AN EMPIRICAL STUDY OF THE RELATIONSHIP BETWEEN MANAGERIAL SKILL AND TECHNICAL EFFICIENCY OF COMMERCIAL BANKS IN KENYA

BY

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Declaration

This management research project is my original work and has not been presented for a degree award in any other university.

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This research project has been submitted with my approval as the University Supervisor.

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Dedication

I dedicate this research report to my family members especially my wife Ndanu and son Allan for their encouragement and support during the time of my studies.

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Abstract

This study analyses the relationship between technical efficiency of commercial banks in Kenya and managerial skill characteristics namely the level of education, years of experience and frequency of training. The study also examined the substitution possibilities between a manager's level of education and years of experience in relation to technical efficiency. The hypotheses of the study were that a positive relationship exists between managerial skill characteristics and technical efficiency and that there are substitution possibilities between years of experience and education level.

Utilizing a stochastic production frontier and regression analysis, it was found that there is a positive relationship between technical efficiency and the level of education, years of experience, and frequency of training. The results also indicated that larger bank size, higher capitalisation and greater profitability are associated with higher technical efficiency. The findings did not suggest any substitution possibilities between a manager's level of education and years of experience in relation to technical efficiency. In light of the results, banks ought to appoint managers with high levels of education and experience and improve through continuous training, the skills of the managers as this leads to higher technical efficiency. These findings are consistent with previous studies that have recognized managerial skill as a major reason why technical efficiency among firms varies (Jones, 1994; Kirkley et al., 1998; Gallacher, 2001; Ugur, 2004; and Bottazzi et al., 2006). The study however does not support previous literature indicating possible substitution between education and years of experience (Vandenberg, 1980; Kirkley et al., 1998; and Imai, 2003).

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List of Abbreviations and Acronyms

ATM	:	Automated Teller Machine
CBK	:	Central Bank of Kenya
CRS	:	Constant Returns to Scale
DEA	:	Data Envelopment Analysis
DFA	:	Distribution-Free Approach
FDH	:	Free Disposal Hull Approach
HR	:	Human Resource
LR	:	Likelihood Ratio
M&A	:	Mergers and Acquisitions
MLEs	:	Maximum Likelihood Estimates
OLS	:	Ordinary Least Squares
SFA	:	Stochastic Frontier Approach
SMS	:	Short-Messaging Service
TFA	:	Thick Frontier Approach
VISA	:	International credit card service trade mark
VRS	:	Variable Returns to Scale

CHAPTER ONE

1.0 INTRODUCTION

1.1. Background to the Study

A financial institution is an organization (public or private) that collects funds (from the public or other organizations) and invests them in financial assets (Berger and Humphrey, 1997). Financial institutions in Kenya comprise commercial banks, development finance institutions, non-bank financial institutions, non-governmental organizations and Government programmes. Financial institutions perform a wide range of functions in the financial system but their primary role is to assist in channeling funds from surplus into deficit economic entities (Gondwe, 2005). Efficiency is a key concept for financial institutions (Cinca et al, 2002). Not only does efficiency have important ramifications for the institutions themselves such as profitability, competitiveness and solvency but also in the demands placed upon by the regulatory authorities, and in the provision of low risk financial intermediation. The efficiency of financial institutions has been addressed in literature either in terms of scale and scope or in terms of X-efficiency or both.

According to Limam (2001), *Scale efficiency* addresses the question of whether a firm is operating at the minimum of its long-run average cost curve. On the other hand, *scope efficiency* is measured by the difference between the cost of joint production and the sum of producing the different outputs individually. *Cost X-efficiency* refers to how close a firm's actual costs are to the costs of a best-practice firm producing the same outputs. Cost X-inefficiency may arise because managers use more inputs than would a best practice firm (*technical inefficiency*) or because they employ an input mix that does not minimize costs for a given input price vector (*allocative inefficiency*) (Berger, 2000).

This study sought to examine the extent to which technical efficiency among commercial banking firms in Kenya is explained by differences in managerial skill. Technical efficiency measures the extent to which banks could reduce input costs for a given level of output (input orientation) or expand output for given levels of inputs (output orientation). Technical efficiency could be deterministic or stochastic and gives the maximum output that can be attained for a given level of input, or the minimum cost for a given level of output and input prices (Limam, 2001).

In order to measure the technical efficiency of a bank, the stochastic frontier analysis approach was used. The most important advantage of this approach in comparison with deterministic methods is that it takes into account the fact that deviation from the frontier could be due to noise in the data or mis-specification errors and not necessarily to inefficiencies (Limam, 2001). For the purpose of this study, the intermediation approach to define bank output and input was considered. According to this approach, banks in their role as financial intermediaries use capital, labour, deposits and other borrowed funds to produce earning assets. Within the framework of financial intermediation, banks are also regarded as optimizers of interest income and other income subject to interest and other operating expenses (Leong et al., 2002).

The concept of productivity is closely linked with the issue of efficiency. If a firm is efficient, it is said to be operating on the production frontier i.e. it is achieving best practice. Rising efficiency would therefore imply rising productivity (Rogers, 1998). Gascon and Adenso-Diaz (1997) pointed out that productivity gains have the potential to contribute to an increase in business profit and proved this by analyzing Spanish commercial banks for the period 1987-1994. Further, the increased competitiveness, internationalization, sophistication of markets and the increased concern about social and ecological issues make productivity improvement important (Tolentino, 2004).

Researchers have long recognized that entrepreneurial or managerial skill is a major determinant of productivity or the reason why production among firms varies (Kirkley et al, 1998). Typically, managers are responsible for organizing efficiently the transformation of inputs into productive outputs (Dawson and Dobson, 2002). Part of this process requires the manager to monitor and evaluate the inputs as well as motivate labour. The manager's performance may be crucial for the success of the business – if the manager performs well (and output is maximized for a given set of inputs), profit maximization will result (Dawson and Dobson, 2002). Given that the financial system in most developing countries is dominated by commercial banks and that the performance of the banking sector has repercussions across the length and breath of the economy (Mohan, 2006), the analysis in this paper focused on the commercial banks as the key financial institutions in the financial system.

In this paper, managerial skill was measured by assessing a manager's primary characteristics such as education level, years of experience, number of training courses and job related conferences attended. Since engineering information on the technology of banks was not available, efficiency analysis relied on accounting measures of costs, outputs, inputs, revenues and profits. The study is divided into five chapters. These chapters are presented as follows: First is the introduction chapter, followed by literature review in chapter two and research methodology in chapter three. Chapter four is devoted to data analysis and a discussion of the findings while chapter five provides a summary of the study and its conclusions. Chapter 1 is organized as follows: In section 1.2, an overview of the commercial banking industry in Kenya is provided. Section 1.3 describes the statement of the problem while section 1.4 states the objectives of the study. Section 1.5 discusses the importance of the study.

1.2. The Commercial Banking Industry in Kenya

The banking industry in Kenya has undergone a number of major structural changes since independence whose objective was partly to create leaner but efficient banks. These changes include computerization, branch rationalization and staff retrenchment. One of the major reforms undertaken in the 1990s entailed the liberalization of interest rates and replacing direct controls on lending with open market operations (Cihak and Podpiera, 2005). However, it is not clear whether the liberalization has improved the efficiency of credit allocation in the presence of widespread distortions elsewhere in the economy (Cihak and Podpiera, 2005). According to the authors, efforts to enhance efficiency of intermediation in the Kenyan banking sector have in the past been undermined by the presence of large, weak government-owned banks, which accounted for most of the banking system's non-performing loans.

Following the sector reforms in the 1990s, the banks, currently 42 in number are growing fast and outpacing the economy. In 2005 and 2004, the industry grew by 11% and 18% while the economy managed 5% and 4.3%. This shows that banking is accounting for the increase in national output more than the other sectors collectively (Market Intelligence Banking Survey, 2006). The growth being experienced in the sector is attracting attention from the big banks on the African continent. Standard Bank of South Africa (Africa's largest bank by asset base) is reportedly in talks, through its Kenyan subsidiary Stanbic Bank, to acquire a controlling interest in the CFC Bank group. Nigeria's Ecobank has also been reportedly sizing a buyout target among the local banks. Increasing competition from banks expanding into new markets as well as from non-bank institutions is putting strong pressure on banks to improve their earnings and efficiency. Banks are therefore re-packaging their services and products in order to satisfy the needs of their customers and retain their market value. In the long run, the success and soundness of the banks and the entire sector depends in part on the achievement of operational efficiency (Central Bank of Kenya Annual Supervision Report, 2006).

In order to enhance efficiency, commercial banks in Kenya have continued to adopt technological innovation, in the form of improvements in communication and data processing. Such improvements are giving the institutions opportunities to raise productive efficiency. Much of the consolidation movement in Kenya is also being spurred by the hope of increasing efficiency. Examples of recent consolidations include the acquisition of First American Bank of Kenya by Commercial Bank of Africa and the East Africa Building Society merger with Akiba Bank. Equity Bank seems to have digested well the commercial banking operations of Industrial Development Bank (Market Intelligence Banking Survey, 2006). Organizations commonly view acquisitions as a way to spread the costs of backroom operations and product development over a large base. Acquisitions also allow the design of more efficient branch delivery systems by eliminating overlapping offices, personnel, and other duplicative resources and services (Spong et al., 1995). All these trends suggest that increased productivity must be a central objective of bankers and that utilizing resources in an efficient and effective manner is of paramount importance to banking success.

1.3. Statement of the Problem

A review of the literature on the nature of the relationship between managerial skill and technical efficiency provides contradicting results. Some studies support the existence of a positive relationship between the two variables (Jones, 1994; Kirkley et al., 1998; Gallacher, 2001; Ugur, 2004; and Bottazzi et al., 2006). However, other studies have revealed that no relationship exists between technical efficiency and managerial skill (Campell, 1991; Squires et al., 1998; Viswanathan et al., 2000). The contradicting results from these studies have formed the basis for the debate on the nature of the relationship between managerial skill and technical efficiency. This study contributed to the debate by analyzing commercial banks in Kenya. This was based on the formulation of the following research question: Does managerial skill contribute positively to the technical efficiency of commercial banks in Kenya?

In Kenya, two studies have covered the subject of efficiency among commercial banks. Sakina (2006) used Stochastic Econometric Cost Frontier Analysis to investigate the X-efficiency of 33 commercial banks in Kenya and found out that the level of X-efficiency in Kenya's commercial banks is 18%. Evidence was found that the average small bank is relatively more inefficient than the average large bank. Mutanu (2002) used the efficient cost frontier approach to investigate the efficiency scores of highly and lowly capitalized banks. Based on a sample of eight quoted commercial banks, it was found that the low capitalized banks were more efficient than highly capitalized banks.

Although previous studies have presented strong evidence that managerial skill is a major determinant of productivity and efficiency differences among firms, there have been a limited number of studies of this relationship from a financial institutions perspective. The previous studies characterizing managerial skill and technical efficiency have focused largely on the agricultural sector (Kirkley et al, 1998; Viswanathan et al, 2000; Gallacher, 2001) and the manufacturing sector (Jones, 1994; Ugur, 2004; and Bottazzi et al, 2006). This void in the literature is surprising given that the quality of functioning of the financial institutions can be expected to affect the functioning and productivity of all sectors of the economy. The present study partially sought to fill this void by extending the research to financial institutions, specifically banks.

From a Kenyan perspective, the paper sought to improve on previous research in the subject of efficiency by examining a different efficiency concept i.e. technical efficiency as opposed to X-efficiency investigated by Sakina (2006). In addition to determining the technical efficiency levels, the study went a step further to explain the extent to which managerial skills account for technical efficiency differences among banking firms in Kenya. The first hypothesis of the study was that there exists a positive relationship between managerial skill and technical efficiency. This hypothesis was based on the argument that managerial skill is one of the key inputs in the production process that significantly contributes to variations in technical efficiency of firms. For example, it has been shown that education shortens the time needed to adjust to changes in production options and/or price ratios (Gallacher, 2001). In addition, the positive contribution of management experience to efficiency appears to be consistent with the notion of learning by doing and the idea that workers become more productive as they learn both job-specific and industry-specific skills (Jones, 1994). The second hypothesis was that there exists substitution possibilities between managerial years of experience and technical efficiency. This hypothesis is derived from a common corporate recruitment practice supporting the view that a low level of experience could be compensated by higher level of education or vice versa. These hypotheses led to the formulation of the following questions: 1) Does managerial skill contribute positively to the technical efficiency of commercial banks in Kenya? and 2) Can the level of education be substituted for job experience?

1.4. Objectives of the Study

The objectives of this research paper were:

1. To examine the relationship between managerial skill and technical efficiency of commercial banks in Kenya; and
2. To investigate the substitution possibilities between a manager's level of education and years of experience in relation to technical efficiency.

1.5. Importance of the Study

1.5.1. Policy makers

An analysis of the determinants of productivity and efficiency of the banking systems is of relevance from a policy standpoint. As literature suggests, if banks become better-functioning entities, this is expected to be reflected in safety and soundness of the financial system, ultimately leading to increases in the rate of economic growth. More importantly, such an analysis is useful in enabling policy makers to identify the success or failure of policy initiatives or alternatively, highlight different strategies undertaken by banking firms which contribute to their successes.

1.5.2. Shareholders

Shareholders' decision making would be improved. This is because they would be able to assess whether those entrusted with the investment and management of their funds possess the right mix of managerial skills required to drive the firm's efficiency and profitability to the required levels.

1.5.3. Bank managers

Since a bank's profitability is directly driven by its operating efficiency, the bank managers can maximize shareholders wealth by ensuring that the banks attain maximum level of efficiency. The results of the study will provide a basis for the bank managers to evaluate how their levels of managerial skill may be impacting on their productivity and efficiency.

1.5.4. Human Resource Managers

The study will inform HR decision-making process, for example, the extent to which managerial skills such as experience and education contribute to efficiency improvement in organizations. The study will seek to determine whether recruitment of employees with a relatively higher level of education as well as experience puts banking firms on a superior technical efficiency path.

CHAPTER TWO

2.0. LITERATURE REVIEW

2.1. Introduction

This chapter presents a review of the literature related to the subject of the study as presented by various researchers, scholars, analysts and authors. The chapter is organized as follows: Section 2.2 describes the relationship between managerial skill characteristics and technical efficiency of firms while section 2.3 details how technical efficiency is measured. Section 2.4 presents the literature on measurement of managerial skills while section 2.5 outlines various definitions of bank inputs and outputs. Sections 2.6, 2.7 and 2.8 provide a review of financial institutions technical efficiency in developed countries, developing countries and in Kenya, respectively. Lastly, a summary of the chapter is presented in section 2.9.

Firm efficiency depends upon the way it produces outputs from inputs. Producing more outputs than competitors for the same amount of inputs or consuming fewer inputs for the same amount of output is a sign of relative efficiency (Gascon and Adenso-Diaz, 1997). According to Rossi and Ruzzier (2000), productive or overall efficiency is the firm's ability to produce an output at a minimum cost. To achieve that minimum cost the firm must produce the maximum output given its inputs (technical efficiency) and choose the appropriate input mix given the relative price of its inputs (allocative efficiency). Thus, productive efficiency requires both technical and allocative efficiency. Related to the decision of what kind of efficiency concept is going to be used is the type of relation that is going to be estimated: A production function or a cost function. A production function displays the produced quantities as a function of the inputs employed and gives information on technical efficiency only, whereas a cost function shows the total cost of production as a function of the level of output/s and the input prices. This allows for the estimation of the overall productive efficiency (Rossi and Ruzzier, 2000).

The study of bank efficiency is of vital importance from both a microeconomic and macroeconomic point of view. From the micro perspective, studies have shown that the most efficient banks have substantial cost and competitive advantages over those with average or below average efficiency (Spong et al., 1995). From the macro perspective, the efficiency of the banking industry influences the cost of financial intermediation and the financial markets, as banks constitute the spinal cord of financial markets (Rossi et al., 2005). Previous studies have examined efficiency and the associated effects on financial institutions' performance from several perspectives. Barr et al (1999) evaluated the productive efficiency and performance of US commercial banks for the period 1984-1988. Using Data Envelopment Analysis model, the authors found out that there is a noticeable tendency for efficiency to be positively correlated with interest income and negatively correlated with interest expense. The level of non-performing loans to total loans was found to be significant and negatively related to the efficiency scores of the banks.

Production in the banking industry involves the use of intermediate inputs, which take part in the production of final or semi-final outputs. For example, the use of deposit funds for the provision of loans or risk taking behaviour of some bankers by channeling deposits and other available funds into the stock market with the aim of making more money (Mlima and Hjalmarsson, 2002).

It has been observed that one of the major inputs in the production process is human capital. Human capital may contribute to growth in a way analogous to any other factor of production such as the amount of labour or physical capital. In this sense, the higher the level of human capital, ceteris paribus, the greater the production (Serrano et al., 2003). The term human capital covers a wide range of elements including: Knowledge accumulated via education, skills acquired by training, experience gained during employment, ideas and inventions developed in research, or even personal networks established in the workplace (Tang and Tseng, 2004).

The efficiency performance of banks has been discussed for years. It has been argued that if the financial institutions operate more efficiently, they might expect an improved profitability and a greater amount of intermediated funds (Hung, 2005). Bottazzi et al (2006) defined profitability as the outcome of a firm's effort to perform economically viable operations by keeping costs relatively low and setting price relatively high. The authors argue that efficiency in production is obviously of crucial help, especially in keeping costs low, and it is not surprising to observe that profitability increases with productivity.

2.2. The Relationship between Managerial Skill and Technical Efficiency of Firms

Campell (1991) used subjective rankings of managerial skill to assess whether or not skill might be an important determinant of productivity and efficiency in the Tasmanian rock lobster fishery. Campell concluded that skill and technology were not important in the inshore fishery but were very important for explaining efficiency and productivity differences in the offshore fishery. Jones (1994) surveyed 200 manufacturing firms in Ghana in 1993 and by utilizing Cobb-Douglas production function that allows the inclusion of variables affecting productivity, it was found that the more experienced workers are in the firm, the higher the level of productivity. Experience is an important managerial characteristic that affects efficiency. It has been argued in the learning by doing literature that management experience can lead to gains in efficiency through better organization and knowledge of the results of experimenting with alternative production techniques (Stefanou and Saxena, 1998). An increase in efficiency may therefore result from more management experience.

Squires et al (1998) found that participation in a skipper training program did not affect the technical efficiency and productivity of an onshore fishery and noted that perhaps in an offshore fishery, such a program might achieve more success. Kirkley et al (1998) used data on output and input levels for 10 Mid-Atlantic scallop dredge vessels operating between 1987 and 1990, to examine the relationship between technical efficiency of the vessels and characteristics of the skipper (fishing vessel captain). Based on an analysis of the stochastic production frontier, the researchers concluded that skipper skill is an important determinant of vessel productivity and technical efficiency. The better captains or those with better managerial skills tend to have higher earnings, production and technical efficiency. Although the authors were not able to determine threshold or essential levels of experience and education, substitution possibilities were found to exist between years of experience and education levels. Additional analysis of efficiency for two captains of the same background and experience revealed that additional characteristics need to be considered in the examination of skipper skill or the good-captain hypothesis.

Viswanathan et al (2000) studied technical efficiency and fishing skill in a developing country context by analyzing a trawler fishery in Malaysia. Using a stochastic frontier analysis, the researchers found that skipper characteristics other than ethnicity did not significantly affect technical efficiency. In light of this, there does not appear to be any readily observed characteristic pertaining to skipper skill to monitor. The dummy variable for Chinese skippers was found to be positive and statistically significant in the technical efficiency function. Similarly, the number of Malay skippers declined with increases in efficiency whereas the number of Chinese and other ethnic group skippers rises with increases in efficiency. The possible explanation behind differences in technical efficiency arising from ethnicity could be cultural. Viswanathan et al (2000) found that among the Chinese skippers, there was greater networking and sharing of information within the Chinese community as opposed to Malay fishers. The authors also observed that Chinese skippers were generally the first in the trawl and purse seine fisheries and Malays were comparative late comers. The ethnicity or race variable in the Kenyan banking sector may not be of relevance as most managers of the commercial banks are Kenyans.

Kebede (2001) used a stochastic frontier analysis in a study of farm household technical efficiency and conducted a survey of 105 farmers from three villages in western development region of Nepal. An analysis of the determinants of technical efficiency indicated that farming experience and education are both significant variables for improving technical efficiency. Kebede concluded that policies designed to educate people through proper agricultural extension services could have a great impact in increasing the level of efficiency and hence agricultural output. Kebede (2001) also found that female-headed households were more efficient demonstrating good management capacity. Female-headed households had better opportunities to carry out frequent follow up and supervision of the farm activities on their plot.

In a study of Master of Business Administration (MBA) program reputation in the US, Jeon et al (2003) pointed out that good management education should produce efficient managers. The researchers argued that efficient management of production requires optimization of resources and that decision making problems parallel production processes, where desirable outcomes of the decision play the role of outputs, while actions or conditions facilitating these outcomes play the role of inputs. Gallacher (2001) stated that efficient input and output combinations are better achieved by more educated managers. Studies on the relationship between technical efficiency and managerial skill have thus provided mixed results. Due to the apparent importance of human capital as revealed in firm efficiency literature, this paper characterizes managerial skill as one of the inputs to the production process and analyzes its contribution to technical efficiency in Kenyan commercial banks.

2.3. Measurement of Technical Efficiency

The idea of measuring a firm's performance with respect to a best practice frontier goes back at least to the 1950s. Koopmans (1951) defined technical efficiency as the capability of a firm to maximize output for a given inputs and argued that not all producers were technically efficient. This notion did not however offer any guidance concerning the degree of inefficiency. This issue was addressed by Farrell (1957) when he extended the work initiated by Koopmans and suggested measuring inefficiency as the observed deviation from a frontier isoquant.

Farrell (1957) defined the measure of technical efficiency as one minus the maximum equi-proportionate reduction in all inputs that still allows continued production of given outputs. A score of unity indicates technical efficiency because no equi-proportionate input reduction is feasible, and a score less than unity indicates technical inefficiency. Farrell pointed out that a technical efficiency measure could be obtained by using input and output quantity without introducing prices of these inputs and outputs.

Farrell (1957) was the first to measure productive efficiency empirically. Using data on US agriculture, he defined cost efficiency and decomposed it into its technical and allocative parts using linear programming techniques rather than econometric methods. His work using linear programming eventually led to the Data Envelopment Analysis and this method is widely used in the literature as a non-parametric non-stochastic technique. Farrell's work also led to the development of stochastic frontier analysis which involved estimating deterministic production frontiers, either by means of linear programming techniques or by modification of the least squares techniques.

Following Farrell's work on the measurement of technical efficiency, researchers in the area of firm efficiency argue that the production possibility set that economic theory associates with any productive activity is unknown (Hung, 2005). The subsequent research has therefore focused on the best way to identify the frontier of the production possibilities set. Two methodologies are now available: a) parametric methods; and b) non-parametric methods.

2.3.1. Parametric Methods

These methods focus on the difference or distance from the best-practice firm (efficient frontier), i.e. the distance reflects the inefficiency effect. For example, if costs are higher than those of the best-practice firm, then the firm is cost inefficient. The key characteristic of parametric techniques is that they a priori impose a rule (assumption) for how random errors can be separated from inefficiency (Kosak and Zajc, 2004).

2.3.1.1. Stochastic Frontier Approach (SFA)

The method is also referred to as the econometric frontier approach and specifies a functional form for the cost, profit, or production relationship among inputs, outputs, and environmental factors, and allows for random errors (Berger and Humphrey, 1997). SFA posits a composed error model where inefficiencies are assumed to follow an asymmetric distribution, usually the half-normal, while random errors 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 (Berger and Humphrey, 1997).

Under SFA, the estimated inefficiency for any firm is taken as the conditional mean or mode of the distribution of the inefficiency term, given the observation of the composed error term. The half-normal assumption for the distribution of inefficiencies is relatively inflexible and presumes that most firms are clustered near full efficiency (Berger and Humphrey, 1997). The stochastic frontier is specified with two error terms (Aigner et al., 1977). One term v_i, is assumed to be independently and identically distributed as $N(0,\delta_v^2)$ and captures exogenous shocks beyond the control of firms. A one sided, non-negative error term, u_i, is introduced to represent technical inefficiency. The truncated normal distribution $u \sim N(\mu,\delta_\mu^2)$ is considered. If $u_i = 0$, production lies on the stochastic frontier and is technically efficient. If $u_i > 0$, production lies below the frontier and is technically inefficient.

The stochastic production frontier permits output Y to be specified as a function of inputs X and a disturbance term:

$$Y_{it} = f(X_{1it}, X_{2it}............, X_{Nit}, A)e^{\varepsilon_{it}} \quad (1)$$

Where Y_i is the output of the i[th] firm, t is the year, X_{ji} is the j[th] input of firm i, A represents a vector of parameters, e is the exponential operator, and $\varepsilon_{it} = v_{it} - u_{it}$ is the disturbance term. The technical efficiency for the individual firm, $TE = e^{-u_i}$, or as shown by Coelli's (1994) formula laid out in Kirkley et al (1998), equals the algebraic representation of equation (2):

$$TE_i = \frac{E(Y_i^* \mid U_i, X_i)}{E(Y_i^* \mid U_i = 0, X_i)} \quad (2)$$

Where E is the expectations operator, Y_i* is the production of the i[th] firm, and equals Y_i when the dependent variable is in original units and Exp (Y_i) when production is in logs. The actual calculation of ***TE*** requires deriving the conditional expectation of u_{it} conditional on ε_{it} or $v_{it} - u_{it}$. Coelli derived this equation based on a computer program Frontier® Version 4.1 that enables the formulation of stochastic production and cost estimation functions. The estimates for all the parameters of the stochastic frontier production function and technical efficiency can be simultaneously obtained using the program Frontier® Version 4.1.

In general form, Kirkley et al (1998) show that the conditional expected value of u_{it} equals the algebraic representation of equation (3):

$$E(u_i \mid \varepsilon_i) = \frac{\delta\lambda}{(1+\lambda^2)}\left(\frac{\phi(u^*)}{\{1-\varphi(u^*)\}} - u^*\right) \quad (3)$$

Where $u^* = \frac{\varepsilon\lambda}{\delta} + \frac{u}{\delta^2}$, $\lambda = \frac{\delta_u}{\delta_v}$, $\delta = (\delta_v^2 + \delta_u^2)^{1/2}$;

ϕ and φ are the standard and cumulative normal density functions respectively. The value and statistical significance of u_{it} is important in determining the existence of a stochastic frontier: Rejection of the null hypothesis, H_0: $\lambda = 0$, implies the existence of a stochastic frontier. If the value of $\lambda > 1$, production may be said to be dominated by technical inefficiency. Coelli (1995) as stated in Kirkley et al (1998) recommended that the preferred test should be a one-sided likelihood ratio test of $\gamma = \frac{\delta_u^2}{\delta_v^2 + \delta_u^2}$.

2.3.1.2. The Distribution-Free Approach (DFA)

According to Berger and Humphrey (1997), this method specifies a functional form for the frontier, but separates the inefficiencies from random errors in a different way. Unlike SFA, DFA makes no strong assumptions regarding the specific distributions of the inefficiencies or random errors. Instead, the method assumes that the efficiency of each firm is stable over time, whereas random error tends to average out to zero over time. The estimate of inefficiency for each firm in a panel data set is then determined as the difference between its average residual and the average residual of the firm on the frontier, with some truncation performed to account for the failure of the random error to average out to zero fully. With DFA, inefficiencies can follow almost any distribution, even one that is fairly close to symmetric, as long as the inefficiencies are non-negative.

Berger (1993) referred to this method as "distribution free" since no specific distribution for the inefficiency component u_i is chosen. However, Berger assumed that managerial inefficiency is persistent and constant over time and thus in a panel data context it is expected that $u_{ti} = u_i$. On the other hand, the random error v_{ti} will cancel out over the years. DFA involves estimation of the panel data model represented by equation (4):

$$\ln TC_{it} = \ln C_t(Y_{it}, w_{it}) + \ln u_i + \ln v_{it} \quad \text{.......................................} (4)$$

Where TC is the total costs of firm i in period t, C_t is the industry cost function in period t, Y_{it} is the output vector and w_{it} is a vector of input prices and *ln* represents the natural logarithm operator. Zellner's Seemingly Unrelated Regression (SUR) estimator is used to estimate equation (4) with composite disturbance $\varepsilon_{it} = \ln u_i + \ln v_{it}$. The average of the regression residuals per cross-sectional unit i is then computed to estimate $\ln u_i$.

The following conditions (equation 5) must hold to successfully apply DFA (Berger, 1993):

$$u_i \in [1, \infty),\ E[\ln v_{ti}] = 0 \quad \text{..} (5)$$

and the usual orthogonality condition must be satisfied. If the cost function contains a constant then no unbiased estimate of the inefficiency component $\ln u_i$ can be obtained. However, the relative X-efficiency measure represented by equation (6) is still accurate in this case.

$$XEFF_i = \exp(\ln u^*_{min} - \ln u^*_i) = \frac{u^*_{min}}{u^*_i} \quad (6)$$

$\ln u^*_{min}$ is the minimum of $\ln u^*_i$ where the latter is the estimate of $\ln u_i$. X-efficiency refers to a measure of managerial/operational efficiency and can be contrasted with scope or scale efficiencies. The measure ***XEFF*$_i$** is equal to 1 for an efficient firm and takes lower values otherwise (Wagenvoort and Schure, 1999).

2.3.1.3. The Thick Frontier Approach (TFA)

This method specifies a functional form and assumes that deviations from predicted performance values within the highest and lowest performance quartiles of observations (stratified by size class) represent random error, while deviations in predicted performance between the highest and lowest quartiles represent inefficiencies (Berger and Humphrey, 1997). This approach imposes no distributional assumptions on either inefficiency or random error except to assume that inefficiencies differ between the highest and lowest quartiles and that random error exists within these quartiles (Berger and Humphrey, 1997). TFA itself does not provide exact point estimates of efficiency for individual firms but is intended instead to provide an estimate of the general level of overall efficiency. The TFA reduces the effect of extreme points in the data, as can DFA when the extreme average residuals are truncated.

While formulating a recursive thick frontier approach to estimating production efficiency, Wagenvoort and Schure (2005), considered *n* cross-sectional units ("firms") indexed by *i* = 1,..,*n* , and T time-periods indexed by t = 1,..,T , so that the full sample contains *n*T observations. They further let the set of firms N = {1,......,n} to be comprised of two subsets E and H , the sets of technically efficient and technically inefficient firms, respectively. They postulated the linear panel data model represented by equation (7):

$$y_{ti} = c_i + \alpha + x_{ti}\beta + \varepsilon_{ti}, \text{ where } c_i = 0, i \in E \quad (7)$$

This model describes the relationship between output y_{ti} and a k-dimensional input bundle x_{ti} for technically efficient firms only. As usual, α is an unknown constant, β is a k dimensional column vector of unknown parameters and ε_{ti} is the error term of firm *i* in period t. The error term is random and does not reflect technical inefficiency. For inefficient firms the relationship between output and inputs remains unknown but, on average, inefficient firms are located below the production frontier represented by equation (8):

$$\frac{1}{T}\sum_{t=1}^{T}(y_{ti} - x_{ti}\beta) = c_i < 0; i \in H \quad \text{.......} (8)$$

2.3.2. Nonparametric Methods

These methods rely on linear programming to obtain a benchmark of optimal cost-and production-factor combinations (Fiorentino et al., 2006).

2.3.2.1. Data Envelopment Analysis (DEA)

DEA is a linear programming technique where the set of best-practice or frontier observations are those for which no other decision making unit or linear combination of units has as much or more of every output (given inputs) or as little or less of every input (given outputs) (Berger and Humphrey, 1997). 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. As such, DEA does not require the explicit specification of the form of the underlying production relationship.

DEA was originally intended for use in public sector and not-for-profit settings where typical economic behavioral objectives, such as cost minimization or profit maximization, may not apply. Thus, DEA could be used even when conventional cost and profit functions that depend on optimizing reactions to prices could not be justified. From the perspective of input requirements to produce a given output, DEA presumes that linear substitution is possible between observed input combinations on an isoquant (which is generated from the observations in piecewise linear forms) (Berger and Humphrey, 1997).

DEA generalizes the Farrell (1957) single-output/single-input technical efficiency measure to the multiple-output/multiple-input case. The method optimizes on each individual observation with the objective of calculating a discrete piecewise linear frontier determined by the set of Pareto-efficient decision making units (DMUs). Using this frontier, DEA computes a maximal performance measure for each DMU relative to all other DMUs. The only restriction is that each DMU lies on the efficient (external) frontier or enveloped within the frontier. The DMUs that lie on the frontier are the best practice institutions and retain a value of one; those enveloped by the external surface are scaled against a convex combination of the DMUs on the frontier facet closest to it and have values somewhere between 0 and 1.

Several different mathematical programming DEA models have been proposed in the literature (Charnes et al., 1994). Essentially, these various models each seek to establish which of *n* DMUs determine the *envelopment surface*, or best practice efficiency frontier. The geometry of this envelopment surface is prescribed by the specific DEA model employed. To guide this discussion, first assume that there are *n* banks to be evaluated. Each bank utilizes varying amounts of *m* different inputs to produce *s* different outputs. Specifically, bank *j* uses amounts $X_j = (x_{ij})$ of inputs $i = 1,..., m$ and produces amounts $Y_j = (y_{rj})$ of outputs $r = 1,...,s$. It is further assumed that the observed values are positive, so that $x_{ij} > 0$ and $y_{rj} > 0$. The ***s x n*** matrix of output measures is denoted by Y and the ***m x n*** matrix of input measures is denoted by X.

Charnes et al (1978), considered an input-oriented DEA model to reduce the multiple-input, multiple-output situation for each bank to a scalar measure of efficiency. The ratio form of their model was as presented in equation (9) below:

$$EFF_k = \left(\frac{\sum u_{rk} y_{rk}}{\sum v_{ik} x_{ik}} \right)$$

$$\textit{Subject to: } \left(\frac{\sum u_{rk} y_{rj}}{\sum v_{ik} x_{ij}} \right) \leq 1; j = 1, \ldots\ldots\ldots\ldots, n$$

$$\sum u_{rk} > \varepsilon; r = 1, \ldots\ldots\ldots\ldots, s \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

$$\sum v_{ik} > \varepsilon; i = 1, \ldots\ldots\ldots\ldots, m$$

$$\varepsilon > 0$$

This model evaluates the relative efficiency of bank *k* based on the performance of $j=1,...,n$ banks in the population, where the y_{rj} and x_{ij} variables in the model represent the observed amounts of the r^{th} output and the i^{th} input, respectively, of the j^{th} bank. Thus, the multiple-input/multiple-output ratio being maximized in the objective function provides a measure of relative productive efficiency that is a function of the multipliers. The multipliers are the unit weights for each of the outputs and inputs, designated by u_{rk} and v_{ik}, respectively. These are the decision variables in the model, so that the objective function seeks to maximize the ratio of the total weighted output of bank *k* divided by its total weighted input. For the constrained multiplier model, these weights must be within an established range specified by the analyst. The $\varepsilon > 0$ in the model represents a non-Archimedean constant that is smaller than any positive-valued real number.

Each firm's maximum efficiency score will be less than or equal to 1 by virtue of the constraints. A value of $EFF_k = 1$ represents full efficiency and it follows that firm *k* is a "best practice" firm. When $EFF_k < 1$, then some level of inefficiency is present. These efficiency values provide not only a way to benchmark productive efficiency, but also make it possible to identify the sources and amounts of inefficiency in each input and output for every unit being evaluated (Bowlin, 1998). The fractional linear programming problem presented by equation (9) can be transformed into an equivalent ordinary linear programming problem following Charnes and Cooper (1962). The results of this transformation, which are described in Charnes et al (1978) result in the linear programming problem of equation (10):

$$
\begin{aligned}
&\text{Max } EFF_k = \sum u_{rk} y_{rk} \\
&\quad \textit{Subject to: } \sum u_{rk} y_{rj} - \sum v_{ik} x_{ij} \le 0 \\
&\qquad \sum v_{ik} x_{ik} = 0 \qquad \qquad \text{.. (10)} \\
&\qquad - u_{rk} \le -\varepsilon \\
&\qquad - v_{ik} \le -\varepsilon
\end{aligned}
$$

This formulation, while equivalent to the fractional problem presented earlier, can be interpreted as maximizing the sum of the weighted outputs (virtual output) for firm *k* subject to unit virtual input for firm *k* while maintaining the condition that virtual output cannot exceed virtual input for any firm. Charnes et al (1985) noted that this implies the conditions for Pareto optimality. That is, further increases in this value can be attained only if some of the x_{ij} inputs are increased or if some of the y_{rj} outputs are decreased.

2.3.2.2. The Free Disposal Hull Approach (FDH)

This is a special case of the DEA model where the points on lines connecting the DEA vertices are not included in the frontier. Instead, the FDH production possibilities set is composed only of the DEA vertices and the free disposal hull points interior to these vertices (Berger and Humphrey, 1997). FDH presumes that no substitution is possible. Consequently, the isoquant looks like a step function formed by the intersection of lines drawn from observed (local) Leontief-type input combinations distribution of inefficiencies across observations except that undominated observations are 100% efficient (Berger and Humphrey, 1997).

According to Härdle and Jeong (2005), in non-parametric hull methods, the production set Ψ and the production function *g* is usually unknown, but a sample of production units or decision making units (DMU's) is available instead (See Equation 11 below):

$$\chi = (x_i, y_i), i = 1, \ldots, n \qquad (11)$$

The aim of productivity analysis is to estimate Ψ or *g* from the data χ. Here consideration is only given to the deterministic frontier model, i.e. no noise in the observations and hence $\chi \subset \Psi$ with probability of 1. For example, when q = 1 the structure of χ can be expressed as in equation (12):

$$y_i = g(x_i) - u_i, i = 1, \ldots, n$$

or .... (12)

$$y_i = g(x_i) v_i; i = 1, \ldots, n$$

Where g is the frontier function, and $u_i \geq 0$ and $v_i \leq 1$ are the random terms for inefficiency of the observed pair (x_i, y_i) for *i* = 1... *n*

The Free Disposal Hull (FDH) of the observed sample χ is defined as the smallest free disposable set containing χ such that the specification of equation (13) holds (Härdle and Jeong, 2005):

$$\hat{\Psi}_{FDH} = (x, y) \in \Re_+^p \times \Re_+^q \mid x \geq x_i, y \leq y_i, i = 1,........, n \quad .... (13)$$

FDH estimates of efficiency scores can then be obtained for a given input-output level (x_0, y_0) by substituting $\hat{\Psi}_{DEA}$ (Equation 14) with $\hat{\Psi}_{FDH}$ in the definition of DEA efficiency scores.

$$\hat{\Psi}_{DEA} = (x, y) \in \Re_+^p \times \Re_+^q \mid x \geq \sum_{i=1}^{n} \gamma_i x_i; y \leq \sum_{i=1}^{n} \gamma_i y_i$$

For some $(\gamma_1, ..., \gamma_n)$ such that

$$\sum_{i=1}^{n} \gamma_i = 1, \gamma_i \geq 0; \forall i = 1, ..., n \quad .... (14)$$

Park et al (1999) showed that the limit distribution of the FDH estimator in a multivariate setup is a Weibull distribution depending on the slope of the frontier and the density at the boundary.

There appears really no consensus on the preferred method for determining the best-practice frontier against which relative efficiencies are measured (Berger and Humphrey, 1997). However, it has been argued that stochastic frontier analysis has several advantages over other methods of estimating the frontier. The most important advantage in comparison with deterministic methods is that the stochastic approach takes into account the fact that deviation from the frontier could be due to noise in the data or mis-specification errors and not necessarily to inefficiencies (Limam, 2001). While the main shortcoming of the SFA is the a priori distributional assumption of random errors (Kosak and Zajc, 2004), Worthington and Hurley (2002) point out that one obvious problem with DEA is that in contrast to the econometric approaches to efficiency measurement, it is both non-parametric and non-stochastic. Thus, no accommodation is made for the types of bias resulting from environmental heterogeneity, external shocks, measurement error, and omitted variables. Consequently, the entire deviation from the frontier is assessed as being the result of inefficiency. This may lead to either an under or over-statement of the level of inefficiency.

2.4. Measurement of Managerial Skills

In a study characterizing managerial skill and technical efficiency in a fishery, Kirkley et al (1998) measured primary captain characteristics from a survey of the firms sampled. Information obtained included a fishing captain's race, age, years of formal education and years of experience. Age was not included in the data analysis as it was found to be highly collinear with years of experience. According to Kirkley et al (1998), motivation is likely to be a critical characteristic of skill. However, determining a measure of motivation is likely to be extremely complicated. One possible measure would be the value of debt and assets, for example, many of the best captains had substantial investments and because they intend to keep their investments or possessions, they will work extremely hard (Kirkley et al., 1998).

Mathijis and Vranken (2001) argue that human capital matters not only through age and education but also through gender. The authors surveyed the characteristics of firm managers in Bulgaria and Hungary and found that those with a high proportion of women were more efficient. According to Limam (2001), continuous development of human resources through training is necessary in order to keep up with the productivity improving, cost-saving and rapid changes in techniques, financial instruments and technological developments in banking. In addition to education level relating to academic qualifications, Van Passel et al (2005) point out that there are other indicators of the level of education, for example, extra training, attending workshops, and reading specialist publications.

2.5. Definition of Bank Inputs and Outputs

Although much attention has been focused on estimating an efficient frontier and measuring the average differences between banks, the major shortcoming of the studies is their failure to define inputs and outputs (Mlima and Hjalmarsson, 2002). This unresolved question has handicapped the research effort when comparing results from different studies. Differences in efficiency estimates are not only blamed on input and output definitions, but also depend on variation in data sources, efficiency concepts and the measurement method used.

For purposes of defining the input-output relationship in financial institutions behaviour, two main approaches have been developed (Leong et al., 2002). First is the production or service provision approach. In this approach, financial institutions are viewed as producers of deposit and loan accounts, defining output as the number of such accounts or transactions (Leong et al., 2002). The second approach is the intermediation approach where banks in their role as financial intermediaries use capital, labor, deposits and other borrowed funds to produce earning assets (Limam, 2001).

According to Leong et al (2002), the principal criticism of the production approach lies in its exclusion of interest costs and an overemphasis on the role of staff costs and rental costs in defining inputs. This appears to neglect the banking sector's traditional function as distributors and perhaps this is why the intermediation approach seems to have dominated empirical research in this area (Leong et al., 2002). The intermediation approach is more inclusive of the total banking cost as it does not exclude interest expenses on deposits and other liabilities. In addition, this approach approximately categorises deposits as inputs and has an edge over other definitions for data quality considerations (Limam, 2001).

Interest income and non-interest income have been widely recognized as outputs of commercial banks (Yao and Han, 2007). However, a fundamental difficulty arises in the treatment of bank deposits (Leong et al., 2002). Considerable debate in the literature surrounds the input-output status of deposits. Traditionally, deposits are regarded as the main ingredients for loan production and the acquisition of other earning assets. On the other hand, high value-added deposit products like integrated savings and checking accounts, investment trusts and foreign currency deposit accounts tend to highlight the output characteristics of deposits (Leong et al., 2002). Outputs are the profits and revenues generated after the provision of bank services (Mlima and Hjalmarsson, 2002).

In the bank production process, risk weighted assets have been considered as better output proxy than just loans due to several reasons. Firstly, risk weighted assets include off balance sheet whose effect on relative efficiency is likely to be significant given the potential economies of scope in the forward books (Leong et al., 2002). Secondly, since risk weighted assets encompass the entire spectrum of a bank's earning assets (e.g. loans, securities, investments and off balance sheet items). Risk weighted assets therefore offer a more realistic abstraction of the bank's production function. Thirdly, using risk weighted assets as an output proxy avoids the problem of variations in product prices across banks (Leong et al., 2002).

During the process of transforming deposits into loans, banks will inevitably incur some impaired loans (Yao and Han, 2007). Impaired loans are the cost the banks have to bear and can be dealt with as a resource to gain interest yields from gross loans (Yao and Han, 2007).

2.6. Technical Efficiency of Financial Institutions in Developed Countries

Although the body of literature on bank efficiency is substantial, it is heavily skewed towards studies of US banks, followed by European banks in a distant second place. There are only few studies on bank efficiency in less developed countries (Kosak and Zajc, 2004). Rangan et al (1988) used a non-parametric frontier approach to measure the technical efficiency of a sample of U.S. banks. The results indicated that the banks could have produced the same level of output with only 70% of the inputs actually used. In addition, most of this inefficiency is due to pure technical inefficiency (wasting inputs) rather than scale inefficiency (operating at non-constant returns to scale). Regression analysis indicated that the technical efficiency of the banks is positively related to size, negatively related to product diversity, and not at all related to the extent to which branch banking is allowed. Marsh et al (2003) used a Bayesian variation of a stochastic frontier model to estimate technical efficiency on commercial banks regulated by the US Federal Reserve System for the year 1990 to 2000. The results indicated that technical inefficiency was decreasing over time and that larger banks are more efficient than smaller banks. Podpiera and Podpiera (2005) carried out a cost efficiency analysis of all Czech commercial banks for the period 1994-2002 to investigate the correlation between cost inefficient management and bank failure. The researchers showed that the risk of bank failure increases with cost inefficient management.

Brissimis et al (2006) specified an empirical framework for measuring both the technical and allocative efficiency among a large panel of European banks over the period 1996 to 2003. The results indicated that both technical and allocative components of efficiency contribute significantly to overall efficiency. The most technically efficient banking sectors were found to be those of Austria, Germany and the United Kingdom. The same countries also recorded lower allocative inefficiency scores. The results revealed that Irish banks have become more efficient possibly due to significant improvement in their operating expenses management coupled with strong economic growth for the region.

Zeng (2006) examined technical efficiency in 100 mega European bank mergers and acquisitions (M&A) events during 1996-2003. Evidence was found that banks with higher technical efficiency levels tend to engage in M&A activities more frequently, and this may help them to improve their technical efficiency in the short term. Meanwhile banks with medium technical efficiency levels are mostly targets for M&A activities. Banks with low technical efficiency will have the lowest possibility to be involved in M&A events, and their technical efficiency is more volatile. Overall, M&A activities seemed to be driven by differences in technical efficiency.

Yao and Han (2007) used a parametric approach to analyse the efficiency of 15 large commercial banks in China during the period 1998-2005. The results indicated that Chinese commercial banks do not have substantial differences in technical efficiency. Although the average scores of efficiency were high, the aggregate gaps in technical efficiency were found to be low at only 15%. The results also showed that the big four banks were able to improve total factor productivity mainly through improving technical efficiency, instead of technological progress.

2.7. Technical Efficiency of Financial Institutions in Developing Countries

Cook et al (2000) used various DEA models and panel data covering the period 1992-1997 on Tunisian banks to investigate the impact of liberalization on the Tunisian banking industry. The authors found that private banks, in general, are more efficient than public sector banks. Private banks seem to owe this superior performance to the fact that they carry fewer problem loans, record higher foreign equity participation, and are generally smaller. The analysis also revealed that the reforms have been less successful in closing the efficiency gap between public, domestically owned and private, foreign owned banks.

Limam (2001) used a stochastic cost frontier approach to estimate technical efficiency of Kuwait Banks. Using earning assets as the output and fixed assets, labour and financial capital as inputs, he found that except for the largest two banks, there was large room for improving technical efficiency of most of the banks. He showed that larger bank size, higher share of equity capital in assets and greater profitability are associated with better efficiency. In light of this, it is argued that the only way for banks to better meet the challenge of increased competitive pressure from more powerful banks and future foreign entry would be to increase technical efficiency. Limam (2001) also found that banks produce earning assets at constant returns to scale and hence have less to gain from increasing scale of production notably, through merging with other banks, than from reducing their technical inefficiency. Kirkpatrick et al (2002) used a translog stochastic cost and profit frontier approach to measure the degree of X-efficiency in a panel of 89 banks in sub-Saharan Africa (including Kenya), covering the period 1992-1999. Evidence was found that deterioration of asset quality, specifically the bad loans syndrome, contributes to cost X-inefficiency as well as profit X-inefficiency. It was also found that high capital ratios increase costs and reduce profits, suggesting that bank managers in Sub-Saharan Africa tend to maintain high capital ratios, relative to an optimal level, and thus erode the banks' cost and profit efficiency.

Sathye (2003) measured the technical efficiency of banks for the period 1997-1998 in India. The measurement of efficiency was done using Data Envelopment Analysis. The efficiency of private sector commercial banks as a group was found to be paradoxically lower than that of public sector banks and foreign banks. Oberholzer and Van Der Westhuizen (2004) measured the technical efficiency and profitability of ten regional offices of one of South Africa's larger banks and showed that there is no significant relationship between technical efficiency and the conventional profitability and efficiency measurements. One of the regions had the second highest technical efficiency but what seemed contradictory is that it was also the most unprofitable region. The conclusion was that it is not necessarily a fact that a region that utilizes its inputs efficiently (technical efficiency) will have a high profit or conventional efficiency ratios.

2.8. Technical Efficiency of Commercial Banks in Kenya

In a study aimed at explaining the factors determining interest rate spread for Kenya's banking sector, Ngugi (2001) observed that during the post-liberalization period (mid 1991), interest rate spreads in the sector were expected to narrow to reflect efficiency gains and reduced transaction costs following the removal of distortionary policies and strengthening of the institutional set-up. However, the experience indicates a widening spread in the post-liberalization period because of yet-to-be gained efficiency and high intermediation costs (Ngugi, 2001). Variations in the interest spread are attributable to bank efforts to maintain threatened profit margins. For example, banks that faced increasing credit risk as the proportion of non-performing loans went up responded by charging a high-risk premium on the lending rate (Ngugi, 2001).

Fiscal policy actions saw an increase in Treasury bill rates and high inflationary pressure that called for tightening of monetary policy. As a result, banks increased their lending rates but were reluctant to reduce the lending rate when the Treasury bill rate came down because of the declining income from loans. The banks responded by reducing the deposit rate, thus maintaining a wider margin as they left the lending rate at a higher level. Thus, there was an asymmetric response of lending rates to Treasury bill rates. High implicit costs were realized with the tight monetary policy, which was pursued with increased liquidity and cash ratio requirements. Consequently, banks kept a wide interest rate spread even when inflationary pressure came down (Ngugi, 2001).

In Kenya, it has been found that low productivity banks find it costly to evaluate and monitor small-value loans (Blattman et al., 2004). The lack of public credit institutions (such as a rating agency) makes the evaluation of firm credibility very costly for banks, and dissuades them from lending to small enterprises. Moreover, deficiencies in the legal system hinder the enforcement of contracts, especially debt, and result in relatively high collateral requirements that small firms find slightly more difficult to meet. As a result, small firms (who are less likely to possess high-value collateral) face dramatically higher costs of lending than larger ones thus making them more inefficient. Smaller firms have been generally observed to report lower use of credit instruments. Such firms are also less likely to apply for a loan because of cost and rejection fear, and are more likely to feel credit constrained (Blattman et al., 2004).

Transactions costs in the Kenyan banking sector are relatively high, and the supply of credit is limited by the legal and institutional structure of the financial sector. High interest rate spreads are driven by low bank productivity, the presence of many small banks, the difficulty of collecting debt contracts, and the relatively high level of non-performing loans. These problems in turn have been traced largely to an inadequate legal and institutional structure, barriers to sector consolidation, and politically motivated interventions (Blattman et al., 2004).

According to Cihak and Podpiera (2005) the overhead costs in East African banks i.e. Kenya, Uganda and Tanzania are by far the most important component of the interest rate spreads, accounting for about 6–8¾ percentage points of the spread. The high overhead costs are related to the low productivity and overstaffing of East African banks compared to banks in other sub-Saharan African countries and other emerging market countries. East African banks seem to be overstaffed and their employees less productive (Cihak and Podpiera, 2005). The banks have more than three times as many employees for a given amount of assets, loans and deposits than other banks in emerging market countries. In Kenya, state-owned banks are significantly overstaffed and less productive compared to private domestic banks, which are in turn overstaffed and less productive than foreign-owned banks. This indicates a significant potential for productivity improvements (Cihak and Podpiera, 2005).

Efforts to increase productivity and efficiency in the commercial banking sector in Kenya are evident from the strategies the sector continues to undertake. The very few banks that have not yet completed the decentralization of branches in order to offer 'branchless banking' are close to doing so. No bank worth its salt now wants to be caught without an ATM network, and VISA or MasterCard branded cards. Offering Internet banking is a done thing and does not make news any more. SMS banking is also routine. Banks are naturally asking the question of what next (Market Intelligence Banking Survey, 2006). It has been shown that the very best banks in Kenya have the best balance in terms of assets size, asset quality, profitability and efficiency (Market Intelligence Banking Survey 2006). Banking is increasingly becoming a game of scale, size and scope so the bigger banks over the years have dominated the upper end of the rankings (Market Intelligence Banking Survey 2006).

According to Mutanu (2002), low capitalized banks in Kenya are more efficient than highly capitalized banks. The low capitalized banks by taking more risks increase their efficiency while the highly capitalized banks feel that taking more risks would be too much risk for their capital and this increases their inefficiency (Mutanu, 2002). The large banks are therefore not utilizing their resources well (Mutanu, 2002). Sakina (2006) found that the level of X-efficiency was increasing with time which means that the banks are operating further from the efficient cost frontier than before.

2.9. Summary

A review of the literature on the nature of the relationship between managerial skill and technical efficiency provides results that support the existence of a positive relationship between the two variables (Jones, 1994; Kirkley et al., 1998; Gallacher, 2001; Ugur, 2004; and Bottazzi et al., 2006). However, other studies have revealed that no relationship exists between technical efficiency and managerial skill (Campell, 1991; Squires et al., 1998; Viswanathan et al., 2000). This study sought to extend studies of technical efficiency in developing countries by measuring the contribution of human capital elements to technical efficiency among Kenyan commercial banks. The first hypothesis of this study envisages a positive relationship between managerial skill and technical efficiency. This hypothesis was based on the arguments in the literature that managerial skill is one of the key inputs in the production process that appears to significantly contribute to variations in technical efficiency of firms. The second hypothesis was that there exists substitution possibilities between managerial years of experience and technical efficiency. This hypothesis is mainly derived from a common corporate recruitment practice suggesting that a low level of experience could be compensated by higher level of education or vice versa.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1. Introduction

This chapter presents the research methodology used in this study. Section 3.2 and 3.3 describe the population and sample respectively. Section 3.4 describes the data while section 3.5 presents the conceptual and analytical models. Section 3.6 presents the diagnostic tests applied.

3.2. The Population

As at October 2007 when the data for this study was collected, the commercial banking sector was comprised of 42 banks (see Appendix II). These banks formed the population of the study.

3.3. The Sample

The sample was made up of 39 commercial banks for which data was available for all the years covered by the study period (2002-2006). Among the three excluded banks, two had been in operation for less than three years while one had been put under statutory management.

3.4. Data

The data was made up of both secondary and primary data. Secondary data was obtained from the audited financial statements of the commercial banks. The financial statements were sourced from the Bank Supervision Department of the Central Bank of Kenya (CBK). Data on labour which refers to bank personnel and the management expertise necessary for the provision of bank services was captured in the form of staff expenses (***SE***), while data on borrowed funds and deposits (***FDE***) was the funds collected on the liabilities side of the balance sheet comprising customer deposits and borrowed funds such as lines of credit.

Investment in physical capital was captured as fixed assets (***FA***) on the asset side of the balance sheet as measured by investments in offices, branches and hardware (Kosak and Zajc, 2004). Additional input data captured included interest expenses (***IE***) and operating expenses (***OE***). The output variables were captured as risk weighted assets (***RWA***) and (***TI***). Data on

RWA was obtained from the notes to the banks' financial statements while total income was computed as the sum of interest income and other income.

On the other hand, primary data for bank managers was obtained through a survey of the human resource managers of the banks using a questionnaire. The human resource managers were targeted as the respondents because they are the custodians of human resource records for their organisations. Maximum effort was made to get the managers or their representatives to complete the questionnaires. This included day to day follow up and revisits to the respondents where cases of incomplete questionnaires were detected. The questionnaire contained closed questions, where the respondent's answers to the questions were selected from a given set of possible responses. The data obtained for the bank managers included: years of experience (***EX***), level of education (***ED***), frequency of training (***TR***) and gender (***GE***). The data for each of these variables was obtained for each financial year under study. Experience was measured by an index of years of managerial experience. Education level was determined by asking how many managers possessed a given level of academic qualifications, for example, doctor of philosophy, masters' degree, bachelors' degree, diploma or certificate. Data on the gender of the managers was obtained by asking how many managers in a particular year were female or male, thus making it possible to determine the proportion of female managers in each bank. Due to the difficulties in measuring manager motivation requiring data on the managers' debt, assets or wealth, we restricted our characterization of managerial skill to the relationship between technical efficiency and primary manager attributes.

3.5. Research Model

3.5.1. Conceptual Model

The conceptual model defines the relationship between the dependent variable and the independent variables. The dependent variable is technical efficiency while the independent variables are the managerial skills characteristics namely: Level of education, years of experience and frequency of training.

The expected signs of the education and experience variables in the model should be positive (Kebede, 2001). The frequency of training variable should also have a positive sign (Limam, 2001). In addition to the managerial skill characteristics, four dummy variables were included. The first dummy variable ***GE*** relates to the proportion of female managers which was included to test the suggestion that the higher the proportion of female managers the higher the technical efficiency. The expected sign of this variable should be positive (Mathijis and Vranken, 2001). The inclusion of total assets (***ASSETS***) as the second dummy variable is intended to test the validity of the claim frequently found in the literature that larger banks tend to be more efficient (Fedhi and Duygun, 2000; and Limam, 2001). It is therefore expected that the sign of the total assets variable is positive. The third dummy variable is the degree of capitalization measured by total value of capital (***CAP***) whose expected sign is negative (Mutanu, 2002). The fourth dummy variable was the level of profitability measured by the value of profit before tax whose expected sign should be positive (Limam, 2001).

Equation (15) below presents the conceptual model for this relationship.

$$TE = f(ED, EX, TR, GE, ASSETS, CAP, PBT) \ldots\ldots\ldots\ldots\ldots\ldots \quad (15)$$

Where:

TE = Technical efficiency

ED = Managerial level of education

EX = Years of managerial experience

TR = Frequency of managerial training programs and job related conferences

GE = The proportion of female managers to total number of managers

ASSETS = Total value of assets

CAP = Total capital

PBT = Profit before tax

3.5.2. The Analytical Models

A multiple regression model of technical efficiency versus manager characteristics was applied to examine the relationship between the variables. The translog flexible functional form was chosen for the stochastic frontier (Kirkley et al., 1998). This form permits a limited determination of the underlying technology and accommodates the inclusion of a one sided error term to allow estimation of technical efficiency for each observation. In order to determine the technical efficiency of each bank in a given financial year, a balance sheet oriented production function referred to as Model A was formulated where the output variable, ***RWA***, is expressed as a function of ***FDE***, ***SE***, and ***FA***, as follows:

$$Ln(RWA)_{it} = \beta_0 + \beta_1 Ln(FDE)_{it} + \beta_2 Ln(SE)_{it} + \beta_3 Ln(FA)_{it} + \beta_{11}(Ln[FDE]_{it})^2$$
$$+ \beta_{22}(Ln[SE]_{it})^2 + \beta_{33}(Ln[FA]_{it})^2 + \beta_{12}\{[Ln(FDE)_{it}][Ln(SE)_{it}]\} +$$
$$\beta_{13}\{[Ln(FDE)_{it}][Ln(FA)_{it}]\} + \beta_{14}\{[Ln(SE)_{it}][Ln(FA)_{it}]\} + \varepsilon_{it} \quad \text{.....(16)}$$

Where *i* indexed individual banks and *t* indexed financial years. The dependent variable is risk weighted assets (***RWA***$_{it}$) by the i^{th} bank on the t^{th} financial year, while the independent variables are borrowed funds and deposits (***FDE***$_{it}$), staff expenses (***SE***$_{it}$), and fixed assets (***FA***$_{it}$). $\varepsilon_{it} = v_{it} - u_{it}$ is the disturbance term. According to Leong et al (2002), technical efficiency scores may vary due to the variables used in the definition of a production function and therefore, for comparison purposes, the study included Model B based on income and expense items whose relationship is expressed as follows:

$$Ln(TI)_{it} = \beta_0 + \beta_1 Ln(IE)_{it} + \beta_2 Ln(OE)_{it} + \beta_{11}\{Ln(IE)_{it}\}^2 + \beta_{22}\{Ln(OE)_{it}\}^2 +$$
$$\beta_{12}\{[Ln(IE)_{it}][Ln(OE)_{it}]\} + \varepsilon_{it} \quad \text{.....(17)}$$

Where *i* indexed individual banks and *t* indexed the financial years. The dependent variable is total income (***TI***$_{it}$) by the i^{th} bank on the t^{th} financial year, while the independent variables are interest expenses (***IE***$_{it}$) and operating expenses (***OE***$_{it}$). $\varepsilon_{it} = v_{it} - u_{it}$ is the disturbance term.

Kirkley et al (1998) specified inefficiency u_i as a function of dummy variables representing random variables assumed to account for technical efficiency in production. The independent variables are further assumed to be independently distributed as truncations at zero of the $N(\mu_{it}, \delta_\mu^2)$ distribution and $\mu_{it} = Z_{it}\delta$. Z_{it} is a 1 x p vector of dummy variables which are thought to possibly influence the efficiency of commercial banks and δ is a p x 1 vector of unknown parameters to be estimated.

In this study, it was assumed that each bank operates on the constant returns to scale production frontier and hence there is a one-to-one, linear relationship between inputs and outputs. For example, if a 10% increase in inputs yields a 10% increase in outputs, the bank is operating at constant returns to scale. This assumption was important since variable returns to scale requires the decomposition of technical efficiency into pure technical efficiency and scale efficiency. Such an analysis is supported by the DEA methodology (Cummings, 1997) as opposed to the Stochastic Frontier Analysis which was applied in this study.

The technical efficiency function, comprising the vector variables was specified by the algebraic representation of equation (18):

$$TE_{it} = a + b_1(ED)_{it} + b_2(EX)_{it} + b_3(TR)_{it} + b_4(GE)_{it} + b_5(ASSETS)_{it} + b_6(CAP)_{it} + b_7(PBT)_{it} + \varepsilon_{it} \qquad (18)$$

Where $\boldsymbol{TE_{it}}$ is the bank level technical efficiency measure for financial year t, ***a*** is a constant, ***ED*** is the level of education for financial year t, ***EX*** is the number of years of managerial experience for financial year t, ***TR*** is the frequency of training acquired by attending job related courses and conferences in financial year t, ***GE*** is the proportion of female managers to total number of managers for financial year t, ***ASSETS*** are represented by the value of total assets for financial year t, ***CAP*** is total capital for financial year t and ***PBT*** is profit before tax for financial year t. The partial coefficients for ***ED, EX, TR, GE, ASSETS, CAP*** and ***PBT*** are denoted as b_1, b_2, b_3, b_4, b_5, b_6 and b_7 respectively, while ϵ_{it} is the error term which is defined by the truncation of the normal distribution with zero mean and variance $\delta_v^{\ 2}$. The possibility of substitution between the level of education and the years of experience was computed by determining whether a positive linear relationship exists between the two variables and hence the substitution possibilities.

3.6. Diagnostic Tests

In order to test the overall significance of the regression model, F-test and LR tests were used to estimate if all the individual coefficients together were statistically different from zero at the 95% significance level. To establish the significance of individual variables in each of the models, T-test was applied at both 95% and 99% levels of confidence.

CHAPTER FOUR

4.0 DATA ANALYSIS AND DISCUSSION

4.1. Introduction

This chapter presents the data analysis, interpretation and discussion of the research findings. The chapter is organized as follows: Section 4.2 covers ordinary least squares estimation of technical efficiency while section 4.3 provides an estimation of technical efficiency using SFA. Section 4.4 provides the link between technical efficiency and managerial skills while section 4.5 provides a discussion of the findings.

4.2. Ordinary Least Squares (OLS) Estimation of Technical Efficiency

Ordinary least squares (OLS) estimates of the input parameters were computed for the translog functional form (model A) and the findings presented in Table 4.1.

Table 4.1: OLS Estimates of Parameters Derived using Translog Functional Form (Model A)

MODEL A:

$$Ln(RWA)_{it} = \beta_0 + \beta_1 Ln(FDE)_{it} + \beta_2 Ln(SE)_{it} + \beta_3 Ln(FA)_{it} + \beta_{11}(Ln[FDE]_{it})^2 + \beta_{22}(Ln[SE]_{it})^2 + \beta_{33}(Ln[FA]_{it})^2 + \beta_{12}\{[Ln(FDE)_{it}][Ln(SE)_{it}]\} + \beta_{13}\{[Ln(FDE)_{it}][Ln(FA)_{it}]\} + \beta_{14}\{[Ln(SE)_{it}][Ln(FA)_{it}]\} + \varepsilon_{it}$$

Parameters	Coefficients	t-ratios	P-values	T-Tests on restrictions $\beta_i = 0$
β_0	31.529	6.050**	0.000000	Reject H_0
β_1	-3.169	-5.601**	0.000000	Reject H_0
β_2	0.566	0.860	0.391000	Accept H_0
β_3	1.123	2.223*	0.027000	Reject H_0
β_{11}	0.086	6.412**	0.000000	Reject H_0
β_{22}	-4.461	-2.718**	0.007195	Reject H_0
β_{33}	-0.016	-0.642	0.521000	Accept H_0
β_{12}	-12.203	-4.574**	0.000009	Reject H_0
β_{13}	7.108	3.667**	0.000320	Reject H_0
β_{14}	-0.022	-0.619	0.537000	Accept H_0

Adjusted R^2 = 0.937; ($F_{(6, 187)}$ = 481.702, p-value < 0.01)

*** denotes significance at 5% level (P-values < 0.05); Critical values = 1.96 (at 5%)**

**** denotes significance at 1% level (P-values < 0.01); Critical values = 2.57 (at 1%)**

With the adjusted R^2 value of 0.937, the inputs of model A were able to explain 94% of the variations in the output proxy variable of risk weighted assets, ***RWA***. The T-statistics (alongside their corresponding p-values) were used to determine the significance of each variable in the model. Table 4.1 indicates that the coefficients of funds & deposits (***FDE***) and fixed assets (***FA***) are statistically significant. Staff expenses (***SE***) were found to be insignificant in the production process. Since ***SE*** was individually insignificant in the model, a T-test was performed on the linear restriction of the parameter β_2 under the null hypothesis H_0: $\beta_2 = 0$. A t-statistic of 0.860 was obtained and since it is less than 1.96 (critical value of t-test at 5% level), the null hypothesis was accepted. Therefore, in subsequent analyses using Model A only ***FDE*** and ***FA*** were used as the explanatory variables.

Similarly, Table 4.2 indicates the Ordinary least squares (OLS) estimates of the input parameters that were computed for the translog functional form (model B). With the adjusted R^2 value of 0.938, the inputs of model B (interest expenses and operating expenses) were able to explain 94% of the variations in the output proxy variable which is total income (***TI***). The findings indicate that the explanatory variables (***IE & OE***) were jointly significant in the model ($F_{(4, 190)} = 736.976$, P-value < 0.01). Therefore, in subsequent analyses using model B both explanatory variables were used.

Table 4.2: OLS Estimates of Parameters Derived using Translog Functional Form (Model B)

MODEL B:

$$Ln(TI)_{it} = \beta_0 + \beta_1 Ln(IE)_{it} + \beta_2 Ln(OE)_{it} + \beta_{11}\{Ln(IE)_{it}\}^2 + \beta_{22}\{Ln(OE)_{it}\}^2 + \beta_{12}\{[Ln(IE)_{it}][Ln(OE)_{it}]\} + \varepsilon_{it}$$

Parameters	Coefficients	t-ratios	P-values	T-Tests on restrictions $\beta_i = 0$
β_0	29.208	5.333**	0.000000	Reject H_0
β_1	-0.705	-2.059*	0.041000	Reject H_0
β_2	-1.197	-2.539*	0.012000	Reject H_0
β_{11}	-0.022	-1.310	0.192000	Accept H_0
β_{22}	1.202	1.006	0.316000	Accept H_0
β_{12}	0.096	3.949**	0.000111	Reject H_0

Adjusted R^2 = 0.938; ($F_{(4, 190)}$ = 736.976, p-value < 0.01)

*** denotes significance at 5% level (P-values < 0.05); Critical values = 1.96 (at 5%)**

**** denotes significance at 1% level (P-values < 0.01); Critical values = 2.57 (at 1%)**

4.3. Estimation of Technical Efficiency Using Stochastic Frontier Analysis

4.3.1. Parameter Estimation for Appropriateness of Stochastic Frontier Analysis

Generalized likelihood ratio tests were performed to establish whether the stochastic production frontier is appropriate for the sample of data (H_0: $\gamma = 0$). The null hypothesis seeks to establish whether or not technical inefficiency effects are present. The value of γ is calculated as follows: $\gamma = \frac{\sigma_u^2}{\sigma_v^2 + \sigma_u^2}$

and lies between 0 and 1. Where: σ_u^2 is the variance of the non-negative technical efficiency component of the error term (u_i) and σ_v^2 is the variance of the two-sided "noise" component of the error term (v_i). By testing for $\gamma = 0$, the test indirectly tests whether or not $\sigma_u^2 = 0$. Acceptance of the null hypothesis $\gamma = 0$ indicates that the u term is absent in the production function's error term. It also implies that the stochastic production frontier should be rejected in favour of ordinary least squares estimation. The LR statistics were computed for both models A and B using the Frontier® Version 4.1 following the methodology outlined by Coelli (1996). The findings are presented in Table 4.3 below and indicate that the null hypotheses were rejected in both cases. Therefore, further analysis applied the stochastic frontier estimation approach.

Table 4.3: Generalized Likelihood Ratio Tests of Hypotheses for Parameters of the Stochastic Frontier Production Function

Model	Null Hypothesis	Likelihood Ratio	D.f.	Decision
Model A	$\gamma = 0$: (u term is absent in the error term derived from the production function)	175.2517**	3	Reject H_0
Model B	$\gamma = 0$: (u term is absent in the error term derived from the production function)	26.5291 **	3	Reject H_0

Tests for H_0: $\gamma = 0$ follows a mixed chi-square distribution
Degrees of freedom are defined by the number of restrictions imposed
*** denotes significance at 5% level; Critical values = 5.138 (at 5%)** Kolde & Palm, 1986
**** denotes significance at 1% level; Critical values = 2.57 (at 1%)** Kolde & Palm, 1986

4.3.2. The Maximum Likelihood Estimates (MLEs)

The Maximum Likelihood Estimates (MLEs) of the stochastic frontier production model with assumption of the half-normal were generated and the findings for both models are presented in Table 4.4 below. The table indicates that model A yielded a γ value of 0.94503, (which is the ratio of the variance of the bank-specific technical efficiency to the total variance of the output). This implies that more than 94% of the variations in the technical efficiency scores reported under model A were due to variations in the level of input variables across banks. On the other hand, model B yielded a γ value of 0.7944. This implies that more than 79% of the variations in the technical efficiency scores reported under model B were due to variations in the level of input variables across banks.

Table 4.4: Maximum Likelihood Estimates of the Stochastic Frontier Production Function: A Half-Normal Model

MODEL A $Ln(RWA)_{it} = \beta_0 + \beta_1 Ln(FDE)_{it} + \beta_2 Ln(FA)_{it} + \varepsilon_{it}$				MODEL B $Ln(TI)_{it} = \beta_0 + \beta_1 Ln(IE)_{it} + \beta_2 Ln(OE)_{it} + \varepsilon_{it}$			
Variable	**Parameter**	**Coefficient**	**t-ratios**	**Variable**	**Parameter**	**Coefficient**	**t-ratios**
Constant	β_0	19.3411 (1.0417)	18.566**	Constant	β_0	1.3404 (0.4114)	3.2576**
FDE	β_1	0.0466 (0.0110)	4.223**	IE	β_1	0.2474 (0.0288)	8.5974**
FA	β_2	0.2179 (0.0453)	4.8034**	OE	β_2	0.7410 (0.0313)	23.6975**
	σ^2	1.0416 (0.1014)	10.2705**		σ^2	0.4397 (0.1257)	3.4977**
	γ	0.94503 (0.0118)	79.9259**		γ	0.7944	12.8480**
	log likelihood	-0.9226			log likelihood	-0.5653	
	N	195			N	195	

*** denotes significance at 5% level (P-values < 0.05); Critical values = 1.96 (at 5%)**
**** denotes significance at 1% level (P-values < 0.01); Critical values = 2.57 (at 1%)**
Figures in brackets are the standard errors

4.3.3. Summary Statistics for Technical Efficiency Estimates from Stochastic Frontier Model

Table 4.5 presents the descriptive statistics of technical efficiency scores. The average efficiency scores for Model A (15%) are seen to differ significantly from model B (86%). This may be explained by the differences in the structure of the models. Model A is based on balance sheet variables, which differs significantly from the income and expense variables used in Model B. This indicates that the derived efficiency rankings are sensitive to variable changes.

Table 4.5: Descriptive Statistics of Technical Efficiency Estimates

MODEL A		MODEL B	
Statistic	**Efficiency Score**	**Statistic**	**Efficiency Score**
Minimum	0.013237	Minimum	0.294429
Maximum	0.914428	Maximum	0.960613
Mean	0.153655 *(0.013074)*	Mean	0.861030 *(0.006911)*
Standard Deviation	0.182575	Standard Deviation	0.096511
Skewness	2.432005 *(0.174082)*	Skewness	-3.280908 *(0.174082)*
Kurtosis	6.254219 *(0.346456)*	Kurtosis	14.074905 *(0.346455)*
N	195	N	195

Figures in brackets are the standard errors

Model A is a production oriented model where banks transform borrowed funds, deposits and physical capital into assets such as loans and investment securities. The findings indicate that on average, the banks were only able to generate 15% outputs (risk weighted assets) from the input variables (borrowed funds, deposits and fixed assets). While the banks have been very successful in deposit mobilization as evidenced by the high liquidity levels and huge customer funds on their balance sheets, the utilization of these deposit funds to produce loans has not yielded proportionate loan output. This could partly be attributed to the capital to risk weighted assets ratio which could be restricting commercial banks in their lending operations. As the banking industry is characterized by many small banks with relatively low levels of capitalization, this poses a challenge to the banks' ability to expand their loan book despite having a healthy deposit base. A skewness value of 2.4 for this model indicates that the distribution of technical efficiency was not symmetric about the mean. A majority of the observations were clustered below the mean technical efficiency score of 15%. A kurtosis value of 6.3 indicates that the distribution was highly peaked. This is attributed to the high scores of technical efficiency reported by the top 5 banks in relation to the overall sample.

Model B results which measure the ability to maximise income from loans and advances, investment securities and other assets while minimizing interest expenses and operating expenses, yielded a higher level of technical efficiency compared to Model A. On average, the banks were able to achieve a high ratio of total income to interest and operating expenses (86%). The possible explanation of the high level of efficiency lies in the high cost of financial intermediation characteristic of the banking industry in Kenya. While deposits are poorly remunerated, the interest charged on loans and advances has remained high thus yielding high interest margins for the banks. A skewness value of -3.28 for this model indicates that the distribution of technical efficiency was not symmetric about the mean. A majority of the observations were clustered above the mean score. A kurtosis value of 14.07 indicates that the distribution was highly peaked. This is attributed to the high scores of technical efficiency of over 90% reported by the top 12 banks.

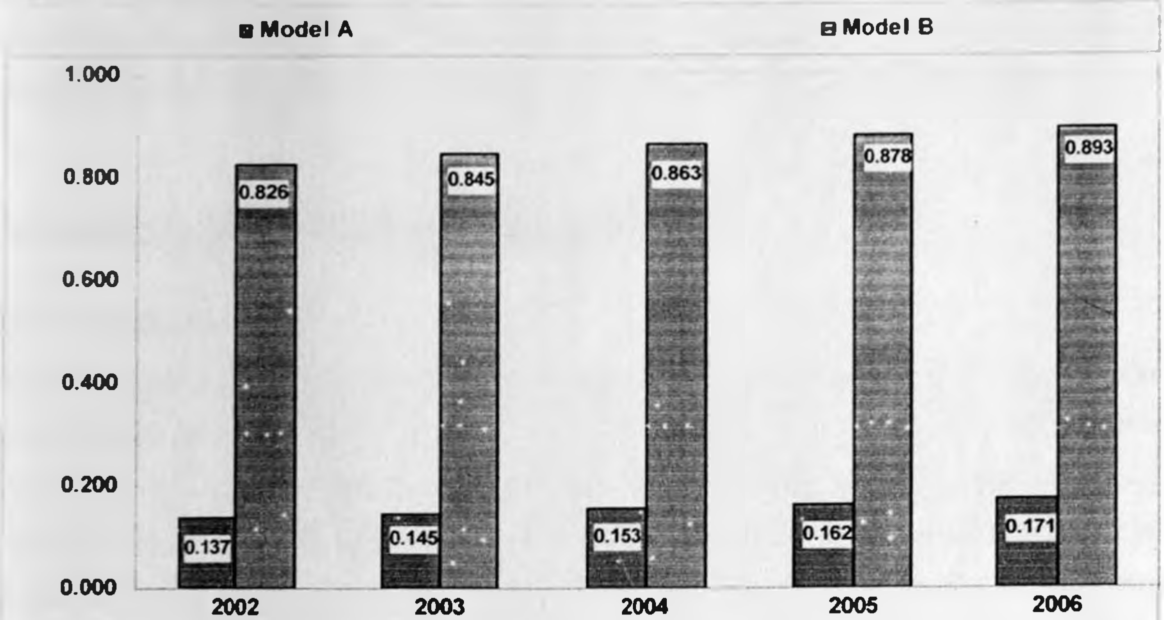
Based on the average technical efficiency scores presented on table 4.6 below, over the period of study, Model A reported that 26 out of 39 or 67% of the banks generated a lower proportion of risk weighted assets (below the average of 15%) compared to the inputs of borrowed funds and deposits. Under Model B, 14 out of the 39 or 35% of the banks achieved a technical efficiency level of below the average score of 86% as presented in table 4.6.

Table 4.6: Rankings Implied by Average Efficiency Scores (2002 – 2006)

MODEL A			MODEL B		
Name of the bank	**Mean TE**	**Rank**	**Name of the bank**	**Mean TE**	**Rank**
Barclays Bank of Kenya	0.9077633500	1	Development Bank of Kenya	0.9476143840	1
Kenya Commercial Bank	0.5696355480	2	Standard Chartered Bank	0.9464176820	2
Standard Chartered Bank	0.5524678400	3	Barclays Bank of Kenya	0.9446307900	3
Citibank	0.4015974040	4	National Bank of Kenya	0.9435551740	4
National Bank of Kenya	0.3622789820	5	Trans-National Bank	0.9344786740	5
Co-operative Bank of Kenya	0.2993972520	6	City Finance Bank	0.9243597080	6
CFC Bank	0.2341946200	7	Imperial Bank	0.9231017380	7
I&M Bank	0.2205707940	8	I&M Bank	0.9226737800	8
NIC Bank	0.2105232140	9	Bank of India	0.9148266920	9
Stanbic Bank	0.1892364300	10	Citibank	0.9140312160	10
Commercial Bank of Africa	0.1696505180	11	Equatorial Commercial Bank	0.9107585240	11
Diamond Trust	0.1604618520	12	Victoria Commercial Bank	0.9073668940	12
HFCK	0.1510125120	13	NIC Bank	0.8990112300	13
EABS Bank	0.1191977332	14	Oriental Commercial Bank	0.8931983640	14
Imperial Bank	0.1126076872	15	Prime Bank	0.8908316020	15
Prime Bank	0.0992314916	16	Commercial Bank of Africa	0.8887468700	16
Fina Bank	0.0959455558	17	Dubai Bank	0.8856261980	17
Guardian Bank	0.0955406832	18	Bank of Baroda	0.8845530420	18
Giro Commercial Bank	0.0777242012	19	Guardian Bank	0.8795380440	19
Bank of Baroda	0.0707245732	20	Kenya Commercial Bank	0.8775674240	20
ABC Bank	0.0675545638	21	Fina Bank	0.8767577900	21
Equatorial Commercial Bank	0.0660533382	22	Habib AG Zurich	0.8715767540	22
Southern Credit Bank	0.0627656034	23	Diamond Trust	0.8700941460	23
K-Rep Bank	0.0571171510	24	CFC Bank	0.8686946680	24
Middle East Bank	0.0559862126	25	Chase Bank	0.8637520100	25
Bank of India	0.0527838032	26	EABS Bank	0.8541656860	26
Chase Bank	0.0503490828	27	Fidelity Commercial Bank	0.8503010780	27
Victoria Commercial Bank	0.0482821644	28	ABC Bank	0.8466317480	28
Credit Bank	0.0477698160	29	Habib Bank	0.8459794840	29
Fidelity Commercial Bank	0.0476258062	30	Credit Bank	0.8414604460	30
Habib AG Zurich	0.0463785854	31	Southern Credit Bank	0.8402750500	31
Oriental Commercial Bank	0.0452999272	32	Giro Commercial Bank	0.8389938260	32
Trans-National Bank	0.0449324924	33	Co-operative Bank of Kenya	0.8343161580	33
Consolidated Bank	0.0429872770	34	HFCK	0.8283201860	34
Development Bank of Kenya	0.0409535308	35	Stanbic Bank	0.7858132680	35
Paramount Universal Bank	0.0383344298	36	Middle East Bank	0.7854694080	36
Habib Bank	0.0314514784	37	Paramount Universal Bank	0.7646324240	37
Dubai Bank	0.0274154836	38	K-Rep Bank	0.6846758340	38
City Finance Bank	0.0187344582	39	Consolidated Bank	0.3953722620	39

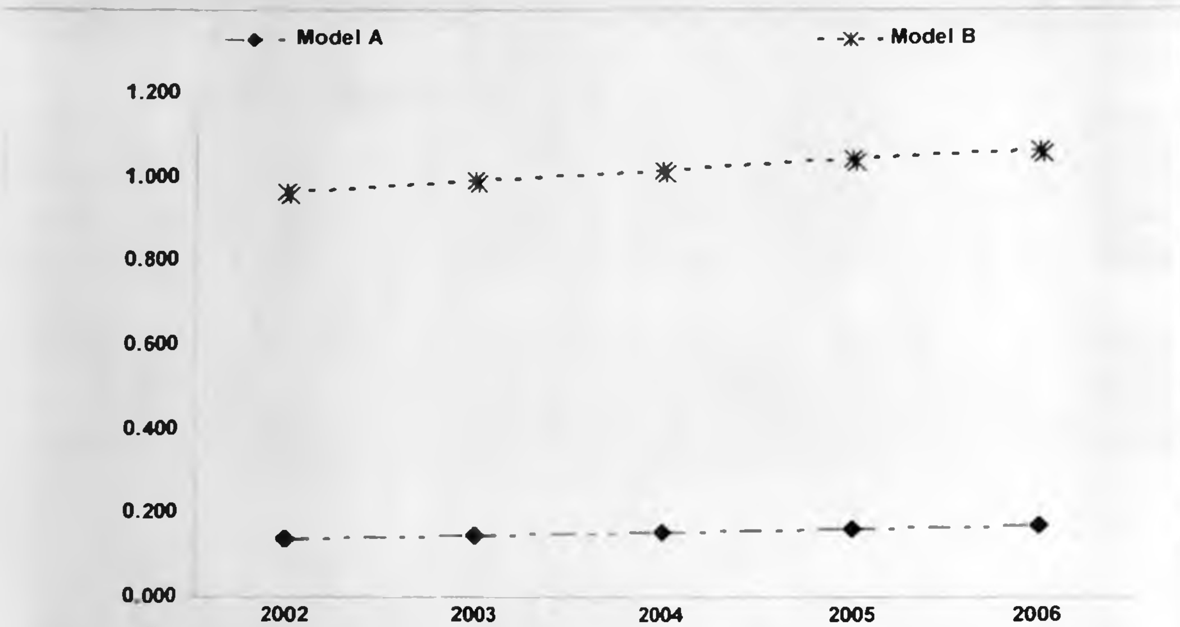
Figure 4.1 and Figure 4.2 below illustrates the distribution of mean technical efficiency scores for the sample banks for each of the years. 2002 -2006.

Figure 4.1: Mean Plots for Average Technical Efficiency Scores (2002 – 2006)



	2002	2003	2004	2005	2006
Model A	0.137	0.145	0.153	0.162	0.171
Model B	0.826	0.845	0.863	0.878	0.893

Figure 4.2: Graphical Presentation of the Average Technical Efficiency Scores (2002 – 2006)



	2002	2003	2004	2005	2006
Model B	0.826	0.845	0.863	0.878	0.893
Model A	0.137	0.145	0.153	0.162	0.171

In both figures, the findings under model A indicate that the average productivity of risk-weighted assets improved by 3 percentage points from 14% in 2002 to 17% in 2006. On the other hand, the findings under model B indicate that the average growth in the efficiency of generating income improved by 6 percentage points from 83% in 2002 to 89% in 2006.

4.4. Linking Technical Efficiency to Managerial Skills

4.4.1. Correlation Analysis

Pearson's correlation coefficient measure of linear association was used to examine the relationship between technical efficiency scores, managerial skills and four dummy variables (Proportion of female managers, assets, capital, and profitability). Two variables can be perfectly related, but if the relationship is not linear, Pearson's correlation coefficient is not an appropriate statistic for measuring their association. Pearson correlation test was thus conducted and the findings presented in Table 4.7 below. The null hypothesis was the non-existence of correlation between technical efficiency and managerial skills (H_0: $\rho = 0$).

Table 4.7: Linking Technical Efficiency Scores to Managerial Skills

$$TE_{it} = a + b_1(ED)_{it} + b_2(EX)_{it} + b_3(TR)_{it} + b_4(GE)_{it} + b_5(ASSETS)_{it} + b_6(CAP)_{it} + b_7(PBT)_{it} + \varepsilon_{it}.$$

MODEL A			MODEL B		
Variable	**Pearson Correlation Coefficient (ρ)**	**Decision (H_0:$\rho = 0$)**	**Variable**	**Pearson Correlation Coefficient**	**Decision (H_0:$\rho = 0$)**
Education	0.158*	Reject H_0	Education	0.308**	Reject H_0
Experience	0.240**	Reject H_0	Experience	0.062	Accept H_0
Training	0.210**	Reject H_0	Training	0.157*	Reject H_0
Proportion of Female Managers	***-0.132****	***Reject H_0***	***Gender***	***0.115***	***Accept H_0***
Total Assets	***0.965*****	***Reject H_0***	***Total Assets***	***0.255*****	***Reject H_0***
Total Capital	***0.954*****	***Reject H_0***	***Total Capital***	***0.252*****	***Reject H_0***
Profit Before Tax	***0.790*****	***Reject H_0***	***Profit Before Tax***	***0.255*****	***Reject H_0***
N	195		N	195	

H_0: $\rho = 0$ (No significant correlation between TE and MS)
*** denotes significance at 5% level (P-values < 0.05);**
**** denotes significance at 1% level (P-values < 0.01);**
Variables in italics represent dummy variables

4.4.2. Regression Analysis

The model represented by equation (7) was first subjected to F-Test to establish whether the variables were jointly significant. T-tests were further computed for the individual variables' coefficients to determine their significance in the respective models. Using the technical efficiency scores derived from model A as dependent variables, the F-Test yielded $F_{(7,187)} = 394.858$; (P-value < 0.01) and an adjusted R^2 value of 0.934. This implies that 93.4% of variations in the efficiency scores could be explained jointly by managerial skill characteristics and the dummy variables. Using the technical efficiency scores derived from model B as the dependent variables, the F-Test yielded $F_{(7,187)} = 7.811$; (P-value < 0.01) and an adjusted R^2 value of 0.820 implying that 82% of variations in the efficiency scores could be explained by the mix of managerial skill characteristics and the dummy variables. The values of F-statistics were found to be statistically significant implying the existence of linear relationships in both cases. The results of the T-tests are presented in Tables 4.8 and 4.9.

Table 4.8: Regression Estimates on the Relationship between Technical Efficiency and Managerial Skills

MODEL A:

$$TE_{it} = a + b_1(ED)_{it} + b_2(EX)_{it} + b_3(TR)_{it} + b_4(GE)_{it} + b_5(ASSETS)_{it} + b_6(CAP)_{it} + b_7(PBT)_{it} + \varepsilon_{it}$$

Parameters	Coefficients	t-ratios	P-values	T-Tests on restrictions $b_i = 0$
a	-0.0103	-0.236	0.813000	Accept H_0
b_1	0.1430	2.134*	0.025800	Reject H_0
b_2	1.4783	11.504**	0.000000	Reject H_0
b_3	0.166	13.744**	0.000000	Reject H_0
b_4	-1.3537	-2.339*	0.029500	Reject H_0
b_5	0.615	8.284 **	0.000000	Reject H_0
b_6	0.0213	3.0550 **	0.002570	Reject H_0
b_7	0.543	9.5181**	0.000000	Reject H_0

*** denotes significance at 5% level (P-values < 0.05); Critical values = 1.96 (at 5%)**
**** denotes significance at 1% level (P-values < 0.01); Critical values = 2.57 (at 1%)**
Dependent Variable = Technical Efficiency scores derived from Model A

The findings presented on Table 4.8 indicate that the technical efficiency scores under Model A were positively correlated at both 95% and 99% levels of confidence to the level of education, years of experience and the frequency of training. In addition, three dummy variables namely bank size, level of capitalisation and profitability were all found to be positively correlated to technical efficiency. On the contrary, the fourth dummy variable which is the proportion of female managers to total number of managers was found to be negatively correlated to technical efficiency.

Model B findings on Table 4.9 are consistent with those of Model A. The findings indicate that the technical efficiency under Model B is positively correlated to the level of education, years of experience and the frequency of training at the 95% and 99% confidence level. Positive correlation between technical efficiency and the size of the bank, capitalization level, and level of profitability was also reported. The results of Table 4.8 and Table 4.9 therefore support the Pearson correlation analysis results reported in Table 4.7. The regression results of model A indicated a significant (negative) relationship between technical efficiency and the proportion of female managers (Table 4.8). To the contrary, the results of model B (Table 4.9) showed that there is no significant relationship between technical efficiency and the proportion of female managers. A negative coefficient under the results of model A implies that commercial banks with high proportions of female managers are likely to report reduced productivity in loans and other risk-weighted assets. The results of model B imply that the proportion of female managers in managerial positions has no significant effect on the bank's ability to generate income by incurring interest and operating expenses.

Table 4.9: Regression Estimates of the Relationship between Technical Efficiency and Managerial Skills

MODEL B:

$$TE_{it} = a + b_1(ED)_{it} + b_2(EX)_{it} + b_3(TR)_{it} + b_4(GE)_{it} + b_5(ASSETS)_{it} + b_6(CAP)_{it} + b_7(PBT)_{it} + \varepsilon_{it}$$

Parameters	Coefficients	t-ratios	P-values	T-Tests on restrictions $b_i = 0$
a	0.399	4.936**	0.000002	Reject H_0
b_1	0.121	5.206**	0.000000	Reject H_0
b_2	0.0015	0.8303	0.407400	Accept H_0
b_3	0.0044	1.9840*	0.048700	Reject H_0
b_4	0.083	1.1182	0.354700	Accept H_0
b_5	0.164	4.229 **	0.000000	Reject H_0
b_6	0.354	2.7477**	0.000697	Reject H_0
b_7	0.276	2.6165 **	0.000004	Reject H_0

*** denotes significance at 5% level (P-values < 0.05); Critical values = 1.96 (at 5%)**
**** denotes significance at 1% level (P-values < 0.01); Critical values = 2.57 (at 1%)**
Dependent Variable = Technical Efficiency scores derived from Model B

The findings did not suggest possibilities of substitution between a manager's level of education and years of experience in relation to technical efficiency. This was arrived at after applying F-test to establish whether or not there exists a linear relationship between the two variables. The null hypothesis of the test was that there exists no linear relationship between the manager's level of education and the years of experience. The value of F-statistic obtained was $F_{(1,193)} = 0.672$, P-value> 0.05 and hence the null hypothesis was accepted. Therefore, in the Kenyan banking sector, the manager's level of education cannot be substituted for years of experience in relation to technical efficiency.

4.5. Discussion of Findings

The study hypothesized a positive relationship between managerial skill and technical efficiency. This hypothesis was based on the argument that managerial skill is one of the key inputs in the production process that appears to significantly contribute to variations in technical efficiency of firms. The analysis was based on two stochastic production frontier models. In the first model (Model A), it was regarded that banks use labour, borrowed funds & deposits, and fixed assets as inputs to produce risk-weighted assets (as output). The results from OLS estimations however established that the labour input was insignificant in the model at 95% level of confidence. This implies that banks produce their risk-weighted assets through use of borrowed funds & deposits and their fixed assets. Technical efficiency scores under Model A showed that on average the banks were able to produce 15% of the output (loans, securities, investments and other off balance sheet items) after input of borrowed funds & deposits and fixed assets. This is 3% points lower than the average 18% score of X-efficiency reported by Sakina (2006) upon studying 33 commercial banks in Kenya. Under Model A, the overall trend in technical efficiency of the commercial banks improved slightly from 14% in 2002 to 17% in 2006. This implies that there is huge room for improvement as far as transformation of deposits and borrowed funds into risk weighted assets is concerned. The slow pace at which the banks are moving towards the best production frontier implies that liberalization of the banking sector has not had the desired effects of enhancing the efficiency of financial intermediation.

In the second model (Model B), banks incur interest expenses and operating expenses as inputs in order to generate income. Both input variables (***IE*** & ***OE***) were found to be jointly significant in the model at 95% level of confidence. Technical efficiency scores indicated that over the sample period, the banks were able to realize about 86% of the total income from interest and operating expenses. This is in agreement to Barr et al (1999) that there is a noticeable tendency for efficiency to be positively correlated with interest income. The upward trend in technical efficiency from 83% in 2002 to 89% in 2006 under Model B implies that the banks are moving closer to the best production frontier in terms of maximizing income from loans, securities and other investments. Pearson's correlation coefficient measure of linear association indicated that the technical efficiency scores were positively and significantly correlated at 95% level of confidence to the level of education and experience as well as the frequency of training. Positive correlation was reported between technical efficiency and the three dummy variables namely: The size of the bank, capitalization level, and profitability.

The findings of this study are consistent with those of previous studies that found a positive relationship between managerial skill and technical efficiency. Kirkley et al (1998) and Kebede (2001) found that managerial skill characteristics such as experience and education are an important determinant of firm productivity and technical efficiency in the sense that they enhance the ability of managers to seek, decipher, and make good use of information about production inputs. Stefanou and Saxena (1998) also found that an increase in efficiency may result from more management experience.

The technical efficiency of commercial banks can therefore be improved by hiring managers with high educational levels and longer years of experience. In addition, continuous development of managers through training is necessary in order to keep up with the rapid changes in techniques, financial instruments and technological developments in banking (Limam, 2001). Regression results of model A indicated a significant (negative) relationship between technical efficiency and the proportion of female managers. To the contrary, the results of model B showed no significant between technical efficiency and the proportion of female managers. These findings contradict those of Mathijis and Vranken (2001) who found that firms in Bulgaria and Hungary with a high proportion of women were more efficient. The study does not support the findings of (Kirkley et al., 1998; Vandenberg, 1980; and Imai, 2003) who suggested possible substitution possibilities between education and years of experience.

The findings were consistent with the expectation that there is a positive relationship between technical efficiency and the bank's size and profitability and supported the findings of Sakina (2006) that the average large bank is more efficient than the average small bank. However, the results contradicted those of Mutanu (2002) who found that highly capitalised commercial banks in Kenya are more inefficient than lowly capitalised banks. The positive correlation between the level of capitalisation and technical efficiency observed in this study could be due to the evolution of the banks' capital structure over the period of study. Commercial banks have avoided expensive long term borrowing and prefer the less expensive equity capital. This is evidenced by more and more banks resorting to equity offerings such as share splits and bonus issues. When there is an increasing preference for equity to long term debt, it has been shown that banks would be more efficient as shareholders are in a position to apply stricter monitoring on bank's management (Limam, 2001).

CHAPTER FIVE

5.0 SUMMARY AND CONCLUSIONS

5.1. Introduction

This chapter is organized as follows: Section 5.2 presents a summary of the study including the key findings. Conclusions are presented in section 5.3 while the limitations of the study are addressed by section 5.4. Section 5.5 gives the recommendations for future research.

5.2. Summary

The study's objectives were twofold. Firstly to analyse the relationship between managerial skill and technical efficiency of commercial banks in Kenya and secondly to investigate the substitution possibilities between a manager's level of education and years of experience. The study hypothesized that there is a positive relationship between managerial skill and technical efficiency. This hypothesis was based on the argument that managerial skill is one of the key inputs in the production process. Empirical evidence shows that managerial skill significantly contributes to variations in technical efficiency of firms (Kirkley et al, 1998; Viswanathan et al. 2000). The key research question was: Does managerial skills contribute positively to the technical efficiency of commercial banks in Kenya? The second research question was: Is there a possibility of substituting a manager's level of education and years of experience? In answering these questions, the study used both secondary and primary data. Secondary data was obtained from the audited financial statements of the commercial banks. The financial statements were obtained from the Bank Supervision Department of the Central Bank of Kenya (CBK). In order to measure the technical efficiency of Kenyan banks, two models comprising different inputs and different outputs were defined. Primary data on managerial skills was obtained from human resource managers from each of the commercial banks. A response rate of 100% was achieved. This was made possible by administering the questionnaires in two rounds to ensure the respondents who were not able to fill in the first round were recaptured.

The key findings of the study are as follows: First, there exists a positive relationship between technical efficiency scores of commercial banks and managerial skills. Secondly, there are no substitution possibilities between a manager's level of education and years of experience in relation to technical efficiency. The findings on the positive relationship between managerial skill and technical efficiency were in agreement with previous studies (Stefanou and Saxena, 1998; Kirkley et al., 1998; Barr et al., 1999; and Kebede, 2001). The findings however did not support studies suggesting possible substitution possibilities between education and years of experience (Vandenberg, 1980; Kirkley et al., 1998; and Imai, 2003).

5.3. Conclusions

Managerial skill was found to be significant and positively correlated to technical efficiency. This implies that if bank managers are equipped with better managerial skills, then the banks will tend to report higher earnings, production, and technical efficiency. Three characteristics of managerial skill namely level of education, the number of years of managerial experience, and the frequency of training were found to explain variations in technical efficiency scores across banks.

Substitution possibilities between years of experience and managerial skill were non existent indicating that the two variables are independent and that the manager's level of education and years of experience cannot replace each other. An analysis of the technical efficiency scores in relation to the three dummy variables (size, capital, and profit) indicated that the size of a bank, level of capitalization, and profitability are essential determinants of banks' productivity and technical efficiency.

5.4. Limitations of the Study

This study did not address the determinants of bank efficiency other than the characteristics of the banks themselves. The external environment in which the banks operate in Kenya is also an important factor affecting their efficiency. The impact of competition, risk management practices and excessive Government intervention through various regulatory mechanisms are important variables whose importance in the technical efficiency function would be worth studying. In addition, it was not possible to ascertain from the data whether there are differences in the level of education and years of experience among male and female managers that could be linked to the negative relationship between technical efficiency and the proportion of female managers revealed by Model A.

5.5. Recommendations

Further research is recommended to shed light on variations of technical efficiency in relation to other bank characteristics apart from size. Such characteristics include country of origin (indigenous or foreign) and ownership (state-owned or private). In addition, given that banks are multi-output firms, the definition of output followed in this study could be disaggregated to take into account the variety of services and earning assets produced by banks. In this case, scope efficiency could be assessed along other forms of efficiencies. Finally, stochastic frontier analysis used in this study could be combined with other alternative methods of estimating the frontier. This should testify to the robustness of the results of the study against alternative estimation techniques such as the DEA.

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Appendices

Appendix I: Managerial Characteristics Questionnaire

Dear Respondent,

This survey seeks to assess some of the primary characteristics of commercial bank directors and managers in Kenya, for the period from 2002 to 2006.

The objective is to study how managerial characteristics influence the efficiency of the banks over time.

If your bank was not operational in Kenya for any of the above years, please only provide data for those years when it was operational.

Should you require a copy of the final paper, please do not hesitate to contact the author on 0722824831 or nziokanicholas@yahoo.com.

Thank you for taking time to complete the questionnaire.

1. Name of your Bank______________________________

2. Position held in the Bank ______________________________

3. Date of completing this questionnaire______________________

Please indicate for the year below, the **NUMBER** of managers falling within each of the educational levels and experience categories, and their **NUMBER** in terms of gender. (*Please take into account ALL managers at the head office and branches*).

YEAR 2006

Number of managers with the following educational qualifications		Number of managers with the following years of experience		Number of male or female managers	
Doctor of Philosophy (PhD)	☐	1 – 2 years	☐	Male	☐
Masters degree	☐	3 – 4 years	☐	Female	☐
Bachelors degree	☐	5 –10 years	☐		
Diploma	☐	over 10 years	☐		
Certificate	☐				

How many training courses did the managers attend in 2006? ☐

How many conferences did the managers attend in 2006? ☐

Please indicate for the year below, the **NUMBER** of managers falling within each of the educational levels and experience categories, and their **NUMBER** in terms of gender. (*Please take into account ALL managers at the head office and branches*).

YEAR 2005

Number of managers with the following educational qualifications		Number of managers with the following years of experience		Number of male or female managers	
Doctor of Philosophy (PhD)	☐	1 – 2 years	☐	Male	☐
Masters degree	☐	3 – 4 years	☐	Female	☐
Bachelors degree	☐	5 –10 years	☐		
Diploma	☐	over 10 years	☐		
Certificate	☐				

How many training courses did the managers attend in 2005? ☐

How many conferences did the managers attend in 2005? ☐

Please indicate for the year below, the **NUMBER** of managers falling within each of the educational levels and experience categories, and their **NUMBER** in terms of gender. (*Please take into account ALL managers at the head office and branches*).

YEAR 2004

Number of managers with the following educational qualifications		Number of managers with the following years of experience		Number of male or female managers	
Doctor of Philosophy (PhD)	☐	1 – 2 years	☐	Male	☐
Masters degree	☐	3 – 4 years	☐	Female	☐
Bachelors degree	☐	5 –10 years	☐		
Diploma	☐	over 10 years	☐		
Certificate	☐				

How many training courses did the managers attend in 2004? ☐

How many conferences did the managers attend in 2004? ☐

Please indicate for the year below, the **NUMBER** of managers falling within each of the educational levels and experience categories, and their **NUMBER** in terms of gender. (*Please take into account ALL managers at the head office and branches*).

YEAR 2003

Number of managers with the following educational qualifications		**Number of managers with the following years of experience**		**Number of male or female managers**	
Doctor of Philosophy (PhD)	☐	1 – 2 years	☐	Male	☐
Masters degree	☐	3 – 4 years	☐	Female	☐
Bachelors degree	☐	5 –10 years	☐		
Diploma	☐	over 10 years	☐		
Certificate	☐				

How many training courses did the managers attend in 2003? ☐

How many conferences did the managers attend in 2003? ☐

Please indicate for the year below, the **NUMBER** of managers falling within each of the educational levels and experience categories, and their **NUMBER** in terms of gender. (*Please take into account ALL managers at the head office and branches*).

YEAR **2002**

Number of managers with the following educational qualifications		Number of managers with the following years of experience		Number of male or female managers	
Doctor of Philosophy (PhD)	☐	1 – 2 years	☐	Male	☐
Masters degree	☐	3 – 4 years	☐	Female	☐
Bachelors degree	☐	5 –10 years	☐		
Diploma	☐	over 10 years	☐		
Certificate	☐				

How many training courses did the managers attend in 2002? ☐

How many conferences did the managers attend in 2002? ☐

End. Thank you for completing this questionnaire.

Appendix II: List of commercial banks operating in Kenya

1. African Banking Corporation Ltd
2. Bank of Africa Kenya Ltd
3. Bank of Baroda (K) Ltd
4. Bank of India
5. Barclays Bank of Kenya Ltd
6. CFC Bank Ltd
7. Charterhouse Bank Ltd
8. Chase Bank Ltd
9. Citibank NA Kenya
10. City Finance Bank Ltd
11. Co-operative Bank of Kenya Ltd
12. Commercial Bank of Africa Ltd
13. Consolidated Bank of Kenya
14. Credit Bank
15. Development Bank of Kenya
16. Diamond Trust Bank Ltd
17. Dubai Bank Kenya Ltd
18. EABS Bank Ltd
19. Equatorial Commercial Bank Ltd
20. Equity Bank Ltd
21. Family Bank Ltd
22. Fidelity Commercial Bank
23. Fina Bank Ltd
24. Giro Commercial Bank Ltd
25. Guardian Bank Ltd
26. Habib Bank A.G. Zurich
27. Habib Bank Ltd
28. Imperial Bank Ltd
29. Investments & Mortgages Bank Ltd
30. K-Rep Bank Ltd
31. Kenya Commercial Bank Ltd
32. Middle East Bank Ltd
33. National Bank of Kenya Ltd
34. National Industrial Credit Bank Ltd
35. Oriental Commercial Bank Ltd
36. Paramount Universal Bank Ltd
37. Prime Bank Ltd
38. Southern Credit Banking Corporation Ltd
39. Stanbic Bank Kenya Ltd

40. Standard Chartered Bank (K) Ltd
41. Transnational Bank Ltd
42. Victoria Commercial Bank Ltd

Source: Central Bank of Kenya