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Drivers of Technical Efficiency of Ethiopian Commercial Banks: DEA Approach & Tobit Model

Yidersal Dagnaw Dinberu [1*] Man Wang [2]
1.Accounting School, Dongbei University of Finance and Economics
217 Jianshan St, Shahekou, Dalian, Liaoning, China
2.Accounting School, Dongbei University of Finance and Economics, Internal Control Research Center in China
217 Jianshan St, Shahekou, Dalian, Liaoning, China

Abstract
This study was conducted to identify the driving factors of technical efficiency of commercial banks in Ethiopia, initiated following the issuance of different research outputs with varied empirical findings. The study used panel data set of 8 commercial banks with duration in the business of more than 10 years. The technical efficiency scores of the banks were computed with an input oriented Data Envelopment Analysis (DEA) approach. The scores, ranging from 0 to 1, were regressed against the explanatory variables identified, using Tobit Regression Model. The result shows that profitability and management quality have significant positive impact on the efficiency of the banks. It is also revealed that capital adequacy has a negative significant influence. Moreover, the study shows that owner ship of the banks have a significant influence on the efficiency of the banks. State owned banks are found to have better performance efficiency than private owned ones. Size, liquidity and credit risk of the banks have found to have no significant impact on the efficiency of the commercial banks in Ethiopia.
Keywords: DEA, Efficiency Determinants, Ethiopia, Technical Efficiency, Tobit model

1. Introduction

The sustainability of the economic growth of a country depends on the robust banking sector development, as it has vital impact/role on the efficient mobilization and allocation of the funds so as to improve saving and investment required (Djalilov & Piesse, 2014). The intermediary role of the financial sector of an economy gets boosted as the performance of the banking system gets improved.

One measure of bank performance which could indicate the vulnerability of a bank to financial distress is Technical Efficiency (TE). As stated by (Haiyan, et al., 2013), it measures the distance of a firm's performance from the best practice frontier that exemplifies the optimal use of resources. It indicates the resource utilization performance of a firm relative to its competitors (Adusei, 2016).

The measurement and identification of the determinants of the technical efficiency of the banking sector has paramount importance in the identification of the best among the competing banks. Moreover, the influence of the policy intervention of national banks in the banking sector can be assessed by having detail investigation of the technical efficiency driving forces of the industry. In addition, in a competitive banking sector, only technically efficient and profitable banks are able to give reasonable returns on the investments of the owners of the banks. And hence, measurement of efficiency and investigating the forces driving it is the main area of study in the banking sector, and identification of the determining factors of the performance of the banking sectors in different economic setups has got the focus of researchers.

There are the two widely used techniques (parametric & non parametric) of measuring the efficiency of commercial banks in the literatures. The Data Envelopment Analysis (DEA) approach is a non-parametric techniques which was initially developed by Farrell in 1957 by relating one output to more than one input under the constant returns to scale (CRS). His work was extended by Charnes, Cooper and Rhodes (CCR) in 1978 by applying it to the case of more than one output. The DEA technique was further improved by (Banker, et al., 1984) by making it applicable to increasing, constant and decreasing returns to scale. Since then lots of research are being released, by applying the DEA technique in measuring the efficiency of the banking sector. Studies conducted using DEA released recently include (Gwahula, 2013), (Adusei, 2016), (Djalilov & Piesse, 2014), (Ke, et al., 2014), (Giulia & Andrea, 2011), (Chiang & Shiang-Tai, 2014), (Xiaotian & Yong, 2014) and (Kun-Li, et al., 2015).

Investigating the determinant factors affecting the efficiency of the commercial banks estimated using the DEA technique is another area being examined recently in the literatures including (Gwahula, 2013), (Adusei, 2016), (Lemma, 2017), (Djalilov & Piesse, 2014), (Tesfaye, 2016), (Lelissa, 2014), (Khalad & Mazila, 2014), (P. O. Eriki: Osagie, 2015), (Moh'd, et al., 2011), (Dharmendra & Bashir, 2015) and (Tung-Hao & Shu-Hwa, 2013).

However, the majority of the studies have been conducted either in a developed economy or developing ones where there is competition from foreign banks in the sector. Studies conducted in the identification of the determinants of the efficiency of banks operating in countries like Ethiopia, where the financial system is closed for foreign investment, is very limited.

Following the change in the government and issuance of a new Financial Proclamation No 84/1994 which allows the involvement of the private sector, the number of commercial banks have been increased, though the proclamation prohibits involvement of foreigners in the sector. Thus, the intensity of competition among the commercial banks has increased, that leads to improvement in the efficiency of the sector. Investigating determinants factors of technical efficiency of the banking sector is essential for further strengthening of the banking sector in Ethiopia.

The purpose of this paper, therefore, is to investigate the bank specific determinants of Technical Efficiency of the commercial banking industry in Ethiopia, where there is no competition from foreign banks in sector, and development of the financial sector is at its infant stage.

2. Research Objective and Significance

The Objective of this study is to identify the driving factors of the Technical Efficiency of the commercial banks in Ethiopia,

This study will have a significant importance in extending existing literature on the determinants of efficiency of commercial banks. And the finding will also be useful for the different policy making bodies in Ethiopia as the expansion of the competition of the domestic banks is increasing from time to time. And hence, will be useful in improving technical efficiency by focusing on factor identified in the research paper.

3. Review of related Literatures

Over the previous decades, numerous researches have appeared focusing on the study of bank efficiency. The most widely method used to measure efficiency in those studies is Data Envelopment Analysis (DEA). DEA is a non-parametric technique initially developed by Farrell in 1957, relating one output to more than one input under the Constant Returns to Scale (CRS) assumption. Farrell's analysis was further extended by Charnes, Cooper and Rhodes (CCR) in 1978, by applying DEA to the case of more than one output while keeping the assumption of CRS. Banker et al. (1984) made a contribution to DEA by removing the CRS by making applicable to increasing & decreasing returns to scale as well. Application of DEA in evaluating efficiency of banking was started with the pioneering work of Sherman and Gold in1985, and they evaluated the efficiency of 14 branches of a US savings bank. Since then, DEA technique has been adopted by numerous researchers to study efficiency of banks in different economic setups.

A research conducted by (Jenifer & Kent, 2016) on the methodology of measuring efficiency of the Jamaican banks for the period 1998 to 2007, using GLS random two variable regression test, and concluded in favor of DEA than the traditional accounting ratios. Moreover, (Selcuk & Tuba, 2006) used DEA to measure and evaluate the efficiency of commercial banks operating in Turkey. Others like (Chiang & Shiang-Tai, 2014) also conducted research to measure multi period efficiency of Taiwanese commercial banks using DEA technique. In their research, (Xiaotian & Yong, 2014) also adopted the DEA technique to investigate the production efficiency of Chinese commercial banks for the period 2004 to 2011. There also numerous researchers adopted the DEA method in measuring the efficiency of banks for different objectives of their study including (Gwahula, 2013), (Adusei, 2016), (Djalilov & Piesse, 2014), (Ke, et al., 2014), (Giulia & Andrea, 2011), (Chiang & Shiang-Tai, 2014), and (Kun-Li, et al., 2015).

There are also studies conducted to investigate the determining factors affecting the technical efficiency of the commercial banks (Adusei, 2016), (Seelanatha, 2012), (Gwahula, 2013), (Xiaofeng & Sun, 2013), (Tarek, et al., 2015), (Zawadi & Patel, 2014), (Djalilov & Piesse, 2014), (Dharmendra & Bashir, 2015). Though the number of studies conducted to examine the determinants of efficiency are increasing, those researches are conducted either in a developed countries or in countries where there exits strong competition among the private domestic, state owned and foreign owned banks.

Studies conducted to identify the determining factors of technical efficiency of commercial banking sector in developing economies in general, and in Ethiopia particularly, where there is no competition from the foreign banks & the sector is at its infant stage, are very limited. A researcher (Lelissa, 2014) analyzed the technical efficiency of the Ethiopian commercial banks with descriptive statistics after computing the efficiency scores of the banks using DEA, though Investigation of the determining factors was not the focus of his research. Another scholar (Tesfaye, 2016) published a paper on the bank specific determinants of the efficiency of the commercial banks in Ethiopia, examined them using Tobit model, but determinant factors like credit risk (Tarek, et al., 2015) and ownership type (Djalilov & Piesse, 2014), were not considered. Moreover, the input and output variables selected in computing the efficiency scores are not clearly defined in the research article. Another researcher (Lemma, 2017) also produced a paper on the same topic incorporating relatively large number of banks though the period covered was only for 4 years. The stockholder's equity amount, considered to be a major input for the banking sector (Djalilov & Piesse, 2014) and (Adusei, 2016) was not included in the computation of efficiency scores.

And hence, this research paper is conducted to fill the gaps mentioned above by investigating the Technical

Efficiency drivers of the commercial banks in Ethiopian using Data Envelopment Analysis (DEA) and Tobit regression model.

4. Methodology

4.1 Data Type and Source

The overall objective of the study is to investigate the driving factors of the technical efficiency of the commercial banks in Ethiopia. Currently, there are 19 banks operating banking business in Ethiopia, of which 3 (Commercial Bank of Ethiopia, Development Bank of Ethiopia, and Construction & business bank of Ethiopia (recently merged with Commercial Bank of Ethiopia) are government owned and the remaining 16 are privately owned (www.nbe.gov.et). The Development Bank of Ethiopia is the one financing long term development projects of the government, doesn't engage in commercial activities, and hence it has been excluded from this study. In general it is considered that the duration of the bank affects the efficiency due to the learning effect. To clearly identify the most influential driving forces of the efficiency of the banks, the researchers believed to use minimum of 10 years panel data. In this study, out of the 19 banks, 8 commercial banks have been included in this study to achieve the purpose mentioned above.

To achieve the research objective, based on previous studies conducted, financial data affecting the efficiency of the commercial banks have been collected from the audited annual financial statements of the commercial banks. The researchers have used a panel data set of 8 banks for the years from June 30, 2005 to June 30 2014 (the fiscal year runs from July 1 to June 30). We used panel data due to the availability of consistent financial data of the banks over the period under study. Moreover, as indicated by (Russ & Cummings, 2010), panel data usually contain more degrees of freedom, less multi-collinearity problem than simple cross sectional data, and provides greater capacity of capturing firms characteristics than time series or cross sectional data.

Data related to other non-financial variables of the banks have been collected from the National Bank of Ethiopia, which is responsible in the licensing and supervision of the banking, insurance and microfinance sectors in Ethiopia.

4.2 Variable Definition and Measurement

To achieve the aforementioned objective of investigating driving factors for the efficiency of the commercial banks under study, we used the Data Envelopment technique. In determining the efficiency scores under the technique, we identified input and output variables of the banks, following the intermediation approach which considers deposits as inputs for commercial banking in rendering their services (Adusei, 2016). The inputs and output variables used, and variables explaining efficiency with their respective measures, have been summarized in the following table.

Table 1. Summary the variables and the respective measurement

Variables		Measurement	Sources
Input Variables	Stockholder's Equity (SHE)	Measured by the total stockholder's Equity of the bank, including paid-up capital, share premiums and reserves	(Djalilov & Piesse, 2014), (Adusei, 2016)
	Deposits (DEP)	Measured by the total deposit; including Demand, Saving and Fixed deposits	(Xiaotian & Yong, 2014), (Seelanatha, 2012), (Adusei, 2016)
Output Variables	Loans and Advances (LOAD)	Measured by the total loans and advances (term loans, overdrafts and advances)	(Xiaofeng & Sun, 2013), (Seelanatha, 2012)
	Earnings Before Tax (EBT)	Measured by the net profit of the banks before business income tax	(Adusei, 2016)
Dependent Variable	Efficiency Scores (EFF)	Computed using DEA based on the input and output variables given above.	(Gwahula, 2013), (Seelanatha, 2012), (Adusei, 2016), (Dharmendra & Bashir, 2015)
Explanatory variables	Capital Adequacy (CAPADQ)	Measured by the percentage of total stockholder's equity to that of total assets	(Gwahula, 2013), (Xiaofeng & Sun, 2013), (Tarek, et al., 2015), (Adusei, 2016)
	Size (LnTA)	Measured by the natural logarithm of total amount of assets owned by the bank.	(Gwahula, 2013), (Xiaofeng & Sun, 2013), (Adusei, 2016)
	Liquidity (LiQui)	Measured by the percentage of Liquid Assets to Total Deposits	(Tarek, et al., 2015)
	Profitability (PROFF)	Measured by the Return on Assets and Return on Equity	(Xiaofeng & Sun, 2013), (Tarek, et al., 2015), (Adusei, 2016)
	Credit Risk (CrRk)	Measured by the percentage of Loan loss provision to total loans and advances.	(Tarek, et al., 2015)
	Management Quality (MgtQual)	Measured as the percentage of non-interest expense to total assets	(Zawadi & Patel, 2014)
	Ownership (Own)	A dummy variable which takes a value of 1 if it is Privately Owned, and 0 if state owned	(Djalilov & Piesse, 2014)

4.3 Method of Data Analysis

This research article followed a two-step procedure in identifying the drivers of the efficiency of the commercial banks in Ethiopia. In the first step, Technical Efficiency scores of the banks are calculated for the period 2005 up to 2014, using the Data Envelopment Analysis technique. In the second step, the efficiency scores computed are regressed against variables explaining the efficiency using the Tobit Regression model.

4.3.1 Data Envelopment Analysis (DEA)

The efficiency scores of the commercial banks computed using the Data Envelopment Analysis (DEA) have been used as dependent variables to investigating the determinants of the same (Banker, et al., 1984). The DEA techniques which was first proposed by Farrell (1957), was not given much detailed empirical attention until a publication of paper by (Charnes, et al., 1978). It is a mathematical programming approach for the construction of production frontiers and the measurement of efficiency relative to the constructed frontiers. As clearly stated by (Wade D. Cook, et al., 2013), DEA is not a regression model, but rather it is a frontier based linear programming optimization technique. DEA efficiency score for a specific Decision-Making Unit (DMU) is not defined by an absolute standard, but it is defined relative to the other DMUs in the specific data set under consideration. This feature differentiates DEA from the parametric approaches. Moreover, whereas the conventional parametric techniques requires prior assumptions about the distributions of the observations, DEA does not (Adusei, 2016).

DEA minimizes inputs and maximizes outputs; in other words, smaller levels of the former and larger levels of the latter represent better performance or efficiency (Wade D. Cook, et al., 2013). And hence, there are two commonly used orientations under the DEA technique, input-orientation and output-orientation. In their original paper, (Charnes, et al., 1978) proposed a model that had an input orientation and assumed constant returns to scale (CRS). Later studies have considered alternative sets of assumptions. The variable returns to scale (VRS) assumption was first introduced by (Banker, et al., 1984). The CRS assumption is only suitable when all DMUs

are functioning at an optimal scale. However, factors like imperfect competition and constraints on finance may cause a DMU not to be operating at optimal scale. As a result, the use of the CRS specification when some DMUs are not operating at optimal scale will result in measures of technical efficiency (TE) which are confounded by scale efficiencies (SE).

In the input-orientated models, the DEA method seeks to identify technical inefficiency as a proportional reduction in input usage. It is also possible to measure technical inefficiency as a proportional increase in output production. These two measures provide the same value under CRS, but do not equate when VRS is assumed. Many studies (Adusei, 2016), (Dharmendra & Bashir, 2015) have tended to select input-orientated measures because the input quantities appear to be the primary decision variables. And hence, our research follows the input oriented approach, as the input variables are the primary concerns in the decision making of the commercial banks in Ethiopia, using variable returns to scale (VRS), and the following DEA equation following (Banker, et al., 1984) have been used.

$$\min \Theta_q^*$$

$$s.t. \quad \sum_{j=1}^{n} x_{ij}\,\lambda_j \le \Theta_q x_{iq} \qquad i = 1, 2, \dots, m,$$

$$\sum_{j=1}^{n} y_{rj}\,\lambda_j \ge y_{rq} \qquad r = 1, 2, \dots, s,$$

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

$$\lambda_j \ge 0 \qquad j = 1, 2, \dots, n,$$

Where, Θ_q^* is input-oriented technical efficiency (TE_q) of Decision Making Unit ($DMUq$) in the input oriented DEA model, y_{rq} is produced amounts of r^{th} output ($r = 1,2, \dots, s,$) for DMU_q, x_{iq} is consumed amounts of i^{th} input ($i = 1,2, \dots, m,$) for $DMUq$, y_{rj} is produced amounts of r^{th} output ($r = 1,2, \dots, s,$) for DMU_j ($j = 1,2, \dots, n,$), x_{ij} is consumed amounts of i^{th} input ($i = 1,2, \dots, m,$) for DMU_j ($j = 1,2, \dots, n$), λ_j is weight assigned to the DMU_j ($j = 1,2, \dots, n,$).

4.3.2 Tobit Regression Model

In the second stage of the analysis, we used the Tobit model (truncated or censored) regression model to obtain the estimates of the factors which affect the efficiency of the commercial banks in Ethiopia. The Tobit model is a statistical model, initially proposed by Tobin (Tobin, 1958) to describe the relationship between a non negative dependent variable y_i and an independent variable x_i. As explained by (Gwahula, 2013), the model is able to handle equations with restricted threshold, like our efficiency estimates which ranges from 0 to 1. Previous researches like (Dharmendra & Bashir, 2015), (Gwahula, 2013), (Djalilov & Piesse, 2014), (Khalad & Mazila, 2014) etc also used the same model in identifying the efficiency determinants.

The following standard Tobit regression model was used;

$$y^* = \boldsymbol{\beta} x_0 + \varepsilon_0$$

$$y_0 = y^*, if\ y^* > 0\ otherwise$$

$$y_0 = 0,\ \varepsilon_0 \approx N(0, \delta^2)$$

Where, x_0 and β are the explanatory variables and its coefficient respectively, y_0 and y^* are the vectors of the observed DEA efficiency scores and vector of latent variable respectively.

Therefore, we can extend the above equation, by including explanatory variables and efficiency estimate scores as dependent variable as follows;

$$\mathbf{Eff_{it}} \quad \alpha + \beta_1 \mathbf{LnTa_{it}} + \beta_2 \mathbf{CapAdq_{it}} + \beta_3 \mathbf{ROA_{it}} + \beta_4 \mathbf{MgtQual_{it}} + \beta_5 \mathbf{Own_{it}} + \beta_6 \mathbf{Liqui_{it}} + \beta_7 \mathbf{CrRk_{it}} +$$

Where, Eff_{it} are the efficiency scores of the banks; $\beta_1, \beta_{2\dots} \beta_7$ are coefficients of the explanatory variables; α is the constant estimate of the regression, and the explanatory variables are defined above (table 1).

5. Results and Discussion

5.1 Descriptive statistics

As described above, the technical efficiency scores computed using DEA approach are the dependent variables, and the summary statistics of the scores across periods and commercial banks have been given in the following tables.

Table 2. Summary statistics of the efficiency Scores

year	mean	Std. Dev.	max	min
2005	0.97	0.07	1	0.8
2006	0.86	0.13	1	0.7
2007	0.87	0.14	1	0.59
2008	0.91	0.08	1	0.82
2009	0.90	0.13	1	0.69
2010	0.98	0.03	1	0.94
2011	0.99	0.02	1	0.94
2012	0.98	0.04	1	0.88
2013	0.97	0.06	1	0.81
2014	0.90	0.12	1	0.7

As can be seen from the table, the maximum and minimum mean efficiency score of the banks was registered in the year 2011 and 2006, amounting 0.99 and 0.86 with a standard deviation of 0.02 and 0.13 respectively. The highest inefficiency (least efficiency) of the banks was registered in the year 2007 with efficiency score of 0.59, indicating that it was possible to reduce the amount of inputs used by 41% to have the same level of outputs as compared to the best performing bank during the year.

Descriptive summary statistics of the explanatory variables used in the Tobit regression model have also been given in the following table.

Table 3. Summary statistics of the explanatory variables

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
lnta	80	22.7376	1.144351	20.8	26.2
capadq	80	11.6099	3.607254	4.23	19.2
roa	80	3.17063	0.790666	0.38	5.1
mgtqual	80	2.61625	0.834455	0.9	5.8
liqui	80	48.285	14.8209	21.3	78.2
crrk	80	4.93875	3.973536	1.5	21.2

5.2 Multi-collinearity Test

To detect multi-collinearity problems among the dependent and independent variables used in the data (excluding the dummy 'ownership'), correlation analysis was performed, and given in the table below.

Table 4. Correlation Matrix, (Authors' computation)

	eff	lnta	capadq	roa	mgtqual	liqui	crrk
eff	1						
lnta	0.2	1					
capadq	-0	-0.3791	1				
roa	0.2	0.0381	0.4272	1			
mgtqual	-0	-0.5347	0.4035	-0.12	1		
liqui	-0	-0.2888	0.1113	-0.05	0.09	1	
crrk	0	-0.1462	-0.3676	-0.32	0	0.3808	1

From the correlation coefficients provided in the above table, there is no significant correlations among the variables used in the Tobit regression model.

5.3 The Tobit Model Result

To achieve the aforementioned objective of identifying the driving factor of efficiency of the commercial banks, the efficiency scores computed using DEA were regressed against the explanatory variables using Tobit regression model. The result of the model is given in the table below.

Table 5. Tobit regression result

Explanatory Variable	**Coefficient**	**P-value**
Size (lnta)	0.0221839	0.4030
Capital Adequacy (capadq)	-0.0146255	0.0440**
Profitability (roa)	0.1096562	0.0000*
Management Quality (mgtqual)	0.0726798	0.0160**
Ownership (own)	-0.1079758	0.0870***
Liquidity (liqui)	-0.0025383	0.1120
Credit Risk (crrk)	0.7958991	0.248

N.B. :*(significant at 1%), **(significant at 5%) & ***(significant at 10%).

The table shows that from the drivers identified, Profitability, Management quality, Capital adequacy and ownership are found to have statistical significant impact on the technical efficiency of the commercial banks at a significant level of 1%, 5%, 5% and 10% respectively.

It is revealed in the result that the Profitability of the commercial banks measured by the Returns on Assets (ROA) has significant positive impact on the technical efficiency scores. It means that the higher the return on assets of the banks, the better the performance efficiency. The research output is consistent with the previous findings (Gwahula, 2013), (Xiaofeng & Sun, 2013), (Adusei, 2016), (Khalad & Mazila, 2014), (Zawadi & Patel, 2014), and (Dharmendra & Bashir, 2015). On the other hand this empirical finding is refutes the research result of (San, et al., 2011), which concluded as there is no significant impact of profitability on efficiency.

The table above also shows that there is a significant negative effect of capital adequacy, measured by the percentage of the equity capital to that of total assets, on the efficiency scores of the banks. The result is consistent with the findings of (Gwahula, 2013), (San, et al., 2011), (Adusei, 2016), (Khalad & Mazila, 2014), and (Moh'd, et al., 2011). The research output suggests that commercial banks need to increase their leverage in order to improve their technical efficiency. On the other hand, the finding opposes the results of (Tarek, et al., 2015) and (Zawadi & Patel, 2014), found that there is positive impact of capital adequacy on efficiency and doesn't affect efficiency at all respectively.

The regression result table above also shows that there is a positive significant impact of management quality measured by the ratio of non-interest expense to that of total assets, which is against the expectation and findings of previous studies (Zawadi & Patel, 2014). The result is against the logic that an increase in non-interest expenses reduces profitability, and hence affect efficiency.

Regarding the ownership variable, the table above shows as it affects the efficiency of the commercial banks significantly. The negative coefficient for the dummy ownership variable shows that the private banks are inefficient as compared to the state owned banks. As per the result, private banks can reduce on average 10.8% their inputs to have the same level of outputs, had they been as efficient as their counterpart state owned ones during the period under study. The research finding is against the agency theory, which states that the financial performance of private owned firms is better than that of state owned ones (Eisenhardt, 1989), (Jensen & Meckling, 1976), (Ross, 1973), (Wasserman, 2006). The finding also contradicts with the research result of (Djalilov & Piesse, 2014), which concludes that state owned banks are less profit efficient.

As shown (table 5), size of the commercial banks as measured by the total assets of the commercial banks has no significant impact on the performance efficiency of the commercial banks. It is consistent with the previous findings of (Seelanatha, 2012) & (Dharmendra & Bashir, 2015). It means that the amount of total assets of the banks doesn't matter to improve the efficiency of the banks. This finding refutes the findings of (Gwahula, 2013), (Xiaofeng & Sun, 2013), (San, et al., 2011), (Adusei, 2016), (Khalad & Mazila, 2014), and (P. O. Eriki: Osagie, 2015).

The tobit regression result also shows that Liquidity has no significant impact on the efficiency of the commercial banks, consistent with the finding of (Xiaofeng & Sun, 2013). It means that increasing or decreasing the ratio of liquid assets to that of deposits of the banks doesn't improve the efficiency scores. The finding refutes the previous studies (Gwahula, 2013), (Tesfaye, 2016), (Dharmendra & Bashir, 2015), & (Tarek, et al., 2015) showed as it has positive impact.

It is also shown that credit risk has no significant effect on the efficiency of the commercial banks, as opposed to the findings of (Xiaofeng & Sun, 2013), (San, et al., 2011), & (Tarek, et al., 2015). It leads to a conclusion that the percentage of the loan loss provision out of the total loans and advances of the banks doesn't affect the performance efficiency of the banks.

6. Conclusion and Recommendations

This research study was designed to examine the driving factors of the performance efficiency of the commercial banks in Ethiopia taking 10 years panel data set of 8 banks for the period from 2005 to 2014.

The efficiency scores of the banks under study were computed using the Data Envelopment Analysis (DEA) approach. We used the intermediation approach in identifying the inputs and output variables for the calculation of the scores using an input oriented DEA,

Considering the previous literatures, we have identified size, capital adequacy, profitability, management quality, dummy ownership, liquidity and credit risk as the driving factors of efficiency.

After regressing the latent variable computed using DEA, efficiency (EFF), against the explanatory variables identified above using the Tobit regression model.

The empirical finding shows that the higher the profitability the better the efficiency of the commercial banks. The result also revealed that the lower the capital adequacy the better the performance efficiency is. It means that banks with high proportion of debt financing perform better in terms of technical efficiency.

The research study concluded that the state owned banks used lower amount of inputs than private owned ones to provide a given level of output /services, citrus paribus. This is a contradiction to the agency theory that

states private owned firms perform better than state owned ones. Another variable having positive significant impact on efficiency was found to be the management quality as explained by the non-interest expense, which is against the logic that non-interest expenses have negative impact on performance efficiency.

The other explanatory variables identified like the variation in the size of the banks, liquidity and credit risk of the banks found to have no significant impact on the performance efficiency of the commercial banks for the period covered.

And hence, it is suggested for the commercial banks to increase their leveraging of the equity capital so as to reduce the level of inputs used to produce a certain level of output/services. Moreover, it is also suggested that is possible to improve the performance efficiency scores by improving the profitability (return on assets) of the banks. And hence, it is recommended to examine factors enhancing profitability, and in return improve technical efficiency.

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