FIRM CHARACTERISTICS AND FINANCIAL INTERMEDIATION EFFICIENCY OF DEPOSIT TAKING SAVING AND CREDIT CO-OPERATIVE SOCIETIES IN KENYA

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DOCTOR OF PHILOSOPHY

(Business Administration)

JOMO KENYATTA UNIVERSITY OF

AGRICULTURE AND TECHNOLOGY

2016

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A Thesis Submitted in Partial Fulfillment for the Degree of Doctor of Philosophy in Business Administration of the Jomo Kenyatta University of Agriculture and Technology

2016

DECLARATION

This thesis is my original work and has not been presented for examination in any other University:

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This thesis has been submitted for examination with our approval as University supervisors.

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DEDICATION

To my parents; Tarcisio Kariuki and Hannah Njoki

To my dear wife; Peninah Wanjiru and lovely daughter; Cheryl Wanjiku

ACKNOWLEDGEMENTS

My first acknowledgement goes to the almighty God for granting me life, good health and strength in the course of writing this thesis. My sincere gratitude goes to my able supervisors, Dr. Patrick Ngugi and Dr. Willy Muturi. Their immense support, wise counsel and encouragement to move on despite the challenges have helped me soldier on to the end. Special thanks to Dr. Christine Nanjala for her valuable comments on this thesis that led to significant improvement. My thanks go to the officers at SASRA for granting me access to the audited annual reports of SACCOs targeted in this study.

I sincerely thank my two research assistants, Mr. Ibrahim Kiragu and Mr. Charles Githira for their excellent work during data collection and analysis respectively. I wish also to thank Mrs. Jane Kamiri for her assistance in proofreading and editing this work. Finally, I am glad for the moral support given to me by my workmates at KCA University; they continually challenged me which encouraged me to pace on. I am greatly indebted to all people who helped me in one way or the other and are not mentioned. Any errors in this thesis are the sole responsibility of the author, and not any of the individuals mentioned in this acknowledgement.

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ABBREVIATIONS & ACRONYMS

ACCOSSCA	Africa Confederation of Cooperative Society Savings and Credit Association
ANOVA	Analysis of Variance
ASQ	Assets Quality
BCBS	Basel Committee on Banking Supervision
BOSA	Back Office Saving Activities
CA	Capital Adequacy
CAMEL	Capital Adequacy, Asset Quality, Management, Earnings and Liquidity
CBK	Central Bank of Kenya
CMA	Capital Markets Authority
CRSTE	Constant Return to Scale Technical Efficiency
DIV	Diversification
DMU	Decision Making Unit
DTSs	Deposit Taking SACCOs
FDH	Free Disposal Hull
FEM	Fixed Effect Model
FOSA	Front Office Saving Activities
FSD	Financial Sector Deepening
GMM	Generalized Method of Moments
IRA	Insurance Regulatory Authority
KUSCCO	Kenya Union of Saving and Credit Co-operatives
LIQ	Liquidity
MPI	Malmquist Productivity Index
NCUA	National Credit Union Administration
NII	Non Interest Income
NPA	Non Performing Assets
NPLS	Non Performing Loans
PEARLS	Protection, Effective Financial Structure, Asset Quality, Rates of

	Return and Costs, Liquidity and Signs of Growth
PROF	Profitability
PTE	Pure Technical Efficiency
RBA	Retirement Benefits Authority
REM	Random Effect Model
RMP	Relative-Market Power Hypotheses
ROK	Republic Of Kenya
SACCO	Saving and Credit Co-operative
SASRA	SACCO Society Regulatory Authority
SCP	Structure-Conduct-Performance
SFA	Stochastic Frontier Analysis
TEC	Technical Efficiency Change
TEFF	Technical Efficiency
TFP	Total Factor Productivity
VIF	Variance Inflation Factor
VRSTE	Variable Return to Scale Technical Efficiency
WOCC	World Council of Credit Unions

DEFINITION OF KEY TERMS

Asset quality: It refers ability of bank assets (loans) to provide income; it is the timely manner with which borrowers are meeting their contractual obligations. The ratio of non-performing loans to gross loans and advances is used as the indicator for asset quality (Alhassan, Kyereboah-coleman, & Andoh, 2014).

Capital Adequacy: It is the extent to which capital is enough to meet any contingency. It is measured by the capital adequacy ratio. It is the ratio which protects banks against excess leverage, insolvency and keeps them out of difficulty. It is defined as the ratio of banks capital in relation to its current liabilities and risk weighted assets (Fatima, 2014).

Data Envelopment Analysis (DEA): A multi-factor productivity analysis model for measuring the relative efficiencies of a homogenous set of decision making units (DMU) such as a bank. DEA uses the principles of linear programming theory to examine how a particular DMU operates relative to other DMUs in the sample. DEA method constructs a frontier based on actual data (Nasieku, Kosimbei, & Obwogi, 2013).

Financial intermediation efficiency: refers to mobilization of funds from surplus units and availing them to deficit units with minimal or no wastage. 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 (Sufian, 2009).

Firm characteristics: This refers to the aspects of a firm that are affected by firm-level management and can be used to distinguish one firm from another (Arora, 2014).

Liquidity: Refers to the ability of the bank to meet up deposit withdrawals, maturing loan request and liabilities without setback (Akhtar, Ali, & Sadaqat, 2011). Failure of the bank to meet its obligation due to insufficient liquidity will lead to poor credit worthiness, loss of creditor's confidence, or at times legal fail resulting in the closure of the bank (Donkor & Tweneboa-Kodua, 2013).

ABSTRACT

There has been growing concerns over the financial soundness of a number of SACCOs with a few having collapsed in the recent past. Empirical evidence indicates that there exists a strong association between efficiency and stability of financial institutions and that efficient banking sector is better able to withstand negative shocks incase of financial crises. Recent developments in the subsector may point to intermediation inefficiency; this includes a sustained increase in SACCO lending rates accompanied by a loss of customer base. The study first sought to evaluate the financial intermediation efficiency of DTSs and subsequently determine the relationship between firm characteristics and efficiency. Specifically, the relationship between capital adequacy, asset quality, liquidity, diversification, profitability & size and financial intermediation efficiency was assessed. A balanced panel data for 103 DTSs over the period 2011-2014 was collected and analyzed using a two staged methodology. In the first stage, efficiency scores were generated using data envelopment analysis (DEA). DEA Computer Program Version 2.1 was used to generate the efficiency scores. The results showed that on average, there had been a sustained increase in intermediation efficiency over the years from a low of 0.646 in year 2011 to a high of 0.707 in 2014. This was attributed to regulatory compliance indicating that as more and more DTSs met regulatory requirements, they improved in their financial intermediation efficiency. Over the period; the scale efficiency was higher than pure technical efficiency implying that inefficiencies were due to managerial underperformance rather than suboptimal size. Malmquist total factor Productivity Index (MPI) was used to assess the changes in productivity over the period. The results indicated that, technical efficiency increased by 5.7% which could largely be attributed to increase in pure technical efficiency by 3.8% and increase in scale efficiency by 1.5%. In the second stage, firm characteristics were regressed on the efficiency scores using fixed effects panel regression model. The bias corrected efficiency score were used instead of conventional DEA scores and

incorporated into EViews version 8 and STATA for regression analysis. The study used forward selection approach to select the most significant measure for each independent variable. The study revealed an insignificant relationship between capital adequacy, liquidity and financial intermediation efficiency. This was attributed to the fact that most DTSs maintained the minimum ratio set by the regulator. This effectively rendered capital adequacy and liquidity non firm specific. In case of asset quality, the relation was found to be direct implying that as the asset quality improves, efficiency of a DTS increases. Diversification was found to be hurting efficiency. As non-interest income increases, the level of efficiency was found to decline. More profitable DTSs were found to be more efficient indicating that profitability is efficiency enhancing. The results also revealed a positive relationship between size and efficiency. The study recommends that managers and policy makers should concentrate on how to improve the managerial efficiency and also increase the size of SACCOs. Policy framework should also be directed towards encouraging DTSs to consolidate their operations and limit their diversification into non-interest income. Additionally, sufficient resources should be directed towards improving quality of asset held by SACCOs through increased monitoring of the credit process.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

This study sought to examine the relationship between firm characteristics and financial intermediation efficiency of deposit taking saving and credit co-operatives societies (DTSs) in Kenya. This chapter provides a broad overview of the topic under study. The chapter begins with the background of the study that highlights the global view on co-operatives as well as the local perspective. The terms financial intermediation efficiency and firm characteristics are explained. To provide a deeper understanding, the place of SACCO Societies in the Kenyan financial sector is addressed. The problem statement, objectives of the study, research hypothesis, scope of the study and significance of the study are also well articulated in the chapter.

A co-operative is an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise (Birchall, 2004). Internationally, co-operatives are founded on seven principles promulgated by the International Co-operative Alliance (ICA), (1995); voluntary and open membership; democratic member control; member economic participation; autonomy and independence; provision of education, training and information; co-operation among cooperatives; and concern for the community.

There are two broad categories of co-operatives; financial co-operatives and non-financial co-operatives. Financial co-operatives are those that provide basic financial services to individuals. Financial co-operatives are referred to in different terms in different countries. In countries like UK, USA, Canada, Australia, etc., they are referred to as credit unions. In Kenya, they are referred to as Savings and Credit Co-operative Societies (SACCOs). According to Goddard, Mckillop and Wilson (2008a), credit

unions were originally distinguished from other financial institutions by their emphasis on small value, unsecured, non-mortgage loans to individuals and households.

Recent developments in the financial markets have motivated credit unions to reorient their operations. This has resulted to a transition process. Ferguson and Mckillop (2000) used an organizational life-cycle methodology to partition credit unions into distinct growth phases; nascent (formative), transition and mature. Mature movements were found to be in developing countries among them, United States, Canada, Australia, France and Korea. Kenya was the only African country whose credit unions (SACCOs) were classified as transition movements. All other African country's credit unions were classified as nascent or formative.

Transition movements are characterized by large asset size, evolving regulatory and supervisory frameworks, less common bond restrictions, higher levels of product diversification, developed professional trade associations and a greater emphasis on growth and efficiency (Ferguson & Mckillop, 2000). The diversification into nontraditional markets and breaking the common bond however exposes SACCOs to systemic risks that threaten their stability. Empirical evidence indicates that there exists a strong association between efficiency and stability of financial institutions. In fact inefficiency is constantly said to be the leading cause of bank failure (Rozzani & Rahman, 2013). Delis and Papanikolaou (2009) argue that an efficient banking sector is better able to withstand negative shocks and contribute to the stability of the financial system.

In addition to stability, efficiency enables financial institutions to provide affordable services with potential of drawing a larger number of Kenyans to the financial system (Kamau, 2011). The Kenya's vision 2030 envisages a financial sector that is able to (i) improve stability, (ii) enhance efficiency in the delivery of credit and other financial services, and (iii) improve access to financial services and products for a much larger number of Kenyan households. This is informed by significant number of Kenyans who

are financially excluded. The 2013 Financial Access survey revealed that 25.4% of the adult population is totally excluded from financial services (FSD Kenya, 2013).

1.1.1 Financial Intermediation Efficiency

In the recent past, the concept of efficiency has gained prominence as an alternative measure of firms' performance. A closely related concept is that of productivity. Coelli, Rao, O'Donnell, and Battese (2005) argue that productivity of a firm refers to the ratio of the output(s) that it produces to the input(s) that it uses. Efficiency on the other hand refers to firm's ability to attain an amount of output with a minimum level of resources (Daraio & Simar, 2007). It is described as a distance between the quantity of input and output, and the quantity of input and output that defines a frontier, the best possible frontier for a firm in its cluster (industry). Any producing unit is said to be technically efficient when it can produce the maximum amount of output using the given level of input, or it can produce a given level of output using minimum amount of input (Sharma, Sharma, & Barua, 2013).

The measures of efficiency are more accurate than those of productivity in the sense that they involve a comparison with the most efficient frontier, and for that they can complete those of productivity, based on the ratio of outputs on inputs (Coelli *et al*., 2005; Daraio & Simar, 2007). Early efforts in the investigation of efficiency and its measurement were made by Koopmans (1951) and Debreu (1951). It was later advanced by Farrel (1957) who proposed that efficiency of a firm consists of two components; technical efficiency, which reflects the ability of a firm to obtain maximal outputs from a given set of inputs, and allocative efficiency, which reflects the ability of a firm to use the inputs in optimal proportions, given their respective prices. Due to challenges in determining the input prices in financial institutions, the technical efficiency is widely used as a measure of efficiency.

The Importance of financial institutions stems from their role as main channels of savings and allocators of credit in an economy. They collect and collate deposits from micro-savers and channel them to investors. This is the intermediation process which they must achieve efficiently (Arora, 2014; Ndung'u, 2010). Financial intermediation efficiency refers to mobilization of funds from surplus units and availing them to deficit units with minimal or no wastage. 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 (Sufian, 2009).

Financial system is a nerve centre of economic development across the globe. It provides intermediation services by bringing together savers and investors by channeling funds to investments that guarantee positive return. A stable and efficient financial system pools, transfers, and minimizes risks while at the same time increases liquidity and information sharing through the use of more sophisticated financial products and technology (ROK, 2012). According to Ndung'u (2010), efficiency is achieved when there are strong institutions with requisite capacity to satisfy market needs while complying with statutory and prudential requirements. This may have informed the establishment of the SACCO Societies Regulatory Authority (SASRA) to provide statutory and prudential regulations of deposit taking SACCOs similar to what is provided by the Central Bank to all commercial banks.

1.1.2 Firm Characteristics

The study of efficiency of financial institutions is enhanced by investigating environmental variables that are likely to influence efficiency. This involves a two-stage estimation procedure where efficiency scores are estimated in the first stage, and the resulting efficiency estimates are regressed on some environmental variables in a second stage. The term "environmental variables" is usually used to describe factors, which could influence the efficiency of a firm (Sufian, 2009). According to Sharma, Sharma, and Barua (2013), these determining factors are categorized into three categories: (1)

bank (firm) specific variables; (2) macro economic variables; and (3) regulatory variables. Arora (2014) agrees arguing that the reasons for efficiency differences (among banks) may be attributed to two types of forces, namely (a) external macro-economic forces influencing all banks and (b) internal bank-specific forces.

Most studies on efficiency have concentrated on commercial banks hence the term "bank characteristics" is widely used instead of "firm characteristics". Firm characteristics refer to the aspects of a firm that are affected by firm-level management. Arora (2014) argues that while differences in efficiency across banks may be due to forces internal to the banks itself such as objectives, bank conduct, size, ownership styles and managerial capabilities of banks; it may not be possible to account for all bank-specific determinants due to measurement challenges. For this reason the current study narrowed to those characteristics that are observable from the financial statements.

According to Athanasoglou *et al.*, (2008), firm characteristics, also referred to as internal or micro factors, are those that originate from the financial statements such as income statements and/or statement of financial position. Given that firm characteristics reported in financial statements are largely controllable by the firm level management, much attention is accorded to them by researchers. Empirical evidence of strong significant relationship between firm characteristics and financial intermediation efficiency will lead to increased managerial attention in a bid to improve efficiency. This study focused on capital adequacy, asset quality, liquidity, profitability, income diversification and asset size.

1.1.3 Savings and Credit Cooperative Societies (SACCOs) in Kenya

The Savings and Credit Cooperative Societies (SACCOs) have continued to play a critical role in Kenya's financial sector in terms of access, savings mobilization and wealth creation. The subsector is a critical player to achieving the 10% annual economic growth target as envisioned by Kenya's economic blueprint, Vision 2030 (SACCO

Society Regulatory Authority (SASRA), 2013). SACCOs are voluntary financial institutions owned and operated by members for the purposes of promoting saving, providing cheap credit and providing other financial services to members. According to Olando, Mbewa and Jagongo (2012), SACCOs have solid bases of small saving accounts constituting a stable and relatively low-cost source of funding and low administrative costs. In addition, SACCOs have the ability and opportunity to reach clients in areas that are unattractive to banks such as rural or poor areas. Importantly, the core objective of cooperative societies is to ensure that their members are empowered through encouragement of savings and provision of credit (Khalayi, Ondiek, & Musiega, 2014).

According to SASRA (2013), the SACCO sub sector can be described as two-tiered given the range of financial services to members and regulatory regime. The traditional SACCOs described in law as non-deposit taking SACCOs provide a limited range of savings and credit products popularly referred to as back-office activities (BOSA). They are registered and supervised under the Cooperative Societies Act, CAP 490 and as such not required to register with SASRA. The deposit taking SACCOs (DTSs) besides the basic savings and credit products, also provide basic 'banking' services (demand deposits, payments services and channels such as quasi banking services commonly known as ATMs), FOSA and are licensed and supervised under the SACCO Societies Act, 2008. The SACCO societies operating FOSAs reflect near retail banking business operations (ROK, 2012).

Kenya has the largest and the most vibrant SACCO sector in Africa commanding 67% and 62% of the total assets and deposits/savings respectively in the African continent (SASRA, 2011). However, Kenya lags behind in terms of penetration with 19% compared to Senegal which has 21.9% of total population (WOCC, 2013). The subsector has also seen a reduction in membership. The 2013 Fin Access survey estimated that the use of SACCOs has decreased since 2006, from 13.5% in 2009 to 9.1% in 2013 (FSD Kenya, 2013). DTSs accounts for 78% and 77% of the total assets and deposits

respectively of the entire SACCO subsector underscoring the fact that the growth potential for the SACCOs remains in the deposit taking SACCO business (SASRA, 2013).

1.2 Statement of the problem

The Kenya's vision 2030 envisages creating a vibrant and globally competitive financial sector, driving high levels of savings and financing Kenya's investment needs. This is achievable only if the financial sector is more efficient (Nasieku, 2014). By enhancing efficiency, financial institutions are capable of offering more affordable banking services. Efficiency is important for promoting access to financial services as well as stability of the banking sector as integral component of the financial system (Kamau, 2011; Nasieku, 2014). Delis and Papanikolaou (2009) posit that an efficient banking sector is better able to withstand negative shocks and contribute to the stability of the financial system. Efficiency of financial institution should constantly be assessed and maintained at the highest possible levels.

SACCOs play a significant role in financial intermediation, according to SASRA (2013); SACCO's savings translates to 48.55% of the gross national savings. The efficiency of SACCOs is therefore of great importance for the overall stability of the financial sector. However, there are a few indicators of inefficiency in SACCOs. First, there has been a sustained increase in average SACCO lending rate from 11.96% in 2011 to 15.38% in 2013 representing an increase of 3.42% compared to commercial banks whose average lending rate increased by 3.02% over the same period (SACCO Society Regulatory Authority (SASRA), 2013). Hamadi and Awdeh (2012) postulates that interest rate margin is among the most important factors that gauge the efficiency of financial institutions. Secondly; the population served by SACCOs has decreased from 13.5% in 2009 to 9.1% in 2013 (FSD Kenya, 2013).

Lastly, despite Kenya ranking first in Africa, in terms of total assets held by SACCOs, it lags behind in terms of penetration with 19% compared to Senegal which has 21.9%

(WOCC, 2013). Ombado (2011) posit that low penetration is often attributed to inefficiencies among other reasons. Due to low penetration of financial market players, a considerable proportion of adult population remains financially excluded. The Financial Access 2013 survey results revealed that 25.4% of the adult population was totally excluded from financial services (FSD Kenya, 2013).

It is therefore imperative that efficiency of SACCOs specifically DTSs be evaluated. However, despite DTSs being significant players in the provision of financial services to the Kenyan households and small businesses segments, there is limited research on their efficiency. Much of the research done in Kenya has largely focused on efficiency of commercial banks (Beck *et al.*, 2010; Kamau, 2011; Muthuva, 2009; Nasieku, 2014). While both Kamau (2011) and Nasieku (2014) used DEA methodology to evaluate efficiency, both fell short of critical evaluation of the relationship between firm characteristics and efficiency of financial institutions. Arora (2014) argues that, the study of effcieincy is complemented by evaluating the factors that influence it, among them firm charactristics. Mwangi (2014) evaluated efficiency of SACCOs but concentrated on a few characteristics such as age, bond of association, adoption of technology and managerial competency. This research sought to fill the gap by not only evaluating the efficiency but also examining the relationship between other firm characteristics and financial intermediation efficiency of deposit taking SACCO societies in Kenya.

1.3 Objectives of the Study

1.3.1 General objective

To examine the relationship between firm characteristics and financial intermediation efficiency of deposit taking SACCO Societies in Kenya

1.3.2 Specific objectives

1. To evaluate the relationship between capital adequacy and financial intermediation efficiency of deposit taking SACCO societies in Kenya.
2. To determine the relationship between asset quality and financial intermediation efficiency of deposit taking SACCO societies in Kenya.
3. To examine the relationship between liquidity and financial intermediation efficiency of deposit taking SACCO societies in Kenya.
4. To evaluate the relationship between income diversification and financial intermediation efficiency of deposit taking SACCO societies in Kenya.
5. To determine the relationship between profitability and financial intermediation efficiency of deposit taking SACCO societies in Kenya.
6. To examine the relationship between size and financial intermediation efficiency of deposit taking SACCO societies in Kenya.

1.4 Research Hypotheses

The following hypotheses were tested;

H_{01}: There exists no significant relationship between capital adequacy and financial intermediation efficiency of deposit taking SACCO societies in Kenya.

H_{02}: The relationship between asset quality and financial intermediation efficiency of deposit taking SACCO societies in Kenya is not significant.

H_{03}: Liquidity has an insignificant relationship with financial intermediation efficiency of deposit taking SACCO societies in Kenya.

H_{04}: There exists no significant relationship between income diversification and financial intermediation efficiency of deposit taking SACCO societies in Kenya.

H_{05}: There exists no significant relationship between profitability and financial intermediation efficiency of deposit taking SACCO societies in Kenya.

H_{06}: SACCO size does not have a significant relationship with financial intermediation efficiency of deposit taking SACCO societies in Kenya.

1.5 Significance of the study

The findings of this study will be of particular importance to various stakeholders. Scholars and other researchers interested in SACCOs will benefit from the findings of this study. The study will fill the gap existing in literature concerning intermediation efficiency in DTSs and its relationship with firm characteristics. The findings will add to the limited body of knowledge existing in this field. The study may provide opportunities for further research in the area of co-operative movement in Kenya especially in SACCOs. In addition to scholars, the study will benefit the following;

Policy makers: The information acquired from this study will be useful to policy-makers in the financial sector to strengthen policy considerations and regulatory framework. Such policy improvement and regulations may come in handy in enhancing intermediation efficiency of SACCOs and other financial institutions. This will not only improve quality of services offered to members but also improve the levels of financial inclusion in the economy.

SACCO management: The results of study will be beneficial to all SACCO managers both at the board and executive levels by highlighting how financial intermediation efficiency can be enhanced. By identifying the most efficient SACCO(s), it will provide suitable grounds for benchmarking. Given that the firm characteristics are under the control of the management, the results will direct the managements' focus in order to improve efficiency and promote profitability. Of importance to managers is the appreciation that there is a close connection between efficiency and financial stability.

SACCO members: By gaining an insight on the drivers of efficiency, the SACCO membership may get an impetus to continuously hold the management accountable on improvement of the highlighted facets of efficiency. This is so because the members stand to benefit most if the intermediation efficiency is enhanced. In addition, it may lead to members' satisfaction and trust in the societies and hence increased share contribution.

1.6 Scope of the study

The study focused on the relationship between firm characteristics and financial intermediation efficiency of deposit taking SACCO societies (DTSs) in Kenya. This was informed by the fact that DTSs accounts for 78% and 77% of the total assets and deposits respectively of the entire SACCO subsector underscoring their significance in the sector. The efficiency scores were generated for a period of four years, 2011-2014. This is the period in which the prudential guidelines have been in place making it possible for the research data to be available in standard form. All licensed DTSs as at 31st December 2013 were envisaged to be used in the study. While there are many firm characteristics that may influence financial intermediation efficiency, the study focused on the characteristics that have been used by earlier scholars, are consistent with the available theories and could be determined from the financial statements.

1.7 Limitation of the study

The study experienced a number of challenges which may limit the results. First, though the regulations were effected in 2009, there was a grace period of four years for compliance. This meant that different DTSs complied at different times. It was therefore noted that there was no standardized way of disclosure in the financial statements with some DTSs leaving out some information. The researcher therefore used some of the ratios provided in the financial statements and recomputed the required values. Additionally the researcher ended up having a smaller number of DTSs in the study than those earlier anticipated.

The limited period that prudential regulation had been in place also meant that comprehensive data would only be available for a short period. This therefore limits the study as it cannot cover prolonged period on time. Longer panel are capable of providing more insights into both temporal and spatial changed in the study variables. A future study with longer time horizon on the same aspect is therefore recommended.

Lastly, it is acknowledged that each of the independent variable is capable of being measured in more than one way. However, these measures are determined from financial statements and are alternate, implying that they cannot enter the regression model at the same time. This is because inclusion of more than one measure of a firm characteristic is likely to result into multicollinearity. A selection had therefore to be made for the measures to be used by applying the forward selection method. The results may be different with alternate measure.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides a clear account of the developments in the literature relating to the study. It consists of theoretical review, empirical review and research gaps. Theoretical review concerns review of theories informing the study variables while empirical review involves review of past researches related to the study. The variables are reviewed in the chapter in order to lay the ground for the research. The chapter also attempts to justify the study in addition to reinforcing and underpinning the conceptual framework. In the final analysis, the chapter gives a brief summary of the reviewed empirical studies and highlights the existing knowledge gaps.

2.2 Theoretical Review

2.2.1 The Modern Theory of Financial Intermediation

The modern theory financial intermediaries was developed by Allen and Santomero (1998). The theory builds on the economics of imperfect information that began to emerge during the 1970s with the seminal contributions of Akerlof (1970), Spence (1973) and Rothschild and Stiglitz (1976). The traditional theory posits that the existence of banks is justified because financial markets are informational imperfect and there are transaction costs. It builds on the notion that intermediaries serve to reduce transaction costs and informational asymmetries (Benston & Smith, 1975; Klein, 1971; Leland & Pyle, 1977).

However, the deregulation of financial markets, the technological and financial innovations such as internet and financial derivatives, the changing composition of

household portfolios which now include more risky assets, the gigantic size of pension funds and mutual funds in relation to bank assets, and such have led mainstream economists to question the validity of the relevance of transaction costs and informational asymmetry in the financial intermediation theory (Scholtens & Wensveen, 2003). Thus the theoretical justification for existence of banks has ceased but banks still exists. This has led to the development of the modern theory of financial intermediation. The modern theory of financial intermediation lays emphasis on what banks do rather than why they exist (Claus & Grimes, 2003).

Allen and Santomero (1998) posit that intermediaries are facilitators of risk transfer and deal with the increasingly complex maze of financial instruments and markets. They argued that participation costs are crucial to understanding the current activities of intermediaries and in particular their focus on risk management. Financial intermediaries play an important role in credit markets because they reduce the cost of channeling funds between relatively uninformed depositors to users. They specialize in collecting information, evaluating projects, monitoring borrower's performance and risk sharing (Claus & Grimes, 2003).

The theory is premised on the existence of free markets devoid of government interventions. However, in modern economic times, prudential regulations are put in place which limits the behavior of financial intermediaries. According to Mwangi (2014), regulation reduces the degrees of freedom of financial institutions with regard to what they can or cannot do. Despite the limitation, the theory provides an insight as to what financial intermediaries do. The theory is anchored in the study to explain not only why financial intermediaries exist but also what role they play. It provides theoretical underpinning to the effect that the dynamics of financial markets have continued to change and financial institution must reorient to facilitate financial intermediation efficiency. DTSs have continued to change their mode of operation in line with changing economic and social environments.

2.2.2 Buffer Capital Theory

The buffer theory of Calem and Rob (1996) predicts that a bank approaching the regulatory minimum capital ratio may have an incentive to boost capital and reduce risk in order to avoid the regulatory costs triggered by a breach of the capital requirements (Ochei, 2013). The theory predicts that the behavior of banks depends on the size of their capital buffer, banks with high capital buffers will aim at maintaining their capital buffers while banks with low capital buffers will aim at rebuilding an appropriate capital buffer. Hence for banks with high capital buffers, capital and risk adjustments will be positively related while, for banks with low capital buffer, capital and risk adjustments will be negatively related (Heid, Porath, & Stolz, 2004).

A general consensus is that banks with higher capital and liquidity buffers are better able to support businesses and households in bad times since buffers enhance the capacity of banks to absorb losses and uphold lending during a downturn (Gudmundsson, Ngoka-kisinguh, & Odongo, 2013). Abdalla and Obeidat (2013) agree that capital plays a very important role in maintaining safety and solidarity of banks as it represents the buffer gate that prevents any unexpected loss that banks might face which might reach depositors funds. Capital regulation is motivated principally by the concern that a bank may hold less capital than is socially optimal relative to its riskiness as negative externalities resulting from bank default are not reflected in market capital requirements.

Heid *et al*. (2004) used panel data to test the capital buffer theory and found out that; (i) the coordination of capital and risk adjustments depends on the amount of capital the bank holds in excess of the regulatory minimum (the "capital buffer") (ii) Banks with low capital buffers try to rebuild an appropriate capital buffer by raising capital while simultaneously lowering risk (iii) banks with high capital buffers try to maintain their capital buffer by increasing risk when capital increases and (iv) they found mixed (no) evidence that banks with low capital buffers adjust capital (risk) faster than banks with high capital buffers.

Prudential regulations issued by SASRA prescribe the minimum amount of capital that should be held by DTSs. The theory supports the study by explaining why individual DTSs may decide to hold higher than the prescribed minimum capital. This facilitated analysis of the effect of capital adequacy as a firm characteristic on intermediation efficiency. If all DTSs were to hold the minimum capital prescribed by the regulator, capital adequacy would cease to be specific firm characteristic. The theory therefore justifies the choice of capital adequacy as firm characteristics.

2.2.3 Theory of Informational Asymmetry

The theory builds on the economics of imperfect information that began to emerge during the 1970s with the seminal contributions of Akerlof (1970), Spence (1973) and Rothschild and Stiglitz (1976). According to the theory, information asymmetry causes market to become inefficient; since all the market participants do not have access to the information they need for their decision making process. A situation that arises when one party has insufficient knowledge about the party involved in a transaction makes is impossible to make accurate decision when conducting the transaction (Mishkin, 2004). Financial intermediaries make lending decision and the borrower is likely to have more information than the lender about the risks of the project for which they receive funds (Matthews & Thompson, 2008).

In the presence of asymmetric information, the market may break down completely with the three distinct consequences emerging; (a) adverse selection, (b) moral hazard, and (c) monitoring cost. According to Mishkin (2004), asymmetric information problem arises before the transaction occurs. It occurs when a potential borrower who is likely to produce an undesirable (adverse) outcome in form of bad debt risk are the one who actively seek out and are the most likely to be selected. Moral hazard on the other hand arises after a transaction. Moral hazard arises when a borrower engages in activities that reduce the likelihood of a loan being repaid.

Kwambai and Wandera (2013) posit that the theory of asymmetric information indicates that it may be complex to distinguish between good and bad borrowers which may result into adverse selection and moral hazards problems. As a result, moral hazard and adverse selection leads to reduction of the efficiency of the transfer of funds from surplus to deficit units. This is because lenders may decide in some circumstances that they would rather not make a loan and credit rationing may occur (Matthews & Thompson, 2008). Asset quality refers to the timely manner with which borrowers are meeting their contractual obligations (Alhassan *et al*., 2014). The asset quality is therefore inversely related to the amount of non-performing Loans (NPLs).

There exists empirical evidence that adverse selection and moral hazards have led to significant accumulation of nonperforming loans in banks (Kwambai & Wandera, 2013; Ombaba, 2013). Michael, Vasanthi and Selvaraju (2006) emphasized that NPA in loan portfolio affect operational efficiency which in turn affects profitability, liquidity and solvency position of banks. The theory also acknowledges that credit appraisal cannot be effective and therefore non performing loans (NPLs) will always arise. However, measures may be put in place to reduce information asymmetry, one such measure is credit information sharing. Kwambai and Wandera, (2013) found that, credit information sharing, helps the banks lend prudently, lowers the risk level to the banks, acts as a borrowers discipline against defaulting and reduces the borrowing cost. DTSs in Kenya have progressively registered with credit reference bureaus which is commendable.

2.2.4 The Shiftability Theory of Liquidity

Formally developed by Moulton (1918), the theory held that banks could most effectively protect themselves against massive deposit withdrawals by holding, as a form of liquidity reserve, credit instruments for which there existed a ready secondary market (Maaka, 2013). Accordingly the liquidity of a bank depends on its ability to shift its assets to someone else without any material or capital loss when the need for liquidity arises. According to the theory, the liquidity of a bank may be measured by the extent to

which it can shift its assets readily to other buyers for cash at satisfactory price (Casu *et al.*, 2006).

Moulton (1918) specified that, to attain minimum reserves, relying on maturing bills is not needed but maintaining quantity of assets which can be shifted to other financial institutions whenever necessary. It must fulfill the attributes of immediate transferability to others without loss. In case of general liquidity crisis, bank should maintain liquidity by possessing assets which can be shifted to the Central Bank. The theory informs the choice of measures of liquidity in financial institutions where loan-to-deposit ratio and the liquid asset ratio are used. Higher loan-to-deposit ratio (or the lower the liquid asset ratio) indicates that the bank is less able a bank to meet any additional loan demands (Moore, 2010). The theory recognizes and contends that shiftability, marketability or transferability of a bank's assets is a basis for ensuring liquidity (Ibe, 2013).

A major defect in the shiftability theory is that in times of general crisis the effectiveness of secondary reserve assets as a source of liquidity vanishes for lack of a market (Casu et al., 2006). The role of the central bank as lender of last resort gained new prominence, and ultimately liquidity was perceived to rest outside the banking system. It is however appreciated that DTSs do not have access to the central bank which depict the liquidity challenges they are likely to face. Further- more, the soundness of the banking system came to be identified more closely with the state of health of the rest of the economy, since business conditions had a direct influence on the cash flows, and thus the re-payment capabilities, of bank borrowers (Maaka, 2013).

The theory supports the study by justifying that apart from holding the minimum liquidity as stipulated in the prudential guidelines, financial institution are able to peg their liquidity on the market conditions and their ability to liquidate their assets. This justifies why liquidity may be firm characteristic where firms hold different level of liquidity over and above the minimum prescribed by the regulator. It also points to an important linkage between liquidity and efficiency of financial institutions. Odunga *et*

al., (2013) argue that more liquid banks may be more efficient in the sense that, all other things being equal, an efficient bank can produce more output part of which includes liquid and other assets.

2.2.5 Modern Portfolio Theory

A theory developed by Harry Markowitz (1952, 1959) allows investors to analyze their returns relative to risk. It seeks to determine the most efficient combinations of assets to maximize portfolio expected returns for given level of risk or minimize risk for a given level of expected return (Elton & Gruber, 1997; Omisore, Yusuf, & Nwufo, 2012). The theory holds that by investing in more than one stock, an investor can reap the benefits of diversification chief among them, a reduction in the riskiness of the portfolio which is depicted by variance. It quantifies the benefits of diversification. The theory mathematically formulates the concept of diversification in investing, with the aim of selecting a collection of investment assets that has collectively lower risk than any individual asset. The possibility of this can be seen intuitively because different types of assets often change in value in opposite ways. But diversification lowers risk even if assets' returns are not negatively correlated-indeed, even if they are positively correlated (Omisore *et al*., 2012).

The theory has however found a wide application beyond the domain of securities management for which it was originally intended. It is used in evaluation of corporate diversification where it is argued that is that the expected variance in the returns of a firm is best minimized by bringing together independent, non interactive business units by the process called unrelated diversification. When two unrelated businesses are combined, portfolio theory predicts a sharp drop in the unsystematic variance in the returns of the diversified firm (Lubatkin & Chatterjee, 1994).

Diversification in SACCOs into noninterest income can be evaluated in the context of the modern portfolio theory since the motivation is to enhance return. The conventional

view of SACCO members that they can diversify away any increases in idiosyncratic risk associated with increased non interest income. Barry and Laurie (2010) sought to evaluate the impact of bank non-interest income on bank risk and return. The study showed that fee-based income is riskier than margin income but offers diversification benefits to bank shareholders. Baele, de Jonghe and Vander (2007) found that bank diversification into non interest income reduces bank total risk, but increases bank systematic risk.

The shortcoming of the theory arises from its assumptions. The major assumptions of portfolio theory are that the investors are rational and the market is efficient and perfect (Kiaritha, 2015). In reality, markets are inefficient and imperfect which limits the applicability of the theory. In spite of the shortcomings, the theory provided important insights. The theory is relevant to the study since it provides a theoretical justification for income diversification and selection of optimal investment schedule. It is therefore possible for DTSs to select a portfolio of products that enhances stability in performance and also efficiency in their provision.

2.2.6 Market Power Theory

The market-power theory evolved from as series of seminal work by Shepherd (1986), Schmalensee (1987) and Berger and Hannan (1998).The theory includes two hypotheses; the traditional structure-conduct performance and the relative-market power hypotheses. According to Al-muharrami and Matthews (2009), the structure-conduct-performance (SCP) hypothesis states that; markets characterized by a structure with relatively few firms and high barriers to entry will conduct pricing aimed at achieving joint profit maximization through collusion, price leadership, or other tacit pricing arrangements. This type of price conduct should in turn yield profits and prices that are greater than the competitive norm. As such, more concentrated markets lead to higher loan rates and lower deposit rates because of lessened competition (Jeon & Miller, 2005).

The relative-market power hypothesis asserts that only firms with large market shares and well-differentiated products are able to exercise market power and earn supernormal profits (Al-muharrami & Matthews, 2009). Market power refers to the possibility that diversified firms indulge in various forms of anti-competitive behavior (Goddard et al., 2008a). The difference between those two hypotheses revolves around whether market power proves generic to a market or specific to individual banks within a market (Jeon & Miller, 2005).

Some empirical studies test the SCP and RMP hypotheses by analyzing the profit-concentration relationship (Al-muharrami & Matthews, 2009; Barbara Casu & Girardone, 2009; Jeon & Miller, 2005). However, these studies are incapable of favoring one of the two hypotheses. The reason is that the effects of market power and efficiency might be simultaneously present in the variables describing market structure and they are neutralized at the level of the concentration coefficient (market share). Another problem might arise, inconsistently with the theory; efficiency and concentration are negatively correlated. In this case, a significant and positive coefficient of market structure might be fallacious (Mensi & Zouari, 2010).

The theory predicts that under the pressure of market competition, efficient firms win the competition and grow, so that they become larger, obtain greater market share, and earn higher profits (Casu & Girardone, 2009). The SACCO subsector in Kenya is characterized by existence of many small SACCOs. The concentration in the subsector is therefore limited. The extent of collusion in pricing is also limited. This therefore implies that each firms' conduct towards profitability is distinct which make profitability a firm characteristic. In the current study, it was expected that more profitable DTSs were highly efficient as there is a linkage between diversification, size and profitability as postulated by the theory. The theory effectively anchors profitability, diversification and size in the study.

2.2.7 Economic Efficiency Theory

The theory originated from Debreu (1951). It states that firms should achieve their output at the lowest possible cost per unit produced. According to this theory, optimal production can be achieved by economies of scale because, given the combination of fixed and variable costs typical in business, low levels of output are inefficient since fixed costs are shared out across a relatively small number of units (Said, 2012). Thus, in the short run, maximum operational efficiency is attained at the level of output at which all accessible economies of scale are taking advantage of such efficiency. In the long run, lifting the capacity of existing systems can increase the optimal level of productive efficiency (Odunga, Nyangweso, Carter, & Mwarumba, 2013).

There are two perspectives of economic efficiency theory; allocative (price) efficiency criteria that states that for banks to operate at efficient level, then all bank products have to be priced optimally. This will in turn reduce unfair competition in the market and reduction in interest rate spreads. The productive efficiency (technical efficiency) which takes place when the business employs all of its resources efficiently, producing the most output from the least input (Arora, 2014; Saad & El-moussawi, 2009; Said, 2012).

The theory includes two hypotheses; the X-efficiency and scale efficiency hypotheses. The X-efficiency hypothesis argues that banks with better management practices control costs and raise profit, moving the bank closer to the best-practice, lower bound cost curve (Jeon & Miller, 2005). The scale-efficiency hypothesis argues some banks achieve better scale of operation and, thus, lower costs. Lower costs lead to higher profit and faster growth for the scale-efficient banks. It is therefore expected that highly profitable DTS will demonstrate high level of efficiency. However the actual direction of causation between profitability and efficiency may differ from firm to firm.

This theory guides the current study by underscoring the importance of the principle of economies of scale in efficiency measurement. It supports the variable of size by

depicting a direct relationship between size and efficiency. It is expected that large DTSs are more efficienct due to economies of scale. The DTSs considered under the study were assumed to be following the least cost expansion path to realize these economies.

2.3 Conceptual framework

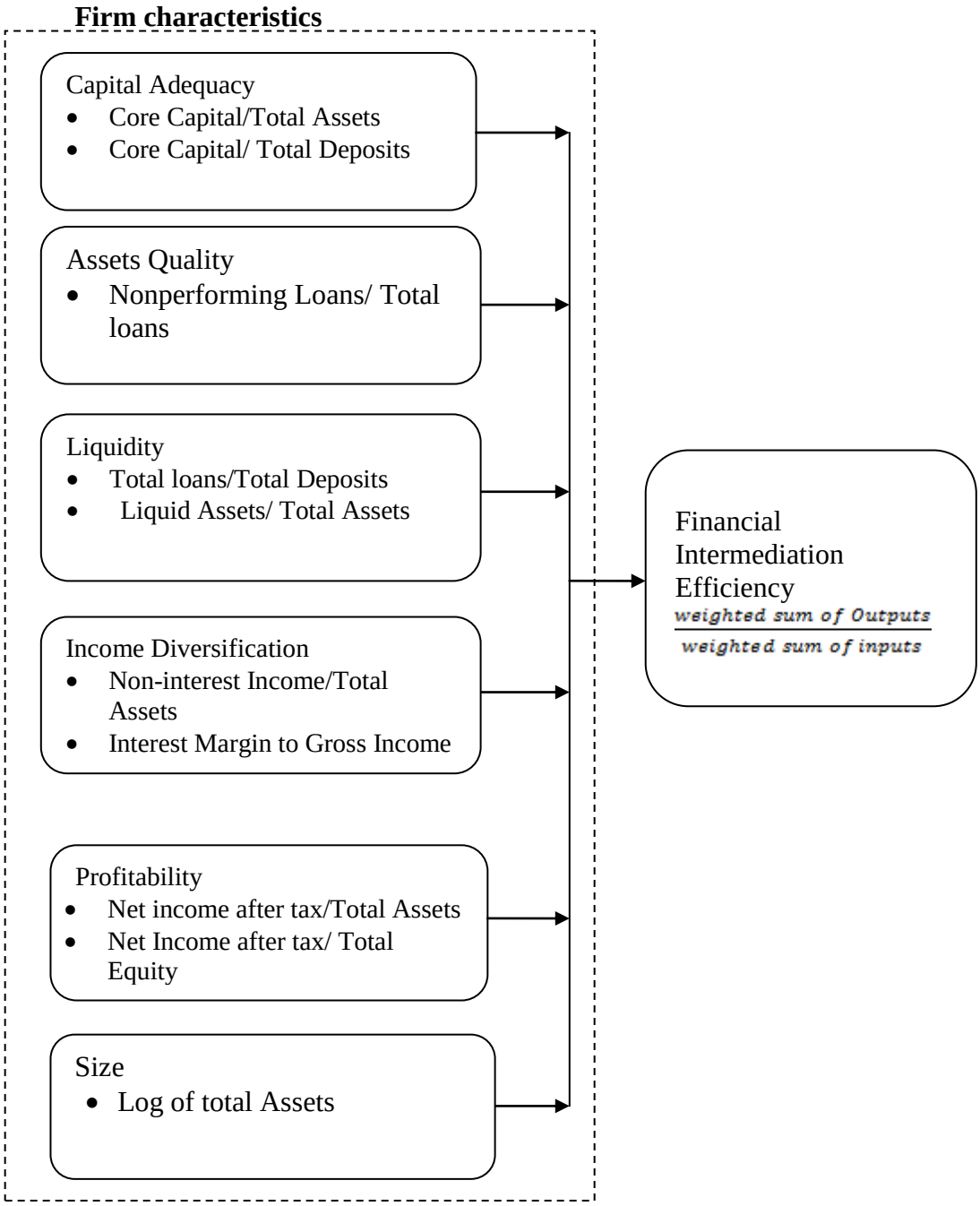

Figure 2.1 Conceptual framework

2.3.1 Measurement of Efficiency

Investigation of efficiency of financial institution has gained prominence in recent time because of the important role played by such institution in economic growth. The efficiency of such institutions is important for promoting access to financial services as well as stability of the sector. There has been considerable development on efficiency measurement of financial institutions. The concept of efficiency measurement began with Koopmans (1951) and Debreu (1951). It was later advanced by Farrel (1957) who proposed that efficiency of a firm consists of two components; technical efficiency, which reflects the ability of a firm to obtain maximal outputs from a given set of inputs, and allocative efficiency, which reflects the ability of a firm to use the inputs in optimal proportions, given their respective prices. Combining the two measures provides a measure of cost efficiency or total economic efficiency.

Within Farrel (1957) proposition, there has been different approaches used in the analysis of efficiency in financial institution and other decision making units (DMUs). The approaches are categorized into parametric and non parametric. An analysis by Sharma et al., (2013) revealed that parametric approaches include; stochastic frontier analysis (SFA) (Aigner, Lovell, & Schmidt, 1977), distribution free approach (DFA) (Berger, 1993) and thick frontier approach (TFA) (Berger & Humphrey, 1991) are the most widely used techniques. Under non parametric approach; Data envelopment analysis (DEA) (Charnes, Cooper, & Rhodes, 1978) and free disposal hull (FDH) (Deprins, Simar, & Tulkens, 1984) are the common techniques. The mostly used parametric measure is the stochastic frontier analyses (SFA) while the mostly used nonparametric measure in the data envelopment analysis (DEA). The section that follows expounds on both approaches.

Parametric Approach: Stochastic Frontier Analysis

Formulated by Aigner, Lovell, and Schmidt (1977) and Meeusen and Broeck (1977), SFA is a regression-based approach which integrates two unobserved error terms representing inefficiency and statistical noise. In the context of technical efficiency, it is about a production function indicating the maximum attainable output given the particular inputs. Any lower performances can be traced back to random noise beyond the managers' control as well as inefficiency (Behr & Tente, 2008). The main advantage of SFA over DEA is that it allows a distinction to be made between inefficiency and others to stochastic shocks in the estimation of efficiency levels (Srairi, 2010). In SFA, the technical efficiency when assuming different inputs and outputs is estimated in the following equation:

$$TE_i = \frac{y_i}{y_i^*} = \frac{y_i}{g(x_i;\beta)} \qquad \epsilon[0,1]$$

Where;

TE_i - Technical efficiency of i^{th} firm under consideration

x_i - input vector of i^{th} firm under consideration

y_i - output vector of i^{th} firm under consideration

And $g(x_i;\beta)$ the deterministic production function

It is the aim of SFA to estimate the underlying technology constituting the production possibility of a set of firms.

$y_i = g(x_i;\beta).e^{v_i}.e^{-\mu_i}$

In logarithmic form;

$$log(y_i) = log\left(g(x_i;\beta)\right) +$$

where v_i is considered as a normal error $v_i \sim N(\mu_v;\ \delta_v^2)$ and μ_i is positive representing inefficiency (Behr & Tente, 2008).

Non Parametric Approach: Data Envelopment Analysis

Data envelopment analysis (DEA) is a multi-factor productivity analysis model for measuring the relative efficiencies of a homogenous set of decision making units (DMUs). DEA uses the principles of linear programming (LP) theory to examine how a particular DMU such as a DTS operates relative to other DMUs in the sample. The method constructs a frontier based on actual data. Firms on the frontier are efficient, while firms off the efficiency frontier are inefficient (Nasieku et al., 2013). Because efficiency is measured as the distance to this frontier, without considering statistical noise, DEA is a deterministic model (Andor & Hesse, 2011). An efficient firm does not necessarily produce the maximum level of output given the set of inputs. Further, efficiency means that the firm is a "best practice" firm in the taken sample (Talluri, 2000).

Andor and Hesse (2011) posit that the main advantage of DEA is the flexibility due to its non-parametric nature, i.e. no assumption about the production function is required. However, its main disadvantage lies in the fact that this technique is unable to decompose the deviations of certain banks from the efficient production frontier into components: inefficiency and random error parts (Kiyota, 2011).

There are two models that have been developed in DEA methodology; Constant Returns to Scale Model (Charnes et al., 1978) and Variable Returns to Scale Model (Banker, Charnes, & Cooper, 1984). The Constant Returns to Scale Model (CRS DEA) also referred to as CCR model presupposes that there is no significant relationship between

the scale of operations and efficiency thus gives the overall technical efficiency (OTE). Sufian (2007) posits that the CRS assumption is only justifiable when all DMUs are operating at an optimal scale. If not all DMUs are operating at the optimal scale, the computed measures of technical efficiency will be contaminated with scale efficiencies. The Variable Returns to Scale Model (VRS DEA) also referred to as BCC model provides the measurement of pure technical efficiency (PTE), which is the measurement of technical efficiency, devoid of the scale efficiency effects. If there appears to be a difference between the TE and PTE scores of a particular DMU, then it indicates the existence of scale inefficiency (Sufian, 2007).

The study adopts the DEA models as presented by Coelli (1996) where the DEA is in a ratio form. For each DMU a ratio of all outputs over all inputs is given as $u'y_i/v'x_i$ where u is a $M \times 1$ vector of output weights and v is a $K \times 1$ vector of input weight. To select optimal weight the problem is specified as a mathematical programming problem thus;

$$max_{u,v}(u'y_i/v'x_i),$$

$$st$$

$$u'y_j/v'x_j \leq 1, j = 1,2,\dots,N$$

$$u, v \geq 0 \qquad 1$$

To ensure that the problem do not have infinite number of solutions a constraint $v'x_i = 1$ is imposed which provides;

$$max_{\mu,v}\ (\mu' y_i)$$

$$st$$

$$v'x_i=1$$

$$\mu' y_j - v'x_j \leq 0, \qquad j = 1,2,\dots,N$$

$$u, v \geq 0 \qquad 2$$

Where the change from u and v to μ and ν depicts transformation. This form is known as the *multiplier* form of linear programming problem (Tim Coelli, 1996).

The problem can be converted into a dual as follows;

$$
\begin{aligned}
&Min_{\lambda,\theta}\theta \\
&st \quad -y_i + Y\lambda \geq 0 \\
&\qquad \theta x_i - X\lambda \geq 0 \\
&\qquad\qquad \lambda \geq 0
\end{aligned}
\qquad\qquad 3
$$

where θ is a scalar and λ is $N \times 1$ Vector of constants. This envelopment form involves fewer constraints than the multiplier form $(K + m < N + 1)$ and hence generally preferred form to solve. The value of θ obtained were the efficiency score for the i^{th} DMU and shall satisfy $\theta \leq 1$. The LP must be solved N times once for each DMU.

CRS DEA is only appropriate when all DMU are operating at an optimal scale however if some DMU are not operating at optimal scale, it is appropriate to use Variable Return to Scale (VRS) DEA. The CRS Linear programming is modified to account for VRS by adding a convexity constraint; $N1'\lambda = 1$. Thus the problem becomes;

$$
\begin{aligned}
&Min_{\lambda,\theta}\theta \\
&st \quad -y_i + Y\lambda \geq 0 \\
&\qquad \theta x_i - X\lambda \geq 0 \\
&\qquad\qquad N1'\lambda = 1 \\
&\qquad\qquad\qquad \lambda > 0
\end{aligned}
\qquad\qquad 4
$$

where $N1$ is an $N \times 1$ vector of ones. This approach forms a convex hull of intersecting planes which envelope the data points more tightly than the CRS conical hull and thus provides technical efficiency scores which are greater than or equal to those obtained using the CRS model**.**

Malmquist Total Factor Productivity (TFP)

Productivity is closely related to efficiency. Productivity of a firm refers to the ratio of the output(s) that it produces to the input(s) (Coelli et al., 2005). Like efficiency, productivity can also be assessed using both parametric and non parametric approaches. According to Sharma et al., (2013); parametric approach results production, cost or revenue functions, whereas non parametric approach follows the index number method. Non parametric approach include; Fischer (1922) index, Tornqvist (1936) index and Malmquist (1953) index.

Malmquist productivity index is used to analyze the relation between productivity and efficiency, since productivity growth is defined as the change in output due to efficiency change and technical change. It was first introduced by Malmquist (1953) and then extended by Caves, Christensen and Diewert (1982) and Färe, Grosskopf, Norris, and Zhang (1994). The Malmquist productivity index (MPI) uses a distance function approach to measure productivity improvements. Following DEA, if inefficiency does exist, the movements of any given DMU over time will depend on both its position relative to the corresponding frontier (technical efficiency) and the position of the frontier itself (technical change). This enables a distinction between improvements emanating from the DTS's catch up to the frontier and that resulting from the frontier shifting up over time. For this purpose, the output - oriented Malmquist index is used to assess the sources of factor productivity change in DMUs. The index decomposes total factor productivity change into efficiency change and technological change. Malmquist index is defined as follows:

$$M_0^{t+1}(y_t, x_t, y_{t+1}, x_{t+1},) = \frac{d_0^{t+1}(y_{t+1}, x_{t+1})}{d_0^t(y_t, x_t)} \left[\frac{d_0^t(y_{t+1}, x_{t+1})}{d_0^{t+1}(y_{t+1}, x_{t+1})} \times \frac{d_0^t(y_t, x_t)}{d_0^{t+1}(y_t, x_t)} \right]^{1/2}$$

where the subscript *o* indicates an output-orientation, *M* is the productivity of the most recent production point (x_{t+1}, y_{t+1}) (using $t+1$ technology) relative to the earlier production point (using *t* technology), d are output distance, and all other variables are as previously defined. A score of greater than unity indicates productivity progress in the sense that the DTS delivers a unit of output in period $t+1$ using fewer inputs. In other words, a DTS in period $t+1$ is more efficient relative to itself in period t . Similarly, a score less than unity imply productivity regress and a unit score indicates constant productivity.

2.3.2 Capital Adequacy

The fundamental aspect of regulation of the financial sector is capital requirement. Setting capital requirements is a major policy issue for regulators across the world. It received more prominence after 2007/2008 financial crises that led to the review of Basel capital requirements. Motivated by ensuring stability in the SACCOs, which entered to more risky business of deposit taking, SASRA issued prudential guidelines which require DTS to hold a minimum of KSh. 10 Million as core capital. In addition they should hold a core capital of not less than eight per cent (8%) of the total deposits liabilities.

The theoretical justification of increased capital base is twofold; one, capital adequacy is seen as an instrument limiting excessive risk taking of bank owners with limited liability and, thus, promoting optimal risk sharing between bank owners and depositors. On the other hand it is seen as a buffer against insolvency crises, limiting the costs of financial distress by reducing the probability of insolvency of banks (Abdalla & Obeidat, 2013; Alhassan *et al*., 2014; Karminsky & Kostrov, 2014). The general consensus is that banks with higher capital and liquidity buffers are better able to support businesses and

households in bad times since buffers enhance the capacity of banks to absorb losses and uphold lending during a downturn (Gudmundsson *et al*., 2013).

On the flipside; increased capital might induce a bank to assume greater risks. If this effect outweighs the buffer effect of capital, highly capitalized bank might experience a higher probability of failure. Such banks are likely to lend less, charge more for loans and pay less on deposits as part of their actions to restore an acceptable return on the larger capital base (Gudmundsson *et al*., 2013). It may also hinder competition since high capital requirement acts as a barrier to entry. In relation to efficiency, it is agreeable that expansion in bank capital may be efficiency enhancing since equity serves as an alternative source of funding, it is also used to mitigate the risks of bank failure and the externalities associated with it (Nasieku *et al*., 2013).

2.3.3 Asset Quality

Financial institutions such as DTSs in their intermediation role receive deposits for onward lending to borrowers. Once lent the loans are assets since future economic benefits are expected to flow to the firm. Asset quality in financial institutions refers to the timely manner with which borrowers are meeting their contractual obligations (Alhassan *et al.*, 2014). The asset quality is thus inversely related to the amount of nonperforming assets. According to Ombaba (2013) a nonperforming loan/asset is a credit facility in respect of which the interest and or principal amount has remained past due for a specific period of time.

With the breaking of common bond witnessed in many DTS, the exposure to the risk of default is now relatively higher. This is because most of the new members under the so called class B are business people whose earnings are more volatile. The creation of loan asset exposes DTSs to risk of default thus affecting their intermediation efficiency. Latif et al., (2014) argue that due to information asymmetry, bank are more likely to adversely select high risk loan clients because they can afford the high loan price demanded by the

banks. Additionally, the high loan rates may also induce ex-post behavior by borrowers in investing in risky projects which increases probability of default. A larger share of earning assets to total assets is a sign of good asset quality, which leads to higher profitability at given level of expenses (Burki & Niazi, 2010).

Nonperforming loans has attracted a great deal of attention since it has been linked the banking crises. NPLs have been identified as a significant source of bank failures. Ombaba (2013) argues that NPLs generate a vicious effect on banking survival and growth, and if not managed properly leads to banking failures. Michael, Vasanthi and Selvaraju (2006) emphasized that NPA in loan portfolio affect operational efficiency which in turn affects profitability, liquidity and solvency position of banks. Empirical evidence strongly supports a negative relationship between the level of NPAs and efficiency. There is however differing opinion on the direction of causality. Banking literature presents three hypotheses on the relationship between asset quality (NPAs) and efficiency. These are "bad luck" hypothesis, "bad management" hypothesis and "skimping" hypothesis.

The "bad luck" hypothesis predicts that external events increase non-performing loans in banks which leads to the bank incurring greater operating costs to deal with these problem loans, which, in turn, hampers banking efficiency (Podpiera & Weill, 2007). The extra costs arise from the increased efforts of recovery and inability of the loan asset to generate revenues to facilitate further lending. Michael, Vasanthi and Selvaraju (2006) emphasized that nonperforming assets in loan portfolio affect operational efficiency which in turn affects profitability, liquidity and solvency position of banks.

On the other hand, the "bad management" hypothesis predicts that inefficiency exerts an impact on non-performing loans, as bad managers do not monitor loan portfolios efficiently. Low efficiency is therefore a signal of poor managerial performance which apply to input-usage, day-to-day operations and managing the loan portfolio (Sufian, 2009). Poor managers do not adequately monitor loan portfolio management, owing to

poor loan evaluation skills or to inadequate allocation of resources to loan monitoring which results in a greater volume of non-performing loans (Podpiera & Weill, 2007).

An alternative hypothesis predicts a positive relationship between efficiency and the level of NPAs is the "skimping" hypothesis. It suggests that the amount of resources allocated to loan monitoring affects both non-performing loans and banking efficiency (Podpiera & Weill, 2007). Managers face a trade-off between short-term operating costs and future loan quality. In order to achieve short term profits, banks prefer lower costs thus reducing the amount of resources expended on loan monitoring and underwriting, which in the long run affects the quality of loans (Abdessalem & Younes, 2013; Ahmad & Bashir, 2013). Thus as managers strive to achieve high cost efficiency they dedicate less effort in ensuring quality of loans which leads to increase in NPAs in the long run.

Another hypothesis that has been largely tested relating to NPLs is the "moral hazard" hypothesis. It argues that banks having low capital tends to increase earnings through increase in loan portfolio riskiness by allocating funds to low quality borrowers, resulting in the future growth in NPLs (Ahmad & Bashir, 2013). According to Abdessalem and Younes (2013), moral hazard behavior suggests that managers of thinly capitalized banks are less risk averse because the upside risk of low capitalization outweighs the downside risk. In other words, expected return is positively related to the amount of risk assumed by bank management whilst the bank has relatively less capital to lose in the event of default. Low capitalization therefore results to increase in NPLs thus decline in asset quality.

2.3.4 Liquidity

A lot of emphasis has been placed by regulators on liquidity risk management by all financial institutions. This is informed by the fact that inability to meet financial obligations as they fall due may lead to a bank run that may have a contagion effect on the entire financial system. Liquidity refers to the ability of the bank to meet up deposit

withdrawals, maturing loan request and liabilities without setback (Akhtar *et al*., 2011). According to Vento and Ganga (2009), liquidity signifies the ability of a financial firm to keep up all the time a balance between the financial inflows and outflows over the time. The objective of liquidity management is to honor all cash outflow commitments on a daily and ongoing basis, minimize opportunity cost of idle liquidity, satisfy regulatory standards, and avoid additional cost of emergency borrowing and forced liquidation of assets (Kavugizo, 2011).

According to Moore (2010), one can measure liquidity either from a stock or flow perspective. The stock approach employs various balance sheet ratios to identify liquidity trends. These ratios include: (a) loans as a ratio of deposits (referred to as the loan-to-deposit ratio); (b) investment securities maturing in one year or less divided by total assets, and; (c) cash less required reserves plus government securities divided by total assets (referred to as the liquid asset ratio). The flow approach, in contrast, treats liquid reserves as a reservoir: the bank assesses its liquidity risk by comparing the variability in inflows and outflows to determine the amount of reserves that are needed during a period (Moore, 2010). The challenge is that of accurately forecasting inflows and outflows which make the stock method more preferred. The two most popular stock ratios are the loan-to-deposit ratio and the liquid asset ratio, where the higher the loan-to-deposit ratio (or the lower the liquid asset ratio) the less able a bank to meet any additional loan demands. Both indicators have their short-comings; the loan-to-deposit ratio does not show the other assets available for conversion into cash to meet demands for withdrawals or loans, while the liquid assets ratio ignores the flow of funds from repayments, increases in liabilities and the demand for bank funds (Moore, 2010). This study employed loan-to-deposit ratio and liquid asset to total asset ratio as a measure of liquidity.

The fundamental role of DTSs to transform deposit into long term loans subjects them to liquidity risk. According to Iqbal (2012), liquidity risk is defined as the risk of being unable either to meet the obligations of the depositors or to fund increases in assets as

they fall due without incurring unacceptable costs or losses. Liquidity risk is one sort of financial risk faced by a financial intermediary that may eventually create contagion effects like insolvency risk, bail out risk and more predominantly reputation risk (Anam, Hasan, Huda, & Uddin, 2012).

The relationship between liquidity and efficiency may be expected to be positive since more liquid DTS are able to provide further loans as demanded by members without delay. Odunga *et al.* (2013) argue that more liquid banks may be more efficient in the sense that, all other things being equal, an efficient bank can produce more output part of which includes liquid and other assets. According to Gorton and Huang (2002), banks and banking systems that produce more liquidity than others perhaps can be viewed as both more 'liquidity efficient' and also less risky. On the other hand, it may be argued that; more efficient DTSs would be less liquid due to the fact that when DTSs hold high liquidity levels, they do so at the expense of other investment opportunities which could generate earnings (Sufian & Habibullah, 2014). This may be the case if DTSs have to hold high liquidity at the expense of lending.

2.3.5 Income Diversification in SACCOs

In the recent past, there has been a considerable change in the operations of SACCOs. These changes are two faceted; first, there has been diversification towards non-interest income which has seen many SACCOs introduce front-office service activities (FOSA) thus deposit taking. Secondly, there has been a concerted effort to break the common bond and accommodate nontraditional members which is accompanied by geographical diversification. As a result of the changes, DTSs closely mirror the operations of commercial banks.

The importance of common bond has been highlighted by several scholars. Mckillop and Wilson (2015) argue that common bond mitigates information deficiencies inherent in financial transactions and enables credit unions to provide banking facilities and credit

to financially excluded members where it would be deemed too risky by mainstream financial institutions. The original purpose of the common bond was to enable members to substitute their knowledge of each other's creditworthiness for collateral *(Goddard et al.*, 2008a).

The shift to non-interest income has seen SACCOs bear a resemblance to the operation of commercial banks. However, the consequences of non-interest income on the financial performance of commercial banks are not well understood. It has largely been believed that diversification into non-interest income would reduce earnings volatility due to diversification effects as postulated by the portfolio theory. Chiorazzo, Milani and Salvini (2008) found that the increase in non-interest income had been associated with an increase in profits per unit of risk.

Deyoung and Rice (2004) suggests three main reasons why non-interest income may increase the volatility of earnings: (1) a financial institution is more likely to lose clients with whom it engages in a fee-based relationship rather than a loan-based relationship. In spite of the greater sensitivity to movements in interest rates and economic downturns, "revenue from a bank's traditional lending activities is likely to be relatively stable over time, because switching costs and information costs make it costly for either borrowers or lenders to walk away from a lending relationship". (2) Moving from interest to non-interest income can require heavy fixed investments in technology and human resources. As a consequence, there is an increase in operating leverage and earnings volatility. (3) Many fee-based activities can be performed holding little or no regulatory capital and this suggests a higher degree of financial leverage and, as a consequence, earnings volatility.

The increased competitive pressure has forced the DTSs to break the common bond and change their names in an effectively compete with other players and cement their market share. In pursuit of the aforesaid, they tend to encounter an array of risks for which mitigation is desired. The emergence of the said risks has necessitated the issuance of

prudential guidelines by the regulator in a bid to enhance stability and financial soundness. Regulations prohibit DTSs from engaging in certain income generating activities such as foreign trade, trusts, land and transactions with non-members.

2.4 Empirical Review

2.4.1 Capital Adequacy and Financial Intermediation Efficiency

Empirically, there exists is no conclusive evidence that strengthened capital will improve banking system stability and enhance intermediation efficiency. Maghyereh and Awartani (2014) argue that while higher capital proportions may reduce bank lending and the associated costs thus increasing efficiency, it may on the other side raise the funding cost as capital is expensive thus adversely affect efficiency.

Maghyereh and Awartani (2014) used DEA and truncated regression model to investigate the determinants of efficiency in Gulf cooperation countries (GCC) banking sector. The study revealed that there was compelling evidence that a stringent capital requirement, a strong supervisory review, transparency, and market discipline promote efficiency. The results were argued to support the hypothesis that increased capital requirement will reduce lending, enhance loan quality, and decrease monitoring costs.

Nasieku (2014) investigated the effects of Basel capital adequacy framework on the economic efficiency of banks in Kenya during the period 2001-2011. The study adopted data envelopment analysis (DEA) to analyze banks economic efficiency. The study found out that the behavior of the Kenyan banking sector in terms of resource allocation and utilization (efficiency) was affected by the level of capital held by the bank and the country's economic situation. The study found that the existence of voluntary capital cushions as measured by the leverage ratio had no implications to the efficacy of banks in Kenya but risk based capital cushions positively influenced bank efficiency.

Girardone, Molyneux and Gardener (2004) investigated the main determinants of Italian banks' cost efficiency over the period 1993–1996, by employing a fourier-flexible stochastic cost frontier in order to measure X-efficiencies and economies of scale. The results indicated that the most efficient and profitable institutions are more able to control all aspects of costs, especially labour costs. Most significantly, the study revealed that inefficiencies appeared to be inversely correlated with capital strength and positively related to the level of non-performing loans in the balance sheet. This they argued that it could an indication that higher capital ratios may prevent moral hazard both for the bank and its managers.

Othman, Mansor and Kari (2014) assesed the performance of co- operatives in Malaysia using a data envelopment analysis approach with a sample of 56 out of the 70 co-operative groups. The productivity and efficiency scores were then regressed upon the co-operative variables (turnover, member, equity) using non-linear Tobit regression. The second-stage analysis attempted to investigate if any of the co-operative group characteristics (turnover, profits, members' equity and membership) have any influence on the efficiency scores. The result showed that turnover, profit and equity were statistically significant in influencing the technical efficiency. Turnover was positively correlated to all three scores which postulate that the higher the turnover of co-operative groups, the greater the efficiency scores. The result showed that as equity and members increased all three efficiency scores decrease suggesting that co-operatives are less efficient when membership size and equity gets bigger.

Kamau (2011) examined the trends in efficiency and productivity changes of the banking industry in Kenya during the post liberalization period (1997-2009). Efficiency scores and total factor productivity growth are estimated using the output oriented DEA model. In terms of ownership and size, foreign banks are found to be more efficient than local banks. And in the local category local private are more efficient than local public. Large sized banks are found to be more efficient than medium and small banks.

Muthuva (2009) undertook a study focused on the relationship between capital adequacy and cost-income ratio on one side and bank profitability on the other hand. He evaluated Kenyan Commercial banks between 1998 and 2007. The study found out that there exist a negative relationship between the equity capital ratio and profitability. Non-risk weighted capital adequacy measure (i.e. the equity capital ratio) was found to be negatively related to profitability of a bank (as measured by both ROA and ROE) while a positive relationship between risk-adjusted capital adequacy measure (i.e. tier 1 risk based capital ratio and core capital ratio) and profitability of a bank (as measured by both ROA and ROE). He argued that the differential relationships between bank profitability and capital could be explained by the differential effects of various measure of capital adequacy (due to risk measurement) on the profitability of the bank.

Isik and Hassan (2003) in a study of Turkish commercial banks investigated the relationship between capitalization and efficiency. They found that well-capitalized firms were more efficient. They offered two plausible explanations; one is that efficient firms have higher profits, which might lead to higher equity-to-asset ratios. Alternatively, the positive relationship may be an indication that inefficient banks with lower financial capital have less to lose from taking a risky gamble than an efficient bank. Therefore, as the level of financial capital decreases, managers of the inefficient banks have growing incentives to bet the bank. This explanation is consistent with the moral hazard theory.

2.4.2 Asset Quality and Financial Intermediation Efficiency

Conventional wisdom favors a strict negative relationship between non-performing assets (NPAs) and efficiency since the lower level of NPAs would facilitate higher efficiency in banking operations (Gulati, 2015). Empirically; there exists strong evidence of a negative relationship between non-performing loans and cost efficiency. High levels of NPAs impair the firms' intermediation role since much effort is expended

on recovery of overdue assets. However, there has been a varied opinion on the direction of causality as depicted by the "bad luck" hypothesis and "bad management" hypothesis.

Arora (2014) used a balanced panel of 54 commercial banks operating in India during 1991–92 to 2006–07 to study the effects of reforms and ownership on bank efficiency. The efficiency scores were generated using DEA and both ANOVA and profitability analysis used to evaluate the determinants. The study showed that the least efficient banks had higher levels of non-performing assets implying a positive relationship between asset quality and efficiency.

Odunga, Nyangweso, Carter, and Mwarumba (2013) undertook a study on credit risk, capital adequacy and operating efficiency of commercial banks in Kenya. The study revealed that the credit risk ratios had a significant impact on operating efficiency of the banks. This they argue implied that in a bid to minimize credit risk, banks should ensure that the agency problems between shareholders and management were minimized. They recommended that experienced and superior management should be employed to manage credit risk affairs of banks.

Burki and Niazi (2010) undertook a study on the impact of financial reforms on efficiency of state-owned, private and foreign banks in Pakistan. Using a sample of 40 banks for the period 1991–2000 they used data envelopment analysis to generate efficiency score and tobit regression to investigate how efficiency measures were correlated with some key bank-related attributes. The study revealed that there exist an important link between bank size, asset quality and bank branches with efficiency indexes. These measures were also found to correlate with efficiency scores. It was also noted that every 10% increase in share of nonperforming to total loans decreases banking efficiency by 6 to 10% highlighting the importance of asset quality in banks efficiency. In addition the efficiency of banks was found to be negatively associated with the number of bank branches.

Sufian (2009) used data envelopment analysis (DEA) under the three major approaches viz., intermediation approach, value added approach and operating approach to analyze efficiency in Malaysian banking sector. The analysis further linked the variation in calculated efficiencies to a set of explanatory variables, i.e. bank size, profitability and ownership. The empirical findings indicated that the Malaysian banking sector had high degree of inefficiency after the East Asian crisis. The decline in technical efficiency was more abrupt under the intermediation approach relative to the value added approach and operating approach. The results from the multivariate regression analysis suggested that technical efficiency was positively and significantly associated with loans intensity, suggesting that banks with higher loans-to-asset ratios exhibits higher efficiency scores. This he argued supported the "bad management" hypothesis.

Podpiera and Weill (2007) investigated the causality between non-performing loans and cost efficiency in an attempt to examine whether either of these factors is the deep determinant of bank failures. By extending the granger causality model developed by Berger and DeYoung (1997) they applied GMM dynamic panel estimators on a panel of Czech banks between 1994 and 2005. The study provided clear support for the "bad management" hypothesis, according to which reduced cost efficiency fosters an increase in non-performing loans. No evidence was found in support for the "bad luck" hypothesis, which suggests that an accumulation of non-performing loans hampers cost efficiency.

2.4.3 Liquidity and Financial Intermediation Efficiency

The empirical findings clearly indicate a negative relationship between bank efficiency and the level of liquid assets held. Pacelli and Mazzarelli (2015) undertook a study aimed at measuring and comparing the efficiency of French, German, Italian, Spanish and UK banking groups in a context of financial crisis, over the period 2006-2010. Using DEA and double boost rapping procedure, they found that more liquid, less capitalized banking groups and those more oriented towards the traditional activity of

lending were more efficient. This depicts a positive relationship between liquidity and efficiency.

Sufian and Habibullah (2014) while investigating the impact of economic freedom on the efficiency of the Malaysian banking sector used data envelopment analysis and bootstrap regression. The study found a negative relationship between bank liquidity and efficiency level implying that more efficient banks tend to be less liquid. They argued that this could be due to the fact that when banks hold high liquidity levels, they do so at the expense of other investment opportunities which could generate earnings.

Sufian and Habibullah (2010) undertook a study on developments in the efficiency of the Thailand banking sector using the DEA approach. The central tendency and parametric method based on the Tobit regression was employed to investigate the production efficiency while controlling for the potential effects of internal (bank-specific characteristics) and external (macroeconomic and industry specific) contextual variables. They also employed ordinary least square regression method, while the standard errors were calculated by using White's specification to adjust for cross-section heteroskedasticity. The results indicated that bank liquidity (LOANS/TA) is positively related to the efficiency indicating a negative relationship between bank efficiency and the level of liquid assets held by the bank. As higher figures of the ratio denote lower liquidity, the results imply that less liquid banks tend to exhibit higher efficiency levels.

Odunga, Nyangweso and Nkobe (2013) investigated the effect of liquidity and capital adequacy on operating efficiency of commercial banks in Kenya. The study used 40 commercial banks for the period 2005-2011 applying fixed effect regression in the analysis. The results indicated that previous year's operational efficiency, liquidity and capital adequacy combined explained about 41% of the bank's operating efficiency. Further, total capital ratio and liquid asset to deposits ratio positively affected the operating efficiency of the banks. The other liquidity ratios such as interbank ratio, loan ratio, net loans to deposits ratio and capital adequacy ratios - core capital ratio, risk

based capital ratio and equity to total asset ratio had insignificant effect on operating efficiency of the banks.

Sufian (2009) in his study on Malaysian banking sector used total loans over total assets (LOANS/TA) as an indicator for bank liquidity position. The results revealed a positive and statistically significant relationship between LOANS/TA and efficiency scores. This implied that banks with higher loans-to-asset ratios tend to have higher efficiency scores. This he argued showed support for the efficient market hypothesis and that market power in loan markets may be the result of efficient operations. He further argued that; relatively efficient banks due to their ability to manage operations more productively, have lower production costs, which enable them to offer more reasonable loan terms and ultimately gaining larger market shares over inefficient banks.

2.4.4 Income Diversification and Financial Intermediation Efficiency

Intense competition in the financial markets has forced SACCOs to move from the traditional BOSA products to FOSA products. There is also a sustained move to geographical diversification accompanied by the breaking of the common bond. According to Mercieca, Schaeck and Wolfe (2007), the diversification in banking sector has three dimensions: (a) financial products and services diversification, (b) geographic diversification, and (c) a combination of geographic and business line diversification.

Prior studies on the impact of diversification on bank performance remain inconclusive with divergent views. The conventional view is that product diversification reduces an institution's exposure to any particular activity and thus leads to lower risk. An alternative view is that the expansion of financial institutions activities beyond traditional deposit taking and lending leads to greater risk taking (Acharya, Hasan, & Saunders, 2006; Barry & Laurie, 2010; Esho, Kofman, & Sharpe, 2005; Kiweu, 2012). Fee income is often believed to be more stable than interest revenue, the latter being

affected by movements in interest rates and the business cycle (Esho et al., 2005). Overwhelming empirical evidence tends to show no gains for diversified banks.

Elyasiani and Wang (2012) investigated the effects of diversification on production efficiency of Bank Holding Companies (BHCs) in USA over the period 1997–2007. They used the data envelopment analysis (DEA) to calculate the Malmquist index of productivity and the total factor productivity change. The results showed that activity diversification was negatively associated with technical efficiency. In addition, changes in diversification over time were found not to affect the total factor productivity change but to be negatively associated with technical efficiency change over time. The results thus indicated that diversification harms efficiency.

Kiweu (2012) used a sample consisting of 35 commercial banks in Kenya for the period 2000 – 2012 to examine how income focus verses diversification impacts on bank performance (as measured by ROA and ROE). The study investigated whether diversification of income sources for Kenyan banks leads to better earnings and reduced individual bank and systemic risks. The study found that there are a few benefits, if any, to be expected from income diversification from traditional banking. The benefits of the evolution of non-interest income did not seem to fully offset the increase in risk that come with fee based income. A positive correlation between net interest income and non-interest income seemed to exist, a finding that suggests that non-interest income may not be used to stabilize total operating income.

Barry and Laurie (2010) investigated the impact of bank non-interest income on bank risk and return. They found that income derived from traditional sources is less risky than income derived from non-interest based revenue. Non-interest income or fee-based income as a source of diversification for bank income was found to be riskier than margin income. It however offers diversification benefits to bank shareholders by reducing bank exposure to interest incomes. While improving bank risk-return tradeoff,

these benefits are of second order importance compared to the large negative impact of poor asset quality on shareholder returns.

Goddard, Mckillop and Wilson (2008) used nested analysis of variance to identify the sources of variation in performance, measured by growth of membership and growth of assets, for a large sample of US credit unions. The results suggested that state, common bond and charter effects all make relatively small although statistically significant contributions to the explanation of the variation in growth performance. The findings of the study also indicated that performance is positively related to increase in diversification for large CUs. The relationship was however negative for smaller CUs.

Mercieca et al. (2007) investigated whether the shift into non-interest income activities improves performance of small European credit institutions. Using a sample of 755 small banks for the period 1997-2003, they found no direct diversification benefits within and across business lines and an inverse association between non-interest income and bank performance. The results indicated that small banks can improve their performance by expanding their resources within their existing business lines where they possess distinctive comparative advantages.

Huang and Chen (2006) investigated whether the reliance on different sources of non-interest incomes affects bank efficiency. They employed the DEA to calculate the cost efficiency of Taiwan domestic commercial banks from 1992 to 2004. The banks were equally divided into three sub-sample groups based on the percentage of the interest or non-interest incomes to the operating incomes. The Kruskal-Wallis pairwise comparison test was employed to examine whether there were significant differences within the sub-sample groups. The results indicated that bank efficiency tended toward extreme opposite cases. The banks either with the largest or smallest percentages of interest and non-interest incomes to operating incomes outperformed those with middle percentage of those incomes. This implied that the banks with a relative high and low concentration in interest and non-interest incomes operate more cost-efficiently. The banks with more

diversified income sources, which are the group of the middle percentage of interest and non-interest incomes to operating incomes, were less cost-efficient.

Esho, Kofman and Sharpe (2005) used a cross-sectional ordinary least squares regression analysis of 198 Australian credit unions and six risk measures to examine the relationship between a credit union's products mix, pricing policy, risk, and earnings. The results confirmed that increased reliance on fee income generating activities is associated with increased risk. Credit unions with highly concentrated revenues were found to have higher levels of risk and returns. Moreover, credit unions with a higher proportion of total revenue in the form of interest on residential loans and a lower proportion of revenues in interest on personal loans have significantly lower risk and returns, consistent with modern portfolio theory. However, credit unions that diversify by increasing the revenue share of transaction fees on loans and deposits, matched by a reduction in the revenue share of interest on personal loans, will increase their risk while reducing returns. Most importantly the study revealed that diversification may enhance X-efficiencies if larger credit unions are able to employ better managers.

2.4.5 Profitability and Financial Intermediation Efficiency

Generally, the relationship between profitability and efficiency is expected to be positive since highly profitable SACCOs are less cost and profit inefficient (Srairi, 2010). Empirically, there are mixed results, majority of scholars have reported a positive relationship between profitability and efficiency; Arora (2014), Maghyereh and Awartani (2014), Alrafadi, Kamaruddin and Yusuf (2014), Othman, Mansor and Kari (2014), Srairi (2010) and Sufian (2009). However other scholars such as Gulati (2015) found a negative relationship while Awdeh and Moussawi (2009) found no relationship at all. The inverse relationship can be a pointer towards the prevalence of '*quite life*' hypothesis. According to Berger and Hannan (1998), in more concentrated markets, efficiency of banks worsen because the absence of competitive pressures results in

lessened effort by managers to minimize costs. Managers can simply have a '*quiet life*', translating higher inefficiencies in higher prices.

Gulati (2015) while investigating trends of cost efficiency in response to financial deregulation in Indian banks used DEA and a Tobit model for post-DEA analysis. The results indicated a negative and significant relationship between profitability and efficiency. He argued that this may arise from the fact that most of cost efficient banks have invested heavily on IT in their drive to provide better customer services at low transaction cost which inversely affected their margins. On the other hand, the cost inefficient banks enjoy higher profitability due to high margins charged by those banks.

Alrafadi, Kamaruddin and Yusuf (2014) undertook a comparative analysis regarding the performance of 17 Libyan banks over the period 2004 to 2010 using DEA and Tobit regression. The results showed that the specialized banks have exhibited higher mean technical efficiency relative to commercial and private banks. The results suggested that the ROA was positively related to bank efficiency, and the coefficient had a positive statistically significant relation to the technical efficiency score. This they attributed to the fact that more profitable banks are usually preferred by clients and therefore attract the biggest share of deposits as well as the best potential creditworthy borrowers. This creates a favorable environment for efficiency in the intermediation process.

Srairi (2010) used stochastic frontier analysis to investigate the cost and profit efficiency of 71 commercial banks in Gulf Cooperation Countries over the period 1999 to 2007. A comparative analysis between conventional and Islamic banks was done. On average, conventional banks were found to be more efficient compared to Islamic banks. The results indicated that the banks were more effective at generating profits than at controlling costs. A positive correlation between cost and profit efficiency with bank capitalization and profitability was found.

Awdeh and Moussawi (2009) undertook a study on bank efficiency and foreign ownership in the Lebanese banking sector for the period 1996 and 2005. In addition, they investigated the factors behind the efficiency differences. They concluded that there was no direct relationship between efficiency and profitability. Their argument was similar to that of Gulati (2015) that a bank may be efficient, but realizes low profitability, possibly due to large expenditures on staff, IT, real estate, or else. On the other hand, an inefficient bank may enjoy high profitability due to high margins charged by that bank.

2.4.6 Bank size and Financial Intermediation Efficiency

An important question underlying policy on financial institutions is which size optimizes efficiency. Regulators in the financial sector have continued to lay emphasis on the size of the players by prescribing the minimum capital base. It is expected that with increase in size, stability is enhanced. Intuitively, we expect a positive relationship arising from the fact that larger DTSs are able to develop technical, financial, human and material resources enhancing their efficiency. In a reverse direction, since agency, coordination and dysfunction problems, are more accentuated in greater firms, we can expect smaller banks to generate inefficiency scores lower than those of larger banks (Karray & Chichti, 2013).

Hauner (2005) argue that there are two potential explanations why size could have a positive impact on bank efficiency. First, large banks due to their market power should be able pay less for their inputs. Second, there may be increasing returns to scale through the allocation of fixed costs (e.g. research or risk management) over a higher volume of services or from efficiency gains from a specialized work force.

Delis and Papanikolaou (2009) posits that though the effect of a growing size on efficiency has been proved to be positive to a certain extent, as banks become extremely large, the effect of size could be negative due to bureaucratic and other reasons.

However, the empirical evidence remains inconclusive as to the effects of the size on performance and efficiency of financial institutions.

Rozzani and Rahman (2013) used Stochastic Frontier Analysis to analyze the determinants of banks' efficiency focusing on conventional and Islamic banks in Malaysia. A sample of 19 conventional banks and 16 Islamic banks that operated in Malaysia for the period 2008 to 2011 was used. The results indicated that the levels of profit efficiency for both conventional and Islamic banks in Malaysia were similarly high. Further, it was observed that efficiency would be better for conventional banks with the increment of bank size and also the decrement of both operational cost and credit risk, while the efficiency for Islamic banks would be better with only the decrement of operational cost.

Karray and Chichti (2013) used a panel of 402 commercial banks from 15 developing countries over the period 2000-2003 to assess the effect of bank size on technical efficiency and its two components: pure technical and scale efficiencies. They used data envelopment analysis (DEA) adopting the intermediation approach and value added approach. The results indicated that examined banks suffered from serious problems of technical inefficiency involving a total average waste of resources that exceeded 46% of their actually levels. This inefficiency was mainly due to pure technical inefficiency for all size of banks except the largest banks for which they found high levels of scale inefficiency.

Wheelock and Wilson (2011) used annual data on all U.S. retail credit unions for 1989 to 2006 to estimate both ray scale and expansion-path scale economies. The study revealed that throughout the sample period, the vast majority of credit unions (almost all) operated under increasing returns to scale. Most credit unions were however found to be too small to fully exploit possible scale economies. They projected that competitive pressures among credit unions and from other types of depository

institutions were likely to encourage further growth in the average size of credit unions. The study evidently shows the benefit of large credit unions.

Kiyota (2011) utilized the stochastic frontier approach in a comparative analysis of profit efficiency and cost inefficiency of commercial banks operating in 29 sub-Saharan African for the period 2000-07. Tobit regression was used to assess the impact of environmental factors on the efficiency of commercial banks. The results indicated that foreign banks were more profit efficient compared to domestic banks. In addition, it was established that the smaller the bank, the more profit efficient it was. However medium or relatively large banks tend to be the most cost efficient.

Delis and Papanikolaou (2009) analyzed the determinants of bank efficiency using Data envelopment analysis and double bootstrapping procedure using a panel of 364 banks from selected 10 EU countries for the period 1994-2005. They considered a number of bank-specific, industry specific and macroeconomic determinants among them size of the bank. The results indicated that bank size had a positive significant economic and statistical effect on bank efficiency. This they argued was in support of mainstream view that large banks are able to hire more efficient managers, who succeed in their attempt to establish scale and scope economies.

2.5 Critique of Existing Literature

Two measures of efficiency have been widely used in evaluating efficiency of financial institutions. A considerable number of researchers have used a non parametric approach; Data Envelopment Analysis (DEA) (Alrafadi *et al.*, 2014; Arora, 2014; Burki & Niazi, 2010; Delis & Papanikolaou, 2009; Girardone *et al.*, 2004; Kamau, 2011; Karray & Chichti, 2013; Maghyereh & Awartani, 2014; Nasieku *et al.*, 2013; Othman *et al.*, 2014; Paxton, 2006; Sufian & Habibullah, 2014). Other researchers used parametric approach such as the Stochastic Frontier Analysis (SFA) (Girardone *et al.*, 2004; Kiyota, 2011; Rozzani & Rahman, 2013; Srairi, 2010). The authors who have used DEA have credited

it with the fact that no functional relationship (between production inputs and outputs) has to be assumed and its capability to handle multiple inputs and outputs.

In the second stage analysis the methodoloy used include; ordinary least square, Tobit regression and truncated regression model using double bootstrap. Delis and Papanikolaou (2009) used both Tobit regression and double bootstrap methodology indicating that latter offers more relevant results. The determinant of efficiency evaluted by different scholars has differed with mixed results as shown in the table below.

Table 2.1: Summary of empirical evidence on relationship between the variables and efficiency scores

Variable	Positive	Negative	Non significant
Capital Adequacy	Maghyereh and Awartani (2014), Nasieku (2014), Girardone, Molyneux and Gardener (2004), Alrafadi, Kamaruddin and Yusuf (2014), Srairi (2010), Awdeh and Moussawi (2009).	Othman, Mansor and Kari (2014), Sufian (2009)	
Asset quality	Kiyota (2011)	Arora (2014), Maghyereh and Awartani (2014), Kiyota (2011), Burki and Niazi (2010), Sufian (2009),	
Liquidity	Sufian (2009) Odunga, Nyangweso and Nkobe (2013) Pacelli and Mazzarelli (2015),	Sufian and Habibullah (2014)	
Diversification	Maghyereh and Awartani (2014) Sufian (2009) Esho, Kofman and Sharpe (2005)	Elyasiani and Wang (2012)	
Profitability	Arora (2014) Maghyereh and Awartani (2014) Alrafadi, Kamaruddin and Yusuf (2014) Othman, Mansor and Kari (2014) Srairi (2010) Sufian (2009)	Gulati (2015)	Awdeh and Moussawi (2009)
Size	Maghyereh and Awartani (2014) Alrafadi, Kamaruddin and Yusuf (2014) Rozzani and Rahman (2013) Karray and Chichti (2013) Burki and Niazi (2010) Srairi (2010) Delis and Papanikolaou (2009) Awdeh and Moussawi (2009) Sufian (2009)	Othman, Mansor and Kari (2014) Kiyota (2011)	Arora (2014)

2.6 Research Gaps

From the foregoing literature review it is evident that although efficiency in financial institutions has been evaluated in a number of studies, there has been no comprehensive study on all the firm characteristics at the same time. Internationally, only a few study focused of credit unions despite their significance in the financial sector. Much of the research done in Kenya has largely focused on efficiency of commercial banks (Beck *et al*., 2010; Kamau, 2011; Muthuva, 2009; Nasieku *et al.,* 2013). While both Kamau (2011) and Nasieku *et al*., (2013) used DEA methodology to evaluate efficiency, both fell short of critical evaluation of the realtionship between firm characteristics and efficiency of financial institutions.

Kamau (2011) evaluated efficiency of commercial banks without an analysis of environmental factors that influence efficiency. Nasieku (2014) assessed the Basel capital adequacy framework and its influence on economic efficiency of commercial banks in Kenya. Mwangi (2014) on the other hand evaluated efficiency of SACCOs and its determinants but concentrated on a few characteristics such as age, bond of association, adoption of technology and managerial competency. This research sought to fill the gap by not only evaluating the efficiency but also examining the relationship between other firm characteristics and financial intermediation efficiency of deposit taking SACCO societies in Kenya.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides a discussion of the methodology that was used to undertake the study and analyze the data. It includes research philosophy, research design, the target population, data collection procedure and data analysis. Zikmund, Babin, Carr and Griffin (2010) describe a research methodology as a part that must explain technical procedures in a manner appropriate for the audience. As such research design, sampling and data analyses methodology must be well presented.

3.2 Research Philosophy

The study was anchored on the positivist research paradigm. The positivist position is derived from natural science and is characterized by the testing of hypothesis developed from existing theory (hence deductive or theory testing) through measurement of observable social realities (Saunders, Lewis, & Thornhill, 2009). It assumes that reality is fixed, directly measurable, and knowable and that there is just one truth, one external reality and thus provides an objective reality against which researchers can compare their claims and ascertain the truth (Creswell, 2008).

Positivism presumes the social world exists objectively and externally, that knowledge is valid only if it is based on observations of this external reality and that universal or general laws exist or that theoretical models can be developed that are generalisable, can explain cause and effect relationships, and which lend themselves to predicting outcomes (Creswell, 2008; Saunders *et al.*, 2009). This stance is appropriate for this study since we seek to determine the relationship between firm characteristics and financial intermediation efficiency which is a quantitative study thus eliminating subjectivity.

3.3 Research Design

The study adopted a descriptive research design. Descriptive research design was adopted because the study involved an investigation of the firm characteristics and their relationship with financial intermediation efficiency of deposit-taking SACCOs in Kenya. Descriptive research is used to obtain information concerning the current status of the phenomena to describe "what exists" with respect to variables or conditions in a situation (Kothari, 2013; Mugenda & Mugenda, 2003; Sekaran, 2010). It also describes the characteristics or behaviour of a given population in a systematic and accurate version (Sekaran, 2010).

A descriptive research design is appropriate since it involves collecting and analyzing study units data at a point in time in order to assess strength of relationships among variables (Saunders *et al*., 2009). However, the design does not possess the ability to establish a causal relation between the variables. Kiaritha (2015) used the descriptive design in a study on determinants of financial performance of savings and credit co-operatives in the banking sector in Kenya. Mwangi (2014) also used descriptive design in as study of the influence of members' income and conduct of SACCOs in the relationship between characteristics and efficiency of SACCOs in Kenya.

3.4 Study Population

The study focused on deposit taking SACCOs in Kenya. According to SASRA (2014), the SACCO sub sector can be described as two-tiered given the range of financial services to members and regulatory regime. The traditional Savings and Credit Cooperative Societies (SACCOs), described in law as non-deposit taking SACCOs provide a limited range of savings and credit products, are registered and supervised under the Cooperative Societies Act, CAP 490.

The deposit taking SACCOs (DTSs) besides the basic savings and credit products, also provide basic 'banking' services (demand deposits, payments services and channels such

as quasi banking services), FOSA and are licensed and supervised under the SACCO Societies Act of 2008. The study focused on the latter category and envisaged to use a census of all the one hundred and thirty-five (135) licensed deposit taking SACCOs in Kenya as at 31st December 2013 as per Appendix II. According to SASRA (2014), by close of 2013, there were 215 deposits taking SACCOs out of which one hundred and thirty-five (135) were licensed.

3.5 Sampling Frame and Technique

The sampling frame for this study is all the one hundred and thirty-five (135) licensed deposit taking SACCOs in Kenya as at 31st December 2013 as per Appendix II. The study envisaged to use a census which is a study of all items in the target population. Saunders *et al.* (2009) argue that census is highly recommended especially where it is practical to do so since it eliminates errors that are associated with sampling. In this case, availability of secondary data from the regulator for all licensed DTS validates the use of a census.

3.6 Data Collection Procedure

The study used secondary data derived from financial statement submitted to SASRA by each DTS. Kothari (2004) posit that secondary data is data collected by someone else and which have already been passed through the statistical process. The researcher with the help of a research assistant paid a physical visit to SASRA offices and used data collection sheet in Appendix 1 to collect data from audited annual reports of DTSs filed with the regulator. A balanced panel data for all 135 registered DTS over a period of four years (2011-2014) was envisaged to be collected. This was the period in which the prudential guidelines had been in place making it possible for the research data to be available in standard form.

3.7 Data Analysis

The subsection that follows elaborates the methodology used in the analysis and further on the data required to measure each of the study variables. A two stage analysis is adopted in the study. In the first stage efficiency scores were generated using the DEA methodology. In the second stage, a multiple regression analysis was used to regress DEA efficiency score on the firm characteristics. Similar to Casu and Molyneux (2003), in order to minimize the bias arising from the inherent dependency problem of efficiency scores, we substitute the conventional efficiency scores with the bootstrapped scores. The panel data collected was analyzed quantitatively using mathematical and regression equations, which were solved using statistical tools programs. Specifically the mathematical linear programming problems were solved using the DEA Computer Program Version 2.1.The pooled data forming the panel model was incorporated into STATA and EViews version 8.

3.7.1 Data Envelopment Analysis (DEA)

The study used a non parametric approach; data envelopment analysis (DEA) in measuring the efficiency and productivity in financial intermediation process of DTSs in Kenya. Data envelopment analysis has several attractive features in this context. Firstly, it places no constraint on the functional form of the production relationship. Secondly, it focuses on the individual observations rather than on population averages, compared with statistical regression analysis. Finally, it concentrates on revealed best-practice frontiers, rather than on the central tendency properties of frontiers (Burki & Niazi, 2010; Kamau, 2011; Othman *et al.*, 2014; Paxton, 2006; Zheng, Xiaoxuan, & Bigsten, 1998).

Selection of inputs and outputs

The banking literature provides two approaches to efficiency measurement; a production approach and an intermediation approach. The production approach treats banks as providers of services to customers. The output under this approach represents the

services provided to the customers and is best measured by the number and type of transactions, documents processed or specialized services provided over a given time period (Gulati, 2015). The intermediation approach treats banks as financial intermediaries channeling funds between depositors and creditors. In this approach, banks produce intermediation services through the collection of deposits and other liabilities and their application in interest-earning assets, such as loans, securities, and other investments (Burki & Niazi, 2010; Gulati, 2015; Kamau, 2011; Paxton, 2006). Gulati (2015) posit that the intermediation approach is best suited for analyzing bank level efficiency. The following table describes the approaches followed by other scholars and their definition of inputs and outputs.

Table 3.1: Summary of Banking Inputs and Outputs Applied by previous Authors

Authors	Method	Inputs	Outputs
Nasieku (2014)	DEA	Total costs and total deposits	Total loans and other earning assets
Arora (2014)	DEA	Wages (labour), Fixed assets (capital) and Deposits	Investments and Advances
Karray and Chichti (2013)	DEA	Labour expenses, fixed assets, and deposits &other borrowed funds	Loans, other paying assets and Non-interest Income
Karimzadeh (2012)	DEA	Fixed assets, deposits, and number of employees.	Loans and investments
Kamau (2011)	DEA	Capital, Deposits and Labour cost	Loans and investments
Sufian (2009)	DEA	Deposits, labour and capital	Loans and investments

By acknowledging the main role of DTSs, the study adopted the intermediation approach and defined the inputs and outputs as follows:

Inputs: X_1= Total Deposits, X_2= Labour cost, X_3= Core capital

Outputs: Y_1=Loans, Y_2=Investments

The variables are selected due to their ease of determination from the financial statements given that the study relies on secondary data.

Descriptive statistics of inputs and outputs variables

The mean values, standard deviations and correlation coefficients of inputs and output variables were determined. The statistics indicates the trend of inputs and outputs over the period of the study and their variability. The product moment correlation between the inputs and outputs were also determined. According to Kamau (2011), correlations among input and output variables can be used to show the appropriateness of such variables with high correlation coefficients indicating that selected input and output variables are appropriate.

3.7.2 Second Stage Regression Analysis

The second stage analysis involved evaluating the firm characteristics that influence efficiency. The DEA score lie between the interval 0 and 1 i.e. making it a limited dependent variable. Mcdonald (2009) argues that since the DEA scores are fractional data, OLS is a consistent estimator, and, if White's heteroscedastic-consistent standard errors are calculated, tests can be performed which are valid for a range of disturbance distribution assumptions. Accordingly, DEA efficiency scores obtained in the first stage is used as a dependent variable in the second stage and are regressed on a set of firm characteristics. The study included firm characteristics that were consistent with the reviewed theories and could be determined from financial statements. The envisaged the following panel model was as follows.

$$TEFF_{it} = \alpha_0 + \beta_1 \mathrm{CA}_{it} + \beta_2 \mathrm{ASQ}_{it} + \beta_3 \mathrm{LIQ}_{it} + \beta_4 DIV_{it} + \beta_5 PROF_{it} + \beta_6 SIZE_{it} + \varepsilon_{it}$$

Where i = 1,2, …,135, and t = 1,2,3,4

In the model i stand for the i^{th} cross-sectional unit and t for the t^{th} time period. The dependent variable is the intermediation efficiency (TEFF) which is hypothesized to depends on capital adequacy (CA), asset quality (ASQ), liquidity (LIQ), income diversification (DIV), profitability (PROF), and size (SIZE) for each DTS i on the sample over the 2011-2014 period t of analysis.

Variable description and measurement

This section gives a brief description of each of the independent variable and the measurement adopted in the study. Most of the dependent variables can be measured in more than one way as stipulated in the conceptual framework. However, the measures are determined from financial statements and are alternate implying that both measures cannot enter the regression model. This is because of inclusion of more than one measure of a variable is likely to result into multicollinearity. According to Gujarati (2012), existence of multicollinearity results to regression coefficients that posses large standard errors which means they cannot be estimated with precision. To avoid such eventuality, the study shall use only one measure for each variable based on the results of the forward selection method.

Capital adequacy is defined as the extent to which capital is sufficient to meet any contingency. It is the ratio which protects banks against excess leverage, insolvency and keeps them out of difficulty. It is defined as the ratio of banks capital in relation to its current liabilities and risk weighted assets (Fatima, 2014). The Basel framework provides more elaborate measure of capital adequacy for banks which is classified into tier 1and tier 2. Tier 1 capital is a bank's core capital, whereas tier 2 capital is a bank's supplementary capital. The regulatory framework on DTSs in Kenya on the other hand is still elementary incorporating only Tier 1 capital. As such the ratio of core capital to

total assets and core capital to total deposits are used as measures of capital adequacy. The variable was expected to have a positive relationship with efficiency (Alrafadi *et al.*, 2014; Awdeh & Moussawi, 2009; Girardone *et al*., 2004; Maghyereh & Awartani, 2014; Srairi, 2010).

Asset quality refers ability of bank assets (loans) to provide income; it is the timely manner with which borrowers are meeting their contractual obligations (Alhassan *et al.*, 2014). The ratio of non-performing loans provisions to total loans or the ratio of non-performing loans to net of provisions to capital are used as measures of asset quality. Due to ease of computation, the ratio of non-performing loans provisions to total loans was used as a proxy of the asset quality (Kiyota, 2011; Sufian, 2009) or credit risk. Higher levels of nonperforming assets indicate lower asset quality. It was expected that higher levels of non-performing assets would result in lower efficiency levels and therefore an inverse relationship (Arora, 2014; Burki & Niazi, 2010; Kiyota, 2011; Maghyereh & Awartani, 2014; Sufian, 2009).

Liquidity refers to the ability of the bank (DTS) to meet up deposit withdrawals, maturing loan request and liabilities without setback (Akhtar *et al.*, 2011). As depicted in the literature review, liquidity can be measured in two ways; the loan-to-deposit ratio and liquid asset ratio. Liquid asset are defined as cash less required reserves plus government securities (Moore, 2010). The higher the loan-to-deposit ratio (or the lower the liquid asset ratio) the less able a bank (DTS) to meet any additional loan demands. The variable was expected to enter the regression model positively (Sufian, 2009).

Diversification in DTSs has largely focused on breaking the common bond, increase in number of branches and moving towards non-interest income. The study focuses on the later. The ratio of interest margin to gross income and non-interest income to total assets are used as measures of income diversification (Maghyereh & Awartani, 2014; Sufian, 2009). It was expected that the variable would have a positive coefficient indicating that income diversification enhances efficiency.

Return on assets (ROA) and return on equity (ROE) were used as a measure of profitability. The variable was expected to have a positive relationship with efficiency since highly profitable banks are more efficient (Alrafadi *et al.*, 2014; Arora, 2014; Maghyereh & Awartani, 2014; Othman *et al*., 2014; Srairi, 2010; Sufian, 2009). Natural logarithm of total assets was used as a proxy of bank size to captures the possible cost advantages associated with size (economies of scale). The variable was expected to take a positive sign arising from the fact that larger banks are more able to develop technical, financial, human and material resources enhancing their efficiency (Alrafadi *et al*., 2014; Awdeh & Moussawi, 2009; Burki & Niazi, 2010; Karray & Chichti, 2013; Maghyereh & Awartani, 2014; Rozzani & Rahman, 2013; Srairi, 2010; Sufian, 2009).

Table 3.2: Summary of the research variables data measures

Variable	Proxy	Measurement	Model/ Analysis
Dependent Variable			
Intermediation Efficiency	TEFF	$\frac{\text{weighted sum of outputs}}{\text{weighted sum of inputs}}$	Panel/Quantitative
Independent Variables			
Capital Adequacy	CA	Core Capital to Total Assets	Panel/Quantitative
		Core Capital to Total Deposits	Panel/Quantitative
Assets Quality	ASQ	Nonperforming Loans to Gross loans	Panel/Quantitative
Liquidity	LIQ	Total loan to Total Deposits	Panel/Quantitative
		Liquid Assets to Total Assets	Panel/Quantitative
Income Diversification	DIV	Non-interest Income to Total Assets	Panel/Quantitative
		Interest Margin to Gross Income	Panel/Quantitative
Profitability	PROF	Net income after tax to Total Assets	Panel/Quantitative
		Net Income after tax to Total Equity	Panel/Quantitative
Size	SIZE	Log of total Assets	Panel/Quantitative

3.7.3 Panel Model Specification

The study used a balanced panel data for the period 2011-2014. Compared with purely cross-sectional data, panels are attractive since they often contain far more information than single cross-sections and thus allow for an increased precision in estimation (Hoechle, 2007). According to Gujarati (2012), by combining time series of cross-section observations, panel data gives more informative data, more variability, less collinearity among variables, more degrees of freedom and more efficiency. However, despite their substantial advantages, panel data pose several estimation and inference problems that plague cross-sectional data and time series data.

There are several estimation techniques to address these problems. The first, Pooled OLS, simply combines or pools all the time series and cross-sectional data and the estimates the underlying model by utilizing ordinary least squares (OLS). The model is presented in equation 4;

$$Y_{it} = \alpha + \beta X'_{it} + \epsilon_{it} \quad (4)$$

Where ϵ_{it}= error term

Y_{it} = TEFF for i^{th} firm in t^{th} year.

X'_{it}= vector representing independent variables for firm *i* in year *t*,

β = Vector of coefficients of the independent variables,

α = the intercept for each entity,

i= 1, 2, …, 135 (individual DTS),

t = 1, 2, 3, 4 (time indicator).

According to Pindyck and Rubinfeld (1998), the difficulty with pooled OLS procedure is that assumption of constant intercept and slope may be unreasonable. It is appropriate to allow the intercept term to vary over time and over cross-sectional unit. The second model, fixed effects model (FEM), involves recognition that omitted variables may lead to changes in cross-sectional and time series intercepts. In FEM, the intercept in the regression model is allowed to differ among individuals in recognition to the fact that each individual or cross-sectional unit may have some special characteristics (Gujarati, 2012). The model is presented in equation 5;

$$Y_{it} = \alpha_i + \beta X'_{it} + \in_{it} \quad (5)$$

Models with fixed effects add dummy variables to allow for these changing intercepts (Pindyck & Rubinfeld, 1998). The FEM using dummy variables referred to as the least-square dummy variable (LSDV) model is presented in equation 6;

$$Y_{it} = \alpha_i + \beta X'_{it} + \mu + \in_{it} \quad (6)$$

Where μ = fixed effect

Where ε_{it} = error term

The third, random effect model (REM) improves the efficiency of the first least square estimation process by accounting for cross-sectional and time series disturbances. Since the inclusion of dummy variable represents a lack of knowledge about the model, this lack of knowledge is described through the disturbance term (Pindyck & Rubinfeld, 1998). In REM, it is assumed that the intercept of an individual unit is random drawing from a much larger population with a constant mean value (Gujarati, 2012). The model is as shown in equation (7);

$$Y_{it} = \alpha + \beta X'_{it} + \mu_i + \in_{it} \quad (7)$$

Where ε_{it} = within entity error term

μ_i = between entity error term

3.7.4 Panel Model Specification Tests

To determine the nature of the panel data and the best model for analysis, diagnostic test for heteroskedasticity, serial correlation and fixed effects were carried out. A summary of the test carried out and the criteria for making the decision is presented in table 3.3.

Table 3.3 Panel Data Diagnostic Tests

Test	Test Used	Conclusion
Use of pooled or random effects model	Breusch Pagan LM test	If P value >0.05, use pooled effects model.
Time Fixed Effects	F statistics	If p value >0.05, there are no time fixed effects do not use two way model or introduce dummy variables
Heteroskedasticity	Modified Wald Test	If P value <0.05, presence of non-uniform variance.
Serial correlation	Wooldridge Drukker test	If P>0.05, no serial correlation
Random or fixed effects	Hausman test	If p value>0.05, use random effects model.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

The study sought to investigate the relationship between firm characteristics and financial intermediation efficiency of deposit taking SACCO societies in Kenya. Specifically, the study focused on capital adequacy, asset quality, liquidity, income diversification, profitability and size and how they relate to financial intermediation efficiency. The study adopted a two staged methodology for analysis; the first stage involved solving mathematical linear programming problems using the DEA computer program version 2.1 to generate of efficiency scores. In the second stage, the efficiency scores were corrected for bias and regressed on firm characteristics using STATA and Eviews. This chapter contains the findings and discussions of the study and test of the hypothesis depicted in the study. It begins with providing a general description of the study objects and a summary of efficiency scores. Necessary test for regression analysis are carried out and reported. Ultimately, the hypothesis testing is carried out and the model fitted.

4.2 Success Rate

The study focused on deposit taking SACCOs (DTSs) that are licensed and regulated by SASRA. In total, there are 215 DTSs in Kenya out of which 181 were licensed as at 31st December 2014. To enhance comparability for a longer period, the study envisaged a census of all 135 that were licensed as at 31st December 2013. However, due persistent failure to address non-compliance issues, three DTSs had their licenses cancelled and ordered to liquidate or revert to non deposit taking business popularly referred to BOSA. In addition, one DTS was put under statutory management. This effectively left 131

eligible for analysis. To enable detailed analysis a balanced panel data for four years was necessary. Those DTSs whose entire four years financial data was not available were eliminated.

Data was available for 103 DTSs translating to a success rate of 79%. The response/success rate was considered adequate given the recommendations by Saunders et al., (2009) who suggest a 30-40% response, Sekaran (2010) who documents 30%, and Mugenda and Mugenda (2003) who advise on response rates exceeding 50% as adequate, 60% as good and above 70% rated very good. Based on these assertions, the response rate for this study was adequate. Past studies on SACCOs have reported relatively lower response rate with Mwangi (2014) recording a success rate of 67% (144/215) and Kiaritha (2015) 70%.

Though many DTSs and other non deposit taking SACCOs have continued to break the common bond by admitting non traditional core members, they have continued to be classified on the basis of their dominant membership. SASRA (2013) classifies DTSs into five categories; government based, farmers based, private institutions based and teacher based. Government based DTSs are those where majority of the members comprise employees of government ministries, departments, state corporations, public universities and colleges and county government. Farmer based DTSs **c**omprise of farmers engaged in different agricultural activities. Private institutions based DTSs consist of members who are employees of private organizations including non-Governmental organizations operating in Kenya**.** Community based DTSs comprise members who are residents of a given geographical area so long as they are engaged in a productive economic activity, whether business or employment; and thus have farmers, employed persons and business people in their membership. Teacher based DTSs comprise employees of public/private schools, colleges and universities.

Table 4.1 shows the breakdown of the DTSs for which data was available, it shows that out of 103 DTSs, 17 (68%) were government based, 31 (97%) were teachers based, 23 (59%) were farmers based, 13 (87%) were private institutions and 19 (95%) were community based. Evidently, teachers based and community based had the highest response rate. Farmers based DTSs recorded the lowest response rate (59%) which can be attributed to the fact that they lagged behind in complying with regulatory requirements and therefore did not file their returns with the regulator for the earlier years of regulatory regime.

Table 4.1: Success Rate

Membership	Target	Actual	Percent of Actual to Target (%)
Government based	25	17	68
Teachers based	32	31	97
Farmers based	39	23	59
Private institutions	15	13	87
Community based	20	19	95
Total	**131**	**103**	**79**

As shown in Figure 4.1, the DTSs whose data was available consisted of 16% large DTSs, 33% medium DTSs and 51% small DTSs. Large DTSs are those with assets in excess of Kshs 4 billion, medium DTSs are those with assets of between Kshs 1 billion and Kshs 4 billion and Small DTSs are those with assets asset below Kshs 1 billion (SASRA, 2013). It therefore indicates that majority of DTSs (51%) have asset base of less than Kshs 1 billion.

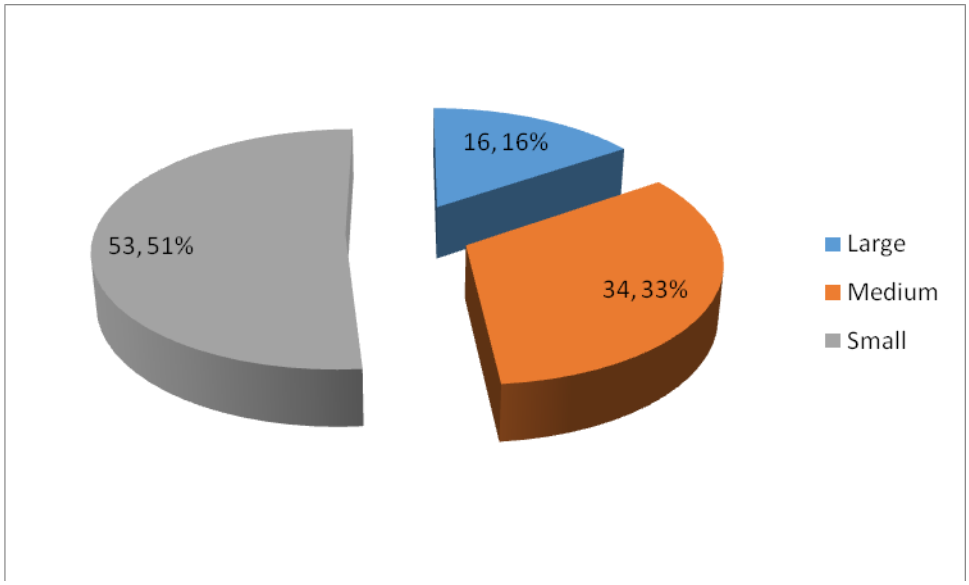

Figure 4.1: Success Rate by Size

4.3 Analysis of DEA Inputs and Outputs

4.3.1 Descriptive Statistics of DEA Inputs and Outputs

The study adopted the intermediation approach of DEA since the focus was on intermediation efficiency. It sought to evaluate the efficiency with which DTSs collate member's deposit, capital and employ labour to advance loans to the members and also acquire investments for their benefits. Effectively, total deposits, labour cost and core capital were selected as inputs whereas gross loans and investments as outputs. Table 4.2 presents the descriptive statistics of these inputs and outputs. It can be observed that the mean deposits amounted to Ksh. 1.31billion with a standard deviation of Ksh. 2.46 billion. Labour cost had a mean of Ksh. 38 million with a standard deviation of Ksh. 63 million. The trend is the same for all other variables where the standard deviation is significantly higher that the mean which shows that the data is highly spread. This can also be seen from the difference between the maximum and minimum values. This indicates that DTSs included in the study differ significantly in their scale of operation.

These results are similar to those of Kamau (2011) in a study of commercial banks in Kenya.

Table 4.2: Descriptive Statistics of inputs and outputs

	Total deposits	Labour cost	Core capital	Gross loans	Investments
Mean (Ksh. Millions)	1,310	38	211	1,550	69
Median (Ksh. Millions)	492	16	77	547	19
Maximum (Ksh. Millions)	18,300	566	5,000	19,800	1,350
Minimum (Ksh. Millions)	0	1	-60	20	0
Std. Dev. (Ksh. Millions)	2,460	63	446	3,030	162
Skewness	4	4	6	4	5
Kurtosis	20	23	49	18	32
Observations	412	412	412	412	412

4.3.2 Trend analysis of inputs and output

Figure 4.2 provides a quick visual impression of the trend of the inputs used over the period covered by the study. The inputs are; members' deposits, labour cost and core capital. It can be observed that the average annual members' deposits increased from sh. 1.026 billion in 2011 to sh. 1.606 billion in 2014 representing a 36% increase. The increase can be seen to be gradual with an average increase of Ksh. 200 million per year. Labour costs on the other had increased from Ksh.29 million to sh. 48 million over the same period representing a 40% increase. It can be observed that labour cost registered a steady growth over the period. This gives an indication that DTSs were keen to maintain a modest labour costs.

Core capital registered the highest growth from an average of Ksh.127 million to Ksh.338 million representing a 62% increase. The biggest increase was recorded in the year 2013 where it increased to an average of Ksh.239 million from Ksh.140 million in

2012 representing a 40% jump. This could be attributed to the concerted efforts by the DTSs to build up their capital to meet the regulatory requirements. The transition period within which DTSs were expected to be fully compliant was four years commencing June 2010. Additionally, more and more DTSs were getting under the armpit of the regulator having met the minimum requirements for licensing.

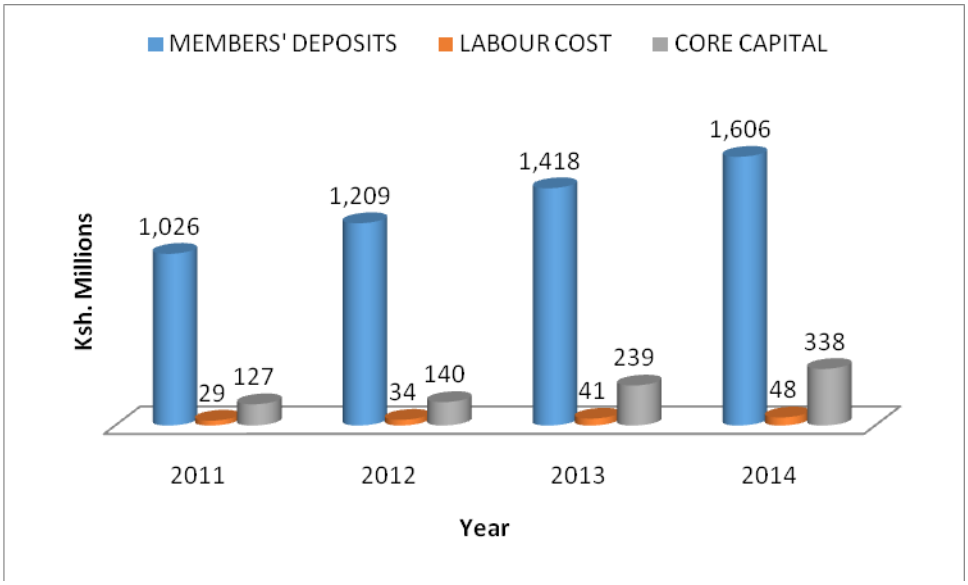

Figure 4.2: Growth Trend in Inputs

On receipt of deposits, DTSs convert them into outputs which are loans to members and investment in other earning assets. Figure 4.3 presents the growth trend of the two inputs. It can be observed that the gross loans increased from an average of Ksh.1.25 billion in 2011 to Ksh.1.9 billion in 2014 representing a 34% increase. The increase can be seen to be gradual with an average increase of around Ksh. 200 million per year except in 2014 where it increased by around Ksh. 300 million. Investments on the other hand increased from an average of Ksh.59 million in 2011 to Ksh. 85 million in 2014 representing a 31% increase. It is worth noting that on average the inputs increased by a bigger magnitude that the outputs. It will be interesting to find out the trends in efficiency over the same period.

It is also important to note that the investments were maintained at a relatively lower levels compared to loans advanced to members. In 2011, the investments were only Ksh.59 million compared Ksh. 1.25 billion in loans. The trend is the same in other years with investments being only 4% of the total outputs (loans plus investments). This underscores the focus of the DTSs on their core mandate of encouraging savings and provision of credit to their members (Khalayi et al., 2014).

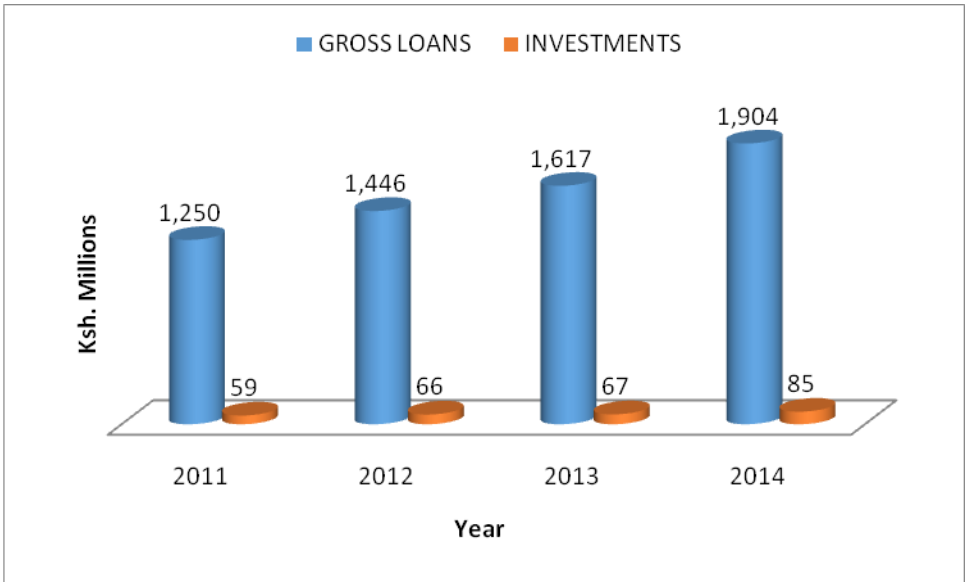

Figure 4.3: Growth trend in Outputs

4.3.3 Input and Output Correlation Analysis

The choice of the inputs and outputs is important in defining the validity of efficiency scores generated. According to Kamau (2011), the appropriateness of the inputs and outputs can be shown by correlation analysis. Table 4.3 presents the Karl Pearson's (product moment) correlation coefficient among the inputs and outputs. It can be observed that all variables depict strong positive correlations that are significant at 0.01 since their P values are less than 0.01.The recorded high correlation coefficients between input and output variables, confirm that selected input and output variables for performance evaluations are appropriate.

Table 4.3: Karl Pearson's Correlation Coefficient among inputs and outputs

	Gross loans	Investments	Total Deposits	Labour Cost	Core capital
Gross Loans	1				
Investments	0.6409***	1			
	0.0000	-----			
Total Deposit	0.9725***	0.6117***	1		
	0.0000	0.0000	-----		
Labour Cost	0.8751***	0.6171***	0.8836***	1	
	0.0000	0.0000	0.0000	-----	
Core Capital	0.6788***	0.4679***	0.6982***	0.6892***	1
	0.0000	0.0000	0.0000	0.0000	-----

***(**)(***) significant at 10%(5%)(1%).**

4.4 Financial Intermediation Efficiency Analysis

4.4.1 Efficiency over the years

The intermediation efficiency is determined using output oriented data envelopment analysis (DEA). The choice of output orientation is informed by the core mandate of DTSs where members upon provision of capital and deposits expect them to be utilized efficiently in provision of loans and other earning assets for their benefit. Of importance is therefore to generate as much output as possible given the resources provided by members. A variable return to scale (VRS) is preferred due do its realistic assumption that all firms do not operate under optimal scale. The constant return to scale (CRS) is appropriate when all DTSs are operating at an optimal scale i.e. at the flat portion of the long run average cost curve which is skeptical in reality due to market imperfections and resource constraints. It is however important to determine both CRS and VRS efficiency scores since this help in explaining the main cause of inefficiencies in a firm.

CRS efficiency scores are decomposed into two components; Scale efficiency and VRS TE ("pure" technical efficiency) (Coelli, Rao, O'Donnell, & Battese, 2005). The efficiency measure corresponding to VRS assumption represents pure technical efficiency (PTE) which measures inefficiencies due to only managerial underperformance whereas scale efficiency indicates whether the DMU (DTS) is producing at the most efficient size (Lothgren & Tambour, 1999; Yadav & Katib, 2015). A firm with a scale efficiency of one is efficient in the sense that the chosen input–output mix is optimal and maximizes the average (multiple-output) productivity. Scale efficiency of less than one indicates that the input–output mix is not scale efficient, and the firm in question is operating either in a region of increasing returns to scale (inefficient small scale), or in a region of decreasing returns to scale (inefficient large scale) (Lothgren & Tambour, 1999).

The data in Table 4.4 shows that there has been a sustained increase in intermediation efficiency over the years from a low of 0.646 in year 2011 to a high of 0.707 in 2014. This may be attributed to regulatory compliance indicating that as more and more DTSs met regulatory requirements, they improved in efficiency. An average of 67.7% (0.677) over the four years period indicates that DTSs are capable of increasing their outputs (loan to members and investments) by 32.3% without any additional increase in inputs (deposits, labour and capital). This corroborates Mwangi (2014) who found overall average efficiency of 0.775 in a study of SACCOs in Kenya for the period 2009-2013. Kamau (2011) in a study of intermediation efficiency of commercial banks in Kenya for the period 1997-2009 found overall average efficiency of 70% while Nasieku et al., (2013) in a similar study over the period 2001-2011 found an average of 84%. Though the studies covered different time periods, they indicate a possibility that commercial banks are relatively better in terms of efficiency compared to DTSs.

Table 4.4 also shows that the average scale efficiency for the period was 0.872 indicating that DTSs would need to increase their scale of operation by 12.8% to be fully efficient. The highest scale efficiency was realized in 2013 when the average was 0.907

and then reduced to 0.885 in 2014. For the entire period scale efficiency was higher than VRS (pure) technical efficiency. Hassan, Sanchez and Ngene (2012) suggests that where scale efficiency is higher than pure technical efficiency, the managers and policy makers should concentrate on how to improve the managerial efficiency rather than the size of the firm.

Table 4.4: Summary Efficiency Scores over the Years

Year	Constant Return to Scale (CRS) Technical Efficiency	Variable Return to Scale (VRS) Technical Efficiency	Scale Efficiency
2011	0.541	0.646	0.849
2012	0.540	0.648	0.846
2013	0.639	0.706	0.907
2014	0.626	0.707	0.885
Mean	**0.587**	**0.677**	**0.872**

4.4.2 Efficiency Measure by Membership

Table 4.5 shows efficiency measures by membership over the four years period. It can be seen that the variable return to scale (VRS) efficiency scores is highest for the government based DTS with a mean of 0.775 followed by private institutions at 0.7660. The farmers based DTSs record the lowest efficiency at 0.5390 followed by community based DTSs at 0.6551. However, the teacher based DTSs recorded the highest scale efficiency of 0.9145 followed by government bases DTSs at 0.8919. High scale efficiency (closer to 1) indicates that DTSs are operating at a point very close to the lowest point of the long run average cost curve.

Table 4.5: Efficiency Measure by Membership

Core Membership		N	Mean	Std. Deviation
Government based	CRSTE	68	0.6890	0.2023
	VRSTE	68	0.7750	0.2066
	SE	68	0.8919	0.1083
Teachers based	CRSTE	124	0.6396	0.2426
	VRSTE	124	0.7006	0.2457
	SE	124	0.9145	0.1068
Farmers based	CRSTE	92	0.4580	0.2257
	VRSTE	92	0.5390	0.2484
	SE	92	0.8613	0.1550
Private institutions	CRSTE	52	0.6468	0.2505
	VRSTE	52	0.7660	0.2383
	SE	52	0.8557	0.1977
Community based	CRSTE	76	0.5214	0.2129
	VRSTE	76	0.6551	0.2451
	SE	76	0.8092	0.1489

4.4.3 Efficiency Measure by Size

Table 4.6 shows the mean efficiency scores according to the size of DTSs. Large DTSs are those with assets in excess of Kshs 4 billion, Medium DTSs are those with assets of between Kshs 1 billion and Kshs 4 billion and Small DTSs are those with assets asset

below Kshs 1 billion (SASRA, 2013). A look at the VRS efficiency scores indicates that large DTSs are the most efficient with an efficiency of 0.8929 followed by medium DTSs at 0.6711. Small DTSs are the least efficient with an efficiency score of 0.6150. The results agree with Kamau (2011) who in a study of intermediation efficiency of commercial banks in Kenya revealed that large sized banks were more efficient than medium and small banks.

Interestingly, medium sized DTSs had the highest scale efficiency score of 0.9097 followed by small DTSs at 0.8624. Large DTS recorded the least scale efficiency score of 0.8240. This implies that large DTSs though big in size have not fully exploited their economies of scale. Additionally, the fact that Large DTSs had their scale efficiency smaller than pure technical efficiency (VRSTE) indicates they could be operating in a region of decreasing returns to scale (inefficient large scale). Efforts should be made to ensure that they optimize their size by generating more outputs given the same inputs.

Table 4.6: Efficiency Measure by Size

Size		N	Mean	Std. Deviation
Large	CRSTE	64	0.7406	0.2055
	VRSTE	64	0.8928	0.1491
	SE	64	0.8240	0.1562
Medium	CRSTE	136	0.6164	0.2409
	VRSTE	136	0.6711	0.2309
	SE	136	0.9097	0.0925
Small	CRSTE	212	0.5205	0.2309
	VRSTE	212	0.6150	0.2560
	SE	212	0.8624	0.1622

4.4.4 Malmquist Productivity Index (MPI)

To further analyze the efficiency changes over years, the study used the Malmquist total factor productivity index (MPI), based on DEA technique. MPI analyses the relation between productivity and efficiency, since productivity growth is defined as the change in output due to efficiency change and technical change. The study used Data Envelopment Analysis (Computer) Program (DEAP) developed by Coelli (1996) to determine the Malmquist total factor productivity index.

MPI measures the productivity change over the period; decompose the changes in productivity into what are generally referred to as a 'catching-up' effect [technical efficiency change (TEC)] and a 'frontier shift' effect [technological change (TC)]. TEC is further decomposed into scale change (SE) and pure efficiency change (TE) components as TEC = TE × SE. The value of the decomposition is that it attempts to provide information on the sources of the overall productivity change in DTSs. A value of the index greater than one indicates positive TFP growth while a value less than one indicates TFP decline over the period.

Table 4.7 presents the efficiency scores broken down into their respective components. The results indicate that total factor productivity reduced by 10.3%, 8% and 0.3% in 2012, 2013 and 2014 respectively. On average, the total factor productivity reduced by 6.3%. This decline could be attributed to increased 'catching-up' effect (technical efficiency change of 5.7%) and a significant decline in the 'frontier shift' effect (technological change of -11.6%). Evidently, there was a decline in technological improvements over the period. On average, over the four year period, technical efficiency increased by 5.7% which can largely be attributed to increase in pure technical efficiency by 3.8% and increase in scale efficiency by 1.5%. The results concur with those of Nasieku et al., (2013) in relation to the banking sector in Kenya

over the period 2002 -2011 who also found that the main source of technical efficiency was pure efficiency change and not scales efficiency.

Evidently, the highest technical efficiency change was realized in 2013 (20.6). This is decomposed into an increase in pure technical efficiency by 10.9% and scale efficiency by 8.7%. In the same period the highest decline in technological change was realized (-24.4%). This can be attributed to the election period in Kenya which has routinely resulted to a slowdown in the economy. This results to firms (among then DTSs) cutting back on their technology investment plans. The results also indicates that the banks output deteriorated in 2012 and 2014 thereby reporting decline in scale efficiency by 1.3% and 2.5% respectively. This is despite a significant improvement in scale efficiency of 8.7% in 2013.

Table 4.7: Malmquist TFP Index Summary of Annual Means; 2011-2014

Year	Technical Efficiency change	Technological change	Pure technical efficiency	Scale efficiency change	Total factor productivity change
2012	1.007	0.889	1.013	0.987	0.897
2013	1.206	0.756	1.109	1.087	0.920
2014	0.972	1.026	0.997	0.975	0.997
Mean	1.057	0.884	1.038	1.015	0.937
		Broken down indices			
2012	0.7	-11.1	1.3	-1.3	-10.3
2013	20.6	-24.4	10.9	8.7	-8.0
2014	-2.8	2.6	-0.3	-2.5	-0.3
Mean	5.7	-11.6	3.8	1.5	-6.3

All the index averages are geometric means

2012 refers to the change between 2011 and 2012, and so on.

4.4.5 Bias Corrected Efficiency Scores

In the second stage of analysis, the efficiency scores are regressed on firm characteristics. The results of such a regression are only valid if basic assumptions of the regression analysis are satisfied. One such assumption is the assumption of independence within the sample. Simar and Wilson (1998) pointed out that efficiency scores generated by DEA models are clearly dependent on each other in statistical sense. The reason for dependency is the well-known fact that the DEA efficiency score is a relative efficiency index, not an absolute efficiency index. The calculation of the DEA efficiency of one DMU involves all other DMUs in the observation set (Xue & Harker, 1999).

The presence of the inherent dependency among efficiency scores implies that the assumption of independence within the sample is violated. As a result, the conventional regression procedure is invalid. To address this issue, Simar and Wilson (1998) proposed a double bootstrap procedure, which enables consistent inference in the second-stage regression models. Casu and Molyneux (2003) concur that to overcome the problem of inherent dependency of DEA efficiency scores when used in regression analysis, a bootstrapping technique should be applied. The bootstrap is a computer-based method for assigning measures of accuracy to statistical estimates. It is based on the idea of re-sampling from the original data to assign statistical properties for the quantities of interest (Sufian & Habibullah, 2014). In this study, the bootstrapping was implemented using rDEA package embedded in statistical package R.

The summary of the results are shown in table 4.8. The results show that in the year 2011, the variable return to scale technical efficiency (VRSTE) score was 0.646 where as the bias corrected VRSTE was 0.306. The trend where the VRSTE scores are higher than the bias corrected scores is replicated in all the years. This is expected since the DEA efficiency scores tend to be overstated due to sampling bias. According to

Tziogkidis (2012), the DEA sampling bias is associated with the fact that the observed sample is (randomly) drawn from an underlying, unobserved population and the efficiency scores of the DMUs in the sample depend on the DMUs that define the frontier. This causes DEA efficiency scores to be overestimated compared to the "true" frontier, with the only highly unlikely exception that the DMUs which define the population frontier are all included in the sample. The bias corrected efficiency scores replaced the VRSTE for purposes of regression analysis.

Table 4.8: Summary of Bias Corrected Efficiency Scores

YEAR	VRSTE	Bias Corrected VRSTE
2011	0.646	0.306
2012	0.648	0.311
2013	0.706	0.403
2014	0.707	0.381
Average	**0.677**	**0.350**

4.5 Descriptive Analysis

4.5.1 Descriptive statistics of the regression variables

The study sought to examine the relationship between firm characteristics and financial intermediation efficiency of deposit taking SACCO Societies in Kenya. According to Athanasoglou et al., (2008), firm characteristics, also referred to as internal or micro factors, originate from the financial statements such as income statements and/or statement of financial position. The firm characteristics included in the study were; capital adequacy, asset quality, liquidity, income diversification, profitability and size.

Financial intermediation efficiency is measured by technical efficiency determined through output oriented data envelopment analysis (DEA). The intermediation approach as opposed to production approach is used in the choice of inputs and outputs. The

efficiency score are however corrected for bias through bootstrapping. The descriptive statistic for the study variables are presented in table 4.9. The bias corrected technical efficiency had a mean of 0.350 with an overall standard deviation of 0.192. The standard deviation between the DTSs is higher (0.141) as compared to within the same DTSs over the years (0.130). This depicts that efficiency varies more from one DTS to the next DTS rather from year to year for each DTS.

Capital adequacy as measured by the ratio of core capital to total asset gave an average of 0.138 with an overall standard deviation of 0.090. The results differ slightly from results of the regulatory body SASRA which reported an the average capital adequacy of 0.112 in 2014 and 0.0774 in 2013 (SASRA, 2014). Capital adequacy as measured by the ratio of core capital to total deposit had a mean of 0.268 and an overall standard deviation of 0.288. The regulator reported a mean of 0.164 and 0.109 for 2014 and 2013 respectively (SASRA, 2014). The difference between the values reported by the study and the regulator may be attributed to the fact that the regulator used all 135 and 181 licensed DTSs in 2013 and 2014 respectively whereas in this study the data was available for 103 DTSs over the four years period.

The results also revealed that some DTSs reported negative capital adequacy ratio (Min -0.069). This can be attributed to difference in financial reporting framework as DTSs complied with prudential regulations at different points. Most DTSs were classifying member's contribution as deposits rather than splitting between capital (non-refundable) and deposits. Negative capital adequacy ratio indicates that some DTSs were financing their operations through deposit liabilities. According to Nasieku (2014), a company operating with a negative capital ratio has an aggressive financing policy and may be highly profitable but inefficient.

Asset quality as measured by the ratio of nonperforming loans to gross loans gave a mean of 0.038 with an overall standard deviation of 0.076. This indicates that only 3.8% of all loans granted by DTSs are likely to default. The result mirror those of the regulator

who reported an average 0.053 and 0.0472 in the year 2013 and 2014 respectively (SASRA, 2014). It is also important to note that there exists no significant difference in between the DTSs (standard deviation=0.054) and within the same DTSs over the years (standard deviation=0.053). This implies that there exist some elements of stability in the asset quality of DTSs.

Liquidity as measured by the ratio of liquid assets to total assets had an average of a 0.110 with an overall standard deviation of 0.101. This implies that on average, DTSs hold 11% of their assets as liquid assets (cash and cash equivalents and other short term investments). The finding slightly differs with the averages reported by the regulator at 0.0995 and 0.0776 in 2013 and 2014 respectively (SASRA, 2014). A keen look at the spread shows that variations within the DTSs over the years (0.101) is higher that the variations between various DTSs (0.011). This point to significant changes in the amount of liquid assets held by a DTS from one year to another which can be attributable to compliance. Prudential regulations require DTSs to maintain liquidity level of 15 percent of their savings deposits and other short term liabilities in liquid assets (SASRA, 2014).

On the other hand, liquidity as measured by the ratio of total loans to total deposits had an average of a 1.230 with an overall standard deviation of 0.363. This indicates that DTSs in the sample lend 23% more than their total deposits. This average was relatively higher compared to what was reported by the regulator; 1.1095 and 1.0806 in 2013 and 2014 respectively (SASRA, 2014). It is evident that DTS lend more than their cumulative deposits implying they have to borrow for onward lending. SASRA (2014) posit that DTSs are usually faced with liquidity mismatch when issuing loans based on multiplier of savings. This is informed by the fact that SACCOs offer loan three or four times of a member's savings.

Income diversification as measured by the ratio of non-interest income to total assets had an average of 0.032. The minimum recorded value was zero implying than some DTSs

had not diversified into non-interest income. This indicates that the extent of income diversification is still limited in some DTSs. It can also be seen that the variations between the DTSs (standard deviation=0.002) is significantly lower compared with variations within the same DTS over the years (standard deviation=0.015). This depicts the concerted efforts by DTSs to diversify over the years.

On the other hand, income diversification as measured by the ratio of interest margin to gross income had an average of 0.488 with an overall standard deviation of 0.485. The results are consistent with those of the regulator for years 2014 (0.457) and 2013 (0.4686). This indicates that DTSs are having a significant amount of income from other sources other than the interest. Non Interest income is made up of the following sources: (i) fees and commission on loan portfolio, (ii) revenue from government securities, (iii) interest revenue from deposits with banks and other financial institutions, (iv) revenue from other investments and (v) other operating income (Goddard *et al.*, 2008a).

Table 4.9 also shows that profitability as measured by return on assets (ROA) had an average of 0.022 with overall standard deviations of 0.024. The minimum ROA was -0.116 indicating some DTSs reported losses over the period 2011-2014. On the other hand, return of equity (ROE) had an average of 0.222 with overall standard deviations of 0.514. Evidently, ROE was more volatile compared to ROA. This is informed by the concerted efforts by DTSs to build up their equity to meet regulatory requirements. In both cases, the cross sectional variations were found to be higher than temporal variation within the same DTS.

Size as measured by logarithm of total asset had an average of 8.880 with overall standard deviations of 0.586. The smallest DTS had a log of total asset of 7.729 whereas the biggest had 10.456 depicting a significant disparity in the size of the licensed DTSs. It is also evident that the variations between DTSs are higher (0.579) than variations within the same DTSs over the years (0.100).

Table 4.9: Descriptive statistics for study variables

Variable	Measure		Mean	Std. Dev.	Min	Max
Intermediation Eff.	Bias Corr. T. Eff.	overall	0.350	0.192	-0.016	1.082
		between		0.141	0.108	0.716
		within		0.130	-0.118	0.902
Capital Adequacy	Core Cap. to Total Assets	overall	0.138	0.090	-0.069	0.707
		between		0.017	0.122	0.158
		within		0.088	-0.053	0.723
	Core Cap to Total Dep.	overall	0.269	0.288	-0.153	3.235
		between		0.241	0.035	1.404
		within		0.159	0.159	2.460
Asset Quality	NPLs to Total Assets	overall	0.038	0.076	0.000	0.544
		between		0.054	0.001	0.278
		within		0.075	-0.225	0.401
Liquidity	Liq. Asset to total assets	overall	0.110	0.101	-0.060	0.573
		between		0.090	0.001	0.488
		within		0.046	-0.120	0.334
	Total Loans to total dep.	overall	1.230	0.363	0.811	1.925
		between		0.148	0.231	1.810
		within		0.094	0.229	1.011
Income Div.	NII to total Ass.	overall	0.032	0.037	0.000	0.295
		between		0.002	0.030	0.168
		within		0.015	-0.048	0.209
	Int. Margin to Gross Inc.	overall	0.488	0.485	-0.065	6.675
		between		0.416	0.026	4.300
		within		0.252	-3.196	2.863
Profitability	ROA	overall	0.022	0.024	-0.116	0.151
		between		0.018	0.050	0.079
		within		0.014	-0.080	0.118
	ROE	overall	0.222	0.514	-0.545	9.119
		between		0.302	-0.257	2.589
		within		0.417	-2.118	6.751
Size	Log of Total Assets	overall	8.880	0.586	7.729	10.456
		between		0.579	7.810	10.368
		within		0.100	8.385	9.381

4.5.2 Correlation Analysis of the regression variables

The study evaluated the correlation among the study variables aimed at establishing the nature and strength of the relationship between variables under examination. Table 4.10 shows that there exists significant correlations between bias corrected efficiency scores and all measures of the independent variables except interest margin to gross income, ROA, ROE and logarithm of total assets. The correlation between efficiency scores and both measures of capital adequacy is negative albeit weak (core capital to total assets; -0.244 and core capital to total deposits; -0.230). This implies that increase in capital adequacy is associated with decrease in efficiency levels. These results are consistent with those of Nasieku (2014) who found negative correlation between efficiency scores and capital ratios.

Asset quality (NPLs to gross loans) was found to have a weak negative correlation with intermediation efficiency (r=-0.197, p=0.000). This implies that a decline in asset quality is associated with decline in efficiency of DTSs. Liquidity as measured by the ratio of liquid assets to total assets was found to have a weak negative correlation (r=-0.249, p=0.000) whereas total loan to total assets recorded a weak positive correlation (r=0.269, p=0.000). This is plausible since the two measures are inverse measures of liquidity. A higher ratio of liquid assets to total asset and lower ratio of total loan to total deposits imply high levels of liquidity. It therefore implies that liquidity has a weak negative correlation with intermediation efficiency. This contrast findings by Nasieku (2014) in a study on commercial banks in Kenya.

The correlation between efficiency scores and income diversification was found to be negative but weak. The ratio of non-interest income to total assets had a weak but significant correlation (r=-0.270, p=0.000) whereas the ratio of interest margin to gross income had a non significant correlation (r=-0.033, p=0.499). It is imperative to note that while the former (non-interest income to total assets) measures the extent of

diversification, the later (interest margin to gross income) measures the extent of concentration.

The result in Table 4:10 indicate that, there exists a weak positive correlation between profitability and intermediation efficiency. Profitability as measured by return on assets (ROA) and return on equity (ROE) had significant correlations with efficiency. It reveals that most efficient DTSs are characterized by high profitability. The DTSs' size has a weak positive correlation with intermediation efficiency. The correlation is significant at 10%. This implies that the larger the DTSs, the higher the intermediation efficiency.

Table 4.10: Karl Pearson's Correlation Coefficients of Study Variables

		TEFF	Core Capital to Total Assets	Core Capital to Total deposit	NPLS to Gross Loans	Liquid Assets to Total Assets	Total Loan to Total Dep.	Non-interest Income to total Assets	Interest Margin to Gross Income	ROA (Income to Total Assets	ROE (Income to Equity)	Log of Total Assets
	Corr.	1.000	-.244**	-.230**	-.197**	-.249**	.269**	-.270**	-0.033	0.039	-0.036	0.051
TEFF	Sign.		0.000	0.000	0.000	0.000	0.000	0.000	0.499	0.434	0.460	0.299
Core Capital to	Corr.		1.000	.553**	0.025	.273**	-.389**	.344**	.194**	.248**	-.188**	-.272**
Total Assets	Sign.			0.000	0.608	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Core Capital to	Corr.			1.000	0.012	.097*	-.321**	.278**	0.073	0.054	-.140**	-.212**
Total deposit	Sign.				0.814	0.050	0.000	0.000	0.139	0.279	0.004	0.000
NPLS to Gross	Corr.				1.000	.132**	-.124*	.239**	0.007	-0.046	0.073	0.011
Loans	Sign.					0.007	0.012	0.000	0.881	0.352	0.139	0.830
Liquid Assets to	Corr.					1.000	-.446**	.452**	-0.056	.114*	-0.069	-.158**
Total Assets	Sign.						0.000	0.000	0.255	0.021	0.164	0.001
Total Loan to Total	Corr.						1.000	-.491**	0.014	0.083	.194**	.286**
Assets	Sign.							0.000	0.773	0.092	0.000	0.000
Non-interest Inc. to	Corr.							1.000	-.177**	-0.055	-.100*	-.433**
total Assets	Sign.								0.000	0.268	0.043	0.000
Interest Margin to	Corr.								1.000	.147**	-0.039	0.044
Gross Income	Sign.									0.003	0.433	0.370
ROA (Income to	Corr.									1.000	.231**	.136**
Total Assets	Sign.										0.000	0.006
ROE (income to	Corr.										1.000	0.087
Equity)	Sign.											0.079
Log of Total Assets												1.000

***(**)(***) significant at 10%(5%)(1%).**

4.5.3 Selection of the variables for regression analysis

As shown in the conceptual framework, some independent variables can be measured in more than one way. However, this is likely to be problematic in regression analysis due to the problem of multicollinearity. It is therefore important to select the best measure for each variable. A standard procedure for variable selection is based on the procedure of sequentially introducing the predictors into the model one at a time. Three methods; forward selection, backward elimination and stepwise, may be used. According to Chong and Jun (2005), forward selection has an advantage where a large number of correlated variables are involved compared to backward elimination. The study used forward selection method to select the significant measures of firm characteristics. It was used to retain all variables whose F value in the five models was greater than the F-critical of 3.84 and significant at the 0.05 level. The results of are presented in table 4.11.

Table 4.11: Model Summary Using the Forward Selection Method

				Std.	Change Statistics				
Model	R	R Square	Adjusted R Square	Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.270[a]	.073	.070	.18490	.073	32.172	1	410	.000
2	.314[b]	.099	.094	.18251	.026	11.817	1	409	.001
3	.347[c]	.120	.114	.18053	.022	10.010	1	408	.002
4	.366[d]	.134	.125	.17936	.014	6.348	1	407	.012
5	.382[e]	.146	.136	.17829	.012	5.903	1	406	.016

a. Predictors: (Constant), Noninterest Income to total Assets

b. Predictors: (Constant), Noninterest Income to total Assets, Core Capital to Total Assets

c. Predictors: (Constant), Noninterest Income to total Assets, Core Capital to Total Assets , NPLS to Gross Loans

d. Predictors: (Constant), Noninterest Income to total Assets, Core Capital to Total Assets , NPLS to Gross Loans, Liquid Assets to Total Assets

e. Predictors: (Constant), Noninterest Income to total Assets, Core Capital to Total Assets , NPLS to Gross Loans, Liquid Assets to Total Assets, Core Capital to Total deposit

f. Dependent Variable: Bias Corrected DEA Score

Table 4.12 presents the conceptualized measures and the selected measures of the independent variables based of the forward selection method. Notably, none of the measures of profitability and size passed the selection criteria. For size, only one measure was conceptualized thus included. ROA on the other hand is selected as it is a key measure of the earnings of a SACCO as per CAMEL ratings by NCUA and WOCCU's PEARL framework. It reflects the growth and stability of earnings (Goddard *et al.*, 2008a).

Table 4.12: Selected Measures of Independent Variables

Independent Variable	**Conceptualized Measures**	**Selected Measure**
Capital Adequacy	Core Capital to Total Assets Core Capital to Total Deposits	Core Capital to Total Assets
Assets Quality	Nonperforming Loans to Gross loans	Nonperforming Loans to Gross loans
Liquidity	Total loan to Total Deposits Liquid Assets to Total Assets	Liquid Assets to Total Assets
Income Diversification	Non-interest Income to Total Assets Interest Margin to Gross Income	Non-interest Income to Total Assets
Profitability	Net income after tax to Total Assets Net Income after tax to Total Equity	Net income after tax to Total Assets
Size	Log of total Assets	Log of total Assets

4.6 Panel Data Estimation Model and Specification Tests

The study used a balanced panel data for the period 2011-2014. Compared with purely cross-sectional data, panels are attractive since they often contain far more information than single cross-sections and thus allow for an increased precision in estimation (Hoechle, 2007). According to Gujarati (2012), by combining time series of cross-section observations, panel data gives more informative data, more variability, less collinearity among variables, more degrees of freedom and more efficiency. However, despite their substantial advantages, panel data pose several estimation and inference problems that plague cross-sectional data and time series data.

There are several estimation techniques to address these problems. The first, pooled OLS, simply combines or pools all the time series and cross-sectional data and the estimates the underlying model by utilizing ordinary least squares (OLS). The second, fixed effects model (FEM), involves recognition that omitted variables may lead to changes in cross-sectional and time series intercepts. In FEM, the intercept in the regression model is allowed to differ among individuals in recognition to the fact that each individual or cross-sectional unit may have some special characteristics (Gujarati, 2012). Models with fixed effects add dummy variables to allow for these changing intercepts (Pindyck & Rubinfeld, 1998). The FEM using dummy variables is referred to as the least-square dummy variable (LSDV) model.

The third, random effect model (REM) improves the efficiency of the first least square estimation process by accounting for cross-sectional and time series disturbances. Since the inclusion of dummy variable represents a lack of knowledge about the model, this lack of knowledge is described through the disturbance term (Pindyck & Rubinfeld, 1998). In REM, it is assumed that the intercept of an individual unit is random drawing from a much larger population with a constant mean value (Gujarati, 2012).

The validity of the regression results heavily relies on the use of the appropriate model. The section that follows documents tests for the correct or the best panel model for the

study. To determine the nature of the panel data and test if the model was the "correct" or the "true" model for analysis, the following tests were conducted on the data. The specification tests are classified into two; exploratory tests and diagnostic tests (Torres, 2007).

4.6.1 Exploratory tests

Proper analysis is carried out after understanding the nature of data used. Exploratory tests provide visual impression of the nature of panel data through graphical presentation. Consistent with Torres (2007), two most important exploratory tests, trend graph and overlay graph, were used.

Trend Graph for the bias corrected efficiency scores

Before examining the relationship between firm characteristics and efficiency of DTSs, the study explored the efficiency among different DTSs over the four year period; 2011-2014. The study used the empirical growth plots as shown in Figure 4.4. The result indicates that there were variations in efficiency among DTSs under consideration though some DTSs had almost the same efficiency scores across the period under investigation. It can also be observed that there was an upward trend for many DTSs depicting an improvement in efficiency over the period under study.

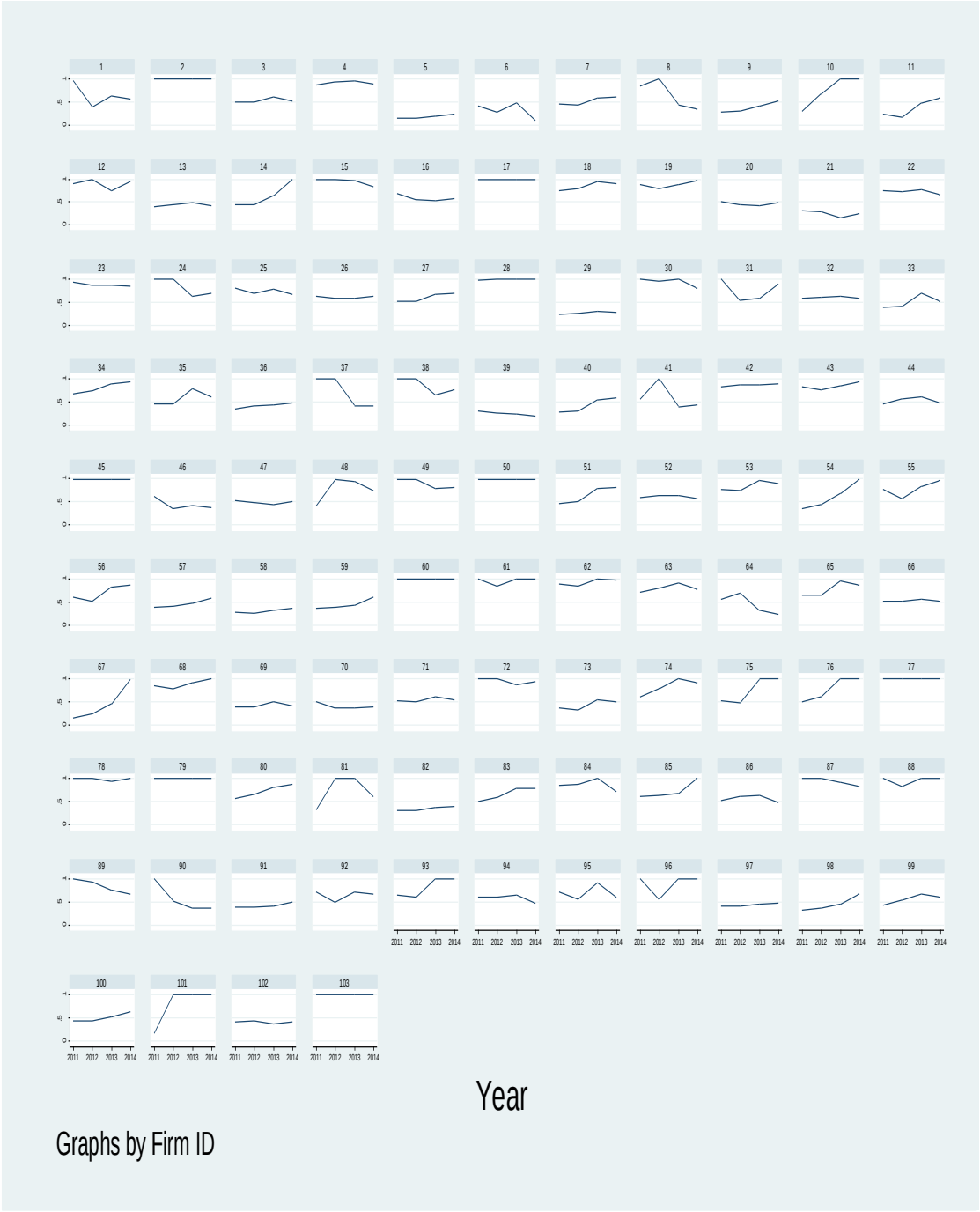

Figure 4.4: Trend Graph for Bias Corrected Efficiency Scores

Overlay Graph

The pictorial presentation in Figure 4.5 shows the overlay of DTSs intermediation efficiency over the period under consideration. From the findings, it can be inferred that all DTSs had different intercept. It can however be observed that the slopes are not significantly different from each other. This preliminary result confirms the absence of time related effects indicating that the appropriate model may be fixed effects model. This type of panel model has constant slopes but intercepts that differ according to the cross-sectional (group) meaning there are no temporal effects. The section that follows presents more thorough tests to identify the appropriate model.

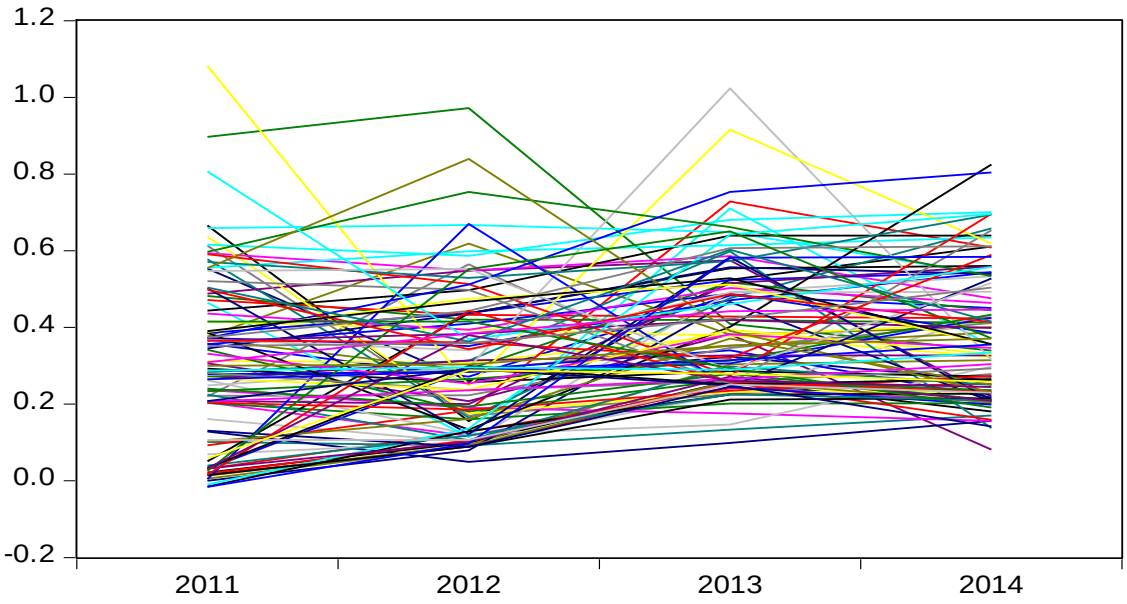

Figure 4.5: Overlay graph of bias corrected efficiency score

4.6.2 Diagnostic Tests

The panel data collected has both cross sectional and time series characteristics. As highlighted earlier, there are various estimation techniques that can be applied to panel data. This includes; pooled OLS, fixed effects model (FEM) and random effect model (REM). Diagnostic tests are used to identify the best model for the study. This section the study reports panel data diagnostics tests which were carried out.

Random Effect or Pooled OLS Model

According to Torres (2007), the Breusch-Pagan Lagrange multiplier (LM) test helps in deciding between a random effects regression and a simple OLS (pooled effects) regression. The null hypothesis in the LM test is that variances across entities are zero i.e. there are no significant difference across units (no panel effect). Table 4.7 shows the results of the Breusch Pagan LM test which gives a p value of 0.000 which is less than 0.05. This indicates that there are significant differences on technical efficiency among the DTSs. The null hypothesis is therefore rejected and the alternative hypothesis accepted. The study concluded the pooled effects (OLS) regression model was not appropriate for the study.

Table 4.13: Chi-Square values for the Breusch-Pagan LM Test

Model	Dependent variable	χ^2-value	p-value
1	TEFF	43.27	0.000

Random Effects or Fixed Effects Model

Breusch Pagan LM test has shown that pooled effects model was not appropriate for the study. The appropriate model for the study was panel regression model which could either be random effects model (REM) or fixed effects model (FEM). Fixed effect regression modeling is more appropriate when the study seeks to examine the effect of independent variables over time. More so the independent entity should be having a

relationship with the independent variables. In contrast random effect model assumes that independent variables have no collinearity with independent entities. In addition, it assumes that there are random variations across the error terms and both independent variables and specific's entities too are treated as independent variables. To make a choice between random and fixed effects panel regression model, Hausman test was applied.

Hausman test basically tests whether the unique errors (u_i) are correlated with the regressors and the null hypothesis is that they are not (Greene, 2012). The test's null hypothesis is that the preferred model is random effects vs. the alternative the fixed effects (Torres, 2007). The results are presented in Table 4.14 shows a p value of 0.0000 which is less than 0.05. This results to the rejection of null hypothesis and acceptance of the alternative hypothesis. This implies that the most appropriate model to explain the relationship between intermediation efficiency and firm characteristics was the fixed effects regression model.

Table 4.14: Hausman Test Results

Variable	Fixed	Random	Variable (Diff.)	Prob.
Capital Adequacy	-0.0138	-0.2508	0.2369	0.0968
Asset Quality	-0.3432	-0.3161	-0.0272	0.0624
Liquidity	0.0424	-0.2386	0.2809	0.1154
Diversification	-0.8823	-0.7448	-0.1375	0.3418
Profitability	1.1526	0.9851	0.1676	0.2798
Size	0.2790	-0.0104	0.2894	0.0715
Chi square = 33.61, P value =0.0000				

Time Fixed Effects

To determine if time fixed effects are needed when running a fixed effect model, a joint test is carried out to determine if the dummies for all years are equal to 0, if they are, then no time fixed effects are needed (Torres, 2007). Results in Table 4.15 shows the test results for time fixed effects. The p value (0.0000) is less that 0.05 indicating that there are no significant time affects and therefore no need to introduce dummy variables.

Table 4.15: Test Results for Time Fixed Effects

Dependent variable	F- value	p-value
TEFF	3.01	0.000

Heteroskedasticity

An important assumption is that the residuals have a constant variance or are homoskedastic across time and individuals. When heteroskedasticity is present the standard errors of the estimates are biased. The presence of heteroskedasticity was tested using modified Wald test. For modified Wald test the null hypothesis is that there exists homoskedasticity (or constant variance) (Drukker, 2003). Results in Table 4.16 reveal that the p value is less than 0.05 (p=0.0000) resulting to rejection of the null hypothesis and subsequent acceptance of the alternative hypothesis. This leads to the conclusion that there exists heteroskedasticity. When heteroscedasticity is present, the standard errors of the estimates are biased and the study should use robust standard errors to correct for the presence of heteroscedasticity (Antonie, Cristescu, & Cataniciu, 2010; Hoechle, 2007). The study therefore used White's heteroscedasticity consistent standard errors.

Table 4.16: Result for Heteroskedasticity Tests

		Test for heteroskedasticity	
Model	**Dependent variable**	**χ^2-value**	**p-value**
1	TEFF	2.3e+05	0.0000

Serial correlation

According to Gujarati (2012), serial correlation may be defined as correlation between members of series of observations ordered in time or in space. Drukker (2003) argues that, because serial correlation in linear panel-data models biases the standard errors and causes the results to be less efficient, researchers need to identify serial correlation in the idiosyncratic error term in a panel-data model. The study used the Wooldridge Drukker test to test for presence of serial correlation. In this test the null hypothesis that there is no serial correlation. The result in table 4.17 shows that the p value is more than 0.05 (p=0.0892) resulting to acceptance of the null hypothesis. This indicates that there exists no serial correlation.

Table 4.17: Result for Serial Correlation Tests

Model	**Dependent variable**	**F-value**	**p-value**
1	TEFF	2.945	0.0892

4.6.3 Other Regression Model Assumptions Tests

The validity and reliability of any regression results heavily relies on satisfaction of the underlying assumptions. In addition to the test for heteroscedasticity and serial Correlation already carried out, it is important to undertake additional tests of regression to ensure valid inferences are drawn from the data. The additional assumptions tested include; normality, multicollinearity and that there exists no specification bias.

Normality test

According to Greene (2012), it is convenient to assume that the disturbances (error terms/residuals) are normally distributed with zero mean and constant variance. Although normality is not necessary to obtain many of the results in multiple regression analysis, it enables several exact statistical results and proves useful in constructing confidence intervals and test statistics (Greene, 2012). Figure 4.4 presents the normality test results. It can be seen that the histogram takes the shape of the normal distribution. According to Gujarati (2012), if a bell shaped normal distribution curve superimposed on a histogram, it gives an idea as to whether normal approximation is appropriate. Figure 4.6 also indicates that the error term is normally distributed with a zero mean (-5.85^{-16}) and standard deviation of 1 (0.993).

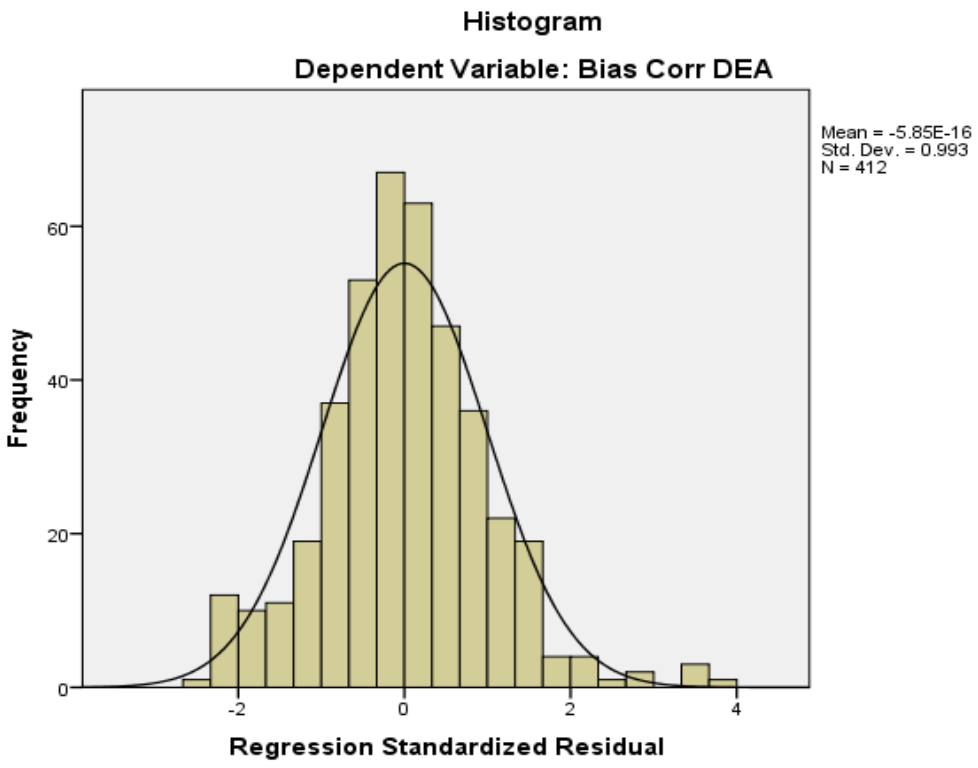

Figure 4.6: Normality test for bias corrected efficiency score

Multicollinearity Test

Multicollinearity is a said to exist when two or more predictor variables in a multiple regression model are highly correlated. It leads to imprecision in the estimator, though not to any systematic biases in estimation (Greene, 2012). Gujarati (2012) argues that existence of multicollinearity results into regression coefficients with large standard errors meaning the coefficients cannot be estimated with great precision and accuracy. Additionally, the estimators and their standard error are sensitive to small changes in the data. The study used the variance inflation factor (VIF) to test for multicollinearity.

VIF quantifies the severity of multicollinearity and provides an index that measures how much the variance of an estimated regression coefficient is increased because of collinearity. As a rule of the thumb, a VIF of 1 indicates no correlation between predictors; a value of between 1 and 5 indicates moderate correlation and a value above 5 indicate that predictor variables are highly correlated (Gujarati, 2012). Table 4.18 indicates a mean VIF of 1.31 which is between 1 and 5 and indeed very close to one. The predictor variables are moderately correlated showing nonexistence of multicollinearity.

Table 4.18: Variance Inflation Factor (VIF) Test results

Variable	VIF	1/VIF(Tolerance)
Capital Adequacy	1.30	0.7706
Asset Quality	1.08	0.9226
Liquidity	1.31	0.7617
Diversification	1.69	0.5928
Profitability	1.14	0.8749
Size	1.32	0.7559
Mean	**1.31**	

Test for Omitted Variables and incorrect functional form

It is important to test whether the model specified for the data is the correct one. Specification test is essentially a test of a proposition "the model is correct" vs. "the model is inadequate" (Greene, 2012). This test pits the theory of the model against "some other unstated theory." The null hypothesis may be stated as "model has no omitted variables". The study uses Ramsey's RESET test to test for omitted Variables and incorrect functional form. Test According to Gujarati (2012), RESET test is easy to apply and does not require one to specify what an alternative model is making it more attractive. Table 4.19 presents the results of the test that gives a p value more than 0.05 (0.0629) which results to the acceptance of the null hypothesis that the model has no omitted variables. The model is therefore of the correct functional form.

Table 4.19: Ramsey RESET test results using powers of the fitted values of TEFF

F(3, 402)	Prob > F
2.45	0.0629

4.7 Hypotheses Testing Using Regression Analysis

Supported by the tests conducted on the panel data, the best model for the analysis was a fixed effect model with robust (white's cross-section heteroscedastic consistent) standard errors. To facilitate hypothesis testing, a model is estimated for each independent variable (IV) against the dependent variable (DV). Additionally, a multiple regression model is estimated with other independent variable acting as control variables. The overall model helps in determination of the changes in the relationship between an independent variable and dependent variable after controlling for other independent variables hypothesized in the study. It should be noted that hypothesis testing is carried out using the multiple regression results presented in table 4.26.

4.7.1 Capital Adequacy and Financial Intermediation Efficiency

The first objective of the study was to evaluate the relationship between capital adequacy and financial intermediation efficiency of deposit taking SACCO societies in Kenya. The ratio of core capital to total assets was used as a measure of capital adequacy. The study predicted a positive significant relationship between capital adequacy and financial intermediation efficiency. Fixed effects regression model was used to assess if the relationship was statistically significant. The following null hypothesis was tested.

H_{01}**:** There exists no significant relationship between capital adequacy and financial intermediation efficiency of deposit taking SACCO societies in Kenya.

The simple regression results are presented in table 4.20 while multiple regression results are presented in table 4.26. Results in table 4.20 indicate that capital adequacy had a negative coefficient (-0.0835). The relationship is however not significant given that the p value (0.3939) is more than the significance level (0.05). After controlling for other firm characteristics as shown in table 4.26 the relationship remains negative (-0.0139) but the magnitude reduces. This implies that the partial effect has declined when other factors are accounted for. The relationship is however not significant given that the p value (p=0.8811) is more than the significance level, 0.05. It is therefore concluded that: there exists no statistically significant relationship between capital adequacy and financial intermediation efficiency of deposit taking SACCO societies in Kenya.

The results concur with a those of Nasieku (2014) in a study focusing on commercial banks in Kenya. This implies that capital adequacy does not necessarily improve the efficiency of financial institutions. The underlying reason is that most institutions hold the minimum or slightly above the specified minimum with varied levels of efficiency. The general consensus is that banks with higher capital and liquidity buffers are better

able to support businesses and households in bad times (Gudmundsson *et al.*, 2013). However, it remains inconclusive whether this is efficiency enhancing.

The results indicate that the buffer capital theory may not be applicable to DTSs in Kenya. The theory predicts that a bank approaching the regulatory minimum capital ratio have an incentive to boost capital and reduce risk in order to avoid the regulatory costs triggered by a breach of the capital requirements (Ochei, 2013). It predicts that the behavior of banks depends on the size of their capital buffer: banks with high capital buffers will aim at maintaining their capital buffers while banks with low capital buffers will aim at rebuilding an appropriate capital buffer. Evidently, DTSs in Kenya have not build up buffer capital which would make them hold distinct levels of capital.

Table 4.20: Fixed-effects regression on capital adequacy and financial intermediation efficiency

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.3382	0.0147	23.0825	0.0000
Capital Adequacy	-0.0835	0.0979	-0.8538	0.3939
R-squared	0.5371	Mean dependent var		0.3497
Adjusted R-squared	0.3823	S.D. dependent var		0.1918
S.E. of regression	0.1507	Akaike info criterion		-0.7327
Sum squared resid	6.9977	Schwarz criterion		0.2823
Log likelihood	254.9391	Hannan-Quinn criter.		-0.3312
F-statistic	3.4694	Durbin-Watson stat		2.2912
Prob(F-statistic)	0.0000			

4.7.2 Asset Quality and Financial Intermediation Efficiency

Asset quality refers to the timely manner with which borrowers are meeting their contractual obligations (Alhassan et al., 2014). The asset quality is thus inversely related to the amount of nonperforming assets. The ratio of nonperforming loans to total loans is therefore used as a proxy of asset quality. A higher ratio depicts poor asset quality as it indicates that a DTS is having a higher proportion of its assets (loans) as nonperforming. The second objective of the study was to determine the relationship between asset quality and financial intermediation efficiency of DTSs in Kenya. The following null hypothesis was tested.

H_{02}: The relationship between asset quality and financial intermediation efficiency of deposit taking SACCO societies in Kenya is not significant.

The simple regression results are presented in table 4.21 while multiple regression results are presented in table 4.26. Table 4.21 presents the results of the fixed-effects regression between asset quality and financial intermediation efficiency. It can be observed that assets quality has a negative beta coefficient (-0.2938) implying an inverse relationship between the ratio of nonperforming loans to total loans and financial intermediation efficiency. This reflects a positive relationship between asset quality and efficiency. It indicates that, as asset quality improves (ratio on non performing loans to total loans reduces) intermediation efficiency of a DTS also improves. The value of R-square is 0.5433 indicating that 54.33% of the variations in efficiency can be explained by variations in the asset quality.

The same conclusion is arrived at after controlling for other firm characteristics as shown in table 4.26 albeit the increase in the value of beta to -0.3434. This indicates that an increase in the ratio of non-performing assets to total assets by one unit results to a decline in mean efficiency by 0.3434, holding other factors constant. Additionally, the coefficient has a p value of 0.0000 which is less than 0.05 implying that the null

hypothesis is rejected. It can therefore be concluded that asset quality has a positive significant relationship with financial intermediation efficiency.

The results were similar to those of earlier studies (Arora, 2014; Burki & Niazi, 2010; Kiyota, 2011; Sufian, 2009). The positive relationship between asset quality and efficiency (negative coefficient) underscores the need of continued monitoring of borrowers to ensure loan repayments are made when due. According to Swamy (2012), the problem of NPAs has become synonymous to functional efficiency of financial intermediaries and believed to be the major causes of the economic stagnation problems. Michael *et al*., (2006) emphasized that NPAs in loan portfolio affect operational efficiency which in turn affects profitability, liquidity and solvency position of banks.

The results points towards existence of either "bad luck" or "bad management" hypothesis in the operation of DTSs in Kenya. According to "bad luck" hypothesis, exogenous factors may lead to increase in NPAs (deterioration of assets quality) which impacts negatively on the intermediation efficiency of DTSs. On the other hand, it is possible that minimal managerial efforts are expended in credit appraisal process resulting to high levels of NPAs. This consequently impairs the intermediation efficiency. In the light of diversification of DTSs' operations accompanied by breaking of common bond, a review of the credit appraisal process is important. While in the past most members had a common employer with significance amount of job security, admission of non salaried members increases the credit risk. Such unsalaried members rely on businesses income which is highly volatile.

The results are consistent with theory of information asymmetry. According to the theory, financial intermediaries make lending decision and the borrower is likely to have more information than the lender about the risks of the project for which they receive funds (Matthews & Thompson, 2008). As a result, moral hazard and adverse selection leads to reduction of the efficiency of the transfer of funds from surplus to deficit units (Mishkin, 2004). This underscores the need to review the credit appraisal process in

DTSs including employing people with relevant skills. This is anticipated by the theory of delegated monitoring which argues that, due to inability of fund owners to effectively monitor borrower, they should engage people who have the time, inclination or expertise to monitor institutional borrowers for default risk (Matthews & Thompson, 2008).

The result provides empirical evidence of relationship between NPAs and efficiency. While it has been widely recognized that collapsing financial institutions are characterized by high levels of NPAs, little is known about their intermediation efficiency. Rozzani and Rahman (2013) posit that inefficiency is leading cause of bank failure. The empirical results indicate the linkage between NPAs and efficiency. Sufian (2009) points out the banks approaching failure tend to have low cost efficiency and experience high ratios of problem loans and that failing banks tend to be located far from the best practice frontiers. It is therefore imperative that significant managerial efforts be expended on improving asset quality.

Table 4.21: Fixed-effects regression between Asset Quality and Financial Intermediation Efficiency

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.3608	0.0225	16.0638	0.0000
Asset Quality	-0.2937	0.0505	-5.8109	0.0000
R-squared	0.5433	Mean dependent var		0.3497
Adjusted R-squared	0.3905	S.D. dependent var		0.1918
S.E. of regression	0.1497	Akaike info criterion		-0.7462
Sum squared resid	6.9041	Schwarz criterion		0.2688
Log likelihood	257.7119	Hannan-Quinn criter.		-0.3447
F-statistic	3.5570	Durbin-Watson stat		2.2934
Prob(F-statistic)	0.0000			

4.7.3 Liquidity and Financial Intermediation Efficiency

A lot of emphasis has been placed by regulators on liquidity risk management by all financial institutions. This is informed by the fact that inability to meet financial obligations as they fall due may lead to a bank run that may have a contagion effect on the entire financial system. The third objective of the study was to examine the relationship between liquidity and financial intermediation efficiency of deposit taking SACCO societies in Kenya. This resulted to the following hypothesis that was tested.

H_{03}**:** Liquidity has an insignificant relationship with financial intermediation efficiency of deposit taking SACCO societies in Kenya.

The ratio of liquid assets to total assets was used as a proxy of liquidity. According to Pacelli and Mazzarelli (2015), liquid assets to total assets ratio measures the bank's ability to meet its short-term obligation through liquid assets. The simple regression results are presented in table 4.22 while multiple regression results are presented in table 4.26. Table 4.22 presents the fixed-effects regression results between liquidity and financial intermediation efficiency. The results show that liquidity has a negative beta coefficient (-0.0827) implying an inverse relationship between liquidity and efficiency. This relationship is however not statistically significant given that the p value (0.5117) is more than the significance level (0.05). The relationship remains insignificant even after controlling for other firm characteristics as shown in table 4.26.

This results to acceptance of the null hypothesis that; liquidity has an insignificant relationship with financial intermediation efficiency of deposit taking SACCO societies in Kenya. Like capital adequacy, minimum liquidity ratios are set by the regulator. The insignificant results point to the fact that many DTSs maintain the minimum prescribed ratio. This means that the liquidity held by one DTS is not significantly different from another. This contrast findings in commercial banks in Kenya where they were found to

hold higher differing level of liquidity over and above the regulatory requirements (Kamau, 2011; Nasieku, 2014; Olweny & Shipho, 2011).

The results are inconsistent with shiftability theory of liquidity. According to the theory, the liquidity of a bank may be measured by the extent to which it can shift its assets readily to other buyers for cash at satisfactory price (Casu et al., 2006). As a result, the theory depict that financial institutions hold differing levels of liquidity due to differing shifting ability. According to Dutta and Kapur (1998), liquid assets are held for a purpose, and efficiency requires that its cost be made as small as possible. As a result, firms may hold different level of liquidity above the minimum required by the regulator.

Table 4.22: Fixed-effects regression between Liquidity and Financial Intermediation Efficiency

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.3588	0.0211	16.9807	0.0000
Liquidity	-0.0827	0.1258	-0.6574	0.5117
R-squared	0.5370	Mean dependent var		0.3497
Adjusted R-squared	0.3822	S.D. dependent var		0.1918
S.E. of regression	0.1507	Akaike info criterion		0.7326
Sum squared resid	6.9983	Schwarz criterion		0.2824
Log likelihood	254.9207	Hannan-Quinn criter.		0.3311
F-statistic	3.4688	Durbin-Watson stat		2.2859
Prob(F-statistic)	0.0000			

4.7.4 Income Diversification and Financial Intermediation Efficiency

Competitive pressure has motivated SACCOs to diversify their earnings by venturing into non-interest income. According to Mercieca, Schaeck and Wolfe (2007), the diversification in banking sector has three dimensions: (a) financial products and

services diversification, (b) geographic diversification, and (c) a combination of geographic and business line diversification. The study focused on the product line where the ratio of non-interest income to total income was used as a proxy of diversification. The study sought to evaluate the relationship between income diversification and financial intermediation efficiency of deposit taking SACCO societies in Kenya. In line with this, the following hypothesis was tested.

H_{04}**:** There exists no significant relationship between income diversification and financial intermediation efficiency of deposit taking SACCO societies in Kenya.

The simple regression results are presented in table 4.23 while multiple regression results are presented in table 4.26. Results in table 4.23 shows that diversification has a negative coefficient (-0.6884). This depicts an inverse relationship between diversification and efficiency. The relationship is however not significant at 5% since the p value (0.0865) is higher than 0.05. The model fitted between diversification and intermediation efficiency is however significant (F= 3.5065, p=0.0000) with a predictive power of 53.97% (R Square = 0.5397).

After controlling for other firm characteristics as shown in table 4.26, the relationship between diversification and efficiency was found to be significant at 0.05 (p=0.0095). This results to the rejection of the null hypothesis. It is therefore concluded that there exists a negative significant relationship between diversification and financial intermediation efficiency of deposit taking SACCO societies in Kenya. The beta coefficient was found to be -0.8817. This implies that if all other independent variables were to be held constant, an increase in the ratio of non-interest income to total income by one unit would lead to a reduction of mean efficiency by 0.8817.

The empirical results are consistent with those of Elyasiani and Wang (2012) and Huang and Chen (2006) but contradict those of Maghyereh and Awartani (2014) and

Sufian (2009). The inverse relationship implies that income diversification hurts efficiency through more idiosyncratic risk and decreased incentives to monitoring. This may be seen to contradict the portfolio theory that posit that diversification into non-interest income would reduce volatility and enhance returns. The logical explanation for this phenomenon is that as the management focuses on diversification, they reduce their attention on the core mandate of the DTS which is provision of credit to members.

The increase in the number of activities is generally associated with increased opaqueness and information asymmetry and agency problems (Elyasiani & Wang, 2012). The core mandate of DTSs is to collate deposit and advance loan to members at favorable terms. Diversification into other activities such as provision of ATM services, salary processing and over the counter operations, may hurt efficiency with which they undertake their core mandate. Additionally; the size of DTSs could act as a bottleneck, with a small DTSs, no significant economies of scale are realized with income diversification. Goddard *et al.,* (2008a) suggest that where credit unions neither have sufficient scale nor the requisite expertise to diversify, they should limit diversification and continue to operate as simple savings and loans vehicles.

Goddard *et al*. (2008a) found that, though much of the growth in US credit unions was via diversification into non-interest earning activities, this did not lead to enhanced returns for members. Among the motives for diversification, Santomero and Eckles (2000) cite growth, realization of efficiency gains via economies of scale and scope, reduction of idiosyncratic risk, and strengthening of the financial system. Evidently, the realization of efficiency gains is not evident in case of DTSs in Kenya.

Table 4.23: Fixed-effects regression between Income Diversification and Financial Intermediation Efficiency

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.3720	0.0238	15.6601	0.0000
Diversification	-0.6884	0.4002	-1.7199	0.0865
R-squared	0.5397	Mean dependent var		0.3497
Adjusted R-squared	0.3858	S.D. dependent var		0.1918
S.E. of regression	0.1503	Akaike info criterion		-0.7384
Sum squared resid	6.9577	Schwarz criterion		0.2766
Log likelihood	256.1190	Hannan-Quinn criter.		-0.3370
F-statistic	3.5065	Durbin-Watson stat		2.2859
Prob(F-statistic)	0.0000			

4.7.5 Profitability and Financial Intermediation Efficiency

A lot of managerial effort is expended in enhancing financial performance of many decision making units (DMU) among them DTSs. A lot of attention is given to profitability which may happen at the expense of other aspects of performance. Of essence is therefore to determine if there exists any relationship between profitability and efficiency. The study sought to determine the relationship between profitability and financial intermediation efficiency of deposit taking SACCO societies in Kenya. To this end, the following null hypothesis was tested.

H_{05}**:** There exists no significant relationship between profitability and financial intermediation efficiency of deposit taking SACCO societies in Kenya.

Return on assets (ROA) was used as a proxy for profitability. The simple regression results are presented in table 4.24 while multiple regression results are presented in table 4.26. Results in table 4.24 shows that profitability has a positive coefficient (1.2066) implying a direct relationship between profitability and intermediation efficiency. It has a p value of 0.0001 which is less than the significance level (0.05). The model fitted is also significant (F= 3.5887, p=0.0000) with a predictive power of 54.55% (R Square = 0.5455).

Similar results were found after controlling for other firm characteristics. Results in table 4.26 show that profitability has a positive beta coefficient (1.1518) depicting a direct relationship. The coefficient has a p value of 0.0014 which is less than the significance level; 0.05. This results to the rejection of the null hypothesis and adoption of an alternative hypothesis. It is therefore concluded that; there exists a positive significant relationship between profitability and intermediation efficiency.

The findings corroborate those by Arora (2014), Maghyereh and Awartani (2014), Alrafadi, Kamaruddin and Yusuf (2014), Othman, Mansor and Kari (2014), Srairi (2010) and Sufian (2009). However, Gulati (2015) found negative relationship. It reveals that most efficient DTSs were on an average characterized by higher profitability. There are a number of explanation that may be advanced on this phenomenon; First, profitable DTSs are capable of employing and retaining high caliber staff members and investing in technology which is efficiency enhancing. Secondly, they are capable of providing incentives to their staff thus motivating them to perform even better and reduce wastages. Lastly, more profitable DTSs are capable of attracting more deposits from members due to the returns earned. This enables then to provide more loans and investment opportunities to members.

The results indicate that there exists goal congruence such that as the management strives to maximize the members' wealth through increased profitability, the efficiency also improves. This supports the market power theory. The theory predicts that under the

pressure of market competition, efficient firms win the competition and grow, so that they become larger, obtain greater market share, and earn higher profits (Casu & Girardone, 2009). It therefore predicts a direct relationship between efficiency and profitability as indicated by the result.

Table 4.24: Fixed-effects regression between Profitability and Financial Intermediation Efficiency

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.3235	0.0259	12.5007	0.0000
ROA	1.2066	0.3050	3.9567	0.0001
R-squared	0.5455	Mean dependent var		0.3497
Adjusted R-squared	0.3935	S.D. dependent var		0.1918
S.E. of regression	0.1494	Akaike info criterion		-0.7510
Sum squared resid	6.8708	Schwarz criterion		0.2640
Log likelihood	258.7088	Hannan-Quinn criter.		-0.3495
F-statistic	3.5887	Durbin-Watson stat		2.2696
Prob(F-statistic)	0.0000			

4.7.6 Size and Financial Intermediation Efficiency

An important question underlying policy issues on financial institutions is which size optimizes efficiency. From economists' point of view, increase in size enhances economies of scale resulting to least average cost of output. However, beyond a given point diseconomies of scale may stem. The study sought to examine the relationship between size and financial intermediation efficiency of deposit taking SACCO societies in Kenya. This led to the sixth hypothesis of the study;

H_{06}**:** SACCO size does not have a significant relationship with financial intermediation efficiency of deposit taking SACCO societies in Kenya.

The logarithm of total assets was used as a proxy for the size of the DTSs. The fixed-effects regression results between size and financial intermediation efficiency are presented in table 4.25. Evidently, size has a positive coefficient (0.2747) implying a direct relationship between the size of DTSs and the efficiency. The model fit is fairly good given that 55.72% (R-square=0.5572) of the variations in efficiency can be explained by variations in size of the DTS. The relationship between size and financial intermediation efficiency was found to be statistically significant given that the p value = 0.0000 is less than the significance level of 0.05.

The same results (positive significant relationship) are found after controlling for other firm characteristics as shown in table 4.26. The beta coefficient was found to be 0.2791 (p=0.0000). This implies that a unit increase in the log of the total assets of a DTS results to an increase in mean efficiency by 0.2791, holding other variables constant. It can therefore be concluded that; size has a positive and significant relationship with financial intermediation efficiency in deposit taking SACCO societies in Kenya. The results of the study were consistent with a number of earlier studies (Delis & Papanikolaou, 2009; Karray & Chichti, 2013; Kiyota, 2011; Mwangi, 2014; Wheelock & Wilson, 2011). Arora (2014) however found no conclusive evidence regarding a relationship between size and efficiency.

The results suggest that DTSs have not fully optimized their scale of operation. Continued expansion would therefore be efficiency enhancing. Rozzani and Rahman (2013) posits that large banks (DTSs) are capable of mobilizing more funds and generating high returns for its depositors and equity holders due to its diversification, which is achieved from having more resources. With more resources, larger DTSs are able to finance large numbers of profitable investment opportunities and have better access to investment activities. Additionally, DTSs with large asset base are capable of investing in efficiency enhancing technology and also engaging in promotion activities. This results into ability to mobilize even more resources. On the other side, the effect of

size could be negative for banks that are extremely large due to bureaucracy (Nigmonov, 2010).

Table 4.25: Fixed-effects regression between Size and Financial Intermediation Efficiency

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-2.0899	0.4719	-4.4285	0.0000
Size	0.2747	0.0536	5.1284	0.0000
R-squared	0.5572	Mean dependent var		0.3497
Adjusted R-squared	0.4092	S.D. dependent var		0.1918
S.E. of regression	0.1474	Akaike info criterion		-0.7772
Sum squared resid	6.6933	Schwarz criterion		0.2378
Log likelihood	264.1009	Hannan-Quinn criter.		-0.3757
F-statistic	3.7632	Durbin-Watson stat		2.3679
Prob(F-statistic)	0.0000			

4.7.7 Full Model

The general objective of the study was to examine the relationship between firm characteristics and financial intermediation efficiency of deposit taking SACCO societies in Kenya. To facilitate this analysis, a multiple regression model was fitted with bias corrected efficiency scores as the dependent variables and firm characteristics as the independent variables. According to Athanasoglou et al., (2008), firm characteristics, also referred to as internal or micro factors, originate from the financial statements such as income statements and/or statement of financial position. Consequently, capital adequacy, asset quality, liquidity, diversification, profitability and size were incorporated in the study. The hypothesized model is replicated below;

$$TEFF_{it} = \alpha_0 + \beta_1 \mathrm{CA}_{it} + \beta_2 \mathrm{ASQ}_{it} + \beta_3 \mathrm{LIQ}_{it} + \beta_4 DIV_{it} + \beta_5 PROF_{it} + \beta_6 SIZE_{it} + \varepsilon_{it}$$

Where i = 1, 2, …,135, and t = 1,2,3,4

Where; i is the i^{th} cross-sectional unit and t for the t^{th} time period.

TEFF – Financial intermediation efficiency (bias corrected technical efficiency scores)

CA-Capital Adequacy (core capital to total assets)

ASQ-Asset Quality (non performing loans to gross loans)

LIQ- Liquidity (liquid assets to assets)

DIV- Diversification (non-interest income to total income)

PROF- Profitability (ROA)

Size- Logarithm of total assets

The results of the overall regression model are presented in table 4.26. Incorporating the regression coefficients determined results into the following model;

$$TEFF_{it} = -2.1150 - 0.0139\text{CA}_{\text{it}} - 0.3434\text{ASQ}_{\text{it}} + 0.0424\text{LIQ}_{\text{it}} - 0.8817DIV_{\text{it}} + 1.1518PROF_{\text{it}} + 0.2791SIZE_{\text{it}} + \varepsilon_{it}$$

In the overall model, capital adequacy (p value=0.8811) and liquidity (p value=0.7534) were found to have a non significant relationship with intermediation efficiency at 5% significance level. The model fitted was fairly good with a predictive power of 58.49% (R-squared = 0.5774). This implies that 57.74%% of the variations in intermediation efficiency (as measured by variable return to scale technical efficiency) are explained by variations in firm characteristics. However, 42.26% of variations in technical efficiency are explained by variables not captured in the model.

Ultimately the following hypothesis was tested;

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$

H_1: At least one of $(\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6) \neq 0$

The results show that the model had an F value of 3.9525 with a p value of 0.0000 thus resulting to rejection of the null hypothesis and accepting of the alternative hypothesis. This implies that the overall model is statistically significant even at 1% ($p<0.01$) significance level. This showed that the coefficients in the regression model fitted were jointly not equal to zero implying a good fit. The results suggest that managerial attention should be directed to the firm characteristics and efficiency will be enhanced. Specifically, managerial efforts should focus on improvement of the asset quality (reduction in nonperforming assets) through continued monitoring of credit advanced to members. Limited effort should be directed towards diversification to non-interest income due to it adverse effect of efficiency.

Table 4.26: Fixed Effects Regression on Firm characteristics and Financial Intermediation Efficiency

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-2.1150	0.4394	-4.8127	0.0000
Capital Adequacy	-0.0139	0.0925	-0.1497	0.8811
Asset Quality	-0.3434	0.0502	-6.8357	0.0000
Liquidity	0.0424	0.1347	0.3144	0.7534
Diversification	-0.8817	0.338	-2.6083	0.0095
Profitability	1.1518	0.3571	3.2255	0.0014
Size	0.2791	0.0495	5.6394	0.0000
R-squared	0.5774	Mean dependent var		0.3497
Adjusted R-squared	0.4267	S.D. dependent var		0.1918
S.E. of regression	0.1452	Akaike info criterion		-0.7995
Sum squared resid	6.3885	Schwarz criterion		0.2643
Log likelihood	273.7	Hannan-Quinn criter.		-0.3787
F-statistic	3.833	Durbin-Watson stat		2.3844
Prob (F-statistic)	0.0000			

4.7.8 Determination of the Optimum Model

In order to determine the optimal model for the study, three models were estimated. The results are presented in appendix V. The first model included all the independent variable as hypothesized in the study. Both capital adequacy and liquidity are found to be insignificant at 0.05. Capital adequacy is first dropped since it had a higher p value. This results to the second model where only liquidity is insignificant. Evidently, model 2 has a higher predictive ability than model 1 given that the value of adjusted R^2 increased from 0.4267 to 0.4286. The adjusted R-squared increases only if the new term improves the model more than would be expected by chance (Gujarati, 2012).

Model 3 is determined after dropping liquidity. This results into a model with all variables being significant at 5%. Model 3 also has a better predictive power than model 2 given that it has a higher value of adjusted R^2. The value of adjusted R^2 increased from 0.4286 to 0.4304. Notably, all the models are statistically significant but the value of F statistic increases from 3.8330 to 3.9294 after dropping the two variables confirming that the model specification improves. The full result for optimal model is presented in table 4.27.

Table 4.27: Regression results for the optimal model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-2.0719	0.4892	-4.2351	0.0000
Asset quality	-0.3441	0.0604	-5.6962	0.0000
Diversification	-0.8670	0.3534	-2.4531	0.0147
Profitability	1.1541	0.3841	3.0044	0.0029
Size	0.2745	0.0567	4.8376	0.0000
R-squared	0.5773	Mean dependent var		0.3497
Adjusted R-squared	0.4304	S.D. dependent var		0.1918
S.E. of regression	0.1447	Akaike info criterion		-0.8090
Sum squared resid	6.3901	Schwarz criterion		0.2353
Log likelihood	273.6487	Hannan-Quinn criter.		-0.3959
F-statistic	3.9294	Durbin-Watson stat		2.3858
Prob(F-statistic)	0.0000			

The optimum model for the study is replicated below with variables arranged in descending order of significance;

$$TEFF_{it} = -2.0719 - 0.3441\text{ASQ}_{it} + 0.2745SIZE_{it} + 1.1541PROF_{it} - 0.8670DIV_{it} + \varepsilon_{it}$$

The conceptual framework is therefore revised as follows;

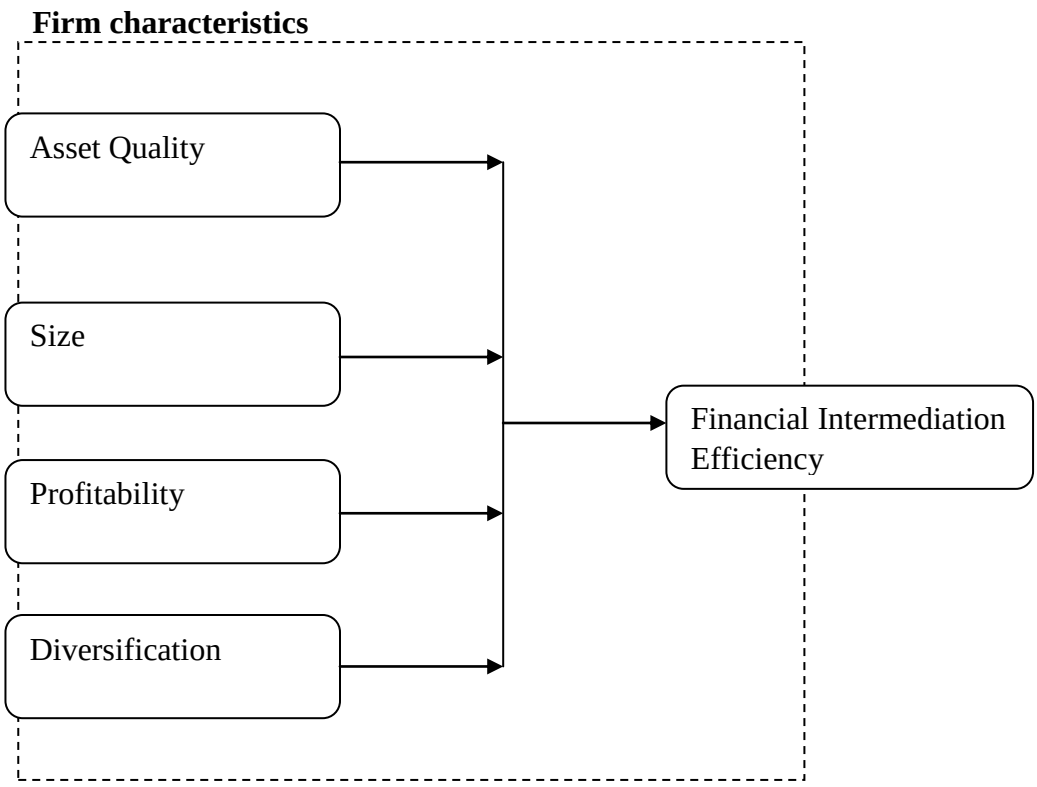

Figure 4.7: Revised conceptual framework

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The study investigated the relationship between firm characteristics and financial intermediation efficiency of deposit taking SACCO societies in Kenya. This chapter presents the summary of major findings of the study, conclusions and the necessary recommendations. The summary is done in line with the objectives and research hypotheses of the study. Policy recommendations based on the conclusions drawn are provided. Finally, areas for further study are given.

5.2 Summary of findings

5.2.1 Financial Intermediation Efficiency

The results showed that on average, there has been a sustained increase in intermediation efficiency over the years from a low of 0.646 in year 2011 to a high of 0.707 in 2014. This was attributed to regulatory compliance indicating that as more and more DTSs met regulatory requirements, they improved in efficiency. Over the period; the scale efficiency was higher than pure technical efficiency implying that inefficiencies were due to managerial underperformance rather than suboptimal size.

When classified by core membership, government based DTSs recorded the highest efficiency with a mean of 0.775 followed by private institutions at 0.7660. The farmers based DTSs recorded the lowest efficiency at 0.5390 followed by community based DTSs at 0.6551. This was attributed to managerial capabilities since government based and private institution based are capable of employing high calibre of staff compared to farmer and community based. In terms of size, it was found that large DTSs were the most efficient with an efficiency of 0.8929 followed by medium DTSs at 0.6711. Small

DTSs are the least efficient with an efficiency score of 0.6150. This was logical since large DTSs are able to enjoy economies of scale thus better efficiency. The results also indicated that DTSs are operating at a point very close to the lowest point of the long run average cost curve.

To further analyze the efficiency changes over years, the study used the Malmquist total factor Productivity Index (MPI), based on DEA technique. The results indicated that on average the total factor productivity reduced by 6.3% over the four year period; 2011-2014. This decline could be attributed to increased 'catching-up' effect (technical efficiency change of 5.7%) and a significant decline in the 'frontier shift' effect (technological change of -11.6%). This indicated that there was a decline in technological improvements over the period. In the same period, technical efficiency increased by 5.7% which could largely be attributed to increase in pure technical efficiency by 3.8% and increase in scale efficiency by 1.5%. This showed that the main source of technical efficiency for DTSs was pure efficiency change and not scales efficiency.

5.2.2 Capital adequacy and Financial Intermediation Efficiency

The study sought to evaluate the relationship between capital adequacy and financial intermediation efficiency of deposit taking SACCO societies in Kenya. The forward selection approach indicated that the best measure of capital adequacy in the study was the ratio of core capital to total assets. The results indicated that capital adequacy have an insignificant relationship with financial intermediation efficiency. This implies that capital adequacy does not necessarily improve the efficiency of financial institutions. The underlying reason is that most institutions hold the minimum or slightly above the specified minimum with varied levels of efficiency. The average ratio of capital adequacy was 13.8% while the minimum prescribed by the regulator is 10% underscoring the fact that significant number of DTSs holds the minimum or slightly

more than the minimum. The results indicated that the buffer capital theory may not be applicable to DTSs in Kenya.

5.2.3 Asset quality and Financial Intermediation Efficiency

The study sought to determine the relationship between asset quality and financial intermediation efficiency of deposit taking SACCO societies in Kenya. Empirical results indicate that, asset quality (as measured by the ratio of nonperforming assets to total asset) has a positive significant relationship with financial intermediation efficiency. This predicts that an increase in asset quality (reduction in the ratio of nonperforming loans to total loan) would result to an improvement in efficiency. The results points towards existence of "bad luck" or "bad management" hypothesis in the operation of DTSs and are consistent with information asymmetry theory.

5.2.4 Liquidity and Financial Intermediation Efficiency

The third specific objective of the study was to examine the relationship between liquidity and financial intermediation efficiency of deposit taking SACCO societies in Kenya. The forward selection approach indicated that the best measure of liquidity in the study was the ratio of liquid assets to total assets. The results indicate that liquidity have an insignificant relationship with financial intermediation efficiency of DTSs in Kenya. Like capital adequacy, minimum liquidity ratios are set by the regulator. The insignificant relationship also point to the fact that many DTSs maintain the minimum prescribed ratio. This means that the liquidity held by one to another DTS is not statistically significantly different. This effectively renders liquidity non firm specific. This was seen to contradict the he shiftability theory of liquidity.

5.2.5 Income diversification and Financial Intermediation Efficiency

The study sought to evaluate the relationship between income diversification and financial intermediation efficiency of deposit taking SACCO societies in Kenya. The

forward selection approach indicated that the best measure of income diversification in the study was the ratio of non-interest income to total income. The results depict a significant inverse relationship between income diversification and efficiency. An increase in the ratio of non-interest income to total income results is seen to result to a decline in efficiency. This implies that diversification hurts efficiency through more idiosyncratic risk and decreased incentives to monitoring. This may be seen to contradict the portfolio theory that posit that diversification into non-interest income would reduce volatility and enhance returns. Additionally; the size of DTSs could act as a bottleneck, since in small DTSs, no significant economies of scale are realized with income diversification.

5.2.6 Profitability and Financial Intermediation Efficiency

The study sought to determine the relationship between profitability and financial intermediation efficiency of deposit taking SACCO societies in Kenya. Return on assets was selected as the best measure of profitability in the study. The results indicate that there exists a positive significant relationship between profitability and intermediation efficiency. This reveals that most efficient DTSs were on an average characterized by higher profitability. Most profitable DTSs are capable of employing and retaining high caliber staff members and investing in technology which is efficiency enhancing. They also provide incentives to staff which motivates them to perform even better and reduce wastages. More profitable DTSs are also capable of attracting more deposits from members due to the returns earned. This enables them to provide more loans and investment opportunities to members.

5.2.7 Size and Financial Intermediation Efficiency

The study sought to examine the relationship between size and financial intermediation efficiency of deposit taking SACCO societies in Kenya. Logarithm of total assets was used as a proxy of size in the study. The results indicate that the size of the DTSs have a

positive and significant relationship with financial intermediation efficiency. The model fitted between the two variables was fairly good. The results suggest that DTSs have not fully optimized their scale of operation. Continued expansion would therefore be efficiency enhancing.

5.3 Conclusions

The study investigated the relationship between firm characteristics and financial intermediation efficiency of deposit taking SACCO societies in Kenya. In the first stage, the financial intermediation efficiency of the DTSs was assessed using the DEA approach. The results showed that there had been a sustained increase in intermediation efficiency over the years. This implied that as more and more DTSs complied with prudential regulations, their efficiency improved. It can therefore be concluded that compliance is efficiency enhancing. Over the period; the scale efficiency was higher than pure technical efficiency implying that inefficiencies are due to managerial underperformance rather than suboptimal size. The results of the Malmquist Productivity Index (MPI) pointed to the fact that there was limited growth in technological advancement.

In the second stage of analysis, the study sought to determine the relationship between firm characteristics and the efficiency. Specifically, the study focused on Capital Adequacy, Asset quality, liquidity, diversification, profitability and size and how they relate to financial intermediation efficiency. The study revealed an insignificant relationship between capital adequacy, liquidity and intermediation efficiency. However, asset quality, diversification, profitability and size were found to have significant relationships with intermediation efficiency.

In case of asset quality the relation was found to be direct implying that as the asset quality increases, efficiency of a DTS increases. Diversification was found to be hurting efficiency. As net interest income increases, the level of efficiency was found to decline. More profitable DTSs were found to be more efficiency indicating that profitability in

efficiency enhancing. The study also revealed a positive relationship between size and efficiency.

5.4 Recommendations

The Kenya's vision 2030 envisages creating a vibrant and globally competitive financial sector, driving high levels of savings and financing Kenya's investment needs. This will only be realized if the financial intermediaries undertake their intermediation activity as efficiently as possible. SACCOs specifically DTSs play a critical role in Kenya's financial sector in terms of access, savings mobilization and wealth creation. DTSs advance credit to their member based on the amount of deposits held. Their ability to provide credit at favorable terms compared to other financial institutions has led to an increased appetite for credit by members. The policy focus should be on how to enable them collate deposits and advance credit to members using the least amount of resources. At the same time, the safety of members' deposits should be guaranteed.

On the intermediation efficiency, the results indicate that on average, the DTSs are underperforming. They are capable of providing more loans and investment opportunities given the same amount of resources. The result also showed that, over the period of the study; scale efficiency had been higher than pure technical efficiency. This implied that the sources of inefficiencies in DTSs are management issues. It is therefore recommended that managers and policy makers should concentrate on how to improve the managerial efficiency rather than the size of the firm (though the results on size also indicate that it is equally important). Specifically, the qualification and experience of the top level management should be emphasized.

Based on the findings, the study also recommends that managerial and policy makers efforts be directed towards the efficiency enhancing characteristics. First, the existence of a direct relationship between asset quality and intermediation efficiency means that there should be a continued monitoring of the loan portfolio. This would ensure that the level of nonperforming loans is kept at minimum levels as they are found to hamper

efficiency. The entire credit policy framework should be well thought out with much emphasis being given to credit appraisal and monitoring of repayments. This would also help to reduce moral hazard and adverse selection by providing appropriate information for decision making.

Secondly, the study found that income diversification to non-interest income hampers the efficiency of a DTS. It is therefore recommended that the management should continue to focus on how to maximize on interest incomes. Continued expansion of the loan book is therefore encouraged. To facilitate this, there should be continued mobilization of deposit from members to meet the credit needs. The regulator and other policy makers should draft guidelines that encourage DTSs to consolidate their operations and limit their diversification into non-interest income.

Thirdly; the direct relationship between profitability and intermediation efficiency underscore that a DTS should not only be technically efficient but also profit efficient. Profitability was found to be efficiency enhancing. The results provide an interesting linkage in the goals of DTSs. They imply that the management should therefore focus at maximizing profitability of the DTS and in the process enhance efficiency. The regulator should also continually monitor the profitability of DTSs.

Lastly, empirical evidence suggests that large DTSs are more efficient in their intermediation role. Contrary, small DTSs are less efficient. Large DTSs are capable of enjoying the economies of scale. The results also indicate that there exist scale inefficiencies in the DTSs. It is therefore recommended that the regulator comes up with policies meant to encourage existence of large DTSs. This may mean forced merging of the small DTSs. One such policy is continued increase of the minimum capital that DTSs should hold. This would be in line with the trend in commercial banks where the minimum capital has continued to be reviewed upward resulting to consolidation of the banking sector.

5.5 Areas for Further Research

The study investigated the relationship between firm characteristics and financial intermediation efficiency of deposit taking SACCO Societies in Kenya. Future study may focus on incorporation of industry specific and macroeconomic factors and evaluate their effects on intermediation efficiency of DTSs. This may result to an improved R square. The current study was also limited by the period in which the prudential regulation has been in existence and therefore focused on the period 2011-2014. Future studies may focus on longer period of analysis. Prolonged period of study may specifically help to evaluate the direction of causality between asset quality and efficiency. It may therefore be possible to test the 'bad management' versus 'bad luck' hypothesis. Future studies may also seek to evaluate efficiency of other financial institutions such as micro-finance and insurance institutions. Literature review indicated that past studies have majorly focused on commercial banks.

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APPENDICES

Appendix I: Data Collection Sheet/ Questionnaire

Name of the SACCO…… Date Licensed…….

Dominant Membership…… Physical Address……

		2011	2012	2013	2014
Inputs	Total deposits				
	Labour cost (personnel expenses)				
	Capital				
Outputs	Loan and advances				
	Investments				
	Dividends				
Capital Adequacy	Equity (Members share capital per Bylaws)				
	Total assets				
	Total deposits				
Asset Quality	Allowance for loan loss				
	Gross loan portfolio				
Liquidity	Total loans				
	Total deposits				
	Liquid assets				
	Total assets				
Diversification	Non-interest income				
	Total assets				
	Interest margin				
	Gross income				
Profitability	Net income(after tax before donations)				
	Total assets				
	Equity				
Size					
	Total assets				

Appendix II: List of Licensed Deposit Taking SACCOs

1	AIRPORTS SACCO	46	KURIA TEACHERS SACCO	91	SUKARI SACCO
2	AFYA SACCO	47	LENGO SACCO	92	TAI SACCO
3	ASILI SACCO	48	MAGADI SACCO	93	TAIFA SACCO
4	BANDARI SACCO	49	MARAKWET TEACHERS SACCO	94	TAITA TAVETA SACCO
5	BARAKA SACCO	50	MARSABIT TEACHERS SACCO	95	TEMBO SACCO
6	SKYLINE SACCO	51	ENEA SACCO	96	TENHOS SACCO
7	BORESHA SACCO	52	MMH SACCO	97	THARAKA NITHI TEACHRS SACCO
8	BIASHARA SACCO	53	SOLUTION SACCO	98	ORIENT SACCO
9	BINGWA	54	DHABITI SACCO S	99	TRANS-NATIONAL TIMES SACCO
10	VISION POINT SACCO	55	MERU SOUTH SACCO	100	UKULIMA SACCO
11	NG'ARISHA SACCO	56	METROPOLITAN SACCO	101	UN SACCO
12	BURETI TEA SACCO	57	MOMBASA PORT SACCO	102	UNIVERSAL TRADERS SACCO
13	CHAI SACCO	58	MOMBASA TEACHERS SACCO	103	WAKENYA PAMOJA SACCO
14	CHEMELIL SACCO	59	MUHIGIA SACCO	104	WAKULIMA COMMERCIAL SACCO
15	CHEPSOL TEA GROWERS SACCO	60	NITUNZE	105	WANAANGA SACCO
16	CHUNA SACCO	61	DAIMA SACCO	106	WANANCHI SACCO
17	COMOCO SACCO	62	UNAITAS SACCO	107	WANANDEGE SACCO
18	CENTENARY SACCO	63	MENTOR SACCO	108	WARENG TEACHERS SACCO
19	WINAS SACCO	64	MURATA SACCO	109	WASHA SACCO
20	FARIJI SACCO	65	MWALIMU NATIONAL SACCO	110	WAUMINI SACCO
21	FORTUNE SACCO	66	MWITO SACCO	111	NASSEFU SACCO
22	GITHUNGURI DAIRY SACCO	67	NACICO SACCO	112	FUNDILIMA SACCO
23	GUSII MWALIMU SACCO	68	NAKU SACCO	113	MAISHA BORA SACCO
24	HARAMBEE SACCO	69	COSMOPOLITAN TEACHERS SACCO	114	COUNTY SACCO
25	HAZINA SACCO	70	NANDI HEKIMA SACCO	115	MUDETE TEA GROWERS SACCO
26	IMENTI SACCO	71	NAROK TEACHERS	116	SUPA SACCO

27	KENYA ACHIEVAS SACCO	72	NATION SACCO	117	NAFAKA SACCO
28	JAMII SACCO	73	NDEGE CHAI SACCO	118	BUSIA TESO TEACHERS SACCO
29	JIJENGE SACCO	74	NDOSHA SACCO	119	KENVERSITY SACCO
30	KAKAMEGA TEACHERS SACCO	75	THAMANI GROWERS SACCO	120	EGERTON SACCO
31	KEIYO TEACHERS SACCO	76	NTIMINYAKIRU SACCO	121	DIMKES SACCO
32	KENPIPE SACCO	77	NYAMBENE ARIMI SACCO	122	MAGEREZA SACCO
33	KENYA BANKERS	78	NYAMIRA TEA FARMERS SACCO	123	TIMES- U SACCO
34	KENYA CANNERS	79	TOWER TEACHERS SACCO	124	NRS SACCO
35	KENYA POLICE SACCO	80	NYERI TEACHERS SACCO	125	CAPITAL SACCO
36	KENYA HIGHLANDS SACCO	81	ORTHODOX SACCO	126	LAIKIPIA TEACHERS SACCO
37	KIAMBAA DAIRY RURAL SACCO	82	SAFARICOM SACCO	127	NAWIRI SACCO
38	K- UNITY SACCO	83	SHERIA SACCO	128	UKRISTO NA UFANISI
39	KILIFI TEACHERS SACCO	84	TARAJI SACCO	129	PUAN SACCO
40	KINGDOM SACCO	85	SIMBA CHAI SACCO	130	KENYA MIDLANDS SACCO
41	IMARISHA SACCO	86	SIRAJI SACCO	131	ISIOLO TEACHERS SACCO
42	KITE SACCO	87	SOT TEA GROWERS	132	ELGON TEACHERS SACCO
43	KITUI TEACHERS SACCO	88	SOTICO SACCO	133	UFANISI SACCO
44	KMFRI SACCO	89	YETU SACCO	134	NYAHURURU UMOJA SACCO
45	KONOIN TEA GROWERS SACCO	90	STIMA SACCO	135	KIPSIGIS EDIS SACCO

Source: SASRA (2013)

Appendix III: List of Successful subjects and their efficiency scores

	2011				2012				2013				2014			
DTS	crste	vrste	scale	Bias Corr. vrste	crste	vrste	scale	Bias Corr. vrste	crste	vrste	scale	Bias Corr. vrste	crste	vrste	scale	Bias Corr. vrste
AIRPORTS SACCO	0.830	0.951	0.873	0.358	0.393	0.405	0.971	0.271	0.598	0.628	0.952	0.483	0.510	0.572	0.892	0.451
AFYA SACCO	0.930	1.000	0.930	0.031	0.957	1.000	0.957	0.128	1.000	1.000	1.000	0.241	1.000	1.000	1.000	0.253
ASILI SACCO	0.405	0.508	0.797	0.897	0.395	0.508	0.777	0.972	0.603	0.603	0.999	0.409	0.525	0.531	0.989	0.340
BANDARI SACCO	0.678	0.876	0.774	0.666	0.740	0.947	0.782	0.156	0.966	0.966	0.999	0.525	0.886	0.888	0.998	0.611
BARAKA SACCO	0.137	0.147	0.933	0.102	0.148	0.155	0.953	0.092	0.182	0.189	0.962	0.134	0.213	0.238	0.895	0.170
SKYLINE SACCO	0.376	0.407	0.923	0.306	0.278	0.284	0.981	0.208	0.461	0.486	0.948	0.382	0.112	0.114	0.988	0.081
BORESHA SACCO	0.391	0.455	0.858	0.376	0.384	0.431	0.890	0.618	0.582	0.602	0.966	0.381	0.499	0.605	0.824	0.400
BIASHARA SACCO	0.747	0.864	0.865	0.554	0.886	1.000	0.886	0.261	0.422	0.430	0.982	0.323	0.354	0.359	0.986	0.261
BINGWA	0.262	0.291	0.899	0.205	0.260	0.303	0.860	0.118	0.356	0.416	0.856	0.244	0.436	0.531	0.822	0.207
FARIJI SACCO	0.241	0.304	0.792	0.220	0.351	0.676	0.519	0.564	0.694	1.000	0.694	0.255	0.525	1.000	0.525	0.235
FORTUNE SACCO	0.220	0.251	0.877	0.161	0.152	0.180	0.845	0.101	0.371	0.491	0.756	0.226	0.501	0.602	0.831	0.432
GITHUNGURI DAIRY	0.894	0.913	0.980	0.464	1.000	1.000	1.000	0.114	0.726	0.746	0.973	0.710	0.936	0.943	0.992	0.352
NG'ARISHA SACCO	0.377	0.409	0.922	0.313	0.395	0.436	0.907	0.309	0.492	0.494	0.995	0.379	0.431	0.433	0.996	0.323
CHAI SACCO	0.384	0.440	0.873	0.372	0.412	0.452	0.913	0.351	0.639	0.640	0.998	0.471	1.000	1.000	1.000	0.544
COMOCO SACCO	1.000	1.000	1.000	0.093	1.000	1.000	1.000	0.183	0.914	0.969	0.943	0.729	0.789	0.849	0.929	0.608
CENTENARY SACCO	0.499	0.679	0.735	0.482	0.479	0.547	0.875	0.420	0.500	0.535	0.934	0.420	0.484	0.566	0.856	0.412
HARAMBEE SACCO	0.820	1.000	0.820	0.022	0.991	1.000	0.991	0.100	0.757	1.000	0.757	0.260	0.748	1.000	0.748	0.181
WINAS SACCO	0.590	0.748	0.788	0.578	0.629	0.799	0.787	0.165	0.943	0.954	0.988	0.477	0.882	0.896	0.985	0.658
HAZINA SACCO	0.704	0.879	0.801	0.488	0.616	0.801	0.769	0.548	0.850	0.885	0.960	0.575	0.797	0.971	0.820	0.220
IMENTI SACCO	0.462	0.519	0.892	0.369	0.436	0.450	0.969	0.288	0.379	0.435	0.870	0.352	0.387	0.480	0.806	0.387

KENYA ACHIEVAS	0.283	0.305	0.928	0.128	0.224	0.296	0.759	0.050	0.144	0.161	0.895	0.099	0.199	0.246	0.810	0.156
JAMII SACCO	0.681	0.756	0.902	0.594	0.652	0.732	0.890	0.549	0.756	0.771	0.981	0.586	0.655	0.656	0.998	0.476
KAKAMEGA TEACHERS	0.723	0.927	0.780	0.613	0.684	0.871	0.785	0.170	0.869	0.870	0.999	0.226	0.835	0.836	0.999	0.279
KEIYO TEACHERS	1.000	1.000	1.000	0.069	1.000	1.000	1.000	0.102	0.609	0.618	0.986	0.492	0.610	0.697	0.874	0.534
KENPIPE SACCO	0.715	0.808	0.885	0.659	0.519	0.685	0.757	0.667	0.779	0.780	0.998	0.649	0.672	0.675	0.995	0.537
KENYA BANKERS	0.397	0.636	0.624	0.416	0.376	0.575	0.654	0.395	0.563	0.587	0.960	0.379	0.524	0.637	0.822	0.411
KENYA CANNERS	0.504	0.518	0.972	0.386	0.511	0.516	0.991	0.438	0.653	0.666	0.980	0.524	0.647	0.684	0.945	0.544
KENYA POLICE	0.586	0.968	0.605	0.017	0.677	1.000	0.677	0.089	1.000	1.000	1.000	0.255	1.000	1.000	1.000	0.231
KENYA HIGHLANDS	0.195	0.239	0.817	0.203	0.212	0.265	0.801	0.161	0.286	0.289	0.989	0.201	0.269	0.269	0.999	0.203
KIAMBAA DAIRY RURAL	0.394	1.000	0.394	0.051	0.484	0.944	0.512	0.437	0.672	1.000	0.672	0.554	0.540	0.798	0.676	0.561
K- UNITY SACCO	1.000	1.000	1.000	0.031	0.452	0.529	0.853	0.290	0.483	0.584	0.827	0.340	0.594	0.886	0.671	0.217
KILIFI TEACHERS SACCO(imarika)	0.415	0.581	0.714	0.472	0.456	0.615	0.742	0.433	0.590	0.628	0.941	0.428	0.463	0.588	0.788	0.423
KINGDOM SACCO	0.352	0.379	0.929	0.272	0.381	0.407	0.936	0.291	0.639	0.690	0.926	0.517	0.489	0.518	0.945	0.444
IMARISHA SACCO	0.565	0.674	0.838	0.444	0.590	0.747	0.790	0.497	0.847	0.886	0.956	0.639	0.860	0.940	0.916	0.639
KITE SACCO	0.411	0.460	0.894	0.283	0.412	0.461	0.893	0.313	0.774	0.790	0.979	0.599	0.585	0.616	0.950	0.138
KONOIN TEA GROWERS SACCO	0.323	0.349	0.925	0.265	0.358	0.411	0.872	0.314	0.387	0.433	0.892	0.327	0.413	0.486	0.850	0.327
LENGO SACCO	0.451	1.000	0.451	0.013	0.488	1.000	0.488	0.093	0.245	0.406	0.604	0.304	0.263	0.424	0.621	0.315
MARSABIT TEACHERS	1.000	1.000	1.000	0.000	1.000	1.000	1.000	0.079	0.608	0.645	0.943	0.467	0.641	0.771	0.831	0.207
ENEA SACCO	0.214	0.312	0.685	0.237	0.198	0.257	0.773	0.190	0.182	0.235	0.777	0.176	0.143	0.200	0.716	0.156
MMH SACCO	0.280	0.289	0.969	0.221	0.309	0.309	1.000	0.223	0.528	0.539	0.980	0.346	0.559	0.587	0.951	0.412
DHABITI SACCO S	0.512	0.569	0.899	0.262	0.723	1.000	0.723	0.121	0.380	0.385	0.989	0.147	0.447	0.448	0.999	0.298
METROPOLITAN	0.625	0.839	0.745	0.555	0.625	0.867	0.720	0.599	0.859	0.874	0.982	0.615	0.767	0.888	0.864	0.634

SACCO																
MOMBASA PORT																
SACCO	0.705	0.834	0.846	0.637	0.661	0.758	0.873	0.175	0.854	0.861	0.992	0.232	0.925	0.942	0.982	0.233
MOMBASA TEACHERS	0.453	0.458	0.991	0.356	0.544	0.559	0.973	0.410	0.589	0.610	0.965	0.488	0.470	0.490	0.959	0.385
MUHIGIA SACCO																
(OLLIN)	1.000	1.000	1.000	0.019	1.000	1.000	1.000	0.106	1.000	1.000	1.000	0.256	1.000	1.000	1.000	0.159
NITUNZE	0.610	0.611	0.998	0.342	0.253	0.368	0.687	0.181	0.225	0.431	0.522	0.263	0.279	0.377	0.741	0.236
DAIMA SACCO	0.511	0.532	0.960	0.293	0.460	0.483	0.953	0.257	0.385	0.445	0.866	0.286	0.398	0.500	0.797	0.271
UNAITAS SACCO	0.351	0.421	0.834	0.225	0.528	1.000	0.528	0.105	0.446	0.935	0.476	0.298	0.379	0.744	0.510	0.250
MENTOR SACCO	1.000	1.000	1.000	0.209	1.000	1.000	1.000	0.200	0.763	0.798	0.956	0.516	0.779	0.815	0.956	0.559
MWALIMU NATIONAL	0.504	1.000	0.504	0.005	0.594	1.000	0.594	0.091	0.642	1.000	0.642	0.260	0.499	1.000	0.499	0.205
MWITO SACCO	0.399	0.466	0.857	0.345	0.456	0.516	0.884	0.437	0.749	0.796	0.941	0.557	0.763	0.808	0.944	0.539
NAKU SACCO	0.512	0.603	0.848	0.436	0.509	0.637	0.800	0.393	0.644	0.645	0.998	0.503	0.578	0.584	0.990	0.464
COSMOPOLITAN																
TEACHERS SACCO	0.600	0.780	0.769	0.521	0.538	0.751	0.717	0.498	0.939	0.965	0.974	0.254	0.832	0.891	0.934	0.653
NANDI HEKIMA SACCO	0.312	0.346	0.900	0.249	0.406	0.434	0.935	0.295	0.627	0.682	0.920	1.023	0.939	1.000	0.939	0.316
NAROK TEACHERS	0.763	0.776	0.984	0.616	0.559	0.564	0.992	0.587	0.818	0.846	0.967	0.680	0.826	0.976	0.847	0.700
NATION SACCO	0.552	0.599	0.923	1.082	0.488	0.514	0.950	0.248	0.824	0.828	0.996	0.916	0.842	0.870	0.968	0.619
NDOSHA SACCO	0.328	0.382	0.858	0.278	0.350	0.413	0.848	0.284	0.414	0.470	0.882	0.307	0.446	0.586	0.760	0.425
NYAMBENE ARIMI																
SACCO	0.243	0.278	0.875	0.204	0.235	0.259	0.907	0.185	0.292	0.318	0.918	0.235	0.319	0.372	0.860	0.274
NYAMIRA TEA																
FARMERS SACCO	0.361	0.367	0.985	0.233	0.388	0.395	0.983	0.266	0.404	0.434	0.930	0.313	0.586	0.604	0.970	0.434
NYERI TEACHERS																
SACCO	1.000	1.000	1.000	-0.015	1.000	1.000	1.000	0.129	1.000	1.000	1.000	0.225	1.000	1.000	1.000	0.227
ORTHODOX SACCO	0.364	1.000	0.364	0.004	0.377	0.847	0.445	0.670	0.336	1.000	0.336	0.245	0.286	1.000	0.286	0.199

SAFARICOM SACCO	0.788	0.890	0.886	0.591	0.784	0.833	0.942	0.513	1.000	1.000	1.000	0.274	0.960	0.970	0.990	0.697
SHERIA SACCO	0.527	0.719	0.733	0.598	0.555	0.791	0.701	0.753	0.900	0.915	0.984	0.662	0.741	0.775	0.956	0.534
TARAJI SACCO	0.492	0.557	0.882	0.386	0.666	0.691	0.964	0.134	0.286	0.319	0.898	0.402	0.225	0.242	0.931	0.825
SIMBA CHAI SACCO	0.655	0.657	0.997	0.570	0.648	0.657	0.986	0.529	0.939	0.959	0.979	0.573	0.824	0.869	0.947	0.694
SIRAJI SACCO	0.325	0.513	0.634	0.365	0.351	0.521	0.674	0.384	0.430	0.564	0.762	0.420	0.425	0.525	0.810	0.399
SOT TEA GROWERS (stegro)	0.159	0.160	0.991	0.102	0.234	0.241	0.972	0.162	0.443	0.451	0.983	0.371	1.000	1.000	1.000	0.251
STIMA SACCO	0.545	0.856	0.636	0.502	0.551	0.774	0.712	0.122	0.762	0.920	0.829	0.583	0.723	1.000	0.723	0.211
SUKARI SACCO	0.367	0.399	0.920	0.332	0.380	0.391	0.971	0.254	0.501	0.503	0.996	0.382	0.400	0.422	0.949	0.347
TAIFA SACCO	0.415	0.497	0.836	0.281	0.266	0.371	0.719	0.237	0.322	0.369	0.872	0.259	0.307	0.387	0.795	0.293
TAITA TAVETA /QWETU	0.514	0.527	0.975	0.368	0.479	0.498	0.961	0.340	0.593	0.607	0.977	0.491	0.528	0.554	0.952	0.493
TEMBO SACCO	1.000	1.000	1.000	0.009	1.000	1.000	1.000	0.136	0.857	0.868	0.988	0.642	0.902	0.940	0.960	0.696
TENHOS SACCO	0.284	0.364	0.779	0.267	0.269	0.329	0.816	0.238	0.447	0.550	0.813	0.394	0.331	0.492	0.674	0.331
ORIENT SACCO	0.588	0.614	0.958	0.372	0.750	0.774	0.970	0.512	0.981	1.000	0.981	0.753	0.841	0.913	0.921	0.804
TRANS-NATIONAL TIMES SACCO	0.519	0.519	0.999	0.366	0.481	0.488	0.987	0.361	1.000	1.000	1.000	0.320	0.849	1.000	0.849	0.589
UKULIMA SACCO	0.353	0.491	0.718	0.240	0.410	0.612	0.671	0.194	1.000	1.000	1.000	0.279	1.000	1.000	1.000	0.210
UN SACCO	0.779	1.000	0.779	0.015	0.860	1.000	0.860	0.089	0.937	1.000	0.937	0.212	0.836	1.000	0.836	0.215
WAKENYA PAMOJA	1.000	1.000	1.000	0.040	1.000	1.000	1.000	0.118	0.521	0.948	0.549	0.226	1.000	1.000	1.000	0.210
WAKULIMA COMMERCIAL SACCO	0.534	1.000	0.534	0.032	1.000	1.000	1.000	0.101	1.000	1.000	1.000	0.271	1.000	1.000	1.000	0.209
WANAANGA SACCO	0.510	0.575	0.886	0.555	0.615	0.655	0.939	0.839	0.782	0.808	0.967	0.391	0.809	0.872	0.928	0.231
WANANCHI SACCO	0.314	0.342	0.918	0.131	1.000	1.000	1.000	0.088	0.950	1.000	0.950	0.246	0.563	0.608	0.926	0.528
WANANDEGE SACCO	0.281	0.322	0.872	0.206	0.290	0.309	0.937	0.236	0.370	0.371	0.997	0.265	0.385	0.392	0.983	0.304
WARENG TEACHERS	0.505	0.508	0.994	0.374	0.562	0.602	0.933	0.443	0.775	0.782	0.990	0.607	0.784	0.787	0.997	0.612
WASHA SACCO	0.654	0.865	0.756	0.547	0.636	0.887	0.717	0.553	0.535	1.000	0.535	0.289	0.513	0.735	0.698	0.516

WAUMINI SACCO	0.469	0.624	0.752	0.807	0.479	0.629	0.761	0.369	0.665	0.678	0.980	0.461	0.955	1.000	0.955	0.558
NASSEFU SACCO	0.509	0.535	0.952	0.388	0.557	0.624	0.893	0.475	0.629	0.632	0.996	0.512	0.480	0.486	0.987	0.356
FUNDILIMA SACCO	1.000	1.000	1.000	-0.016	1.000	1.000	1.000	0.097	0.844	0.912	0.926	0.582	0.738	0.825	0.895	0.584
MAISHA BORA SACCO	0.957	1.000	0.957	0.016	0.632	0.837	0.755	0.443	1.000	1.000	1.000	0.259	1.000	1.000	1.000	0.231
COUNTY SACCO	1.000	1.000	1.000	0.026	0.835	0.931	0.896	0.552	0.710	0.762	0.931	0.650	0.655	0.661	0.990	0.372
MUDETE TEA																
GROWERS SACCO	0.484	1.000	0.484	0.035	0.355	0.518	0.685	0.299	0.310	0.352	0.881	0.252	0.305	0.360	0.848	0.266
NAFAKA SACCO	0.373	0.380	0.982	0.265	0.380	0.388	0.979	0.285	0.368	0.407	0.903	0.314	0.437	0.489	0.894	0.355
BUSIA TESO TEACHERS	0.713	0.714	0.999	0.499	0.483	0.484	0.998	0.343	0.676	0.700	0.966	0.486	0.644	0.660	0.976	0.414
KENVERSITY SACCO	0.583	0.655	0.890	0.415	0.515	0.601	0.857	0.415	1.000	1.000	1.000	0.294	1.000	1.000	1.000	0.191
EGERTON SACCO	0.511	0.604	0.846	0.390	0.518	0.602	0.859	0.467	0.651	0.651	0.999	0.529	0.474	0.475	0.998	0.356
DIMKES SACCO	0.509	0.704	0.723	0.504	0.523	0.561	0.932	0.363	0.798	0.912	0.875	0.603	0.558	0.594	0.940	0.416
MAGEREZA SACCO	1.000	1.000	1.000	0.032	0.411	0.551	0.746	0.380	0.878	1.000	0.878	0.260	1.000	1.000	1.000	0.245
NRS SACCO	0.387	0.396	0.977	0.300	0.402	0.406	0.989	0.303	0.419	0.441	0.950	0.353	0.429	0.467	0.918	0.371
CAPITAL SACCO	0.256	0.318	0.805	0.208	0.316	0.356	0.889	0.292	0.438	0.441	0.995	0.249	0.601	0.670	0.897	0.142
UKRISTO NA UFANISI	0.316	0.431	0.733	0.309	0.402	0.546	0.735	0.384	0.625	0.659	0.948	0.442	0.569	0.596	0.955	0.447
PUAN SACCO	0.416	0.446	0.933	0.351	0.433	0.451	0.959	0.359	0.482	0.526	0.917	0.423	0.513	0.647	0.792	0.504
KENYA MIDLANDS	0.117	0.183	0.642	0.107	0.094	1.000	0.094	0.107	0.680	1.000	0.680	0.252	1.000	1.000	1.000	0.230
ELGON TEACHERS	0.358	0.428	0.836	0.287	0.363	0.437	0.831	0.296	0.334	0.378	0.883	0.290	0.329	0.430	0.767	0.335
KIPSIGIS EDIS SACCO	0.500	1.000	0.500	0.058	0.533	1.000	0.533	0.288	0.695	1.000	0.695	0.279	0.521	1.000	0.521	0.259
mean	**0.541**	**0.646**	**0.849**	**0.306**	**0.540**	**0.648**	**0.846**	**0.309**	**0.639**	**0.706**	**0.907**	**0.403**	**0.626**	**0.707**	**0.885**	**0.381**

Appendix IV: Frequency Distribution of Variable Return to Scale Efficiency Score

Year	Class	Frequency	Percent	Valid Percent	Cumulative Percent
2011	.1000 - .1999	3	2.9	2.9	2.9
	.2000 - .2999	5	4.9	4.9	7.8
	.3000 - .3999	15	14.6	14.6	22.3
	.4000 - .4999	13	12.6	12.6	35
	.5000 - .5999	14	13.6	13.6	48.5
	.6000 - .6999	10	9.7	9.7	58.3
	.7000 - .7999	7	6.8	6.8	65
	.8000 - .8999	9	8.7	8.7	73.8
	.9000+	27	26.2	26.2	100
	Total	**103**	**100**	**100**	
2012	.1000 - .1999	2	1.9	1.9	1.9
	.2000 - .2999	6	5.8	5.8	7.8
	.3000 - .3999	10	9.7	9.7	17.5
	.4000 - .4999	17	16.5	16.5	34
	.5000 - .5999	14	13.6	13.6	47.6
	.6000 - .6999	13	12.6	12.6	60.2
	.7000 - .7999	8	7.8	7.8	68
	.8000 - .8999	7	6.8	6.8	74.8
	.9000+	26	25.2	25.2	100
	Total	**103**	**100**	**100**	
2013	.1000 - .1999	2	1.9	1.9	1.9
	.2000 - .2999	2	1.9	1.9	3.9
	.3000 - .3999	7	6.8	6.8	10.7
	.4000 - .4999	16	15.5	15.5	26.2
	.5000 - .5999	8	7.8	7.8	34
	.6000 - .6999	17	16.5	16.5	50.5
	.7000 - .7999	9	8.7	8.7	59.2
	.8000 - .8999	9	8.7	8.7	68
	.9000+	33	32	32	100
	Total	**103**	**100**	**100**	
2014	.1000 - .1999	1	1	1	1
	.2000 - .2999	5	4.9	4.9	5.8
	.3000 - .3999	6	5.8	5.8	11.7
	.4000 - .4999	13	12.6	12.6	24.3
	.5000 - .5999	14	13.6	13.6	37.9
	.6000 - .6999	14	13.6	13.6	51.5
	.7000 - .7999	6	5.8	5.8	57.3
	.8000 - .8999	13	12.6	12.6	69.9
	.9000+	31	30.1	30.1	100
	Total	103	100	100	

Appendix V: Determination of the optimal model

Variable	Model 1	Model 2	Model 3
Constant	-2.1150 (0.5124)**	-2.1077 (0.5482)**	-2.0719(0.4892)**
Capital Adequacy	-0.0139 (0.1079)	-	-
Asset quality	-0.3434 (0.0586)**	-0.3434(0.0587)**	-0.3441(0.0604)**
Liquidity	0.0424 (0.1571)	0.0421(0.1564)	-
Diversification	-0.8817 (0,3942)*	-0.8872(0.3863)*	-0.8670(0.3534)*
Profitability	1.1518 (0.4164)**	1.1469(0.3875)**	1.1541(0.3841)**
Size	0.2791 (0.0577)**	0.2781(0.0627)**	0.2745(0.0567**
R-squared	0.5774	0.5774	0.5773
Adjusted R-squared	0.4267	0.4286	0.4304
S.E. of regression	0.1452	0.1450	0.1447
Sum squared resid	6.3885	6.3887	6.3901
Log likelihood	273.7000	273.6946	273.6487
F-statistic	3.8330	3.8814	3.9294
Prob(F-statistic)	0.0000	0.0000	0.0000

*Values in Parentheses are standard errors. * indicate that the variable is significant at 5 percent; and ** indicate that the variable is significant at 1 percent.*