EXPLORING THE OPERATIONAL EFFICIENCY OF COMMERCIAL BANKS IN ZAMBIA

By

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DECLARATION

I, Isaac Mwale do here by declare that this work is my original work achieved through personal reading and research .This work has never been submitted to the University of Zambia or any other university. All sources of data used and literature on related works previously done by others, used in the production of this dissertation have been dully acknowledged. If any omission has been made, it is not by choice but by error.

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APPROVAL

This dissertation by **Isaac Mwale** approved as a fulfillment of the requirements for the award of the degree of the Master of Business Administration in Finance.

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ABSTRACT

Zambia's central bank – Bank of Zambia (BOZ) - has reported that the banking sector has been satisfactory in its performance and conduct, it has relied on financial ratio analysis, an approach which has been found to be inadequate in many aspects. Financial ratio analysis as a measure of efficiency can be considered problematic and rigid and may also fail to account for environmental and broad institutional factors as drivers of efficiency and performance. It also fails to differentiate between the different types of efficiency such as scale and x-efficiency. To circumvent these weaknesses, this study adopted a flexible and heuristic approach – the stochastic frontier approach – to unpack and define efficiency in terms of its operational meaning. A Tobit regression was undertaken to establish the determinants of efficiency as well as to investigate quantitatively the internal and external factors which underpin and drive efficiency in the banking sector.

The study found that commercial banks in Zambia for the study period were inefficient of order of 10.3%. This suggests that, for the Zambian banking industry as a whole, mismanagement of resources may be an impediment to desirable performance. The Tobit regression revealed that foreign owned banks were on average more efficient than domestic banks, it also revealed that bank inefficiency in the Zambian banking sector was underpinned by bank profitability, high Capital adequacy, greater bank liquidity and high percentage of non-performing loans. Inefficiency means that banks are using a costly combination of inputs to produce a feasible level of output.

Keywords: Operational efficiency, X-efficiency, Tobit model, Scale efficiency

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DEDICATION

This dissertation is dedicated to my beloved family and friends who were always there to encourage me physically and emotionally in my daily endeavours. I also give thanks to God almighty who has made it possible for me to do this work.

DEFINITION OF KEY TERMS

a. Efficiency: Efficiency in general, is the deviation of actual output from desired output. It has been defined and studied in different dimensions in banking including: (i) scale efficiency: which refers to the relationship between the level of output and the average cost (ii) Scope efficiency: which refers to the relationship between average cost and production of diversified output varieties; and (iii) Operational efficiency, a wide concept sometimes referred to as x-efficiency, which measures deviation from the cost efficient frontier that depicts the lowest production cost. In this study X-efficiency has been used to measure operational efficiency of all commercial banks in Zambia.(A.Y Lewin and C.A.K Lovell,1990).

b. X-efficiency: also referred to as cost efficiency, stems from technical efficiency, which attempts to measure the degree of waste and friction in the production process, and allocative efficiency, which measures whether the right levels of various inputs are used. X- Efficiency seeks to address the question of how well banks manage their costs relative to the benchmark commercial bank created by the frontier used. The measurement process of X-efficiency involves determining total operating costs given the level of output and the prices of inputs of capital, labour and funds by the bank. If the observed total operating cost is higher than the minimized cost established by the frontier used, the difference represents the banks X-inefficiency. (Kenneth J.Button and Thomas G.Weyman Jones 1992)

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AB BANK	AB BANK ZAMBIA
ACCESS	ACCESS BANK ZAMBIA
BBZ	BARCLAYS BANK ZAMBIA
BOC	BANK OF CHINA (ZAMBIA)
CAVMONT	CAVMONT BANK
CITIBANK	CITI BANK ZAMBIA
CSO	CENTRAL STATISTICS OFFICE
DEA	DATA ENVELOPMENT ANALYSIS
DFA	DISTRIBUTION – FREE APPROACH
ECOBANK	ECO BANK ZAMBIA
FAB	FIRST ALLIANCE BANK ZAMBIA
FBZ	FINANCE BANK ZAMBIA
FNB	FIRST NATIONAL BANK ZAMBIA
GRZ	GOVERNMENT OF THE REPUBLIC OF ZAMBIA
INDO-ZAMBIA	INDO- ZAMBIA BANK
INVESTRUST	INVESTRUST BANK
STANBIC	STANBIC BANK ZAMBIA
STANCHART	STANDARD CHARTERED BANK PLC

UBA	UNITED BANK FOR AFRICA ZAMBIA
ZANACO	ZAMBIA NATIONAL COMMERCIAL BANK PLC
ZICB	ZAMBIA INDUSTRIAL COMMERCIAL BANK ZAMBIA
SE	SCALE EFFICIENCY
SFA	STOCHASTIC FRONTIER APPROACH

CHAPTER ONE

INTRODUCTION

1.0 BACKGROUND TO THE STUDY

The study of the efficiency of commercial banks has gained a lot of popularity in recent times among African countries. First, the efficiency of banks is directly linked to the productivity of the economy. Banking system assets constitute a substantial proportion of total output. Banks provide liquidity, payments and safekeeping for depositors and channel these funds into investment and working capital requirements. Bonds and Stock markets are thin and banks are a major source of intermediation. A basic benefit accompanied by the efficiency of banks is a reduction in spreads between lending and deposit rates. Banks in most developing countries operate with relatively wide spreads.

1.1 HISTORY OF THE BANKING SECTOR

For over 20 years until the early 1990s Zambia pursued predominantly interventionist (command) economic policies which entailed extensive government ownership and administrative controls over markets, including financial and banking markets. The Post -independence financial reforms mostly were centred on three main areas: nationalization of foreign financial institutions, establishment of government owned banks and development finance institutions, and administrative controls over interest rates (Fardi 1991; Jones 1994).

1.1.1 NATIONALISATION OF FOREIGN FINANCIAL INSTITUTIONS

The Banking system in the mid-1960s was dominated by foreign commercial banks mainly serving the credit needs of foreign and expatriate businesses while excluding any locals. To curb that, in

1969 government established Zambia National Bank (ZANACO) whose main major aims included the provision of credit to Zambians and the extension of bank branches into the rural areas. Most of the non-bank financial institutions were nationalized and amalgamated to form financial parastatals such as the State Insurance Corporation and Zambia National Building Society. However, with one exception (the Nederland Bank) the banks were not nationalized because the foreign banks threatened to withdraw their expatriate management and the Zambian government was not confident that it could manage the banks without them (Harvey, 1993:7)

Several other banks financial institutions were set up by the government to serve various purposes. The Indo-Zambia Bank was established in 1984 as a joint venture between the government and three state owned Indian banks, and in 1987 the Zambia Export and Import Bank was founded to supply trade finance.

1.1.3 BANK OF ZAMBIA'S CONTROL OF THE LENDING RATE

Until 1984 commercial bank deposit rates were held within a range of 3.5 per cent and 8.5 per cent and lending rates between 7 per cent and 13 percent (Musokotwane:33 and 55). Nominal rates were generally held below the rate of inflation, which averaged 10 per cent during the 1970s and 20 per cent during 1980-84. There was an increase in both inflation and nominal interest rates from the mid-1980s onwards. Lending rates rose sharply thereafter to around 30 per cent in 1986 - although because this was accompanied by an acceleration of inflation real interest rates remained negative. During the 1990s interest rates were again raised and then liberalized (Mulaisho, 1994)

1.1.4 INCORPORATION OF FOREIGN BANKS TO THE ZAMBIAN FINANCIAL MARKET

During the colonial period three major foreign banks, Barclays bank, Standard and ANZ Grindlays, established operations in Zambia, and dominated the banking system at independence. The government had planned in 1971 to nationalize the foreign banks by purchasing 51 percent share holdings, but this plan was not implemented. Barclays bank and Standard had retained substantial shares of the banking market (approximately 20 per cent and 16 per cent respectively of total bank deposits in 1991) but their market share had been reduced by the growth of ZANACO, Meridien and other local banks. Grindlays was purchased by Standard Bank of South Africa (Because we already had Standard bank in Zambia, they renamed the bank Stanbic) in 1992: it had a much lower market share and focused on the corporate sector.

During the early 1980s two more foreign banks established subsidiaries in Zambia: Citibank, which had concentrated on corporate finance and Bank of Credit and Commerce International (BCCI). The latter - known as Bank of Credit and Commerce Zambia (BCCZ) - expanded rapidly by offering innovative services and attracting business from parastatals to capture 7.5 per cent of total bank deposits by 1989. It was purchased by Union Bank (another local private sector bank) in 1991 after its parent company was closed down.

After the 1991 elections, Union Bank was recapitalised, with additional shareholders and new management brought in, and it reopened in 1992 as New Union Bank. Meridien BIAO Zambia (MBZ) - the Zambian subsidiary of Meridien BIAO - was closed in April 1995 following the closure of Meridien subsidiaries in Swaziland and Kenya. Four more local banks, African Commercial Bank (ACB), Commerce Bank, Credit Africa Bank and Prudence bank were closed

in late 1995. As a result of this financial measures and economic liberalization policies, by 2006 there were 13 commercial banks. Out of these, seven were subsidiaries of foreign banks; one joint venture with majority foreign ownership, four domestic private banks and a public sector bank. This case provides a unique feature of ownership, encompassing foreign financial equity stake, domestic private sector participation and public sector interest. From 2008 to 2015, 6 more subsidiaries of foreign banks have been registered, bringing the total number of banks with foreign ownership to 14 and 19 banks for the whole industry. The number of domestic private banks has remained unchanged.

1.1.5 CURRENT STRUCTURE OF BANKS IN ZAMBIA

The table 1 below depicts the banks ownership operating in Zambia. The table distinguishes bank ownership by varying it between Foreign and Domestic depending on the majority of shareholders.

TABLE 1: CURRENT OWNERSHIP STRUCTURE OF ALL COMMERCIAL BANKS IN ZAMBIA

No.	BANK NAME	TYPE OF OWNERSHIP
1	Access Bank Zambia Limited	FOREIGN
2	Atlas Mara Bank Zambia Limited	DOMESTIC
3	Bank of China Zambia Limited	FOREIGN
4	Barclays Bank of Zambia	FOREIGN
5	Cavmont Bank Limited	FOREIGN
6	Citibank Zambia Limited	FOREIGN
7	Ecobank Zambia Limited	FOREIGN
8	First Alliance Bank Zambia Limited	DOMESTIC
9	First Capital Bank Zambia Limited	FOREIGN
10	First National Bank of Zambia Limited	FOREIGN
11	Indo-Zambia Bank Limited	FOREIGN
12	AB Bank	FOREIGN
13	Investrust Bank Zambia Limited	DOMESTIC
14	Stanbic Bank Zambia Limited	FOREIGN
15	Standard Chartered Bank Zambia Plc	FOREIGN
16	United Bank for Africa Zambia Limited	FOREIGN
17	Zambia Industrial Commercial Bank Limited	FOREIGN

18	Zambia National Commercial Bank Plc	DOMESTIC

Source: Bank of Zambia Official website

According to Soko (2014), Commercial banks in Zambia have continued to show resilience, largely due to the strong capital position. A majority of banks hold capital balances above the regulatory threshold, depicting the strength and stability of the Zambian banking sector. To boost the banks' capital position and strengthen their resilience, the authorities raised regulatory capital further and introduced a tiered structure in April 2012 (GRZ, 2012). The minimum capital requirement for local banks was raised to K104 million (US$20 million) while the requirement for foreign banks was pegged at K520 million (US$100 million). Prior to this revision, the minimum regulatory capital was uniform across all banks at K12 million (about US$2 million). The authorities argue that the new capital requirement is expected to boost banks' lending to the private sector.

1.2 STATEMENT OF THE PROBLEM

Using financial ratios as a measure of performance, the Bank of Zambia reports that the banking sector financial performance and condition has continued to be satisfactory, stable and sound.

The problem with this approach(use of financial ratios) is that it relies heavily on benchmark ratios, which could be misleading as changes in these ratios may be as a result of a change in either numerator or denominator values rather than to changes in the overall ratio [Demirgüç-Kurt and Huizinga (1998)]. These ratios make no distinction between X-efficiency, scale efficiency and scope efficiency as a source of bank performance. Furthermore, these ratios do not capture the long-term performance (Sherman and Gold, 1985); Sathye (2001). Hence, increasing the need for more flexible alternative forms of financial analysis (Yue, 1992), such as econometric models that cater for the deficiency created by the financial ratio approach.

The problem is not only that efficiency has not been measured appropriately but, no attempt has been made using a flexible and heuristic approach to establish the determinants of efficiency as well as pursue a comparison based upon a best practice unobservable benchmark.

1.3 MAIN OBJECTIVE OF THE STUDY

The main objective of this study is to explore and tease out empirically the operational efficiency of commercial banks.

1.3.1 SPECIFIC OBJECTIVES

1. To establish the determinants of efficiency of commercial banks in Zambia.
2. To investigate empirically whether internal and external characteristics drive the efficiency level of commercial banks in Zambia.
3. To explore a model within the context of parametric estimation methods for analysing operational efficiency of commercial banks in Zambia.

1.4 RESEARCH QUESTIONS

This research was aimed at answering the following research questions;

1. What are the determinants of efficiency of commercial banks in Zambia?
2. What internal and external characteristics drive the efficiency level of commercial banks in Zambia?
3. What model can be used to analyse operational efficiency of commercial banks in Zambia?

1.5 SIGNIFICANCE OF THE STUDY

Commercial banks exist because of the various services they provide to various sectors of the economy such as information services, liquidity services, transaction cost services, maturity intermediation services, money supply transmission, credit allocation services, and payment services. Failure to provide these services or a breakdown in their efficient provision can be costly

to both the ultimate sources (households), users (firms) of savings and the banks themselves, which may subsequently affect the overall economy.

Inefficiency means that banks are using a costly combination of inputs to produce a feasible level of output. This may cause macroeconomic instability, in the sense that banks may increase the lending rates and reduce the deposits rates charged - so as to offset the rising operating costs. The increase in the lending rates lowers down the credit multiplier as loans become unattractive to people who may have productive investment opportunities for the funds. In addition, reduced deposit rates are a disincentive to saving. This may lower down the rate of investments and sequentially the rate of economic growth.

Alternatively, the effect of a disruption in the provision of the various services on firms, households, and the overall economy when something goes wrong in the commercial banking sector makes a case for the need to monitor the performance of commercial banks. In addition banks play an important role in effective execution of monetary policy. Thus, the efficiency of the commercial banks is of both academic and policy relevance in Zambia. This study will establish empirically the operational efficiency of commercial banks in Zambia and identify the key drivers of this efficiency. By so doing the study will make a modest contribution to the stock of knowledge and raise the levels of enlightenment on the subject from the policy making perspective: for the Central Bank and the Management of the respective Banks used in the study.

1.6 SCOPE OF THE STUDY

This study explored the status of all commercial banks in Zambia with respect specifically to efficiency in service delivery. The period of study, from 2014 to 2018, represents the most recent full half-decade episode. The significance of this period reflects the recovery from 2008/2009

global financial crisis, such that bank operations are largely and broadly insulated from large and impactful global financial shifts. Within this context, it becomes relatively easy to sieve out bank specific characteristics impacting upon their efficiency.

1.7 LIMITATIONS OF THE STUDY

Nevertheless, although not of concern for this study and therefore a suggestion for further research, it would be crucial to examine a longer period of time as basis for isolating global financial shifts and separating them from regular normal operations at the bank level and also the broader institutional factors, pertaining to, say, the conduct and frequency of monetary policy shocks, including how fiscal policy via deficit financing may impact the efficiency of the banking sector have not been considered.

1.8. CHAPTER ORGANISATION

This research study is organized into five main chapters and these are as follows:

Chapter one: This chapter discusses the background of the study, the problem statement, the research objectives and the research questions. The chapter also discusses the significance and relevance of the study, the scope of the study, the limitation and then the chapter organization.

Chapter two: Chapter two looks at the literature review.

Chapter three: This chapter discusses research methodology which constitutes of the data collection methods, the sample size, the sampling techniques, research design and the population of study.

Chapter four: This chapter looks at Data analysis as well the results and findings of the study.

Chapter five: Chapter five summarizes and concludes the research by making recommendations for further study on the subject.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

This chapter will explore the theoretical foundations of economic efficiency, measurement and application of economic efficiency in banking, itemize the conceptual framework governing the research, review the empirical literature and outline the critique of literature.

2.1 THEORETICAL FOUNDATIONS OF ECONOMIC EFFICIENCY

The concept of economic (productive) efficiency is rooted in neoclassical microeconomic theory, which focuses on resource allocation and utilization. It advocates for non-wastage of resources by emphasizing cost reduction while producing the maximum possible level of output for a given technology and available inputs. The main driving force behind economic efficiency is value creation. In the process of transforming inputs into some output value, a change that increases value is an efficient change and one that decreases value is an inefficient change. For purposes of policy intervention efficiency has often been used to evaluate the effectiveness of policy alternatives. Economic efficiency is better explained by profit maximization (or analogously, cost minimization) but is often associated with perfectly competitive markets than with monopoly because the latter leads to deadweight loss. For firms operating in a competitive industry, efficiency gains accrue when firms earn only normal profits in the long-run and respond to changes in consumer preferences by increasing output. Whether this output in sold at the same, higher or lower price depends in large measure on the position of the cost curves in the long-run. Economic efficiency also encompasses allocative efficiency, which occurs when a firm's inputs are allocated in such a way as to maximise its benefits (profits, revenue and output) depending on the firm's objective function. In a perfectly competitive market, allocative efficient outcomes occur when price is equal to marginal cost. Allocative efficiency also addresses the issue of the right mix of inputs and quality of output produced. Allocative efficiency is thus concerned with informing resource allocation decisions by taking into account both productive efficiency as well as Pareto efficiency.

However, it is still possible to achieve Pareto efficiency without allocative efficiency. At firm level, allocative efficient outcomes occur when price is equal to marginal costs in a perfectly

competitive market. Allocative efficiency also addresses the issue of the right mix of inputs and quality of output produced. X-efficiency, introduced by Leibenstein (1966) refers to efficiency in production by linking inputs to outputs. It is an economic expression for the effectiveness with which an organisation uses its given set of inputs to produce outputs. Specifically, it refers to the internal organisation of firms and its response to external factors. Under such circumstances, both motivational factors (e.g., moral and bureaucratic inertia and human errors) and competitive pressures may affect X-efficiency.

Scale economies and economies of scope provide another perspective for analysing firm efficiency performance. Economies of scale occur when more units of a good or service can be produced on a larger scale, yet with less input costs. Therefore, economies of scale are associated with size of the firm, implying that larger firms enjoy economies of scale due to larger production technology. For a long time, economic growth has been explained by the theory of economies of scale. Marshall (1961) distinguished between internal and external economies of scale, attributing the former to lower costs which lead to higher production and the latter as emanating from external forces such as improvements in the transportation network. External economies of scale may thus benefit all firms in the industry by lowering costs and stimulating firm growth.

In contrast, economies of scope relate to a reduction in costs resulting from joint production. Thus, a firm which decreases its average costs because of changes in production of different products (related or unrelated) is said to be enjoying economies of scope. Economies of scope also provide firms with means to generate operational efficiencies, especially when these are driven by diversification. In the case of banking, for instance, it may be economical for a bank to diversify into different areas of financial services such as investment banking, commercial banking, leasing and factoring, and life insurance rather than pursue traditional commercial banking alone. Such a

strategy may be driven by synergies of knowledge of commercial banking and investment banking of particular corporate customers. For larger banks, diversification may be an important business strategy aimed at reducing portfolio risk and hence gain efficiency.

Although scale economies may be important, bigger may not necessarily be better in the sense that when firms expand in size, the chain of command also becomes cumbersome. Therefore decisions made by top managers may take longer and information distorted by the time it reaches the bottom ladder of the firm. When this happens, the firm may not be realising cost reductions as predicted by theory. Accordingly, diseconomies of scale may set in. Thus, smaller firms may be more efficient than larger firms in this regard. A similar interpretation may be offered for economies of scope. While economies of scope often provide an incentive to expand product lines, the creation of new products is often less efficient than expected, resulting in diseconomies of scope. This is because the introduction of new product brands may entail additional managerial expertise or personnel, higher raw material costs, a reduction in competitive focus, and the need for additional facilities, which collectively could result in high per-unit costs.

2.2 MEASUREMENT AND APPLICATION OF ECONOMIC EFFICIENCY IN BANKING

The concept of productive efficiency was first mooted in Farrell's (1957) seminal work in which he showed that overall efficiency can be decomposed into "price efficiency" and "technical efficiency". He introduced the basic framework for measuring inefficiency, which is defined as "deviation of actual from optimum behavior." The frontier establishes the optimum benchmark against which deviations are calculated. His definition of technical efficiency led to the evolution of different methods for estimating relative efficiencies of firms. The common feature of these

approaches is that information on relative efficiency is obtained from extreme observations of available data to determine the best practice production frontier (Lewin & Lovell, 1990).

Using this information, relative efficiency of each individual decision making unit can be estimated and comparisons made among them. Although frontier approaches possess some similarities, there are significant methodological differences among them. Therefore, the approaches used for estimating economic efficiency can be categorised broadly as being either parametric (stochastic) or non-parametric (linear programming) depending on the specification and estimation of the efficiency frontier and assumption made about the distribution of the error component. The stochastic frontier approach (SFA) was first developed by Aigner *et al.* (1977) and Meeusen and van den Broeck (1977) who estimated efficiencies using cross-sectional data. Subsequently, Ferrier and Lovell (1990) applied the methodology to banks. The SFA specifies a particular form for the production/cost function allowing for a composite error term. Thus, the methodology involves parameterising the relationship between the level of inputs and the technically efficient level of output. Stochastic frontier models use econometric modelling. However, an often cited criticism of the stochastic frontier approaches is that when the specification of the efficiency function and stochastic term are assumed a priori, it may not be clear whether or not the efficiency measure is contaminated by the misspecification of the estimated econometric model.

Another variant of frontier estimation techniques in founded in the so-called non-parametric approaches based on data envelopment analysis (DEA) or linear programming techniques following the seminal work of Charnes *et al.* (1978). The approach by Charnes *et al.* (1978) uses Farrell's (1957) concept of efficiency under constant returns to scale (CRS). Later reformulation of the DEA model by Banker *et al.* (1984) showed that overall efficiency can be divided into "pure

technical" and "scale efficiency" and suggested that firms may in fact be characterised by variable returns to scale (VRS). The DEA also decomposes overall efficiency into technical and allocative efficiency. Data envelopment analysis does not explicitly make any assumptions regarding the functional form of the frontier but empirically builds a best-practice function from observed (actual) inputs and outputs (Favero & Papi, 1995). However, a major criticism leveled against the DEA methodology is that it assumes absence of measurement error and statistical noise. Accordingly, errors are taken as measures of inefficiency. However, as Herrero & Pascoe (2002) have observed these inefficiency scores may be biased if the production process is largely characterised by stochastic elements.

Berger and Humphrey (1997) reported that there are approximately an equal number of studies using non-parametric methods and applications of parametric methods in analysing efficiency of financial institutions. Yet, other studies have estimated efficiency using both approaches (Beccalli, Casu, & Girardone, 2006; Resti, 1997; Weill, 2004). According to Resti (1997) there is no significant difference between the two frontier approaches. When differences occur, they can be explained by revisiting the intrinsic features of the models. On the other hand, Eisenbeis, et al. (1999) argue that efficiency scores derived from the DEA are two to three times larger than those estimated by the SFA. However, the patterns of scores across banks are similar and there is a relatively high correlation between the efficiency scores derived from the two methods.

Given that in developing economies the quality of banking data is not perfect and measurement errors are quite widespread, Fries and Taci (2005) argue that parametric methods, which are more robust to DEA which is a non-parametric method for calculating data problems, would constitute more suitable empirical tools for analyzing banking efficiency. This study therefore, employs the stochastic frontier model based on a composed error model, which has been considered superior

to non-parametric frontiers in measuring efficiency as it will enable us to distinguish between inefficiency and other exogenous shocks.

2.3 CONCEPTUAL FRAMEWORK

The definition and measurement of inputs and outputs in the banking function remains a contentious issue among researchers. Banks are typically multi-input and multi-output firms. As a result, defining what constitutes 'input' and 'output' is fraught with difficulties, since many of the financial services are jointly produced and prices are typically assigned to a bundle of financial services. Additionally, banks may not be homogeneous with respect to the types of outputs actually produced. To determine what constitutes inputs and outputs of banks, one should first decide on the nature of banking technology. In the banking theory literature, there are two main approaches competing with each other in this regard: the production and intermediation approaches (Sealey and Lindley, 1977).

Under the production approach, a financial institution is defined as a producer of services for account holders, that is, they perform transactions on deposit accounts and process documents such as loans. Hence, according to this approach, the number of accounts or its related transactions is the best measures for output, while the number of employees and physical capital is considered as inputs. Previous studies that adopted this approach are among others by Sherman and Gold (1985), Ferrier and Lovell (1990) and Fried *et al.* (1993). The intermediation approach on the other hand assumes that financial firms act as an intermediary between savers and borrowers and posits total loans and securities as outputs, whereas deposits along with labour and physical capital are defined

as inputs. Previous banking efficiency studies research that adopted this approach are among others Charnes *et al.* (1990), Bhattacharyya *et al.* (1997) and Sathye (2001).

Maigua and Mouni (2016) investigated the effect of interest rate determinants on banks' performance in which they used a sample size of 26 banks using multiple regression analysis to analyze data collected. The study results found that inflation rates, discount rates and exchange rates positively affected the banks' performance whereas reserve requirement ratio negatively influenced the banks' performance. After the analysis, it concluded that exchange rates, inflation rates and high discount rates lead to banks' higher performance whereas high levels of reserve requirement lowered the banks' performance.

In another study, Alemu (2015) examined determinants of commercial banks profitability of eight banks in Ethiopia from for 10 years from 2002 - 2013. The study used multiple linear regressions and the fixed effect regression model to analyze data. This study established that size of banks; capital adequacy and gross domestic product have a positive and statistically significant relationship with profitability of banks. The findings of the study also revealed that liquidity risk, operational efficiency, funding cost and banking sector development have a negative and statistically significant relation with profitability of banks. Secondly, the findings from this study further revealed that the relationship between efficiency of management, efficiency of employee, inflation and foreign exchange rate was statistically insignificant, thereby contradicting the some of the findings from Maigua and Mouni (2016) study.

Abebe (2014) assessed the internal and external determinants of financial performance Ethiopia's banks using panel data of banks for a period between the year 2002 and the year 2013. This study employed the fixed effect regression model. The regression results established that capital structure, income diversification, operating cost had a significant negative relationship with

performance while bank size had a positive significant 18 relationships with profitability measured using ROA. The study also established that various macroeconomic variables had insignificant effect on financial performance of Ethiopians commercial banks save for tax rate, which had a negative and significant relationship with profitability.

Anwar (2014) evaluated the factors that improve the profitability of Islamic banks with keen focus on the Gulf African bank in Kenya. The study employed a survey research and used questionnaires to collect data for the study and then employed the Chi-square test to establish the association between the study variables. The findings of the research established a positive relation between Islamic banking products, Shari'ah Compliance, customer satisfaction and profitability of Islamic banks in Kenya. It was concluded that Islamic banking products, Shari'ah compliance and customer satisfaction were the major factors which affected Islamic banks' profitability.

Chinoda (2014) explored the internal factors that influence bank profitability in Zimbabwe. The study sampled five commercial banks, which were randomly selected and used secondary data from the banks financial reports. Using the general linear regression model the study found that size of the bank; liquidity, gross domestic product and inflation had a positive correlation with profitability (ROA) while operating expenses had a negative association with profitability of commercial banks in Zimbabwe. The study recommended that inflation control policies should be given priority to foster financial intermediation.

Another study by Lipunga (2014) evaluated the determinants of profitability of listed banks in Malawi for a period of 5 years from 2009 and 2012 using external (market) and internal measures of profitability. The study employed multivariate regression and correlation analysis where

Earning Yield (EY) and return on assets (ROA) were used to determine the internal and external determinants of profitability. Regression analysis results established that size of the bank, management efficiency and liquidity had a statistically significant effect on return on assets whereas capital adequacy had insignificant impact. Additionally, the research established that earnings yield significantly influences by size of the banks, management efficiency and capital adequacy while liquidity had an insignificant impact on earnings yield.

Mbugua and Rotich (2014) explored the impact of intellectual capital on profitability of commercial banks quoted at the NSE with focus on relational capital, innovation capital, human capital and structural capital, and. The study employed a descriptive research design and secondary data for 5 years from 2009-2013. The research found that structural capital and innovation capital affects listed commercial banks of Kenya profitability. The study recommended that listed banks in bank should enhance strong control over structural and innovation capital, more allocations for intellectual capital investment should be made to the two elements of intellectual capital for more growth in profitability.

Rono, Wachilonga and Simiyu, (2014) assessed the relationship of interest rate spread on l performance of Kenyan quoted banks. The study employed a descriptive design and secondary from published annual reports from the year 2007 to 2012. Using the Pearson product moment correlation the study found that commercial banks adopt different interest rate spreads to cover their costs and earn profit. The research findings also found that there was a significance correlation between interest rate spread and ROA, interest 20 spread and ROE, while the study found an insignificant correlation between interest rate spread and non-performing loan expense.

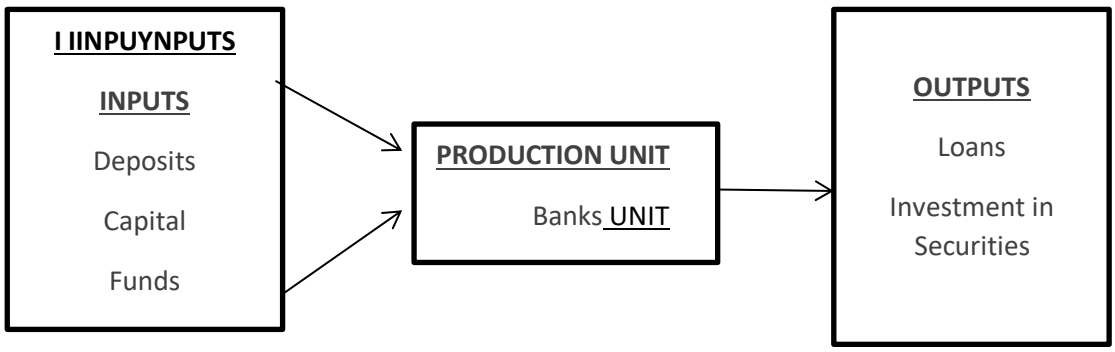
Kyalo (2013) examined the factors influencing profitability of banks in Kenya for a 3 years period from 2010 – 2012. Secondary data collected from the 44 banks in Kenya was used in the study.

Using the regression model the study established that capital invested has a significant influence on ROE while operational efficiency, GDP and inflation have insignificant effect on ROE on equity. The study recommended that commercial banks in Kenya should put more focus both the bank specific factors and the external environment together to come up with effective strategies to enhance their financial performance.

Sawe (2011) assessed external and internal determinants of commercial bank profitability in Kenya. The research used a panel data approach. The research revealed that the coefficients of capital, bank size, liquidity, expense management, inflation, market share, and loan loss provisions were the significant factors that influenced banks profitability. The research also established that coefficients for exchange rates interest rate, GDP per capita and market concentration had the least influence on banks' profitability.

For the purpose of this study, a variation of the intermediation approach or asset approach originally developed by Sealey and Lindley (1977) will be adopted in the definition of inputs and outputs used in equation (2). According to Berger and Humphrey (1997), the production approach might be more suitable for branch efficiency studies, as at most times bank branches basically process customer documents and bank funding, while investment decisions are mostly not under the control of branches. Furthermore, the intermediation approach has more appeal to a developing country such as Zambia where banks continue to perform the basic function of financial intermediation. Figure 1 below depicts the selection of inputs and outputs that are under the intermediation Approach. As seen in figure 1, banks use the inputs such as deposits, Capital and Funds to produce Loans and Investments in securities.

Figure 1 - Intermediation Process Illustration



Source: Author's drawings adopted from literature

What the literature has shown and what has been adapted for this conceptual framework is that banks as production units make use of inputs to produce outputs, but the context within which they operate matters for how these inputs are used and which outputs are likely. In addition, the specific composition of a bank in terms of size for example has a bearing on how inputs are used to produce outputs.

2.4 EMPIRICAL LITERATURE

This section reviews and discusses some of the related empirical literature on banking efficiency. Over the years, models of bank efficiency have evolved along the two distinct frontier estimation techniques discussed above. Both the stochastic frontier and DEA models have received substantial application in the banking efficiency literature. Traditionally, technical efficiency in banking was measured using the production function capturing scale and scope efficiencies. However, technical efficiency is only a component of overall economic efficiency. Although extensive in use, scale and scope efficiency measures are of little economic significance for financial institutions (Kwan & Eisenbeis, 1996). This view is supported by Berger *et al.* (1993) and Berger and Humphrey (1991) who argue that scale and scope inefficiencies are less important than X-inefficiency in the banking industry**.** Similarly, Bauer *et al.* (1998) argue that for policy

purposes, economic efficiency is a much broader concept than technical efficiency in the sense that the former encompasses the latter and involves an optimal choice of inputs and/or outputs based on the reactions to market prices.

The literature on the studies of bank efficiency in sub-Saharan African (SSA) countries has lagged those of other developing countries. Only recently has there been a noticeable increase in the number of studies analysing the efficiency performance of commercial banks. The slow pace in growth of the bank efficiency literature for SSA is partly due to lack of bank-level data during the control regimes. Bank efficiency studies for SSA include Ikhide (2000; 2008) and Adongo, et al. (2005a; 2005b) for Namibia; Hauner and Peiris (2008) and Beck and Hesse (2009) for Uganda and Čihák and Podpiera (2005) for Kenya, Tanzania and Uganda.

In the efficiency analysis of Namibian banks, Ikhide (2000; 2008) and Adongo, et al. (2005a; 2005b) reached contrasting conclusions. The studies by Ikhide (2000; 2008) measure economies of scale and scope with the suggestion that banks in Namibia were characterised by inefficiency. On the other hand, using an alternative profit X-efficiency approach, Adongo, et al. (2005a; 2005b) argue that Namibian banks compared relatively well with international evidence. The variations in conclusions may be due to differences in the approaches used to measure banking efficiency. For east African countries, Čihák and Podpiera (2005) and Hauner and Peiris (2008) reached similar conclusions and observed that the increase in bank competition due to breaking up of entry barriers and entry into the sector of foreign banks was associated with a rise in efficiency. Of the two studies, Hauner and Peiris (2008) deduced changes in efficiency using competition analysis while Čihák and Podpiera (2005) applied descriptive analysis based on several bank performances indicators, including interest margins. Recent evidence by Beck & Hesse (2009) shows that the

high spreads characteristic of Ugandan banks is suggestive of inefficiency performance in the banking industry. It is important to point out that the accounting ratios and narrow measures of efficiency such as spreads are only indicative of actual bank performance and may not provide reliable estimates of banking efficiency (World Bank, 2006).

More recently there have been studies conducted for a group of African countries. For example, Chen (2009) estimated a frontier function for SSA middle-income countries and evaluates the Determinants of efficiency. The study shows that bank inefficiency was in the order of 20-30 percent. Foreign banks were found to be more efficient than public and domestic private banks. Chen (2009) also argues that besides macroeconomic stability, bank competition and financial development, institutional factors also explain the differences in bank efficiency for the sample countries. Kablan (2007) and Kirkpatrick, et al. (2008) also provide evidence of banking efficiency for countries in the West African Monetary Union (WAEMEU) and SSA, respectively. Kablan (2007) observed that cost efficiency was generally higher in the majority of WAEMU states except for Burkina Faso and Cote D"Ivoire while Kirkipatrick, et al. (2008) found lower profit X-inefficiency than cost X-inefficiency for SSA countries. Both studies observed that inefficiency was sensitive to the quality of loans and bank soundness. Interestingly, Kirkipatrick, et al. (2008) also found a negative effect of financial liberalisation but submit that foreign bank penetration helped improve cost X-efficiency. Although many countries were already implementing financial reforms during this period, it is important to note that the banking industry in a majority of these countries also experienced significant macroeconomic instability. It is not surprising therefore that cost-efficiency was susceptible to risk and solvency factors and the turbulent economic environment.

Figueira, et al. (2006) interrogated the effect of ownership structure on efficiency of African banks, using a much larger sample. Using both the parametric SFA and non-parametric DEA, they show that private domestic banks did not appear to outperform public banks. However, foreign owned banks posted higher efficiency than any of the two bank groups, namely domestic private and public banks. Efficiency indicators also showed wide variations across different bank categories. Grigorian and Manole (2002) study the determinants of bank performance in transition economies. They estimate the efficiency scores by applying the Data Envelopment Analysis (DEA) methodology and then run a Tobit censored regression in order to obtain the determinants of bank efficiency. Their main results suggest that foreign ownership and consolidation enhance commercial bank efficiency. They also find that well capitalized banks, greater market share, and GDP per capita are positive determinants of bank efficiency. Finally, they find evidence suggesting that the securities market and nonbank financial institutions hinder bank efficiency.

Casu and Molyneux (2003) apply the DEA approach in order to investigate whether the productive efficiency of European banking systems has improved and converged to a common frontier for the period 1993-1997. They also employ a Tobit regression to indentify the main determinants of European bank efficiency. Their main results indicate that profitability ratios are positively related to bank efficiency as well as public listed banks; at the same time they do not find any relationship between the degree of capitalization and bank efficiency. Pasiouras *et al*. (2007) analyse the cost efficiency of Greek banks and its determinants. They apply a DEA approach to estimate technical, allocative and cost efficiency. Moreover, they use a Tobit regression to find the internal and external factors influencing the level of bank efficiency. The main results indicate that Greek banks operate at an average efficiency of 82%. Furthermore, they find that the size of the bank is positively associated with greater bank efficiency; however, they find that GDP per capita and

unemployment influences bank efficiency negatively. Finally, they argue that the degree of capitalization, the number of branches and quantity of ATMs influence bank efficiency differently depending on the measure of efficiency used.

Hassan and Sanchez (2007) study the determinants of efficiency and its dynamics on the banking industry in Latin America. Their results indicate that the degree of capitalization, profitability ratios, the interest rate spread and GDP growth are positively related to greater bank efficiency. On the other hand, loan loss reserves, the value of stock traded, and the inflation rate have an inverse relationship with bank efficiency. Delis and Papanikolaou (2009) study the determinants of bank efficiency in ten newly acceded European countries. They apply a semi-parametric two-stage model to examine the effects of bank-specific, industry specific and macroeconomic variables on bank efficiency. The main results indicate that foreign ownership, market interest rates and GDP growth are positively related to bank efficiency. On the other hand, credit risk and the concentration of the industry presents a negative relationship with bank efficiency. Naceur *et al*. (2009) evaluate the level of bank efficiency in Middle East and North African (MENA) countries using a Meta frontier calculated by DEA. Afterwards, they apply a Tobit regression to investigate the impact of institutional, financial and bank-specific determinants of bank efficiency. They find that on average, MENA countries show an efficiency score of 67%. On the other hand they find that highly capitalized banks, greater liquidity, and stock market developments increase bank efficiency; whilst greater credit to the private sector and higher market concentration lowers bank efficiency.

Daley and Mathews (2009) use the DEA methodology to estimate technical efficiency scores among a group of Jamaican banks for the period 1998-2007. They estimate conditional convergence using panel data estimation techniques and find that cost over income and the size of

the bank are inversely related to bank efficiency; whereas GDP growth is positive with regards to bank efficiency. Kalluru and Bhat (2009) examine the determinants of cost efficiency of commercial banks in India for the period 1992- 2006. In order to calculate the efficiency scores, they apply the parametric Stochastic Frontier Approach (SFA) and then obtain the determinants of the efficiency scores by applying a Tobit regression. The first set of results indicates that cost efficiency in commercial banks in India has decreased for the period of study. They also find that the earning capacity of banks is the main positive determinant of bank efficiency followed by diversification and other non-interest activities.

Tecles and Tabak (2010) study the determinants of bank efficiency in Brazil for the period 2000-2007. They apply a Bayesian Stochastic Frontier in order to obtain the determinants of bank efficiency. The main results suggest that large banks are the most cost and profit efficient alongside foreign owned banks. Furthermore, they find a positive relationship between the degree of capitalization and bank efficiency. Wezel (2010) investigates the efficiency of domestic and foreign banks in Central America for the period 2002-2007. He applies the DEA and SFA methodologies in order to obtain the efficiency estimates. His main findings suggest that foreign banks are not necessarily more efficient than domestic banks and that large banks are consistently more efficient than smaller banks.

In Mexico, Guerrero and Negrin (2006) analyse the efficiency of the Mexican banking sector for the period 1997-2004. They apply a trans-logarithmic cost and profit functions to generate an efficient frontier. Both static and dynamic models were estimated and the overall results indicate that the average inefficiency of the banking system is around 15% to 19%. In terms of efficiency evolution, the efficiency indicators have decreased from 1997 to 2001 but have increased

afterwards. Solis and Maudos (2008) study the social costs of market power and the "quiet life" hypothesis in the Mexican banking sector for the period 1993-2005.7 They find that the social cost attributable to market power in around 0.15% of GDP; whilst the cost inefficiency of bank management is around 0.075% of GDP. The authors use the DEA methodology to estimate the X-efficiency scores. Guerrero and Villalpando (2009) test the Market Power and Efficient-Structure hypotheses and their validity in the Mexican banking sector for the period 1997-2005. In order to estimate the efficiency scores they apply the Distribution Free Approach (DFA) and obtain measures of X-efficiency and two measures of scale efficiency. They conclude that profitability in the Mexican banking sector is dependent on the degree of market share and not on the efficiency levels.

Sharma, Raina and singh (2012) employed panel data through stochastic frontier analysis model to measure the source of technical efficiency of Indian banking sector. The major determinant of technical efficiency as revealed by the study are fixed asset, deposit and deposit to total liabilities while the cash deposit ratio is not insignificant. In a study on the determinants of operating efficiency in Egypt banking sector, Armer, Mustapha and Eldomiaty (2011) found asset quality, capital adequacy, credit risk and liquidity as the main determinants of efficiency in the highly competitive banks. Using non parametric approach of measuring efficiency by focusing on total factor productivity in the measurement of the determinant of efficiency in the central Asian banks between 2003-2006, Djahlilor and Piesse (2007) revealed that majority of the banking organization are efficient and that the inefficiency observed in some of the central Asian banks are traceable low capital adequacy, poor asset quality and low profitability. Employing Data Envelopment Analysis, it is evident that the main sources of efficiency in Nigeria banking sector is market size and the banking sector is not efficient in the pre and post liberalization period because of the

distribution in the financial system. (Obafemi, Ayodele and Ebong 2013). There is a negative relationship between bank efficiency and profitability (Ismail, Rahim and Abdul Majid 2011; Amer *et al* 2011; Adewoye and Omoriegie 2013; Oke and Poloamine 2012).

In Mexico again, Garza- Garcia (2009) using Data Envelopment Analysis, concluded that loan intensity growth rate of GDP and foreign ownership are better predictors of bank efficiency while non-interest expenses, non-performance loan and inflation rate impede bank efficiency. With the use of Non parametric Data Envelopment Analysis, Inefficiency in Tazanian banks could be traced to inadequate long term capital, poor remuneration, poor management capacity and excess liquidity in terms of technical efficiency. Foreign banks take the lead followed by small and large domestic banks while small banks are scale efficient followed by foreign and large domestic banks respectively (Aikaeli 2008).

Efficiency can be improved through investment in new piece of technology. Financial market in India is dominated by public banks and the ranking revealed that they are the most efficient compared to private banks. However, banking sector in India is characterized by fluctuation in the level of efficiency (Karmzadeh 2012). Consequent to rising number of bank customers, there has been a significant growth in the Jordanian Islamic banks with a concomitant increase in innovation efficiency. Ajloumi and Omari (2009), using both Data Envelopment and financial ratio analysis found that the most profitable banks faced higher risk which makes them operationally inefficient. According to Ines Ayadi (2013), studying the determinants of Tunisian Bank Efficiency using Data Envelopment Analysis, it was discovered that market share in Tunisian banks has inverse impact on their efficiency. Quality of asset suggests that most banks engage in risky activities including credit. In the study, high ratio of quality of asset has negative effect on efficiency because it shows a small yield of bank assets. Tunisian banks tend to be less efficient because they suffer

from under evaluation of credit risk and misallocation of resources. Therefore, it was denoted that the cost of the Tunisian banks increases with non-performing loans. Employing Data Envelopment fixed effect regression analysis by Sarchez, Hassan and Bartkus (2013), efficient banks in Latin American capitalize earnings in liquidity because the ratio of loan loss reserve to gross loan is negatively related to efficiency and banks with low quality loan are expected to have low efficiency. Also, Kamarudaddin and Rohani (2013) in their Data Envelopment analysis of efficiency in Malaysian Islamic banks found that size of banking operation, asset quality improves operational efficiency as opposed to corporate social responsibility which is negatively related to cost/operational efficiency (see also Rozzani, Rashidah and Rahman,2013).

Malaysian banks will be more efficient if they can control non-performing loans, the high cost of maintaining loan default will be avoided. Similar method was used by Endri and Divilestari (2014) where it was noted that variable of interest rate is inversely related to technical efficiency and the rate of inflation on the contrary is has positive relationship with banks operational efficiency. In conjunction with other studies, Ahmad and Noor (2011) in their study of determinants of Efficiency and profitability of World Islamic banks using the non-parametric Data Envelopment Analysis denoted that bank size and capital adequacy has direct relationship with bank efficiency, while loan intensity gives an indirect relationship, which means banks with higher loan to total asset ratio tends to exhibit lower efficiency level. Also, Wang, Zhou and Yan (2012) in their analysis of banking efficiency from an international perspective found that Asset quality and GDP shows a direct relationship with bank efficiency which is contrary to the findings of Kwan and Eisenbeis (1995). Moreover, in the study of Canadian banks efficiency by Allen and Engert (2007) using Data Envelopment Analysis, it was found that Canadian banks has increasing return to scale which denotes that Canadian banks have tended to move closer to the efficient frontier over time,

and cost efficiency is comparatively low suggesting that Canadian banks are relatively efficient according to this measure.

2.5 CRITIQUE OF LITERATURE

This research recognizes the work of Kiyota (2009) who studied the efficiency of commercial banks of sub-Saharan Africa: A Comparative analysis of Domestic and Foreign Banks, who used a fraction of Zambian banks in his Sample for his regional efficiency analysis using data obtained from Bank Scope Database. However, as evidenced by the literature review there is little literature which exclusively measures the efficiency of all Commercial Banks in Zambia. This is therefore why the researcher in this vain seeks to empirically measure the operational efficiency of all commercial banks in Zambia.

2.6 SUMMARY OF LITERATURE REVIEW

This section reviews and discusses some of the related empirical literature on banking efficiency. Both the stochastic frontier and DEA models have received substantial application in the banking efficiency literature. Traditionally, technical efficiency in banking was measured using the production function capturing scale and scope efficiencies. However, technical efficiency is only a component of overall economic efficiency. The slow pace in growth of the bank efficiency literature for SSA is partly due to lack of bank-level data during the control regimes. In the efficiency analysis of Namibian banks, Ikhide (2000; 2008) and Adongo, et al. (2005a; 2005b) reached contrasting conclusions. It is important to point out that the accounting ratios and narrow measures of efficiency such as spreads are only indicative of actual bank performance and may not provide reliable estimates of banking efficiency (World Bank, 2006).

Foreign banks were found to be more efficient than public and domestic private banks. Chen (2009) also argues that besides macroeconomic stability, bank competition and financial development, institutional factors also explain the differences in bank efficiency for the sample countries. Efficiency indicators also showed wide variations across different bank categories. Finally, they find evidence suggesting that the securities market and nonbank financial institutions hinder bank efficiency.

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CHAPTER THREE

RESEARCH METHODOLOGY

3.0 INTRODUCTION

This chapter states the hypothesis and explains the research design adopted by the researcher, it identifies the population and sampling frame, and also explains the data sources and estimation techniques used for analysis.

3.1 HYPOTHESIS

The test hypotheses for this study are:

- H_o : Commercial Banks are not operating efficiently in Zambia
- H_1: Commercial Banks are operating efficiently in Zambia
- H_o: There is no relationship between the Commercial Banks efficiency and the efficiency determinants in Zambia.
- H_1: There is a relationship between the Commercial Banks efficiency and the efficiency determinants in Zambia

3.2 DATA SOURCES

The study used secondary cross sectional data sourced from all the respective banks in Zambia through their published consolidated financial reports.

3.3 STOCHASTIC FRONTIER MODEL

According to Greene (1980), the transcendental logarithmic (Trans-log) function is the most frequently selected model to measure bank efficiency because it is a flexible functional form. For this reason this paper employs a basic multi-product trans-log stochastic cost function. A basic multi-product trans-log is specified and deviations from the cost frontier are estimated based on it. Let total cost for the *n*th banking firm be TC_n, with the measure of its outputs Q_i and input prices P_j. The two-component error term cost function for the firm is

$$\text{In } TC_n = f(Q_i, P_j) + \mathcal{E}_n \qquad (1)$$

Where $\mathcal{E}_n = V_{it} + U_{it}$, of which V_{it} is uncontrollable component of error term ($\mathcal{E}_n$), while U_{it} is its controllable component, which accounts for inefficiency. Because of the fact that the probability of a bank in Zambia to be efficient at one period of time is almost the same as the probability for it to be inefficient at any other subsequent period, therefore exponential distribution assumption fits best the analysis at hand. Exponential conditional distribution of U_{it} given $\mathcal{E}_n$ is written as $N(-\sigma_v A, \sigma^2_v)$, where $A = \mathcal{E}_n / \sigma_v + \sigma_v / \sigma_u$. X-inefficiency of bank *n* denoted by C_n can be specified as the expected value of U_{it} conditional on $\mathcal{E}_n$

$$C_n = E(U_{it} / \mathcal{E}_n) = \sigma_v [\{\phi(A) / 1 - \Phi(A)\} - A] \qquad (2)$$

ϕ represents a standard density function while Φ is a cumulative density function in this formulation. In the stochastic frontier model, the ratio of standard deviations of μ_n and δ_n is defined as $\lambda = \sigma_u / \sigma_v$, while $\sigma^2 = \sigma^2_u + \sigma^2_v$. Estimates of x-inefficiency (C_n) are obtained by evaluating equation (2) at estimates of σ^2_u and σ^2_v.

To estimate parameters for the prediction of x-inefficiency in (2), multi-product trans-log cost function (1) is now expressed as

$$lnTC_n = \beta_0 + \beta_1 lnP_L + \beta_2 lnP_K + \beta_3 lnP_F + \beta_4 lnQ_L + \beta_5 lnQ_I + \mathcal{E}. \quad (3)$$

Equation (1) and (3) is estimated in one step using Maximum Likelihood Method (MLM). In this study the variables included in equation (3) are measured as seen in Table 2 below.

TABLE 2: DESCRIPTION OF VARIABLES FOR STOCHASTIC FRONTIER ANALYSIS

VARIABLE	DESCRIPTION
Total Cost (TC)	Total interest Expenses + Total Non- Interest Expenses + loan loss provision
The two major Qutputs (Q_i)	Q_L and Q_I , Loans and investments in Securities respectively
Input Price of Capital(P_K)	Depreciation over Fixed Assets
Input Price of Labour (P_L)	All Personnel Expenses over Total Assets
Input Price of Funds (P_F)	Total interest expenses over (Deposits plus other borrowed funds)

Source: Author's own elaboration on the computations used

The model is therefore specified with x-inefficiency index as a function of regressors hypothesized as determinants of x-inefficiency of all Commercial banks in Zambia.

$$lneff = f(OWN, ROA, K, L, S, NPL, NIM, LOATA) \quad (6)$$

Where *Ineff* denotes x-inefficiency index estimated from the multi-output trans-log cost function. *OWN* is a proxy for ownership type constructed by using a Dummy where 1 means foreign and 0 Domestic. *ROA* is a proxy for profitability captured by the ratio Profit before Tax to Total Assets. *K* is a proxy for capital adequacy measure, of which we use the proportionate spending on the

capital goods relative to other non-tax expenses as a proxy. *L* is a proxy for bank liquidity captured by the ratio of Total bank's liquid Assets to Total assets , while *S* is a bank size variable measured by natural logarithm of total assets in this case. *NPL* is a proxy for Credit Risk, captured in this case by the ratio of non-performing loans to total loans. *NIM* is a proxy for Net Interest margin captured by Net interest rate income minus Net interest rate expense over Total Assets. *LOATA* is a proxy for Loan intensity which is captured by the ratio of Net Loans to Total Assets. X-inefficiency function is expressed mathematically as a two-limit Tobit estimation model,

$$Ineff = \alpha_0 + \alpha_1 OWN + \alpha_2 ROA + \alpha_3 K + \alpha_4 L + \alpha_5 S + \alpha_6 NPL + \alpha_7 NIM + \alpha_8 LOATA + \mathcal{E}_i$$

$$if\ LHS > 0 \qquad (7)$$

$Ineff = 0$, otherwise

This means x-inefficiency index is estimated for all inefficient observations; otherwise, observations that are efficient have indices of zero inefficiency. Bearing in mind that the higher the bank inefficiency the lower the efficiency; We expect a negative relationship between *Ineff* and *OWN* because Delis and Papanikolaou (2009), suggests that foreign ownerships contributes to overall bank efficiency by increasing competition, by better governance and risk management, and by introducing greater amounts of capital in the sector. We expect a negative relationship between *ROA* with bank inefficiency suggesting that profitability plays an important part in determining greater bank efficiency and according to Mester, 1996; Pastor *et al*., 1997; Carbo *et al*., 1999; Casu and Molyneux, 2003, more profitable banks attract more deposits as well as more creditworthy customers and more efficient banks generate higher returns.

The expected sign between *Ineff* and *K* is negative. According to Alkeali (2008) the intuition is, as long as the bank spends more on improvement of its capital base, it increasingly adds to its efficiency gain. Spending on capital goods in commercial bank caters among other things-for equipment like ATMs, computers, and network development to enhance efficient service provision. Under-investment in fixed capital goods is thus among the factors that derive x-inefficiency in banks. The expected sign between *Ineff* and *L* is negative because according to Naceur *et al*. (2009) greater bank liquidity lowers inefficiency.

The expected sign between *Ineff* and *S* is positive because of the managerial utility maximization theory of the firm. The underpinning conceptual framework is, the large firms are more vulnerable to managerial utility maximization which may rather be motivated more by other external factors than the internal firm performance goals. As the firm grows, the separation of ownership and management increases, agency problem heightens, and the management self-interests easily entrench firm Objectives.

This increases inefficiency in a decision making unit. The expected sign between *Ineff* and *NPL* is positive because the level of credit risk and the expected relationship with bank efficiency is negative since more efficient banks have a better quality portfolio (Kwan and Eisenbeis, 1995; Resti, 1997; Bar *et al*., 2002). However, the empirical literature finds mixed evidence, Altunbas *et al*. (2000) suggests that efficiency is not very sensitive to credit risk whilst Hughes and Mester (1993) and Delis and Papanikolaou (2009) found an inverse relationship between credit risk and bank efficiency.

The expected sign between *Ineff* and *NIM* is positive because Demirguc-Kunt and Huizinga (1999) suggested; that wider margins imply lower banking competition which reflects a degree of lower

bank efficiency. Furthermore, Mirna DUMIČIĆ and Tomislav RIDZAK (2002) also found that the important contribution of higher efficiency is lowering banks' margins.

The expected sign between *Ineff* and *LOATA* is negative because according to J.G. Garza-Garcia, (2011) lending intensity of the banking sector and a positive relationship with bank efficiency is expected since loans are the main source of bank profits; however, the quality of the loans may deteriorate under some circumstances, for example during an economic recession, in which case a higher degree of loan intensity may be detrimental to bank efficiency.

3.4 DATA ANALYSIS PROCEDURE

STATA 13 is the statistical software package used in the analysis of data. It is a fast and multi-purpose data analysis and statistical software with a wide array of estimation and statistical features that apply to both standard and advanced statistical methods and techniques. Stata is also a developer and programmer-friendly solution. It allows users to use and execute commands as they make inferences on their data. As they run these commands and perform analyses, the platform keeps a record of the commands they are using and the sessions they are doing within the solution. Because of this, Stata makes it possible for researchers to easily replicate whatever analyses they previously conducted and share them with their colleagues.

This however is not all, Stata is equipped with robust data management capabilities which enable researchers and business professionals to rapidly capture, consolidate, explore, and present their data so they can come up with meaningful and powerful observations and insights. Last but not least, the software solution simplifies the creation of graphs and other visualizations which are ready to be printed, published, and reproduced.

This is the reason for choosing this statistical data analysis tool for this research.

3.5 DATA PRESENTATION

The research used various forms in presenting data such as Tables and Equations.

3.6 ETHICAL CONSIDERATIONS

Data was collected from published documents of the respective banks and reported for analysis accordingly without biasness. No part of data received has been altered but every data point was recorded and reported honestly so as to avoid biasness and help the researcher obtain accurate and reliable results.

CHAPTER FOUR

PRESENTATION, DISCUSSION AND INTERPRETATION OF FINDINGS

4.0 INTRODUCTION

This chapter will base its focus on the findings. It will comprise of descriptive statistics of data and detailed presentation and discussion of the results from the estimated models. At the bank individual level and as will be explored and shown below, determinants of efficiency will be presented in response to specific objectives 1 and 2, while objective 3 will be pursued within the context of the overall parametric estimation framework, also presented below.

4.1 DESCRIPTIVE STATISTICS OF THE DATA

TABLE 3: DESCRIPTIVE STATISTICS OF THE DATA (N=190)

VARIABLES	Mean	Std. Dev.	Min	Max
TRANSLOG COST FUNCTION:				
TC	61440.37	60036.19	3890	223194
Q_L	973976.4	1138052	12252	3806872
Q_I	457728.5	517988.7	226	2251838
P_L	.0241544	.0211901	.0014696	.1433305
P_K	.0574788	.0455571	.0023073	.5171052
P_F	.0173357	.0192672	.000126	.1300429
TOBIT MODEL:				
OWN	.6842105	.4660576	0	1
ROA	.0002519	.0216374	-.1056222	.0534359
CAM	1.285115	1.568903	.1762609	18.17242
EL	.3971712	.1615458	.1151585	.9359755
S	13.95677	1.328142	10.32885	15.82993
NPL	.0068029	.0149493	0	.1023875
NIM	.014442	.0072666	-.0037894	.0611051
LOATA	.411025	.1489098	.0396812	.6896687

Source: Author's computations based on Published Banks' Consolidated Annual Reports.

Note: INDO-ZAMBIA bank being a Joint Venture (Foreign Public) was captured as a Domestic bank.

Table 4.0 shows the descriptive statistics of all the variables used in the study. The descriptive statistics revealed insights about the operations of the Commercials Banks throughout the period of study. It revealed that the average total cost (TC) of Banks is K61440.37 with a Minimum cost of K3890 and a Maximum cost of K223194. The average amount of Net Loans, Advances and Overdrafts given out by Banks is K973976.4 with a Minimum and Maximum amount of K12252 and K3806872 respectively. The average amount of Investment in Securities is K457728.5 with the Minimum and Maximum amount of K226 and K2251838 respectively.

4.2 RESULTS OF THE ESTIMATION OF THE MODELS

4.2.1 RESULTS FROM STOCHASTIC FRONTIER MODEL

Table 4.1 below gives the empirical results of the maximum likelihood parameter estimates obtained from the trans-log cost function. Overall the trans-log cost function is well behaved and passes a battery of diagnostic tests.

TABLE 4: EMPIRICAL RESULTS FROM THE MULTI-OUTPUT TRANS-LOG COST FUNCTION

InTC	Coef.	Parameter	t-statistic	P-value
$\ln Q_L$	β_5	.6051135	26.81	0.000*
$\ln Q_I$	β_4	.2205848	9.58	0.000*
$\ln P_L$	β_3	.5928624	13.63	0.000*
$\ln P_K$	β_2	.1868888	5.57	0.000*
$\ln P_F$	**β_1**	**.0363454**	**1.22**	**0.223**
INTERCEPT	β_0	2.88026	15.36	0.000*
Diagnostics:				
Log likelihood function	1.6744167			
Wald test statistic	3783.63			
Wald chi square (p-value)	0.0000*			
σ^2_u (P-value)	0.000*			
σ^2_v (p-value)	0.000*			
σ^2	0.0611			

LR test of one-sided error	38.45*
Observations	190

Significance level: * p<0.01, ** p<0.05, *** p<0.10

Source: Author's computations from data obtained from the respective bank's annual reports

As seen in Table 4.1 above, the variance of the inefficient component (σ^2_μ) in the composed error model is statistically significant at 1 percent level of significance. The significance of σ^2_μ reveals that banks experienced some x-inefficiency during the study period. From the Wald test statistic 3783.63 is significant at 1%. We therefore reject the null hypothesis that there is no relationship between the dependent and independent variables at 1 percent level of significance and it further reinforces that the overall model is significant at 1 percent level of significant. More importantly, the test for the one-sided inefficiency error as the dominant structure cannot be rejected at 1 percent. The likelihood ratio (*LR*) statistic was calculated as 38.45 and is significant at 1% level. This implies that there is a presence of the inefficient component and the errors are not normal errors as they have been separated into inefficiency component and idiosyncratic term. Thus, the specification of the model is correct.

Sample parameter estimates are plausible, consistent with a priori expectations. We observe a positive and significant coefficient on the unit price of labour at 1 percent. The estimated coefficient shows that a unit increase in the labour factor price directly translates into 0.59 percent increase in total costs. This means there is a near correspondence between labour costs and overall bank expenses. The estimated coefficient for the price of capital was found to be statistically significant at 1 percent, carrying a positive sign. The estimated coefficient for capital implies that if the input price of capital rises by 1 unit the overall cost will rises by 0.19.

However, equipment and buildings are of a fixed nature, costs related to these assets tend to be of less significance over time. Despite the input price of funds being insignificant it carries a positive

coefficient that shows that the input price of funds may have little to no significant impact on overall cost in the Zambian banking sector. Estimates for the trans - log frontier model also depict an important effect of bank outputs on costs. The point estimates for both output measures Loans (Q_L) and Investment in securities (Q_I) are statistically significant at 1 percent. This shows that bank costs increase with the scale of production. The model shows that if a bank increases output measure of Loans by 1 unit, the overall costs will rise by 0.61 percent. Alternatively, if a bank decides to increase its output measure of investments in securities by 1 unit, the overall costs rises by 0.22 percent.

4.2.1 RESULTS OF THE ESTIMATION OF INDIVIDUAL BANK MEAN INEFFICIENCY

The significance of σ^2_μ reveals that banks experienced some x-inefficiency during the period. X-inefficiency indices are predicted from the estimates of the stochastic frontier model using the distribution of inefficiency term u_i conditional on $\mathcal{E}_n$ (equation 2). Table 4.2 below depicts the mean inefficiency indices of all commercial banks for the period of 2018 annual report.

The table ranks them on average according to the least inefficient to the most inefficient Bank. It is imperative to note that the inefficiency scores generated for each Bank represents the deviation from the cost efficient frontier which can be expressed in terms of Percentages. That is to say a given inefficiency scores indicates by how much, in terms of percentage, a particular Bank is above the minimum cost represented by the cost efficient frontier.

TABLE 5: MEAN INEFFICIENCY SCORES FOR ALL COMMERCIAL BANKS (N = 10)

No.	Bank Name	Mean inefficiency Score	Std. Dev.	Min.	Max.
1	AB	0.0873783	.0025325	.0778879	.0938143
2	ICB	0.0916146	.0039329	.0861997	.0991238
3	BOC	0.0919737	.0040813	.0864031	.0968361
4	FAB	0.0919882	.0029827	.0865849	.096964
5	ACCESS	0.0924029	.0018868	.0887748	.0950324
6	INTERMARKET	0.0925697	.0021237	.0882594	.0948765
7	UBA	0.0927576	.0019255	.090207	.0969771
8	CAVMONT	0.1007414	.0013205	.0989576	.1028779
9	CITIBANK	0.1010772	.0012566	.0992137	.1033287
10	ECOBANK	0.1024824	.0030229	.0985616	.1075386
11	INDO-ZAMBIA	0.1060778	.006396	.0880987	.1092374
12	ATLAS MARA	0.1066672	.0022709	.1039867	.1094985
13	INVESTRUST	0.1079946	.0006415	.1069569	.1091881
14	FNB	0.1124362	.0021421	.109061	.1160254
15	STANCHART	0.1167482	.0010275	.1147514	.1179439
16	ZANACO	0.1185001	.0035475	.108646	.1204552
17	BBZ	0.1185805	.0004516	.1182238	.119447
18	STANBIC	0.1189109	.0013099	.1163629	.1206296

Source: Author's computations from data obtained from the respective bank's annual reports

As seen in Table 4.2 above, on average AB Bank was found to be the least inefficient bank for the study period under consideration. It had an average inefficiency score of 8.7% with minimum inefficiency score of 7.7% and a Maximum inefficiency Score of 9.3%. This result implies that AB Bank had costs that are 8.7 percent above minimum defined by the frontier. It also means that 8.7 percent of its costs were wasted relative to the "best-practice" commercial bank producing the same output and facing the same conditions.

ICB on average was found to have an inefficiency score of 9.2% with a minimum inefficiency score of 8.6% and a Maximum inefficiency score of 9.9%. This result implies that ICB had costs that are 9.2 percent above minimum defined by the frontier. It also means that 9.2 percent of its

costs were wasted relative to the “best-practice” commercial bank producing the same output and facing the same conditions.

BOC on average was found to have an inefficiency score of 9.2% with a minimum inefficiency score of 8.6% and a Maximum inefficiency score of 9.7%. This result implies BOC had costs that are 9.2 percent above minimum defined by the frontier. It also means that that 9.2 percent of its costs were wasted relative to the “best-practice” commercial bank producing the same output and facing the same conditions.

FAB on average was found to have an inefficiency score of 9.2% with a minimum inefficiency score of 8.7% and a Maximum inefficiency score of 9.7%. This result implies that FAB had costs that are 9.2 percent above minimum defined by the frontier. It also means that 9.2 percent of its costs were wasted relative to the “best-practice” commercial bank producing the same output and facing the same conditions.

ACCESS on average was found to have an inefficiency score of 9.2% with a minimum inefficiency score of 8.9% and a Maximum inefficiency score of 9.5%. This result implies that ACCESS had costs that are 9.2 percent above minimum defined by the frontier. It also means that 9.2 percent of its costs were wasted relative to the “best-practice” commercial bank producing the same output and facing the same conditions.

Intermarket on average was found to have an inefficiency score of 9.3% with a minimum inefficiency score of 8.8% and a Maximum inefficiency score of 9.5%. This result implies that Intermarket had costs that are 9.3 percent above minimum defined by the frontier. It also means that 9.3 percent of its costs were wasted relative to the “best-practice” commercial bank producing the same output and facing the same conditions.

UBA on average was found to have an inefficiency score of 9.3% with a minimum inefficiency score of 9.0% and a Maximum inefficiency score of 9.7%. This result implies that UBA had costs that are 9.3 percent above minimum defined by the frontier. It also means that 9.3 percent of its costs were wasted relative to the "best-practice" commercial bank producing the same output and facing the same conditions.

CAVMONT on average was found to have an inefficiency score of 10.0% with a minimum inefficiency score of 9.9% and a Maximum inefficiency score of 10.2%. This result implies that CAVMONT had costs that are 10.0 percent above minimum defined by the frontier. It also means that 10.0 percent of its costs were wasted relative to the "best-practice" commercial bank producing the same output and facing the same conditions.

CITIBANK on average was found to have an inefficiency score of 10.1% with a minimum inefficiency score of 9.9% and a Maximum inefficiency score of 10.8%. This result implies that CITIBANK had costs that are 10.1 percent above minimum defined by the frontier. It also means that 10.1 percent of its costs were wasted relative to the "best-practice" commercial bank producing the same output and facing the same conditions.

ECOBANK on average was found to have an inefficiency score of 10.2% with a minimum inefficiency score of 9.9% and a Maximum inefficiency score of 10.8%. This result implies that ECOBANK had costs that are 10.2 percent above minimum defined by the frontier. It also means that 10.2 percent of its costs were wasted relative to the "best-practice" commercial bank producing the same output and facing the same conditions.

INDO-ZAMBIA on average was found to have an inefficiency score of 10.6% with a minimum inefficiency score of 8.8% and a Maximum inefficiency score of 10.9%. This result implies that INDO-ZAMBIA had costs that are 10.6 percent above minimum defined by the frontier. It also

means that 10.6 percent of its costs were wasted relative to the “best-practice” commercial bank producing the same output and facing the same conditions.

ATLAS MARA on average was found to have an inefficiency score of 10.7% with a minimum inefficiency score of 10.4% and a Maximum inefficiency score of 10.9%. This result implies that ATLAS MARA had costs that are 10.7 percent above minimum defined by the frontier. It also means that 10.7 percent of its costs were wasted relative to the “best-practice” commercial bank producing the same output and facing the same conditions.

INVESTRUST on average was found to have an inefficiency score of 10.8% with a minimum inefficiency score of 10.7% and a Maximum inefficiency score of 10.9%. This result implies that INVESTRUST had costs that are 10.8 percent above minimum defined by the frontier. It also means that 10.8 percent of its costs were wasted relative to the “best-practice” commercial bank producing the same output and facing the same conditions.

FNB on average was found to have an inefficiency score of 11.2% with a minimum inefficiency score of 10.9% and a Maximum inefficiency score of 11.6%. This result implies that FNB had costs that are 11.2 percent above minimum defined by the frontier. It also means that 11.2 percent of its costs were wasted relative to the “best-practice” commercial bank producing the same output and facing the same conditions.

STANCHART on average was found to have an inefficiency score of 11.7% with a minimum inefficiency score of 11.5% and a Maximum inefficiency score of 11.8%. This result implies that STANCHART had costs that are 11.7 percent above minimum defined by the frontier. It also means that 11.7 percent of its costs were wasted relative to the “best-practice” commercial bank producing the same output and facing the same conditions.

ZANACO on average was found to have an inefficiency score of 11.9% with a minimum inefficiency score of 10.9% and a Maximum inefficiency score of 12.0%. This result implies that ZANACO had costs that are 10.9 percent above minimum defined by the frontier. It also means that 10.9 percent of its costs were wasted relative to the "best-practice" commercial bank producing the same output and facing the same conditions.

BBZ on average was found to have an inefficiency score of 11.9% with a minimum inefficiency score of 11.8% and a Maximum inefficiency score of 11.9%. This result implies that BBZ had costs that are 10.9 percent above minimum defined by the frontier. It also means that 10.9 percent of its costs were wasted relative to the "best-practice" commercial bank producing the same output and facing the same conditions.

STANBIC on average was found to have an inefficiency score of 11.9% with a minimum inefficiency score of 11.6% and a Maximum inefficiency score of 12.0%. This result implies that STANBIC had costs that are 11.9 percent above the minimum defined by the frontier. It also means that 11.9 percent of its costs were wasted relative to the "best-practice" commercial bank producing the same output and facing the same conditions.

It is crucial to note that the inefficiency scores generated by the trans-log cost function do not imply that the Commercial banks in Zambia are not efficient to any degree; they are efficient to some degree. The inefficiency scores basically indicate that there is room for improvement by all the commercial banks in the Zambian banking Sector; as the cost efficient frontier depicts attainable output. To compute their level of efficiency we convert the inefficiency scores into efficiency scores as seen in Table 6 - by finding the exponential of the reciprocal of the inefficiency score {EXP(-U); the value obtained is the efficiency score.

Table 6 reveals the average efficiency scores of all commercial banks in Zambia. As before the banks are ranked accordingly - from the most efficient bank to the least efficient bank for the period of the study. As seen in Table 6, the higher the efficiency of a bank, the lower its inefficiency – in Table 5 AB Bank was the least inefficient, after the transformation AB Bank was found to be the most efficient bank (Table 6) for the study period. An efficiency score obtained for a bank, measures how efficient a bank is in using a combination of labour, physical capital and collected deposits to produce an output combination of Loans and Investment in securities under price constraints.

TABLE 6: MEAN EFFICIENCY OF ALL COMMERCIAL BANKS (N=10)

No.	Bank Name	Mean inefficiency Score	Mean Efficiency Score {EXP(-U)}
1	AB BANK	0.0873482	0.916357964
2	ICB	0.0916146	0.912456743
3	BOC	0.0919737	0.912129138
4	FAB	0.0919882	0.912115912
5	ACCESS	0.0924029	0.911737736
6	INTERMARKET	0.0925697	0.911585671
7	UBA	0.0927576	0.9114144
8	CAVMONT	0.1007414	0.90416682
9	CITIBANK	0.1010772	0.903863252
10	ECOBANK	0.1024824	0.902594035
11	INDO-ZAMBIA	0.1060778	0.899354676
12	ATLASMERA	0.1066672	0.898824752
13	INVESTRUST	0.1079946	0.897632444
14	FNB	0.1124362	0.89365436
15	STANCHART	0.1167482	0.889809219
16	ZANACO	0.1185001	0.888251727
17	BBZ	0.1185805	0.888180314
18	STANBIC	0.1189109	0.887886908

Source: Author's own calculations based on published bank consolidated annual reports

On average AB BANK was found to be Efficient by 91.6%. ICB, BOC, FAB, ACCESS, UBA, CAVMONT, CITIBANK, ECOBANK, INDO-ZAMBIA, ATLASMERA, INVESTRUST, FNB, STANCHART, ZANACO, BBZ and STANBIC are on average efficient by 91.2%, 91.2%, 91.2%, 91.2%, 91.2%, 91.1%, 90.4%, 90.4%, 90.3%, 89.9%, 89.9%, 89.8%, 89.6%, 89.4%, 88.9%, 88.8%, 88.8% and 88.8% respectively.

4.2.1.2 OVERALL ANNUAL REPORT X-INEFFICIENCY ESTIMATES

In view of all the inefficiency indexes of all commercial banks over the study period, the mean inefficiency index is 10.3%. This result implies that the Zambian banking sector for the period under this study was inefficient of degree 10.3%. This means that for the banking industry as a whole, mismanagement of resources remains an impediment to good performance .The annual report inefficiency index was changing ranging from 10.1 to 10.5. This implies the existence of certain static management approaches which deliver with some sustained inefficiency rates varying little from the period mean of 10.3 percent. The changes were up and down with the standard deviation of 0.01.

4.2.2 RESULTS FROM TOBIT REGRESSION

X-inefficiency indexes obtained from the Trans-log Cost function (equation 3) were regressed against eight explanatory variables comprising Ownership, Profitability, Capital adequacy, bank liquidity, bank size, Credit Risk, Net interest Margin and Loan Intensity (equation 7). Using consolidated data for all banks, the Tobit model is estimated and the results are presented on Table 9.

The Log-Likihood ratio (LR) test statistic 505.97 is significant at 1 percent level of significance. This implies that we reject the null hypothesis that states that at least one variable is equal to Zero. Thus, the overall model is statistically significant – that is to say there is a relationship between all the independent variables and the dependent variable and that all the independent variables are simultaneously not equal to zero. Furthermore, all variables were found to be statistically significant at varying levels of significance.

Table 7: Tobit Estimates of the Sources of X-inefficiency

INEFF	Coef.	Parameter	t-statistics	P-value
OWN	α_1	-.001063	-2.13	0.034**
ROA	α_2	-.0813193	-5.84	0.000*
K	α_3	-.0010316	-7.07	0.000*
L	α_4	-.0196109	-8.40	0.000*
S	α_5	.0081481	37.21	0.000*
NPL	α_6	.0308563	2.05	0.042**
NIM	α_7	.0630771	1.99	0.048**
LOATA	α_8	.0099464	4.04	0.000*
INTERCEPT	α_0	-.0059034	-1.86	0.065***
Diagnostics:				
Pseudo R2		-0.4279		
Wald test statistic		505.97		
p-value		(0.0000)*		
Log likelihood		844.23705		
Observations		190		

Significance level: * p<0.01, ** p<0.05, *** p<0.10

Source: Author's own calculations from the respective Banks' Published consolidated annual reports.

Starting with Ownership variable, *Own*, we see that it's significant at 5 percent level of significance and bears a negative sign. This suggests that ownership does have a bearing on bank efficiency in Zambia and that on average foreign owned banks are more efficient than domestic owned banks in the Zambian banking sector. This result is consistent with the findings of Delis and Papanikolaou

(2009), Figueira, et al. (2006) and Chen (2009). Contrary to the findings of Wezel (2010) who found that foreign banks are not necessary efficient in North America.

At 1 percent level of significance, Profitability *ROA* is statistically significant and has a negative sign. This implies that the profitability of commercial banks reduces X-inefficiency in this sector thereby enhancing the banks efficiency. This result is consistent with the findings of Mester, 1996; Pastor *et al*., 1997; Carbo *et al*., 1999; Casu and Molyneux, 2003. However, contrary to the finding of Ajloumi and Omari (2009) who found that profitability of Jordanian Islamic Banks was negatively related to bank efficiency.

With capital adequacy variable, *K*, we see that it is significant at 1 percent level of significance and bears a negative sign. This implies that high capital adequacy has a positive impact on Zambian banks efficiency. This result is consistent with findings of Alkeali (2008), Djahlilor and Piesse (2007) and Armer, Mustapha and Eldomiaty (2011): who suggested that capital inadequacy underpins banks efficiency.

In connection with banks liquidity, estimated parameter established a significant relationship between bank inefficiency and bank liquidity at 1 percent level of significance and has a negative sign. This implies that low bank liquidity lowers bank efficiency in Zambian banks. This result is in lie with the findings by Naceur et al. (2009) and Armer, Mustapha and Eldomiaty (2011): who found that greater bank liquidity enhances efficiency in banks.

Bank size, S, is statistically significant at 1 percent level of significance and has a positive sign. This implies that the bank size, S, is positively related to x-inefficiency. This result is in conformity with the findings of Ahmad and Noor (2011): who suggested that the bigger a bank size the lower the efficiency levels. Contrary to Hauner (2005) who explains that larger banks could pay less for

their inputs than their counterparts and that there could be increasing returns to scale through the allocation of fixed costs thereby enhancing bank efficiency.

The same result can be found with *NPL*, which also has positive sign and is statistically significant at 5 percent level of significance. *NPL* represents credit risk, suggesting that greater credit risk reduces the degree of bank efficiency. This result is consistent with other studies (Demir *et al.*, 2005; Kalluru and Bhat, 2009; Delis and Papanikolaou, 2009) arguing that reduced efficiency in banks can be a result of large amounts of non-performing loans relative to Net loans. Similar findings have been reported in previous studies. For example, Carvallo and Kasman (2005) found that high risk undermined banks' ability to improve cost efficiency performance of Latin American and Caribbean banks.

With regards to net interest margin, *NIM*, we see it being statistically significant at 5 percent level of significant and have a positive sign. This result implies that net interest margin is positively related with X-inefficiency in the Zambian banking firms. This result is in line with the findings of Demirguc-Kunt and Huizinga (1999) and Mirna DUMIČIĆ and Tomislav RIDZAK (2002).

Finally, Loan intensity, *LOATA*, is statistically significant at 1 percent level of significance and has a positive sign. This result implies that Loan intensity is positively related to x-inefficiency in the Zambian banking sector. This result suggests that banks with a higher loan to total asset ratio tends to exhibit lower efficiency level. This result suggests that loan intensity increases the overall bank cost and reduces the quality of Loans provided. This result is consistent with findings of Ahmad and Noor (2011).

4.2.3 EFFICIENCY WITH REGARD TO TOTAL ASSETS

The researcher wanted to find out that if there is any significant difference regarding the efficiency related to total assets among all the banking groups during.

This was tested as under: Null Hypothesis

H0: There is no significant difference in total assets among all the 18 commercial banks during the study.

H1: At least one of the estimated parameters are not equal to zero. The test for overall significance is conducted using the F test (n=190).

TABLE 8: ANALYSIS OF VARIATION

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	7.2E+12	2.4E+12	5.085904	0.002094
Residual	187	8.69E+13	4.72E+11		
Total	190	9.41E+13			

Source: Author's own compilation from the data

The above ANOVA table indicates that the calculated value of F is 5.08, which is more than the table p-value at 5% level of significance. Hence, the null hypothesis is rejected. It means that there is a significant difference in total assets among all the three banking groups. The model is statistically significant and can be used for inference.

The total assets of banks have a huge impact on efficiency of the bank operations. If a firm is cost efficient, then it should be profitable and negatively correlated with other cost performance like ratio of operating cost to total assets or the ratio of operating to income.

TABLE 9: MODEL SUMMARY

R	R Squared	Adjusted R^2	Level of Significance
0.71782	. 93197	. 918231	0.05

Source: Author's own compilation from the data

Using the model statistical analysis, the return to assets level obtained from the sample are statistically significant and 95% level of significance. The results obtained are statistically significantly.

The data obtained shows that, the 91.82% of the commercial bank total assets would enhance the efficiency levels of the commercial banks operations, holding other factors constant. These finding are statistically significant at 5% level of significance.

Therefore, because of the above conditions being meet, the data is normality distributed and the t test can be used in the validation of the findings.

CHAPTER FIVE

SUMMARY OF THE FINDINGS CONCLUSION AND RECOMMENDATIONS

5.0 INTRODUCTION

This chapter concludes the overall research paper. This chapter comprises of a summary of findings, Recommendations and Recommendations for further studies.

5.1 SUMMARY AND CONCLUSION

This study was aimed at exploring the operational efficiency of all commercial banks in Zambia for the study period consisting of 4 years. It did this by employing a two stage analysis: in the first stage a Trans – log cost function was used to predict the cost estimates (X-inefficiency scores) for all commercial banks in Zambia and the second stage a Two - limit Tobit was used to derive the determinants of X-inefficiency for all commercial banks in Zambia.

The Trans–log cost function estimates revealed that the Zambian banking sector for the period under the study was inefficient of order 10.3 % which implies that on average, Zambian banks were 10.3 percent above the minimum cost defined by the frontier. This means that for the banking industry as a whole, mismanagement of resources remains an impediment to good performance. The annual report mean inefficiency scores were within a range of 10.1% and 10.5% which clearly suggests static management in the banking sector.

The Tobit regression revealed that foreign owned banks were average more efficient than domestic banks. The Tobit regression further revealed that bank profitability, high Capital adequacy and Bank liquidity reduce bank inefficiency and conversely, bank inefficiency was found to be enhanced by Bank size, Credit Risk, Net interest Margin and loan intensity.

5.2 RECOMMENDATIONS

Based on the findings and critical consideration of the literature, the following recommendations can be made:

1. Banks should enhance their management capacity as the bank expands by employing decentralization policies to break down the bureaucracy that is exhibited by commercial banks in Zambia.
2. The banks should carefully monitor the ratio of non- performing loans to total loans by them ensuring that their management and credit officers abide by the banks' credit guidelines in the consideration of loan proposals, not least align these to national, regional and international guidelines to minimize risk to exposure. The results indicate that the rising incidence non-performing loans have a consequent adverse on operational efficiency. This calls for banks to acquire the employment of a sound management team and credit officers with regular examination of banks asset book by the supervisory bodies as a way to curb this menace.
3. Banks should lower their net interest margins if they want to reduce on their x-inefficiency. If banks want to charge high lending rates, they also have to charge high deposit rates to reduce their net interest margin. This will make them more competitive and enhance their efficiency levels.
4. Capital inadequacy is among the critical impediments to x-efficiency. Banks should optimize productivity through rearrangement of their capital - labour balance.

5. Domestic banks should aim to address their efficiency issues by participating in international banking, with guidance from the central bank, to align with monetary policy shifts. This entails domestic owned banks setting up their stations/subsidiaries in foreign

countries, if possible, to run competitively but to also spread their risk profile. This outreach to other economies by domestic banks will compensate for the capital flight from the economy through foreign banks.

6. Fiscal consolidation and management of macroeconomic risk is necessary: increasing public debt and increased debt servicing have been shown to be positively linked to higher interest rate margins; which may ultimately underpin bank efficiency.

5.3 RECOMMENDATIONS FOR FURTHER RESEARCH

This study only focuses on investigating the efficiency levels of the Zambian Commercial banks using Parametric Measure of efficiency (Stochastic methods), however further investigations can be made using a different methodology like non-parametric measures such as Data Envelopment Analysis, but should take into account the broader macroeconomic policies, such as monetary and fiscal policy shocks.

This study also focused on Bank specific factors to determine factors that affect bank efficiency in Zambian banks. This is one side of determinants of bank efficiency. There are other determinants that may influence bank efficiency such as macroeconomic variables. There is need to investigate further their influence on bank efficiency.

In addition, a different approach can be useful to determine whether introduction of certain technologies in banking such as mobile money banking services have had a positive effect on bank efficiency. This would require exploring efficiency within the context of a difference-in-difference framework to establish the status with respect to efficiency before and after technological innovation.

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APPENDIX

Table 10.3: Analysis of variation: Summary

Regression Statistics

Multiple R	0.279637
R Square	0.93197
Adjusted R Square	0.918231
Standard Error	684698.9
Observations	190

Table 10.4: ANOVA

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	7.36E+12	3.68E+12	7.846786	0.000536
Residual	187	8.67E+13	4.69E+11		
Total	190	9.41E+13			

Table 10.5: Alternative Test: Coefficients

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	509462.3	398365.2	1.278882	0.20254	-276461
ROA	0.155099	0.07958	1.948974	0.052811	-0.0019