

Application of DEA in the Evaluation of Bank Efficiency in Zimbabwe: A Comparative Analysis of Multi-Currency Era and Zimbabwean Dollar Period (2004-2010)

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Abstract. Banks are very important intermediaries in the economy. They eliminate the informational problems between surplus economic units and deficit economic units by monitoring the latter and ensuring a proper use of the depositors' funds. An efficient financial sector should reduce transaction costs and thus increases the share of savings channelled into productive investments. In the past eight years Zimbabwe's economy recorded negative growth rates, but measures put in place in the past two years were highly targeted on the achievement of positive growth rates. Attainment of the set economic targets relies so much on a well functioning financial sector. The main objective of the study was to ascertain bank efficiency scores of Zimbabwean banks for the two currency periods under study, that is the Zimbabwe dollar era and multicurrency era. Furthermore an analyses on the degree of improvement required for each bank to be efficient was carried-out. The study utilised the financial intermediation approach based on data envelopment analysis. The methodology had two inputs and two outputs; total deposits , interest expenses , total loans and advances, and interest income. Adoption of multi-currency in 2009 was associated with a drop in bank efficiency. All private owned banks, both foreign and locally owned banks, recorded higher efficiency scores as compared to the publicly owned banks, both foreign and locally owned banks .Bank efficiency of seven of the banks under study improved under the multi-currency regime, whilst six banks recorded a decline of bank efficiency in multi-currency. Year 2004 had four banks with efficiency scores of 100%, whereas 2009 had three banks and lastly 2010 has two banks. Under this criteria year 2004 is more efficiency than the two periods in multi-currency, however year 2004 had four banks with efficiency scores below 50%, 2009 has three banks and lastly 2010 has one bank. Migration of an entity from one banking type to another, resulted a drop on bank efficiency .Size of a bank in terms of deposits does not translate to high bank efficiency. The low efficiency of foreign owned banks during the Zimbabwean dollar era was attributed to restrictive credit creation policies. The bank inefficiency in 2009 was mainly caused by high interest expenses emanating from liquidity challenges associated with the use of foreign currencies in place of the domestic currency. Banks with the least requirement adjustment for interest expense during year 2010 were expected to increase their loans and advances in order to achieve efficiency, in an environment characterised by liquidity improvements.

Keywords: Bank Efficiency, Multi-currency ; Financial intermediation

1. Introduction

Banks perform various roles in the economy. Their main role is to ameliorate the information problems between investors and borrowers by monitoring the latter and ensuring a proper use of the depositors' funds. (Carletti and Allen, 2008).As noted by Arjomandi (2011), the majority of studies have employed the intermediation approach to conduct their efficiency analysis because data is more readily available, and it also involves the use of different categories of deposits , loans ,financial investments and borrowing.Sufian(2007) applied intermediation approach to analyse the performance of Malaysian non-bank financial institutions during post crises period 2000-2004.He modelled Malaysian banks as multi-product firms producing two outputs and employing two inputs.

2. Research Objectives

- To measure the efficiency of banks segmented between the Zimbabwean dollar and the multicurrency periods.
- Identifying the more efficient between the two periods.
- Ascertaining improvements figures required on inputs and outputs in order to achieve efficiency.
- To determine the drivers of efficiency during the two periods.

3. Significance of the Study

The study will help bank managers and regulators with relevant information needed to improve Zimbabwean banks performance. This can also position banks and monitor the financial condition by their own efficiency scores, which is very important to stock holders, depositors, investors and bank managers.

4. Review of Literature

The evaluation of commercial bank efficiency/ performance has been approached from a variety of dimensions. According to Chen and Yeh (1997) the first approach on efficiency and performance evaluation of banks used a variant ratio analysis among several banks using a number of financial ratios (e.g. return on assets, return on investments). These ratios promise to provide valuable information about a bank's financial performance when compared with previous periods and for peer ranking. The main weakness of ratio analysis is that there is a lack of agreement on the relative importance of various types of input or output. It is a short-run measure and may be inappropriate for describing the actual efficiency of a bank in the long run (Oral and Yolalan, 1990). The second approach is based on Data envelopment analysis.

5. Methodology

The basic idea of DEA is to identify the most efficient decision-making unit (DMU) among all DMUs. The most efficient DMU is called a Pareto-optimal unit and is considered the standard for comparison for all other DMUs. The Pareto-optimal unit is the one such that any change that makes some people better off makes others worse off. In this paper, DEA establishes a "benchmark" efficiency score of unity that no commercial bank score can surpass.

Consequently, efficient banks can enjoy efficiency scores of unity, while inefficient banks receive DEA scores of less than unity.

As noted by Chen and Yen et al (1997) The idea of calculating DEA scores can be formulated as a fractional linear programming problem. Where Y_{kj} as the j th output of the k th DMU and X_{ki} as the i th input of the k th DMU. If a DMU employs p input to produce q output, the score of k th DMU, E_k , is a solution from the fractional linear programming problem)

$$\begin{aligned} \text{Max}_{U_j, V_i} \quad E_k &= \frac{\sum_{j=1}^q U_j Y_{kj}}{\sum_{i=1}^p V_i X_{ki}} & i=1,2,\dots,p \quad j=1,2,\dots,q \\ \text{s.t.} \quad & \frac{\sum_{j=1}^q U_j Y_{rj}}{\sum_{i=1}^p V_i X_{ri}} \leq 1 & r=1,2,\dots,k,\dots,R \\ & U_j, V_i \geq 0 \end{aligned}$$

where U_j and V_i give the slack in the j th output and the i th input, respectively. We have generalized the usual input/output ratio measure of efficiency for a given bank with fractional constraints. In the case of banks, the efficiency of a particular bank is calculated by finding the ratio of a weighted sum of output to a weighted sum of input.

This study used the financial intermediation approach which is related to the financial intermediation role of banks, a major role of banks. The intermediary approach views bank 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 (Berger and Humphrey, 1990; Yue, 1992). The intermediary approach views banks as financial intermediaries whose deposits are treated as an input here because a bank's primary task is to borrow funds from depositors and lend it to others.

6. Bank Population and Sample

Banks included in the sample were drawn from a population comprised of the following licensed banks in Zimbabwe: Barclays, King, CBZ, Agribank, Tetrad Interfin, Stanchart, Stanbic, NMB, MBCA, ZB, FBC and Metropolitan. In coming up with a sample purposeful sampling was used taking into account the ability of getting consistent secondary data. The sample was made up of the following banks: Barclays, Kingdom, CBZ, NMB, MBCA, FBC, Tetrad, Agribank, Stanbic, Stanchart, Metropolitan, Interfin and ZB. The sample is made of both; public, foreign, domestic, private and government owned banks.

7. Data Presentation and Analysis

Table I and II : Bank efficiency scores

Year	2004	2009	2010
Bank(s)	%	%	%
Agribank	51	100	73.5
Barclays	50.4	17.9	36.8
CBZ	46.4	69.1	63.4
kingdom	33.2	100	100
FBC	100	75.8	87.3
Stanbic	58.1	100	98.3
Stanchart	83.3	100	100
MBCA	100	71.3	100
NMB	76.9	46.7	87.8
ZB	23.5	42.8	85.5
Interfin	47.2	92.3	59.4
Metropolitan	100	50.9	54.7
Tetrad	100	65.4	58.1

Year	2009 & 2010 Average efficiency
Bank(s)	%
Agribank	86.75
Barclays	27.35
CBZ	66.25
kingdom	100
FBC	81.55
Stanbic	99.15
Stanchart	100
MBCA	85.65
NMB	67.25
ZB	64.15
Interfin	75.85
Metropolitan	52.8
Tetrad	61.75

During the year of inception of multi-currency 2009, bank efficiency was lower than bank efficiency in the following year (2010), this was attributed to the problems faced in building up foreign currency denominated deposits, and this impacted negatively on credit creation. Private foreign banks were highly efficient, listed locally owned banks were more efficient compared to public domestic owned banks. Public domestic banks efficiency increased in 2010 as their capacity to lend were influenced by the ability to raise additional capital through rights issue. One bank in which government has an interest was less efficient, during this period government as a shareholder was not able to finance its stake in the bank. Migration of a bank from one type to another i.e. from a discount to a Merchant bank, or Merchant bank to a commercial bank cause a drop on efficiency, this is illustrated by the drop of efficiencies for both Interfin and Tetrad

Furthermore size of a bank in terms of total deposits does not imply higher efficiency,

Table III: Forecasted changes on improvements to achieve efficiency

Year		2004			
Bank (DMU)	Deposits % Δ	Interest expense % Δ	Loans and advances % Δ	Interest income % Δ	
Agribank	408.6	-49.1	0	0	
Barcalys	-49.60	-49.60	107.70	0	
CBZ	-53.60	-53.60	-89	0	
Kingdom	-66.8	-66.8	73.3	0	
FBC	0	0	0	0	
Stanbic	-41.9	-41.9	258.2	0	
Stanchart	-52.0	-16.7	178.8	0	
MBCA	0	0	0	0	
NMB	-23.1	-28.3	117.2	27.0	
ZB	-76.5	-76.5	13.2	0	
Interfin	-52.8	-52.8	105.2	0	
Metropolitan	0	0	0	0	
Tetrad	0	0	0	0	

From table III above, to achieve financial intermediation efficiency banks should have reduced their deposit taking activity, and this will help in the reduction of the interest expense. Out of the thirteen banks one bank was expected to increase its deposit taking capacity by 408.6%, for this bank the results are correct in the sense that it was still in the process of being transformed from an agriculture financing company into a fully fledged commercial banking entity involved in both lending and deposits taking. Coming to loans and advances seven banks were supposed to increase their loans portfolio. Out of the seven banks, five banks were expected to increase their loans portfolio by more than 100% an indication that these banks were highly avoiding offering loans and advances. For foreign banks the figures are too high an indication that these banks were very cautious in providing credit and this can be attributed to the high perceived political risk and country risk.

Table IV: Forecasted changes on improvements to achieve efficiency

Year		2009			
Bank (DMU)	Deposits % Δ	Interest expense % Δ	Loans and advances % Δ	Interest income % Δ	
Agribank	0	0	0	0	
Barcalys	-82.10	-82.10	0.00	0	
CBZ	-30.90	-30.90	0	25.60	
Kingdom	0	0	0	0	
FBC	-24.2	-24.2	0	17	
Stanbic	-1.7	-1.7	65.76	0	
Stanchart	0	0	0	0	
MBCA	-28.7	-76.8	0	0	
NMB	-53.26	-53.26	0	27.03	
ZB	-57.17	-65.59	0	0	
Interfin	-7.75	-78.04	0	0	
Metropolitan	-49.06	-66.53	0	0	
Tetrad	-34.64	-57.62	0	732.49	

With reference to Table IV above, the inception of multi-currency in 2009 undermined bank efficiency as portrayed by the need to reduce the interest rate expense at rates higher than those required on deposits. The results are confirmed by the fact that borrowing rates in 2009 were very high due to liquidity constraints in the economy, the use of USD dollars, Rands ,and pula instead of the Zimbabwe dollar on the back of

depleted foreign exchange reserves heavily increased borrowing rates in the economy and the interbank market. The situation that was prevailing during that time didn't warrant an increase of loans and advances as there was no funding for such loans; however the need to increase loans and advances for Stanbic bank by 65.76% highlight the ease at which the bank managed to attract deposits from multinational corporations based in South Africa and also operating in Zimbabwe. Stanbic bank is headquartered in South Africa. South Africa is Zimbabwe's number one trading partner.

Year 2010, the second year since the adoption of multi-currency in Zimbabwe, banks were expected to increase their loans and advances to achieve efficiency especially those banks with a least requirement to adjust their interest expense (Stanbic, FBC, NMB and ZB), except the three banks (Stanchart, Kingdom and MBCA) that are already efficient. Compared to the previous year, the increase in deposits and liquidity require a complimentary increase in loans and advances for banks to achieve efficiency. For banks like CBZ, to achieve efficiency the bank should reduce its interest expense and increase interest income for it to achieve efficiency.

In conclusion a comparison of the two periods reveal that attainment of efficiency during the domestic currency era required a massive upward adjustment of the loans and advances, highlighting how banks should attain high efficiency in an environment characterised by high levels of money supply and liquidity. Contrastly in an environment short of money supply and liquidity, high efficiency is achieved when interest expense is reduced, through avoiding highly costing deposits, this will give an increase on interest income (see the interest income column on both tables).

Table V: Forecasted changes on improvements to achieve efficiency

Year	2010			
Bank (DMU)	Deposits % Δ	Interest expense % Δ	Loans and advances % Δ	Interest income % Δ
Agribank	-26.5	-26.5	0	54.8
Barcalys	-96.30	-63.20	1.70	0.00
CBZ	-36.60	-36.60	0	10.50
Kingdom	0	0	0	0
FBC	-12.7	-12.7	61.1	0
Stanbic	-1.7	-1.7	65.76	0
Stanchart	0	0	0	0
MBCA	0	0	0	0
NMB	-12.21	-12.21	14.75	0
ZB	-14.49	-14.49	50.67	0
Interfin	-40.59	-40.59	0	-68.81
Metropolitan	-45.33	-45.33	0	7.09
Tetrad	-41.91	-41.91	0	77.35

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