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Efficiency of Rural Community Banks in Ghana: An Application of Data Envelopment Analysis

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Abstract

Rural financial markets in Ghana remain underdeveloped, largely because of the legacy of glaring failures in government-led programs. The basic functions of rural banks in Ghana are the mobilization of savings and the extension of credit to deserving customers in their areas of operation. Through their financial intermediation roles, rural banks act as catalysts for economic development in rural Ghana. Despite their role in the Ghanaian context, these banks have not been the subject of academic studies. The purpose of the study is to measure the efficiency and performance of the rural banks using Data Envelopment Analysis (DEA). The use of DEA is demonstrated by evaluating the management of 137 rural community banks in Ghana for the period 2004 to 2014. The estimation process explicitly, modelled for all the parameters especially efficiency using the non- parametric Data Envelopment Analysis (DEA). ROA was used as a performance measurement. The study pleaded in favor of investment to total asset, the total operating expenses to total asset and loan to total asset; and to be the main drivers to rural banks profitability measurement in Ghana since they were significant. The study registered liquidity (LIQ), total asset and inflation to be insignificant. The DEA results reveals 92.70% of RCBs to be inefficient. For RCBs to be more efficient and profitable the RCBs must strengthen effective credit administration by way of credit appraisal, monitoring the progress of loans and their efficient recovery. Important policy implications of these findings include the need to enhance confidence in the Ghana's rural banking system, to encourage savings in regional rural banks, and to ensure efficient transfer of resources from savers to investors.

Keywords: Rural Community Banks; Data Envelopment Analysis; Return on Asset.

1. Introduction

The economic development of low-income countries is hampered by an inability to bring adequate financial services to vast numbers of rural micro-entrepreneurs in a timely fashion and at reasonable cost (Mohindra and Gain, 2012). This failure reinforces market segmentation, prolongs economic inequality, precludes marginalized rural producers from taking advantage of opportunities created by economic reform, and limits the expansion of nationwide financial markets. Despite the efforts of the government of Ghana, multilateral development banks, and development practitioners in general, an effective solution to this problem is not in sight. Rural financial markets remain underdeveloped, largely because of the legacy of glaring failures in government-led programs. The basic functions

of rural banks in Ghana are the mobilization of savings and the extension of credit to deserving customers in their areas of operation. Through their financial intermediation roles, rural banks act as catalysts for economic development in rural Ghana. Despite their role in the Ghanaian context, these banks have not been the subject of academic studies. The commercial banks that coexist with them in rural credit markets has been studied by several researchers such as Khankhoje (2008); Eken and Kale, (2011) and Sathy, (2001). Efficiency study of rural banks would be helpful in locating sources of inefficiencies and enable all the stakeholders to take a fresh look at their functioning and initiate suitable strategic measures given their importance in achieving national objectives of alleviation of rural poverty. In evaluating their overall performance and monitoring their financial condition is important to depositors, owners, potential investors, managers and, of course regulators. Currently, financial ratios are often used to measure the overall financial soundness of a bank and the quality of its management. Bank regulators, for example, use financial ratios to help evaluate a bank's performance as part of the CAMEL system. Evaluating the economic performance of banks, however, is a complicated process. Often a number of criteria such as profits, liquidity, asset quality, attitude toward risk, and management strategies must be considered. The changing nature of the banking industry has made such evaluations even more difficult, increasing the need for more flexible alternative forms of financial analysis. This paper describes a particular methodology called Data Envelopment Analysis (DEA) that has been used previously to analyze the relative efficiencies of industrial firms, universities and more recently, commercial banks. The use of DEA is demonstrated by evaluating the management of 135 rural community banks in Ghana for the period 2004 to 2014. Investors who are interested in expanding in rural credit market in Ghana for diversification of risk may find acquiring the Rural Community Banks (RCBs) as a possible option to consider and would be interested in knowing their efficiency. To the best of our knowledge, this is the first time a DEA efficiency study has been done on rural banks in Ghana. The rest of the paper is follows: section two provides an overview of the rural community banks in Ghana whiles section three focuses on the literatute review. Section four deals with the data and methodology of the paper. This section also put emphasis on the conceptual framework of DEA and the model specification. Section five presents the results and interpretation and section six deals with conclusion. Section seven also focuses on policy implications and recommendations.

2. Overview of Rural Community Banks in Ghana

The Rural Community Banks are unit banks owned by members of the rural community through the purchase of shares and are licensed to provide financial intermediation in the rural areas. Rural Banks (RCBs) were first initiated in 1976 to expand savings mobilization and credit services in rural areas not served by commercial and development banks. The number expanded rapidly in the early 1980s in response to the demand for rural banking services created by the government's introduction of special checks instead of cash payment to cocoa farmers (Aryeetey & Kanbur, 2005).

The small number of rural outlets of commercial banks was woefully inadequate to meet the demand to cash these checks, let alone provide other banking services, thereby creating undue hardships on farmers who often had to travel long distances or spend days at the banks to cash their checks.To this end, more agencies and RCBs were opened to services areas that did not have banking facilities. The strong promotion of RCBs to service the government's policy of paying cocoa farmers by check had an adverse effect for their financial performance. With acute inflation currency depreciation, economic decline and mismanagement of funds and natural disasters, combined with weak supervision contributes to the weak performance of the RCBs. The number of RCBs reached a peak of 133 in 1998, but fell to 111 in 1999 with the closure of 23 distressed banks and the commissioning of one new bank (Aryeetey & Kanbur, 2005). These closures sent a strong signal to the remaining rural banks to maintain or improve their operations in order to achieve satisfactory status. To promote and strengthen the rural banking concept, an association was formed in 1981 as an NGO with an initial membership of 29 and by the end of 2001 membership reached 115. In 2001 ARB Apex Bank was formed to perform some financial services to the RCBs and eventually take the supervision control of the RCBs (Aryeetey & Kanbur, 2005). Originally, RCBs made standard commercial loans to individuals or groups, often related to agriculture. While term lending may have been justified by the agricultural planting cycle or investment in a productive asset, it tended to result in portfolio performance problems, as borrowers had difficulty making balloon payments and RBs had weak capacity to follow up and enforce repayment. During the 1990s, however, a number of the more progressive RCBs drew on emerging microfinance techniques to introduce new programs for saving and credit, often in association with NGOs that could provide the expertise in implementing the approach.

3. Literature Review

Several studies have been conducted to see the efficiency and performance of rural community banks in Ghana. The literature available in the working and performance of RCBs in Ghana is a little limited. Many efficiency studies related to banks and financial institutions using DEA method have been carried out in different countries, in different contexts. Studies by Taylor et al., (1997) of Mexican banks, , Portela and Thanassoulis (2007) of Portuguese banks, Schaffnit, Rosen and Parade (1997) of large Canadian banks, and Soteriou and Zenios (1999) of Cyprus Commercial banks, are a few of the efficiency studies in the banking sector. The existing literature on banking efficiency hexes out two divergent approaches to measure efficiency (1) accounting measure (2) economic measure. Accounting measure denotes to the use of various financial ratios that focus on one or more outputs and their relevant inputs to measure the performance of a banking unit. The financial ratio approach has been widely used by the researchers and working groups/committees to analyze the performance of RCBs. Though financial accounting ratios are simple to use and relatively easy to understand, but their use to measure bank performance is plagued by various problems. As a precautionary measure, regulatory frame works (such as CAMEL rating) based on these ratios has been put in place in most of the supervisory systems across the globe. Yeh (1996) noted that the major demerit of this approach is its reliance on benchmark ratios. These benchmarks could be arbitrary and may mislead analysts. Sherman and Gold (1985) further noted that financial ratios don't capture the long-term performance such as operations, marketing and financing. In recent years, there is a trend towards measuring bank performance using one of the frontier analysis methods. In frontier analysis, the institutions that perform better relative to a particular standard are separated from those that perform poorly. Such separation is done either by applying a non-parametric or parametric frontier analysis to firms within the financial services industry. The parametric approach includes stochastic frontier analysis, the free disposal hull, thick frontier and the Distribution Free Approaches (DFA), while the non-parametric approach is Data Envelopment Analysis (DEA) (Molyneux et al., 1996). In this paper, the DEA approach has been used. There are many studies that have measured the efficiency of banks the world over; however, very few studies have evaluated the efficiency of Ghana's rural banks. Delis and Papanikolaou (2009) investigated the determinants of bank efficiency. They found that the banking sectors of almost all sample countries show a gradual improvement in their efficiency levels. The model used shows that a number of determinants like bank size, industry concentration and the investment environment have a positive impact on bank's efficiency. Using panel data for the period 1993 to 2005 from 16 regions of the Philippines, Los Baños **(2007)** investigated whether the resource allocation efficiency of Philippine rural banks resulting from the quantity and quality of banking intermediation activities affects regional economic growth. In the light of this, four measures of resource allocation efficiency were tested by employing pooled generalized least squares estimation. His findings suggested that Philippine rural banks need to make allocative adjustments in the areas of branch presence, operational efficiency and credit participation. Los Banos results lend support to government efforts to strengthen the rural banking sector and to increase the volume of investments in the regions. Tesfamariam, Tesfay andTesfay (2013) employed the Data Envelopment Analysis (DEA) method to evaluate the relative efficiency of Saving and Credit Cooperatives (SACCOs) in Tigrai region of Ethiopia. Data were collected from 329 rural SACCOs during the year 2012. The result revealed that the degree of technical efficiency varies athwart geographical location and scale size of the cooperatives. From the total of 329 SACCOs, compared to their respective peers, only 18 (5.5%) were identified as relatively efficient with the maximum efficiency score of one. The remaining SACCOs were found to be relatively inefficient with efficiency score of less than one. The average efficiency was 21.3% which indicates that there were substantial amount of inefficiency among rural SACCOs in the study area. Technical efficiency was high for larger SACCOs. In relations to   geographical location, the highest mean efficiency were observed in the southern and western zones of the region with a mean score of 0.276 and 0.259 respectively. The most fascinating characteristic of their study was that most of the efficient rural SACCOs were the ones that received incentives from the regional government for their preeminent performance, during the year 2012. They suggested that to strengthens the efficiency of the rural banks, the government should support the rural banks with technical know-how and banking infrastructure. Westhuizen (2007) used Data Envelopment Analysis (DEA) to estimate the monthly technical and scale efficiency for the four largest banks over a period of 36 months in South Africa. In this study Westhuizen group banks into four groups; bank A; B; C and D as large medium small medium and small respectively. The study found that Bank B seems to be the most technically efficient bank. However it does not mean that bank B is fully considered efficient as it's operates under increasing return to scale zone, implying that it was operating at a scale that is too small. Bank C has an average technical efficiency estimate of 0.951(input-orientated), followed by Bank A with an average technical efficiency estimate of 0.917. Bank D could at no time during the sample period, be regarded as being fully technically efficient. The technical efficiency estimates range from 0.751 to 0.900 with an average value of 0.806 (input-orientated) and from 0.758 to 0.895 with an average value

of 0.809 (output orientated). This bank operated mainly in the region of decreasing return to scale implying that it was operating at a scale that was too large. At the end, Westhuizen (2007) asserted that from an input-orientated perspective, all four banks could reduce their inputs without reducing their outputs. Abidin (2007), used DEA to investigate the level of efficiency among commercial banks in Indonesia. The inputs for modelling were deposits, interest, and other expenses. For outputs were loan, interest income and other income. His results found state bank to be more efficient than private and regional bank. Similar to Hauner (2004), the bigger bank are more efficient. However, for regional banks, there is tendency of diseconomies. A study on rural banks efficiency conducted by Kediri (2008) also found very interested result. In term of cost efficiency, rural banks owned by regional government were more efficient (85.69) compared to privately owned (83.61) and cooperative (78.31).It means cooperative rural banks is least efficient. Statistically there is no difference in cost efficiency among banks operating in different regency. Kablan (2007) examined the efficiency of West African Economic Monetary Union (WAEMU) banks after the period of banking crises (1993-1996). The study used Data Envelopment Analysis method (DEA) for assessing technical efficiency and to evaluate cost efficiency, the study used stochastic Frontier Analysis (SFA). The study found that WAEMU banks efficiency is responsive to variables like financial soundness, the ratio of bad loans per country, the banking concentration and the GDP per capita.

Halkos and Salamouris (2004) apply the DEA to evaluate the performance of Greek banking sector. In the study, a series of financial efficiency ratios are used to examine the efficiency of the banks. In addition, it is demonstrated that the DEA is an alternative or complementary approach to traditional ratio analysis. It is stated that there is a positive relationship between firm size and firm performance (Eken and Kale, 2011). In this respect, banks with higher total assets are more effective and the decrease in the number of banks in the economy resulting from mergers and acquisitions induce an increase in efficiency. While mergers and acquisitions ensure the continuous increase in the efficiency of the large banks, they decrease the efficiency of small banks (Sathye, 2001). Fethi and Pasiouras (2009) specify 136 studies that use DEA-like techniques to estimate bank efficiency, while only 28 studies about branch efficiency are listed. Of the 28 studies, 17 adopt production and 12 adopt intermediation approach. Paradi et al. (2010) evaluated the bank branch efficiency in two stages. From the point that a single perspective evaluation cannot fully reflect a branch's multi-function nature, they first measured production, profitability and intermediation efficiency of branches and then aggregated the results with modified Slack Based Model to generate a composite performance index for each branch. Oral and Yolalan (1990) studied the operational efficiency of 20 Turkish commercial bank branches. They indicated that DEA is complementary to traditional financial ratios method and also it is a useful tool in reallocating resources between the branches in order to achieve higher efficiencies. Frimpong (2010) used DEA to examine the relative efficiency of the banks in Ghana during the year 2007. His results shows only four out 22 banks under study were efficient. Eken and Kale (2011) used DEA to measure the relative efficiency and potential improvement capabilities of bank branches in Turkish banks, by identifying their strength and weaknesses. The relationship between efficiency and market structure is not so clear-cut. Dabla-Norris and Floerkemeier (2007) study the Armenian banking system over the period 2002–06, and found that banks with higher market power have higher net interest margins, and high concentrations in loan and deposit markets have a positive effect on both interest spreads and net interest margins. Beck and Hesse (2006) find that in Uganda during 1999–2005, market structure played a limited role in determining bank efficiency, and structural impediments were more significant in lowering spreads and margins. Demirguc-Kunt, et al (2004) finds no robust association between bank concentration and interest rate margins. Korsah et al. used DEA to measure efficiency in Ghana's banking sector and found the sector to be inefficient. They attribute the inefficiency in the Ghana banking system to the overuse of capital relative to staff cost. This was due to the fact that, during the pre- Financial Structure Ajustment Policy (FINSAP) era, regulation of interest rates and the sectoral allocation of loans drove price competition from the banks. The efficiency of the banking system's operation is also constrained by the Ghanaian economy's technological underdevelopment as well as information asymmetry (limited information). Unlike the United States where automation and the use of computers have increased the productivity and efficiency of bank employees, the production of banking services in Ghana is labor intensive; bank ledgers, customer accounts, and other records are still processed by hand. This has led to low productivity, under-utilization of human capital, and inefficient operation in the banking sector. In view of these inefficiencies, which result in a considerable amount of waiting time at the banks, a large section of the Ghanaian population prefers to hold liquid cash outside the banking system (Aryeetey & Kanbur, 2005). A number of studies have found a positive relationship between competition and efficiency, and between competition and the rate of productivity growth. Banks simply have to operate at high level of efficiency to ensure their survival (Frimpong, 2011). Hauner and Peiris (2005) investigated whether the banking sector reforms undertaken in Uganda to improve competition and efficiency have been effective. Using the model of Panzar and Rosse (1987) to assess competitiveness and data envelopment analysis (DEA) to assess

efficiency, they found that competition has increased significantly and has been associated with a rise in efficiency. Using the same model, Buchs and Mathiesen (2005), found that bank size is a determining factor of bank revenue in Ghana, and foreign banks are more efficient in generating revenue (interest, commissions, and fees. All these lay credence to the fact that prior studies involving the rural banks efficiency and performance have yielded varying results.

4. Methodology

4.1 Data Sources and Consideration

The current study uses data for the years 2004-2014 complied from Financial Statement of rural community banks complied by the Bank of Ghana and the Apex bank. The study covers 135 rural banks in Ghana. Perhaps the most important step in using DEA to examine the relative efficiency of any type of firm is the selection of appropriate inputs and outputs. This is partially true for banks because there is considerable disagreement over the appropriate inputs and outputs for banks. Previous applications of DEA to banks generally have adopted one of two approaches to justify their choice of inputs and outputs. The first intermediary approach views banks as financial intermediaries whose primary business is to borrow funds from depositors and lend those funds to others for profit. In these studies, the banks outputs are loans (measured in dollars) and their inputs are the various costs of these funds (including interest expense, labor, capital and operating costs). A second approach views banks as institutions that use capital and labor to produce loans and deposit account services. In these studies, the banks outputs are their accounts and transactions, while their inputs are their labor, capital and operating costs, the banks' interest expenses are excluded in these studies. Our analysis of 135 rural banks uses a modification of the intermediary approach. The banks' outputs are interest income (IC), non-interest income (NIC) and total loans (TL). Interest income includes interest and fee income on loans, income from lease-financing receivables, interest and dividend income on securities, and other income. Non-interest income includes service charges on deposit account, an income from fiduciary activities and other non-interest income. Total loans consist of loans and lease net of unearned income. These outputs represent the banks' revenues and major business activities.

The banks' inputs are interest expenses (IE), non-interest expenses (NIE), transaction deposits (TD), and non-transaction deposits (NTD). Interest expenses include expenses for bank of Ghana funds federal funds and the purchase and sale of securities and the purchase and sale of securities and the interest on demand notes and other borrowed money. Non-interest expenses include salaries, expenses associated with premises and fixed assets, taxes and other expenses. Bank's deposits are disaggregated into transaction and non-transaction deposits because they have different turnover and cost structures. These inputs represent measures for the banks' labor, capital and operating costs. Deposits and funds purchased (measured by their interest expense) are the source of loanable funds to be invested in assets. DEA is sensitive to the choice of input-output variables. This is the strength of the technique, since it reveals which of the input-output variables need to be closely monitored by bank management to improve efficiency.

4.2 Data Envelopment Analysis

Data envelopment analysis (DEA) is a linear programming technique for measuring the relative performance of organizational units where the presence of multiple inputs and outputs makes comparisons difficult. DEA assumes that all firms face the same unspecified technology which defines their production possibilities set. The objective of DEA is to determine which firms or decision making units (DMUs) operate on their efficiency frontier and which firms do not. That is, DEA partitions the inputs and outputs of all firms into efficient and inefficient combinations. Charnes, Cooper and Rhodes (1978) were the first to develop DEA and used it to evaluate the efficiency of public sector non-profit organization. DEA were first applied to banking by Sherman and Gold (1985). DEA calculates the relative efficiency scores of various Decision-making Units (DMUs) in the particular sample. The DMUs could be banks or branches of banks. The DEA measure compares each of the banks/branches in that sample with the best practice in the sample. It tells the user which of the DMUs in the sample are efficient and which are not. The ability of the DEA to identify possible peers or role models as well as simple efficiency scores gives it an edge over other methods. As an efficient frontier technique, DEA identifies the inefficiency in a particular DMU by comparing it to similar DMUs regarded as efficient, rather than trying to associate a DMU's performance with statistical averages that may not be applicable to that DMU. The characteristics of DEA can be described through the original model developed by Charnes, Cooper and Rhodes. Consider *N* units (each is called a Decision Making Unit (DMU) that converts *I* inputs into J outputs, where *I* can be larger, equal or smaller than *J*. To measure efficiency of this converting process for a DMU, Charnes et al. (1978) propose the use of the maximum of a ratio of weighted outputs

to weighted inputs for that unit, subject to the condition that the similar ratio for all other DMUs be less than or equal to one. That is

$$\text{Max } e^0 = \frac{\sum_{J=1}^{J} u^0_j y^0_j}{\sum_{I=1}^{I} v^0_i x^0_i} \qquad (1)$$

Subject to

$$\frac{\sum_{J=1}^{J} u^0_j y^n_j}{\sum_{I=1}^{I} v^0_j x^n_j} \leq I; \ n = 1, \ldots \ldots .N$$

$V^0_i, u^0_j \geq 0; \ I = 1, \ldots \ldots .I; \ J = 1, \ldots \ldots .J$

where y^n_j; x^n_j are positive known output and inputs of the nth DMU and v^0_j, u^0_j are the variable weights to be determined by solving problem (1). The DMU being measured is indicated by the index 0, which is referred to as the base DMU. The maximum of the objective function e^0 given by problem (1) is the DEA efficiency score assigned to DMU^0. Since every DMU can be DMU^0, this optimization problem is well-defined for every DMU. If the efficiency score $e^0 = 1$, DMU^0, satisfies the necessary condition to be DEA efficient; otherwise it is DEA inefficient. It is difficult to solve problem (1) as stated, because the objective function is non-linear and fractional. Charnes et al, however, transformed the above nonlinear programming problem into a linear one as follows,

$$\text{Max } h^0 = \sum_{J=1}^{J} u^0_j y^0_j \qquad (2)$$

Subject to

$$\sum_{I=1}^{I} v^0_i x^0_i = 1, \qquad \sum_{j=1}^{J} u^0_j y^n_j - \sum_{i=1}^{I} v^0_i x^n_i \leq 0; \ n = 1 \ldots \ldots .N,$$

$V^0_i \geq \varepsilon \quad u^0_j \geq \varepsilon \qquad I = 1 \ldots \ldots .I \qquad j = 1 \ldots \ldots .J$

The variables defined in problem (2) are the same as those defined in problem (1). An arbitrarily small positive number, ε is introduced in problem (2) to ensure that all of the known inputs and outputs have positive weight values and that the optimal objective function of the values assigned to the dual slack variables in computing the DEA efficiency score for each DMU. The condition $h^0 = 1$ ensures that the base DMU^0 is DEA efficient; otherwise it is DEA inefficient, with respect to all other DMUs in the test. A complete model involves the solution of N such problems, each for a base DMU, yielding N different (v^n_j, U^n_j) weight sets. In each program, the constraints are held constant while the ratio to be maximized is changed. DEA has the ability to accommodate a multiplicity of inputs and outputs. It is also useful because it takes into consideration returns to scale in calculating efficiency, allowing for the concept of increasing or decreasing efficiency based on size and output levels. Another advantage of the DEA is that it uses actual sample data to derive the efficiency frontier against which each firm in the sample can be evaluated. DEA has some limitations. The results are potentially sensitive to the selection of inputs and outputs, so their relative importance needs to be analyzed prior to the calculation. However, there is no way to test their appropriateness. The number of efficient firms on the frontier tends to increase with the number of inputs and output

variables. Where there is no relationship between explanatory factors (within inputs and or/ or within outputs), DEA views each company as unique and fully efficient and efficient scores are very close to 1, which results in a loss of the discriminatory power of the method. The DEA technique has been used in efficiency analysis of banks (rather branches) (Khankhoje, 2008). Some recent examples are Resti (1997), Sathye, 2001) and Yue, (1992).

5. Results and Interpretations

We employed the Data Envelopment Analysis (DEA) method to evaluate the relative efficiency of the rural banks base on technical efficiency. The degree of efficiency computed in our study are comparative in nature. The performance of a RCBs is not evaluated in an uttered means but is compared with the best in the banking industry. The bases of inefficiency can be gritted by comparing the relative sizes of various efficiency procedures. The predicted efficiency scores for each DMU and the estimated mean efficiency scores are in the appendix. To project the efficiency of the rural banks, several models with different variables are assessed. The DEA model under variable return to scale (VRS) can provide a better indication of the relative performance of the RCBs. TE represents technical efficiency in the Charnes, Cooper and Rhodes's (CCR) model in VRS and SE represents scale efficiency with VRS. The summary of estimated results for efficiency is presented in Table 1.

Table 1: Summary of Efficiency Scores								
				Descriptive Statistics				
Description	**No. of DMUs Evaluated**	**Efficient**	**Inefficient**		**Mean**	**Max**	**Min**	**SD**
VRS	137	10	127		.073	1.00	.002	.166
SE	137	3	134		.0219	1.00	.023	.166

The results for the DEA run with variable returns to scale indicate that the average technical relative efficiency is 0.073, which means that overall technical inefficiency of RCBs is to the jingle of 92.70% in the year 2014. Of 137 RCBs, 10 RBCs are identified as "moderately efficient" with technical efficiency score equal to one. The remaining 127 RCBs have been found to be "fairly inefficient" with efficiency score less than one in the same year. The inefficient RCBs can improve their efficiency by decreasing resource inputs and increasing outputs. This, implies that the RCBs will be maximizing the output at given inputs or minimizing the inputs at given output level depending on the amount of resource utilized. The inefficiency of the most RCBs provides a possible room for the RCBs to improve their efficiency through improved utilization of their inputs and outputs. The 10 RCBs which are efficient are in relative terms.

As shown in Table 6 the specific size categories were determined by our discretion. Based on the capital size of the DMUs, majority of the RCBs (63%) are below 100,000 Ghana cedis capital balances and are considered as small scale. DMUs with Capital balances over 200,000 ghana cedis are grouped as large scale and account for 19% of the total. 18% of the DMUs have capital balances ranging from 100,000 to 200,000 Ghana cedis and are put as medium scale. The efficiency scores also are analyzed for the size categories.

Table 2: Size Metric of the RCBS				
Size	Large	Medium	Small	Scale
Capital	19%	18%	63%	Large=More than 200,000 Ghana cedis
				Medium= 100,000 to 200,000 Ghana cedis
				Small= Less than 100,000 Ghana cedis

The mean DEA scores for each DMU are considered for this analysis. The TE efficiency score of large scale categories was 19%, during the year 2014. Small scale and medium scale DMUs had TE scores of 18% and 63% respectively. The estimated overall mean of TE score were higher for larger DMUs compared to medium and small size DMUs.

Various studies were reviewed over the period of study. The rural banking system over the years studied has improved considerably due to regulation and deregulation, competition, and improvement in the prudential system. The overall profitability of the rural banks increased from 8.29% in 2000 to 56% during the period of study. The number of rural banks also increased from 94 to 140 due to financial restructuring. We also proceed to determine

whether the RCBs are performing. To do this we took the heed to measure the performance of the 137 RCBs by employing the standard accounting measurement of performance indicator using financial ratios. To this effect we employ the return on asset (ROA) as an indicator to measure performance. This is computed by dividing net income by total assets. ROA proxies for bank efficiency borrowing from the dealership model first used by Ho and Saunders (1981). According to Demirguc- Kunt and Huizinga (2000), a higher ROA is an indicator of the efficiency of the banking system in performing its financial intermediation role. Rivard and Thomas (1997) suggest that bank profitability is best measured by ROA in that ROA is not distorted by high equity multipliers and ROA represents a better measure of the ability of a firm to generate returns on its portfolio of assets. ROE on the other hand, reflects how effectively a bank management is in utilizing its shareholders funds. Since ROA tend to be lower for financial intermediaries, most banks heavily utilized financial leverage to increase their ROE to competitive levels (Hassan and Bashir, 2003).

We also employ seven different independent variables: To this effect model 3 is establish with ROA as the dependent variable

$$LnROA = \alpha_0 + \Omega_1 lnLTA_{it} + \Omega_2 lnINTA_{it} + \Omega_3 lnTA_{it} + \Omega_4 lnLIQ_{it} + \Omega_5 lnTOETA_{it} + \Omega_6 lnINFL_{it} + \varepsilon \quad (3)$$

The model is in loglinear form and return on asset (ROA) is established as the dependent variable and proxy as a measurement indicator.

Before presenting the models, descriptive statistics for the dependent and the independent variables are presented. Details of information on the mean of variables, the minimum and maximum of variables, the standard deviation of variables as reported by the data over the period 1987 to 2014 is presented in table 1. It is observed that the dispersion of variables over the sample period is quite low. The mean value and the standard deviation for the dependent variables return on asset (ROA) fluctuate throughout the sample period. The mean value of ROA is 64.06 and this indicates that on the average, for every dollar worth of total assets of the firm, 64.06 was earned as profit after tax. The mean values of the independent variables range from 0.3788 per cent, as recorded by loan to total asset (LTA), to .3788, as also recorded by total operating expenses to total asset (TOETA). It is also worth noting that apart from the mean of total operating expenses to total asset which also lies around 863.13 percent, all the other explanatory variables have their means ranging from 3.26 per cent to 632.86 percent. Again, the standard deviation of the variables over this period was high especially for total operating expense to total asset (105.65) and inflation (13.77). Casual observation tends to show that for most of the cases, a higher mean is also associated with a higher standard deviation, so also is a low mean and standard deviation.

Table 3: Descriptive Statistics for the Period 1987-2013				
	MEAN	**STD**	**MIN**	**MAX**
ROA	64.063	10.659	41.98	82.9
LTA	.3788	.150	.15	.6
INTA	26.510	28.640	4.81	80.01
TA	3.260	4.101	237.98	1.06
INTR	20.218	8.198	8.89	35.76
TOETA	863.13	105.65	57.55	28.56
INFL	21.910	13.77	8.58	70.82
LIQ	632.86	449.76	259.71	174.15

Note: ROA denotes return on asset; LTA is loan to total asst; INTA represents investment to total asset; LIQ denotes liquidity; TOETA is total operating expenses to total asset; TA represents total assets a proxy for size and INFL denotes inflation.

As a preliminary step of the empirical investigation that aims to assess the link between the rural banks specific variables and economic indicator and the role played by the rural banks in the Ghana's banking system, the study tested for correlation between selected dependent variable and the explanatory variables. Table 4 presents the results of correlation analysis for the study.

Table 4: Correlation Matrix						
	LTA	INTA	TA	INTR	TOETA	INFL	LIQ
LTA	1.00						
INTA	-0.5301	1.00					
TA	0.9242	-0.4893	1.00				
INTR	0.7301	-0.3183	0.6874	1.00			
TOETA	-0.4991	0.6426	-0.4643	-0.4103	1.00		
INFL	0.9364	-0.5540	0.9900	0.6742	-0.4790	1.00	
LIQ	0.4285	-0.0479	0.3563	0.8622	0.2373	0.3682	1.00

Note: LTA is loan to total asst; INTA represents investment to total asset; INTR denotes interest rate; TOETA is operating expenses; TA represents total assets a proxy for size, INFL denotes inflation and LIQ denotes liquidity gross domestic product.

The correlation matrix in table 4 exhibits the extent to which the independent variables relate to each other. The explanatory variables are not supposed to be dependent on each other or statistically relate to each other. To this effect, we check for the existence of the multicollinearity and serial or autocorrelation problems. In the light of this we computed variance inflation factor to verify the existence of multicollinearity. As a rule of thumb a variance inflation factor (VIF) in excess of 10 is considered as an indicator of injurious to multicollinearity (Zikmund et al., 2010). All the VIF is less than 10 and the average VIF is 1.201. The results of the VIF are presented in table 5

Table 5: 5.1 Results of VIF						
LTA	INTA	TA	INT	TOETA	INFL	LIQ
2.7	5.93	6.36	2.24	6.66	2.16	5.93

Source: Authors calculations

The results of VIF in table 5 suggested that multicollinearity is not an issue since none of the explanatory variables were above 10. To check for any violation of the classical linear regression assumption of homoskedasticity residual or error, Breusch-Pagan test were used. Heteroskedasticity is an assumption that the residuals from a regression estimates are not constant, otherwise they are Homoskedastic (Drury, 2007). The Breusch-Pagan test for Heteroskedasticity with chi of 0.18 suggests that there is no problem of heteroskedasticity in the residuals.

5.2 Test for Serial Autocorrelation

We used The Breusch-Godfrey LM test to test for any serial autocorrelation. The results suggest that there is no problem of serial correlation in the residuals. This implies that successive residuals are not correlated with each other, a violation of the classical linear regression assumption of the absence of correlation between successive residuals or errors. This renders the regression below efficient and reliable for prediction. The results of serial autocorrelation is shown on table 6.

Table 6 : Results of Serial Autocorrelation			
lags (p)	chi2	df	Prob > chi2
1	0.131	1	0.7177

Ho: No Serial Correlation

The results of this study show a significant positive effect of most of the variables in rural bank performance as measured by return on assets. The result is statistically significant and in line with most studies on the determinants of bank profitability. Table 7 presents the results of the ROA model.

Table 7: ROA Regression Results			
Variables	**Coefficient**	**t-statistics**	**P> (t)**
Cons	114.8433	15.09***	0.000
LTA	0.5244	-1.79*	0.099
INTA	0.4856	5.29***	0.000
TA	0.066	-0.39	0.701
INTR	-0.593	-2.11***	0.51
TOETA	-4.005	-2.55***	0.022
INFL	-0.061	-0.52	0.610
LIQ	0.1284	-0.820	0.427
R^2	0.4587		
F-Statistics	27.12		
DW	1.862		

Note: LTA is loan to total asst; INTA represents investment to total asset; INTR denotes interest rate; TOETA is operating expenses; TA represents total assets a proxy for size, INFL denotes inflation and LIQ denotes liquidity. R^2 denotes coefficient of determination; F denotes F statistics and DW is the Durbin Watson statistics.

The R^2 of 45.87% shows the variability in the use of financial performance measures that explained by the variability in the explanatory variables of the rural community banks. The F test was used to determine whether the regression equation explained a significantly greater amount of the total bank revenues than would be accounted for by random chance. The F ratio was 27.12 and significant at the .01 level. The t-tests were used to determine the significance of the explanatory variables. The study tested for autocorrelation using Durbin-Watson statistics. The Durbin-Watson statistics of 1.862 is less than 5 and therefore shows no autocorrelation problem.

The reported coefficient for rural bank liquidity (LIQ) is given as 0.1284. This variable represented through cash in the hand of the RCBs as a proportion of their assets. Bank with high liquidity means that the bank would be able to sustain or meet its financial obligation when payments are due. In essence banks with high liquidity are more solvent than banks with less liquidity. The liquidity variable has a positive on profitability contrary to its priori assumptions and theory for that matter. This variable is not significant in explaining the variability in the return on assets of rural community banks in Ghana and is not consistent with the study by Robison and Barry (1977) who found liquidity to be positive and significant. This indicates that liquidity is not a driver of profitability among rural community banks in Ghana. Robison and Barry (1977) in their study identified that rural banks often experience liquidity problems, which mainly arise from seasonal flows of loans and deposits. Robison and Barry suggest that banks with low risk portfolios are less efficient than those with high-risk portfolios.

The coefficient for investment to total asset (INTA) was 0.4856. The reported coefficient for INTA during the period under study was positive and significant at the .01 level. The sign agreed with the direction hypothesized. The positive coefficient implies that an increase in total investment leads to higher revenue. It also indicates that the rural banking sector sustained the deployment of more of its resources to the investment portfolio. This was consistent with the study by Owusu-Antwi, Antwi and Crabbe (2013). The reported coefficient of the ratio of total overhead expense to total assets (TOETA), is -0.401. This variable provides information on the efficiency of the management regarding expenses relative to the assets in year t, did not only have a negative impact on profitability and thus conformed to the a priori restriction, but was also a significant driver of rural banks in Ghana's profitability. The level of significance was at 10%. This shows that minimizing rural in Ghana operating costs would indeed improve their performance, which conforms to the study by Sufien and Choung. (2008), who asserts a negative relationship between the operating expense ratio and profitability.

The reported coefficient for loan to total asset (LTA) during the period under study was 0.5244 and significant at .10 level. The sign agreed with the direction hypothesized. The implication of the positive relationship is that rural

banks are generating higher proportions of revenue from loans in relations to total assets. In addition, it may also capture the fact that most of the rural banks, have not embarked on extensive lending to public enterprises which are prone to defer loan payments. The positive relationship may also reflect those loan recipients are paying a sizable share of commissions and fees. The positive coefficients also reflect the rural banks eased on credit stance on loans or credit lines to enterprises.

The reported coefficients total asset (TA) is given by 0.0663. This variable has a positive impact on profitability and conforms to the priori restriction. It is statistically insignificant in the model and it is not a vital parameter and a significant driver in banks performance. This is consistent with the results obtained by Sufien and Choung (2008). Suffien and Choung., indicated that total asset is usually used as a proxy to measure size, it is however used to capture potential economies or diseconomies of scale in the banking sector.

The results reveal that the annual rate of inflation has a positive impact on profitability, and very significant driver in the performance of rural banks in Ghana. The reported coefficient is given by 0.279. The Annual Inflation Rate (INFL) in Ghana is the prime data used in the determination of the central bank lending rates to the commercial banks in Ghana. Thus the higher the rate of inflation, the higher the prime rate at which the central bank lends to the commercial banks. When this happens the rural banks will also have to lend at a higher rate. Considering these the customer bases of the rural banks, they will not be able to lend to these people at a higher rate which may then affect profitability.

The results of this study have therefore helped to explain the explanatory variables that help to measure rural bank's performance using ROA as the dependent variable. Generally, this study has pleaded in favor of investment to total asset, the total operating expenses to total asset; loan to total asset; and interest rate spread to be the main drivers to rural banks profitability measurement in Ghana since they were significant. The study registered liquidity (LIQ), total asset and inflation to be insignificant.

6. Summary and Conclusion

The main goal of this study was to assess overall efficiency of RCBs in Ghana by taking 137 rural community banks which were operating from 2004 to 2014. We employed the non-parametric Data Envelopment Analysis (DEA). The estimation process explicitly, modelled for all the parameters especially efficiency. The DEA results reveals that 92.7% of the RCBs are inefficient implying that they did not utilized their inputs or resources efficiently. The study scale the efficiency into three tier categories, small, medium and large and used capital as a proxy to size. It was found that large RCBs are technically efficient than the small and medium RCBs. This implies that size matters when it comes efficiency determination. The study also measure the performance of the RCBs by employing accounting ratios using ROA as a performance measurement indicator. The results of the model pleaded in favor of; loan to total asset, total operating expense to total asset and investment to total asset to be significant and considered these variables as the main drivers to influence rural bank's performance in Ghana. The result however registered liquidity, total asset and inflation to be insignificant). Inflation rate in Ghana has been quite high over the period of the study and the study confirmed a negatively impacts on bank profitability.

This efficiency study is much important for policy makers and managers, the reason that, after the year 2008 many new microfinance entered the rural finance market in the country and many commercial banks diversified their activities to include microfinance services. Hence, it is important to assess that pioneers of the microfinance activities in the country, RCBs, operate their activities in different market segments especially as changing macroeconomic conditions. Moreover, the findings of this study may convince the sector decision makers to establish more comprehensive policy setting for promoting RCBs activities in the Ghanaian rural financial sector and survival of the institutions.

Further work could extend our research by comparing the efficiency of the RCBs to that of microfinance and in addition the net interest margin (NIM) could be use as the performance indicator measurement.

7. Policy Recommendations

For RCBs to be successfully meet the challenges of the ever-evolving financial environment and acquire global competitiveness, much effort and systemic improvement is still needed. In the new financial setting, a comprehensive management system must be created for the varying credit, liquidity, and market risks, together with other risks. Gaining the confidence of the markets by preemptive action to cut potential losses to investors and other shareholders through improved risk-management skills is not a goal but a necessity. This goes hand in hand with the exercise of effective internal controls. RCBs need risk-management systems that cater to their particular needs. To

make risk-management effective, management accountability must be specific and clearly spelled out. At the same time, RCBs need to set up their compensation systems in line with risk-management performance. Moreover, they should cultivate the training of professionals capable of designing object-centric databases for the more sophisticated risk-management systems. There must be a constant flow of investment to bring together risk management as well as regulatory interpretation and technological expertise.

Despite the wide array of measures that have been taken to improve financial supervision so far, the improvement of the supervisory system is a never-ending task. The supervisory system should be preemptive and risk-based, should allow for early warning, and should be market-friendly. In other words, financial supervision should start with preemptive risk-management of financial institutions and markets using forward-looking criteria. Risks detected in the process of monitoring should be grasped swiftly and decisively, and supervisory resources should be reallocated toward those parts of the financial sector where the greatest risks are found. Financial supervision should participate, in a market-friendly way, with a series of activities such as early discovery, accurate assessment, and optimal control of risks exposed in the markets, and should implement prompt corrective measures decisively to avoid failure.

All domestic and foreign banks operating in Ghana should come under the new capital-adequacy framework. The selection of the methodologies to be used for calculation of the capital requirement is to be left to each individual bank. The implementation of Basel II is expected to upgrade the level of risk-management of domestic banks and thereby promote their sound management and competence, along with their financial stability and economic growth in the long run.

The function of the banks' fund distribution to the national economy needs to be revitalized. It has become more important for banks to avoid cutthroat competition in specific asset markets and to generate new lucrative business activities by specializing in areas of comparative advantage on the basis of their business characteristics. For example, it is helpful for large banks to expand their investment banking and international finance business, while small and medium-sized banks should specialize in relationship banking such as lending to small and medium enterprises (SMEs). In addition, the credit derivatives market needs to be galvanized and brought to a level of sophistication where banks can manage credit risk effectively, in line with the implementation of Basel II.

New financial products and services must be developed to provide convenience to customers while improving profitability. RCBs should have a system that identifies and discerns customer needs to provide products and services accordingly. For banks to be competitive in today's market, in which information revolves around the customer, they must develop specific products and carry out marketing initiatives to create more value through deep data mining and customer analysis. The RCBs must strengthen effective credit administration by way of credit appraisal, monitoring the progress of loans and their efficient recovery. In addition the RCBs have to be very careful and reduce the operating expenses, because it has been found from our study that these expenses have increased the total expenditure of the banks. Rural banks need to remove lack of transparency in their operation which leads to unequal relationship between banker and customer. Banking staff should interact more with their customers to overcome this problem. RCBs have to concentrate on speedy, qualitative and secure banking services to retain existing customers and attract potential customers.

8. Policy Implication

Financial markets in developing economies like Ghana are highly imperfect making credit risk management an important consideration for banks. Problems of loan default are quite high in developing economies mainly due to information asymmetry. Banks' ability to enrich informational asymmetries between borrowers and lenders and their ability to manage risks are the essence of bank production. According to Berlin and Mester (1999) these abilities forms the integral components of bank output which influence the managerial incentives to produce financial services judiciously and efficiently. Therefore for Rural Community Banks to defeat the information asymmetry problem which have widen the gap between the customers and the banks, there should be a formidable relationship and available information to the public. Berlin and Mester explained that banks' liabilities are demandable debt that gives banks an incentive advantage over other intermediaries. Rural Community Banks in Ghana has a very high debt in their capital structure this high level of debt in a bank's capital structure supposed to disciplines managers' risk-taking and their diligence in producing financial services by exposing the bank to an increased risk of insolvency. However this is not the case in the Ghana's banking industry, the demandable feature of the debt, to the extent is not fully insured, which further intensifies performance pressure, efficiency and safety which concerns by increasing liquidity risk. These incentives tend to make banks good monitors of their borrowers.

Hence, the banking relationship can improve the financial performance of bank customers and increase access to credit for firms too informationally impervious to borrow in public debt and equity markets.

For Banks' to have an ability to perform efficiently its needs to obtain accurate information concerning its customers' financial prospects and to write effective contracts and to enforce them will depends in part on the property rights, legal, regulatory, and contracting environments in which they operate. Such an environment includes accounting practices, chartering rules, government regulations, and the market conditions (e.g., market power) under which banks operate. Differences in these features across political jurisdictions can lead to differences in the efficiency of banks across jurisdictions (Demirguc-Kunt, Jane and Laeven, 2007).

The operating environment can also influence the external and internal mechanisms that discipline bank managers. Internal discipline might be induced or reduced by organizational form, ownership and capital structure, governing boards, and managerial compensation. External discipline might be induced or reduced by government regulation and the safety net, capital market discipline (takeovers, cost of funds, stakeholders' ability to sell stock (stock price)), managerial labor market competition, outside blockholders (equity and debt), and product market competition.

Many of financial intermediation studies find that the rule of law is a particularly important determinant of financial sector development. Banks will be reluctant to make loans if they cannot enforce their claims in court. If they have difficulty making loans they have less incentive to solicit deposits. Enforcement of existing laws is even more important than law on the books, and enforcement is correlated with per capita GDP (e.g. LaPorta et al, 1997, 1998; Pistor, Raiser and Gelfer (2000).

Ghana particularly has serious weaknesses in this area because of their economic backwardness. Bank efficiency, and hence bank spreads, also depend on the quality of bank regulation and supervision. Neyapti and Dincer (2005) construct an index of the quality of regulation and supervision for the transition economies; some CIS-7 countries rank near the bottom on their rating scale while Poland, Hungary and Estonia rank highest. Important policy implications of these findings include the need to enhance confidence in the Ghana's rural banking system, to encourage savings in regional rural banks, and to ensure efficient transfer of resources from savers to investors.

List of Abreviations

DEA: Data Envelopment Analysis

DMU: Decision Making Units

NIM: Net Interest Margin

RCBS: Rural Community banks

ROA: Return on Assets

SE: Scale Efficiency

TE: Technical Efficiency

VRS: Variable Return to Scale

References

[1]   Abdin, Z, 2007, Kinerja Efisiensi Pada Bank Umum, Proceeding Pesat (Psikologi, Ekonomi, Sastra, Arsitek & Sipil) Vol. 2, Issn : 1858 – 2559

[2]   Andah D O, Steel WF (2003). Rural and microfinance regulation in Ghana: Implications for development and   performance of the industry, Africa Region Working Paper Series No 49. Washington, DC World Bank.

[3]   Beck, T. and Hesse, H., (2006). "Bank Efficiency, Ownership and Market Structure: Why areInterest Spreads So High in Uganda?" *World Bank Policy Research Working Paper* 4027,October 2006.

[4]   Bencivenga, V. R. & Smith, B. D. (1998). Economic development and financial depth in a model with costly financial intermediation. *Research in Economics*, 52, 363-386.

[5]   Charnes, A. Cooper, W. W., and Rhodes, E. (1978). Measuring efficiency of decision making units. European Journal of Operations Research 2, 429-44.

[6] Dabla-Norris, E., Floerkemeier, H., (2007). "Bank Efficiency and Market Structure: What Determines Banking Spreads in Armenia?" *IMF, Working Paper* 07/134.

[7] Demirguc-Kunt, A., Laeven, L., Levine, R., (2004). "Regulations, Market Structure, Institutions, and the Cost of Financial Intermediation," *Journal of Money, Credit and Banking* 36, 593-622.

[8] Demirguc-Kunt, A. & Huizinga, H. (2000). Financial structure and bank profitability. *World Bank Policy Research Working Paper No.2430*, Retrieved June 28, 2007 from http://ssrn.com/abstract=632501.

[9] Drury C. (2007). Management and Cost Accounting. London: Thomson Learning 6th Edition.

[10] Eken, M.H. and Kale, S. (2011). Measuring bank branch performance using data envelopment analysis (DEA); The case of Turkish bank branches. African Journal of Business Management 5 (3) 889-901.

[11] Frimpong J M (2010). Investigating efficiency of Ghana banks: A non-parametric approach. *American Journal of Scientific Research* (7), 64-76.

[12] Halkos, G. E. and Salamouris, D. S. (2004). "Efficiency measurement of the Greek commercial banks with the use of financial ratios: a data envelopment analysis approach", *Management Accounting Research*, (15) 201 – 224.

[13] Hauner , David, 2004, Explaining Efficiency Differences Among Large German and Austrian Banks, International Monetary Fund WP/04/140.

[14] Hassan, M. K., & Bashir, A. H. M. (2003). Determinants of Islamic banking profitability. Paper presented at the 10th ERF Annual Conference, Morocco, 16–18 December

[15] Ho, T.S. Y. & Saunders, A. (1981). The determinants of bank interest margins: theory and empirical evidence. *The Journal of Financial and Quantitative Analysis,* 16(4), 581-600.

[16] Fethi, M. D and Pasiouras, F. (2009). Assessing Bank Efficiency and Performance with Operational Research and Artificial Intelligence Techniques: A survey. University of Bath WP 2009.02.

[17] Kablan, S. (2007). Measuring bank efficiency in developing countries: The case of WAEMU (West African Economic Monetary Union). Paper for African Economic Research Consortium.

[18] Kediri, 2008, Rural Banks Efficiency and its Determinant, Office of Bank Indonesia Research report.

[19] Khankhoje, D. (2008). Efficiency of Rural Banks: The case of India. International Business Research (2), 140-149.

[20] Los Baños, J.A. (2007) Rural Banks, Resources Allocation Efficiency and Regional Economic Performance *Philippine Management Review* Vol. 14, 115-126.

[21] Mohindra Versha and Kaur Gian (2012) Regional Rural Banks in India since Reforms: A Study of Technical Efficiency, Prerana, March.

[22] Molyneux, P. Altunbas, Y. and Gardener, E. (1996). Efficiency of large banking. John Wiley Chichester 198. Oral M and Yolalan R (1990). An Empirical Study on Measuring Operating Efficiency and Profitability of Bank Branches. European Journal Operational, Research., 46(3):282-294.

[23] Paradi J. C., Rouattb S., Zhu H (2010) Two-stage evaluation of bank branch efficiency using data envelopment analysis. Omega.   39(1): 99-109.

[24] Portela, M., & Thanassoulis, E. (2007). Comparative efficiency analysis of Portuguese bank branches. *European Journal of Operational Research, 177*(2), 1275-1288.

[25] Resti, A. (1997). Evaluating the cost-efficiency of the Italian banking system: what can be learned from the joint application of parametric and non-parametric techniques. Journal of Banking and Finance, 21 (2), 221-50.

[26] Robison, L.J., and P.J.Barry."Portfolio Adjustments:An Application to Rural Banking." Amer. J. Agr.Econ.59(1977):311-12.The Competitive Firm's Response to Risk. NewYork: Macmillan Co., 1986.

[27] Sathye, M. (2001). X-efficiency in Australian banking: an empirical investigation. Journal of Banking and Finance, 25. 613-630.

[28]   Sherman, H. D. and Gold, F. (1985). Bank Branch operating efficiency: Evaluation with data envelopment analysis. Journal of Banking and Finance, 9 (2). 297-315.

[29]   Soteriou, A., & Zenios, S. (1999). Using data envelopment analysis for costing bank products. *European Journal of Operational Research, 114*(2), 234-248.

[30]   Schaffnit, C., Rosen, D., & Paradi, J.(1997). Best practice analysis of bank branches: an application of DEA in a large Canadian bank. *European Journal of Operational Research, 98*(2), 269-289.

[31]   Sufian F. and Chong R.R., (2008). "Determinants of bank profitability in a developing economy: empirical evidence from the Philippines". Asian academy of management journal of accounting and finance; AAMJAF, 4, (2), 91–112.

[32]   Taylor, W., Thompson, R., Thrall, R. , & Dharmapala, P. (1997). DEA/AR efficiency and profitability of Mexican banks a total income model. *European Journal of Operational Research, 98*(2), 346-363.

[33]   Tesfamariam , K.,Tesfay, H. and Tesfay, A. (2013) Relative Efficiency of Rural Saving and Credit Cooperatives: An Application of Data Envelopment Analysis   *International Journal of Cooperative Studies* 2, (1), 16-25.

[34]   Westhuizen, G, (2007), Estimating Technical And Scale Efficiency Of Banks Using Balance Sheet Data: A South African Case, wrking paper, School for Economic Sciences North-West University Vaal Triangle Campus, Vanderbijlpark , South Africa.

[35]   Yue, P. (1992). Data envelopment analysis and commercial bank performance with application to Missourie Banks, Federal Reserve Bank of St Louis Economic Review, January/February, 31-45.

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