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Bank-specific, industry-specific and macroeconomic determinants of bank efficiency in Tanzania: A two stage analysis.

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Abstract

The aim of this study is to investigate the effect of bank specific, industry specific and macroeconomic variables of commercial banks' efficiency. Data envelopment analysis is applied to obtain efficiency estimates such as, Technical efficiency (TE), Pure Technical efficiency (PTE) and scale efficiency (SE) for the period of 2005-2008. Afterwards the efficiency estimates were obtained through Tobit regression model. The first stage of our analysis indicates inefficiency estimates are 13%, 9% and 4% for TE, PTE and SE respectively, our efficiency estimates figure indicates the decline of efficiency level during the 2008 study period, the decline in efficiency level may be caused by the international financial crisis which affected some sectors of the economy with no exception of the financial sector. Thereafter showing recovery to reach the score of 97% in 2009, operating under increasing returns to scale. Using Tobit Regression model our findings reveal bank efficiency is influenced by both bank specific, industry specific and macroeconomic factors. More specifically with bank specific factors bank size, profitability measured by NIM, liquidity, as well as capital adequacy were found to be the main factors influencing the bank`s efficiency, while with industry specific characteristic market share and concentration were found to influence significantly bank`s efficiency. Lastly in case of macroeconomic factors only GDP was found to influence the bank`s efficiency. In similar view Non performing loans (NPL), ownership and CPI were found to be insignificant in explaining commercial bank`s efficiency.

Key words: Efficiency, Data Envelopment Analysis, Financial sector.

1. Introduction

Only a hand full of studies in emerging economies and developing countries in particular has shown that there are many factors influencing commercial bank efficiency. Studies in Tanzania in particular have shown commercials banks are more profitable since financial sector reform in eary1990s, when compared with pre reform years. Commercial banks remain a key role in the economic development of any country. A well efficient banking system is more resilient, this is to say, it can be able to withstand various shocks and hence contribute to the stability of the banking system in the country. Because of its significance, the financial sector has attracted attention of many academicians, researchers and bank management in particular to investigate different factors influencing efficiency, effectiveness and performance of commercial banks. Good numbers of studies have focused on profitability determinants using linear regression models, in these studies much of their focus was on internal determinants with only few factors involved. Furthermore the econometric approach in many cases was insufficiently described (Molyneux and Thornton, 1992). Only the meaningful analysis can be performed by considering both micro and macro environment. We consider micro environment as bank specific and industrial characteristics, while macro environment includes all factors that cannot be directly handled by the management. Therefore this study is justified by the fact that most studies in developing countries, Tanzania in particular have directed their attention with much focus on bank's profitability and performance, with little emphasis on efficiency and effectiveness. Therefore this study will add value to the existing literature on efficiency factors with views of enhancing more information on factors affecting efficiency.

Most reviewed studies on bank specific characteristics are represented by the following; size which is presented as the natural logarithm of total asset (LN Total Asset), Nikolaos. I. Papanikolaou (2009); George, A, A; Carlos, P.B; Matousek, R (2011), Miller and Noulas, (1996), Favero and Palpi, (1995). The other bank specific characteristic used

for bank efficiency studies is NPL ratio, which is the ratio of loan loss provision of the total value of loans distributed. The non performing loans tell how well the bank is managing its loan portfolio, which can be interpreted as the lower the percentage (%) the better the managed portfolio. Changes in credit risk may enhance change in efficiency of commercial banks respectively, which the best alternative is the diversification of a portfolio, especially when the risks cannot be anticipated, Cooper et al, (2003). Various studies used this ratio to measure the efficiency of commercial banks, Pastor, J.1992 (Mexico); Sufian&Habibullah, 2009 (Singapore); Sufian, 2009 (Singapore); Seelanatha, L, S, 2012 (Srilanka); Manthos, D.D, 2009 (Greece). Other bank specific characteristics are such as capital adequacy, non interest income to total asset, (NII/TA), noninterest expenses to total assets, (NIE/TA), profitability measures indicated by ROA and NIM, similarly all of these bank specific characteristics were supported by different researchers with contradicting results in relationship with bank efficiency such as, Leong and Dollery, (2002); Mckillop, D.G, (2002); Casu. B and Molynuex (2003); Pasiouras and Tsaklanganos, (2007); Kosmidou, K.F, (2007).

On the other hand the industry specific characteristics have been reported by a number of studies from developing countries emerging economies and developing countries, with similar or different view on determinants of efficiency. Our study includes market share and ownership status. Some of the studies indicate foreign banks were more efficient than the counterpart domestic banks, studies like Murinde and Tefula (2008) argued that the degree of foreign bank penetration is inversely proportion to X-inefficiency as foreign banks were found to collect more deposit and issue more loans, similar view was supported by Bonin, Hassan&Wachtel, (2005). On another hand Industry concentration which is calculated by as Herfindahl –Hirschman Index, as the sum of market share of all banks in the banking industry is used as one of the industry specific characteristics. The HHI index below 0.01 (100) indicates highly competitive market while the below 0.1 indicates unconcentrated market, HHI between 0.1 (100) and 0.18 (1800) indicates moderate market concentration and the HHI above 0.18 indicates a high market concentration, some studies calculate market share in terms of deposits, others in terms of Asset, the studies like Nikolaos. I. Papanikolaou (2009); Darrat, A.F., Topuz, C., &Yousef, T, (2002); Miller, S. M&Noulas, A, G, (1996); Favero, C. A and Papi. L, (1995).

Macroeconomic factors; were also used to determine the efficiency of commercial banks, similarly some of the indicators within this category indicated positive relationship, while others indicators were not significant to efficiency status of commercial banks. In this category Gross Domestic Product (GDP) and Inflation rate measured as CPI was used by a good number of studies to measure the efficiency of commercial banks, both inflation and GDP growth exert a positive and negative impact to the efficiency of commercial banks. It was found that strong economic growth enhances intermediation efficiency, since it encourages more deposits and demand for loans used in various investments, the opposite is true in case of low economic growth. Similarly when noninterest expenses are increasing at a faster rate than inflation, it will affect efficiency status of commercial banks, this is because the utilization of inputs resources does not go in hand with output production level. Similarly the GDP and Inflation rate measured by CPI were used in many efficiency studies such as, Delis, M.D., &Papanikolaou. N. I, 2009 (Greece); Pasiouras, F, 2009 (UK); Sufian, F., 2009 (Malaysia); Dietsch, M., LozanoVivas, A., 2000 (French&Spanish); Hassan, M.K and Bashir, A.H.M, 2003 (Morocco), Favero, C. A. and Papi, 1995 (Italia).

2: Empirical literature review

Empirical studies on determinants of bank efficiency were done in different countries with different social economic conditions using bank specific, industry specific and macro environmental factors. This empirical review takes into account both developed countries, emerging economies countries as well as developing countries. Generally the findings from different researchers were found to contradict on different factors influencing the efficiency of commercial banks; some determinants were significant when a particular method was applied but insignificant when another method was applied or significant in one country but insignificant in another country, even if the same approach is used.

In developed countries a number of studies have investigated the reasons for inefficiency in commercial banks, with more weights put in X-inefficiency. Basing on CAMEL model, which is mostly used in banking supervision, the empirical findings indicate Liquidity as well as the quality of an asset influences the efficiency of commercial banks. David C. Wheelock &Paul W. Wilson, (1995) using stochastic cost and Profit approach investigates the reasons for bank failure in the USA, the empirical findings indicate well capitalized banks , highly liquid banks, less NPL are

likely to perform higher in efficiency and profitability compared to those with low capital, low liquidity and poor asset quality. Similar findings were obtained in the same country by, Berger A.N and Humphrey D.B, (1997); Wheelock, D. C and P.W. Wilson, (1997). Other cross country studies were done in European countries aimed at investigating macro and micro factors for banking efficiency, the study by case, B, and Molyneux, P, (2003) using Data Envelopment Analysis (DEA) examined efficiency status of various European banks, thereafter a Tobit regression model approach was applied. Determinants of bank efficiency were taken into account, the empirical findings indicate since the establishment of the European single market, there has been a small improvement in efficiency levels, with country specific factors being the cause for efficiency in most banks. However with Bootstrapping method, the same conclusion was made as geographical factors do influence the efficiency, but capital ratio (E/TA) and Return on Average Equity (ROAE), do not influence bank efficiency levels, the results contradicts with previous studies by, Mester, L.J (1996); Maudos, J., Pastor, J.M., Perez, F. and Quesada, J. (2002).

In Latin America different studies were done to examine factors influencing the efficiency in banks. In Brazil, the study by Tarbak, B&Ruiz, P (2008), using Stochastic Approach the study examined the cost and profit efficiency in Brazilian banks later on determinants of efficiency were examined, in this study bank specific characteristics were found to influence bank efficiency, with capital strength indicating a strong significant relationship . The other country within this category is Mexico, the two stages Data Envelopment Analysis (DEA) was used to examine the determinants of commercial bank efficiency in Mexico by Garcia-Garza.J.G, (2011) there after the results were regressed trough Tobit model to obtain its main determinants, the empirical findings of this study indicates Mexican banking sector experienced average inefficiencies through period of study, of technical inefficiency(15%),pure technical inefficiency(29%) and scale inefficiency(14%),however the efficiency level increased through 2008 onwards, the main determinants of increase in efficiency were increased loan intensity and GDP growth, but inefficiency was caused by non performing loans, increased noninterest expenses and inflation rate . Similar method was used in Saudi Arabia Banks by, Assaf, G.A., Barros, P.C., and Matousek, R., (2011), for the first stage Bootstrapped DEA-VRS model was used thereafter bootstrapped truncated regression model was used to obtain the determinants of efficiency. The empirical findings indicate Saudi Arabian banks consistently improve its efficiency status since (2004). In case of determinants it was found that bank size significantly influence the efficiency of banks with larger value increase the technical efficiency of the banks, on another hand NPM (Net profit Margin) was found to be significant and positive however its coefficient is small, which implies that even efficient banks still have a lower profit margin. In contrast with the above non parametric approach the other study was done using Stochastic Frontier Approach (SFA) over a recent unstudied period in the same country, SFA was used to estimate profit and cost efficiency there after factors determining inefficiency were determined. The empirical findings indicate bank cost inefficiency was found to be higher than profit efficiency estimates, more over bank size and NPL or credit risk affect the efficiency of commercial banks negatively, however when using Tobit model the results are the same with Manthos, D. D&Papanikolaou, N.I., (2009) which indicate Bank size is a significant element in determining bank efficiency. Moreover the other cross sectional study was done in MENA countries, which are also considered countries within the emerging markets, this study used the Two stage DEA approach to compare the efficiency status within commercial banks operating in these countries, MENA countries include, Middle East; North Africa. The first stage involves obtaining Technical efficiency estimates (TE), then pure technical efficiency (PTE) and Scale efficiency (SE) like previous study, thereafter Tobit regression is used to determine the impact of both internal and external factors on bank efficiency. The empirical findings revealed Islamic banks operating in Middle East performed well compared to the counterpart in Asian countries. Moreover during the period of the study pure technical efficiency were found to be higher than scale efficiency in MENA countries compared to the Asian countries. The Tobit regression model indicates Loan intensity, the size of the banks measured by market share, capitalization and profitability were significantly related to efficiency however technically small banks and those with a lower NPL ratio were found to be more efficient than others in this study.

In developing countries different factors were also used to determine the efficiency of commercial banks. Some are bank specific characteristics, industry specific characteristics as well as macro environment. In these developing countries the financial deregulation possesses some challenges, and some studies were able to evaluate the impact of these regulations on bank efficiency especially when it comes to foreign bank's participation in the economy, comparison of efficiency estimates between foreign and domestic banks is important. Therefore ownership is considered as one of the industry specific determinant in most developing country studies. Other factors may include

Inflation which is normally caused by economic instability within these countries, on the other hand economic growth measured by GDP is considered, others are bank size and the level of NPL just to mention a few. A number of studies within sub-Saharan Africa fall within this category. The following are some of selected studies. The study by Sandrine Kablan, (2010) on bank efficiency and determinants in sub Saharan Africa, aimed at assessing the level of financial development as well as the efficiency of banks within this part of the world. The stochastic approach was used in the study followed by Generalized Moment Methods (GMM). With Stochastic approach most Sub Saharan African countries were found to be cost efficient however the NPL were found to undermine the efficiency of these banks which call upon the improvement in regulatory and credit environment. Furthermore the political and economic environment has affected the efficiency and financial development in Sub Saharan Africa which resulted in lowering of efficiency levels. When considering the determinants of banks' efficiency, under the GMM method, the coefficient of ROE was found positive, which is the sign of risk reduction, this argument was supported by Allen and Rai (1996). Moreover increased bank size was found to have a negative impact on efficiency due to the increased cost of operation especially when the large bank is operating under diseconomies of scale.

The single country approach was also used to investigate the determinants of commercial banks' efficiency in some countries of Sub Saharan Africa, a handful of studies were done in the following countries, Anthony, M, 2008 (Zambia); Ikhide, S, 2000 (Namibia); Ncube, M, 2009 (South Africa); Kamau, A, 2011 (Kenya); Aikael, J, 2008 (Tanzania). Using stochastic frontier Approach, Musonda, A (2008) investigates cost and profit efficiency (SFA). Furthermore the determinants of cost and profit efficiency were established, empirical findings indicates Zambian banks were inefficient in the order of 11.4%, the results also indicates foreign banks were more efficient than domestic banks, it was also found that the regulatory environment has no influence on bank efficiency however bank specific characteristics and macro environment uncertainty have contributed to the large extend on the inefficiency of commercial banks. The study recommends on risk improvement and reduction in credit to government in order to enhance the sustainability of commercial banks. Similarly Ncube (2009) analyzed profit and cost efficiency in South Africa using similar methods, banks were divided into large and small, empirical findings indicates a poor correlation between cost efficiency and profit efficiency, however most cost efficient banks were found to be most efficient, in terms of size cost efficiency declines with the increase of size.

In Tanzania only one study was found to investigate the efficiency of commercial banks, focusing on the determinants of X-inefficiency, Aikael, J, (2008) using Translog cost function, X-inefficiency was estimated, thereafter Tobit model analyses factors affecting it. The empirical findings of this study indicate all commercial banks were not fully in technical and scale efficiency; however DEA estimates indicates commercial banks in the country had a chance of enjoying economies of scale throughout the period of study; this is to say the existing banks could expand and the new ones could join the industry. Based on ownership three groups of commercial banks were analyzed as large domestic banks, subsidiaries of major international banks, and small banks; in these categories foreign banks were found to be technically efficient followed by small banks and then large domestic banks. While in terms of Scale efficiency, small banks ranked the first followed by major international banks and then large domestic banks. Regarding the factors for X-inefficiency, bank size was positively related to X-inefficiency, other factors were excess liquidity as one of the elements for inefficiency, and furthermore the balance between labour and capital was improperly managed.

3. Data and Methodology.

We used data from different sources, the Bank of Tanzania (BoT) is one of the major sources of financial information, and similarly macro economic data were obtained from the Tanzania National Bureau of Statistics (NBS) as well as International Financial Statistics (IFS) under International Monetary Fund (IMF). We used unbalanced panel data with 175 observations, comprising of seven years from 2005-2011 .The table 1 of the appendix presents the description of the variables used in the study with hypothesized relationship.

We adopt two stage Data Envelopment analysis, following empirical literature from previous studies. The first stage involves estimation of efficiency scores namely Technical Efficiency (TE), Pure Technical Efficiency (PTE) and Scale efficiency (SE. The second stage of our analysis we used a Tobit regression model using efficiency scores obtained in the first stage as dependent variables by regressing with a series of explanatory variables of bank efficiency. Table 2 of the appendix shows descriptive statistic of explanatory variables.

3.1 Measuring Technical efficiency (TE)

Under Constant Return to Scale (CRS) assumption, we measured technical efficiency using linear programming problem using the following situation.

$$\min\theta$$

$$\theta,\lambda$$

Subject to

$$-y_i + Y\lambda \geq 0$$
$$\theta x_i - X\lambda \geq 0$$
$$\lambda \geq 0$$

In the above linear programming equation, θ represents scalar and λ is N $\times$ 1 vector constant; X is the $(k\times n)$ matrix of inputs while n represents the number of banks, where i=1.2…,n; Y is $(m\times n)$ matrix of out puts. The value of θ obtained above is the score of i^{th} DMU. The scores should range between 0 and 1, therefore $\theta \leq 1$ .This is to say θ= 1 represents the efficient banks, while $\theta \prec 1$ represents the inefficient banks, lies below the frontier. The solution of θ is obtained by solving n times linear programming problem.

3.2 Measuring Pure Technical efficiency (PTE) and scale efficiency

The above LP equation is based on CRS assumption, this assumption does not hold the data more tightly, and hence the feasible region enlarges. It is through Banker`s et al (1984) the above equation was modified to account for VRS by incorporating $N1'\lambda = 1$, therefore the problem becomes as follows,

$$\min\theta$$

$$\theta,\lambda$$

Subject to

$$-y_i + Y\lambda \geq 0$$
$$\theta x_i - X\lambda \geq 0$$
$$N_1' = 1$$
$$\lambda \geq 0$$

Where N1 is an N $\times$ 1 vector of ones. This approach unlike the previous one form a convex hull of intersecting planes which envelop the data more tightly and thus provides an estimate that is greater than or equal to those obtained under the CSR model. The efficiency estimates are obtained by solving linear programming (LP) models for both cases VRS and CRS using the same data. If there is deviation between the two estimates of (DMUs) commercial bank, this indicates the DMUs (commercial bank) are relatively scale inefficient. Therefore the difference between VRS estimates and CRS estimates results into scale inefficiency scores.

We followed intermediation approach, which describes bank as financial intermediaries which is used to channel funds from saver to investors. In selection of outputs and inputs we used approach from previous studies like Bhattacharya (1997); Sealey&Lindley (1977). Therefore our study considers three inputs and four outputs as shown in Table 3 of the appendix

3.3 Measuring Determinants of efficiency

In the second stage of our analysis, we used Tobit model (Truncated or Censored regression model) to obtain the estimates of the factors which affect the efficiency of Tanzanian commercial banks. The reason for choosing the Tobit model is its ability to handle equations with restricted threshold, like efficiency estimates which ranges from 0 to 1 (0, 1), while the use of OLS (ordinary Least Square) could result into biased results. The OLS assumes normality and homoskedastic of the error term, in this study we follow the work of previous researchers like, Coelli et al (1998); Casu, B and Molynuex (2003) to arrive to the estimates scores.

$$y_0^* = \beta' x_0 + \varepsilon_0$$

$$y_0 = y_0^* \text{ if } y_o^* \succ 0 \quad \text{otherwise}$$

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

Where;

x_0 and β = vectors of explanatory variables and its coefficient respectively

y_0 and y_0^* =are the vectors of the observed DEA efficient scores and vector of latent variable respectively.

Then, likelihood function is maximized, to obtain the values for the coefficients and variance of the explanatory variables based on the observed values of the explanatory variables and the efficiency scores.

$$L = \prod_{y_0=0} (1 - P_0) \prod_{y_0^* \succ 0} \frac{1}{(2\prod \sigma^2)^{0.5}} \times e^{-\left[1/(2\sigma^2) \right](y_0 - \beta_{x0})^2}$$

Where, $P_0 = \int_{\infty}^{\beta x_0 / \sigma} \frac{1}{(2\prod)^{0.5}} \times e^{-t^2/2} dt$

We can therefore extend the above equation, by including explanatory variables and efficiency estimates score as dependent variables as follows.

$$EFF_{it} = \alpha + \beta_1 EQTA_{it} + \beta_2 NIM_{it} + \beta_3 ROA + \beta_4 NIE_{it} + \beta_5 NII_{it} + \beta_6 NPL_{it} + \beta_7 MS_{it} + \beta_8 CONC_{it} + \beta_9 SIZE_{it} + \beta_{10} LOTA + \beta_{11} GDP_t + \beta_{12} OWN_t + \beta_{13} CPI_t + \beta_{14} LODE_{it} + \varepsilon_{it}$$

Where EFF_{it} indicates efficiency scores; $EQTA_{it}$ indicates Capital adequacy; NIM_{it} indicates Net Interest Margin; ROA_{it} indicates the return on average Asset; NIE_{it} indicates noninterest expenses to Total Asset ;NNI_{it} Indicates Non Interest Income to total Asset; NPL_{it} indicates loan loss provision to Total Loan; MS_{it} indicates market share; $CONC_{it}$ indicates market concentration in terms of loan; $SIZE_{it,}$ indicates the Logarithm of total asset; $LOTA_{it}$ indicates Loan to Total Asset GDP_t indicates annual economic growth; OWN_t *;* indicates dummy variable, 1 if the bank is foreign owned and 0 if it is not; CPI_t *;* indicates the annual change in the Consumer Price Index.

4 Results

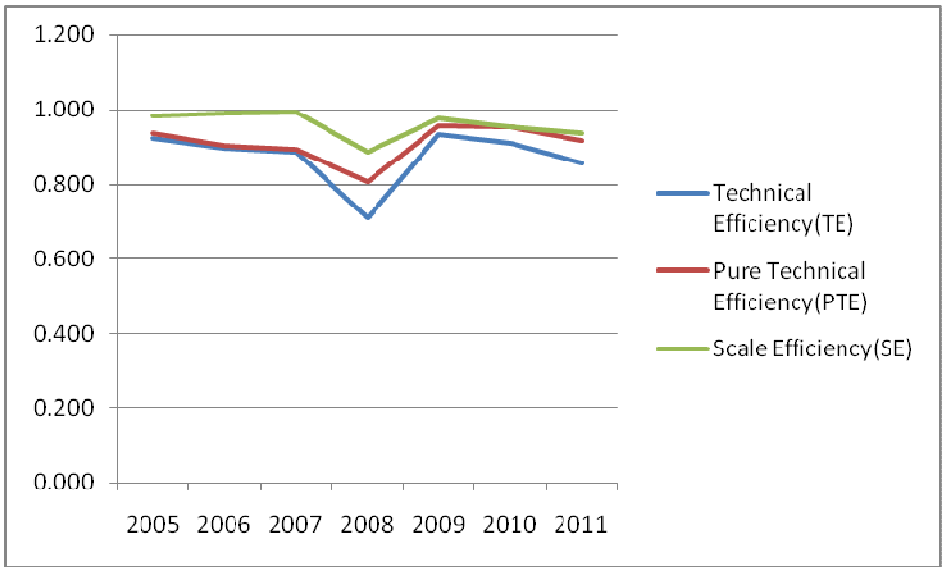
We first analyze the efficiency estimates, using Data Envelopment Analysis methodology as shown below.

Table: 4 Efficiency estimates,

	Technical Efficiency(TE)	Pure Efficiency(PTE)	l Scale Efficiency(SE)
2005	0.923	0.939	0.983
2006	0.895	0.904	0.990
2007	0.886	0.893	0.992
2008	0.710	0.807	0.886
2009	0.933	0.958	0.974
2010	0.910	0.956	0.952
2011	0.858	0.916	0.935
Mean	0.873	0.910	0.959

The overall mean efficiency estimates are 87%, 91% and 96% for TE, PTE and SE efficiency respectively, the results indicates the level of inefficiency is 13%, 9% and 4% for TE, PTE and SE respectively. These rates indicate that the banks can still reduce inputs resources and produce the same outputs levels. The trend of efficiency of commercial banks can be observed through the following figure

Figure: **Efficiency estimates trend**



The lowest recorded period of commercial banks' efficiency is 2008, in which commercial banks were 87% scale efficiency compared to the previous year where Scale efficiency estimate was 99.2%, which indicates a sharp decline of efficiency, however there was an increasing trend in the following year to reach the score of 97% percent (2009), operating under increasing returns to scale environment (IRS).

The second stage of our analysis we run a Tobit Regression with bootstrap so as to obtain the main factors of bank efficiency. The three efficiency estimates TE, PTE and TE were used as Dependent variables in our analysis. The results are shown in Table 6 of the appendix

With reference to the above Tobit regression results, bank size is indicated to have significant influence with bank efficiency, the results confirm with our expectation, when economies of scale are achieved large banks attracts more loan and deposits. Our findings are similar to the previous findings by Molynuex and Thornton (1992) in European banks, in Saudi Arabian banks by Assaf, G.A., Barros, P.C., and Matousek, R., (2011). With reference to

TE and PTE there is a significant relationship between profitability and commercial banks' efficiency, in our case profitability is measured by NIM and ROAA, this is because profitable banks attract more deposit and create loyalty to most customers, hence the interest rates charged on deposits are low, and the findings are also similar to Casu. B and Molynuex (2003); Mester, L.J (1996); Maudos, J., Pastor, J.M., Perez, F.and Quesada, J. (2002). As far as LOTA as a concern, positive significant relationship is revealed in terms of TE while at the same time negative significant relationship is revealed in terms of scale efficiency, the results signify the importance of the Loan to the efficiency of commercial banks since more Loans' results into more interest income, similar findings were obtained with Turkish banking industry by Isik, I., &Hassan, K.M. (2003). On the other hand NPL as well as NIE are found to have negative and significant with all TE, PTE and SE the results fall within our expectation, usually management is responsible in controlling noninterest expenses, the increase of non interest expenses reduce profitability of commercial banks hence affect efficiency levels, Likewise the increase in nonperforming loans ((NPL) affect negatively the performance of commercial banks, as pointed out by Millers and Noulas (1997) that when a given financial institution is accumulated with poor performing loans, reduces its profitability. NII and CA were found to have a positive significant relationship with both TE, PTE and SE, in the case of the NII, the positive significant relationship reveals the importance noninterest income such as commission, service charges and net income from the sale of investment securities in generating income from off balance sheet items, similar findings were observed by the Philippines banking system by Sufian and Chong, R, R (2008). In case of capital adequacy (EQTA) our study positive significant relationship in similar vein positive significant relationship was revealed in Brazil by Tarbak, B&Ruiz, P (2008),and European banks by Mester, L.J (1996); Maudos, J., Pastor, J.M., Perez, F and Quesada, J.(2002).

Coming to bank specific characteristics, the study intended to investigate the impacts of bank concentration (CONC), market share (MS) measured by Total deposit as well as Ownership status (OWN). Commercial banks were found to have a significant positive relationship with CONC measures by HHI with respect to TE, the results support Structural Conduct Performance (SCP) which assume financial market structure in our case, would determine commercial banks conduct which would determine efficiency and profitability, the results are similar with Dermiguc-Kunt, A and H. Huizinga, (1999) similarly with market share the results are relevant to Pure Technical Efficiency (PTE) but negative significantly related to TE.

With macroeconomic factors, the CPI revealed a negative significant relationship with TE and PTE, also the findings are similar to J. G. Garza-Garcia (2011) in Mexican banking system, however the results contradict with Claessens, S., (1996) in Transition countries and Dermiguc-Kunt, A and H. Huizinga, (1999) On other hand GDP was found to have no impact on commercial bank efficiency, the findings are similar to some studies in sub Saharan Africa such as Munyamboneza, E.F (2006) as well as Sandrine, K (2010 however the study contradicts with, studies from developed countries such as J. G. Garza-Garcia (2011), Hassan and Bashir (2003); Manthos, D. D&Papanikolaou, N.I., (2009)

5. Concluding remarks

In this paper our concern was an investigation of the effect of bank specific, industry specific and macroeconomic variables on commercial banks' efficiency. Data envelopment analysis was applied to obtain efficiency estimates such as, Technical efficiency (TE), Pure Technical efficiency (PTE) and scale efficiency (SE) for the period of 2005-2008. Afterwards the efficiency estimates were obtained through Tobit regression model. The first stage of our analysis indicates inefficiency estimates are 13%, 9% and 4% for TE, PTE and SE respectively, our efficiency estimates figure indicates the decline of efficiency level during the 2008 study period, the decline in efficiency level may be caused by the international financial crisis which affected some sectors of the economy including the financial sector. Thereafter showing recovery to reach the score of 97% in 2009, operating under increasing returns to scale. Our findings revealed bank efficiency is influenced by both bank specific, industry specific and macroeconomic factors. More specifically with bank specific factors bank size, profitability measured by NIM, liquidity, as well as capital adequacy were found to be the main factors influencing the bank`s efficiency, while with industry specific characteristic market share and concentration was found to influence significantly bank`s efficiency. Lastly in case of macroeconomic factors only GDP was found to influence the bank`s efficiency. In similar view Non performing loans (NPL), ownership and CPI were found to be insignificant in explaining commercial bank`s

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Table: 3 Descriptive statistics of inputs and outputs

Variable	Obs	Mean	Std. Dev.	Min	Max
INPUTS					
DEPOSIT	183	2.38E+11	3.98E+11	5.00E+08	2.41E+12
INTEREST EXP	183	8.44E+13	1.14E+15	4852658	1.54E+16
NIE	183	1.73E+10	2.68E+10	0	1.52E+11
OUTPUTS					
LOAN	183	1.42E+11	2.29E+11	1.03E+08	1.43E+12
INVESTMENTS	183	6.19E+10	1.12E+11	0	6.31E+11
INTEREST INC	183	1.77E+14	2.39E+15	1.40E+07	3.23E+16
NII	183	1.10E+10	1.95E+10	0	1.92E+11

SOURCE: Bank of Tanzania (BoT); Note, Data in Tsh million; NIE (non interest expenses); NII (Non interest income); Interest Income.

Table 1: Description of variables used in Tobit regression and expected effects.

		Variable	Description	H.E*	
Dependent Variable		TE	Technical efficiency		
		PTE	Pure Technical Efficiency		
		SE	Scale Efficiency		
Explanatory Variables	Bank specific characteristics	SIZE	Indicates natural logarithm of total assets	(+)	
		NIM	Indicates Net Interest margin	(+)	
		LOTA	Indicates loan and advances to total asset	(+)	
		ROA	Indicates Return on average Asset	(+)	
		LODE	Measure of loan to deposits	(+)	
		NPL	Measure loan loss provision to total loan (credit risk)	(+)	
		NIE	Non Interest expenses to Total Asset	(_)	
		NII	Non Interest Income to total income	(+)	
		EQTA	Equity to total asset	(+)	
	Industry-specific	CONC	Measure of bank concentration measured by HHI	(+/-)	
		MS	Total deposits of each bank as the percentage of all banks total deposits	(+/-)	
		OWN	Dummy variable equal to 1 for privately owned and 0 otherwise	(?)	
	Macroeconomic	GDP	Measured by the natural logarithm of GDP.	(?)	
		CPI	Consumer Price Index (inflation rate)	(?)	

Note* H.E is Hypothesized relationship with efficiency.

Table 2: Descriptive statistics for Explanatory variables

Variable	Observation	Mean	Std. Dev.	Min	Max
SIZE	175	25.6632	1.533106	20.4	30.4
NIM	175	66.97714	14.73129	7	96
LOTA	175	0.7281714	2.627626	0	33.43
LODE	175	1.020914	2.972376	0.03	38.91
CONC	175	0.1270286	0.0213422	0.11	0.17
NIE	175	0.1119429	0.3973847	0	3.79
NII	175	0.0914857	0.6083273	0	7.77

EQTA	175	14.53143	9.506071	2	78
MS	175	0.0419429	0.0598148	0	0.33
ROAA	175	1.082857	4.532823	-32.8	6.6
NPL	175	4.297143	6.080555	0	35
OWN	175	0.5885714	0.4935046	0	1
GDP	175	23.68617	0.1970842	23.37	23.89
CPI	175	8.841714	2.843813	5	12.7

Table 5: Tobit regression results.

	Technical Efficiency (TE)	Pure Technical Efficiency (PTE)	Scale Efficiency (SE)
SIZE	0.0270383*	0.073074***	-0.0019734
NIM	0.0034718**	0.0059123***	0.0004779
LOTA	0.026506**	-0.0544314	-0.17175***
LODE	-2.043594	0.2145117**	0.0750692**
CONC	0.1896599***	-0.0146871	-1.461585
NIE	-0.7777055*	-1.187579	-0.4640988***
NII	5.485872***	5.211019***	3.332125***
EQTA	0.0074479***	0.0085477**	0.0041527**
MS	-0.9752374***	4.666845***	0.1009643
ROAA	-0.0031349	0.0193641***	-0.0007187
NPL	-0.0022965	-0.019364***	-0.0745153*
OWN	-0.0643831**	-0.0789173	-0.1493244
GDP	-0.3968401	0.4704636	-0.0146321
CPI	-0.0048237	-0.0166133	0.9340283***
_cons	9.699748	-9.762942	3.551891
Pseudo R2	0.3153	0.2845	0.508
Prob > chi2	0.000	0.000	0.0003
Log likelihood	-50.968194	-59.472404	-14.937471
LR chi2 (14)	46.95	47.29	30.84
Observation	175	175	175

Note: ***, **, * represents a level of significance at 1%, 5% and 10% respectively.

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