DETERMINANTS AND MEASURES OF TECHNICAL AND SCALE EFFICIENCIES OF SAVINGS AND LOANS COMPANIES IN GHANA

by

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DECLARATION

I hereby declare that this is original work first presented to this department. And thus has never been presented to this department or any Faculty in this University for the award of any Degree. I also declare that, as required by academic rules and conduct, I have fully cited and referenced all other materials and results that are not original to this work.

Every chapter of this work has been discussed thoroughly with my supervisor including all recommendations and suggestions for the success of this study.

I accept sole responsible for any error or omission, which might have occurred during the course of the work.

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ABSTRACT

The Savings and Loans (S&Ls) industry is very young in the financial system of Ghana which came into being in the early 1990s. With almost two decades since the establishment of the savings and loans law PNDC Law 328, legalizing their operations, the industry has experienced enormous growth with respect to their assets and service providers. The growth of the industry coupled with expanding branch networks and providers presupposes the good performance of their operation. But literature on determinants and measures of efficiency of Savings and Loans is limited. This study was carried out to measure and determine the technical and scale efficiencies of Savings and Loans Companies in Ghana for the period 2006-2010. Five Savings and Loans Companies were involved in the study due to other companies' reluctance to give out data relating to their operations. The efficiency measure and determinants were carried on via Data Envelopment Analysis (DEA) and Tobit regression model respectively. The DEA employed the constant returns to scale approach whilst focusing on input oriented model. Out of the sampled five S&Ls, four were technically efficient whilst only two were scale efficient during the period under study. Total assets, number of branch networks and quality of asset were found to be good determinants of technical and scale efficiencies. The study recommends that managers focus on loan creation whilst improving on deposits and expanding branch networks.

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DEDICATION

This work is dedicated to ALLAH.

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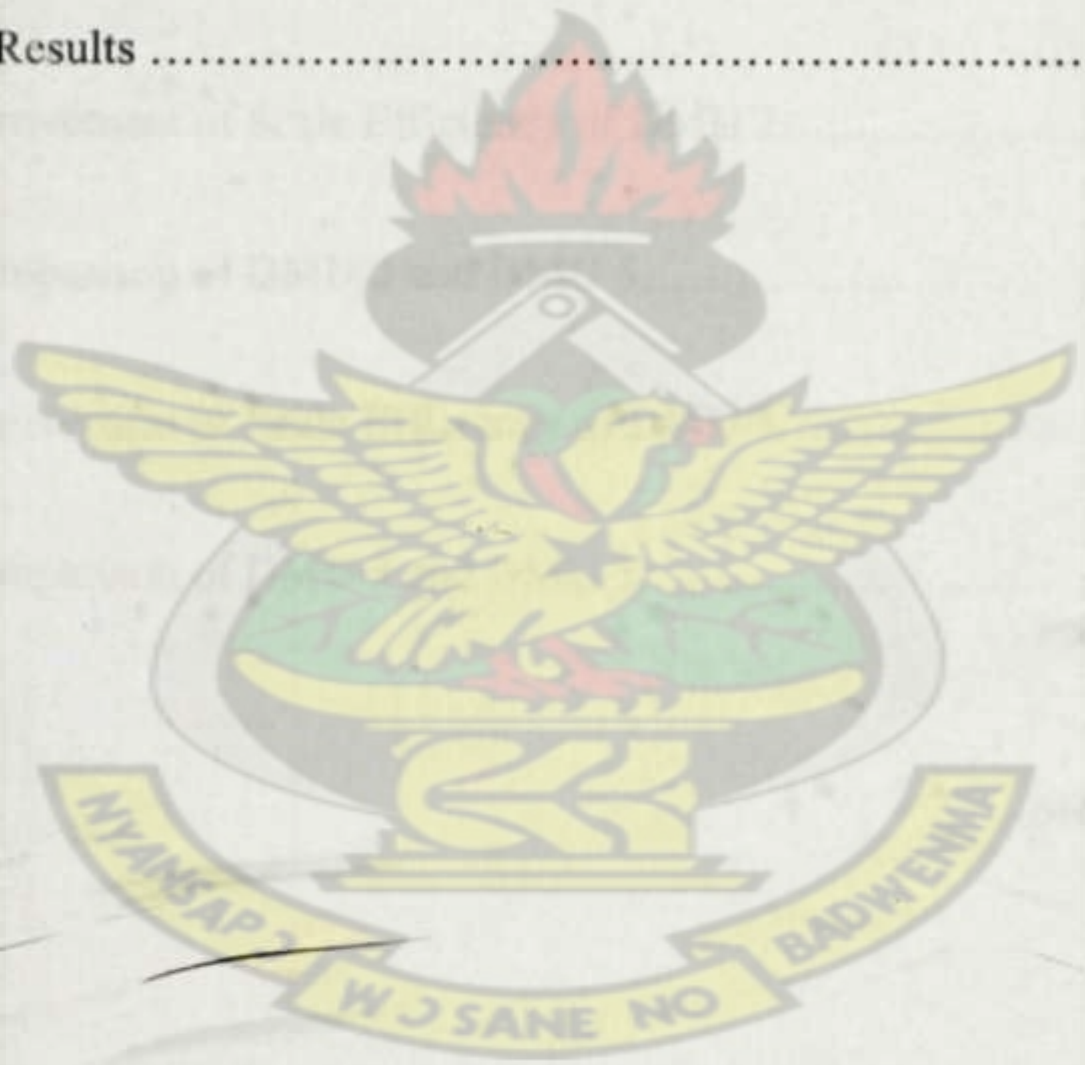

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CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

The financial system of the Ghanaian economy can broadly be categorised into banking financial institution and non-banking financial institution (Bank of Ghana, 2007). However, irrespective of which section one belongs, the central bank, Bank of Ghana (BoG) regulates and supervises the activities of these financial institutions as mandated by the constitution of Ghana. All forms of financial institutions play crucial role in the economic development of a country and as such must be given equally the needed support for its growth.

Savings and Loans companies fall under the Non-Banking Financial Institutions (NBFIs) Law 1993 (PNDCL 328). In accordance with the act establishing these institutions, Savings and Loans Companies are not banks and are therefore not permitted to use the word "bank" as part of their registered names.

Until 1993 when the first Savings and Loans Company started operation, financial intermediation was skewed towards the formal sector neglecting the broader spectrum of the informal sector. In other words, financial services were available to only those in the formal sector of the Ghanaian economy prior to 1993. Savings and Loans Companies under the act establishing them brought financial intermediation to the door steps of the "ordinary" Ghanaians. At a UN World Summit, held in New York, in 2005, to review progress in reaching the Millennium Development Goals, the former president of Benin, Mathieu Kerekou said: "Access by poor people to financial services is a powerful tool to fight poverty. Microfinance is an important element of the financial system and must be treated as such". He added, "It makes a

huge difference when poor people have access to a broad range of financial services, whereby they can invest in income producing activities and meet their vital needs such as health, education and nutrition". The Savings and Loans Companies have provided financial assistance and continue to do so for small and medium enterprises which are not categorized under the formal sector. Savings and Loans Companies have made credit facilities available to those in the informal sector, and thus have helped bridge the financial accessibility gap that hitherto existed between those in the formal and those in the informal sector.

The growing number of companies operating under the Savings and Loans code presupposes the increasing demand for their services. The growing number, notwithstanding, has also created fierce competition among providers. The Savings and Loans industry is no doubt growing and hence impacting positively on the financial system in particular and the economy in general. Therefore, there is the need to conduct more studies or research in the area to harness the full potentials of the Savings and Loans Companies for the economic development of Ghana. Thus, we must be able to measure the efficiency levels of these companies to determine how well they are doing. In other words, are Savings and Loans Companies operating efficiently? If yes, then what can be done to sustain such efficiency level, if no, then what could be done to improve on the efficiency level of these business entities? Efficiency as defined by Notodihardjo (2009) is the ratio of actual production to potential production of every Decision Making Unit (DMU) or individual firm. Another important issue underlying this study is how to determine the factors affecting the efficiency of Savings and Loans Companies. All these are meant to inform government policy, and managers of Savings and Loans Companies to address issues pertaining to the sector.

Currently, the number of Savings and Loans Companies operating in Ghana's financial system is approximately 19 (GHASALC, 2010). This marks a tremendous increase of Savings and Loans companies from one in 1993 to 12 in 2006. Savings and Loans Companies though have increased the number of service points in the past years by opening new branches across the country, however the focus of this expansion drive has been limited to the southern part of the country.

It is estimated that, at the end of 2008, for example, the total assets of all Savings and Loans Companies in the country was more than GH₵247 million and, altogether, Savings and Loans Companies in Ghana mobilised a total of GH₵130 million from the public in 2008. The industry also disbursed a total of GH₵61 million in loans to private enterprises and as much as GH₵81 million to individuals (BoG, 2011). The Savings and Loans industry has seen some tremendous injection of foreign capital and benefited immensely from technical assistance from institutional investors. This has boosted operations and increased their competitiveness. Thus, do these developments in the Savings and Loans industry affect their efficiency level? Or what accounts for these strives in efficiency if there is any or otherwise?

In sum the efficiency of Savings and Loans companies are very paramount in terms of measurement and determination as it provides financial service to the larger chunk of Ghanaian who at the same time constitutes the informal sector. Thus, by this it has been able to reduce to appreciable level the financial vacuum that use to exist for those in the informal sector.

1.1 Problem Statement

Savings and Loans Companies are deposit-taking financial institutions regulated by the Bank of Ghana under the Non- Bank Financial Institutions (NBFI) Law 1993 (PNDCL 328), and subsequently the passage of the Non-Bank Financial Institutions (NBFI) Act 2008, Act 774 with

a minimum capital requirement (GH₵7,000,000.00) much lower than that of the universal banks but above that for rural and community banks. According to the Bank of Ghana (BoG), Savings and Loans Companies would transact business by accepting deposits and any other repayable funds from the public through lending, financial leasing and money transfer services.

With most of the companies starting operations in early 2000, the number of Savings and Loans Companies has increased tremendously mainly due to increasing demand for their services. In a Daily Graphic publication on July 20, 2011; data from the Bank of Ghana indicate that from 12 Savings and Loans Companies in 2006, the figure has grown to 19 as of March 2011. The growth in the numbers has also led to substantial mobilisation of deposits and the granting of loans. Total deposits of the industry had rose from GH₵47.76 million in 2006 to GH₵235.15 million by the close of March, 2011 while total assets over the same period under review increased from GH₵86.97 million to GH₵482.12 million (BoG, 2012).

The role Savings and Loans Companies play in the economic development of Ghana can therefore not be underestimated. During the 5th anniversary celebration of First Capital National and Loans Company in 2011, the Deputy Governor of the Bank of Ghana, Mr. Millison Narh was quoted as saying that; "Savings and Loans Companies were established to bridge a gap; a gap that was created by the neglect of the self-employed, artisanal and small scale operators in our urban centres, that is, micro businesses that are regarded as the growth poles of our developing economy". Thus with the coming into being of Savings and Loans Companies, businesses and individuals that were hitherto considered un-bankable now have access to finance and credit through the country's non-banking financial institutions. Savings and Loans industry have produced remarkable results in recent years through their all-important role of providing

financial intermediation to Ghanaians most importantly those in the informal sector. The Central Bank has been of the view that in spite of the increasing number of financial intermediaries and the growing spread of financial institutions across the country, access to financial services is still relatively low for a lower middle income country like Ghana. Thus, Savings and Loans Companies efficiencies seem to have been neglected. Therefore, the growing number of Savings and Loans Companies in Ghana raises several issues with regard to the efficiency of the industry.

However, apart from few studies relating to the impact and challenges of Savings and Loans Companies in particular and micro finance in general, there has not been any rigorous work which has been carried out on the sector, most especially concerning efficiency, a very vital economic variable needed to assess the efficacy of an economic sectors. It is against this background that this study proposes to investigate the determinants and measures of technical and scale efficiencies of the Savings and Loans Companies in Ghana.

1.2 Objective of the Study

The goal of this study is to empirically determine and measure the technical and scale efficiencies of Savings and Loans Companies in Ghana. Specifically, the objectives of the study are

1. To measure the technical and scale efficiencies of Savings and Loans Companies in Ghana.
2. To identify what factors influence the technical and scale efficiency of Savings and Loans Companies in Ghana.
3. To compare the technical and scale efficiencies of Savings and Loans Companies in Ghana.

4. To set a benchmark for measuring the efficiency of Savings and Loans Companies in Ghana.

1.3 Research Questions

The following questions are guide to the researcher in advancing the core objective of the study and will include but will not be limited to the following;

1. How is technical and scale efficiencies of Savings and Loans Companies in Ghana measured?
2. What factors influence the technical efficiency of Savings and Loans Companies in Ghana?
3. Is there a benchmark for measuring the efficiency of Savings and Loans companies in Ghana?
4. What factors influence the scale efficiency of Savings and Loans Companies in Ghana?

1.4 Study Hypothesis

H_0: All Savings and Loans Companies in Ghana are technical and scale efficient

H_1: Not all Savings and Loans Companies in Ghana are technical and scale efficient

1.5 Method of the Study

The study adopts the Constant Returns to Scale Data Envelopment Analysis (hereafter, CRS-DEA) proposed by Charne, Cooper and Rhode in 1978. This methodology measures efficiency based on a threshold of 0 to 100 percent, meaning a DMU is technical or scale efficient only when it attains 100 percent score and technical and scale inefficient when it attains an efficiency score less than 100 percent. The CRS-DEA is to be measured via frontier analyst software which produces the efficiency score of each DMU whilst at the same time exhibits the *reference* set (i.e.

the best practice) and the *peer*, which implies the reference set an inefficient DMU can learn from to improve on its efficiency. Again, Tobit model is used in this study in determining the factors that affect the technical and scale efficiency of Savings and Loans Companies in Ghana. The Tobit model (Tobin, 1958) is a statistical model that describes the relationship between a non-negative dependent variable and an independent variable

1.6 Justification for the Study

The financial system of all economies across the world is very crucial for growth and development. The current financial meltdown around the world has pushed many economies into economic recession and debt crisis affecting the world economic trend in terms of growth. The Wall Street crisis and the European debt crisis are crucial examples at the moment. Many financial institutions have run into bankruptcy forcing governments to bail some of them out in order to avoid these institutions from collapsing.

The Savings and Loans institutions as part of the generality of the financial system equally serve a crucial role in every economy. In providing financial services to small and medium enterprises, it wets down the problem of the universal banks not reaching these groups of people. These institutions (micro finance) go beyond groups of businesses to providing loans or financial intermediations to private individuals. These companies have made banking services available to the then unbanked group in the informal sector. Again, the customer base of these Savings and Loans Companies continue to grow year after year.

Therefore, it is unarguable to state that modern economies would need the Savings and Loans industry to complement the efforts of the universal banks for effective performance of the financial system of all economies. Thus, any inefficiency in the operation of Savings and Loans Companies could have equivalent effect on any economy just as it is being witness in the

universal banks in the advanced economies. Better still, the repercussions of such inefficiency in the Savings and Loans institutions on the banking sector and the economy in general will be equally very huge. Hence, under no circumstance should any economy underestimate the crucial role of Savings and Loans Companies. Thus, there is the need to ensure that these Savings and Loans Companies operate efficiently in the quest to deliver essential financial services to the general public.

Thus the motivation behind this study in general is the appreciation of the crucial role the Savings and Loans Companies play in the economic development of Ghana. The specific justifications include but are not limited to the following;

- Helping policy makers or regulators to ensure that the environment that these companies operate within is conducive and attractive.
- Help managers of various financial institutions especially the Savings and Loans Companies adopt prudent measures to improve on their efficiency level in order to stay in business.
- To identify a standard for measuring efficiency among Savings and Loans Companies.
- To add to the existing literature, the determinants and measure of technical and scale efficiency of the Savings and Loans institutions.

1.7 Organisation of the Study

The study is organized into the five broad chapters. Chapter one presents the general overview of the study including the statement of the problem. The chapter also includes research hypothesis, research questions, objective of the study and the justification for the study.

In chapter two, various works relating to the study area both theoretical and empirical data are reviewed, including institutional framework concerning financial system of Ghana. Chapter three presents the methodology of the study. Chapter four presents data analysis vis-a-vis the methodology adopted in chapter three. Finally, chapter five concludes and evaluates the study whilst giving out some recommendations based on conclusions drawn from the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews various works relating to the study area. The relevance of this chapter is to aid the researcher to adopt the ideal technique in achieving the research objective and research design. The chapter is presented in three sections; the first section has to do with reviewing theoretical literature, whereas the second section reviews empirical literature. The final section presents institutional framework with respect to financial system and intermediation in Ghana in particular and the world in general.

2.1 Theoretical Literature

Economic theory indicates that the main role of financial markets and institutions is to minimize the costs of information and transactions. Consequently, savings rates, investment decisions, technological innovation, and long-run growth rates depend crucially on the efficiency of the financial system which acts as the spine for sustained economic growth and development (Claessen, 2007).

The general meaning of efficiency in economics relates to achieving the maximum possible result or output from the available scarce resource at one's disposal. The concept of efficiency is therefore very important in all facets of an economy in order to ensure that scarce economic resources are put into good use to attain maximum satisfaction.

In the financial system of any economy, attainment of efficiency is therefore paramount as the sector takes the largest share of the world's economy. Thus the efficiency of the sector is a

prerequisite for economic growth. The general definition of efficiency is very broad and also controversial, as efficiency can be classified into four broad categories (Shahooth and Battall, 2006) .

2.1.1Economic Efficiency

The concept of economic efficiency is crucuial in neoclassical microeconomic theory, which stresses on resource allocation and utilization. It calls for non-wastage of resources by concentrating on cost reduction while producing the maximum possible level of output for a given technology and available inputs (Masunda, 2008). This is to say that economic efficiency emphasises using the available set of scarce resources (inputs) to produce the maximum possible output. In that case, full employment of resources and economic efficiency are simultaneously attained. Accordingly, in the process of transforming inputs into some output value, a change that increases value is an efficient change and one that decreases value is an inefficient change.

According to Griffiths and Wall (2000) economic efficiency is better explained by profit maximization (or cost minimization) but is most often associated with perfectly competitive markets than with monopoly due to the deadweight loss associated with monopoly pricing and production. For firms operating in a competitive industry, efficiency gains occur when firms earn only normal profits in the long-run and respond to changes in consumer preferences by changing output. Whether this output is sold at the same, higher or lower price depends at large the position of the cost curves in the long-run. Paxton (2003) defined economic efficiency as the overall efficiency, since it combines both technical and allocative efficiency. Therefore, from the theory of economic efficiency, Savings and Loans Companies as deposit institutions will be

economically efficient by using their deposits and other assets (inputs) to create the maximum loans and other financial services (outputs) possible to investors or customers.

2.1.2 Technical Efficiency

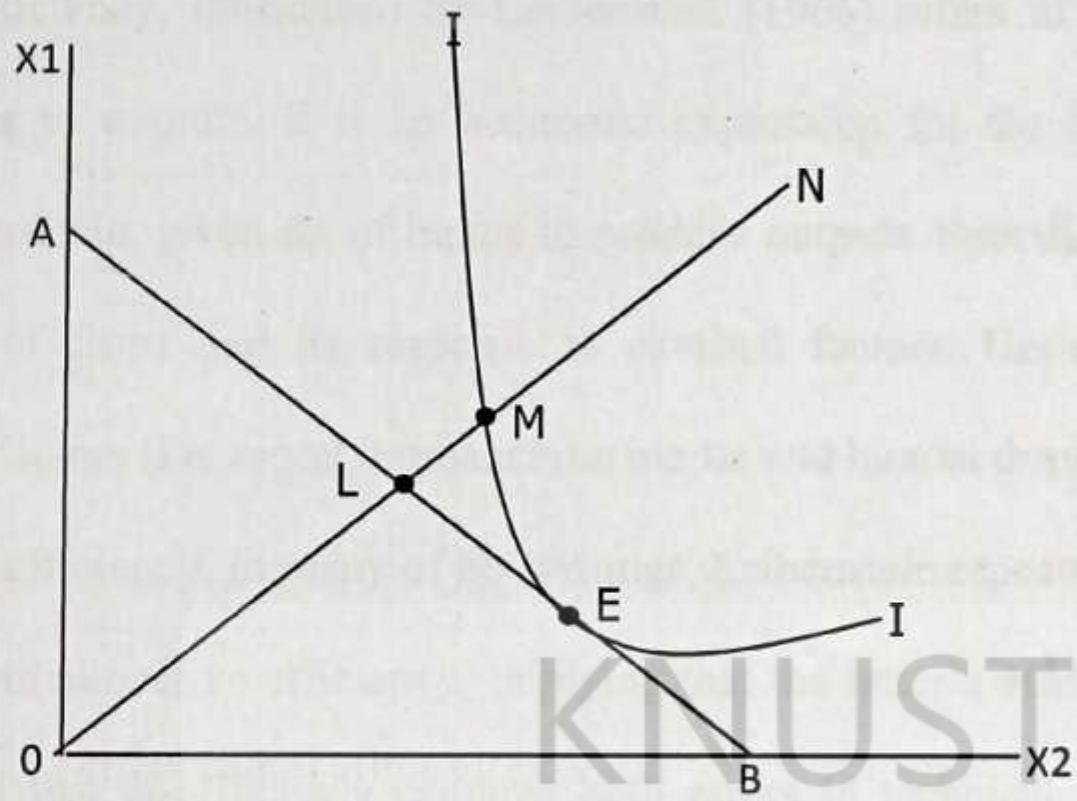
Technical efficiency has been defined as the ability of a Decision Making Unit (DMU) to produce maximum output from a given set of input. Thus, a bank is considered to be technically efficient if it produces optimal quantities of output given the amount of inputs, or alternatively, if it produces given amount of output with minimum quantities of inputs (Neils and Hong, 2008). From this definition, it is realised that "efficiency" is synonymous to "technical efficiency". Technical efficiency in other words means transferring physical inputs such as labour and capital into outputs at the best level of performance, which means there is no waste in using inputs to produce specific quantity of output (Shahooth and Battall, 2006). In this respect, when DMUs expected output (frontier) is equal to its actual output then technical efficiency is attained. However, there is technical inefficiency when a DMU's actual output falls short of the expected output (frontier). Hence, a full technical efficiency is achieved if and only if a DMU cannot improve some of its inputs or outputs without worsening some of its inputs or outputs. Therefore, a firm is technically efficient when it cannot increase any output or decrease any input without reducing other output or increasing other inputs (Shahooth and Battall, 2006). This is tantamount to Pareto efficiency of welfare maximization. In financial institutions, inputs of firms include deposits and assets whilst its loans and other services provided to the public constitute the output. In such situation, estimating production function might tell us if the firm is technically efficient- when managers organise production so that the firm maximizes the amount of output produced with a given amount of inputs. Thus, the firm is operating on its production frontier.

2.1.3 Allocative Efficiency

This refers to firm's ability to utilize inputs in their optimal proportions, given relative prices. It could also be used to mean "distributive efficiency" or "price efficiency" (Paxton, 2003). This means choosing of inputs in the production of specific level of outputs at specific level of the prices of the inputs. The concept of allocative efficiency occurs when right input mix is chosen to produce a given amount of output. The mix of inputs chosen is also dependent on the prices of the inputs and their contribution to the production of a given output. It is in this regards that allocative efficiency is most often described as "price efficiency" or "distributive efficiency" (Shahooth and Battall, 2006). Thus in making such decision, inputs are allocated in such a way as to maximise their benefits (profits, revenue and output) depending on the firm's objective function. Allocative efficiency is thus concerned with informing resource allocation decisions by taking into account both productive efficiency as well as Pareto efficiency. However, it is still possible to achieve Pareto efficiency without allocative efficiency. At firm level, allocative efficient outcomes occur when price is equal to marginal costs in a perfectly competitive market (Musonda, 2008).

From the graph below, supposing that a firm uses two inputs X1 and X2 to produce Y of output represented by isoquant I, which also represents all combinations technically efficient between the two inputs to produce the same level of output. AB represents isocost. This shows that all points along the AB curve exhibits cost efficiency.

Figure 1.1: Graphical illustration of Economic, Technical and Allocative efficiencies



Source: Shahooth and Battall, 2006

The tangent point E represents the optimal operation point or firm's equilibrium point, where marginal rate of technical substitution MRTS between X1 and X2 is equal to the ratio of their prices, and a firm which operates at this point achieves technical and economic efficiencies. A firm at the point M is technically efficient because it lies on the isoquant*, but it is not cost efficient. A firm operating at point N is not efficient either technically or economically. Technical efficiency of this firm is equal OM/ON, whilst its allocative efficiency is equal OL/OM. It reflects the ability of the firm to use the inputs at optimum combination at given prices.

Cost (economic) efficiency is calculated by OL/ON, or is equal to (OM/ON) x (OL/ON). It is the product of technical and allocative efficiency coefficients. All the three measures are bounded by values from zero to one.

2.1.4 X-Efficiency

Finally, X-efficiency, introduced by Leibenstein (1966) refers to efficiency in production by linking inputs to outputs. It is an economic expression for the effectiveness with which an organisation uses its given set of inputs to produce outputs. Specifically, it refers to the internal organisation of firms and its response to external factors. Under such circumstances, both motivational factors (i.e. moral, bureaucratic inertia and human errors) and competitive pressures may affect X-efficiency. In many of his writings, Leibenstein repeatedly argued that X-efficiency was superior to allocative efficiency, implying that the latter's effect was trivial. Yi-Kai (2001) also observed that X-efficiency captures both errors in technical inefficiencies and allocative efficiencies and this supports Leibenstein assertion that allocative efficiency is trivial with regard to X-efficiency. This is to say X-efficiency concept comprises of two components: technical and allocative efficiencies. Yi-Kai defined X-efficiency as the ratio of the minimum costs that could have been expended to produce a given output bundle to the actual costs expended. Thus, X-efficiency ranges between 0 to 100 percent.

2.1.5 Parametric and non-parametric approaches to efficiency measurement

Efficiency measurement in financial institutions based on existing literature (e.g. Mester 1992, Berger and Humphrey 1997, Paxton 2002, et al.) varies with regard to the methodological approach. Excluding financial ratio methodology, there are basically two main approaches of measuring efficiency of a financial institution and these are parametric and non-parametric approaches. There is however no theory backing which of these approaches is better than the other and thus the choice is determined based on the researcher's own prerogative (Berger and Humphrey, 1997).

The parametric approach also known as stochastic approach uses econometric modeling in establishing the relationship between inputs and efficiency level of output. There are basically three methods associated with parametric approach of efficiency measurement which include; Stochastic Frontier Approach (SFA), Distribution Free Approach (DFA), and the Thick Frontier Approach (TFA). Thus the approach specifies a functional form for the cost, profit, or production relationship among inputs, outputs, and environmental factors, and allows for random error (Berger and Humphrey, 1997). Assumptions underlying all the three approaches are related. But the most widely used approach among the three aforementioned approaches is the Stochastic Frontier Approach (SFA).

The Stochastic Frontier Approach (SFA) was first developed by Aigner et al. (1977) and Meesen and Broeck (1977) who estimated efficiencies using cross-sectional data. The SFA also incorporates the notion of an efficient frontier. However, the determination of the frontier (the most efficient point) is done parametrically by adding the random error (Paxton, 2003). Subsequently, Ferrier and Lovell (1990) also applied the methodology to banks efficiency determination. The SFA specifies a particular form for the production / cost function allowing for a composite error term. Thus, the methodology involves parameterising the relationship between the level of inputs and the technically efficient level of output. SFA posits a composed error model where inefficiencies are assumed to follow an asymmetric distribution, usually the half-normal, while random error follow a symmetric distribution, usually the standard normal. The logic is that the inefficiencies must have a truncated distribution because inefficiencies cannot be negative. Both the inefficiencies and the errors are assumed to be orthogonal to the input, output, or environmental variables specified in the estimating equation. The estimated

inefficiency for any firm or Decision Making Unit is taken as the conditional mean or mode of the distribution of the inefficiency term, given the observation of the composed error term. However, an often cited criticism of the Stochastic Frontier Approaches is that when the specification of the efficiency function and stochastic term are assumed a priori, it may not be clear whether or not the efficiency measure is contaminated by the misspecification of the estimated econometric model (Berger and Humphrey, 1997).

The non-parametric frontier approach such as much of the works in the Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH) on the other hand put relatively little structure on the specification of the best practice frontier. The DEA which is often used is a linear programming technique where the set of best practice or frontier observations are those for which no other Decision Making Unit (DMU) or linear combination of units has as much or more of every output (given inputs) or as little or less of every input (given output). As noted in Dilip and Milind (2008), the DEA methodology was developed first by Charnes, Cooper and Rhodes (1978) and applied to non-profit organizations where the objective of profit maximization and cost minimization may not be considered as the vital factor. Sherman and Gold (1985) were the first to apply DEA to banking. DEA calculates the relative efficiency scores of various Decision-Making Units (DMUs) in a particular sample. The DMUs could be banks or branches of banks. The DEA measure compares each of these banks / branches in that sample with the best practice in the sample. According to Haq, Skully and Pathan (2006), the DEA frontier is formed as the piecewise linear combinations that connect the set of these best practice observations, yielding a convex production possibilities set. Thus the DEA efficiency score for a specific Decision Making Unit (DMU) is not defined by an absolute standard, but it is

defined relative to the other DMUs in the specific data set under consideration (Casu and Molyneux, 1998). As such, DEA does not require the explicit specification of the form of the underlying production relationship. The DEA also decomposes overall efficiency into technical and allocative efficiency. Data Envelopment Analysis does not explicitly make any assumptions regarding the functional form of the frontier but empirically builds a best-practice function from observed (actual) inputs and outputs (Favero & Papi, 1995). However, a major criticism leveled against the DEA methodology is that it assumes the absence of measurement error and statistical noise. Accordingly, errors are taken as measures of inefficiency. However, as Herrero & Pascoe (2002) have observed, these inefficiency scores may be biased if the production process is largely characterised by stochastic elements.

Again, apart from the non-parametric approach committing the sin of not incorporating the random error, Subhash (2004) also identify two other defects of the DEA approach in addition to the random error. First, the DEA approach does not estimate production, cost, or profit function. This precludes evaluating marginal products, partial elasticities, marginal costs, or elasticities of substitution from a fitted model. Hence, the derivation of usual conclusions concerning the technology, which are possible from a parametric functional form, simply becomes impossible. Second, the DEA method employs the linear programming instead of the usual least squares regression approach.

Berger and Humphrey (1997) broadly categorized the approaches of measuring economic efficiency into either parametric (stochastic) or non-parametric (linear programming) depending on the specification and estimation of the efficiency frontier and assumption made about the

distribution of the error component. But is there a "best" frontier method? They noted that the lack of agreement among researchers regarding a preferred frontier model at present boils down to a difference of opinion regarding the lesser of evils. The parametric approaches commit the sin of imposing a particular functional form (and associated behavioral assumptions) that presupposes the shape of the frontier. If the functional form is misspecified, measured efficiency may be confounded with the specification errors. The non-parametric approach on the other hand, imposes less structure on the frontier but commits the sin of not allowing for random error owing to luck, data problems, or other measurement errors. If random error exists, measuring efficiency may be confounded with these random deviations from the true efficiency frontier. The conflict between the parametric and non-parametric approaches is important because the two types of methods tend to have different degrees of dispersion and rank the same financial institutions somewhat different.

While both parametric and non-parametric techniques have been applied to the analysis of institutional efficiency in the banking sector by different researchers in different environment, no consensus exists in the literature about the preferred method for analysis. In general, non-parametric analyses impose a more flexible structure on the frontier, but have the shortcoming of assuming no random error (Paxton, 2003). Likewise, parametric estimations incorporate random error but necessarily impose a particular functional form. The use of one technique over another can lead to divergent results however research addressing the limitations of each approach will allow the parametric and non-parametric results to be increasingly comparable (Berger and Humphrey, 1997).

2.1.6 Economies of Scale and Economies of Scope

The concepts of economies of scale and scope are very crucial in the efficiency measurement in the financial system. Thus a financial institution can be measured as being efficient or otherwise in relation to its operational size or profit portfolio. Hughes and Mester (2008) have conceptualized the theory of economies of scale and economies of scope in the banking institutions. They see either the average cost function or cost frontier as a good measure of scale economies, which refers to how the bank's scale of operations (its size) is related to cost and give a measure of whether the bank is operating at an optimal scale. A bank is operating with scale economies if a one percent increase in scale leads to a less than one percent increase in cost; it is operating with scale diseconomies if a one percent increase in scale leads to a greater than one percent increase in costs; it is operating with constant returns to scale if a one percent increase in scale leads to a one percent increase in cost. Scope economies refer to whether the bank is producing the optimal combination of products to minimize cost (or maximize profits). In particular, a bank is operating with scope economies if the cost of producing the bank's product bundle is less than the cost of separating the bundle into specialized firms. The bank is operating with scope diseconomies if specialized banks could produce the product mix more cheaply. The essence of scope economies is that firms should be able to produce multiple outputs from the same group of inputs at lower cost, in terms of inputs, than if they specialized in producing only one type of output. In the perspective of a financial institution, we might be looking at a situation where a firm produced both loans and deposit services, using the same staff and branch networks, rather than specializing in just one of these functions by itself (Berger, 2003).

Traditionally, technical efficiency in banking was measured using the production function which captures both scale and scope efficiencies. However, technical efficiency is only a component of overall economic efficiency. Although extensive in use, scale and scope efficiency measures are of little economic significance for financial institutions (Kwan & Eisenbeis, 1996). This view is supported by Berger et al. (1993) and Berger and Humphrey (1991) who argue that scale and scope inefficiencies are less important than X-inefficiency in the banking industry. Similarly, Bauer et al. (1998) argue that for policy purposes, economic efficiency is a much broader concept than technical efficiency in the sense that the former encompasses the latter and involves an optimal choice of inputs and/or outputs based on the reactions to market prices.

2.2 Empirical Literature

According to United Nations Economic Commission for Africa (UNECA), any well-doing economy would need a financial system that moves funds from people who save to people who have productive investment opportunities. In other words, a sound financial system acts as a breeding ground for sustainable economic growth. As cited in UNECA's publication, the relevance of financial development and economic growth which was first put forward in the literature by Walter Bagehot (1873) and John Hicks (1969), disclosed that the economic growth and development of England was possible due to the use of the financial system to generate productive financial capital. Fries and Taci (2004) found that just like productivity in other sectors of an economy, ensuring improved efficiency in the banking sector (financial system) also contributes immensely and directly to the overall economic development of a country. Banks as service industry also contribute to economic growth not in terms of goods production,

but by providing financial wheel in facilitating production in other industries. Thus, an efficient banking sector will be a catalyst in promoting economic growth (Northcott, 2004).

There are many studies that have measured the efficiency of banks in general the World over. However, there are limited studies in determining and measuring the efficiency of Savings and Loans Companies in the existing literature and only few in the financial system of Ghana.

Almost all studies on bank efficiency have focused on the commercial (universal) banks. Very limited literature use Savings and Loans Companies (micro finance) as research area. One of the studies is by Desrochers and Lamberte (2003). The study found that agency costs significantly reduce the cost-efficiency of cooperative rural bank (CRB). Manager's compensation significantly improves cost efficiency and it is according to the theory of asymmetric information or expense preference theory.

2.2.1 Determinants of Efficiency

The efficiency of any firm may be influenced by some unique factors based on the type and the operating environment of the firm. As Lovell (1993) indicated, "the identification of the factors that explain differences in efficiency is essential for improving the results of firms although, unfortunately, economic theory does not supply a theoretical model of the determinants of efficiency".

A DMU is to be rated as fully (100%) efficient on the basic of available evidence if and only if the performances of other DMUs does not show that some of its inputs or outputs can be

improved without worsening some of its other inputs or outputs (Cooper, Seiford, and Zhu , 2004). This means that efficiency relates to full usage of available resource without any waste to achieve the best result. In other words if the available scarce resource could be used to produce more than what is currently being produced then there is some sort of inefficiency in the performance of the Decision Making Unit (DMU).

Two other papers have investigated general efficiency in Savings and Loans. Cebenoyan et al. (1992) used the stochastic cost frontier approach to study S&Ls operating in the Federal Home Loan Bank (FHLB) District in US in 1998 and concluded that mutual S&Ls were less efficient than stock S&Ls. However, they assumed mutual and stock S&Ls were operating with the same production function (and hence the same cost frontier) and with the same error distribution. Again, Mester (1992) studied the efficiency in the Savings and Loans industry in US, and concluded through various measures of inefficiency that on average, stock S&Ls are less efficient than mutual S&Ls

Hughes and Mester (2008) have also observed that banks' ability to perform efficiently – to obtain accurate information concerning its customers' financial prospects and to write effective contracts and to enforce them–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 factors across political jurisdictions can lead to differences in the efficiency of banks across different countries. This means that

efficiency of bank cannot be determine in isolation, but both endogenous and exogenous factors are very crucial in bank efficiency analysis.

2.2.1.1. Environmental Factor

The efficiency of financial institutions is determined by both internal and the external environment. The internal environment relates to the financial institutions' own internal arrangement such as asset size, staff competency, number of branches, interest rate and technology. On the other hand, the external environment includes macroeconomic indicators, protection laws or property rights, legal environment, regulation, government, market and supervisory policies, recent evidence by Valverde et al. (2007) has shown that correcting bank's external business environment and productivity indicators at industry level significantly reduces inefficiencies fivefold. Thus, based on this new research, inefficiencies from scale operations and X-inefficiencies are ranked equally. Evidently, one would think of industry productivity growth as emanating from firm level scale expansion and therefore, this would translate into lower than expected inefficiencies for individual banks.

2.2.1.2. Government Policy Factor

Government policy literature confirms that deregulation of the financial sector can either improve or worsen efficiency depending upon industry conditions prior to deregulation (Berger and Humphrey, 1997). A study by Olugbenga and Olankunle (1998) in the Nigerian banking performance in relation to deregulation policy, found that banking industry efficiency declined significantly during the years following the adoption of deregulation, with slight improvements noticed only in recent times. The study concluded that Policy Makers, Economists, and Monetary Authorities recognised that the ability of banks to achieve the desired results and to continue to

play the role earmarked for them depends not only on the existence of an enabling environment and the number of operating banks but more importantly on their performance from one financial year to the other. Denizer, Dinc and Tarimcilar (2000) also acknowledged in their study that the impact of deregulation may differ across countries and may also depend on sectoral conditions prior to deregulation. They also observed that the existing literature on deregulation and efficiency studies had all investigated the impact of efficiency after or during the deregulation period without considering the period before deregulation program- a major missing link which may have altered the real impact of such program. Harker and Zenios (as cited in Denizer et al, 2000), extending the evaluation to before and after deregulation program could help improve significantly the actual impact of such program, but this is yet to be demonstrated. They concluded that deregulation program is a continuous process with multiple phases.

Indeed, several studies conducted in industrial countries have revealed unequivocal evidence that deregulation fosters banking efficiency (Sturma & Williams, 2004; Kaparakis, Miller, & Noulas, 1994; Mester, 1997; Mester, 1993; Berger & Mester, 1997; Berger, Hunter, & Timme, 1993). However, other scholars have also found that globalisation of financial markets manifested in increased foreign bank penetration has tended to dwarf banking efficiency although this result must be interpreted in conjunction with the quality of institutions in host countries (Lensink, Meesters, & Naaborg, 2008). Generally, results of banking efficiency during liberalisation period for less developed countries (LDCs) have produced mixed results for a number of countries (Chen, Skully, & Kym, 2005). This thinking supports Berger and Humphrey (1997) argument that deregulation might not always improve efficiency and productivity due to other intervening incentives especially in the early years of reform. Again, two studies by Mester (as cited by

Hughes and Mester, 2008) investigate differences in scale and scope measures for stock-owned and mutual savings and loans by estimating average cost functions. She found evidence of agency problems at mutual S&Ls, as evidenced by diseconomies of scope, prior to the industry's deregulation, and evidence that these agency costs were lessened after the deregulation in the mid-1980s. Thus, deregulation of the financial sector initially improves efficiency level but diminishes as time goes on.

Again, a study conducted in Indian found that 1 percent increase in the number of rural locations banked per capita reduced rural poverty by 0.42 percent and increased total output by 0.34 percent (Burgess and Pande, 2003). From another perspective, such move will have a repercussion effect on employment in general. This has resulted in government compelling banks to open branch network in rural areas than concentrating on the urban centers.

2.2.1.3. Mergers and Acquisition Factor

Mergers and acquisition has also produced mix results with regard to their impact on the efficiency of financial institutions (Berger and Humphrey, 1997). The study found out that on average, mergers have not improved the cost efficiency of the merging institutions. However, merging among high efficient banks will be more successful and can achieve cost efficiency. In a study conducted by Kaur and Kaur (2010) to find out the impact of mergers on cost efficiency of Indian commercial banks, concluded that by and large mergers led to higher level of cost efficiencies for the merging banks. However, technical efficiency has been more pronounced in the efficiency gains from mergers than allocative efficiency. Again, mergers between distressed and strong banks did not yield any significant efficiency gains to participating banks. Franz and

Khan (as cited in Kaur and Kaur, 2010) have observed that mergers of two weaker banks or merger of one healthy bank and with one weaker bank can be treated as the faster and less costly way to improve profitability than spurring internal growth.

2.2.1.4. The Size of the DMU

Wall (1985) examined small and medium sized banks from the early 1970s until deregulation occurred in the early 1980s. He found that profitable banks had lower interest and non interest expenses than less profitable banks. In addition, the more profitable banks had lower cost of funds, greater use of transactions deposits, more marketable securities and higher capital levels.

Bossone and Lee (2004) used the Hughes and Mester (1998) and Hughes, Mester, and Moon (2001) methodologies to study the relationship between productive efficiency and the size of a financial system. Using data on 875 commercial banks from 75 countries, they estimated a cost function and measured scale economies allowing for banks' endogenous choice of risk and financial capital. Consistent with the results from Hughes and Mester (1998) and Hughes, Mester, and Moon (2001), they found significant scale economies that are increasing with the size of the financial system. They also revealed that small banks in larger financial systems are more cost efficient than those in smaller financial systems. They interpret their findings as evidence of what they describe as "systemic scale economies".

Evaluation of efficiency of financial service institutions has also been linked to economies of scale. Thus economies of scale have some positive relationship with efficiency of financial institution. Hughes, Mester, and Moon (2001) applied a model of managerial utility to data on

US bank holding companies to consider how incorporating capital structure and endogenous risk taking into the production model affects the ability of the empirical investigator to detect scale economies. For example, better diversification may lead to a lower cost of risk and an incentive to increase risk-taking for greater profitability. The increased risk-taking may be costly. If larger banks are better diversified and more risky than smaller banks, this source of scale economies may be hard to detect without accounting for endogenous risk-taking: the increase in cost due to the increased risk-taking can lead to the conclusion that there are no economies of scale. The authors provided evidence that better diversification is associated with larger scale economies, and increased risk-taking and inefficiency are related to smaller scale economies.

Zimmerman (1996) examined community bank performance in California during the early 1990's, a period of slow recovery for these institutions. Excessive reliance on real estate lending caused deterioration in asset quality which reduced overall profitability. Lack of geographic diversification further compounded community bank performance.

Critchfield et al. (2005) in a study of past, present and future community bank performance conducted for the FDIC concluded that community banks continue to be of importance because 1) they still constitute over 90% of all banks, 2) they are economically important to medium scale businesses and agricultural lending and 3) they represent a disproportionately large percentage of FDIC failure costs.

2.2.1.5 Institutional Factor

Nevertheless, institutional structure or ownership structure of financial institutional is equally an important determinant of efficiency. Mester (1997), in a study found that stock savings and loans perform more efficiently than mutual savings and loans. Fuentes and Vergara (2003) in a study conducted on Chile found evidence that banks that are established as open corporations tend to show higher level of efficiency compared to branches of international banks. Again, banks with higher concentration of ownership show higher levels of cost and profit efficiency. Meaning that, ownership concentration is used to mitigate principal agent problem. Another study in the microfinance industry found that Non-governmental microfinance institutions, particularly under the production approach, are the most efficient and this result is consistent with their fulfillment of dual objectives of alleviating poverty and achieving financial sustainability (Haq, Skully and Pathan, 2006). Vaithilingam, Nair and Samudram (2006), in identifying key drivers for the soundness of the banking sector, found six key issues; Infrastructure, Intellectual, Institutions, Integrity, Interaction, and Innovation (which together are referred to as 6Is). The analysis showed that well developed institutions, good integrity system and high innovative capability contribute positively to the soundness of the banking sector. Das (2010) study also found that the public sector banks are more cost efficient than private and foreign banks. Aydin, Yalama and Sayim (2009) study in Turkey also confirmed that the most efficient banks were the state owned, followed by foreign owned, development investment and private owned respectively. Subsequent investigation in this area by Usman et al. (2010) in Pakistan also revealed that foreign owned banks were most efficient, followed by state owned banks and domestic private banks were found to be the least efficient. What can be observed about these literatures therefore is that the efficiency of foreign banks is much determined by the economy in which they operate. When a

foreign bank operates in a less or under developed economy, its efficiency level is very high than a foreign bank operating in an advanced economy. Thus what the literature has not been able to recognize is the kind of economy that a foreign bank found itself within.

2.2.1.6 Profit or Quality of Asset Factor

The profit of business entity has a relation with respect to the efficient level upon which the firm is operating. Thus when a financial institution is operating efficiently, it is expected that the profit level will also be high. Bashir (2000) examined the determinants of Islamic bank's performance across eight Middle Eastern countries from 1993-1998. A number of internal and external factors were used to predict profitability and efficiencies. Controlling for macroeconomic environment, financial market situation and taxation, the results showed that higher leverage and large loans to asset ratios lead to higher profitability. Jayamaha and Mula (2011) in a study found that several financial practices (capital adequacy, liquidity, asset quality, loan to deposit structure, profitability, loan portfolio yield, operational efficiency, and operational self-sufficiency) have significant association with the efficiency of community rural banks (CRBs) in Sri Lanka. Thus efficient CRBs maintain good financial practices, which contribute to the higher level of efficiency. There is also evidence that taxation impacts negatively on bank profitability.

2.2.1.7 Macroeconomic Factor

Macroeconomic environment is another major factor that impacts the efficiency of financial institutions. Monetary policy may directly or indirectly affect the output of commercial banks. Thus, macroeconomic conditions do affect efficiency, but larger banks are less affected by those

macroeconomic factors because of the diversification of their portfolios (Chen, 2001). A study in Ghana also indicates that the persistent domestic financing needs of the government have fostered inefficiency in the banking system as holdings of government securities have become the driving force in the revenue function for banks (Buchs and Mathisen, 2005). Notodihardjo (2009) in assessing the cost efficiency level of rural banks in East Java observed that dramatic change in macroeconomic condition and higher competition in 2007 increased rural banks cost of operation. Macroeconomic instability is therefore a major contributing factor to inefficiencies in the financial system of an economy.

2.2.1.8 The Legal and Judicial Factor

Strengthening the legal and judicial environment in which banks operate would also allow the banks to better play their role of financial intermediation in an economy. Thus, banks will have more confidence in the local economy and therefore be willing to give out loans (Kablan, 2007). In developing and under developed countries, the lack of trust by financial institutions with regard to the legal environment also impacts negatively on their efficiency. Since the risk of default is very high, the issue of non-performing loans (NPLs) has been the bane of these financial institutions in fulfilling their objectives.

2.2.2 Efficiency Measurement

2.2.2.1 Definition of Input and Output Variables

Abiding (2007), using DEA investigated the level of efficiency among commercial banks in Indonesia. The inputs for modeling were deposits, interest, and other expenses. For outputs were loans, interest income and other incomes. Hughes and Mester (1993) empirically tested whether

deposit is output or input. In this study, when the relationship between variable cost and deposit is negative, then deposit is an "input". But when the relationship between these two variables is positive, then deposit is considered an "output".

The production approach considers loans and deposits as output but has the deficiency of considering only operating costs whilst excluding the interest expenses. It is not used more often because of non-availability of data on number of accounts and transaction. The intermediation approach on the other hand, measures output in monetary terms and total costs include all operating and interest expenses thereby providing a thorough picture of the economic viability of the bank. Hence, the preferred approach in the literature (Kaur and Kaur, 2010).

2.3 Institutional Framework

According to the Monetary and Financial Statistics Manual (2000), the banking sector consists of all resident corporations mainly engaged in financial intermediation in any given economy. These corporations consist of the central bank which is the national financial institution that exercises control over key aspects of the financial system and other depository corporations (such as commercial banks, merchant banks, savings banks, credit unions, credit cooperatives, insurance firms, rural and agricultural banks), which are principally engaged in the allocation of savings to investment opportunities (financial intermediation) in the interest of making profits. In Ghana, the banking sector is generally sub-divided into banking and non-banking financial institutions (BoG, 2011). The Savings and Loans Companies (S&Ls) are deposit-taking financial institutions regulated by the Bank of Ghana under the Non- Bank

Financial Institution (NBFI) Law 1993 (PNDCL 328), with a minimum capital requirement much lower than that of the universal banks but above that of rural and community banks.

The advent of the NBFI Law gave rise to a rapid growth and transformation of some Financial Non-Governmental Organisations (FNGOs) into Savings and Loans Companies operating in urban and peri-urban areas in the country. This transition was preceded by the financial sector reforms implemented in the late 1980s as part of the then ongoing Economic Recovery Programme (ERP). They began with the partial liberalisation of interest rates in 1987 and removal of sectoral credit ceilings in the following year. This was accompanied by liberalisation of access to foreign exchange and the licensing of foreign exchange bureaux. In 1989 the Financial Sector Adjustment Programme (FINSAP) had begun, supported by a Financial Sector Adjustment Credit (FSAC) from the World Bank.

The objectives of the FINSAP, inter alia, were to address the institutional deficiencies of the financial system in particular, by restructuring distressed banks, reforming prudential legislation and the supervisory system, permitting new entry into financial markets by public and private sector financial institutions (FIs), and developing money and capital markets.

The subsequent restructuring in 1994 saw a second phase of the FINSAP implementation. The major objectives of this phase are the privatisation of public sector banks and development of non-bank financial institutions (NBFIs) to fill the gaps in the financial market not served by the banks. This was necessary in the sense that majority of the populace constituting the informal sector were seen as non-bankable. These developments have indeed brought a number of new institutions into the industry and thus making the financial system more competitive than before.

This reform has ensured tremendous increase in the number of operating institutions in the Savings and Loans industry from one in 1993 to 19 as of March 2011(Bank of Ghana, 2011).

A new regulatory regime for non-bank financial institutions was put in place in 2008 under the Non-Bank Financial Institutions Act, 2008 (Act 774). In this act, Savings and Loans Companies were to be migrated to the regime under the banking act. The Act also provided for minimum prudential requirements (including capital, liquidity, and single party exposure limits for loans and advances, and related-party transactions), accounting and audit requirements, ownership and directorships of NBFIs. For example, a minimum of five directors are required for a non-bank financial institution, and each director is required to be capable of demonstrating an understanding of the financial institution's financial standing and reporting requirements.

Furthermore, to ensure effective and prudent risk management within the financial institutions, the Bank of Ghana has introduced its framework for Risk-Based Supervision to meet the new challenges in the banking industry with respect to new technologies, branch expansion, product innovation, size and speed of financial transactions, and as a precursor to the full implementation of the Basel II accord. This framework involves the critical identification of risks associated with the operations of banks, and the assessment of management oversight functions of risk in order to ascertain the effectiveness of these oversight functions to mitigate the impact of risks. In the process, banks would be compelled to focus more on their risk management systems to facilitate their improvement and thereby improve the overall risk management functions within the institutions.

Again, following the passage of the Non-Bank Financial Institution (NBFI) Act 2008, Act 774, according to the Bank of Ghana (BoG), Savings and Loans Companies would transact business by accepting deposits and any other repayable funds from the public through lending, financial leasing and money transfer services. The rest are credit reference services, safe custody of valuables, electronic banking activity and any other services that the Central Bank may determine. This is in accordance with section 11(2) of the Banking Act, 2004, Act 673 as amended. Importantly, the Savings and Loans Companies were also cautioned not to use the word "bank" as part of their registered names since they were not banks. The regulator of the banking industry also directed the companies to maintain a minimum capital adequacy ratio of 10 percent and a ratio of 8 percent for liquid assets as prescribed by the Bank of Ghana.

The minimum requirement of the various financial institutions has been reviewed by the bank of Ghana in accordance with its role as the head and supervisor of the entire financial system of the economy. Under the review which takes effect from December 31, 2011, all Savings and Loans Companies would be required to shore up their capital to GH¢4.0 million. The companies would also be required to increase their capital to GH¢7.0 million by the end of 2012 as the new minimum capital requirement for all financial intermediaries in the country. New firms are however mandated to raise their minimum capital to GH¢7.0 million.

2.3.1 A Brief History of Savings and Loans Industry in Ghana

The research area covers the entire Savings and Loans industry of Ghana. The study uses the March 2011 estimate of 19 registered S&Ls Companies (Bank of Ghana, 2011). These companies most of which started operations in the 2000s have limited their activities to the southern sector of Ghana, specifically Ashanti and Greater Accra Regions with isolated branches in the other regions. In 1993, a law was established to pave way for the operation of Savings and

Loans industry under the non-banking financial institutions. Thus, Savings and Loans Companies as financial institutions are regulated by the Bank of Ghana under the law establishing them, the Non-Bank Financial Institution (NBFI) Law 1993 (PNDCL 328). Savings and Loans are deposit taking financial institutions which are subsequently prevented from adding 'bank' to their registered names. The First Allied Savings and Loans Company is the oldest existing S&L Company in Ghana starting operation in 1995. A very unfortunate feature of the Savings and Loans industry is the rejection of the three Northern and the Volta regions of Ghana by concentrating much on the south. Out of the total number of 19 S&Ls in Ghana as at March 2011 (Bank of Ghana), only First National has a branch in Tamale, the capital of Northern region.

This study used five S&Ls Companies (DMUs) out of the existing 19 registered as at March 2011. The sample size was influenced largely by the availability and the willingness of the S&Ls Companies (DMUs) to give out data (annual financial statements) concerning their operations. Hence, the five companies (5 DMUs) involved in this study are First Allied, First Capital Plus, Opportunity International, ProCredit, and Advans Groups of Companies Ghana. Therefore there is no statistical reason behind the sample size.

2.3.1.1 First Allied Savings and Loans Company Limited

First Allied is currently the longest serving Savings and Loans Company in Ghana which officially started operation on September 25, 1995 in Kumasi, the capital of Ashanti Region. It was, however, registered in accordance with the Ghana companies' code 1963 (act 197) as a private limited liability company on May 25, 1995 and later incorporated as a Non-Banking Financial Institution to operate as Savings and Loans Company.

As a micro finance institution, First Allied Savings and Loans Company have the vision of creating an excellent institution and to be the leader in the provision of quality financial services to the micro and small enterprise sector in Ghana.

The company now operates in four regions in Ghana –Ashanti, Brong Ahafo, Eastern and Greater Accra with its head office located in Kumasi. At the end of December 2007, it has approximately 14 branches across these four regions through which savings are mobilized from the retail public in aid of providing credits to its target group. In the same year under review, the company had a total asset of GH₵ 32,817,013.

2.3.1.2 ProCredit Savings and Loans Company Limited

ProCredit Ghana is a proud member of ProCredit Group of 22 financial institutions operating in transitional economies in Eastern Europe, Latin America and Africa with its main objective of providing adapted financial services to very small, small and medium sized enterprises. Over 80 percent of its funds come from Germany while the remaining 20 percent come from the Netherlands.

Formally Sikaman Savings and Loans Company, ProCredit Savings and Loans Company limited is a non-banking financial institution which started operation in June 2002 after it has received a certification from the Bank of Ghana to legally start business. It indeed, was registered as a company limited by shares.

By the end of December 2010 financial year, ProCredit Ghana had an estimated total asset of GH₵ 69,893,702 with 26 branches across five regions (Ashanti, Greater Accra, Brong Ahafo, Central, and Western regions) that it operates from. The head office is located in Accra and thus coordinates the activities of the other branches. The institution has the prime objective of

focusing on agribusinesses and SMEs and thus supports its philosophy of ''better banking for everyone''

2.3.1.3 Opportunity International Savings and Loans

Opportunity International is one of the leading Savings and Loans Company in Ghana which received a license from Bank of Ghana in June 2004 and subsequently started operations in September 2004. As a member of the Opportunity International network, which is a global coalition of organizations dedicated to the provision of opportunities to people in less developed countries, has a network of forty-seven branches around the world. Its products and services are built on the values of respect, commitment, integrity and the stewardship of the poor.

Opportunity International has 17 networked branches across six regions of Ghana namely Ashanti, Greater Accra, Eastern, Central, Western, and the Eastern regions. The company runs on the mission of seeing the lives of micro and small entrepreneurs transformed through a partnership in which they provide customer-focused financial and transformational services. The current total asset as at 2010 stood at GH₵36,120,570.

2.3.1.4 Advans Ghana Savings and Loans Company Limited

Advans Ghana is also a member of the Advans Group which seeks to provide adapted financial services primarily to micro, small and medium sized enterprises (MSMEs) in Ghana, which have limited or no access to the formal banking services.

Advans Ghana is just about three years in the S&Ls industry and it started operations in October 2008 with a license from the Bank of Ghana. It now has eight branches across the country with its head office located in Accra. Advans has an asset stock of GH₵ 8,170,444 in 2010 from GH₵3,705,524 in 2009.

2.3.1.5 First Capital Plus Savings and Loans

Initially operating as a Financial Non-Governmental Organisation (FNGO) focusing on micro finance, First Capital Plus started operation as a Savings and Loans Company in October 29, 2009. Registered under the Non-Banking Financial Institutions (NBFIs) Law 1993, PNDCL 328 is a wholly-owned Ghanaian Saving and Loans Company.

It now has 10 networked branches operating in four regions in Ghana namely Ashanti, Greater Accra, Central and the Western region, with its head office located at Amenfi Plaza on the Spintex road, Accra. The total asset of First Capital Plus stood at GH₵ 47,177,977 at the end of 2010 financial year.

2.3.2 Benchmark for Measuring Efficiency of Financial Institution

There is no unique requirement both local and international for assessing or benchmarking the efficiency of Savings and Loans Companies. However, since in general, these institutions constitute the financial hub of all economies, they are invariably constrained by all international standards for improving or promoting transparent and efficient capital market.

In 1998, the then finance ministers from the G7 economies were asked to start consultation and prepare recommendation aimed at establishing minimum requirement or benchmark with the prime objective of ensuring stability and efficiency in the international financial system. By February 1999, the head of the group entrusted with this assignment Mr. Hans Tietmeyer, the then president of Deutsche Bundesbank, submitted 12 key international standards as a benchmark for efficient financial institution. These 12 key international standards have been endorsed by European Bank for Reconstruction and Development (EBRD) as the benchmark for sound financial system / institution and include the following:

1. Code of Good Practices on Transparency in Monetary and Financial Policies
2. Code of Good Practices in Fiscal Transparency
3. Special Data Dissemination Standards / General Data Dissemination System
4. Principles and Guidelines for Effective Insolvency and Creditor Rights Systems.
5. Principles of Corporate Governance
6. International Accounting Standards
7. International Standards on Auditing
8. Core Principles for Systematically Important Payment Systems and Recommendations for Securities Settlement Systems.
9. The Forty Recommendations of the Financial Task Force and Nine Special Recommendations on Terrorist Financing
10. Core Principles for Effective Banking Supervision
11. Objectives and Principles of Securities Regulation
12. Insurance Core Principles

The aforementioned 12 key international standards are the minimum requirement for all financial institutions to follow in order to ensure sound financial practices. Some of these standards are also endorsed and recognized by the International Monetary Fund (IMF) and Organization for Economic Corporation and Development (OECD). However, as to whether individual countries follow strictly these EBRD endorsed standards is questionable as countries have their own set standards for evaluating financial soundness or efficiency.

In Ghana, the standards for determining the efficiency of the banking institutions are centered on financial ratios basically which is a direct deviation from the EBRD standards. Thus, in Ghana

efficiency benchmark of the banking institutions is base on five operational efficiency indicators which include;

1. Cost to Income
2. Operational Cost to Gross Income
3. Cost to Total Assets
4. Operational Cost to Total Assets
5. Personnel Expenses to Non-Interest Expenses

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

In this chapter, focus is on method of data collection and the study design. The chapter comprises of six sections with the first giving brief history of the development of Savings and Loans industry in Ghana, while the second section describes data type and source. The third section presents the definition of input and output variables whilst section four contains the model specification for the study. In section five, emphasis is on the discussion of expected signs of the variables in the model and finally the design which has to do with method of analysing data is contained in section six.

3.1 Data Type and Source

This study used purely secondary data from published annual reports and financial statements of Savings and Loans Companies retrieved from the Banking Supervisory Department (BSD) of Bank of Ghana (BoG). A secondary data is being used in this study first because of the adoption of the Data Envelopment Analysis (henceforth DEA) methodology which focuses mainly on financial statements for measuring efficiency of financial institutions. Secondly, primary data is unavailable and besides, Savings and Loans Companies are not willing to give out firsthand information to the researcher. Even though secondary data usage in research is often questionable with respect to its validity or authenticity, in this instance of DEA it is the ideal method since financial statements cannot be retrieved in a primary form. One major advantage of secondary data, however, it is time saving and less expensive.

3.2 Definition of Input and Output Variables

The issue of input and output variable definition of a financial institution in the literature has been very conflicting and thus there is no single economic theory that explicitly defines and measures what constitutes a financial institutions' input or output, (Berger and Humphrey, 1997). However there are two main approaches that aid in the definition of inputs and outputs of a financial institution which depend on a given set of financial concept and these are the production and intermediation approaches.

The production approach sees a financial institution as the producers of financial services such as the provision of loans and financial advice including the writing of business plans and serving as custodians of valuable assets (Paxton, 2003).

Casu and Molyneux (1998) look at the intermediation approach of a financial institution as a mediator that channels funds from the "have" to the "needy". In other words, this approach sees financial institution as changing savings into loans (that is from supply to demand).

Casu and Molyneus (1998) again observed the underlying difference between the two approaches as the inclusion of interest expenses by the latter whilst the former looks down on the interest expenses. Again, the production approach considers deposit as output but the intermediation approach sees deposits as input. Therefore the superior advantage that the intermediation approach has over the production approach is the inclusion of the interest expenses (Paxton, 2003).

The determination or specification of input and output variable within financial institutions is another controversial issue in efficiency measurement of financial institution of an economy. Thus, there have been varying views with regards to what constitutes input and output in a

financial set up but there is always the need to specify the output and input of a financial institution before efficiency can be measured. Paxton (2003) concluded that there is no consensus within the banking literature with respect to the specification of inputs and outputs. There exist however two main approaches commonly delineated; intermediation approach and production approach. The "intermediation approach" looks at a bank as an intermediary between savers and borrowers. In this view, the bank's inputs are made up of deposits, capital, and labor, and the outputs include loans and investments. Thus, the intermediation approach focuses on the bank's production of intermediation services and the total cost of production, including interest and operating expenses. Hueghes and Mester (2008) identified that usually outputs are typically measured by the dollar volume of the bank's assets in various categories. Inputs are typically specified as labor, physical capital, deposits and other borrowed funds, and in some studies, equity capital. While the intermediation approach treats deposits as inputs, there exist some discussions in the literature about whether deposits should be treated as an output since banks provide transactions services for depositors.

The evaluation of financial institution efficiency has been approached from various angles. Parametric programming approaches have generally been concerned with the production or cost function base. A host of studies have focused on estimating characteristics of the cost function and measuring economies of scale and scope by assuming that all banks were operating efficiently. These studies include Bell and Murphy (1967), Longbrake and Johnson (1975), and Kolari and Zardkoohi (1987), Banker and Maindiratla (1988) who argued that the estimated cost function represented the average behaviours of banks in the sample, and the regression procedure could be changed to direct the estimates toward the frontier. During 1992–1997, efficient cost

frontier approach was used in 116 out of 130 studies relating to financial institution frontier efficiency across 21 countries (Berger and Humphrey, 1997).

There is also a method that uses the bank efficiency frontier to construct measure of overall, technical, and scale efficiency. It uses a non-parametric programming approach and investigates inefficiencies among the sampled banks. This approach estimates how much total productivity in the banking sector can be improved and ranks the efficiency scores of individual banks. Notable among these studies using this particular method include; Berg et al. (1991) for Norwegian banks, Grifell-Tatje and Lovell (1996) for Spanish banks, Lang and Welzel (1996) for German banks, Leightner and Lovell (1998) for Thai banks, Gilbert and Wilson (1998) for Korean banks, Altunbus et al. (1999) and Drake and Hall (2000) for Japanese banks, and Sathye (2001) for Australian banks.

Hermalin and Wallace (1992) used the non-parametric tests of Varian (1984) to study the efficiency of S&Ls. This methodology avoids the maintained hypotheses of the parametric test implicit in the stochastic frontier approach and the non-frontier cost function approach. But it cannot be used to measure the magnitude of a firm's inefficiency. In the non-parametric approach, an S&L is considered to be inefficient if it could have produced more output at lower cost using at least one other S&L's input mix. This is a severe test, given that data are always measured with error and it takes just one firm reportedly doing better to condemn another firm as inefficient. Thus the authors also defined other measures of inefficiency which classify firms as inefficient if the firm could have produced more output using several of the S&Ls' input mixes. Chen (2001) also supported the argument that time plays a vital role in bank efficiency. As the

business environment varies from region to region, this indicates that local economic factors affect the performance of local banks significantly. Although large banks in the future are likely to dominate rural areas, recent changes in banking regulation are to the advantage of small banks in reducing their regulatory burden. They are now allowed to expand into new businesses. Gilbert (1997) also showed evidence that competition from new entrants of large banks would also compel small banks in the rural areas to operate more efficiently.

The approach or methodology used in analyzing efficiency in the financial or the banking sector varies from parametric approach which includes Stochastic Frontier Analysis (SFA), Distribution Free Approach (DFA), and Thick Frontier Approach (TFA) to the non-parametric approach which is the Data Envelopment Analysis (DEA). The SFA and the DEA are the only two methods which have been used extensively. However, the efficacy of these methodologies varies among Economists and Researchers in general.

The DEA approach has been used since "recent research has suggested that the kind of mathematical programming procedure used by DEA for efficient frontier estimation is comparatively robust" (Seiford and Thrall, 1990). Furthermore, after Charnes, Cooper and Rhodes (1978) who coined the term DEA, a 'large number of papers have extended and applied the DEA methodology' (Coelli, 1996). A lot of literature reviewed in this work used the non-parametric approach of DEA, perhaps because of its robustness and flexibility as opposed to the rigid functional specification of the parametric approaches such as the SFA.

The production approach considers loans and deposits as output but has the deficiency of considering only operating costs whilst excluding the interest expenses. It is not used more often

because of non-availability of data on number of accounts and transaction. The intermediation approach on the other hand, measures output in monetary terms and total costs include all operating and interest expenses thereby providing a thorough picture of the economic viability of the bank. Hence, the preferred approach in the literature (Kaur and Kaur, 2010).

Mohindra and Kaur (2011) have done extensive work in efficiency analysis in financial institutions focusing on regional rural banks. In their work, they considered loanable funds (sum of deposits and borrowing), fixed deposits and labour as constituting inputs (Xs). Whereas advances (such as bill purchase and discounted, cash credits etc.) and spread (net interest income) made up the output (Ys). Wosniewska (2008) in measuring the efficiency of Polish banks also considered two items (assets and number of employees) as constituting inputs and three items (loans, deposits and non-interest income) as also constituting outputs. Another variation in the specification of the input and the output function is the case of Khankhoje and Sathye (2008). On their part, input consists of interest expenses and non-interest expenses whilst output is made up of net interest income and non-interest income. Bank's input consist of total own resources, total personnel expenses, and interest and fees paid by the banks and its output is made up of total deposits and incomes from charges and commissions collected (Denizer, Dinc, and Tarimcilar, 2000). Therefore there is absolutely no definite approach to the specification of input and output function in the efficiency measurement of financial institutions literature. Favero and Papi (as cited in Notodihardjo, 2009) observed that there is no simple solution to the problem of output and input specification as reasonable arguments can be made for all approaches. The core of the problem relating to the input and output specification has to do with

deposit, that is, whether or not deposit is input. Berger and Humphrey (1997) however believe that when deposit is treated as output, efficiency is higher than when treated as input.

In this study, the intermediation approach is use since Savings and Loans Companies according to the (Non-Banking) law, 1993 (PNDCL. 328) that establishes them are deposit-taking and lenders to individuals, groups, business enterprises, consumer credit and hire-purchase financing. That is, Savings and Loans Companies take deposits and lend it out in the form of loans to prospective borrowers. Thus, Savings and Loans Companies, based on how they are defined by the Bank of Ghana (BoG) are financial institutions as put up by Casu and Molyneus (1998) that act as mediators between the supply and demand of funds.

Therefore in this study the researcher adopts two inputs and two outputs approach for technical efficiency measurement whilst one input and two output approaches is also adopted in measuring scale efficiency. Khankhoje (2008) found that the choice of variables to represent input and output variables in the intermediation approach in part depends hugely on the availability of data. Thus, the strength of this method aids in unraveling the input-output variables which need to be monitored closely by a DMU to ensure efficiency.

In the case of technical efficiency measurement, the inputs are total deposits (X1) and total expenses (X2). The details of the defined inputs will comprise the following:

X1 - Demand deposit, savings deposit, borrowing from the central bank or any other institutions (Mohindra and Kaur, 2011).

X2 - Operating expenses including fixed assets (such as premises and other administrative expenses) and labour (wages, allowances and the general welfare of workers), and interest expenses (on savings, time deposits and liabilities to borrowers).

The output variables are spread (Y1) and loans and advances (Y2). The details of the defined outputs will comprise of the following:

Y1 - Constitutes net interest income which is the difference between total interest expenses (savings, time deposits and liabilities to borrowers) and total interest income (cash and short term funds, financial instruments, loans and advances, disbursement and processing fees).

Y2 - Cash credits and general loans.

The input for the scale efficiency measurement is the total asset of the DMU whilst the net interest income (Y1) and cash credits and loans (Y2) are still maintained as the two outputs.

3.3 Model Specification

The model used in this study to measure efficiency (both technical and scale) of the Savings and Loans Companies in Ghana is the Constant Return to Scale Data Envelopment Analysis (CRS-DEA) of Charnes, Cooper and Rhodes (1978) whilst Tobit regression model is also use to determine the factors affecting technical and scale efficiency of these financial institutions by regressing the computed efficiency scores on some explanatory variables.

DEA dates back to 1978 when Charnes, Cooper and Rhodes (CCR) introduced this technique in analyzing the efficiency of non-profit organizations. The technique has since been used in measuring the efficiency of Decision Making Units (DMUs) with it being first applied in banking in 1985 by Sherman and Gold. DEA actually measures the efficiency score of each

DMU amorg a given sample without necessary constructing a functional model to measure each DMU in a given sample as it is often seen in the Stochastic Frontier Analysis (SFA). Thus, DEA is a multi-factor linear programming for measuring the efficiency of homogeneous set of DMU (Talluri, 2000). It then compares each DMU efficiency score and identifies the DMU with the best practice. In this study the researcher implored the constant return to scale (CRS) DEA model which assumes that all DMUs under consideration are operating optimally. The efficiency score for DEA lies between zero and hundred (0-100) with the most efficient DMU always attaining the maximum limit of hundred (100). The efficiency (i.e. technical and scale) score based on Charne et al. (1978) DEA model is defined as;

$$efficiency = \frac{weighted\ sum\ of\ outputs}{weighted\ sum\ of\ inputs}$$

As proposed by Charne et al. (1978) for given sets of n DMUs with j outputs and m inputs, the efficiency score of a given DMU will be

$$\max e^0 = \frac{\sum_{j=1}^{J} u_j^0\, y_j^0}{\sum_{m=1}^{M} v_m^0 x_m^0}$$

S.t.

$$\frac{\sum_{j=1}^{J} u_j^0\, y_j^n}{\sum_{m=1}^{M} v_m^0 x_m^n} \leq 1$$

$$u_j,\ v_m \geq 0$$

Where:

u_j = weight given to output j

v_m = weight given to input m

y = output

x = input

j = 1…J

m = 1…M

n = 1…N

e^0 = efficiency score of DMU_0

Therefore by solving the equation above, the values of v_j and u_m can be determined and as indicated above both v_j , u_m and y_j , x_m are positive. Again, e^0 which represents the efficiency score (either technical or scale) of DMU_0 is less than or equal to one ($e^0 \leq 100$). A DMU is thus technical or scale efficient when e = 100 and inefficient when e < 100. This according to the extended Pareto-Koopmans definition, efficiency is attained whereby any DMU if and only if none of its inputs or outputs can be improved without worsening some of its other inputs or outputs. Hence the deviation of a DMU from the most efficient point represents the X-inefficiency of that DMU (Paxton, 2003). Since the above non-linear equation is complex, Charne et al. (1978) reduced it to a linear form to make it more liberal to solve in the form of the equation below (Talluri, 2000);

$$\max \sum_{j=1}^{j} u_j^0 y_j^0$$

s.t.

$$\sum_{m=1}^{M} v_m^o x_m^0 = 1$$

$$\sum_{j=1}^{J} u_j^0 y_j^n - \sum_{m=1}^{M} v_m^0 x_m^n \leq 0$$

$$u_j, v_m \geq 0$$

The dual problem for this linear program is therefore;

$$\text{Min } \theta$$

s.t.

$$\sum_{i=1}^{n} \lambda_i X_i = \theta X_0$$

$$\sum_{i=1}^{n} \lambda_i Y_i = Y_0$$

$$\lambda_i \geq 0$$

The Xs and Ys are again inputs and outputs of the DMUs. Where θ represents efficiency score of a given DMU and thus does not exceed 100, but λ_i is the assigned weight to DMU_i. Therefore θ *and* λ are the dual variables. The assumption underlying the above dual problem is that all Savings and Loans Companies are operating at the optimal level thus Constant Return to Scale Data Envelopment Analysis (CRS-DEA) model (Charnes et al., 1978).

Again, in order to investigate the empirical determinants of both technical and scale efficiency of Savings and Loans Companies in Ghana, the researcher used the efficiency score calculated from the DEA estimation via frontier analyst software as the dependent variable and then regressed on three explanatory variables (QoA, NoB, and TA). James Tobin (1958) considered a statistical model that describes a relationship between a non-negative dependent variable and an independent variable. The model like other econometric models has a normally distributed error

term u_i to capture random influences on the relationship. Therefore, we can estimate the efficiency determinants through the Tobit model (1958);

$$\theta = f(QoA, NoB, TA) \ldots\ldots\ldots\ldots (1a)$$

The above model is going to be estimated by means of Tobit regression model assumption via Gretl software. From equation (1a), the Tobit regression model will therefore be;

$$\theta = \beta_0 + \beta_1 QoA + \beta_2 NoB + \beta_3 TA + u_i \ldots\ldots\ldots\ldots\ldots\ldots (1b)$$

Where;

QoA = Quality of Asset = interest income / spread (loans and investment in securities)

NoB = Number of Branches

TA = Total Asset

u_i = normally distributed error term

Θ = efficiency score (either technical or scale)

The hypothesis that is to be tested at $\alpha = 5$ significant level to investigate the empirical determinants of Savings and Loans Companies will then be;

H_0: $\beta_1 = \beta_2 = \beta_3 = 0$

H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq 0$

3.4 The Expected Signs of the Explanatory (independent) Variables

The QoA is to predict positively with both technical and scale efficiency and thus the ratio of non-performing loans to total asset is small. This means that the parameter / coefficient β_1 is

positively related to the technical and scale efficiency of a DMU. In this study, because DMUs were not willing to disclose their non-performing loans size, the ratio of interest income / spread is used as a proxy to the ratio of non-performing loans / total assets.

The NoB is also expected to be positive which means that Savings and Loans Companies with more branches must be more efficient than those with limited branches. Paxton (2003) in estimating the determinants of technical efficiency in Mexico's Popular Savings and Credit Sector found NoB to be insignificant but was implicitly reflected in the institutional type. In this study we still want to verify the potential impact of the NoB and see if environmental factors may account for the difference. Hence β_2 should be positive in both technical and scale efficiencies.

Finally, the total asset which is meant to determine the size of the Savings and Loans Company is also expected to be positively correlated with technical and scale efficiency. According to Bank of Ghana Survey 2011, there has been an increase in the total assets of S&Ls companies from GH¢86.97 million to GH¢482.12 million between 2006 to March 2011. Hence, the coefficient β_3 should be greater than zero.

3.5 Data Analysis

The concept of data analysis has to do with de-synthesizing data and or factual information to answer research questions (Hamid, 2004). Better still, it is a procedure of gathering the necessary data concerning the research problem area to address the research questions. Such analysis could either be descriptive or inferential.

In this study both the descriptive and the inferential approaches are used. With respect to the descriptive data analysis, information will be presented in the form of tables and charts, which is meant to have easy understanding of outcomes.

Frontier analyst Software is the tool used in this study for measuring both technical and scale efficiency. The Frontier Analyst presents results based on actual and target of inputs and outputs variables used. The software produces efficiency score which ranges from a minimum 0 to maximum 100 percent whilst at the same time determining the input and output contribution of each DMU. Therefore, a DMU is efficient either technical or scale only when it attains a score of 100 percent otherwise it is inefficient. The reference set also produced by the software indicates the efficient frontier and thus all DMUs in the reference sets are efficient (i.e. technical or scale). Another crucial indicator that the Frontier Analyst produces is the "peer" which is a guideline to the inefficient DMUs with regards to the specific efficient DMU that it can emulate and it is based on the ratio of input and output contribution. This means that not all efficient DMUs can be emulated because it might not be in the same peer group with a particular inefficient DMU. Finally, charts are used in determining potential improvement for inefficient DMUs.

However, the analysis of data using the Tobit regression as stated in equation (1) will be based purely on inferential analysis which is also referred to as inferential statistics. This is to help ascertain which S&Ls is / are efficient compared to the other ones and also find out the relationship between efficiency and the parameters stated in the Tobit regression model.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF RESULTS

4.0 Introduction

In this chapter, data results are presented and analyzed to empirically substantiate the problem of the study. The chapter is organized into two sections. The first section presents efficiency measurement results and discussion of the sampled S&Ls while section two discusses the validity or otherwise of the correlation coefficient between efficiency and the explanatory variables based on equation (1) in chapter three.

4.1 Presentation of Efficiency Scores

Efficiency with respect to technical and scale are presented in two folds; efficiency score results on annual bases and efficiency score results based on window analysis both use data from annual financial statements of Savings and Loans Companies.

4.1.1 Annual Efficiency Score Results

In determining the efficiency score, the defined inputs and outputs of Savings and Loans Companies in Ghana were computed from their annual financial statements. Thus the assigned inputs and output variables for technical and scale efficiencies are disclosed in **Table 1** and **Table 2** respectively. Hence, the most efficient frontier is determined via these input and output variables.

Table 4.1: input and output variables for technical efficiency (figures expressed in GH₵)

DMU	INPUTS		OUTPUTS	
	DEPOSIT	EXPENSES	INCOME	LOANS
2006				
DMU 2	14028124	2930706	2992818	13351296
DMU 4	9766351	4967393	3905263	13453412
DMU 5	13810238	4928160	5039478	13282457
2007				
DMU 2	23564891	3873549	4041117	21226296
DMU 4	20568349	8123701	9407374	22795018
DMU 5	24487968	9189625	9803165	27333646
2008				
DMU 1	158077	1543897	97515	392785
DMU 4	23223117	11592900	12963987	24080896
DMU 5	30080308	13475122	13774242	34959440
2009				
DMU 1	422803	1768973	751305	1906514
DMU 4	24496107	13021870	13931071	22988337
DMU 5	41654694	15225789	16957706	49343714
2010				
DMU 1	6421729	3877953	1690567	5755725
DMU 3	39499112	6307908	3819864	27572733
DMU 4	28769064	14000524	13226330	25693103
DMU 5	54071559	20344293	18630329	58844723
WINDOW AND MODIFIED WINDOW ANALYSIS				
DMU 1	422803	1768973	751305	1906514
DMU 2	23564891	3873549	4041117	21226296
DMU 3	39499112	6307908	3819864	27572733
DMU 4	28769064	14000524	13226330	25693103
DMU 5	54071559	20344293	18630329	58844723

Source: Annual Financial Statements and Author's Calculations

Table 4.2: input and output variables for scale efficiency (figures expressed in GH₵)

	INPUT	OUTPUT	
DMU	**ASSET**	**INCOME**	**LOANS**
		2006	
DMU 2	16683280	2992818	13351296
DMU 4	15712387	3905263	13453412
DMU 5	17469209	5039478	13282457
		2007	
DMU 2	32817013	4041117	21226296
DMU 4	29922450	9407374	22795018
DMU 5	33891475	9803165	27333646
		2008	
DMU 1	2079101	97515	392785
DMU 4	32688486	12963987	24080896
DMU 5	42512584	13774242	34959440
		2009	
DMU 1	3705524	751305	1906514
DMU 4	33197405	13931071	22988337
DMU 5	56932834	16957706	49343714
		2010	
DMU 1	8170444	1690567	5755725
DMU 3	47177977	3819864	27572733
DMU 4	36120570	13226330	25693103
DMU 5	69893702	18630329	58844723
		WINDOW AND MODIFIED WINDOW ANALYSIS	
DMU 1	8170444	751305	1906514
DMU 2	16683280	4041117	21226296
DMU 3	47177977	3819864	27572733
DMU 4	36120570	13226330	25693103
DMU 5	69893702	18630329	58844723

Source: Annual Financial Statements and Author's Calculation

From the data envelopment analysis based on input oriented intermediation approach through the constant returns to scale assumption through frontier analyst software result for the five Savings and Loans Companies under consideration in this study for technical and scale efficiencies for the period 2006 to 2010 are produced in table 4.3.

Table 4.3: Technical and Scale Efficiency Score (%) for the Period 2006-2010

DMU	2006		2007		2008		2009		2010	
	TE	SE	TE	SE	TE	SE	TE	SE	TE	SE
DMU 1	-	-	-	-	100	17.66	100	62.23	49.08	83.67
DMU 2	100	93.47	100	80.20	-	-	-	-	-	-
DMU 3	-	-	-	-	-	-	-	-	100	69.42
DMU 4	100	100	100	100	100	100	100	100	100	100
DMU 5	100	100	100	100	100	81.70	100	100	100	100

Source: Author's Construction

TE = Technical Efficiency and SE = Scale Efficiency

The efficiency score result generated in the table 4.3 above is based on the five Savings and Loans Companies (DMUs) being studied. In all, DMU 4 is the only DMU that exhibited consistency in both technical and scale efficiency score of 100 percent during the period under consideration. DMU 2 and DMU 3 on the other hand had similar trend of exhibiting consistency in technical efficiency but were not scale efficient in both years when data were available. However, the efficiency (either technical or scale) score for the DMU 3 company is inconclusive since data for the period 2008 to 2010 were unavailable. In the case of DMU 3, it started operation only in 2010 as a Savings and Loans Company.

DMU 5, one of the biggest in the S&Ls industry in terms of asset size has been operating efficiently in both technical and scale throughout the period under consideration with the exception of 2008 where it had an efficiency score of 91.41 percent because it had exceeded its deposits and expenses target for that year. Thus, DMU 5 would have attained an efficiency score of 100 if it had reduced its inputs (deposits and expenses) by 17.97 and 85.9 respectively whilst

increasing its loans marginally by 6.25. Invariably, DMU 5 peer was DMU 4 since the two had equivalent rate of input / output contribution.

DMU 1 had started operations very well attaining and operating on the efficiency frontier technically in 2008 and 2009. However, in 2010 there was a significant decline in the technical efficiency level to 49.08 percent indicating a great deterioration in technical efficiency. Hence, DMU 1 was inefficient in its operation in the year 2010 mainly because it had exceeded the target deposits and expenses of 11.75 and 50.92 respectively. Scale efficiency wise, DMU 1 started very poorly with a scale efficiency score of 16.66 percent in the first year of operation while attaining 83.67 percent in the current year under review. However, the trend of the scale efficiency score has shown persistence increase from less than 20 percent to over 80 percent.

4.1.2 Efficiency Score through the Window and Modified Window Analysis

Applying the Talluri et al. (1997) modified window analysis which takes its root from the Charnes et al (1985) window analysis. But the variation being that Talluri et al. monitors the performance (efficiency) of a DMU over a time and takes the most efficient performing period instead of the earliest one as suggested by Charnes et al. (1985). Therefore, the best efficient score of each DMU from the period 2006 to 2010 is chosen, but the emphasis is placed on "best-current efficiency score" which in this study is called 'dual window analyses'. The efficiency scores via the 'dual window analyses' of the five DMUs are thus shown in **table 4.4** computed through the efficiency frontier software;

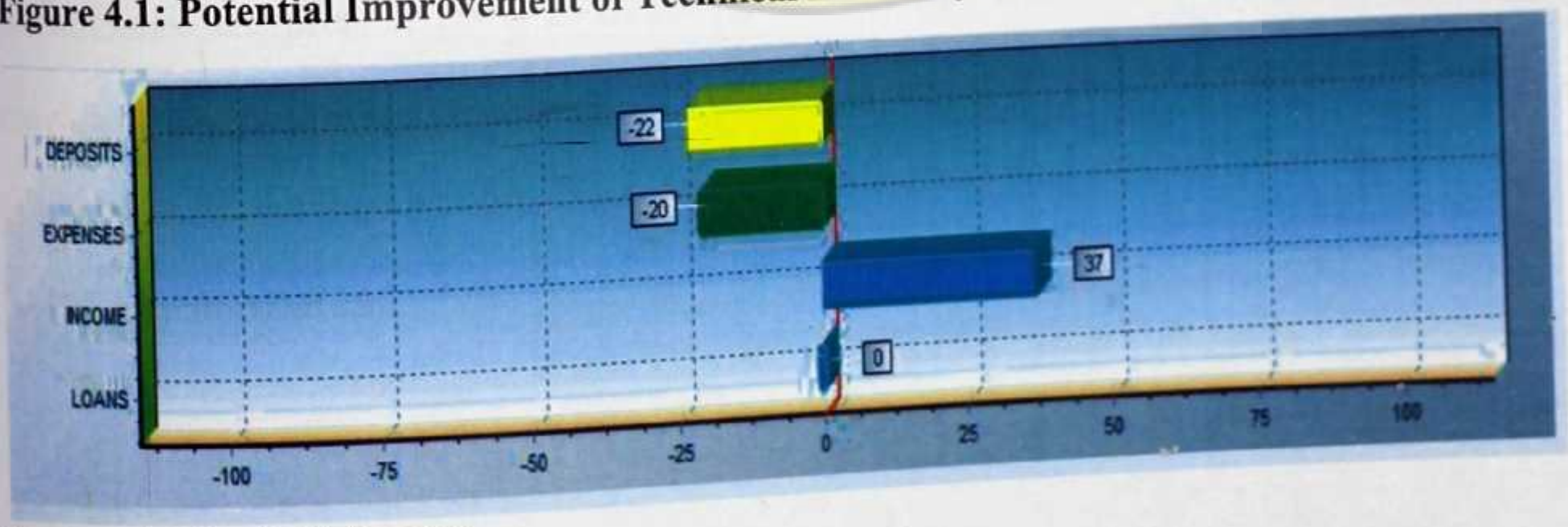
Table 4.4: Standard Technical and Scale Efficiency Scores of Saving and Loans (%)

DMU	TE	TE rank	SE	SE rank
DMU 1	100	1st	83.67	4th
DMU 2	100	1st	95.05	3rd
DMU 3	79.77	5th	69.42	5th
DMU 4	100	1st	100	1st
DMU 5	100	1st	100	1st

Source: Author's Estimates

In table 4.4 showcasing technical and scale efficiency scores of the five DMUs under study, four out of the five DMUs were technically efficient with the exception of DMU 3, meaning DMU 1, DMU 2, DMU 4 and DMU 5 form the efficient frontier hence are technically efficient. Therefore, these four DMUs will serve as the reference set for the inefficient DMU to emulate. With regard to scale efficiency, DMU 4 and DMU 5 were the only DMUs to have attained 100 percent score indicating they are scale efficient (frontier) and are thus reference set with respect to scale efficiency for those DMUs which are scale inefficient. It is also obvious from table 4.4 that in all cases of efficiency (i.e. technical and scale) DMU 3 is the least efficient. Thus, only DMU 3 had signifieantly different technical efficiency score from the score it attained from the best year of 2010. It therefore has DMU 2 as a peer.

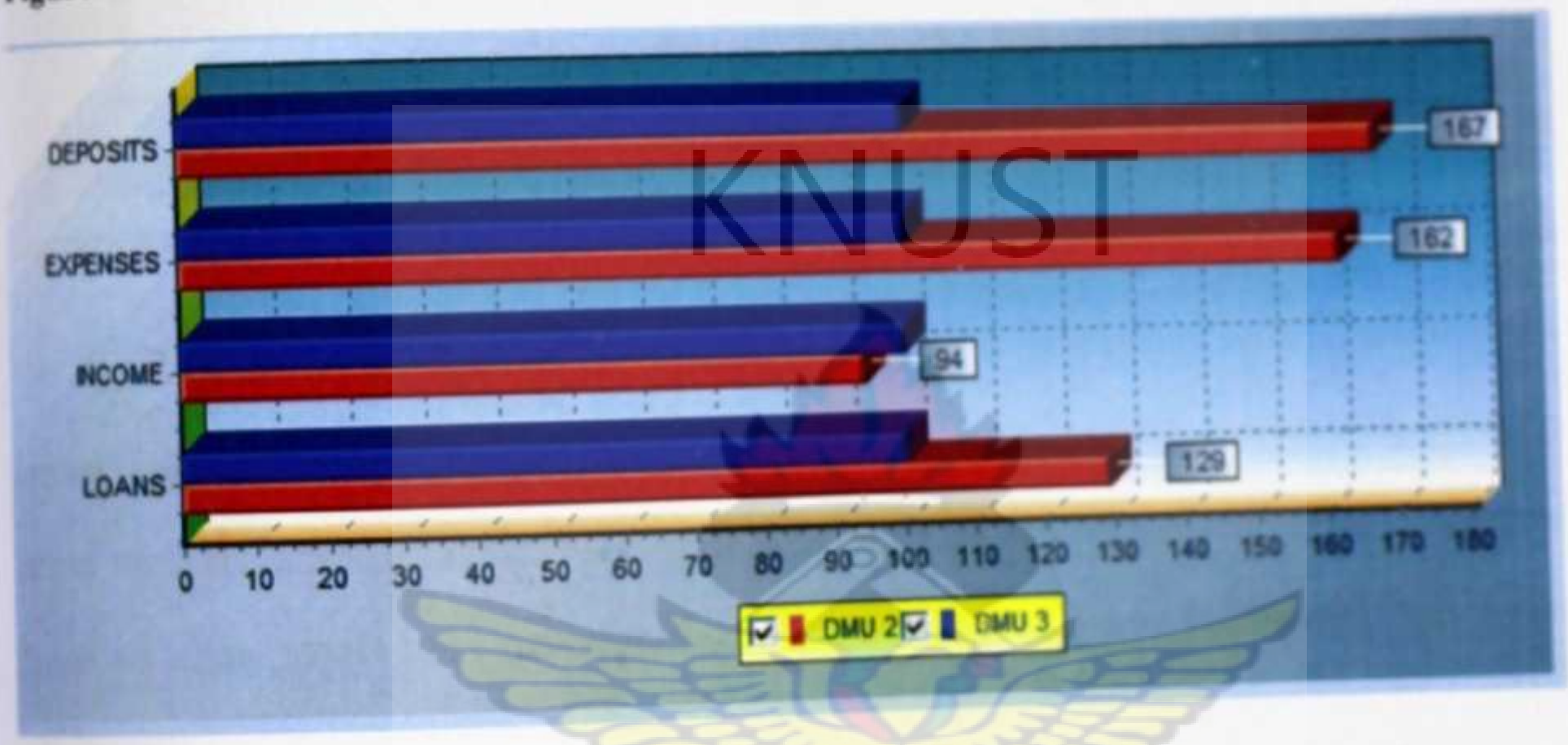
Figure 4.1: Potential Improvement of Technical Efficiency for DMU 3



Source: Author's Estimates

Figure 4.1 is graphical presentation of potential improvement for DMU 3 Savings and Loans in the quest to attain efficiency. From the figure 4.1 above, for First Capital Plus to be technically efficiency, it must reduce deposits and expenses by 22.40 and 20.23 percent respectively whereas increasing interest income by 37.42 percent.

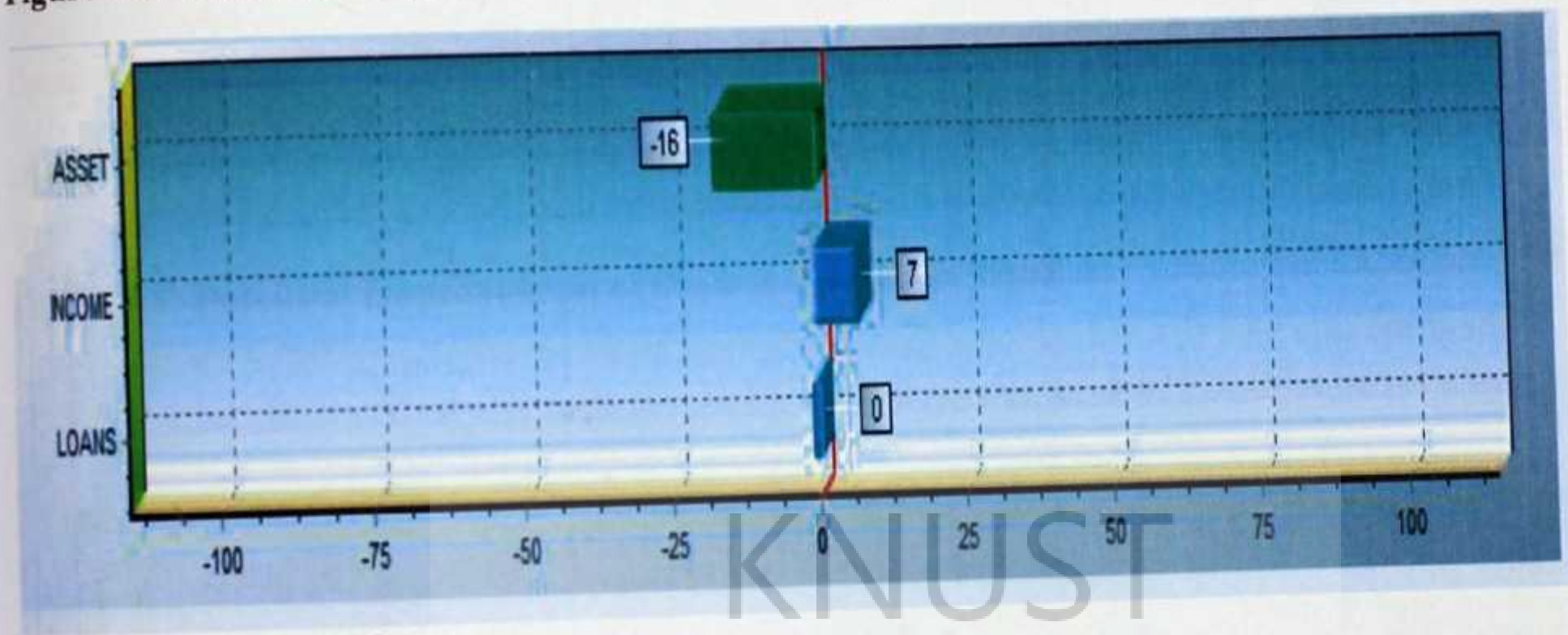
Figure 4.2: Reference Comparison of DMU 2 and DMU 3



Source: Author's Estimates

The reference comparison which is the most similar input and output orientation for which the technically inefficient DMU in this case DMU 3 can emulate is depicted in figure 4.2 above. The bars indicate that in all input and output combinations there are total deviations of DMU 3 from the reference set (peer) of DMU 2. Therefore, the blue bars which represent DMU 3 must be moving in the same direction as the red bars which also represent DMU 2 for technical efficiency to be achieved and thus the differences between the red and blue bars represent the technical inefficiency for DMU 3.

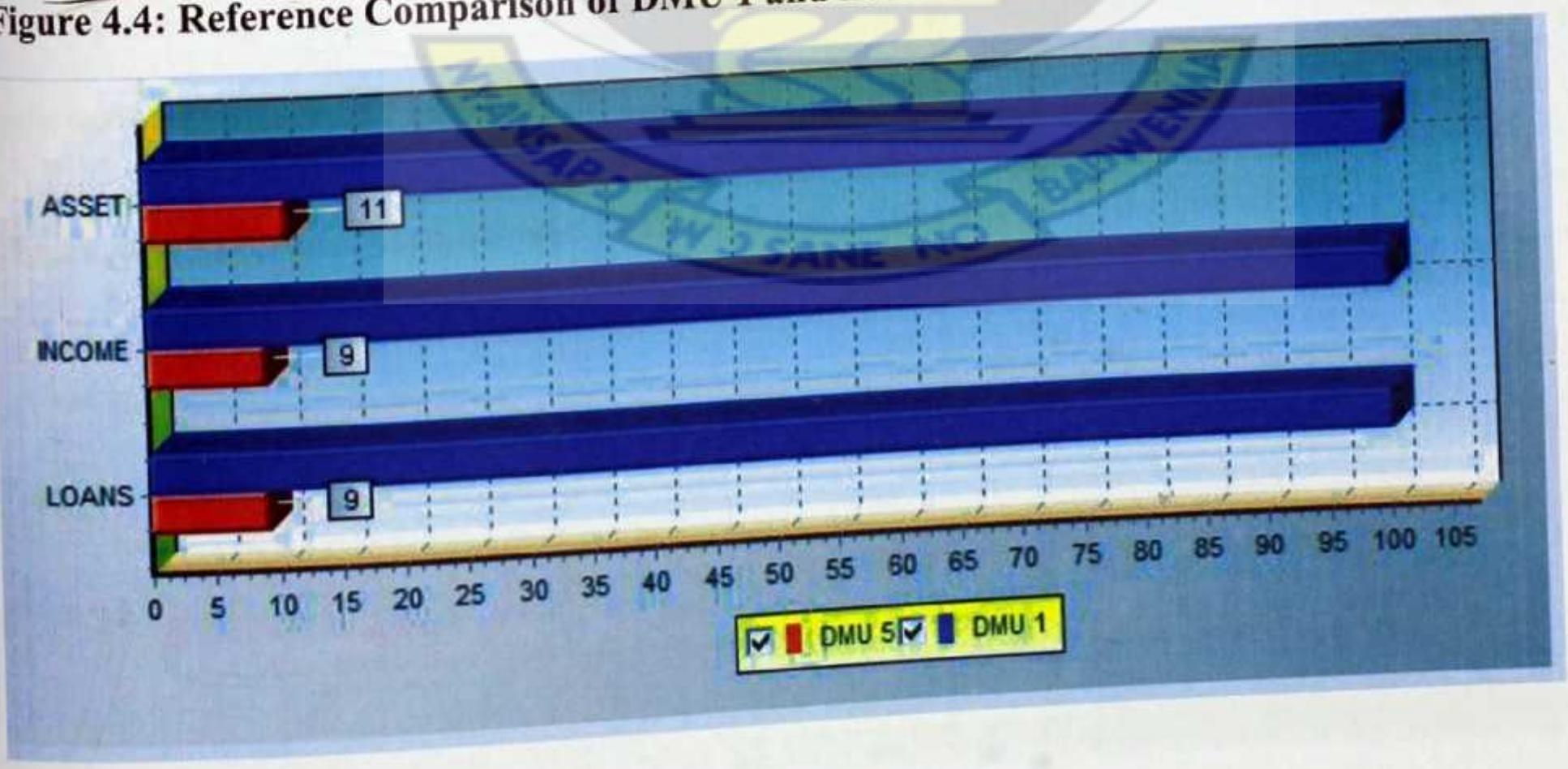
Figure 4.3: Potential Improvement of Scale Efficiency of DMU 1



Source: Author's Estimates

The figure 4.3 shows that for DMU 1 to be scale efficient, it must reduce its total assets by 16 percent whilst at the same time increase its interest income by 7 percent by maintaining the same rate of loans and advances as indicated by the green and blue bars respectively. In the subsequent figure 4.4 below, DMU 1 has exceeded DMU 5 in both input and output combination to be Scale efficiency.

Figure 4.4: Reference Comparison of DMU 1 and DMU 5



Source: Author's Estimates

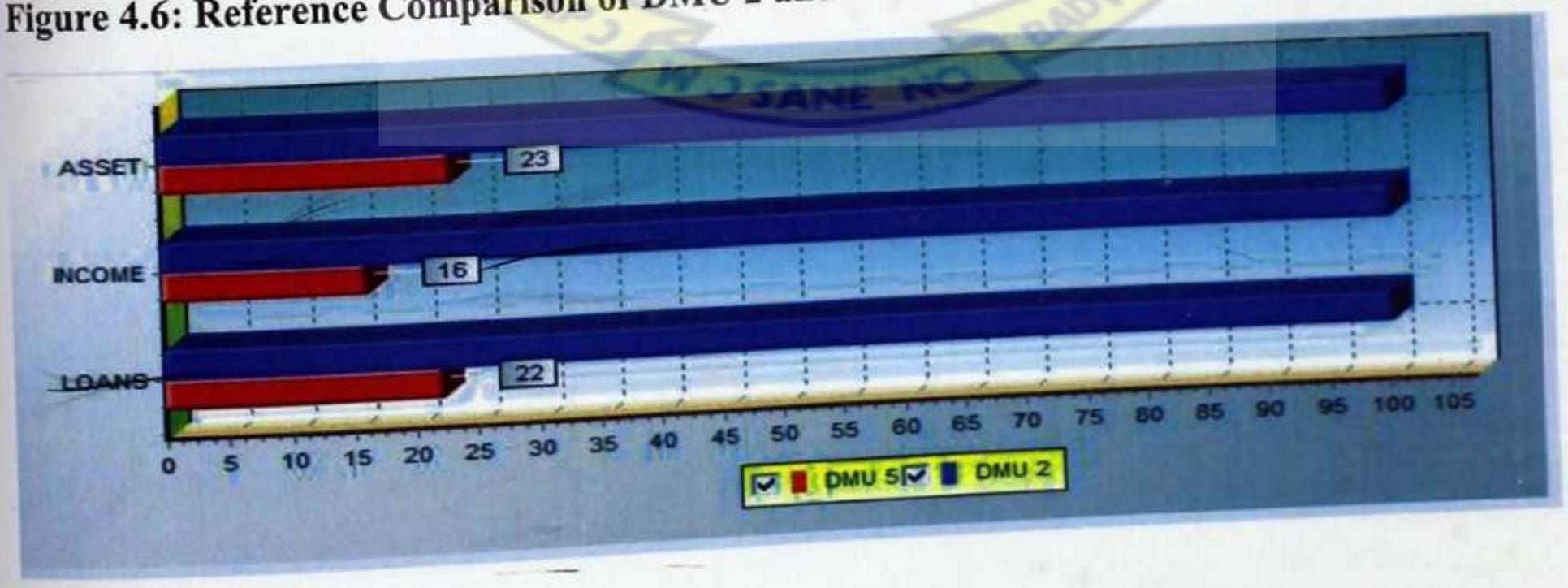
In the reference comparison graph above in figure 4.4, both input and outputs of DMU 1 Company which is scale inefficient are all equal to 100, far outstripping those of scale efficient DMU 5 input and output combinations, which do not exceed 11 percent in either case.

Figure 4.5: Potential Improvement of Scale Efficiency of DMU 2

Source: Author's Estimates

The figure 4.5 depicts the inconsistency in input and outputs of DMU 2 that makes it scale inefficient. That is, total asset has exceeded its target and thus need to be reduced by 4 percent whilst increasing income interest which has fallen short of target by 41 percent. Loans were the only variable to have had target and actual equal.

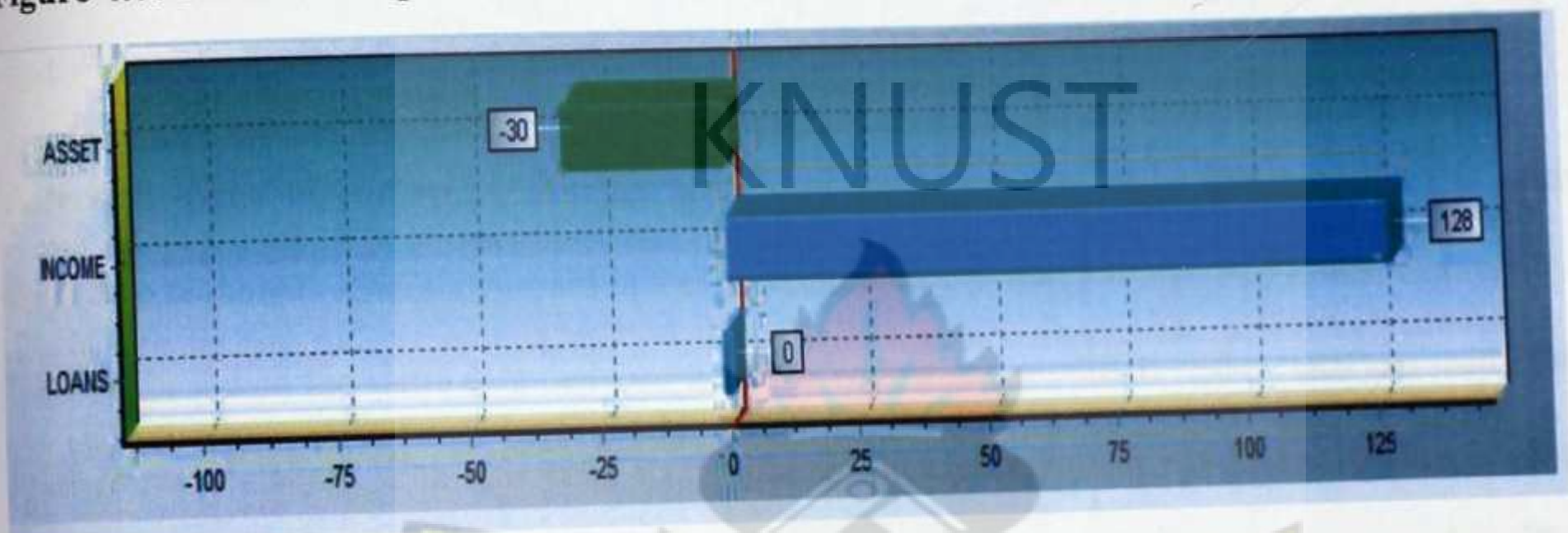
Figure 4.6: Reference Comparison of DMU 2 and DMU 5



Source: Author's Estimates

DMU 2 had both its input and outputs combinations significantly exceeding that of the reference set of DMU 5 as exhibited in figure 4.6. The reference comparison graph above therefore explains the margin of excesses in the input and outputs combination of DMU 2. Thus, the comparison indicates that for DMU 2 to be scale efficient it must have its input and output move in the same direction as DMU 5 representing blue and red bars respectively.

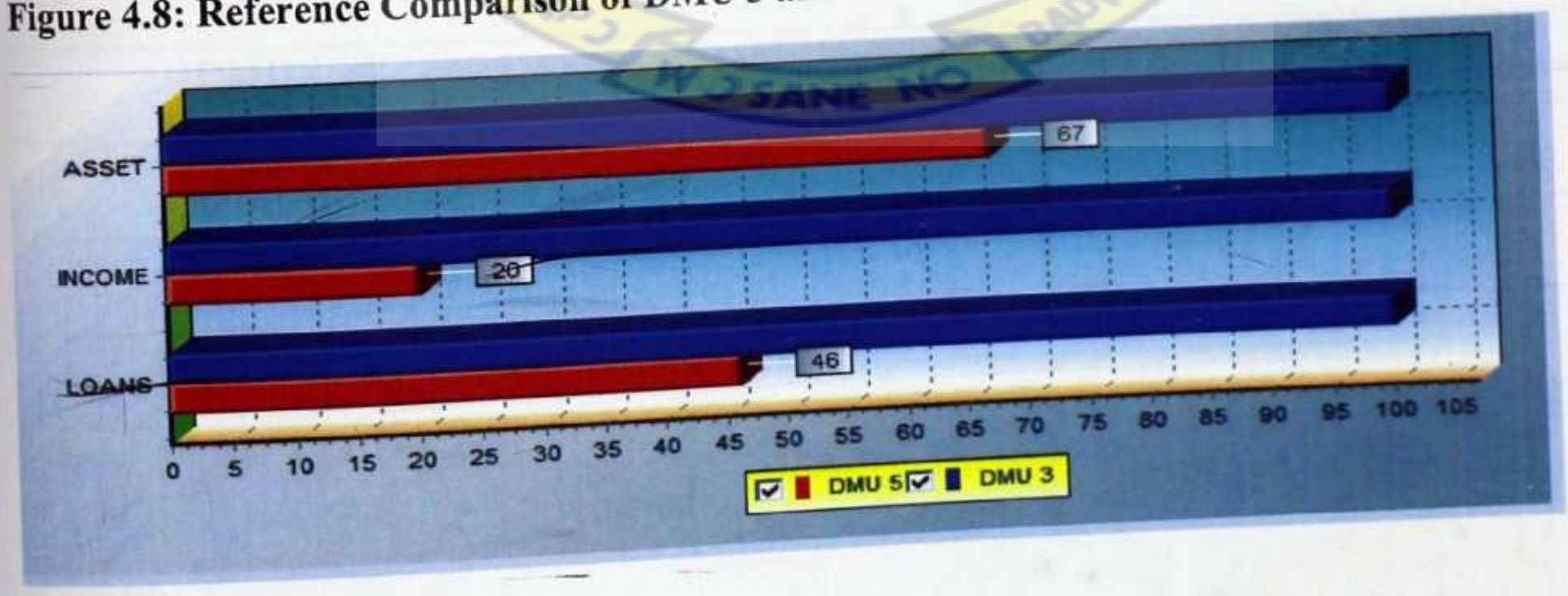
Figure 4.7: Potential Improvement of Scale Efficiency of DMU 3



Source: Author's Estimates

The potential improvement graph in figure 4.7 shows that scale inefficiency of DMU 3 is no mistake. In the first place, total asset is to be reduced by 30 percent whilst more than doubling the output variable of interest income to a tune of 128 percent to attain scale efficiency.

Figure 4.8: Reference Comparison of DMU 3 and DMU 5



Source: Author's Estimates

With regard to the reference comparison of DMU 3 and DMU 5, the deviations in input and output contribution to scale efficiency were not as wide as seen in figure 4.4 and 4.6. Thus, the variation is only wide at approximately 80 percent for the interest income as compared to total asset and loan which is 33 and 54 percent respectively.

In sum, the result exhibits significantly higher average technical and scale efficiency score of 95.95 and 89.63 percent respectively among the five Savings and Loans Companies (DMUs) under study.

A second round of test was conducted to further investigate the super efficiency scores with respect to technical efficiency to aid in a clear ranking of the five Savings and Loans Companies (DMUs) based on the same data deduced from the widow and modified widow analysis using the DEA frontier analysis. The efficiency score produced a contrary result with the exception of dmu 3 that had the same score as the standard efficiency score. The rest had different score from the standard efficiency test.

Table 4.5: Super Technical Efficiency Score of Savings and Loans (expressed in 1000%)

DMU	TE	TE rank
DMU 1	1000	1st
DMU 2	165.50	2nd
DMU 3	79.77	5th
DMU 4	140.23	3rd
DMU 5	126.23	4th

Source: Author's Estimates

With the super efficiency test, only DMU 1 attained the maximum score of 1000 percent serving as the reference set and thus ranked 1st among the sample DMUs with the rest scoring less than 200 percent. Therefore, in the case of super efficiency test, DMU 1 is the most technically super-efficient DMU during the period under review whilst DMU 3 still maintained its poor performance of 79.77 percent.

4.2 Determinants of Technical and Scale Efficiency Results

The parameters used in the Tobit regression model for the estimation of determinants for both technical and scale efficiency were partly retrieved and partly computed from the annual financial statements of the Savings and Loans Companies. The outcome of the Tobit regression estimation for technical and scale efficiency is presented in **table 4.7** and **table 4.8**.

Table 4.6: Variables used in the Tobit regression estimation for technical efficiency

DMU	TE SCORE (%)	QoA	NoB	TA (GH₵)
DMU 1	100	0.3690	3	3705524
DMU 2	100	0.2920	14	32817013
DMU 3	79.99	0.2508	6	47177977
DMU 4	100	0.5255	13	36120570
DMU 5	100	0.3786	26	69893702

Source: Annual Financial Statements and Author's Calculation

Table 4.7: Variables used in the Tobit regression estimation for scale efficiency

DMU	SE SCORE (%)	QoA	NoB	TA (GH₵)
DMU 1	83.67	0.3690	3	3705524
DMU 2	95.05	0.2920	14	32817013
DMU 3	69.42	0.2508	6	47177977
DMU 4	100	0.5255	13	36120570
DMU 5	100	0.3786	26	69893702

Source: Annual Financial Statements and Author's Calculation

The result of the estimated equation for the determinants of efficiency of Savings and Loans Companies in Ghana from equation (1) through Gretl software after the technical and scale

efficiency scores of the 'dual window analyses' have been regressed on the three explanatory variables produced:

Table 4.8: Estimated Coefficient of Technical and Scale Efficiency using the Tobit Model

Parameters	Technical efficiency			Scale efficiency		
	Coefficient	Z	p-value	Coefficient	Z	p-value
Const	92.2094 (3.40141)	27.11	7.68e-162 ***	61.5947 (7.28560)	8.454	2.81e-017 ***
QoA	13.7811 (5.84213)	2.359	0.0183 **	1.59185 (0.330392)	4.818	1.45e-06 ***
NoB	1.52118 (0.697452)	2.181	0.0292 **	56.3525 (8.34153)	-6.640	3.14e-011 ***
TA	-5.30353e-07 (2.42569e-07)	-2.186	0.0288 **	-3.41811e-07 (5.14788e-08)	6.756	1.42e-011 ***

*, **, *** *indicating significance at 10%, 5% and 1% respectively.* **Standard errors in the parenthesis.** ***Results were obtained from Gretl***

From the Gretl software package used, the Tobit regression result indicates that all the explanatory variables are statistically significant. In other words, the null hypothesis is rejected whilst accepting the alternative hypothesis at 95% confident level. Thus all the explanatory variables are statistically significance at 5% error margin in the case of the technical efficiency while statistically significant at 1% error margin in the case of scale efficiency.

4.2.1 Quality of Asset (QoA) and Efficiency (technical and scale)

From the result therefore, QoA has a positive coefficient. This means the returns on asset in interest earning ventures such as loans and securities which were used as proxy for non-performing loans (NPLs) has a positive relationship with both technical and scale efficiency at a significance level of 5% and 1% respectively. Thus, there is a strong positive relationship between quality of asset and scale efficiency than technical efficiency. This result is consistent with existing literature on efficiency of banking such as Casu and Molyneux (1998) and

Girardone et al. (1997) in their study on the comparative analysis of European banking efficiency and analyzing the determinants of bank efficiency of Italian banks respectively. Although the significance level of that of Europe as a whole was questionable, in the case of Italy the variable was statistically significant for all banks and large banks at even 1% confidence level.

4.2.2 Number of Branches (NoB) and Efficiency (technical and scale)

Number of Branches (NoB) also positively determines both technical and scale efficiency and as in the case of QoA, the level of significance are 5% and 1% for technical and scale efficiency respectively. This therefore confirms the study hypothesis and thus indicates that there is a statistical evident that network expansion of Savings and Loans Companies has a positive impact on efficiency (either technical or scale). This result is in variance with Paxton (2003), study of technical efficiency in Mexico's Popular Savings and Credit Sector, where the number of branches (NoB) was statistically insignificant with respect to bank efficiency. But, the number of branches was found implicitly in institutional type which was statistically strong with respect to bank efficiency.

4.2.3 Total Asset (TA) and Efficiency (technical and scale)

In contrast with the expectation of the study, total asset (TA) is found to be inversely related with both technical and scale efficiency and yet statistically significant at 5% and 1% confidence interval respectively. This implies that, as Savings and Loans Companies' assets increase, efficiency (either technical or scale) rate declines. The result is thus similar to that of a study by Girardone, Molyneux and Gardener (1997) in Italian banks which also uncovered a slight inverse trend between total assets and X-efficiency.

In sum, the Tobit regression result has confirmed the study hypothesis and the anticipated outcome of the determinants of technical and scale efficiencies of Savings and Loans Companies in Ghana. It is only total asset (TA) which produced a contrary result yet statistically significant.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND MANAGERIAL IMPLICATIONS

5.0 Introduction

This chapter draws conclusion while summarizing the empirical findings based on the objectives of the study. The chapter also contains policy implications of the Savings and Loans Companies in relation to the financial system of the Ghanaian economy. The final section identifies the limitations of the study.

5.1 Summary of Empirical Findings

The study reveals various results and findings both with regard to the measurement of technical efficiency and scale efficiency. It also had varied findings concerning the determinants of technical efficiency and scale efficiency. The following are the final empirical findings emanating from the study.

First, the study shows that four out of the five sampled Savings and Loans Companies (DMUs) are technically efficient by means of standard efficiency score measured in 100 percent. Thus, technically, apart from DMU 3 which recorded efficiency score of 89.77% all the four remaining DMUs attained the maximum score of 100% implying they are operating on the efficient frontier. This is indeed consistent with theory that a DMU is technically efficient when its expected output is just equal to its actual output, and in this respect those S&Ls that attained the 100% efficiency score had their actual output equal to their target. However, the super technical efficiency test proved otherwise with only DMU 1 attaining the maximum technical efficiency score of 1000% whilst the rest obtained scores less than 200%.

Second, the study also disclosed that only two out of the five sampled Savings and Loans Companies are scale efficient. Therefore, DMU 4 and DMU 5 are the only two Savings and Loans Companies that are scale efficient in the period under consideration.

Again, the study revealed that quality of assets (QoA) is statistically significant at error level of 5% and 1% in determining technical and scale efficiency respectively for Savings and Loans in Ghana. Thus, as quality of asset improves, both technical and scale efficiencies also improve.

Moreover, the number of operational branches (NoB) of Savings and Loans Companies was also significant at 5% and 1% confidence level for technical and scale efficiency respectively indicating that as network branches are expanded, technical and scale efficiencies are improved.

Finally, another finding from the study which seems controversial is the relationship between efficiency and total asset which was found to be negative and still significance at 5% for technical efficiency and 1% for scale efficiency. But, the result is consistent with a similar finding in the Mexico's Popular Savings and Credit Sector. Therefore, as DMU expands in size with regard to increase in assets size, efficiency level is affected negatively. This is not in agreement with the theory that suggests that increase size must correspond with improved efficiency through implicit cost reduction.

5.2 Managerial Implications

From the empirical findings deduced from this study, there are some managerial implications that could help further strengthen and improve the performance of the Savings and Loans industry. In this respect, the study outlines the following recommendations for managers of Savings and Loans Companies and policy makers who through their actions and inactions play crucial role in the industry.

First and foremost, the super efficiency test conducted presupposes that DMUs can still improve and do better than their current operations. Thus, they can reorient their input and output combinations most often with regard to deposit generation and loan creation. These variables which represent input and output respectively coincidentally are the main functions of the Savings and Loans Companies in Ghana with regard to the law establishing them. From the frontier analysis result, there is one unique feature about DMU 1; whenever it attains efficiency score of 100%, its loans attains an output contribution of 100%. Hence, Savings and Loans Companies should endeavor to create more loans rather than investing in government securities in order to be efficient.

Again, since the coefficient of NoB is positive and significant at 5% and 1% for technical efficiency and scale efficiency respectively, Savings and Loans Companies must endeavor to open up new and more branches. It was realized in this study that most of the Savings and Loans Companies have limited network branches across the country. Therefore Savings and Loans Companies must be compelled to establish more network branches across the country. This will directly help make financial intermediation easily accessible to the various part of the country at large.

Finally, the study also has shown the efficacy and the flexibility in the use of non-parametric approach via the Data Envelopment Analysis (DEA) in measuring efficiency of financial institutions as it does not demand any rigorous statistical formulations. Hence, the study recommends this approach of measuring efficiency which is easy to understand and interpret for bank managers in annual assessment of performance.

5.3 Conclusion

Until 1993, financial intermediation was basically the privilege enjoyed by the formal sector neglecting the vast majority of the informal sector which takes a larger proportion of the economy. In 1993, a law was passed, Law 1993 (PNDCL 328) formally establishing Savings and Loans code which will fall under the non-banking financial sector. Since the coming into being of this industry, financial intermediation has become accessible to those hitherto unbanked informal sector and thus witnessing a tremendous growth in the industry with respect to assets and customer base.

In this respect, recognizing the important role of this industry, this study was conducted to investigate the measures and determinants of technical and scale efficiencies of Savings and Loans Companies activities in Ghana. A non-parametric approach through a Data Envelopment Analysis was used to measure the efficiency level of these Savings and Loans Companies whilst DEA Frontier Analyst software was also used to analysed data. With regard to the determinants of efficiency, Tobit regression model was also used to evaluate the correlation between the explanatory variables and the dependent variable (efficiency score).

The study adopted the constant returns to scale assumption of the CCR model and final result shows that most of the DMUs investigated are operating on the efficient frontier because four out of the five sampled S&Ls attained the maximum score technical efficiency score of 100%. While two obtained scale efficiency score of also 100%. This means the threshold for measuring efficiency was between 0-100 percent, indicating that when a DMU attains any score less than 100% then it is inefficient whilst 100% score explains efficiency (either technical or scale). A super efficiency test which is expressed in 1000% was also conducted and it was found that only DMU 1 was technically efficient haven attained a score of 1000% with the rest falling below

200%. Thus, based on the standard efficiency score of 100%, the industry could be said to be operating above average efficiency level.

Again, the study uncovered three major determinants of both technical and scale efficiency of Savings and Loans Companies in Ghana and these are the quality of assets, number of branches and total assets.

Finally, the study recommended for policy makers as well as mangers to adopt measures to increase operational branches whilst focusing more on loan creation than investing in government securities.

5.4 Limitation of the Study

The main limitation of this study has to do with data accessibility. Savings and Loans companies were reluctant to release their annual financial statement for the course of this work, hence affecting the sample size needed to accomplish the objective of the study. This means the empirical finding or result of the study is constrained by only five sampled DMUs out of the existing 19 DMUs as at March 2011.

The limited duration under which this study was conducted coupled with financial constraint might have some effect with regard to the empirical findings.

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Appendix I

DEA technical efficiency result from Frontier Analyst Software

DMU	VARIABLES	ACTUAL	TARGET	PI	X/Y CONT.	TE
DMU 2	DEPOSIT	23564891	23564891	0.00	0.00	100
	EXPENSES	3873549	3873549	0.00	100	
	INCOME	4041117	4041117	0.00	0.00	
	LOANS	21226296	21226296	0.00	100	
DMU 3	DEPOSIT	39449112	39449112	-22.40	0.00	79.77
	EXPENSES	6307908	6307908	-20.23	100	
	INCOME	3819864	3819864	37.42	0.00	
	LOANS	27572733	27572733	0.00	100	
DMU 1	DEPOSIT	422803	422803	0.00	13.45	100
	EXPENSES	1768973	1768973	0.00	86.55	
	INCOME	751301	751301	0.00	61.16	
	LOANS	1906514	1906514	0.00	38.84	
DMU 4	DEPOSIT	28769064	28769064	0.00	5.32	100
	EXPENSES	14000524	14000524	0.00	94.68	
	INCOME	13226330	13226330	0.00	100	
	LOANS	25693103	25693103	0.00	0.00	
DMU 5	DEPOSIT	54071559	54071559	0.00	23.25	100
	EXPENSES	20344293	20344293	0.00	76.75	
	INCOME	18630329	18630329	0.00	78.76	
	LOANS	58844723	58844723	0.00	21.24	

Source: Frontier Analyst Result, 2012

TE = Technical Efficiency (expressed in %) PI = Potential Improvement (expressed in %)

X/Y CONT = Input / output Contribution (expressed in %)

Actual and Target figures expressed in GH₵

Appendix II

DEA Scale Efficiency Result from Frontier Analyst Software

DMU	VARIABLES	ACTUAL	TARGET	PI	X/Y CONT.	SE
DMU 2	ASSET	16683280	15858202	-4.95	100	95.05
	EXPENSES	2992818	4227040.67	41.24	0.00	
	LOANS	13351296	13351296	0.00	100	
DMU 3	ASSET	47177977	32749927.02	-30.58	100	69.42
	EXPENSES	3819864	8729569.30	128.53	0.00	
	LOANS	27572733	27572733	0.00	100	
DMU 1	ASSET	8170444	6836448.66	-16.33	100	83.67
	EXPENSES	1690567	1822271.31	7.79	0.00	
	LOANS	5755725	5755725	0.00	100	
DMU 4	ASSET	36120570	36120570	0.00	100	100
	EXPENSES	13226330	13226330	0.00	100	
	LOANS	25693103	25693103	0.00	0.00	
DMU 5	ASSET	69893702	69893702	0.00	100	100
	EXPENSES	18630329	18630329	0.00	0.00	
	LOANS	58844723	58844723	0.00	100	

Source: Frontier Analyst, 2012

SE = Scale Efficiency (expressed in %) PI = Potential Improvement (expressed in %)

X/Y CONT = Input / output Contribution (expressed in %)

Actual and Target figures expressed in GH₵

Appendix III

Technical efficiency estimation

Model 1: Tobit, using observations 1-5

Dependent variable: index

	coefficient	std. error	z	p-value	
const	92.2094	3.40141	27.11	7.68e-162	***
QoA	13.7811	5.84213	2.359	0.0183	**
NoB	1.52118	0.697452	2.181	0.0292	**
TA	-5.30353e-07	2.42569e-07	-2.186	0.0288	**

Mean dependent var	95.95400	S.D. dependent var	9.047131
Censored obs	0	sigma	0.102742
Log-likelihood	4.872583	Akaike criterion	0.254834
Schwarz criterion	-1.697976	Hannan-Quinn	-4.986316

Appendix IV

Scale Efficiency Estimation

Function evaluations: 1350

Evaluations of gradient: 342

Model 1: Tobit, using observations 1-5

Dependent variable: SE

	coefficient	std. error	z	p-value
const	61.5947	7.28560	8.454	2.81e-017 ***
NoB	1.59185	0.330392	4.818	1.45e-06 ***
TA	-3.41811e-07	5.14788e-08	-6.640	3.14e-011 ***
QoA	56.3525	8.34153	6.756	1.42e-011 ***

Mean dependent var	89.62800	S.D. dependent var	13.11884
Censored obs	0	sigma	0.483675
Log-likelihood	-3.351510	Akaike criterion	16.70302
Schwarz criterion	14.75021	Hannan-Quinn	11.46187

QoA= quality of asset = interest income / spread (loans and investment in securities)

TA = total asset

NoB = number of branches