parametric frontier approach for measuring the relative efficiency of a set of similar units, usually referred to as decision making units (DMUs).

The setting of this study is the East African Community (EAC) commercial banking market. The choice of the sector was due to the integration policies being adopted by the member countries whose ultimate goal as stated in the EAC Treaty is a monetary union.

The study targeted all the 127 commercial banks within the five East African countries (EAC) namely Kenya, Tanzania, Uganda, Rwanda and Burundi. However, due to lack of complete data for commercial banks over the study period (2011), the sample size was reduced to 63 banks.

The inputs used for computing the performance scores included physical capital and loanable funds. The input variable physical capital represented the book value of premises and fixed assets net of depreciation. The input variable loanable fund is obtained by adding both deposits and borrowings.

Empirical results

The results for the 63 commercial banks were averaged and analysed for the period 2006-2011 as well as for the calendar year 2011 individually. For the period 2011, efficiency scores range from 0.0457 to 1, with an average of 0.6321 (as shown in the appendix). The explicit implication of this finding is that EAC banks on average have the potential to increase their traditional outputs (i.e. advances and investments) by about 36.79 percent with the same level of inputs (i.e. physical capital, labour, and loanable funds) that is currently being utilized. Stanbic (Uganda) is both CCR efficient and effective in stages 1 and 2 and has a maximum score of 1. DFCU, International Commercial bank, Habib (Kenya), Imperial bank (Uganda), Prime bank, NIC (Tanzania) and CBA (Tanzania) scored unit values under efficiency but less than unit value in effectiveness. Similarly, National Microfinance bank (NMB), Centenary Rural Development bank (CRDB), National bank of commerce (NBC), credit bank and Krep scored unit values under effectiveness but less than unit value in efficiency.

Table 1: Top 15 Performance scores for East African banks (2011)

Bank	***Efficiency***	***Ranking***	***Effectiveness***	***Ranking***	***Performance***	***Ranking***
Stanbic Ug	1	1	1	1	1	1
National Microfinance Bank	0.8360	10	1	1	0.8360	2
Centenary Rural Development Bank	0.7863	16	1	1	0.7863	3
National Bank of Commerce (Tz)	0.6982	22	1	1	0.6982	4
Azania Bank	0.8449	9	0.8185	3	0.6916	5
DFCU	1	1	0.6717	8	0.6717	6
Bank of Africa	0.9245	5	0.7172	6	0.6630	7
Ecobank	0.6456	26	1	1	0.6456	8
International Commercial Bank	1	1	0.5867	13	0.5867	9
Barclays Bank Tz	0.6078	30	0.9429	2	0.5730	10
Exim Bank (Tz)	0.9291	4	0.5882	12	0.5465	11
CRDB Bank (1996)	0.8319	11	0.6518	9	0.5422	12
Habib bank	1	1	0.4809	24	0.4809	13
Bank of India Ke	1	1	0.4310	29	0.4310	14
Citibank (Tz)	0.8083	14	0.5110	21	0.4130	15

Further, it has been noted that estimated effectiveness scores range from 0.0526 to 1, with an average of 0.5044. This indicates that on an average, EAC banks can effectively increase their net-interest and non-interest incomes by about 49.56 percent by utilizing the same level of advances and investments.

For the overall performance score for a bank which is obtained by multiplying efficiency and effectiveness scores, the scores range from 0.0412 to 1, with an average of 0.3085. It is quite interesting to note that only Stanbic Uganda attained an overall performance score equal to one for the period 2011. However, when the averaged period (2006-2011) is analyzed, none of the banks attains an overall score of one.

To draw a more accurate inference about the relationship between efficiency, effectiveness, and performance measures in banks in the EAC, the Pearson's correlation coefficients was computed among these measures (Table 2). The correlation analysis reveals that there is a positive and statistically insignificant (.316) correlation between efficiency and effectiveness for banks in the EAC.

Table 2 Pearson's correlation for EAC Banks

	Efficiency	Effectiveness	Performance
Efficiency	1		
Effectiveness	0.128 (.316)	1	
Single Performance Measure (SPM)	0.652 (.000)**	0.803 (.000)**	1

Note. The values in parentheses are the p-values
** Correlation coefficient is significant at the 1% level

The most significant finding relates with the correlation between effectiveness and performance measures. It is noted that a positive and strong correlation exists between effectiveness and performance measures in the three EAC countries. Further, this correlation was noted to be statistically significant (.000). The implication of this finding is that the banks can improve their performance by reviewing their effectiveness in terms of income generation.

Effect of size

Besides analyzing the efficiency, effectiveness, and performance measures for individual commercial banks in the EAC, we also made an attempt to explore the effect of size on these measures. For this, we bifurcated the entire sample of 63 commercial banks into two categories:

(1) large banks; and

(2) small banks.

Large banks are defined as those banks which have total assets greater than the median of total assets of the entire sample. Out of 63 commercial banks, 33 banks have been observed as large banks and the remaining 30 banks have been included in the category of small banks. Table 3 provides the summary statistics of efficiency, effectiveness and performance scores for large and small commercial banks in year 2011 alone. The

results pertaining to efficiency score indicate that large banks are more efficient than small banks in producing advances and investments (0.6219 vs 0.5404). Further, large banks have been found to be more effective than small banks in generating net-interest and non-interest incomes (0.5213 vs 0.4181). The results indicate that the overall performance of large banks is better than the small banks (0.3408 vs 0.2062).

Table 3 Results for year 2011

Statistics	Large banks			Small banks		
	Efficiency	Effectiveness	SPM	Efficiency	Effectiveness	SPM
N	33	33	33	30	30	30
Mean	0.6219	0.5213	0.3408	0.5404	0.4181	0.2062
Median	0.6341	0.4953	0.2516	0.5096	0.3234	0.1642
SD	0.2819	0.2761	0.2546	0.3345	0.2867	0.1665
Minimum	0	0	0	0	0	0
Maximum	1	1	1	1	1	0.69

Similar results are obtained when the average for the period 2006-2011 for the 63 commercial banks is applied as shown in table 4. The results pertaining to efficiency score indicate that large banks are equally efficient than small banks in producing advances and investments (0.6665 vs 0.6622). Further, large banks have been found to be more effective than small banks in generating net-interest and non-interest incomes (0.5633 vs 0.4908). The results indicate that the overall performance of large banks is better than the small banks (0.3718 vs 0.3350).

Table 4 Average results for period 2006-2011

Statistics	Large banks			Small banks		
	Efficiency	Effectiveness	SPM	Efficiency	Effectiveness	SPM
N	30	30	30	33	33	33
Mean	0.6665	0.5633	0.3718	0.6622	0.4908	0.3350
Median	0.6554	0.5619	0.3300	0.6371	0.4405	0.2794
SD	0.1688	0.1842	0.1623	0.1558	0.1644	0.1474
Minimum	0.2	0.29	0.12	0.27	0.06	0.02
Maximum	1.0	1.0	0.87	0.99	0.89	0.62

When one year (2011) is analyzed for the results and when the averages for the six years are applied, they give the same outcome where large banks score higher than small banks in terms of efficiency, effectiveness and overall performance.

Limitations of the Study

The study looked at commercial banks in the East African region (Kenya, Uganda and Tanzania) and one of the major limitations was availability of complete information for the period under study (2006-2011).

Due to the moratorium issued by the Bank of Uganda on the opening of new banks, following the lapse a number of new banks were opened but which could not be included due to lack of complete data.

Summary and Conclusions

This section summarizes the findings, interprets the results and draws conclusions. The objective of this study was aimed at analysing bank performance measures and the effect of bank size. The study further derived a single performance measure (SPM). The efficiency and effectiveness scores were measured using data envelopment analysis (DEA). In noting the relation between both models (efficiency and effectiveness) for the three EAC countries, the bank with best efficiency does not always mean having best effectiveness. For example, International Commercial bank (ICB) ranks first in efficiency but ranks thirteenth in effectiveness.

The average efficiency scores is 0.6321 giving the explicit implication that banks have the potential to increase their traditional outputs (advances and outputs) by about 36.79 percent with the same level of inputs (physical capital and loanable funds) that is currently being utilized. In either of the two stages, inefficient banks are able to improve their performance and the DEA projections provide a prescription for improvement.

Further, it has been noted that estimated effectiveness scores average 0.5044 in the EAC countries. This indicates that on average, banks can effectively increase their net-interest and non-interest incomes by about 49.56 percent by utilizing the same level of advances and investments.

It is interesting to note that only one bank (Stanbic Uganda) in the EAC has attained overall performance score equal to one and, thus, does exhibits best practices in efficiency and effectiveness facets simultaneously.

The results indicate that the banks appearing best on efficiency front do not always stand best on effectiveness front, and vice-versa. The banks can therefore enhance their performance by increasing their efficiency (that is, their ability to produce advances and investments using physical capital and loanable funds). This explicitly indicates that there is no apparent correlation between efficiency and effectiveness measures. It is important to note that banks that do not define best practice frontier should be able to improve their performance either by improving their efficiency or effectiveness or both.

The consolidation of banks may be justified from the results which show that large banks perform better than small banks in terms of efficiency, effectiveness and overall performance when compared both for the average period (2006-2011) and 2011 independently.

The practical implication of the research findings is that in their drive to improve overall performance, EAC banks should pay more attention to their income-generating capabilities (effectiveness) relative to their ability to produce traditional outputs such as advances and investments (efficiency). The findings seem to support the drive for consolidation of commercial banks in the banking industry.

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Appendix

Bank	***Efficiency***	***Rank***	***Effectiveness***	***Rank***	***Performance***	***Rank***
Stanbic Ug	1	1	1	1	1	1
National Microfinance Bank	0.8359	10	1	1	0.8359	2
Centenary Rural Development Bank	0.7862	16	1	1	0.7862	3
National Bank of Commerce (Tz)	0.6981	22	1	1	0.6981	4
Azania Bank	0.8448	9	0.8185	3	0.6915	5
DFCU	1	1	0.6717	8	0.6717	6
Bank of Africa	0.9244	5	0.7171	6	0.6629	7
Crane bank	0.8116	13	0.7937	5	0.64423	8
International Commercial Bank	1	1	0.5866	13	0.5866	9
Barclays Bank Tz	0.6077	30	0.9428	2	0.5730	10
Dubai bank					0.5531	11
Exim Bank (Tz)	0.9290	4	0.5881	12	0.5464	12
CRDB Bank (1996)	0.8318	11	0.6518	9	0.5422	13
Habib bank	1	1	0.4809	24	0.4809	14
Bank of India	1	1	0.4310	29	0.4310	15
Citibank Tanzania	0.8082	14	0.5109	21	0.4130	16
Imperial bank Ug	1	1	0.4075	23	0.4075	17
Credit bank	0.4003	44	1	1	0.4003	18
Akiba Commercial Bank	0.7055	21	0.5574	15	0.3933	19
NIC	0.6815	23	0.5212	18	0.3552	20
Bank of Baroda	1	1	0.3370	38	0.3370	21
Citibank	0.5621	34	0.5970	11	0.3356	22
Imperial bank Ke	0.6226	28	0.4815	30	0.2998	23
Transnational bank	0.5663	33	0.5125	20	0.2902	24
Oriental bank	0.5707	32	0.4744	25	0.2707	25
Krep	0.2677	52	1	1	0.2677	26
Barclays bank Ke	0.4294	42	0.6185	10	0.2656	27
Prime bank	1	1	0.2539	47	0.2539	28
Stanbic Bank	0.7864	15	0.3168	40	0.2491	29
KCB	0.4663	38	0.5164	19	0.2408	30
Habib AG Zurich	0.5096	36	0.4561	26	0.2324	31

Kenya Commercial Bank	0.8290	12	0.2731	46	0.2264	32
NIC Bank Tanzania	1	1	0.2258	51	0.2258	33
Fidelity Commercial bank	0.7162	20	0.3041	42	0.2178	34
Africa Banking Corporation (BankBC)	0.6280	27	0.3407	37	0.2139	35
Diamond Trust	0.4642	40	0.4536	27	0.2105	36
Commercial Bank of Africa (Tz)	1	1	0.19286	52	0.1928	37
Fina bank	0.4688	37	0.3981	33	0.1866	38
CFC Stanbic	0.3871	46	0.4521	28	0.1750	39
I&M bank	0.4659	39	0.3585	35	0.1670	40
Standard Chartered Bank Tz	0.9677	2	0.1705	22	0.1650	41
Bank of Baroda (Tz)	0.9563	3	0.1716	56	0.1641	42
Guardian bank	0.6747	25	0.2380	49	0.1606	43
Bank of Africa Tz	0.8520	8	0.1811	54	0.1543	44
Equity bank	0.2228	55	0.6731	7	0.1499	45
NBK	0.2692	51	0.5565	16	0.1498	46
Chase bank	0.4220	43	0.3061	41	0.1291	47
Paramount Universal bank	0.4422	41	0.2919	44	0.1291	48
Habib African Bank	0.6800	24	0.1897	53	0.1290	49
Diamond Trust Bank Tz	0.7820	19	0.1634	59	0.1278	50
I&M Bank (Tz)	1	1	0.1249	62	0.1249	51
Victoria Commercial Bank	0.3733	47	0.3233	39	0.1207	52
CBA	0.2762	50	0.3982	32	0.1100	53
Bank of Africa Ke	0.5318	35	0.1803	55	0.0959	54
Giro Commercial bank	0.3901	45	0.2454	48	0.0957	55
Equatorial bank	0.3401	48	0.2777	45	0.0944	56
Family bank	0.1640	59	0.5637	14	0.0924	57
Standard Chartered bank Ke	0.1721	57	0.5090	57	0.0876	58
ABC	0.2378	54	0.3639	34	0.0865	59
Middle East bank	0.2495	53	0.3035	43	0.0757	60
Co-operative bank	0.1896	56	0.3516	36	0.0667	61
Consolidated bank	0.1416	60	0.3992	31	0.0565	62
Jamii Bora (Fmr City Finance Bank)	0.0456	62	1	1	0.0456	63

Descriptive Statistics

Average	0.6321	0.5044	0.3085
Standard deviation	0.2853	0.2847	0.2417
Min	0.0457	0.0526	0.0412
Max	1	1	1

Author's Calculations (2013)