

Determinants of Commercial Banks Efficiency: Evidence from Selected Commercial Banks of Ethiopia

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Abstract- Banking system is one part of financial institution that plays an important role in economic growth and development of a country. The aim of this study was to assess the determinants of Ethiopian commercial banks efficiency. The study was based on secondary source of data. Quantitative data were obtained from published and audited financial statements of commercial banks in the period of 2003 –2012. To this end, measuring the efficiency of decision-making units (DMUs) has been growing in today's banking system. The efficiency estimation of individual banks was evaluated using Data Envelopment Analysis (DEA). Likewise, to investigate the determinants of efficiency Tobit model was used. In Ethiopia banking industry embraces about nineteen commercial banks. Among which eight banks were selected as a sample size via purposive sampling techniques. The result of this study revealed deposit and liquidity has significant positive relationship with commercial banks efficiency.

Index Terms- commercial banks efficiency, Data Envelopment Analysis (DEA), decision-making units (DMUs), Tobit

I. BACKGROUND AND JUSTIFICATIONS OF THE STUDY

A well-functioning financial system were facilitates efficient intermediate of financial resources to the economy. The more efficient the financial system in resource generation and allocation is the greater in its contribution to economic growth (Mohan, 2005). The global financial landscape has been changing rapidly in the last two decades as a result of regulatory changes and technological progress (Beck, 2006). Financial institutions play a key role in economic growth and development because they supply money for individuals, business sectors, lend government organizations. Moreover, financial institutions help the government in assessing and bearing out the monetary and economic policies, and provide a wide variety of economic services such as money transfer, foreign exchange, facilitate international trade, market stabilization and other related activities (Scott & Timothy, 2006).

Banking system as one part of financial institution plays an important role in economic growth and development of a country. Efficient banking system reflects a sound intermediation process and enhances the banks' sustainability. Efficient functioning of commercial banks' is a best indicator of effective monetary and polices (Aikaeli, 2008; Andries, 2010). Banking system is very important for the modern economy. As financial intermediaries, banks pool resources from savers and distribute to potential investors, allocate resources, and provide liquidity and payment services. Considering this vital role, it is very

important to develop a sound banking system in which banks operate with good performance. To measure performance of banking sector, two kinds of measurement, namely financial ratio measures and efficiency measures are widely used (Suzuki & Sastroswito, 2011).

Efficiency measures for banking system lead to more innovations, improved profitability as well as greater safety and soundness when improvement in productivity is channelled towards strengthening capital buffers that absorb risk. However, in recent years, the banking industry has faced competitive pressure worldwide as the world financial structure has changed rapidly due to the deregulation of financial services and increasing use of information technology. Additionally, financial institutions in general and commercial banks in particular, have experienced rising difficulties since the 1980's. In the dynamic environment and competitive market, different stakeholders are concerned about banks' efficiency; the capacity transform of their expensive inputs into various financial products and services. The banking sector in the developing countries suffered ample mutations with the purpose of creating some efficient banking institutions and with a high degree of soundness capable of facilitating economic growth (kosmidou & zopounidis, 2008; Singh & Ali, 2010).

In our country Ethiopia, the financial market is developing and the banking sector plays key role in mobilizing funds. The number of commercial banks that operate in the country has been increasing over time. An investigation determinate banking efficiency in the banking sector becomes the major issues in the new monetary and financial environment due to rapid changing of the financial environment. Commercial banks face significant challenges in particular with competition, product-service quality and differentiation, transaction security, cost efficiency, and demographic change. As a result of this, various researchers have concentrated in areas of efficiency of banks for the last several years (Bonin, et al. 2005; Matthews & Mahadzir, 2006; Fethi, and Jackson, San, et al., 2011; Sufiana, 2008; Xiping & Yuesheng, n. d).

Commercial banks accumulate deposits from savers and use the proceeds to provide credit to firms, individuals, and government agencies. Thus, they serve investors who wish to invest funds in the form of deposits. Commercial banks use the deposited funds to provide commercial loans to firms and personal loans to individuals and to purchase debt securities issued by firms or government agencies. Efficiency is a key concept for financial institutions. Efficiency is measured with respect to an organization's objective; it can be measured with respect to maximization of output, maximization of profits, or minimization of costs (Mester, 2003). According Berger et al. (1993) as cited in (Molyneux & Iqbal, n. d), in case of financial

institutions efficiency relate with grow in profitability, greater amounts of funds intermediated, better prices and service quality for consumers, and greater safety.

The approaches to bank efficiency analysis can be divided into two categories: parameter approach and non-parameter approach. Parametric approach has the virtue of allowing for noise in the measurement of inefficiency. This method requires assumptions about the particular form of the cost or profit function being estimated and the distribution of efficiency. Nevertheless, non-parametric linear programming approach requires no such specification of the functional form (Molyneux & Iqbal, n.d). From the nonparametric approach, Data Envelopment Analysis (DEA) is widely used for measuring efficiency of banking (Charnes et al., 1978; Ray, 2011). DEA is a mathematical programming, which is introduced by Charnes, Cooper and Rhodes (CCR) in 1978 and they proposed a model of constant returns to scale (CRS). Later studies have considered alternative sets of assumptions and variable returns to scale (VRS) was introduced by Banker, Charnes and Cooper (1984).

The current Ethiopian economic policy liberalizes the investment scheme of commercial banks to domestic investors; as a result, many investors have been involved in the banking sector. Results revealed that banks had better profitability business organizations in Ethiopia (Kiyota et. al, 2007). Consequently, the number of commercial banks in the country is increasing from time to time. Thus, the intensity of competition among the commercial banks in Ethiopia has increased tremendously.

Investigating determinants of efficiency of the banking sector is essential for further improvement especially under the dominance of the globalization of the banking system. The efficiency performance study is essential due to the following reasons. Foremost reason, banks play an important role as financial intermediaries, (money transfer, foreign exchange, pooling deposits and lend to different client, facilitate the international trades etc). Due to this reason, the banks efficiency indirectly affect the whole country's economy. Second, contribute empirical investigations on the determinants of Ethiopian commercial banks efficiency. In addition to this, the profitability of the banks attracted to potential investors but competition is still tough and therefore, only the efficient ones could keep on enjoying the benefits.

II. REVIEW OF RELATED LITERATURES

Organizations need highly performing individuals in order to meet their goals, and to deliver the products and services they specialized in and finally to achieve competitive advantage. Performance is the difference between an action (i.e., behavioral) aspect and an outcome aspect (Kanfer, 1990). The outcome aspect refers to the consequence or result of the individual's behaviour. In many situations, the behavioral and outcome aspects are related empirically, but they do not overlap completely. An outcome aspect of performance depends on factors other than the individual's behavior. Individual performance in these interactions varies largely between different cultures. Performance evaluation helps survival of an organization on the competitive world by reducing its weakness and enhancing best practices (Frese & Sonnentag, 2001).

Definitions of Business Performance Measurement (BPM) systems have been proposed by scholars coming from a number of disciplines. According to Mike et al, (2007), a performance measurement system enables informed decisions to be made and actions to be taken because it quantifies the efficiency and effectiveness of past actions through the acquisition, collection, sorting, analysis, interpretation, and dissemination of appropriate data. The expression "efficiencies" or "economies" reflect any reduction, voluntary or involuntary, of the average cost of production recorded by an economic unit, which can be caused by multiple factors. Efficiency gains in production are based on synergies on costs and reflect increases in economies of scale and scope. Economies of scale occur when the expansion of production capacity for one company or industry causes an increase in the total amount produced without a proportional increase in production cost, While, economies of scope consists on reductions in the total costs obtained by the production of multiple or complementary products.

- i. The performance of a productive unit is often measured by productive efficiency indicators. The general concept of efficiency is related to how resources are used in the production process and can be decomposed into two components: technical efficiency and allocative efficiency. Technical efficiency is related to the evaluation of combinations of observed inputs/outputs compared to the best possible technological alternatives and reflects the efficiency of the production process to convert inputs into outputs. One company is considered allocative efficient if it uses inputs according to the optimal structure that minimizes the production cost. On the other hand, company is considered scale efficient if it produces the amount of output that maximizes profit and if it's working at the optimal scale of production (Martins, n.d).
- ii. There are different approaches used to measure the efficiency of an organizations/ institutions. These approaches can be classified in to two as 'econometric (parametric)' and 'linear programming (nonparametric)' techniques. Parametric approaches are three main frontier approaches. The stochastic frontier approach (SFA) - sometimes also referred to as the econometric frontier approach - specifies a functional form for the cost, profit, or production relationship among inputs, outputs, and environmental factors, and it allows for random error. The distribution-free approach (DFA) also specifies a functional form for the frontier, but separates the inefficiencies from random error in a different way. Unlike SFA, DFA makes no strong assumptions regarding the specific distributions of the inefficiencies or random errors. Finally, the thick frontier approach (TFA) specifies a functional form and assumes that deviations from predicted performance values within the highest and lowest performance quartiles of observations (stratified by size class) represent random error while deviations in predicted performance between

the highest and lowest quartiles represent inefficiencies (Berger & Humphrey, 1997).

The mathematical programming approach to the construction of production frontiers and the measure of efficiency relative to the constructed frontiers is frequently given the descriptive title of data envelopment analysis. The Data Envelopment Analysis (DEA) is used to provide a computational analysis of relative efficiency for multiple input/output situations by evaluating each decision-making unit (DMU) and measuring its performance relative to an envelopment surface composed of best practice units. Units that do not lie on the surface are termed inefficient. Thus, this method provides a measure of relative efficiency (Pawtowska, 2003).

Data Envelopment Analysis (DEA) is also a source of concepts and methodologies that have now been incorporated into several models. Among a number of DEA models, the ones used most frequently are (CCR-model and BCC-model and NIRS-model). The first DEA model was the CCR ratio model (as defined by Charnes, Cooper, Rhodes (1978)) which yields an objective evaluation of overall efficiency and identified inefficiencies. The CCR model estimates efficiency on the assumption of constant return to scale (CRTS). The BCC model was defined by Banker, Charnes, Cooper (1984) and estimates efficiency on the assumption of variable return to scale (VRTS). The BCC model distinguishes between technical and scale inefficiencies by estimating pure technical efficiency at the given scale of operation. The NIRS model identifies in which region the entity is functioning: increasing, decreasing or constant returns to scale.

The study conducted by San, et al. (2011), utilizes non parametric Data Envelopment Analysis to analyze and compare the efficiency of foreign and domestic banks in Malaysia. This finding seems to imply that the PTE of banks in Malaysia was not affected by the Global Crisis of 2008 as Malaysian banking system had healthy volume of international reserves, strong capitalization and ample liquidity. The finding of this study also shows that the PTE is positively correlated with liquidity and profitability. However, the result was not significant. Another study conducted on the efficiency analysis of Australian banks by Chen and Lin, (2007) measured efficiency using DEA and efficiency change using Malmquist productivity indexes. The regression result shows profitability and total assets have a significant positive relationship to overall technical efficiency of big banks. Sufiana, (2008) studied the determinants of bank efficiency in Malaysia during the period of 1995-1999, taking a total of 171 bank years observations. The study employed non-parametric frontier DEA approach with VRS assumption to measure input-oriented technical efficiency of Malaysian banks. The study focused on three major approaches: intermediation approach, value added approach, and operating approach. In addition to DEA, multivariate tobit regression analysis was used to measure the determinants of efficiency. The regression result shows that deposit, loan loss provision to total asset, non-interest expense to total asset, total book value of shareholders equity to total asset and gross domestic product had a negative relationship with bank efficiency. While, total loan to total asset, total asset and non-interest income to total asset had a positive relationship and are statistically significant with efficiency.

A study conducted by Fethi and Jackson, (n. d), evaluated the technical efficiency of 48 Turkish commercial. Bank size and bank profitability have significant positive effects on efficiency, indicating that the larger and more profitable banks have higher technical efficiency. On the other hand, the capital adequacy variable is significantly negatively related to the technical efficiency. The ownership i.e., dummy was insignificant coefficient with negative sign. Xiping and Yuesheng, (n. d) studied the efficiency of China banks by applying DEA and tobit model on the production approach. Further, to investigate the effects of environmental variables on the efficiency of these commercial banks, they used tobit regression by taking the DEA result as dependent and the following explanatory variables: capital adequacy ratio, bank size, and ownership. The tobit regression shows capital ratio is a sign of negative influence on banks' efficiency.

III. METHODOLOGY OF THE STUDY

The population of the study were all commercial banks which have been in operation for more than 10 years. Among which eight banks were selected as a sample size via purposive sampling techniques. These are Commercial bank of Ethiopia, Awash bank, Bank of Abyssinia, Dashen bank, construction and business bank, Nib International Bank, United bank and Wegagen bank for the research purpose. The rationale behind the selection of those banks is their operation period.

The study is based on secondary source of data. Quantitative data are obtained from the published and audited financial statements of commercial banks in the period of 2003 – 2012. The data was collected from National Bank of Ethiopia (NBE) and from the individual commercial banks. This study used Data Envelopment Analysis (DEA) tool to analyze the quantitative data that gathered from the sampled banks. The basic idea of DEA is to identify the relative most efficient decision-making units (DMU) among all DMUs. In addition, multivariate Tobit regression analysis was employed in order to identify the determinant factors of efficiency.

Efficiency of banks can be affected by macroeconomic factors & firm specific characteristics (internal factors). However, to assess the determinants of bank efficiency, the study used the following bank specific variables. The researcher decided to use capital strength as a proxy of capitalization, deposit as proxy of market share, loan quality as a proxy of asset quality, expenses as a proxy of management capability, profitability as a proxy of earning strength, asset size as a proxy of bank size, liquidity and diversification as a proxy of bank's diversification strategy into non-traditional activities to identify the determinants of bank efficiency and its relationship. The selection of determinants of bank efficiency is supported by various literatures (Chen and Lin, 2007; Fethi, and Jackson, n. d; Gupta et al., 2008; San, et al., 2011; Sufiana, 2008; Xiping & Yuesheng, n. d).

$$y_i^* = \beta' x_i + \varepsilon_i$$

$$y_i = y_i^*$$

$$y_i = \begin{cases} y_i & \text{if } y^*_i > 0; \\ 0 & \text{otherwise} \end{cases}$$

y_i^* = the latent variable which is not actually measured and observed but represent the utility or goodwill the bank drive from efficiency,

x_i = the vectors of explanatory variable,

β' = the vectors of coefficient variables,

y_i = the dependent variable which measures the efficiency of the bank score,

ϵ_i = the error term. By using the efficiency scores as dependent variable, the researcher estimates the following regression model:
 $\Theta_{jt} = \beta_0 + \beta_1 \text{CAPSTH}_{jt} + \beta_2 \text{LNDEPO}_{jt} + \beta_3 \text{LOAQU}_{jt} + \beta_4 \text{EXPEN}_{jt} + \beta_5 \text{PROF}_{jt} + \beta_6 \text{LNTA}_{jt} + \beta_7 \text{LIQU}_{jt} + \beta_8 \text{DIVES}_{jt} + \epsilon_{jt}$

The study was conducted by using an output oriented method. In the competitive market, banks must strengthen their lending and must collect high amount of interest income from their loans and other assets. Measuring efficiency is directly related to the management's success in controlling costs and generating revenue. Thus, bank managers have more control over outputs than inputs because output-oriented DEA was adopted for the study. The two most frequently applied Models used in DEA are the CRS and VRS Models. The CRS assumption is appropriate when all the banks are operating at an optimal scale. However, in the case of the banking sector, there are several reasons such as imperfect competition, financial constraints, banking regulation and supervision, concentration, market structure and other factors exist in the real environment that may not allow banks to operate at an optimal scale. Therefore, Banker et al (1984) extended BCC version so that variable returns to scale (VRS) are consider. The mathematical version is as follow:

$$\text{Max } Z_o = \frac{\sum_{r=1}^s u_r y_{ro}}{\sum_{i=1}^m v_i x_{io}}$$

Subject to,

$$\frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} \leq 1; j = 1, 2, \dots, n$$

Table 1 Regression Result of Efficiency Score and Explanatory Variables

Tobit regression				
Number of obs =	80			
Effscore	Coef.	Std. Err.	t	P> t
[95% Conf. Interval]				
-----+-----				

Capitalstr	.3771281	.2304864	1.64	0.106
-.0823381	.8365943			
LnDepo	.0428699	.0196351	2.18	0.021**
.0034692	.0822706			
Expen	-.7758855	.7847083	0.99	0.326
-.7884019	2.340173			

Where, $u_r, v_i \geq 0$,
 X_{ij} = the amount of input i for unit j (i=1, 2...m), V_i
 = weight of input i,
 Y_{rj} = the amount of output r for unit j (r=1, 2...s) U_r
 =weight of output r.

There is no consensus in the literature regarding the specification of outputs and inputs in frontier modelling of financial institutions (Berger and Humphery, 1997). The choice of variables (both inputs and outputs) is often constrained by the availability of data on relevant variables. This study used intermediation approach in order to specify inputs and outputs. The intermediation approach regards banks as entities that collect deposits, use labour and capital and convert those resources into loans and other earnings. To achieve the objective of the study, the researcher selected Deposit and Interest expenses for input variables and Loan and Interest income also as output measurement of efficiency (Aikaeli, 2008; Mesay, 2011; San, et al., 2011; Suzuki & Sastroswito, 2011; Sufian & Abdul Majid, 2007; Yue, 1991).

IV. DATA ANALYSIS AND DISCUSSION

The determinants of commercial bank's efficiency could assist the managers to give attention to these factors in attaining the desired efficiency. The most common method of analysis to determine of bank's efficiency was Tobit regression analysis. Therefore, it is worth to investigate to what extent the obtained results are sensitive to the changes in the estimation.

Empirical data were computed from ten consecutive years (2003 - 2012) using audited financial statements of the selected eight commercial banks which were collected from National Bank of Ethiopia (NBE) and from the individual banks. Therefore, panel data was computed by Tobit regression to provide a comprehensive analysis about the determinants of private banks' efficiency in Ethiopia. STATA application version 11 was used here to run the regressions.

Prof	.3728261	.8954988	0.42	0.678
1.412318	2.15797			
Liquidity	.1537267	.0769392	2.00	0.049**
.0003512	.3071022			
Loaqu	.0325607	.0737936	0.44	0.660 -
.1145441	.1796655			
LnTa	-.0149004	.0816463	-0.18	0.856
-.1776594	.1478586			
Divers	.000012	.0000203	0.59	0.557
-.0000285	.0000525			
_cons	.9125661	.244312	3.74	0.000
.4223182	1.402814			

Note: ** Statistically significant at 5% level of confidence

The overall nature of the model illustrated in Table 1 above shows the summary of regression model run to investigate the effect of the explanatory variables on commercial banks' efficiency. Therefore, based on econometric estimation, the researcher found that deposit and liquidity are significant (at 5%) in determining bank's efficiency. In Table 1, it can be clearly shown that LNDEPO (Natural logarithm of total deposits) reveals a positive relationship and statistically significant with commercial banks efficiency score. This implies that the more efficient banks are associated to the banks with higher market share. Because of maintaining or expanding the banks market share, it might involve extra benefits, which improve the efficiency of the banks. The positive relationship and statistically significant result was contrasted with the findings of other studies like Sufiana (2008) and Sufian and Abdul Majid (2008). The P-value of profitability, loan quality, expenses, bank size and diversification are insignificant. Thus, as per this study, these variables are not determinant factors for the Ethiopian commercial banks' efficiency.

The economics estimation of tobit regression reveals that liquidity has positive relationship and statistical significance at 5% level of confidence with commercial banks efficiency. The result implies that banks which have a higher loan to asset ratio tend to have higher efficiency scores than banks which have lower loan to asset ratio. Under this situation, it is quantitatively designated that change in loan to asset ratio upward side by 1% gives rise to increased efficiency of banks by approximately 0.15%.

V. CONCLUSIONS AND RECOMMENDATIONS

After employing the DEA, the determinants of commercial banks efficiency were obtained by running a tobit regression. Therefore, the main variables increasing bank efficiency are deposit and liquidity while loan quality, expenses, profitability, bank's size and diversification were statistically insignificant. According to this research finding, these variables were not determinant factors of commercial banks efficiency. Therefore these banks should work hard to collect more deposits by design different strategies like convenience of location and quality of customer services to become efficient because it has a positive significance effect on efficiency. Liquidity has also an important role to improve bank's efficiency, so banks should improve their lending capacity based on critically analysed strategies.

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