FINANCIAL SOUNDNESS AND EFFICIENCY OF DEPOSIT TAKING SAVINGS AND CREDIT COOPERATIVE SOCIETIES IN KENYA

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DECLARATION

This thesis is my original work and has not been presented for award in any other university.

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This work is dedicated to my beloved husband Vincent, our daughter Vannia, my parents Esther and Elkana and my siblings for their love, patience, understanding, encouragement and support for me as I pursued this study.

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OPERATIONAL DEFINITION OF TERMS

Asset Quality The ability of deposit taking Saving and Credit Cooperative (DTS) society's assets (loans) to provide income; it is the timely manner with which borrowers are meeting their contractual obligations. This is measured by non-performing loans to total loans.

Capital Adequacy The amount of capital a DTS Society has to hold as required by SACCO Societies Regulatory Authority (SASRA) to absorb any potential losses and risks. It is measured by core capital to total assets and core capital to total deposits.

Core capital Fully paid up members' shares, capital issued, disclosed reserves, retained earnings, grants and donations that a DTS society should not liquidate unless faced with liquidation.

Deposit Taking SACCO SACCO society that accepts member's deposits or conduct front office saving activities**.**

Data Envelopment Analysis Linear programming model which measures relative efficiencies of organizations with multiple inputs and outputs.

Earnings Amount of income that a DTS society produces during a specific period after expenses have been paid.

Earnings Rating It is the rate of return on funds invested. It is measured by Return On Assets (ROA) and Return On Equity (ROE).

Earning Assets	They are income producing assets that are owned by DTS
Efficiency	The ratio of actual output to maximum potential output obtainable from a given input level, or the ratio of minimum potential input to actual input required to produce the given output.
Efficiency Score	It is a measure of efficiency on a scale of 0 to 1.Where a scale of 1 indicates that the DTS is efficient while a score of less than 1 indicates that the DTS is inefficient.
Size of DTS	Extent of growth of the DTS society in terms of the total assets
Financial Soundness	The ability of the DTS society to absorb financial shocks and continue with normal operation even in the face of dynamic and challenging environment such as those brought about by competition from other financial institutions. This is assessed by looking at capital adequacy, asset quality, earnings and liquidity.
Institutional capital	The portion of the core capital that belongs to the DTS society as an institution such that no one member can individually lay claim on it.
Liquidity	The ability of the DTS society to fulfil its obligations mainly to the depositors and honour all cash payment commitments as they fall due. It is measured by liquid assets to short term liabilities and total loans to total deposits.

Non-Performing Loan A loan on which the borrower has not made his scheduled payments for at least 90 days.

Savings and Credit Cooperative (SACCO) Society A private and cooperative financial intermediary where membership is open and voluntary. It belongs to its members who manage it democratically.

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ABBREVIATIONS AND ACRONYMS

ADF	Augmented Dickey Fuller
ANOVA	Analysis of Variance
BCT	Buffer Capital Theory
CAPM	Capital Asset Pricing Model
CBK	Central bank of Kenya
CLRM	Classical Linear regression model
CRB	Credit Reference Bureau
CRSTE	Constant Return to Scale Technical Efficiency
DEA	Data Envelopment Analysis
DMU	Decision Making Unit
DTS	Deposit Taking SACCO
DTSS	Deposit Taking SACCO Societies
EET	Economic Efficiency Theory
FE	Fixed Effects
FEAR	Frontier Efficiency Analysis in R
FGLS	Feasible Generalized Least Squares
IAT	Information Asymmetry Theory
ICA	International Co-operative Alliance

IMF	International Monetary Fund
JB	Jarque-Bera
K–S	Kolmogorov–Smirnov Test
KUSSCO	Kenya Union of Savings and Credit Cooperative Societies
MPT	Modern Portfolio Theory
NACOSTI	National Commission for Science, Technology and Innovation
NPL	Non-performing Loans
OLS	Ordinary Least Squares
ROI	Return on Investments
ROA	Return on Assets
ROE	Return on Equity
RE	Random Effects
SACCOs	Savings and Credit Cooperatives societies
SASRA	Sacco Societies Regulatory Authority
SHF/TA	Shareholders Fund/Total Assets
SFA	Stochastic Frontier Analysis
SPSS	Statistical Packages for Social Sciences
STL	Shiftability Theory of Liquidity
VIF	Variance Inflation Factor
VRSTE	Variable Return to Scale Technical Efficiency
WOCCU	World Credit Council of Credit Union

ABSTRACT

The deposits taking Savings and Credit Cooperative Societies (DTS) have continued to play a critical role in Kenya's financial sector in terms of access, savings mobilization and wealth creation. According to the Kenya's economic blueprint Vision 2030, is a key player to achieving the 10% annual economic growth target. Given the importance of the sector in economic growth, there has been considerable interest in their efficiency. In Kenya, DTS have been reported to have low efficiency, with the average efficiency being less than one against a general expectation of an efficiency level of one. There is limited empirical literature to explain the inefficiency of DTS in Kenya. In view of this, the study sought to establish the effect of financial soundness on efficiency. The specific objectives of the study were: to determine the effect of asset quality, capital adequacy, liquidity and earnings rating on efficiency of DTS. The study further sought to establish the moderating effect of size of DTS on the relationship between financial soundness and efficiency. The study was anchored on Buffer Capital Theory, Economic Efficiency Theory, Asymmetric Information Theory, Modern Portfolio Theory and Shiftability Theory of Liquidity. The study adopted positivist philosophy and explanatory research design. The target population comprised 110 DTS as per SASRA report for the year 2017.The study used secondary data that was collected from the audited financial statements for the period 2012-2016.Data was collected using a document review guide. Data Envelopment Analysis methodology was used to generate efficiency scores. Both descriptive analysis which included mean and standard deviation and inferential statistics which included panel Tobit regression was done and was aided by stata version 11.Tests conducted include: normality, heteroskedasticity, multicollinearity, autocorrelation, stationarity and model specification tests. Issues relating to the ethical conduct of research were upheld, ensuring that permission was sought from relevant authorities before collecting data. The study findings were as follows: DTS have not achieved efficiency however, the efficiency level on average has increased over the study period. Further, the descriptive analysis indicates that the mean of capital adequacy and liquidity is above the required minimum by the regulator. The mean of asset quality is above the required maximum by the regulator. In addition, the correlation analysis indicates that asset quality, earning rating and liquidity have a weak negative relationship with efficiency while capital adequacy has a weak positive relationship with efficiency. Lastly, asset quality, capital adequacy and liquidity had a statistically significant effect on efficiency while earning rating had an insignificant effect on efficiency. Size of DTS was found to have a statistically significant moderating effect on the relationship between financial soundness and efficiency. The study concluded that: DTS are inefficient; increase in asset quality improves efficiency; holding more liquid assets decreases efficiency; the more stringent DTS regulations on capital adequacy the more efficient they are. The study contributes to: Finance Theory, methodology, and empirical literature. The study recommends that: DTS should adopt more robust ICT platforms which facilitates members' access the core services; DTS should develop credit administration strategies that reduce the amount of non-performing loans; a merger policy for the DTS should be developed so as to encourage the smallest DTS to merge in order to increase their economies of scale hence resulting to improved efficiency. Limitations highlighted include: lack of enough empirical evidence in Kenya; lack of uniform classification of accounting items.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

To maximize shareholders' value, all profit making enterprises seek to be efficient. Notwithstanding that Deposit taking Savings and credit cooperative (DTS) societies while not being purely profit making businesses, they seek to maximize the economic wellbeing of their members. They do so mostly through provision of loans for provident and development purposes (Ochola, 2016). DTS are also keen to pay interest on members' deposits as well as dividends on shares; hence their efficiency becomes a key issue. Society's welfare and the economic growth slows down if DTS operate with waste and inefficiency (Adegbaju & Olokoyo, 2008). According to Beck and Polit (2003), DTS that are efficient in resource generation and allocation contributes more to productivity and economic growth.

From both micro and macro level, it is vital to study efficiency of financial institutions. According to Pessarossi and Weill (2013), the issue of inefficient financial system is critical from the microeconomic perspective. This is due to the developments in the supervisory, institutional and regulatory framework and growing competition. From the macroeconomic perspective, the stability of financial market is influenced by efficiency as well as the cost of financial intermediation (Berger & Mester 1997). Efficiency entails how well a DTS is allocating inputs to produce maximum output (Bassem,2008). Knowledge about efficiency is key in assessing continuity of financial services (Burki & Niazi, 2010).

Given that DTS work mainly with high risk and poor clients, it is vital to know their efficiency in order to ensure effective management and responsive policy decisions. During intermediation process efficient DTS are expected to mobilize savings and provide loans to members by decreasing unnecessary expenditures (Marwa & Aziakpono, 2014).In particular, DTS particularly have continued to play an indispensable role in financial intermediation; they have continuously grown to compete with commercial banks. DTS differ from commercial banks in two key ways. First, they seek to collect savings to provide loans to members; on their part commercial banks seek to maximize shareholder's wealth (Owen, 2007). Secondly, the owners of DTS are the customers; customers are predominantly non-owners in commercial banks.

Financial soundness describes the situation where the financial intermediation process functions efficiently, thus building confidence among users (Roman & Sargu ,2013). According to Hagendorff and Nieto (2013), financial soundness is achieved if the financial intermediation processes among households, government and firms supported by a myriad of financial infrastructure is operating smoothly through a variety of financial institutions. In an economy a sound financial system inspires economic growth. This is due to its facilitation of the exchange of value (Swamy,2017). Financial soundness is prioritized over financial growth by many countries because of the fluctuation in the global financial system. Financial growth has been observed to be unsustainable over long periods of time (Schneider, 2008).

Many countries strengthen financial regulations in order to achieve efficiency. From the global financial crisis that began in 2017, it is evident that financial systems can destabilize

and trigger crisis if they are not regulated effectively (Spratt, 2013). According to Stein (2011), sound DTS can withstand shocks and mitigate the chance of failure to apportion savings to profitable investments due to interruptions in the financial intermediation process. Financial soundness indicators include asset quality, capital adequacy, liquidity and earning rating (SASRA, 2015).Various empirical works have documented contradicting results on the effects of financial soundness and efficiency of financial institutions. For instance, Odunga, Nyangweso and Nkobe (2013), contend that the bank operating efficiency is positively and significantly affected by liquid assets ratio and total capital ratio. More liquid, efficient and less risky financial systems are those that produce more liquid capital than others (Gorton & Huang, 2002).

Kashyap, Rajan and Stein (2002), suggested that loan commitments can be created as assets off the balance sheet by financial institutions. Harley (2011), equally states that investment policy, especially in assets for financial institutions, should be regulated in order to be more globally competitive efficient .Kariuki (2017) found that asset quality and financial intermediation efficiency has a positive relationship. Ng'etich and Wanjau (2011), contend that large amounts of non-performing loans (NPL) fail financial institutions. Accordingly, in the finance sector, the issue of NPL is an important issue that needs to be addressed.

Burki and Niazi (2010), suggest that a firm should have good asset quality for it to achieve higher profitability. This is by maintaining more earning assets to total assets. Moses and Umoren (2010) found that liquid asset to deposits ratio and total capital ratio positively affect operating efficiency. Ke, Li and Chiu (2011) established that the efficiency of financial

institutions is affected by core capital ratio, risk based capital ratio, capital adequacy ratios and equity to total asset ratio .Similarly, Fiordelisi, Marques-Ibanez and Molyneux, (2011) intimate that banks that have less capital are likely to incur moral hazard problems rendering them more inefficient than highly capitalized institutions.

The present study focused on DTS in Kenya. This context is exceptional because they have dominated the SACCO sector business claiming eighty one percent of the entire industry worth (WOCCU, 2014) .In the entire SACCO subsector in Kenya, the DTS account for seventy eight percent of the total assets and seventy seven percent of deposits. In addition, the most vibrant and largest SACCO sector in Africa is Kenya, commanding sixty seven percent of the total assets and sixty two percent of deposits/savings (Sang & Kimani 2016). According to Mohammed (2013), DTS are important players in ensuring that individuals and firms are able to mobilize savings for personal development and investments as recognized by Vision 2030 and Kenya's national development blueprint.

1.1.1 Efficiency

Efficiency is the ratio of actual output to maximum potential output obtainable from a given input level (Marwa & Aziakpono, 2014). Efficiency indicates how well an organization utilizes its resources to produce goods and services (Coelli, Rao, O'Donnell & Battese, 2005). Conceptualization of efficiency focuses on inputs, outputs and the rate at which inputs are used to produce the output. Efficiency is improved when fewer inputs are used to produce same amount of outputs or when a fewer or same input produces more outputs of a given quality. If an economic system can use less resources to generate more goods and services

then it is said to be more efficient. According to Pi and Timme (1993) efficient firms are able to offer quality services to the customers. They therefore attract more deposits, leading to improved profitability as well as increased the levels of capital. This enables the firm to absorb risks hence attain greater safety. The most important aspect of running a business is how well it is being run (Carr, 2004).

An efficient business will show increased profitability with less input of resources. Any company will be out of business if it does not operate efficiently. As such, therefore, in order to remain on the cutting edge in a very competitive environment, a business must be efficient (Kariuki,2017).There are considerable debates about what constitutes input and output of financial industry. Berger, Hasan and Zhou (2009) suggest that to analyze efficiency at the bank level the intermediation approach is best suited. However, to determine the efficiency at the branch level, the production approach is appropriate. This is because the main task of management at the branch level is not only to reduce interest expenses on deposits but also reduce total costs. The branch lacks control on financing and investment decisions; it only deals with a large number of customer service processing (Tesfay & Tesfay 2013).

Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA) are the most commonly used methods for measuring efficiency (Marwa & Aziapono 2014; Soboh *et al*., 2010 Fried *et al* ., 1993). Each of this methodology has its own weakness and strength and there is no method which is superior than the other (Coelli *et al*., 2005;Mula,2011).The nature of the data and the context determines the method to be used. If the data set is small non-parametric approach is preffered. In addition, DEA is appropriate when there are

multiple input and outputs. If there are less inputs and outputs and the data set is large SFA is used. Various studies on efficiency of financial institutions have been carried out in various countries and contexts using DEA e.g Taylor *et al*., 2001, Brocket *et al*.,1997, Kas & Liv, 2004 Muller, 2011.The latter have used DEA to measure efficiency. The present study used DEA model because of the nature of the data and the context of the study.

The DEA model developed by Charnes, Cooper and Rhodes (CCR) (1978) and the model developed by Banker Charnes and Cooper (BCC) (1984) are used in this study. BCC and CCR are similar except that BCC does not accommodate variable return to scale and to solve this problem the model includes additional constraints. DEA has a limitation of generating efficiency scores with an upward bias. To solve this problem this study adopted a bootstrap approach proposed by Simar and Wilson (2000).DEA requires specification of inputs and outputs to be made. This decision is key in efficiency modeling. When specifying the inputs and outputs there are three major methods that are used: production, intermediation and asset approach (Nghiem, 2004; Qayyum & Ahmad, 2006; Moffat, 2008).

Financial institutions are producers of deposits and loan under the production approach (Ikpefan, 2013). The number of employees and capital expenditures are important inputs in this approach. Financial institutions are viewed as intermediaries in the intermediation approach ;they facilitate savers to transfer financial assets to the investors (Berger & Bonaccorsi 2006).The inputs in the intermediation approach comprises of labour, capital cost and interest payable on deposits; outputs include loans and financial investments. In the asset approach, the value of assets is considered as output and creation of credit, constituting

the basic function of any financial institution (Pessarossi & Weill 2013). The choice of inputs and outputs differs depending on the approach adopted (Moffat, 2008; Drake & Hall, 2003).Intermediation approach closely matches the main objective of the DTS that is mobilization of Savings and offering Loans.

In the selection of inputs and outputs, this study used the intermediation approach. This is because DTS are treated as financial intermediaries between the savers and borrowers. They seek to maximize the output that is total loans and other incomes given the input level which is savings and total expenses such that, efficiency equals output over the input. There are two orientations that are very important; the input orientation which is appropriate for policies that have an objective of cost minimization; the output orientation is appropriate for policies that focus on profit maximization (Cooper, Seiford & Zhu, 2011). When choosing the orientation the focus should be on the quantities of inputs and outputs that managers are able to control (Coelli *et al*., 2005).In the present study, managers are able to control the inputs than the outputs which are subject to external market forces. Therefore, this study adopted input orientation.

DTS in Kenya have been reported to have low efficiency. Mwangi (2014) observed that the average efficiency score was 0.775 for the period 2009-2013. Ochola (2016) research findings indicate that the average efficiency score in Kenya was 0.683 for the period 2011-2013. Kariuki (2017) found that industry efficiency score in Kenya was 0.677 for the period 2011-2014 which indicates inefficiency. This is an indication that there was declining efficiency among DTS in Kenya.

1.1.2 Financial Soundness

Financial soundness has been defined as the health or condition of a DTS either individually or as a group (SASRA, 2015). Lindgren, Garua and Saal (1996) defined a sound financial system as one in which DTS have a positive net worth; they are profitable hence they are able to withstand unfavourable events. DTS with a negative networth will be fragile and susceptible to failure, exposing members to losses. The importance of financial soundness in a country is economic development and widely recognized in literature and championed by authors such as Ross, Levne and Capro (2001), the authors contend that weak financial systems can inhibit economic development whereas strong financial systems enhance the achievement of economic growth. In 2012 SACCO Society's Regulation Authority (SASRA) adopted and used a CAEL (Asset quality, Capital adequacy, Liquidity and Earnings rating) model; to monitor the financial soundness of the DTS-SACCOs. The soundness of DTS remains a key regulatory focus of SASRA.

Asset quality indicates the risk exposure from loans granted by a financial institution (Dardac & Barbu, 2005). According to Grier (2007), the major cause of failure in financial institutions failure is poor asset quality. In the financial sector, asset quality is considered extremely important. There are twenty-five core principles according to the Basle Committee on banking supervision which regulators of the banking industry use. Out of these, seven are tailored towards addressing the asset quality and credit risk management of the institution (Pan, 2010). Therefore, the financial supervisory authorities worldwide are concerned with

the asset quality of financial institutions because it is one of the key areas in establishing the overall condition of the financial institutions (Ochola, 2016).

A sizeable amount of non-performing loans (NPL) must exist before a financial institution can be declared bankrupt, hence asset quality is a key issue in financial sector (Cole & Wu, 2009). The primary factor affecting overall asset quality is the loan portfolio and the credit administration program (De Bock & Demyanets, 2012). According to Mishkin (2006), a financial institution's rating downgrades and it becomes difficult to earn depositors' trust as a result of bad asset quality. Therefore, such institution can only get more deposits by rewarding depositors or attaching a higher deposit rate on deposits.

Capital adequacy is the level of capital necessary for DTS society as determined by the regulatory and supervisory authorities to assume the financial health and soundness (Onoh, 2002). Capital adequacy is the measure of the solvency; it determines whether DTS has enough capital to support the risks in its balance sheet. There is need to balance the capital levels;too much capital decreases profitability and wasting of cash whereas bankruptcy occurs because of inadequate capital (Chakraborty, 2010). For the owners to enjoy all future earnings, they must contribute capital (paid-up share capital). In addition, such capital is able to support the operations of the business (Ongore & Kusa, 2013). The regulatory authorities have bail out measures to keep the financial system sound in case of financial crisis; hence, the level of capital of a financial institution is very crucial (Ningi & Dutse, 2008).

Capital plays a key role in maintaining safety and solidarity. It represents the buffer gate against unexpected loss the institution might face and spill over to depositors' funds (Moh'd-Al-Tamimi & Obeidat, 2013). This is because financial institutions operate in a highly uncertain environment, exposed to various risks. Though capital adequacy framework under the BASEL Accord is primarily meant for commercial banks, there is a concerted effort to emulate the same in DTS (Seccareccia, 2012). As a result of the 2007-2009 financial crises, the regulators of financial institutions have continuously monitored and tightened the capital requirement. When measuring the soundness of a particular institution, capital is a key factor to be considered (Osei-Assibey & Asenso, 2015). Gudmundsson, Ngoka-kisinguh and Odongo (2013) posit that stronger financial institutions are likely to endure financial turmoil hence increase financial sector soundness. As such, hence there is need for hastened build-up of capital.

DTS are required to maintain minimum core capital of Kshs 10 million, core capital to total assets of 10 percent and core capital to total deposits of 8 percent by the regulatory framework (SASRA, 2016).Odunga, Nyangweso and Nkobe (2013) concluded that financial institutions with more capital resources and operating efficiently were capable of protecting the institution from financial shocks in the financial markets. Capital adequacy ratio is used to measure the capability of DTS to get finance for growth and mitigate risk as a result of the operations (Kamau,2011). Capital adequacy is determined by capital asset ratio; it is a requisite for institutions' effective operation, a function of the deposits and capital funds (Okafor, Ikechukwu & Adebimpe, 2010).

Earning rating is the rate of return on funds invested (Kheeche, 2011). It indicates the ability of management to employ resources efficiently in order to create value for the owners and to sustain the DTS (Quin & Pastroy, 2012). A financial institution is said to be viable if it is able to earn consistent return on assets; as a result, it remains competitive and are able to fund expansions (Barus, Muturi & Koima 2017). Several studies (Wheelock & Wilson 2000; Lanne & Vennet 2006) established a negative relationship between earnings and financial soundness. Constant earnings enable a firm to make sufficiently provide for NPL, absorb loan losses and build public confidence (Dang, 2011). Viability of DTS is measured by its ability to fund expansion and remain competitive by earning appropriate return on its assets.

Liquidity refers to the ability of DT to fulfill its obligations mainly to the depositors (Dang, 2011). It is the ability of a business entity to honour all cash payment commitments as they fall due (Kimathi, 2014). According to Njeru (2016), DTS that manage their liquidity well are able to repay the funds that they have borrowed externally, meet the demand of loans from members, manage operating expenses and provide share and saving withdrawals to members on time. In the new rules for DTS they are obligated to maintain at least not less than 15% of total assets in liquid form. World Council of Credit Unions (WOCCU) recommends a maximum liquidity ratio of 5% .The In order to achieve this DTS are required not to declare dividends or to reduce amount of dividends to be paid if they have to achieve these ratios. Liquidity is essential because it enables DTS to have funds that they can use for expansion, cater for the fluctuations in the balance sheet and meet customer withdrawals (Njeri, 2014). According to Ahmed and Bashir (2013), liquidity is an important determinant of financial performance because firms which are more liquid are likely to realize better

financial performance than firms with liquidity problems. Anupam (2012), opines that firm liquidity is not significant in influencing firm performance

1.1.3 Size of DTS

Size of DTS is defined in terms of total assets, sales revenue or turnover (Zhang, Cheng & Hervie 2013). It reflects how large an enterprise is in infrastructure and employment terms (Kisengo & Kombo, 2014). The size is one of the major drivers of operational costs. One of the most influential characteristics in organizational studies is size. Nag, Hambrick and Chen (2007) contend that size has a relationship to industry sunk costs, concentration, vertical integration and overall industry profitability (Dean *et al.*, 2000). Small DTS are more likely to have less layers of management, few number of departments, limited specialization of skills and functions, less centralization and less bureaucracy than larger DTS.

Kisengo and Kipchumba (2013) pointed out that large microfinances are more productive in terms of average cost per borrower ;they also have better write-off ratios. The authors further found that bigger microfinances enjoy the economies of scale as a result they are more efficient than the smaller ones. Similarly, larger firms have higher ROA, ROE and operational self-sufficiency (Usman & Zahid, 2011).

Sinani *et al*., (2007) indicates that size displays higher levels of financial performance. This finding contradicts Badunenko and Stephan (2004) findings who indicated that size does not have influence on financial performance. Larger firms are able to raise finance at a lower cost because they have a better access to capital markets allowing them to pay higher returns to shareholders (Holder *et al.*,1998).Small firms are unable to grow because they face problems

of accessing finance and have a difficulty competing with large firms in the market. The current study measured size using the total assets.

1.1.4 Deposit Taking SACCOs in Kenya

The first ever co-operative movement was started by Robert Owen in the year 1844. According to Co-operative Bank of Kenya (1993), the co-operative movement in Kenya can be traced back to 1908 when the European farmers at Lumbwa, near Kericho, first established co-operative production and marketing (Bwana & Mwakujonga, 2013).In recent years, the sector has faced tough challenges globally as noted by Kivuvo and Olweny, (2014) to include mission drifts, income generation, compliance, competition and insufficient capital among others. The sector's financial soundness impacts broadly on the nation's economic growth and employment creation. Kenya has the largest and the most vibrant sub-sector in the continent commanding sixty seven percent and sixty two percent of the total assets and deposits/savings respectively (SASRA, 2016).

SASRA (2015) reports an increase in the number of DTS that met the minimum licensing requirements at the end of the transition period given by SASRA. By the end of June 2014, out of eighty that were expected to attain the required minimum requirements for licensing, only forty nine managed to attain (Barus 2017). The remaining thirty one did not attain the minimum requirements. Therefore, the regulator directed them to stop deposit taking business and revert to non-deposit business. In addition, the sector under study recorded an increase in total assets by seventeen percent which was funded by the deposits from members which increased by twelve percent which is attributed to growth in number of members which increased by fifteen percent (Kariuki,2017).

Deposit taking savings and credit cooperative societies play a vital role in Kenya's financial sector in terms of access, savings mobilization and wealth creation. According to the Kenya's economic blueprint Vision 2030, the sector under study is an important player to achieving the 10% annual economic growth target (SASRA, 2016). SACCOS contributes to over forty five percent of the nation's Gross Domestic Product (Njagi *et al.,* 2013). The DTS are actually observed to be controlling more than seventy eight percent of the total deposits and assets of the industry (IMF, 2014).

Hence, it is unrealistic to disregard the integral role that DTS play in providing financial services to their members. According to Owen (2007), DTS are a big contributor to the Kenyan economy; they are also a major player in the financial market as providers of loans. According to Marwa and Aziakpono (2015), the primary role of DTS in the financial market is financial inclusion and the provision of loan facilities to low income earners who do not meet the credit criteria set forth by commercial banks, especially with regard to collateral.

1.2 Statement of the Problem

Efficiency is important to members of DTS; efficient DTS offer better quality services, better loan and deposit rates and have lower service charges (Limam, 2001). Efficiency is also important for promoting access to financial services as well as soundness of the DTS as an integral component of the financial system (Kamau, 2011; Nasieku, 2014). Given that there is increase in competition in the industry, there has been considerable interest in their efficiency. DTS in Kenya have reportedly registered low efficiency. Mwangi (2014) found that the average efficiency score was 0.775 for the period 2009-2013. Ochola (2016)

indicated that the average efficiency score in Kenya was 0.683 for the period 2011-2013. Kariuki (2017) observed that the industry efficiency score in Kenya was 0.677 for the period 2011-2014,an indicator of inefficiency. From the statistics of efficiency it is evident that there is declining efficiency of DTS in Kenya. In view of the above, there is limited empirical literature to explain the declining efficiency among DTS in Kenya. Therefore, this study sought to establish the effect of financial soundness on efficiency.

Despite the significant role of DTS in the Kenyan economy, the relationship between financial soundness and efficiency have received little scholarly attention, creating knowledge gaps. For instance, Pessarossi and Weill (2013) studied the effect of capital adequacy on efficiency of banks. The study findings were that capital adequacy had a significant positive relationship with efficiency. Similarly, Berger and Bonaccorsi di Patti (2006) sought to establish the relationship between capital adequacy ratios and efficiency of the US banking industry.They found that capital adequacy ratios had negative relationship on efficiency. Abdi Karim, Sok and Hassan (2010) investigated the relationship between NPL and efficiency of banks in Malaysia and Singapore and concluded that asset quality has a negative relationship with efficiency.

Burki and Niazi (2010) studied the impact of financial reforms on efficiency of state-owned, private and foreign banks in Pakistan. They found that NPL adversely affected efficiency. The study by Harris, Huerta and Ngo (2013) was based on the impact of troubled asset relief program on bank efficiency. The study findings attributed the decrease in the operating efficiency of troubled asset relief .Most of the aforementioned studies have reported mixed results; they are from developed countries and different contexts, hence their findings cannot

be generalized in Kenya, a developing country. Similarly, the studies did not focus on the relationship between financial soundness and efficiency in regulated SACCOS , hence the need to address the conceptual gap .

Other empirical literature focus on commercial banks. For instance, Odunga, Nyangweso, Carter and Mwarumba (2013) studied the relationship among credit risk, capital adequacy and operating efficiency of commercial banks in Kenya. The study found that capital ratios had a positive and significant effect on efficiency of banks. Khalid (2012) analyzed the effect of assets quality on financial performance of commercial banks in India and found that asset quality and profitability were negatively related. The foregoing studies have focused on performance of commercial banks. However, this study focused on the efficiency of DTS hence bridging the contextual gap. Kariuki (2017) studied firm characteristics and financial intermediation efficiency of DTS in Kenya. The study found an insignificant relationship between capital adequacy and liquidity; it found that asset quality has a positive relationship between financial intermediation efficiency. Kariuki ,2017 study used the multiple regression, which is inappropriate to the study since the dependent variable was censored between a value of 0 and 1. The current study used Panel Tobit regression hence bridging the methodological gap.

In view of the gaps documented in the preceding paragraphs and the importance of these institutions in the economic development, there remain unresolved issues on the relationships between the study variables in context of DTS in Kenya. Consequently, this study sought to

fill the existing gap and establish the moderating effect of size on relationship between financial soundness and efficiency of DTS in Kenya.

1.3 Objective of the Study

The study sought to achieve the general and specific objectives captured hereunder.

1.3.1 General Objective

The general objective of the study was to establish the effect of financial soundness on Efficiency of Deposit Taking SACCOs in Kenya.

1.3.2 Specific Objectives

The specific objectives of the study were:

i. To establish the effect of asset quality on efficiency of Deposit Taking SACCOs in Kenya.
ii. To determine the effect of capital adequacy on efficiency of Deposit Taking SACCOs in Kenya.
iii. To establish the effect of liquidity on efficiency of Deposit Taking SACCOs in Kenya.
iv. To determine the effect of earnings rating on efficiency of Deposit Taking SACCOs in Kenya.
v. To establish the moderating effect of size of a DTS on the relationship between financial soundness and efficiency of Deposit Taking SACCOs in Kenya.

1.4 Research Hypotheses

The study sought to test the following null hypotheses:

H_{01}: Asset quality does not have a significant effect on efficiency of Deposit Taking SACCOs in Kenya.

H_{02}: Capital adequacy does not have a significant effect on efficiency of Deposit Taking SACCOs in Kenya.

H_{03}: Liquidity does not have a significant effect on efficiency of Deposit Taking SACCOs in Kenya.

H_{04}: Earnings rating does not have a significant effect on efficiency of Deposit Taking SACCOs in Kenya.

H_{05}: Size of DTS does not have a significant moderating effect on the relationship between financial soundness and efficiency of Deposit Taking SACCOs in Kenya

1.5 Significance of the Study

The findings of the study are of significance to various parties. The findings provide necessary information to the DTS societies and other stakeholders for purposes of meeting their current and long-term regulatory demands. In the Kenyan economy the cooperative sector supports directly or indirectly over sixty percent of the nation's population. In addition, it contributes to over 31% of the national savings and over 40% of the Gross Domestic product supporting. Managers and stakeholders in DTS societies are informed on

the relationship between financial soundness and efficiency. This goes a long ways in formulation of strategies to enhance their firm performance.

The findings of the study are of significance in policy making process. Stakeholders such as SASRA and other concerned bodies may adopt the findings of this study to formulate policies that enhance the contribution of deposit taking SACCOs to the economy. The findings provide insights on the relationship between financial soundness and efficiency. Finally in theory building, this study is important in expounding the theories that were used to explain the relationship between financial soundness and efficiency. The study will also provide references for scholars who will use the findings of this study as a basis for future studies.

1.6 Scope of the Study

The study focused on DTS in Kenya registered by SASRA and published on the SASRA website. The general objective of the study was to determine the effect of financial soundness on efficiency of DTS in Kenya. The study specifically focused on the effects on asset quality, capital adequacy, earnings rating and liquidity on efficiency. The DTS under study were one hundred and ten. This were the ones whose data was available for the period under review. The time scope was five year period (year 2012 to 2016) which coincides with the period when the SASRA prudential regulations were implemented.

1.7 Organization of the Study

The thesis was organized into five chapters: Chapter One covers the background to the study, statement of the problem, objectives of the study, research hypotheses, significance of the

study, scope of the study and organization of the study. Chapter Two dealt with theoretical and empirical literature review on the research topic, summary of the literature and research gaps and the conceptual framework; Chapter Three describes the research philosophy, research design, empirical model, target population, data collection and analysis, diagnostic tests and ethical consideration. Chapter Four discusses the findings and subsequent interpretations. Chapter Five summarizes the entire study; it makes conclusions of each objective and derives policy recommendation for the study findings. Finally, it documents the areas for future research and the limitations encountered in the course of study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The present chapter reviews various literature in view of the study variables. This chapter explores theories underpinning the study in order to place the research into its proper perspective. It also examines theoretical orientations vis-a vis empirical data with a view to identifying the possible gaps. A review of empirical literature on asset quality, capital adequacy and efficiency is also conducted and gaps identified. The chapter further presents several research gaps from empirical literature and a brief of how the study intends to fill such gaps. Finally, the chapter presents a conceptual framework relating the research variables.

2.2 Theoretical Literature

A theory is a statement which is supported by evidence meant to explain some phenomenon (Saunders *et al*., 2007). Theoretical foundation of the study guides the thinking of the study. The study is guided by the following theories: Buffer Capital Theory (BCT), Information Asymmetry Theory (IAT), Modern Portfolio Theory (MPT), Shiftability Theory of Liquidity (STL) and Economic Efficiency Theory (EET).

2.2.1 Buffer Capital Theory

Buffer Capital Theory (BCT) is attributed to Calem and Rob (1999). The theory predicts that a financial institution increase capital as they approach the minimum requirement by the regulator. They do so in order to reduce risk and avoid the regulatory costs that stream from

the of breach of the capital requirements. According to Ochei (2013), in order for poorly capitalized financial institutions to increase their capital, they are likely risk anticipating higher returns; this helps them increase capital .BCT predicts that DTS maintains a level of capital above the required minimum to avoid falling below the required minimum. According to Lotto (2017), there are various costs (implicit and explicit) incurred by the DTS as a result of maintaining capital below the required minimum. Kleff and Weber (2008) contend that if capital falls below the minimum, the DTS tend to take more risk .This increases the demand for insurance, this are the implicit cost of regulation. Penalties and restrictions enforced by the regulator as a result of breach of regulation requirements are the explicit costs of regulation (Jokipii & Milne, 2011).

Based on the argument of BCT, DTS with high capital adequacy ratio would be more efficient compared to those with low capital adequacy (Ochei, 2013). Lower capital adequacy increases risk taking that may also increase expenditures. Adequately capitalized DTS have the capacity to absorb risks; they increase the operating costs that sustain efficiency. According to Berger and De Young (1997), efficient financial institutions are better at managing their credit risk. In order for financial institutions to reduce the costs of financial distress, they are required to cushion themselves against portfolio risk by maintaining high equity capital ratios (Rime, 2001).

According to Jeitschko and Jeung (2005),intimate that the degree of DT capitalization depends on the short run relationship between capital buffer and risk. Prudential regulations issued by SASRA prescribe the minimum amount of capital that should be held by DTS.

BCT theory therefore underpins the study by explaining why individual DTS may decide to hold more capital than the prescribed minimum capital. Surplus capital leads to reduction of costs. This would attract which could result in penalties in case of breach of regulatory requirement.

2.2.2 Asymmetric Information Theory

The proponents of Asymmetric Information Theory (AIT) are Akerlof 1970; Spence 1973; Rothschild and stiglitz 1976. The theory explains that in an economic transaction,the party that has more information on the specific product to be transacted is in a position to negotiate optimal terms for the transaction than the other party (Auronen, 2003). According to Wangai (2004), a right or a wrong decision concerning a transaction can be made by the party that knows less about the same specific item to be transacted. In a lending transaction, asymmetry information makes it difficult to differentiate between a good and a bad borrower (Bofondi and Gobbi, 2003), hence leading to accumulation of NPL as a result of adverse selection and moral hazard (Ochola, 2016). Adverse selection problem can be reduced through information sharing, whereby DTS share credit information of applicants with other financial institutions.

Moral hazard refers to the risk in which a party to a transaction provides misleading information about its assets liabilities or credit capacity (Wangai, 2014).Moral hazard occurs when a borrower takes unusual risk in order to gather profits (Mishkin & Eakins, 2006). DTS with low capital may respond to moral hazard by increasing the riskiness in the loan portfolio resulting in turn to NPL. This theory underpins the study because it explains the relationship

between asset quality and efficiency. The DTS with high NPL spends more resources in collecting NPL. The net effect is increased operating costs, hence decreasing efficiency.

2.2.3 Economic Efficiency Theory

The Economic Efficiency Theory (EET) is attributed to Debreu (1951). It states that firms ought to use the lowest cost possible per unit in order to achieve their output. Fixed costs are shared out among the number of units produced, while the variable costs are relative. In a business, there is a combination of fixed and variable costs and the fixed costs are always shared out across small number of units, leading to low levels of output which are inefficient (Leibenstein, 1978). Economies of scale can be enjoyed above optimal production. However, since the existing system is overworked, the additional costs is offset by the benefits. Maximum operational efficiency is achieved in the short run if all available economies of scale are exploited at the level of output ; inefficiency is not achieved in the short run, when the existing systems are overstrained by diseconomies of scale (Murillo-Zamorano, 2004). However, in the long run, the efficiency can be raised by increasing the capacity of existing systems (Teece, 1982).

Tripe (2003) contends that with less than proportionate increases in quantities of inputs, increased volumes of output should be produced. This means that with less input, more output is achieved ; this improves the firm's efficiency. Because economies of scale will be exhausted in due course, then, increased output requires a more than proportionate increases in outputs, this would lead to diseconomies of scale (Nadiri, 1970). Economies of scale form another type of efficiency. Here, firms should be able to produce multiple outputs from the

same group of inputs at lower costs than if they specialized in producing only one type of output (Alchian & Demsetz, 1972. This theory was applicable in this study by underscoring the importance of the principle of economies of scale in efficiency measurement.

2.2.4 Modern Portfolio Theory

The modern portfolio theory (MPT) is attributed to Harry Markowitz (1952). MPT allows investors to analyze their returns vis-a vis risk. The capital asset pricing model (CAPM) was developed one decade later based on his work. To describe the risks and returns of portfolios, the results of CAPM (and its extended versions) are widely used, also in measuring performance (Schulmerich, Leporcher & Eu, 2015). This theory of investment emphasizes on minimization of risk by combining various proportions of several assets or maximize expected return from a given level of portfolio risk (Elton, Gruber, Brown & Goetzmann, 2009).The theory encourages investors to diversify their assets in order to hedge against unsystematic risk (Shipway, 2009).

This theory focuses on choosing a combination of assets which has lower risk compared to an individual asset. In investment, this concept is referred to as diversification (Rani, 2012). The likelihood of this can be seen automatically since dissimilar kinds of assets frequently change in value in opposite ways. Through diversification, risk is lowered, even if the return of assets is not negatively correlated (Nzongang & Atemnkeng 2006).According to MPT theory combining assets whose returns are not perfectly positively correlated leads to reduction of the total variance of the portfolio. The main assumptions of the theory are that investors are rational and markets are efficient (Pfaff, 2012). The fundamental concept of

MPT that makes it relevant to this study is that when selecting assets in an investment portfolio, it is vital to study how the price of each asset changes, compared to how the prices of every other assets in the portfolio changes in price (Omisore, Yusuf & Christopher, 2011). DTS should consider diversifying their investment portfolio so as to optimize unsystematic risk. This theory underpins this study because the concept of revenue diversification follows the concept of portfolio theory. When DTS diversify their investments, they stabilize hence their income become less volatile income which improves efficiency.

2.2.5 Shiftability Theory of Liquidity

Shiftability Theory of Liquidity (STL) was developed by Moulton in 1915. It holds that that financial institutions can effectively cushion themselves against massive deposit withdrawal as a form of liquidity reserve. They can do this by investing in credit instruments at the secondary market which includes treasury bills and commercial papers. These instruments are marketable because of their short term maturity (Osoro, 2016).The liquidity of a DTS depends on its ability to shift its assets to another person without incurring any loss when the liquidity need arises (Casu, Girardone &Malyneux 2006).

Moulton (1915) specified that to attain minimum reserves, a financial institution should maintain assets that can easily be shifted to other financial institutions when necessary without material loss. In case of liquidity crisis, financial institutions should maintain liquidity by possessing assets that can easily be shifted (Bibow, 2005). This theory underpins the study by encouraging DTS to hold short term securities. The reason is that they are liquid and can easily be converted into cash. The cash can be used to cushion the DTS against

operating risk hence, improving the efficiency. Odunga *et al.,* (2013) asserts that more liquid financial institutions are more efficient.

2.3 Empirical Review

The section reviews various studies that are related to study variables and study relationships.

2.3.1 Asset Quality and Efficiency

Karim, Sok and Hassan (2010) investigated the relationship between NPL and efficiency of banks in Malaysia and Singapore.This study focused on the cost efficiency and used the Stochastic Frontier Approach (SFA) to generate the efficiency scores. The study found that the banks in Singapore had high efficiency scores compared to the ones in Malaysia. However, the difference was not significant. In addition, the study found that the relationship between NPL and efficiency was negative and significant. This study used the SFA to generate the efficiency scores and only focused on one dimension of efficiency that is cost efficiency. The current study used DEA to generate the efficiency scores and focused on the technical efficiency.

Ochola (2016) studied the relationship between loans, deposits and advances and efficiency of SACCOS in Kenya. The study found that SACCOS in Kenya have not achieved efficiency. Further, loan and advances had a negative relationship with efficiency, and the relationship is statistically significant, indicating that an increase in loans and advances is obstructed efficiency. This study did not focus on indicators of financial soundness. Rather it

focused on the relationship between loans and efficiency. The current study investigated the effect of financial soundness on efficiency of DTS in Kenya.

Burki and Niazi (2010) assessed the relationship between financial reforms and efficiency of banks in Pakistan. The study sampled 40 banks and used panel data for the period 1991-2000. Further, to generate the efficiency scores, it used the DEA. To establish the relationship between banks related attributes and efficiency, Tobit Regression was used. The study found that size, asset quality and bank branches have a significant relationship. In addition, the study established that NPL had a negative relationship with bank efficiency. This study did not give the direction of the link between the study variables. The current study gave direction of the link between the study variables.

Kariuki (2017) evaluated the relationship between firm characteristics on financial intermediation efficiency of DTS societies in Kenya. The study period was 2011-2014 and the target population was 135 DTS. The study used DEA model in the first stage and Multiple Regression in the second stage. The study found that asset quality had a negative relationship with efficiency. This study used the Multiple Regression which is not appropriate to the study since the dependent variable was limited. The use of Tobit Regression is more accurate.

Nguyen and Vivien (2016) sought to establish the relationship between NPL and efficiency in the Nordic banking sector. In this study, the indicator of efficiency was ratio of non-interest income to net operating income. To test the four hypotheses as suggested by Berger

and De young (1997), the study used the Granger Causality Methodology (GCM).The only hypotheses that had evidence is the bad luck hypotheses. Therefore, the study concluded that the efficiency of banks decreases with increase in non-performing loan. This study used GMM and focused on the banking sector. The current study used DEA and Tobit Regression and focused on the DTS in Kenya.

Barus, Muturi, Kibati and Koima (2017) studied the relationship between asset quality and financial performance of SACCOS in Kenya. The study used return on assets (ROA) as a measure of financial performance. The study found that asset quality has a positive relationship with performance. In addition, the relationship was significant. This study used ROA as a measure of financial performance which was not an appropriate measure of financial performance. This was because the main objective of the SACCOs is not to maximize profits. The current study focused on efficiency as a measure of performance which is an appropriate measure of DTS performance since their main objective was not to make profit but to improve the welfare of the members.

Osoro and Muturi (2015) sought to determine the relationship between liquidity risk management practices and performance of SACCO in Kisii County, Kenya. The study used ROA to measure performance. The study found that asset quality had a negative and insignificant relationship with performance. This study used ROA as a measure of performance of SACCOs. This was not appropriate because the main objective of a DTS is not profit maximization. In addition, it focused on one indicator of financial soundness, that is liquidity. The current study focused on efficiency of DTS as a measure of performance.

Khalid (2012) investigated the relationship between asset quality and profitability of private banks in India. The study used ROA to measure profitability. Panel data for the period 2006-2007 to 2010-2011 was used. Multiple Regression models was used to analyze data. The study found that a bad asset ratio has a negative relationship with bank performance. This study focused on NPL and left out other measures of asset quality and also focused on commercial banks. The results of this study contradicts what Adeolu (2014) observed hence forming basis of the current study.

Adeolu (2014) studied the relationship between asset quality and performance of commercial banks in Nigeria. Multiple Regression was used to analyze data in order to establish the relationship between the study variables. Pearson Correlation was used to determine the strength of the relationship between the study variables. The study found that asset quality had a statistically strong positive relationship with bank performance. In addition, the findings indicated that there existed no relationship between bank loans and its profitability. This study contradicts Khalid (2012) whose findings were that asset quality had a negative relationship with profitability of banks.

Swamy (2012) assessed the determinants of bank asset quality and profitability of commercial banks. The study used panel data for period 1997-2009. Further, it used Multiple Regression to analyze data. The study found that capital adequacy and investment activity had a significant effect on efficiency whereas; asset quality had no significant effect on efficiency. This study failed to generate the efficiency scores and did not give the direction of the link between asset quality and performance.

Chimkono, Muturi and Njeru (2016) sought to establish the effect of NPL on performance of commercial banks in Malawi. Secondary data was utilized and panel data of period 2008-2014 was used. Census of all the licensed banks in Malawi was carried out. In addition, correlational design was used. Multiple Regression was used to analyze data. The study found that NPL ratio had a significant relationship with performance of banks in Malawi. This study focused on commercial banks in Malawi and evaluated only one measure of financial soundness. The current study focused on DTS in Kenya and increased and included other measures of financial soundness.

2.3.2 Capital Adequacy and Efficiency

Kariuki (2017) studied firm characteristics and financial intermediation efficiency DTS societies in Kenya. The study period was 2011-2014 and the target population was 135 DTS. The study used DEA model in the first stage and Multiple Regression in the second stage. The study found that capital adequacy had an insignificant relationship with efficiency. This study used the panel multiple regression which is not appropriate to the study since the dependent variable is censored. The current study used panel Tobit Regression which is appropriate because of the nature of the dependent variable.

Pessarossi and Weill (2013) sought to determine the effect of capital requirements on efficiency of banks in China. The study used panel data for period 2004-2009.This period was chosen because of the regulatory changes on capital requirements that took place. In addition, the study used DEA to generate efficiency scores in the first stage and Multiple

Regression in the second stage. The study found that the smaller banks were less efficient than the larger ones. Further it established that capital adequacy had a positive significant effect on efficiency, an indication that bank efficiency improved with capital requirements. This study used DEA in the first stage and Multiple Linear Regression in the second stage. This was viewed as not appropriate which is not appropriate because the dependent variable was censored. The current study used DEA in the first stage to generate efficiency scores and panel Tobit Regression in the second stage.

Fiordelisi, Marques-Ibanez and Molyneux (2011) studied the relation between bank efficiency, risk and capital ratios. The study used the Granger-Causality methodology (GCM) to establish the relationships between the cost efficiency, revenue efficiency and profit efficiency. In addition, the study focused on reverse causality .Findings indicated that higher capital ratios had a positive significant relationship on efficiency. This study used GCM dynamic model to examine reverse causality on efficiency. The current study focused on a forward causality and used DEA to generate the efficiency scores of the DTS in Kenya.

Berger and Bonaccorsi di Patti (2006) assessed the relationship between capital ratios and efficiency of banks in the US. Panel data for period 1990−1995 was used. This study used the parametric distribution-free approach. In addition, the study found that higher efficiency was affected negatively by high capital ratios. This study focused on profit efficiency, it fails to give the direction of the link between capital and efficiency. Further it contradicts the findings of Fiordelisi *et al*., (2011).The current study focused on technical efficiency and gives the direction of the link between capital adequacy and efficiency.

Kamau (2011) studied the relationship between intermediation efficiency and productivity of the banking sector in the post liberalization period in Kenya. The study used DEA to generate efficiency scores. The study found that banks in Kenya have not achieved efficiency. However their performance was better during the study period. In addition, the study found that efficiency had a positive relationship with capital adequacy, profitability and liquidity; size had a negative relationship with efficiency. This study focused on the banking sector ; the current study focused on DTS.

Kipruto,Wepukhulu and Osodo (2017) sought to establish the relationship between capital adequacy ratio and financial performance of commercial banks in Kenya. The target population was 14 banks and the data used was for period 2013-2016.Multiple Regression was used to analyze the data. The study found that capital adequacy has a relationship with efficiency and this relationship was positive and significant. This study focused on performance of commercial banks in Kenya and focused on financial performance but the current study focused on efficiency of DTS in Kenya.

Barus, Muturi, Kibati and Koima (2017) studied the effect of capital adequacy on the financial performance of SACCO societies in Kenya. The study used ROA as a measure of financial performance. The study found that capital adequacy positively influenced financial performance of SACCO societies in Kenya. The study by Barus *et al.,* (2017) used ROA as a measure of performance which is not an appropriate measure of financial performance since the main objective of the SACCOs is not to maximize profits. The current study focused on

efficiency as a measure of performance which is an appropriate measure of SACCO society performance since their main objective is not to make profit but to improve the welfare of the members.

Ikpefan (2013) sought to establish the relationship between capital adequacy, management and performance in the Nigerian commercial bank. Capital adequacy was measured by shareholders fund/total assets with efficiency measured by operating expenses. The study utilized secondary data both cross sectional and time series. Data analysis was done using the Multiple Regression Model. The study found that capital adequacy had a negative impact on performance while efficiency of management had a negative effect on return on capital. This study focused on efficiency of management, capital adequacy and performance of banks .The current study focused on financial soundness and efficiency .

2.3.3. Liquidity and Efficiency

Odunga, Nyangweso and Nkobe (2013) investigated the relationship between capital adequacy on operating efficiency of commercial banks in Kenya. The study used panel data for period 2005-2011 and did a census of all commercial banks in Kenya. Multiple Regression Model was used to analyze data. The findings of the study indicated that capital adequacy as measured by total capital ratio and liquidity as measured by liquid asset to deposits ratio has a positive relationship with operational efficiency. The study focused on commercial banks and did one stage analysis. The current study focused on DTS and did a two stage analysis using DEA and Panel Tobit regression.

Mukoswa (2014) studied the effect of liquidity on operating efficiency of banks in Kenya. Explanatory research design and panel data for period 2005-2011 was used. Data was analyzed using the multiple regression. The study found that liquidity has a significant effect on efficiency. This study did not give the direction of the relationship and it focused on commercial banks. The current study focused on DTS and gave direction of the relationship between liquidity and efficiency.

Sufian (2009) explored determinants of efficiency of banks in Malaysia. Panel data was used and DEA was used to generate the efficiency scores of individual banks. Multiple regression was used to regress the independent variables on the dependent variable. The study found that liquidity has a positive and significant relationship with efficiency. This study focused on the banking sector and used multiple regression in the second stage analysis which is not appropriate because the dependent variable is censored. The current study focused on financial soundness indicators and efficiency of DTS in Kenya and used Tobit Regression in the second stage of analysis.

Auguenaou, Lahrech and Bounekaya (2017), evaluated on CAMEL framework on bank efficiency as a measure of performance in Morocco. Secondary data was obtained from the individual banks financial statements and analyzed using regression model .Efficiency scores were generated using DEA. The study found that liquidity had a negative significant effect on efficiency ; earnings had a negative insignificant on efficiency. This study used Multiple Regression in the second stage of analysis. It is not appropriate since the dependent variable is limited. The current study used Tobit Regression in the second stage of analysis.

Muriithi and Waweru (2017), studied on the relationship between liquidity risk and financial performance of commercial banks in Kenya. The study adopted correlation research design, with a target population of 43 commercial banks. In order to establish the relationship between the study variables, Multiple Regression was used to analyze data .The study found that profitability of the banks was negatively affected by the increase in the liquidity gap. This study measured performance using ROA. The current study used efficiency as a measure of performance and focused on DTS

Njeru (2016) assessed the relationship between liquidity management and financial performance of DTS societies in Kenya. The target population for the study was thirty licensed DTS. Multiple linear regression model was used to analyze data. The study found a significant relationship between liquidity and performance of DTS in Kenya. The study measured performance using ROA. This is not appropriate because the main aim of the DTS is not profit maximization; it did not give the direction of the relationship. The current study used efficiency as a measure of performance and gave the direction of the relationship.

Nyambere (2013) sought to establish the effect of credit risk management on the financial performance of DTS in Kenya. Multiple regression model was used to establish the relationship among variables. The study found that that liquidity had a positive relationship with performance .ROE is an inappropriate measure of financial performance of SACCOs, as the objective of the institution is not to maximize profits.

2.3.4 Earnings and Efficiency

Kongiri (2012) studied the relationship between CAMEL variables and efficiency of commercial banks in Kenya. The target population was 43 licensed commercial banks. The efficiency was measured by interest expense over total income. Multiple Regression was used to analyze data. The study found that earnings and efficiency have a positive relationship. This study did not adopt a two stage analysis and it focused on commercial banks. The current study did a two stage analysis to determine the effect of financial soundness indicators and efficiency and focused on DTS.

Lotto (2018) sought to establish the relationship between earnings and efficiency of banks in Tanzania. The study period was 2009-2015.Multiple regression was used to analyze panel data. The study found that earnings and efficiency have a negative relationship while capital adequacy ratios has a positive relationship with efficiency. This study did not generate the efficiency scores before doing Regression. The current study did a two stage analysis by using DEA and Tobit Regression.

Barus, Muturi, Kibati and Koima (2017) assessed the effect of earnings ability on financial performance of SACCO societies in Kenya. The earnings ability was measured by earnings per share while the financial performance was measured by ROA. The study found that earnings ability has a positive relationship with financial performance of SACCOs. This study used earnings per share to measure earnings and the dependent variable was financial performance. The current study used ROA and ROE to measure earnings rating. ROA is an

inappropriate measure of financial performance of SACCOs since its objective is not to maximize profits.

Asima, Mahmood, Raheel and Arif (2017) studied the effect of financial variables on performance of banks in Pakistan. This study focused on the performance before and after 2008 financial crisis. Multiple Regression was used to analyze data. The study found that 2008 crisis had a significant influence on performance, and earning quality had a negative influence on bank performance. This study focused on banks in Pakistan while the current study focused on DTS in Kenya.

Austina Tortosa (2012) analyzed the relationship between earnings quality and performance of banks in Spain. The study found that earnings ability did not have a significant influence on profitability. This study used performance as the dependent variable. It also failed to give the direction of the link between the variables. The current study used efficiency as the dependent variable and gave the direction of the link between the variables.

2.3.5 Size of DTS and Efficiency

Tesfamariam,Tesfay and Tesfay (2013) studied the efficiency of SACCO societies in Ethiopia. The target population was 329 rural SACCOs which were operating in the year 2012. The study specifically focused on the relationship between size, geographical location and efficiency The study found that 18 of the institutions studied had an efficiency score of one which indicate that they were fully efficient. In addition, the remaining institutions had

an efficiency score of less than one this indicates that majority of the institutions under the study period were inefficient. Further, the study found that there was a difference in efficiency in terms of size and geographical location and this difference was significant. This study focused on the efficiency of rural SACCOS in Ethiopia and its relationship with size and geographical location and only studied one year period. The current study focused on all DTS in Kenya and establish the relationship between the financial soundness indicators having size as the moderating variable and used panel data.

Mwangi (2014) sought to establish the relationship between SACCOs characteristics and efficiency of SACCOs in Kenya. The member's income was used as a moderating variable and the conduct of SACCOS as an intervening variable. The study targeted 215 SACCOs and used cross- sectional data for period 2013. The study found that income of members moderates the relationship between characteristics and efficiency. In addition, size and age had a positive relationship on efficiency. Further, strength of bond association had a negative relationship with efficiency. This study used the Multiple Regression which is not appropriate since the dependent variable is limited, it used size as an independent variable and if used cross- sectional data. The current study used Tobit Regression in the second stage of analysis ,size was used as a moderating variable and used panel data.

Kaguri (2013) studied the relationship between firm characteristics and financial performance of commercial banks in Kenya. Panel data for period 2008-2012 was utilized. Firm characteristics were measured by size, diversification, leverage, liquidity and age) .Data was analyzed using regression model. The study found that all the measures of firm

characteristics had a positive relationship on performance. The correlation analysis indicated that all the variables had strong relationship with performance. This study used firm characteristics as an independent variable. The current study used size as a moderating variable.

Razmi, Sayyed Mohammed and Ali (2014) sought to establish the relationship between size and efficiency of firms listed at Tehran stock Exchange between 2007 and 2011 with a sample size of 75 firms. The study found that there was an inverse relationship between size and efficiency and the relationship was significant. The current study used size as a moderating variable and focused on DTS in Kenya.

2.4 Summary of Literature and Research Gaps

This section summarizes various empirical work in Table 2.1 below:

Table 2.1 Summary of Research Gaps

Author(s) and context	**Focus**	**Key Findings**	**Research Gaps**	**how the current study sought to address the gap**
Fiordelisi, Marques-Ibanez and Molyneux (2011) -Germany	Relation between bank efficiency, risk and capital ratios	Banks that are better capitalized are more efficient than those that are less capitalized	• Examined reverse causality from both efficiency to capital and capital to efficiency. • Failed to give the direction of the link between the variables.	• Examined one direction that is capital to efficiency. • Gave the direction of the link between the variables
Ocholla (2016) -Kenya	Efficiency of SACCO societies in Kenya	SACCOS in Kenya have not achieved efficiency and that loan and advances have a negative significant	• Focused on the relationship between loans and advances and efficiency. • Failed to give the	• Examined the relationship between the financial soundness and efficiency • The moderating effect

Author(s) and context	Focus	Key Findings	Research Gaps	how the current study sought to address the gap
		relationship with efficiency	relationship with other financial soundness indicators.	of size of a SACCO on the relationship between financial soundness and efficiency.
Sufian (2009) -Malaysia	Determinants of efficiency of banks in Malaysia	Liquidity has a positive significant relationship with efficiency	• Used multiple regression analysis in the second stage which is not appropriate because the dependent variable is limited. • Focused on commercial banks	• Used the Tobit Regression in the second stage which is appropriate since the dependent variable is limited. • Focused on the DTS
Odunga, Nyangweso and Nkobe (2015)	Relationship between liquidity and capital adequacy on operating efficiency	Capital adequacy positively affected efficiency and liquidity had insignificant effect	• Did not use DEA to generate efficiency scores and did not include other measures	• Included earnings and asset quality as other indicators of financial soundness.

Author(s) and context	**Focus**	**Key Findings**	**Research Gaps**	**how the current study sought to address the gap**
-Kenya	of commercial banks in Kenya	on operating efficiency	of financial soundness • Used DEA to generate efficiency scores	
Pessarossi and Weill (2013) -China	Effect of capital adequacy on efficiency of banks in China	The relationship between capital adequacy and efficiency was positive	• Used SFA to generate efficiency Scores • Focused on banks in China	• The current study used DEA to generate efficiency scores • Focused on DTS in Kenya
Ikpefan (2013) -Nigeria	Relationship between capital adequacy, management and performance in the Nigerian commercial bank (1986-2006).	Capital Adequacy ratio have negative impact on ROA	• Used shareholders fund to total assets to measure capital adequacy • Focused on direct relationship	• Used core capital to total assets and core capital to total deposits to measure capital adequacy • Included a moderating variable.
Khalid (2012) -India	Relationship between asset quality and	asset quality and profitability were	• Focused on commercial banks in	• Focused on deposit taking SACCOs in

Author(s) and context	**Focus**	**Key Findings**	**Research Gaps**	**how the current study sought to address the gap**
	profitability of private banks in India	negatively related	India. • Findings contradict the findings of Adeolu 2014. • Focused on direct relationship	Kenya • Included a moderating variable
Abd Karim, Sok and Hassan (2010) -Malaysia	Relationship between bank efficiency and NPL using evidence from Malaysia and Singapore	Higher NPL reduces cost efficiency	• Ignored other dimensions of efficiency • Used the SFA to generate efficiency scores	• Incorporated all dimensions of efficiency • Used DEA to generate efficiency scores
Chimkono, Muturi and Njeru (2016)	Effect of NPL on performance of Commercial Banks in Malawi	NPL ratio, cost efficiency ratios and average lending interest rate had a significant effect on the	• Ignored the direction of the relationship. • Focused on commercial banks in Malawi	• Gives the direction of the relationship • Focused on deposit taking SACCOs in Kenya.

Author(s) and context	**Focus**	**Key Findings**	**Research Gaps**	**how the current study sought to address the gap**
		performance of banks in Malawi		
Adeolu (2014)	Relationship between asset quality and performance of commercial banks in Nigeria	No relationship between loans and profitability	• The findings contradicts the findings of Khalid 2012 • Focused only on one indicator of financial soundness • Focused on direct relationship	• Incorporated other indicators of financial soundness • Included a moderating variable
Burki and Niazi (2010) -Pakistan	Relationship between financial reforms and efficiency of banks in Pakistan	There is an important link between asset quality, bank size and efficiency scores	• Failed to give the direction of the relationship • Used bank size as an independent variable	• Gave the direction of the relationship and used size as a moderating variable
Kariuki(2017)	Firm characteristics and financial	Asset quality has a positive relationship with	• Used Multiple Regression	• Used Tobit Regression

Author(s) and context	**Focus**	**Key Findings**	**Research Gaps**	**how the current study sought to address the gap**
-Kenya	intermediation efficiency of DTS in Kenya	efficiency.		
Barus,Muturi,Kibati& Koima(2017) -Kenya	Effects of earning ability on financial performance of SACCOs in Kenya	Earnings ability has a positive relationship with financial performance of SACCOs	• Used ROA as a measure of financial performance • Used earnings per share to measure earnings	• Used efficiency as a measure of performance
Berger and Bonaccorsi (2006)	Relationship between capital ratios and efficiency of banks in tha US.	The higher the capital ratios the higher the efficiency	• Focused on one dimension of efficiency and failed to give the direction of the link	• Focused on all dimensions of efficiency • Gave direction of the

Author(s) and context	**Focus**	**Key Findings**	**Research Gaps**	**how the current study sought to address the gap**
-US			between capital and cost efficiency	link between capital and efficiency
Asima,Mahmood, Raheel (2017) -Pakistan	Effect of financial variables on bank performance pre and post financial crisis of 2008 in Pakistan	Earning quality has a negative influence on bank performance	• Focused on direct relationship between the variables • Focused on bank performance in Pakistan	• Included a moderating variable • Focused on Deposit Taking SACCOs in Kenya.
Lotto (2018) -Tanzania	Effect of capital requirement regulation on bank operating efficiency in Tanzania	Positive relationship between capital adequacy ratios and efficiency, negative relationship between earnings and efficiency.	• The study failed to generate efficiency scores before doing regression analysis • Focused on commercial banks	• Generated efficiency scores in the first stage of analysis • Used Tobit regression in the second stage of analysis. • Focused on DTS
Mwangi (2014)	Relationship between	Size and age have a	• Failed to use Tobit	• used Tobit regression

Author(s) and context	**Focus**	**Key Findings**	**Research Gaps**	**how the current study sought to address the gap**
-Kenya	SACCOs characteristics and efficiency of SACCOs in Kenya	positive effect on efficiency. Strength of bond has a negative relationship with efficiency.	regression given that the dependent variable is limited. • Used size as an independent variable	in the second stage of analysis and size was a moderating variable. • Focused on financial soundness and efficiency

Source: Various Literature Reviewed, 2018

2.5 Conceptual Framework

The conceptual framework is the researcher's conceptualization of the relationship between the variables under study. The study was informed by four variables captured in the conceptual framework. Efficiency was the dependent variable, financial soundness independent variable and size of SACCO moderating variable of the study. Financial soundness is theorized to have an effect on efficiency. Financial soundness (as measured by asset quality, capital adequacy, liquidity, and earnings rating) has an effect on efficiency as documented in various reviewed literature. The study conceptualized that the variation in dependent variable was explained by the individual measures of dependent variable and the relationship moderated by size of SACCO. The conceptual model given in Figure 2.1 presents the relationships explained.

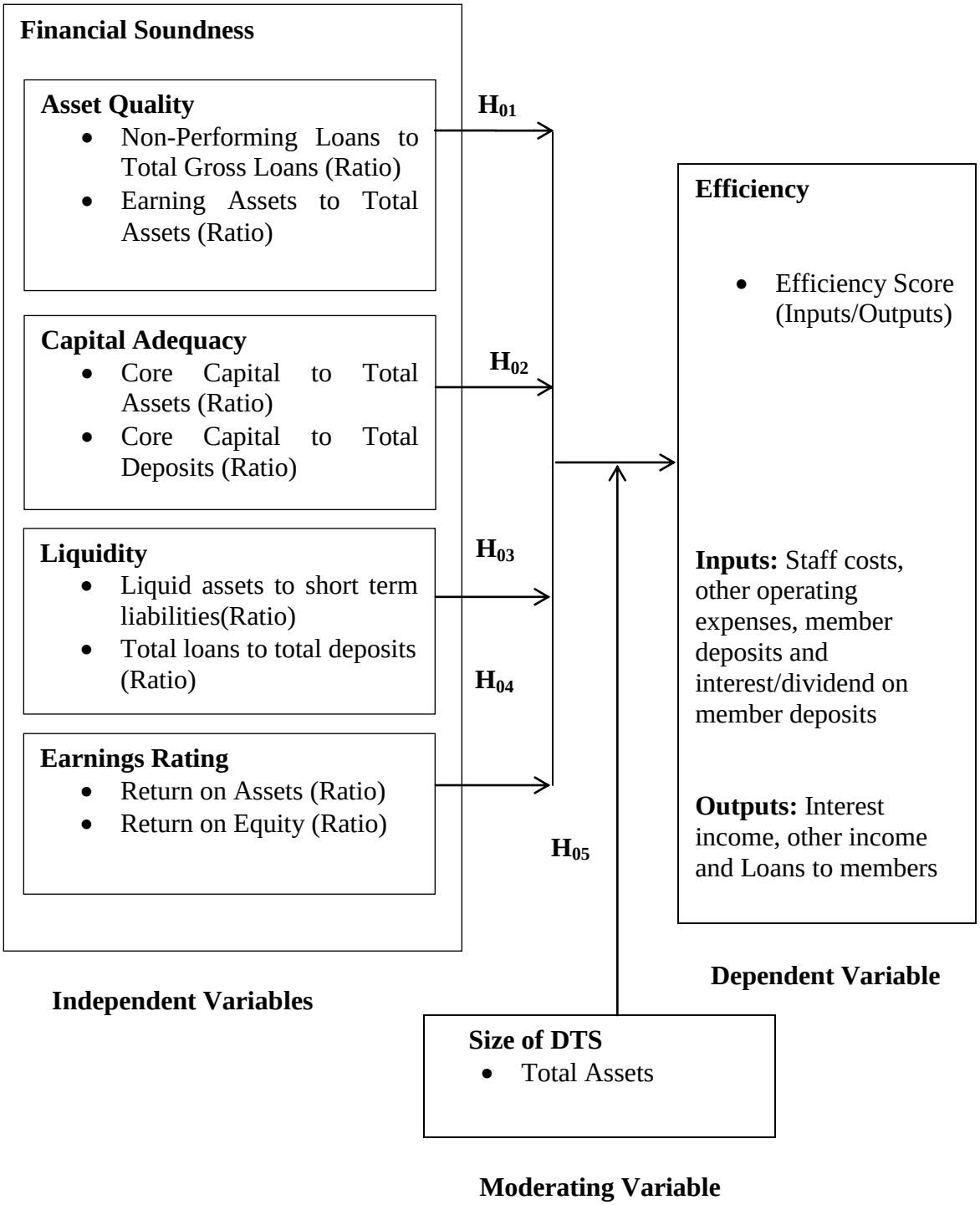

Figure 2.1 Conceptual Framework
Source: Researcher, 2018

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the description of the research methods that the study relied on to achieve meaningful, reliable and valid output. It is the basis on whether the entire research is build and entails aspects such as research philosophy and design, population of interest, study sample and the sampling technique adopted. Type of data to be used and data collection instruments adopted analysis techniques and presentation of the empirical models. Other keys aspects presented in this section include measurement and operationalization of the variables and diagnostics test that were adopted to ensure the data used adhered to all the assumptions of the techniques employed to test the research hypotheses. Lastly, the chapter highlights ethical issues that were likely to emerge and subsequently affect the study outcome.

3.2 Research Philosophy

According to Saunders, Lewis and Thornhill (2009), research philosophy entails both knowledge development and the nature of the knowledge developed. There are two types or research paradigms: phenomenology and positivism. Phenomenology focuses on theory building rather than theory testing. Conversely, positivist research is quantitative and is associated with testing of hypotheses (Mukherji & Albon, 2010). Positivist philosophy was adopted for this study. According to positivists facts do exist and can be measured. The assumptions of positivism are supportive to this study making it appropriate for the study. In this philosophy it is assumed that environment and events of interests are very objective, exterior and highly independent of the research and the researcher unlike social

constructivism that assumes both the knowledge of the environment and the events are socially constructed and entirely subjective of the opinion of the researcher (Bell & Bryman, 2007).

Positivism research philosophy in most cases is adopted when dealing with observable social reality (Cohen & Crabtree, 2006; Saunders *et al.,* 2009). Generalization of research findings can be done in the form of law. To yield hypotheses used in the study the theories adopted played a key role. Based on the research philosophy adopted by the study, quantitative data was gathered and statistically analysed which formed the basis for hypotheses testing by either failing to reject or rejecting the null hypothesis.

3.3 Research Design

The research design is the most fundamental aspects of the research process and is defined by Johnson and John (2002) as the outline of the action to be taken during the research process. Research design spans from development of the measurable research objectives and hypotheses to the reporting of the final outcome. Other authors such as Kothari (2004) define research design as a master plan of the entire research process which specifies methods that are involved in collection and analyzing of the information needed. Sekaran and Bougie (2011) on the other hand posited that a research design has an objective to enable discovery of new information, explain what exists and frequency of occurrence of something and enables categorization of information.

In this study explanatory non-experimental design was found to be most suitable. Kerlinger and Lee (2000) supports this design especially when the variables to be studied are not manipulated during the research. The choice of this design is justifiable since the study

sought to explain factors that cause change and explicitly clarify how some phenomenon operates. This design is further suitable to establishing the causal relationship between study variables against the occurrence of a problem. The study sought give description of certain groups, without manipulation of independent variables and hence the adoption of explanatory non-experimental designs (Were & Wambua, 2014).

3.4 The Empirical Model

In this study a two stage analysis was done. In the first stage efficiency Scores was generated using the Data Envelopment Analysis and in the second stage the Panel Tobit regression Analysis was used to regress bias corrected efficiency scores on financial soundness.

3.4 .1 The Data Envelopment Analysis Model

Since the study sought to determine the efficiency scores of the DTS,DEA was employed for this purpose. Unlike other parametric model, this methodology doesn't require specification of functional forms since it derives a scalar value as efficiency measure. The output producer in the context of DEA is commonly referred to as a Decision Making Unit (DMU) (Marwa, 2014). For every set of decision making units (DMU's) relative efficiencies are determined. In this analysis, every DMU is allocated their highest possible score of efficiency based on the assessment of inputs and outputs.

In DEA, the efficient threshold is constructed for firms that consume fewer inputs for maximum outputs. Based on this threshold firms close to the threshold are considered efficient while those below are considered inefficient (Ocholla, 2016). The efficiency of each units and each DMU are analysis separately in the DEA Model. Efficiency of DMU is

measured by comparing to other DMUs with assumptions that all the DMUs lay below or on extreme threshold (Thanassoulis,2001).

The DEA model used is shown below:

$$\text{Maximize } h_k(U,V) = \frac{\sum_{r=1}^{m} U_r Y_{rk}}{\sum_{i=1}^{n} V_i X_{ik}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(i)}$$

$$\text{Subject to} = \frac{\sum_{r=1}^{m} U_r Y_{rk}}{\sum_{i=1}^{n} V_i X_{ik}} \leq 1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\text{(ii)}$$

$$U_r, Vi \geq 0 \quad r=1,2,3\ldots\ldots s \quad i=1,2,3\ldots\ldots\ldots m\ldots\ldots\ldots\ldots\text{(iii)}$$

Where;

$h_k(U,V)$ is the relative efficiency of DMU_k

m is the No of outputs each DTS using *n* different inputs

n is the No of inputs used by each DTS to produce *m* different outputs

Y_{rk} is the amount of the r^{th} output for the k^{th} DTS

X_{ik} is the amount of i^{th} input used by the k^{th} DTS

V_i is the weight to be determined for input *i*

U_r is the weights to be determined for output *r*

The solution of the above problem is infinite; to solve the problem, we use the Charnes-Copper (1962) transformation to select an illustrative optimal solution (*U*, *V*) for which

$$\sum_{i=1}^{m} V_i X_{ik} = 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \text{(iv)}$$

Hence, a linear programming problem equivalent to the linear functional programming problem (i) to (iii) is derives as follows;

$$\text{Max } h_k (U, V) = \sum_{r=1}^{S} U_r Y_{rk} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(v)}$$

$$\text{Subject to} \quad \sum_{r=1}^{S} U_r Y_{rk} \quad - \quad \sum_{r=1}^{S} V_i X_{ij} \leq 0 \qquad j=1, 2, 3 \ldots n \ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(vi)}$$

$$\sum_{i=1}^{m} V_i X_{Ik} = 1 \qquad i=1, 2, 3 \ldots\ldots m \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(vii)}$$

$$U_r V_i \geq 0 \qquad \text{for } r=1, 2, 3 \ldots\ldots\ldots\ldots s$$

$$i=1, 2, 3 \ldots\ldots\ldots\ldots m$$

Model (iv)-(vii) is the CCR model that is input oriented where maximization is pointed the option of using weights U and V with the highest input output ratio. Solving the dual problem above yields optimum results which represent the technical efficiency score for a particular DMU_k when repeated for all DMUs. The relative efficiency hk, of one DMU *k*, is defined as virtual output to virtual input ratio which also a ratio of weighted sum of outputs to weighted sum of inputs. In the model v_i and u_r indicate significance of each inputs and output and are determined to ensure each DMU has its most efficient. The efficiency is

usually achieved when Max $h_k = h_k^* = 1$ and at this point DMU is considered efficient. However if $h_k^* < 1$ then the DMU_k is considered not efficient.

3.4 .2 Tobit Regression Model

In the second phase of analysis, different type of regression can be adopted ranging from OLS, logistics, probit and Tobit regression analysis (Lundvall, 1999). In DEA studies, the OLS and Logistic models have limitations. The Logistic model collapses when the sample includes fully efficient firms. DEA produces a large number of fully efficient scores for any given sample. Thus Logistic models cannot be applied. On the other hand, the OLS models produce biased results when applied in DEA efficiency variables. In this analysis fully efficient DEA estimates for a large sample are truncated to unity and applying OLS to such a sample leads to extremely biased estimates, therefore, limited variable models are normally adopted to avoid this kind of problem (Goldberger, 1964). In this study DEA yields efficiency scores that vary from 0 to 1 which implies that the dependent variable is limited hence Tobit regression analysis was considered appropriate.

The general Tobit model is specified as follows:

$$E_{it} = \alpha_i + \beta 1 X_{it} + + \varepsilon_{it} \quad \text{3.1}$$

Where E_{it} = efficiency of SACCO *i* at time period *t*

α_i is a constant

X_{it} is Financial Soundness of DTS *i* at time *t*

ε_{it} is the statistical disturbance term (error term)

β is the statistical estimate.

Equation 3.1 above was expanded to yield equation *3.2* which was used for estimation.

$$E_{it} = \beta_0 + \beta_1 AQ_{it} + \beta_2 CA_{it} + \beta_3 LR_{it} + \beta_4 ER_{it} + \varepsilon_{it} \quad \text{.....3.2}$$

Where:

E_{it} = Efficiency of SACCO *i* at time *t*

β's=are coefficients of explanatory variables

AQ_{it}=Composite index of Asset Quality of DTS *i* at time *t*

CA_{it}=Composite index of Capital Adequacy of DTS *i* at time *t*

LQ_{it} = composite index of Liquidity of DTS *i* at time *t*

ER_{it} =Composite index of Earnings Rating of DTS *i* at time *t*

ε_{it}- Error Term

3.4.3 Moderating Effect Model

Hayes and Matthes (2009) indicate that moderation occurs when the relationship of two variables depends on a third variable. The study sought to determine the moderation effect of size of DTS on the relationship between financial soundness and efficiency by applying the Whisman and McClelland (2005) moderation test. The following model was used;

$$E = \beta_0 + \beta_1 AQ_{it} + \beta_2 CA_{it} + \beta_3 LR_{it} + \beta_4 ER_{it} + \beta_5 SDTS_{it} + \varepsilon_{it} \quad \text{.....3.3}$$

$$E=\beta_0 +\beta_1 AQ_{it} +\beta_2 CA_{it} +\beta_3 LR_{it} +\beta_4 ER_{it} + \beta_5 SDTS_{it} + \beta_6 SDTS_{it} * AQ_{it} + \beta_7 SDTS_{it} * CA_{it} +$$

$$B_8 SDTS_{it} * LR_{it} + \beta_9 SDTS_{it} * ER_{it} + \varepsilon_{it} \quad \ldots\ldots 3.4$$

Where: E=Efficiency of SACCO *i* at time *t*

β's= are coefficients

AQ_{it}=Composite index of Asset Quality of DTS *i* at time *t*

CA_{it}=Composite index of Capital Adequacy of DTS *i* at time *t*

LQ_{it} = composite index of Liquidity of DTS *i* at time *t*

ER_{it} =Composite index of Earnings Rating of DTS *i* at time *t*

$SDTS_{it}$ =Size of DTS *i* at time *t*

ε_{it}- Error Term

Given equations 3.3 and 3.4 the following scenarios can occur

Table 3.1 Moderation Decision Making Criteria

Scenario	**Model 3.3**	**Model 3.4**	**Conclusions**
One	β_5 is significant	β_6- β_9 are insignificant	Moderating variable is an explanatory variable
Two	β_5 is insignificant	β_6- β_9 are significant	Moderating variable has a moderating effect

Source: Whisman and McClelland, 2005

Table 3.1 indicates the two possible scenarios that can occur if size of DTS is introduced as an independent variable as well as a moderator. If scenario one occurs then size of DTS is an explanatory variable rather than a moderating variable .If scenario two occurs then size of DTS is a moderating variable.

3.5 Operationalization and Measurement of Variables

Table 3.2 presents the operational definitions and the measures of the study variables. The measures of financial soundness and efficiency adopted in this study have been used and validated by other researchers in view of the literature presented. The scales of measurement for all the study variables were ratios.

Table 3.2: Operationalization and Measurement of Study Variables

Category of Variable	Variable	Operationalization	Measurement	Scale of Measurement
Dependent	Efficiency	Ability of a DTS to transform its resources into revenue	Efficiency Score (Inputs/Outputs)	Ratio
Independent	Asset Quality	Timely manner by which borrowers are meeting their contractual obligation.	$\frac{Non\ Performing\ Loans}{Total\ Gross\ Loans}$ $\frac{Non\ Performing\ Loans}{Core\ Capital}$	Ratio
	Capital Adequacy	Amount of capital a DTS holds as required by the regulator (SASRA)	$\frac{Core\ Capital}{Total\ Assets}$ $\frac{Core\ Capital}{Total\ Deposits}$	Ratio

	Liquidity	Ability of the DTS to meet the short term obligation as they fall due	$\frac{Liquid\ Assets}{Short\ term\ Liabilities}$ $\frac{\text{Total deposits}}{\text{Total Loans}}$	Ratio
	Earnings Rating	The actual surplus made by a DTS above the operating expenses	$\frac{EBIT}{Total\ Assets}$ $\frac{Net\ Income}{shareholders\ equity}$	Ratio
Moderating Variable	Size of DTS	It is a proxy for the size of the DTS	Natural logarithm of Total Assets of each DTS	Ratio

Sources: Researcher (2018)

3.6 Target Population

According to Borg *et al.,* (2007), the whole set of individuals, events or a thing that the researcher anticipates to investigate is the target population. The target population for the study comprised one hundred and ten DTS societies in Kenya that were in existence from period 2012-2016 as shown in Appendix I . A census approach was adopted for this study.

3.7 Data Collection Instrument

This study predominantly relied on quantitative secondary data. Secondary data has various advantages. The data can be used for comparative measures; it has less resource requirements; it could be applied in longitudinal study and it provides permanence (Saunders *et al*., 2007). The data was obtained from DTS financial statements, DTS supervision reports from SASRA. The duration for this study was between 2012 and 2016 and the document review guides are appendixes II and III.

3.8 Data Collection Procedure

The study relied on secondary data gathered from financial statements of the DTS selected. Before undertaking the data gathering process, the researcher sought authorization permission from the University, NACOSTI, SASRA and individual DTS through head offices. The study utilized panel data which comprised both cross-sectional and time series characteristics. Data collected was in panel form which combined both the time series and cross sectional to improve the quality and quantity of the data collected (Gujarati, 2003). The duration for this study was between 2012 and 2016 and the document review guides are appendixes II and III.

3.9 Data Analysis and Presentation

The study adopted a two stage analysis. In the first stage, efficiency scores were generated using the DEA methodology. In the second stage, Tobit Regression analysis was used to regress efficiency scores on financial soundness. In this study DEA yields efficiency scores that vary from 0 to 1 which implies that the dependent variable is limited hence a censored regression analysis such Tobit was considered appropriate. The dependent variable used in the second stage which was the Tobit regression analysis stage were efficiency scores generated from the DEA analysis.

Beside, DEA analysis, this research also employed descriptive analysis which include the use of mean, standard deviation and other measures of central tendency. The research also used Pearson Correlation and Tobit regression analysis to test the formulated research hypothesis. The use of both descriptive and inferential statistics is highly recommended since it improves the quality of the final findings. The tool for analysis in this research was Stata v13 software

which is considered suitable to analyse data in panel form. Since the study data was panel in nature, the panel regression estimation procedure were followed. The study chose panel data regression analysis to enable isolation of theoretical effects and actions to minimize the chances of obtaining misleading findings.

The models used to analyse panel data include pooled effects, random effects and fixed effects (Baltagi, 2005). Pooled effect regression assumes the parameters lack cross section variation while fixed effect assumes the time variation. Random effects take into assumption that coefficients are randomly characterized based on random sample where they are drawn. A test must be undertaken to ascertain the suitability of the model used for panel regression. In this study, Hausman test was adopted to test the suitability of the model to be adopted (Were & Wambua, 2014). In this test the null hypothesis that random effect is suitable was tested at 5% significance level.

3.10 Diagnostic Tests

The use of regression analysis required that care must be taken not to violate the regression assumptions. Violation of regression assumptions lead to biased regression estimates (Gujarati, 2003). To ensure compliance with the assumptions, the study conducted diagnostic test which included test for normality, Heteroscedasticity, test for multicollinearity, test for stationarity and test for model specification prior to fitting regression models. .

3.10.1 Normality Test

Regression analysis requires that the data used must be normally distributed or must take a normal distribution curve. To adhere to this regression assumption the study employed Shapiro Wilk test which compares the distributed to a normal distribution in terms of mean

and standard deviation. The null hypothesis in this test states that data is not significant different from a normal distribution. Therefore, if p-value is greater than the critical significance level, the null hypothesis is not rejected which implies that data is normally distributed Gujarati, 2003; Razali & Wah, 2011). On the other hand, if $p<0.05$ the null hypothesis is rejected meaning the data is significant different from a normal distribution or is not normally distributed. For non-normal distribution data, non-parametric test are usually recommended.

3.10.2 Heteroscedasticity Test

This is the scenario where there is no constant variance in the error terms of different values of explanatory variables. Regression assumptions dictate that the error term must have a constant variance or rather homoscedastic (Gujarati & Porter, 2009). Lack of adherence of these assumptions would lead to biased regression estimates and exaggerated standard errors which lead to biased conclusion. The presence of heteroscedasticity was tested in this study using the Breush Pagan/Cook-Weighsberg test as proposed by Breush and Pagan (1979) and Cook and Weighsberg (1983). The null hypothesis in this test stated that error variance is homoscedastic therefore $p>0.05$ implies that the study fails to reject the null hypothesis while $p<0.05$ implied the study rejects the null hypothesis. If the errors terms are found to be heteroscedastic then FGLS model was to be adopted by the study.

3.10.3 Multicollinearity Test

Multicollinearity problem exists when there exists a correlation of over 70% between two or more independent variables which means one variable can be used in place of the other variable (Kock & Lynn, 2012). This was tested using the Variance Inflation Factor (VIF) as

recommended by Gujarati (2003), the threshold being 10 for severe multicollinearity. The problem of multicollinearity is dealt with by illuminating one of the variables that is highly correlated with the other. If this problem is not dealt with, it would results to infinite standard errors which reject the precision for hypothesis testing. Gujarati (2003), further indicates that multicollinearity is not really a contention of its existence; rather it is the degree or severity. If multicollinearity is present, then some variables would be dropped.

3.10.4 Autocorrelation Test

Autocorrelation which is called serial correlation measure the cross correlation that exists between a signal of the variable and itself at varying time period (Verbeek, 2012). Serial correlation repetitive patterns in a data set. This study used the Breush-Godfrey LM test for the presence of correlation in the linear panel data. Since panel data was involved in this study and serial autocorrelation inherent in such data, this had to be tested to obtain correct regression estimates. Similarly, lack of adherence of this regression assumption may lead to wrong standard errors and estimates approximation (Wooldridge, 2002). The study tested the null hypothesis that there no serial correlation. Rejecting the null hypothesis was done when the p-value was less than the critical values. If serial autocorrelation was concluded to exist then FGLS model which uses maximum likelihood would be adopted.

3.10.5 Stationarity Test

A time series is considered to be stationarity when both its mean and variance are constant over a time period (Fadhili *et al.,* 2011) while a time series with mean and variance that vary across time are said to be non-stationary. It was necessary for the study to conduct test for

stationarity hence the data adopted was panel in nature and had both time and cross sectional dimensions. Regression estimation of time series requires that data system is stationary to avoid spurious results (Gujarati, 2003).

In this study Fisher type test was employed to test of unit root test and also the study performed both ADF and Phillips-Perron tests and the findings of these tests were reported independently for each panel. The study tested the null hypothesis that all the panels have unit roots while the alternate hypothesis stated that one of more panels lack unit root (Choi, 2001). In cases where any of the variables are found to have a unit root then the study would adopt differencing and fit regression models using differenced variables.

3.10.6 Model Specification Test

When dealing with panel data, one must make a choice of either using random effect model or the fixed effect regression model basing on the suitability of the model (Greene, 2008). The most common test used to determine whether a fixed effect or random effect is adequate is the Hausman Specification test. This test relies on consistency and efficiency of random and fixed effect estimators based on the correlation between individuals' effect and the predictor variables. In this study, this test would enable determination of significant correlation between unobserved SACCO specific RE and the independent variables. Random effect is deemed appropriate when no correlation exists while existence of correlation implies that the fixed effect model was appropriate. Greene (2008) further indicated that if the Hausman specification test specifies that FE is the appropriate model then inclusion of time FE is tested which test whether the dummies for all years are zero, if that is the case, then the need for time FE in the specification of the model estimated.

3.11 Ethical Considerations

Ethical considerations are very critical during the research process to ensure effective participations by all stakeholders. Research ethics is the common standard or norms of behaviours which guide the relationship between people and their behaviours (Saunders *et al.,* 2009). Therefore, this study adhered to all the ethical considerations such as confidentiality, privacy, anonymity and purposeful use of the data collected. The study obtained authorization letters from the relevant authorities before embarking on data collection process. This helped to build the confidence of all the participants and to legitimize the process of data collection. The permits were obtained from Kenyatta University and NACOSTI and attached in appendix VI. The findings presented in this study were purely based on data that was gathered and reflected the situation in the current form.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents study findings and subsequent interpretations with regards to the effect of financial soundness on efficiency of DTS societies in Kenya as well as the moderating effect of SACCO size. In addition, the chapter discusses descriptive and inferential statistics. From the results of inferential statistics, the chapter derives meaning of the same by documenting findings in each of the study objective and hypotheses. Consequently interpretations of the findings are made in line with the objectives and relating them to relevant literature.

4.2 Response Rate

The study sought to obtain responses from 110 DTS. However, data was available from 97 DTS representing a response rate of 88.1%. The data for the remaining thirteen SACCOs was incomplete. This is because they were licensed towards the end of year 2012 hence they lacked complete financial statements for that year. A response rate of 50% is adequate, a response rate of 60% is good and a response rate of above 70% is very good (Babbie 2004; Mugenda & Mugenda 2003; Saunders *et al.,* 2007).The response rate of 88.1% observed in this study was considered satisfactory and sufficient for analysis and for drawing conclusions based on the stipulated research objectives. Further, the study's response rate was acceptable as it compared well with similar studies on SACCOs in Kenya such as Mwangi (2014) who achieved 67% and Kariuki (2017) who achieved 79%.

4.3 Descriptive Analysis

This section presents the summary descriptive statistics of DEA inputs and outputs. The statistics includes mean and standard deviation. It also gives the maximum and the minimum values of the DEA inputs and outputs.

4.3.1 DEA Inputs and Outputs

In order to ascertain the nature of the data used in the study to generate efficiency scores, descriptive statistics such as the mean and the standard deviation were determined. Tables 4.1 and table 4.2 presents descriptive statistics of all outputs and inputs used in this study respectively to generate the efficiency scores.

Table 4.1 Descriptive Analysis of Output Variables

Year		Total Loans (Ksh)	Interest Income (Ksh)	Other Income (Ksh)
2012	Mean	1,509,932,128.3093	204,826,319.567	2,9417,088.4227
	Maximum	1,898,908,092	2,844,403,713.00	201,438,666.0
	Minimum	36,595,421	341,795.00	49,846.00
	Std.Deviation	2,806,806,636.31585	373,593,006.025	37,049,713.4971
2013	Mean	1,676,943,012.6804	226,389,652.4948	35,546,200.9588
	Maximum	18,745,046,110.00	3,238,678,855	452,743,779.00
	Minimum	33,085,719.00	324,156.00	272,843.00
	Std.Deviation	3,030,343,008.80084	433,074,673.07367	63,016,099.46564
2014	Mean	1,899,703,228.3918	258,592,204.845	38,810,916.5670
	Maximum	22,003,840,000.00	3,503,797,000.00	430,551,728.00
	Minimum	30,865,677.00	434,675.00	112,908.00
	Std.Deviation	3,478,568,775.91213	473,573,264.89200	65,325,046.97758
2015	Mean	2,077,816,506.1546	296,920,079.8557	43,279,388.8660
	Maximum	22,373,878,000.00	3,647,839,000.00	777,337,000.00
	Minimum	39,102,034.00	543,234.00	74,172.00
	Std.Deviation	3,573,549,962.44938	519,570,239.21889	10,060,533.22200
2016	Mean	2,366,227,472.9897	341,395,853.6598	64,100,804.7320
	Maximum	24,822,935,000.00	3,954,444,000.00	1,238,041,000.00
	Minimum	55,593,920.00	654,342.00	174,000.00
	Std.Deviation	4,186,611,971.64119	603,421,002.72679	16,178,045.91058

Source: Study Data, 2018

Table 4.1 presents results on the mean scores and standard deviation of the outputs used in DEA to generate the efficiency Scores. The mean of total loans increased from year 2012 to 2016: this is due to mobilization of savings by the DTS. It can also be noted that the standard deviation of the total loans is slightly higher than the mean. This indicates that the data is highly spread this can be seen from the difference between the maximum and the minimum values. The reason why the data is highly spread is that the target population comprised both the small and the large DTS in terms of asset base. From the findings, it is important to note that despite the introduction of the interest rate capping law to the banking sector during the

last quarter of year 2016,there was negligible ripple effect on the DTS as evidenced by the growth of total loans in 2016. These findings are similar to those of Ochola (2016) study which sought to determine efficiency of SACCO societies in Kenya.

The interest income (which comprises interest earned from loans and other advances) increased from year 2012 to 2016.This is attributed to the increase in loans over the same period. The other income (which represents DTS earnings other than interest income from member loans) includes items such as rent from investment property, dividends from shares, charges for money transfers and withdrawals and interest from bank deposits, treasury bills and bonds. The other income has increased over the study period. This can be attributed to the DTS effort to make investment to generate more income .The findings are similar to those of Mwangi (2014).

Table 4.2 Descriptive Analysis of DEA Inputs

Year		Staff Cost (Ksh)	Other Operating Expenses (Ksh)	Total Deposits (Ksh)	Dividends and Interest On Deposit (Ksh)
2012	Mean	36,966,050.6186	141,976,414.123	1,351,639,493.9381	150,571,472.2784
	Maximum	315,262,257.00	947,303,000.00	15,137,336,774.00	3,456,345,261.00
	Minimum	1,917,472.00	2,123,332.00	1,550,572.00	167,435.00
	Std.Deviation	58,714,841.4946	218,567,805.27843	2,407,200,835.87857	464,009,525.57315
2013	Mean	42,787,785.0515	142,971,422.1340	1,476,574,789.4433	155,180,346.1753
	Maximum	406,112,294.00	1,182,084,000.00	17,098,820,141.00	3,765,342,387.00
	Minimum	2,775,803.00	2,456,337.00	1,816,890.00	158,080.00
	Std.Deviation	68,999,089.42492	225,453,686.36326	2,731,215,807.85993	405,651,249.97583
2014	Mean	52,671,909.6701	149,638,185.7320	1,684,998,182.3505	164,720,338.9381
	Maximum	565,705,685.00	1,539,228,000.00	19,903,134,000.00	993,965,929.00
	Minimum	2,703,272.00	4,196,002.00	1,234,563.00	198,379.00
	Std.Deviation	93,338,393.28089	252,005,352.31589	3,067,136,727.06010	193,599,235.65700
2015	Mean	63,609,664.9794	172,035,143.3196	1,964,435,259.3711	183,939,238
	Maximum	897,223,000.00	2,026,446,000.00	22,699,334,000.00	3,502,320,000.00
	Minimum	2,834,474.00	3,441,640.00	65,324,119.00	206,205.00
	Std.Deviation	118,395,523.17872	305,571,325.60734	3,504,584,946.40479	396,242,098.99480
2016	Mean	73,318,028.7010	189,736,366.5155	2,246,292,862.5155	185,090,069.7423
	Maximum	1,062,897,000.00	2,430,459,000.00	25,784,711,000.00	2,809,580,000.00
	Minimum	2,976,403.00	70,02715.00	66,543,124.00	206,437.00
	Std.Deviation	138,531,022.20360	351757,435.28487	3,970,750,524.45328	349,518,110.4777

Source: Study Data, 2018

Table 4.2 presents the mean and standard deviation of the DEA inputs used to generate the efficiency scores. Staff cost represents salaries and allowances to employees of DTS. The mean of the staff cost increased over the study period. This indicates that the DTS endeavored to increase access of financial services to their members by opening new branches. It can also be noted that the standard deviation of the staff cost is slightly higher

than the mean. This indicates that the data is highly spread as indicated from the difference between the maximum and the minimum values. Other operating costs represent the expenditure by DTS which includes rent payable, office consumables and communication costs .They exclude staff cost and interest and dividends on member deposits. In view of table 4.2, the other operating expenses kept on increasing over the study period.

Total deposits were evidently increasing over the study period. This underscores the continued role of DTS in the mobilization of savings. The deposits are utilized to finance the loan portfolio. It can be observed that the total loan exceeded the total deposit a pointer that the demand for loans outweighed the ability of DTS to mobilize savings. These findings are similar to those of SASRA (2016). The interest paid on deposits and dividends increased over the study period because of the growth in the member deposits and improved performance as presented in Table 4.2 .

4.4 Correlation Analysis (of DEA Inputs and Outputs)

Table 4.3 presents the results of Pearson's Correlation Analysis between the DEA inputs and outputs used to generate the efficiency scores.

Table 4.3 Correlation Analysis (of DEA Inputs and Outputs)

	Total loans	Interest income	Other income	Staff cost	Other expenses	Total deposit	Interest on deposit
Total loans	1						
Interest income	.891** .000	1					
Other income	.694** .000	.664** .000	1				
Staff cost	.823** .000	.852** .000	.688** .000	1			
Other expenses	.716** .000	.753** .000	.463** .000	.563** .000	1		
Total deposit	.980** .000	.899** .000	.736** .000	.849** .000	.721** .000	1	
Interest on deposit	.618** .000	.638** .000	.541** .000	.572** .000	.412** .000	.639** .000	1

****. Correlation is significant at the 0.01 level (2-tailed).**
Source: Study Data, 2018

Table 4.3 identifies correlations among input and output variables. The choice of input and output variables used in DEA is important as explained by Avkiran (1990), Correlations among input and output variables can be used to show the appropriateness of such variables. The correlation between all variables is strong ,positive and significant at 0.01 since their p

values are less than 0.01. The recorded high correlation coefficients between DEA inputs and outputs provide support for the appropriateness of the selected inputs and outputs used in the DEA model in this study. The findings corroborate the findings of Tesfay and Tesfay (2013) and Kamau (2011) who found high correlation between the DEA inputs and outputs.

4.5 Efficiency

This section presents the technical and scale efficiency of DTS generated from the DEA model and the bias corrected efficiency scores generated after curing the inherent dependency of the scores generated by DEA model.

4.5.1 Technical and Scale Efficiency

Table 4.4 summarizes results per year from the DEA model on technical efficiency as measured by constant return to scale (CRSTE) and variable return to scale (VRSTE) and scale efficiency for period 2012 to 2016 as shown in Appendix IV. If a unit operates under constant return to scale, it indicates that an increase in inputs results in a proportionate increase in the output levels. If a DMU operates under variable return to scale, it indicates that an increase in output does not reflect a proportionate increase in input. This study adopted the variable return to scale because of its assumption which applies to the DTS. However, it is important to calculate the efficiency scores under CRSTE and VRSTE because it helps in explaining the efficiency level.

Table 4.4 Technical and Scale Efficiency

YEAR	VRSTE	CRSTE	SCALE
2012	0.579	0.770	0.753
2013	0.766	0.833	0.916
2014	0.676	0.789	0.865
2015	0.788	0.860	0.917
2016	0.803	0.868	0.927
MEAN	**0.722**	**0.824**	**0.876**

Source: Study Data, 2018

Table 4.4 indicates the technical efficiency as measured under constant and variable returns to scale. On average, the mean efficiency scores for five year period were 72.2% for VRSTE and 82.4% for CRSTE reflecting that the firms are inefficient since they have not achieved a score of 1.VRSTE the DTS are required to decrease inputs (Staff cost, other operating expenses, total deposits and interest on deposit) by 27.8% in order to achieve efficiency or increase outputs (total loans, interest income and other income) by 27.8% without any additional increase in input to achieve efficiency. The minimum score over the same period were 57.9% in the year 2012 for VRSTE and 77.0 % for CRSTE, the same year.

There has been improvement in efficiency over the five-year period. This can be attributed to regulatory compliance; as more and more DTS becomes compliant the efficiency is

improved. This corroborates the study of Mwangi (2014) which found that the average efficiency score for DTS was 0.775 for the period 2009-2013 .Ochola (2016) established that the average efficiency score in Kenya was 0.683 for the period 2011-2013. Kariuki (2017) observed that industry efficiency score in Kenya was 0.677 for the period 2011-2014.The technical efficiency divergence from the efficient point is 22.8% and 17.6% respectively under the VRSTE and CRSTE. This indicates that they could produce the same amount of outputs with approximately 22.8% fewer resources under variable returns and 17.6% fewer resources under constant returns than they actually employed. This finding reveals that the overall inefficiency would be attributed to the technical inefficiency rather than scale inefficiency.

4.5.2 Technical and Scale Efficiency by Size

Table 4.5 presents the technical efficiency as measured by CRSTE and VRSTE and scale efficiency by size. They are classified into large-tier, medium-tier, and small-tier. According to SASRA (2016), large tier are the ones which have assets worth 5 billion and above. Medium tier have assets between 1 billion and 5 billion. The small tier have assets worth 1 billion and below.

Table 4.5 Technical and Scale Efficiency by Size

Size	**NUMBER OF SACCOs**	**VRSTE**	**CRSTE**	**SCALE**
Large-tier DTS	12	0.838	0.853	0.873
Medium-tier DTS	40	0.712	0.850	0.991
Small-tier DTS	45	0.616	0.769	0.765

Source: Study Data, 2018

Table 4.5 presents the mean efficiency of large-tier, Medium-tier, and small-tier as measured by VRSTE as 0.838, 0.712 and 0.616 respectively. This is an indication that the Large-tire are the most efficient, though they have not achieved efficiency; it needs to decrease inputs (staff cost, other operating expenses, total deposits and dividends and interests on deposit) by 16.2% in order to achieve efficiency. The small-tiers are the least efficient: they are required to decrease their inputs by 38.4% to achieve efficiency. This corroborates Pessarossi and Weill (2013),who indicates that large firms were more efficient than small firms. In addition, it is evident that the medium-tiers had the highest scale efficiency, followed by the large-tier then the small-tier. This points out that as much as the large tiers are the most efficient they have not exploited their economies of scale.

4.5.3 Bias Corrected Efficiency Scores

In the second stage of analysis, efficiency scores are regressed on the financial soundness. Scores generated by DEA model are dependent on each other (Simar & Wilson 1998).The presence of dependency among the efficiency scores implies that assumption of independence within the sample is violated. To cure this inherent dependency, bootstrap is done. Bootstrap is a procedure of drawing with replacement, producing multiple estimates which can be used for statistical inference. Simar and Wilson (1998) proposed a homogenous bootstrap algorithm. The algorithm based on the bootstrap approach and attributed to Efron (1979), stresses on repeatedly simulating the data generating process and applying the original estimator in each simulated sample. Then the empirical distribution of resampled estimates can be used to generate the bootstrap confidence interval to give the bias corrected efficiency scores. In this study, the efficiency estimation process was implemented in R

version 3.1 using the FEAR programme. Table 4.6 below presents a summary of the bias corrected efficiency scores for year 2012 to 2016.

Table 4.6 Bias Corrected Efficiency Scores

Year	VRSTE	Mean of Bias Corrected VRSTE
2012	0.579	0.468
2013	0.766	0.609
2014	0.676	0.523
2015	0.788	0.675
2016	0.803	0.631
Mean	0.722	0.581

Source: Study Data, 2018

Table 4.6 indicates that the mean of the bias corrected scores are lower than the DEA efficiency scores due to the presence of sampling bias in the DEA scores. Consequently, the study used the Bias Corrected Scores in the second stage of analysis.

4.6 Descriptive Analysis (of all the study variables)

This section presents the descriptive statistics which include mean and standard deviation of dependent and independent variables. This is presented in Table 4.7.

Table 4.7 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Bias corrected efficiency scores	485	.00	1.00	.5819	.21281
Asset quality	485	.01	2.84	.1125	.18747
Capital adequacy	485	.01	2.84	.2593	.21806
Liquidity	485	.00	3.05	.2826	.28271
Earning Rating	485	.00	5.69	.0353	.25796
Valid N (list wise)	485				

Source: Study Data, 2018

Table 4.7 indicates that the mean of bias corrected efficiency scores was 0.5819, with a standard deviation of 0.21281 and a minimum of 0 and a maximum of 1 respectively, an indication that the dependent variable is censored. The mean of bias corrected efficiency scores demonstrates that the DTS have not achieved efficiency ; they need to increase inputs by 32% in order to achieve the same. The mean of capital adequacy was 0.2596757. This indicates that on average, the DTS have met the minimum requirement by SASRA on capital adequacy which is 10%.

The mean of liquidity ratio was 0.2826. This is an indication that on average, DTS are meeting the SASRA requirement of maintaining a minimum liquidity ratio of 15%. Despite this liquidity position, many DTS are unable to disburse loans to members, a short term obligation (SASRA, 2016). This is because unlike in the banking sector, once a member is qualified to get a loan it is regarded as a right hence liquidity pressures to the DTS. The mean of asset quality is 0.1125. This ratio is above the 5% recommended maximum by the World Council of Credit Unions (WOCCU) and far much higher than 3% SASRA recommends. Loans remain the key asset hence emphasis should be on how to improve the

credit strategies to reduce the ratio to below 3 %. The high percentage could result from most DTS not sharing credit information of their members with credit reference bureau (CRB) since it is on a voluntary basis.

4.7 Inferential Analysis

This section covers the results of hypothesis tests to determine the effect of financial soundness on efficiency of DTS in Kenya, taking into consideration the moderating effect of size of SACCO on the relationship between financial soundness and efficiency. It also presents the diagnostic tests carried out and the correlation results.

4.7.1 Diagnostic Tests

As explained in the preceding chapter, the study carried out different diagnostic tests to ensure that assumptions of CLRM are not violated and appropriate model chosen for analysis. In the event that the CLRM assumptions are violated, the parameter estimates will be inefficient and inconsistent. This section provides the results of the following diagnostic tests: normality test, heteroscedasticity test, multicollinearity test, autocorrelation test, panel unit root test, hausman specification test.

4.7.1.1 Normality Test

The study applied the Shapiro Wilk test to test for normality in the study data. When the p-value is in excess of 0.05, then the data is said to be normally distributed as recommended by Gujarati (2003), Razali & and Wah (2011). The normality results are shown in table 4.8 .

Table 4.8 Normality Test

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
BiasCorrec~s	485	0.99752	0.813	-0.496	0.69010
Assetquality	485	0.99510	1.603	1.132	0.12880
Capitalade~y	485	0.99590	1.341	0.705	0.24051
Liquidity	485	0.99695	1.000	-0.001	0.50040
Earningrat~g	485	0.99811	0.617	-1.157	0.87642
Saccosize	485	0.99653	1.134	0.303	0.38113

.

Source: Study data (2018)

Results in Table 4.8 above, indicates that all p-values are greater than the significance level of 0.05. This is an indication that all the variables were normally distributed hence, regression model is used to estimate the parameters (Gujarati, 2003; Razali & Wah, 2011).

4.7.1.2 Heteroskedasticity Test

The study tested for panel heteroscedasticity using Breush-pagan test. In the event the p-value is less than 0.05, then hereroscedasticity is present (Breush & Pagan, 1979). The hereroskedasticity Test results are captured in Table 4.9.

Table 4.9 Heteroscedasticity Results

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of biasefficiencyscores

         chi2(1)      =     0.28
         Prob > chi2  =   0.5942
```

Source: study data (2018

The null hypothesis was that the error term was homoscedatic. Since the calculated p-value (0.5942) was greater than the significance level of 0.05, the null hypothesis (constant variance) was not rejected. Consequently, this was an indication of absence of heteroscedaticity. Therefore, the regression model for this study was suitable for analyses since the error term was homoscedastic over the time, thereby making the standard errors appropriate for testing the significance of the coefficient.

4.7.1.3 Multicollinearity Test

The study tested for multicollinearity using Variance Inflation Factor (VIF). Multicollinearity is severe if the VIF is greater than 10 and the tolerance is less than 0.1 (Field, 2009). Table 4.10 presents the results of multicollinearity test.

Table 4.10 Multicollinearity Test Results

Variable	VIF	1/VIF
liquidityr~g	1.03	0.974358
assetquality	1.02	0.979858
capitalade~y	1.01	0.993498
earningsra~g	1.00	0.998558
Mean VIF	1.01	

.

Source: Study Data, 2018

The results indicated in table 4.10 ndicates that the independent variables had a VIF of less than 10 and a tolerance value of greater than 0.1 indicating that the study data did not exhibit multicollinearity problem.

4.7.1.4 Test for Autocorrelation

The study used Breush-Godfrey LM test for autocorrelation test. The reason for this was for its ability to test many forms of residual autocorrelation which other tests cannot. When the p-value is less than the significance level of 0.05, the residuals are correlated (Wooldridge, 2002). The Breush Godfrey LM test results are shown in Table 4.11.

Table 4.11 Autocorrelation Test Results

Breusch-Godfrey LM test for autocorrelation

lags(p)	chi2	df	Prob > chi2
1	1.296	1	0.2549

H0: no serial correlation

Source: Study Data, 2018

The null hypothesis was that there is no serial correlation and the alternative hypothesis was that there is serial correlation. From the results in Table 4.11, the p-value is 0.2549 which is greater than the significance level of 0.05. Hence, we do not reject the null hypothesis. Therefore, the residuals do not suffer autocorrelation.

4.7.1.5 Stationarity Test

In order to avoid spurious regression results, panel unit root test is applied for all variables used in the analyses. The output for Augmented Dickey Fuller (ADF) test results and the Philips Perron test results are shown in Table 4.12.It presents a summary of the unit test results as shown in Appendix V.

Table 4.12 Unit root test results

			Unit Root tests			
			ADF Test		PP Test	
Variable	**Level**	**Test**	**Statistics**	**P-Value**	**Statistics**	**P-Value**
Bias Corrected Efficiency Scores	At level	Inverse chi-squared	1164.6101	0.0000	641.9943	0.0000
		Inverse normal	-15.3856	0.0000	-15.6839	0.0000
		Inverse logit	-30.3967	0.0000	-17.1868	0.0000
		Modified inv. chi-squared	49.2753	0.0000	22.7435	0.0000
Asset Quality	At level	Inverse chi-squared	835.9665	0.0000	684.4630	0.0000
		Inverse normal	-10.7406	0.0000	-10.4965	0.0000
		Inverse logit	-19.3314	0.0000	-15.9826	0.0000
		Modified inv. chi-squared	32.5909	0.0000	24.8995	0.0000
Capital Adequacy	At level	Inverse chi-squared	678.6483	0.0000	767.7533	0.0000
		Inverse normal	-3.0900	0.0010	-10.5934	0.0000
		Inverse logit	-11.3343	0.0000	-18.0716	0.0000
		Modified inv. chi-squared	24.6043	0.0000	29.1279	0.0000
Liquidity	At level	Inverse chi-squared	757.0364	0.0000	880.0875	0.0000
		Inverse normal	-7.8446	0.0000	-12.6123	0.0000
		Inverse logit	-16.0148	0.0000	-21.3537	0.0000
		Modified inv. chi-squared	28.5838	0.0000	34.8308	0.0000
Earning Rating	At level	Inverse chi-squared	758.7670	0.0000	736.0483	0.0000
		Inverse normal	-8.4673	0.0000	-10.9724	0.0000
		Inverse logit	-16.8715	0.0000	-17.3435	0.0000
		Modified inv. chi-squared	28.6717	0.0000	27.5183	0.0000

Sacco Size	At level	Inverse chi-squared	860.6624	0.0000	861.4022	0.0000
		Inverse normal	-11.9420	0.0000	-11.9472	0.0000
		Inverse logit	-20.7843	0.0000	-20.8057	0.0000
		Modified inv. chi-squared	33.8447	0.0000	33.8822	0.0000
Significant at 5 percent level						

Source: Study Data, 2018

The fisher type tests, including inverse chi squared, inverse normal, inverse Logit and modified inverse chi squared reported p-values that are less than the significance level of 0.05. This results leads to rejection of the null hypothesis that all panels have unit root for bias corrected efficiency scores, asset quality, capital adequacy, liquidity, earning rating and size of DTS as recommended by Choi (2001). The study therefore concludes that all variables under consideration do not have unit root hence used at level.

4.7.1.6 Hausman Test

In order to estimate the appropriate model to use the study estimated the fixed and the random effect model. The hausman specification test was used to determine on the appropriate model. The hausman test results are shown on Table 4.13

Table 4.13 Hausman test Results

```
. hausman fixed random

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |    fixed       random       Difference          S.E.
-------------+------------------------------------------------------------
assetquality |   .2096425     .0678696       .1417729        .0945682
capitalade~y |   .0080382     .0213596      -.0133214        .0275233
   liquidity |   .0209969     .0127101       .0082868        .0205991
earningrat~g |   .0930394     .0211234        .071916        .0135962
   saccosize |   .1429754      .019017       .1239584        .0185496
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       47.50
                Prob>chi2 =      0.0000
```

Source: Study Data, 2018

The null hypothesis of the hausman test is that the random effect is preferred to the fixed effects model. The hausman test results indicate a chi square of 47.50 and a p-value of 0.0000 which is less than the significance level of 0.05. Hence, the study rejects the null hypothesis that random effect is preferred to fixed effect model. Therefore, the fixed effect model is adopted in this study.

4.8 Correlation Analysis (for all Study Variables)

Before running regression model as per the objectives, the study conducted correlation analysis for the variables in order to examine the nature of the statistical relationships

between each pair of variables. Table 4.14 presents the results of Pearson's Correlation Analysis.

Table 4.14 Correlation matrix

	Bias Corrected Efficiency Scores	Asset Quality	Capital Adequacy	Liquidity	Earnings Rating
Bias Corrected Efficiency Scores	1				
Asset Quality	-.083* .033	1			
Capital Adequacy	.100* .014	.023 .304	1		
Liquidity	-.087* .028	-.137** .001	.073 .054	1	
Earnings Rating	-.003 .477	-.015 .374	.003 .470	-.032 .240	1

*** Correlation is significant at the 0.05 level (2-tailed).**

Source: Study Data, 2018

The findings in Table 4.14 indicate that the correlation between asset quality and efficiency was -0.083 with a corresponding p-value of 0.033. The coefficient was, therefore, negative and significant indicating that asset quality has a weak negative relationship with efficiency. This finding corroborates the findings of Kariuki (2017) and contradicts Kamau (2011). In addition, the correlation between capital adequacy and efficiency was 0.100 with a

corresponding p-value of 0.014. The coefficient was positive and significant indicating that capital adequacy has a weak positive relationship with efficiency which contradicts the findings of Kariuki (2017) .

Further, the correlation between liquidity and efficiency was -0.087 with a corresponding p-value of 0.028. The coefficient was negative and significant indicating that liquidity has a weak negative relationship with efficiency. Lastly, the correlation between efficiency and earning rating was -0.033 with a corresponding p-value of 0.477.The coefficient was negative and insignificant indicating .As such earning rating had weak negative relationship with efficiency.

4.9 Hypotheses Testing

This section presents the study findings based on the specific objectives. In order to determine the statistical significance of the hypothesized relationships, Panel Tobit Regression was conducted. The results were interpreted and discussed at the significance level of 0.05. The results are presented in Table 4.15 .

Table 4.15 Panel Tobit Regression Results

```
Tobit regression                                  Number of obs   =        485
                                                  LR chi2(4)      =      14.39
                                                  Prob > chi2     =     0.0062
Log likelihood =  -123.9834                       Pseudo R2       =     0.0548

------------------------------------------------------------------------------
biaseffici~s |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
assetquality |  -.1251659   .0629762    -1.99   0.047    -.2489084   -.0014234
capitalade~y |   .1497082   .0547532     2.73   0.006     .0421233    .2572931
   liquidity |  -.0973247    .041934    -2.32   0.021    -.1797212   -.0149282
earningsra~g |  -.0098767   .0448155    -0.22   0.826     -.097935    .0781816
       _cons |   .7525167   .0228537    32.93   0.000     .7076112    .7974222
-------------+----------------------------------------------------------------
      /sigma |   .2540892   .0096627                      .2351028    .2730756
------------------------------------------------------------------------------

  Obs. summary:          1  left-censored observation  at biaseffici~s<=0
                       386     uncensored observations
                        98 right-censored observations at biaseffici~s>=1
```

Source: Study Data, 2018

The findings in Table 4.15 indicate that the likelihood ratio chi square is 14.39 (d.f 4) with a p-value of 0.0062 .This is less than the significance level of 0.05. It demonstrates that the Tobit Model was fit to the dependent variable, using a constant term and all the four variables: asset quality, capital adequacy, liquidity and earnings rating. In addition, the null hypothesis that the coefficients of all the variables included in the model were simultaneously equal to zero excluding the constant was rejected. Finally, asset quality, and liquidity have a negative significant relationship with efficiency; capital adequacy has a positive significant relationship with efficiency; earning rating has negative insignificant relationship with efficiency.

4.9.1 Test of Hypothesis One

To establish the relationship between asset quality and efficiency, a null hypothesis (H_{01}) that asset quality has no significant effect on efficiency was tested. Table 4.15 indicates that the p-value of asset quality was 0.047 .This is less than the significance level of 0.05.This indicates a statistically significant relationship between asset quality and efficiency. Therefore, the null hypothesis that asset quality does not have a significant effect on efficiency was rejected and concluded that asset quality affect efficiency. The findings are consistent with empirical work by Nguyen and Vivien (2016), Ocholla (2016) and Karim, Hassan and Sok (2010). Further, the finding contradicts with the empirical studies by Barus, Muturi, Kibati and Koima (2017) and Chisti (2012) whose findings were asset quality have a negative insignificant relationship with efficiency.

4.9.2 Test of Hypothesis Two

To establish the relationship between capital adequacy and efficiency, a null hypothesis (H_{02}) that capital adequacy has no significant effect on efficiency was tested. Table 4.15 indicate that the p-value of capital adequacy was 0.006.This is less than the significance level of 0.05.This indicates a statistically significant relationship between capital adequacy and efficiency. Therefore, the null hypothesis that capital adequacy has no significant effect on efficiency was rejected concluding that capital adequacy affects efficiency. The findings are consistent with empirical studies by Pessarossi and Weill (2013), Fiordelisi, Marques-ibanez and Molneux (2011). Further, the finding contradicts with the empirical studies by Kariuki (2017), Berger and Bonaccorsi di Patti (2006) whose findings were that capital adequacy have a negative insignificant relationship with efficiency.

4.9.3 Test of Hypothesis Three

To establish the relationship between liquidity and efficiency, a null hypothesis (H_{03}) that liquidity has no effect on efficiency was tested. Table 4.15 indicates that the p-value of liquidity was 0.021.This is less than the significance level of 0.05.It indicates that there is a statistically significant relationship between liquidity and efficiency. Therefore, the null hypothesis that liquidity has no effect on efficiency was rejected and concluded that liquidity affect efficiency. The findings are consistent with empirical studies by Guenaou, Lahrech and Bounekaya (2017) and Kongiri (2012).Further, the finding contradicts with the empirical studies by Mukoswa (2014) and Sufian (2009). The findings were that liquidity has a positive significant relationship with efficiency.

4.9.4 Test of Hypothesis Four

To establish the relationship between earning rating and efficiency a null hypothesis (H_{04}) that earning rating has no effect on efficiency was tested. Table above indicates that the p-value of earning rating was 0.826.This is more than the significance level of 0.05. This indicates a statistically insignificant relationship between earning rating and efficiency. Therefore, the null hypothesis that liquidity has no effect on efficiency was not rejected; and concluded that earning rating does not affect efficiency. These findings are consistent with empirical studies by Austina Tortosa (2012), and Aguenaou, Lahrech and Bounekaya (2017). Further, the findings contradicts with the empirical studies by Lotto (2018) whose findings were that earning rating has a negative and significant relationship with efficiency.

The coefficients from Tobit regression analysis are not interpretable. This necessitated the use of marginal effects which can be interpreted. Table 4.16 presents the marginal effects results after Tobit regression.

Table 4.16 Marginal effects after Tobit regression

```
Marginal effects after tobit
      y  = E(biascorrectedefficiencyscores*|0<biascorrectedefficiencyscores<1) (predict, ystar(0,1))
         =  .72779599
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
assetq~y	-.1046883	.05269	-1.99	0.047	-.207967	-.00141	.112469
capita~y	.1252155	.04576	2.74	0.006	.03552	.214911	.259325
liquid~y	-.0814021	.03508	-2.32	0.020	-.150156	-.012648	.282593
earnin~g	-.0082608	.03748	-0.22	0.826	-.081727	.065205	.035279

Source: Study Data, 2018

Based on the analysis above on table 4.16 the following model was formulated

E=0.72779599+-0.1046883*AQ+0.1252155*CA+-0.0814021*LQ+……ε_{it}

Where:

E=efficiency, AQ=Asset Quality, CA=Capital Adequacy, LQ=Liquidity

The coefficient of asset quality was at β= -0.1046883 which indicates a negative and statistically significant relationship between asset quality and efficiency. The regression coefficient indicates that a unit increase in non-performing loans leads to a decrease in efficiency by 0.1046883 units all else held constant. This indicates that as asset quality

improves efficiency improves. These findings are consistent with the Asymmetric information theory (1970) which argues that asset quality has a negative relationship with efficiency. As pointed out by Berger and Young (1997), the negative relationship exists because the DTS will incur additional operating costs such as costs of collecting non-performing loans. The efficient DTS are better at managing their credit risk which leads to lower NPL.

The coefficient of capital adequacy was at β=0.1252155 portraying a positive and statistically significant relationship between capital adequacy and efficiency. The regression coefficient indicates that a unit increase in capital adequacy leads to an increase in efficiency by 0.1252155 units all else held constant. These findings are consistent with the Buffer Capital theory (1999) which argues that capital adequacy has a positive relationship with efficiency. The positive relationship indicates that capital adequacy provides a larger capital cushion. This strengthens financial stability lowering the moral hazard between owners and debt holders which improves efficiency.

The coefficient of liquidity was at β=-0.0814021 reflecting a negative and statistically significant relationship between liquidity and efficiency. The regression coefficient indicates that a unit increase in liquidity leads to a decrease in efficiency by 0.0814021 units all else held constant. These findings are consistent with the shiftability theory of liquidity (1915) which argues that liquidity has a negative relationship with efficiency. The negative relationship indicates that as liquidity ratio increases, the efficiency decreases. The DTS should maintain optimal liquidity because holding more liquid assets will prevent the DTS

from taking advantage of investment opportunities available which leads to increased income hence increased efficiency.

4.9.5 Test of Hypothesis Five

To test the fifth study hypothesis that size of DTS does not have a moderating effect on te relationship between financial soundness and efficiency, the study adopted a two-step procedure as specified Whisman and McClelland (2005) moderation test. The first step was to test size as an explanatory variable. Therefore, model 3.3 were estimated. Table 4.17 reports model 3.3 estimates which test size as an independent variable.

Table 4.17 Size of DTS as an independent variable

```
Tobit regression                                  Number of obs   =        485
                                                  LR chi2(5)      =      15.46
                                                  Prob > chi2     =     0.0086
Log likelihood = -123.44771                       Pseudo R2       =     0.0589

------------------------------------------------------------------------------
biascorrec~s |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
assetquality |  -.1247719   .0629059    -1.98   0.048    -.2483768    -.001167
capitalade~y |   .1457865   .0548312     2.66   0.008     .0380476    .2535254
   liquidity |  -.0993418   .0419355    -2.37   0.018    -.1817417   -.0169419
earningsra~g |  -.0108785   .0447769    -0.24   0.808    -.0988614    .0771044
 sizeofsacco |    .439875    .424854     1.04   0.301    -.3949285    1.274678
       _cons |  -3.193134   3.810928    -0.84   0.403     -10.6813    4.295029
-------------+----------------------------------------------------------------
      /sigma |   .2538106   .0096514                      .2348465    .2727747
------------------------------------------------------------------------------
  Obs. summary:          1  left-censored observation  at biascorrec~s<=0
                       386     uncensored observations
                        98 right-censored observations at biascorrec~s>=1
```

Source: Study Data, 2018

The findings in Table 4.17, indicate that the likelihood ratio chi square is 15.46 (d.f 5) with a p-value of 0.0086 which is less than the significance level of 0.05. This indicates that the Tobit model was fit to the dependent variable using a constant term and all the five variables

which include: asset quality, capital adequacy, liquidity, earnings rating and size. In addition, the null hypothesis that the coefficients of all the variables included in the model were simultaneously equal to zero excluding the constant was rejected. Lastly, asset quality, and liquidity have a negative significant relationship with efficiency; capital adequacy has a positive and significant earning rating ; size has an insignificant relationship with efficiency.

Table 4.18 presents the results of marginal effects after Tobit regression.

Table 4.18 Marginal effects after Tobit regression

Marginal effects after tobit
y = E(biascorrectedefficiencyscores*|0<biascorrectedefficiencyscores<1) (predict, ystar(0,1))
= .72787263

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
assetq~y	-.1043926	.05265	-1.98	0.047	-.207589	-.001196	.112469
capita~y	.1219749	.04585	2.66	0.008	.03212	.21183	.259325
liquid~y	-.0831161	.03509	-2.37	0.018	-.151894	-.014338	.282593
earnin~g	-.0091017	.03746	-0.24	0.808	-.082528	.064325	.035279
sizeof~o	.3680293	.35545	1.04	0.300	-.328631	1.06469	8.97355

Based on the analysis above on Table 4.18 above the following model was formulated:

E=0.72787263-0.1043926*AQ+0.1219749*CA+-0.0831161*LQ+-0.0091017*ER+

0.3680293 *SDTS ……ε_{it}

Where:

E=Efficiency, AQ=Asset Quality, CA=Capital Adequacy, LQ=Liquidity, ER=Earnings Rating, SDTS=Size of SACCO.

The coefficient of asset quality was β= -0.1043926 which indicates a negative and statistically significant relationship between asset quality and efficiency. The regression coefficient indicates that a unit increase in asset quality leads to a decrease in efficiency by 0.1043926 units. The coefficient of capital adequacy was β=0.1219749 which indicates a positive and statistically significant relationship between capital adequacy and efficiency. The regression coefficient indicates that a unit increase in capital adequacy leads to an increase in efficiency by 0.1219749 units. The coefficient of liquidity was β=-0.0831161 which indicates a negative and statistically significant relationship between liquidity and efficiency. The regression coefficient indicates that a unit increase in liquidity leads to a decrease in efficiency by 0.0831161 units.

The coefficient of earning rating was β=-0.0091017 which indicates a negative and statistically insignificant relationship between earning rating and efficiency. The regression coefficient indicates that a unit increase in earning rating leads to a decrease in efficiency by 0.0091017 units. The coefficient of size was β=0.3680293 which indicates a positive and statistically insignificant relationship between earning rating and efficiency .As such, size does not directly affect efficiency hence can moderate the relationship between financial soundness and efficiency. The second step is to test size as a moderator. Table 4.19 reports estimates which tests size as a moderator.

Table 4.19 Size of DTS as a moderator on the relationship between financial soundness and efficiency

Variable	Coefficient.	Std. Err.	P -Value
Asset Quality	-1.670457	0.27388	0.047
Capital Adequacy	0.455697	0.19472	0.020
Liquidity	-0.297448	0.13898	0.013
Earnings Rating	0.347094	0.14806	0.719
Size of DTS	2.718029	0.95322	0.005
AQ*Size of DTS	0.170988	3.05268	0.035
CA*Size of DTS	-0.505647	2.16664	0.020
LIQ*Size of DTS	0.020898	1.54789	0.029
ER*Size of DTS	-0.386146	1.64719	0.019
LR Chi square(5) 15.46			
Prob>Chi square 0.0086			

Source: Study Data,2018

The findings in Table 4.19, indicates that the likelihood ratio chi square is 28.48 (d.f 9) with a p-value of 0.0008 which is less than the significant level of 0.05.Accordingly the Tobit model was fit to the dependent variable using a constant term and all the nine variables. In addition, the null hypothesis that the coefficients of all the variables included in the model

were simultaneously equal to zero excluding the constant was rejected. Further, asset quality, capital adequacy, liquidity, size posted a significant relationship with efficiency while earning rating and size have an insignificant relationship with efficiency. Lastly, when asset quality, capital adequacy, liquidity and earning rating are interacted with size, there was a significant relationship with efficiency. Table 4.20 presents the results of marginal effects after tobit regression.

Table 4.20 Marginal effects after Tobit Regression

Variable	**dy/dx**	**Std.Error**	**P-Value**
Asset quality	-1.404164	0.05269	0.047
Capital Adequacy	0.3830532	0.04576	0.006
Liquidity	-0.2500308	0.03508	0.021
Earnings Rating	2.917629	0.03748	0.826
Size of DTS	2.28474	0.80117	0.005
Asset quality*Size	0.1437201	2.56606	0.035
Capital adequacy*Size	-4.250042	1.82143	0.020
Liquidity*Size	0.0175668	1.30114	0.029
Earning Rating*Size	-32.45894	1.3846	0.019
Cons	0.72866481		

Source: Study Data, 2018

Based on the analysis of the data in above on Table 4.20 above, the following model was formulated:

E=-0.72866481+-1.404164*AQ+0.3830532*CA+-0.2500308*LQ+2.917629ER+
2.28474*SDT+0.1437201AQ*SDTS+--4.250042CA*SDTS+0.0175668LQ*SDTS+
…….ε_{it}

Where:

E=Efficiency, AQ=Asset quality, CA=Capital adequacy, LQ=Liquidity,

SDTS=Size of DTS.

AQ*SS=interaction of asset quality and size of SACCO.

CA*SS=interaction of capital adequacy and size of SACCO.

LQ*SS=interaction of liquidity and size of SACCO.

ε_i =Error term

From Table 4.20, the p-value of asset quality was 0.047. This is less than the significance level of 0.05.This indicates a statistically significant relationship between asset quality and efficiency. The p-value of capital adequacy was at 0.020 which is less than the significance level of 0.05.This indicates a statistically significant relationship between capital adequacy and efficiency. The p-value of liquidity was 0.013, which is less than the significance level of 0.05.This indicates a statistically significant relationship between liquidity and efficiency. The p-value of earning rating was 0.719 which is less than the significance level of 0.05.This indicates a statistically insignificant relationship between liquidity and efficiency .The coefficient of the size was 0.005, which is less than the significance level of 0.05. This points to a statistically significant relationship between size and efficiency. Therefore, size moderates the relationship between financial soundness and efficiency.

When asset quality is interacted with size the p-value was 0.035.This is less than the significance level of 0.05.This indicates a statistically significant relationship. When capital adequacy is interacted with size the p-value was 0.020.This is less than the significance level of 0.05.This indicates a statistically significant relationship. When liquidity is interacted with size, the p-value was 0.029, less than the significance level of 0.05.This indicates a statistically significant relationship. When earning rating is interacted with size the p-value was 0.019, which is less than the significance level of 0.05. This denoted a statistically significant relationship. The significant interactions indicates that size moderates the relationship between financial soundness and efficiency .

Table 4.21 Summary of the moderating effect of size of DTS on the relationship between financial soundness and efficiency

Analysis	**Parameter**	**Result**	**Decision**
Step one Equation 3.3 Size of DTS as an explanatory variable	Coefficient of size	Insignificant coefficient of size	Size can moderate the relationship between financial soundness and efficiency of DTS in Kenya
Step two Equation 3.4 Size of DTS as a moderator	Coefficient of size	Significant coefficient of size	Size moderates the relationship between financial soundness and efficiency of DTS in Kenya
	Coefficient of interaction	Significant coefficients	

Source: Whisman and McClelland, 2005

From the results in Tables 4.19, 4.20 and 4.21, the null hypothesis (H_{05}) that size does not moderate the relationship between financial soundness and efficiency was rejected. The study and concludes that size moderates the relationship between financial soundness and

efficiency. The findings are consistent with that of Mwangi (2014) and Razmi, Sayyed Mohammed and Ali (2014) who found that size has a positive relationship on efficiency.

Table 4.21 Summary of Hypothesis Testing

Null hypothesis	**Result**	**Decision**
H_{01}: Asset quality does not have a significant effect on efficiency of DTS in Kenya	P=0.047<0.05 β = -0.1046883	Reject H_{01}
H_{02}: Capital adequacy does not have a significant effect on efficiency of DTS in Kenya	P=0.006<0.05 β = 0.1252155	Reject H_{02}
H_{03}: Liquidity does not have a significant effect on efficiency of DTS in Kenya	P=0.021<0.05 β = -0.0814021	Reject H_{03}
H_{04}: Earning rating does not have a significant effect on efficiency of DTS in Kenya	P=0.826>0.05 β = -0.0082608	Fail to Reject H_{04}
H_{05}: Size of DTS does not moderate the relationship between financial soundness and efficiency of DTS in Kenya	Moderation effect	Reject H_{05}

Source: Study Data, 2018

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter summarizes the study with specific focus on the statement of the problem, research objectives, methodology used and findings. In addition, the chapter presents conclusions related to each of the specific objectives and hypotheses. The chapter further suggests policy recommendations resulting from the findings and conclusions made. Lastly, the chapter highlights the limitations of the study and suggests areas for further research.

5.2 Summary

The study presents the background to the study which culminates to the statement of the problem. To address the research problem, research objectives were formulated. The study highlights the anticipated value addition from the research effort. The theories underpinning the study are documented and relevant literature on the study variables both local and foreign was reviewed and a conceptual framework was developed to show the study relationships. The study gives an overview of the research methodology used explaining the choice of positivist philosophy. The study used explanatory research design and census of one hundred and ten DTS was taken. Panel data for the period 2012 to 2016 was used in the analysis. The study further documents the data collection method and the model used in analysis.

The study found that the mean of DEA inputs and outputs increased over the study period (2012-2016). In addition, the standard deviation of DEA inputs and outputs was slightly higher than the mean, an indication that the data was highly spread. Furthermore, the study

established that the correlation between DEA inputs and outputs was very high; this is an indication that the selected inputs and outputs were appropriate. Lastly, the study found that the DTS had not achieved efficiency though the efficiency level on average had increased over the study period. When classified by size, the large DTS were more efficient than the small ones. The study found that the mean of bias corrected scores was lower than the DEA efficiency scores due to presence of bias.

First, the study sought to establish the effect of asset quality on efficiency. The study revealed that the mean of asset quality was far much higher than what the regulator recommends. Hence, it appears that DTS are not meeting the requirement by regulator. In addition, the study established that asset quality had a weak and negative relationship with efficiency. Further, there was a negative and significant relationship between asset quality and efficiency. This indicates that as asset quality increases, the efficiency decreases. Hence these findings support the Asymmetric Information Theory.

Secondly, the study sought to determine the effect of capital adequacy on efficiency. The findings were that the mean capital adequacy was higher than the requirement by the regulator. This indicates that on average, DTS are meeting the minimum requirement by the regulator. In addition, there was a weak and positive relationship between capital adequacy and efficiency. Besides, capital adequacy has a positive and significant relationship with efficiency. This points out that as capital adequacy increases, efficiency increases. Hence, these findings support the Buffer Capital Theory.

Thirdly, the study sought to examine the effect of liquidity on efficiency. The study found that the mean liquidity was above the minimum requirement by the regulator. Therefore, on average the DTS meet the minimum requirement. In addition, the liquidity was found to have a weak and positive correlation with efficiency. The study found a negative and significant relationship between liquidity and efficiency, this indicates that as liquidity increases, efficiency decreases. These findings support the Shiftability Theory of Liquidity.

Fourthly, the study sought to determine the effect of earnings rating on efficiency .The study found a weak and negative relationship between earning rating and efficiency. In addition, there was a negative and insignificant relationship between earning rating and efficiency. This indicates that as earning rating increases, efficiency decreases.

Lastly, the study sought to determine the moderating effect of size of a DTS on the relationship between financial soundness and efficiency . The study findings revealed that size significantly moderates the relationship between financial soundness and efficiency.

5.3 Conclusions

On the basis of foregoing empirical findings the study makes several conclusions relating to the study objectives and hypotheses. Most DTS in Kenya are struggling on how to utilize their resources to produce outputs. Small DTS suffer from lack of economies of scale whereas the larger DTS suffer from diseconomies of scale. Large DTS experienced high levels of technical efficiency and struggles with the scale problem. As much as the large DTS are more efficient, they have not exploited their economies of scale. Large DTS are exposed to a larger market where they are forced to compete with commercial banks.

In view of the test of Hypothesis One, the study found that asset quality has a negative and significant effect on efficiency. This finding is supported by several empirical studies though it also contradicts other studies. Hence, the study concludes that as asset quality increases more costs are incurred in collecting the debts, resulting in higher costs hence reducing efficiency. Further, the increase in asset quality increases the provisions. In so doing it limits the DTS from making investments. This in turn decreases the revenue translating into decreased efficiency.

The test of Hypothesis Two indicates that capital adequacy has a positive and significant effect on efficiency. This finding is supported by several empirical studies though it also contradicts other studies. This study, therefore, concludes that the more stringent DTS regulations on capital adequacy are, the more efficient they are. This supports the argument that well capitalized DTS can lower the costs of external financing. In this way, it reduces the total cost, hence improved efficiency.

The test of Hypothesis Three found that liquidity has a negative and significant effect on efficiency. This indicates that as liquidity level increases, efficiency decreases. This finding tallies with several empirical studies though it also contradicts other studies. Hence, the study concludes that as DTS hold more liquid assets above the required minimum by SASRA, they will not be in a position to benefit from investment opportunities available ;this will lead to decreased income, hence decreased efficiency.

Finally, the test results of Hypothesis Five points out that size of SACCO has a moderating effect on the relationship between financial soundness and efficiency. Hence, the study thus concludes that size moderates the relationship between financial soundness and efficiency. Accordingly, small DTS are less efficient compared to large DTS because of economies of scale.

5.4 Recommendations

In light of the findings of this study and conclusions drawn thereof, some recommendations to policy and practice are noteworthy. First, the management of DTS ought to be more careful in handling the inputs in producing output. Better usage of resources, can improve technical efficiency. Secondly, the management of DTS ought to work closely with the regulator (SASRA) to create a supporting environment for the small DTS to increase their size and managerial capacity. This can be done by constantly monitoring and supervising, designing an in-service certificate course in management of DTS to improve managerial capacity and offering technical support. Thirdly, DTS may adopt ICT platforms which enables members to access the core services. This would reduce overhead costs hence improve efficiency.

Fourthly, management should decrease staff costs and operating expenses by investing in advanced technological innovations in order to increase efficiency. Fifthly, the management should formulate a policy of extensively scrutinizing borrowers before issuing loans in order to reduce bad loans, hence increasing efficiency. Sixthly, a merger policy for the DTS should be developed so as to encourage the smallest DTS to merge with large DTS. Likewise, the

large DTS that are efficient may consider merging with a commercial bank or converting to a micro finance institution in order to increase economies of scale, hence improve efficiency

Seventhly, SASRA should continue to enforce the capital adequacy regulation and continually review them with time in order to enhance efficiency. Eighthly, they should come up with credit administration strategies that will help reduce the amount of NPL .This includes amendment of the Sacco Societies Act (SSA) making it compulsory for DTS to share credit information of their members with other credit service providers. Ninthly, academicians can use the contribution of financial soundness on efficiency to identify the knowledge gaps and pursue further research in the area.

Finally, the bulk of liquidity pressures in DTS is occasioned by demand for loans. Therefore, the DTS should devise innovative ways and means of not only mobilizing savings from members but to also retaining the savings. In addition, the regulator should come up with a realistic definition of liquidity ratio. This is because the prevailing regulatory definition did not consider the pressures of demand of loans, hence resulting to an incorrect liquidity position of DTS.

5.5 Contribution to knowledge

First, the study contributes to practice by documenting the level of efficiency of DTS in Kenya. This sector under study is a critical player as envisioned by Kenya's economic blue print Vision 2030.It is indispensable in achieving the envisaged 10% annual economic growth target. Secondly, academicians will appreciate the outcome of the study and use the

contribution of financial soundness on efficiency to identify knowledge gaps and pursue further research in the area in future. Thirdly, the study contributes to methodology by conducting a two stage analysis to determine the effect of financial soundness on efficiency. Previous studies have not done a two stage analysis, and those that did a two stage analysis used Multiple Regression on the second stage which is inappropriate. Fourthly, the study was anchored on buffer capital theory, economic efficiency theory, modern portfolio theory and asymmetric information theory. This study supported all the theories hence making a contribution to Finance Theory. Therefore, future researchers who would wish to conduct a research on financial soundness and efficiency can adopt the theories. Lastly, previous studies examined the direct effect of financial soundness on efficiency. The present study sought to fill the knowledge gap in literature and has documented that size has a moderating effect on the relationship between financial soundness and efficiency of DTS in Kenya.

5.6 Limitations of the study

The study encountered limitations which are noteworthy. Firstly, the study suffered from complications in data collection. In some cases, no uniform classification of accounting items. Classification was based on objective decision by individual DTS .However the researcher consulted the regulator to get the uniform classification of the accounting items. Secondly, the study experienced inadequate empirical evidence in Kenya in the area under study. However, similar studies on foreign literature were used to enhance discussions. Lastly, the data for some of the DTS targeted was incomplete because they were licensed towards the end of year 2012.The study considered only the DTS that had complete data.

5.7 Suggestions for Further Research

The research gaps documented out of the research efforts provide some basis for further empirical investigations. Firstly, the study established that some DTS recorded very high efficiency scores while others recorded very low scores. Therefore, need arises to conduct research to establish the sources of high efficiency scores. This would be important in guiding the DTS that recorded low scores to boost their efficiency. In addition, the current study used DEA to generate efficiency scores. Therefore, if a similar study is undertaken using stochastic frontier analysis (SFA) the inefficiency could change because in DEA each unit efficiency is a relative measure, depicting how its outputs to inputs differ from the unit in the sample with the best output to input ratio. The study thus recommends that a similar study be done using SFA to generate efficiency scores. Finally ,the current study was limited to the period 2012-2016, coinciding with the period having the prudential guidelines. Similar study should be done by increasing the study period a little more than five years.

REFERENCES

Abd Karim, M. Z., Sok, G. C., & Hassan, S. (2010). Bank efficiency and non-performing loans: Evidence from Malaysia and Singapore. Prague Economic Papers.

Adegbaju, A. A. & Olokoyo, F. O. (2008). Recapitalization and banks' performance: a case study of Nigerian banks. *African Economic and Business Review, 6*(1).

Adeolu M.A. (2014). Asset Quality and Bank Performance: A Study of CommercialBanks in Nigeria. Lagos State University.

Aguenaou. S, Lahrech. A, & Bounakaya. S,(2007)Analyzing Banks' Efficiency as a Measurement of Performance in the Moroccan Context: Application of CAMEL Framework

Ahmad, F., & Bashir, T. (2013). Explanatory Power of Bank Specific Variables as Determinants of Non-Performing Loans : Evidence form Pakistan Banking Sector. *World Applied Sciences Journal, 22*(9), 1220–1231.

Akerlof, G. (1970). The Market for Lemons: Quality Uncertainty and the Market Mechanism. *Quarterly Journal of Economics*, *48*, 488–500.

Alhassan, A. L. Kyereboah-Coleman, A. & Andoh, C. (2014). Asset quality in a crisis period: An empirical examination of Ghanaian banks. *Review of Development Finance, 4*(1), 50-62.

Alukwe, G. H. Ngugi, P. K. Ogollah, K. & Orwa, G. (2015). Corporate Governance Challenge to Regulation Compliance by Deposit Taking Savings and Credit Co-Operative Societies in Kenya. *International Journal of Academic Research in Business and Social Sciences, 5*(3), 179.

Baltagi, B. H. (2005). *Econometric Analysis of Panel Data*, third Edition, New York: JohnWiley & Sons Inc.

Barus, J. J., Muturi, W., Kibati, P., & Koima, J. (2017). Effect of Management Efficiency on Financial Performance of Savings and Credit Societies in Kenya. *Journal of Strategic Management, 2*(1), 92-104.

Bassem, B. S. (2008). Efficiency of microfinance institutions in the Mediterranean: an application of DEA. *Transition Studies Review*, *15*(2), 343-354.

Beck, C. & Polit, D. (2003). *Nursing Research*: Principles & Methods, 7th Edition, Williams and Wilkins, Lippincott, London.

Bell, E., & Bryman, A. (2007). The ethics of management research: an exploratory content analysis. *British Journal of Management*, 18(1), 63-77.

Berger A.& Bonacorsi R. (2006). A Study on the Relationship capital ratios and profit Efficiency after the Global Financial Crisis. *Global Business Administration Review, 10*(3)

Berger, A. N. & Mester, L. J. (1997). *Efficiency and productivity change in the US commercial banking industry: A comparison of the 1980s and 1990s* (No. 97-5).

Berger, A. N. Hasan, I. & Zhou, M. (2009). Bank ownership and efficiency in China: What will happen in the world's largest nation? *Journal of Banking & Finance*, *33*(1), 113-130.

Berger, A. N., DeYoung, R. (1997). "Problem Loans and Cost Effi ciency in Commercial Banks." *Journal of Banking & Finance*, Vol. 21 No.7

Borio, C., & Zhu, H. (2012). Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism?. *Journal of Financial Stability*, *8*(4), 236-251.

Breusch, T.S., & Pagan, A.R. (1980). The Lagrange Multiplier test and its Applications to Model Specification in Econometrics. *The Review of Economic Studies*, 47(1), 239- 253.

Buchory, H. A. (2014). Analysis of the Effect of Capital, Operational Efficiency, Credit Risk and Profitability to the Implementation of Banking Intermediation Functions (Study

on Regional Development Bank All Over Indonesia in 2012). *Academic Research International*, *1*(5), 440-457.

Bukhari, I., Cornelsen, J., Esch, F. R., Götz, P., Herrmann, A., ... & Tietz, W. (Eds.). (2014). *Marketingplanung*. Vahlen.

Burki, A. A., & Niazi, G. S. K. (2010). Impact of financial reforms on efficiency of state-owned, private and foreign banks in Pakistan. *Applied Economics*, *42*(24), 3147-3160.

Büyüksalvarci, A. & Abdioglu, H. (2011). Determinants of capital adequacy ratio in Turkish Banks: A panel data analysis. *African Journal of Business Management*, *5*(27), 11199.

Bwana, K. M. & Mwakujonga, J. (2013). Issues in SACCO development in Kenya and Tanzania: The historical and development perspectives. *The International Institute for Science, Technology and Education Journal*, *3*(5).

Cabrita, M. D. R. & Bontis, N. (2008). Intellectual capital and business performance in the Portuguese banking industry. *International Journal of Technology Management*, *43*(1-3), 212-237.

Carr, N. G. (2004). Does IT matter. *Information technology and the corrosion of competitive advantage*, *1*.

Casu, B., Girardone, C., & Malyneux, P. (2006). *Introduction to Banking*. Harlow, Pearson Education Limited.

Chakraborty, I. (2010). Capital structure in an emerging stock market: The case of India. *Research in International Business and Finance*, *24*(3), 295-314.

Chimkono, E. E., Muturi, W., & Njeru, A. (2016) Effect of Non-Performing Loans and Other Factors on Performance of Commercial Banks in Malawi. *African Journal of Business Management*, 7(30), 2938-2950.

Chisti, K. A. (2012). The impact of Asset Quality on Profitability of Private Banks in India. *Journal of African Macroeconomic Review*, *2*(1).

Choi, I. (2001). Unit root tests for panel data. *Journal of International Money and Finance*, 20,249-272.

Coelli, T. J. Rao, D. S. P. O'Donnell, C. J. & Battese, G. E. (2005). *An introduction to efficiency and productivity analysis*. Springer Science & Business Media.

Cohen, D., & Crabtree, B. (2006). Qualitative research guidelines project.

Cole, R. A. & Wu, Q. (2009, April). Predicting bank failures using a simple dynamic hazard model. In *22nd Australasian Finance and Banking Conference* (pp. 16-18).

Cooper, R. D., & Schindker, S. P. (2008). *Business Research Methods*. India: Tata McGraw-Hill

Cooper, W.W., Seiford, L.M. & Zhu, J. (2011). Data envelopment analysis: History, models, and interpretations. In: W.W. Cooper, L.M. Seiford & Zhu, J. (Eds.), *Handbook on data envelopment analysis International Series in Operations Research & Management Science.* US: Springer, 164:1-39.

Dalla, N. O., Muturi, W., & Ngumi, P. (2014) Effect of Real Lending Rate on the Level of Non-Performing Loans in Commercial Banks in Kenya.

Dawson, C. (2009). *Introduction to Research Methods*: A Practical Guide for Anyone Undertaking a Research Project. 3 Newtec Place, United Kingdom.How To Books Ltd

De Bock, R., & Demyanets, M. A. (2012). Bank asset quality in emerging markets: Determinants and spillovers (No. 12-71). International Monetary Fund.

Debreu, G. (1951). The Coefficient of Resource Utilization. *Econometrica: Journal of the Econometric Society*, 273–292.

Drake, L. & Hall, M.J.B. (2003). Efficiency in Japanese banking: An empirical analysis. *Journal of Banking and Finance,* 27:889-917.

Elton, E. J., Gruber, M. J., Brown, S. J., & Goetzmann, W. N. (2009). *Modern portfolio theory and investment analysis*. John Wiley & Sons.

Eriksson, P., & Kovalainen, A. (2008). *Qualitative methods in business research*. London, UK: Sage.

Fatima, N. (2014). Capital Adequacy: A Financial Stability Indicator for Banks. *Global Journal of Finance and Management*, 6(8), 771-776.

Fiordelisi, F., Marques-Ibanez, D., & Molyneux, P. (2011). Efficiency and risk in European banking. *Journal of Banking & Finance, 35*(5), 1315-1326.

Francis, W. B., & Osborne, M. (2012). Capital requirements and bank behavior in the UK: Are there lessons for international capital standards?. *Journal of Banking & Finance*, *36*(3), 803-816.

Fried, H.O., Lovell, K.C.A. & Eeckaut, P.V. (1993). Evaluating the performance of US credit unions. *Journal of Banking and Finance*, 17:251-265.

Golin, J. & Delhaise, P. (2013). *The bank credit analysis handbook: a guide for analysts, bankers and investors*. John Wiley & Sons.

Gorton, G., & Huang, L. (2002). *Banking panics and the origin of central banking* (No. w9137). National Bureau of Economic Research.

Greene, W.H. (2008). *Econometric Analysis* (6th ed.). Upper Saddle River, N.J.:Prentice Hall

Grier, A. (2007). Resilience of Microfinance Institutions to National Macroeconomic Events: An Econometric Analysis of MFI Asset Quality. *SSRN Electronic Journal*.

Gudmundsson, R. Ngoka-Kisinguh, K. & Odongo, M. T. (2013). The Role of Capital Requirements on Bank Competition and Stability: The Case of the Kenyan Banking Industry. *Kenya Bankers Association-KBA Centre for Research on Financial Markets and Policy Working Paper Series*.

Gujarati, D. & Porter, D. (2009). *Basic Econometrics* (Fifth ed.). Boston: McGraw-Hill Irwin. p. 400.

Gujarati,D.(2003) .*Basic Econometrics*.4th ed.New York:McGraw Hill,638-640.

Hagendorff, J., & Nieto, M. J. (2013). The Safety and Soundness Effects of Bank M&A in the EU: Does Prudential Regulation Have any Impact? *European Financial Management, 21*(3)

Harley, D. (2011). *AVIEN Malware Defense guide for the Enterprise*. Elsevier.

Harris, O., Huerta, D., & Ngo, T. (2013). The impact of TARP on bank efficiency. *Journal of International Financial Markets, Institutions and Money*, *24*, 85-104.

Hayes, A., & Matthes, J. (2009). "Computational procedures for probing interactions in OLS and logistic regression: SPSS and SAS implementations." *Behavior Research Methods*, Vol. 41, pp. 924–936.

Heid, F. (2007). The cyclical effects of the Basel II capital requirements. *Journal of Banking & Finance*, 31(12), 3885-3900.

Hsiao, C. (2007). Panel data analysis—advantages and challenges. *Test*, 16(1), 1-22.

Ikpefan, O. A. (2013). Capital adequacy, management and performance in the Nigerian commercial bank (1986-2006). *African Journal of Business Management*, 7(30), 2938-2950.

Jackson, S. (2009). *Research Methods and Statistics*: A Critical Thinking Approach, 3rd Edition. United States of America.Waldsworth Cengage Learning

Jeitschko, T. D., & Jeung, S. D. (2005). Incentives for risk-taking in banking–A unified approach. *Journal of Banking & Finance*, 29(3), 759-777.

Johnson, P. and Gill, John. (2002). *Research Methods for Managers*, 3rd ed., London,.Sage Publications.

Jokipii, T., & Milne, A. (2011). Bank capital buffer and risk adjustment decisions. *Journal of Financial Stability*, *7*(3), 165-178.

Kamau, A. W. (2011). Intermediation efficiency and productivity of the banking sector in Kenya. *Interdisciplinary Journal of Research in Business*, *1*(9), 12-26.

Kariuki, P. W. O. (2017). *Firm Characteristics and Financial Intermediation Efficiency of Deposit Taking Saving and Credit Co-operative Societies in Kenya* (Doctoral dissertation, COHRED, JKUAT).

Kariuki, P. W., Muturi, W. M., & Ngugi, P. K.(2017) Profitability and intermediation efficiency: Evidence from deposit taking saving and credit co-operative societies in Kenya. *International Journal of Economics & Finance (IJEF)*, *2*.

Kashyap, A. K., Rajan, R., & Stein, J. C. (2002). Banks as liquidity providers: An explanation for the coexistence of lending and deposit-taking. *The Journal of Finance, 57*(1), 33-73.

Ke, T. Y., Li, Y., & Chiu, Y. H. (2011). Analyzing for profit efficiency of banks with undesirable output. *African Journal of Business Management*, *5*(20), 8141.

Kenya, F. S. D. (2013). Central Bank of Kenya (2013). *FinAccess National Survey 2013: Profiling developments in financial access and usage in Kenya, Nairobi*.

Kerlinger, F. N., & Lee, H. B. (2000). Foundations of Behavioral Research Thomson Learning. *New York*.

Khalid, A. C. (2012). The impact of Asset Quality on Profitability of Private Banks in India: A Case Study of JK, ICICI, HDFC & YES Banks. *Journal of African Macroeconomic Review*, *2*(1).

Khatmando, Nepal Roman, A., & Şargu, A. C. (2013). Analysing the Financial Soundness of the Commercial Banks in Romania: An Approach based on the Camels Framework. *Procedia Economics and Finance*, *6*, 703-712.

Khemraj, T., & Pasha, S. (2009). The determinants of non-performing loans: an econometric case study of Guyana.

Kirkpatrick, G. (2009). The corporate governance lessons from the financial crisis. *OECD Journal: Financial Market Trends*, *2009*(1), 61-87.

Kisengo, Z. & Kipchumba, S. (2013). Impact of Structure Related Firm Characteristics on Performance of Microfinance Institutions in Nakuru, Kenya.

Kivuvo, R. M. & Olweny, T. (2014). Financial Performance Analysis of Kenya's SACCO Sector Using the Altiman Z Score Model of Corporate Bankruptcy. *International Journal of Business and Social Science*, *5*(9).

Kleff, V., & Weber, M. (2008). How do banks determine capital? Evidence from Germany. *German Economic Review*, 9(3), 354-372.

Kock, N.; Lynn, G. S. (2012). "Lateral collinearity and misleading results in variance-based SEM: An illustration and recommendations". *Journal of the Association for Information Systems* (7): 546–580.

Kothari, C. (2004). *Research Methodology*: Methods & Techniques, 2nd edition. New Delhi, India.New age International Publishers

Kothari, C.R. (2008). *Research Methodology*: Methods & techniques. New Delhi: New Age International (P) Ltd.

Kraemer, H. C., Stice, E., Kazdin, A., Offord, D., & Kupfer, D. (2001). How do risk factors work together? Mediators, moderators, and independent, overlapping, and proxy risk factors. *American journal of psychiatry*, *158*(6), 848-856.

Lavrakas P. (2008). *Encyclopedia of Survey Research Methods*, Vol. 1 &2. Los Angeles, United States of America. Sage Publications.

Leibenstein, H. (1978). *General X-efficiency theory and economic development*. Oxford University Press.

Limam, I. (2001). *Measuring technical efficiency of Kuwaiti banks*. Kuwait: Arab Planning Institute.

Lindgren,C.J.,Garua,G.G & Saal,M.I (1996) Bank soundness and macroeconomic policy.International monetary Fund.

Lotto, J. (2018). The Empirical Analysis of the Impact of Bank Capital Regulations on Operating Efficiency. *International Journal of Financial Studies*, *6*(2), 34.

Martić, M., Novaković, M., & Baggia, A. (2009). Data envelopment analysis-basic models and their Utilization. Organizacija, 42(2), 37-43.

Marwa, N., & Aziakpono, M. (2014). Efficiency and profitability of Tanzanian saving and credit cooperatives: who is a star?.

Meeker, L. G., & Gray, L. (1987). A note on non-performing loans as an indicator of asset quality. Journal of banking & finance, 11(1), 161-168.

Mishkin, F. S. (2006, June). Financial stability and globalization: getting it right. In *Bank of Spain Conference, Central Banks in the 21st Century* (pp. 8-9).

Njeru, M. D (2016) Effect of Liquidity Management on Financial Performance of Deposit Taking Saving and Credit Co-operative Society in Kenya (Doctoral dissertation, COHRED, JKUAT)

Moffat, B. D. (2008). Efficiency and productivity in Botswana's financial institutions. PhD Thesis presented at the University of Wollongong.

Moh'd Al-Tamimi, K. A. & Obeidat, S. F. (2013). Determinants of capital adequacy in commercial banks of Jordan an empirical study. *International Journal of Academic research in Economics and management sciences*, *2*(4), 44.

Moses, C., & Umoren, A. O. (2010). The Effect of Capital Adequacy on Banks' Performance: Evidence from Nigeria. *Journal of Business Research (. JBR)*, *4*(1 & 2), 93-116.

Mugenda, O. M., & Mugenda, A .G. (2003). *Research methods*; quantitative and Qualitative approaches. Nairobi: African Centre for Technology Studies.

Mukherji, P. A. D.(2010). Research Methods in Early Childhood.

Muriithi, J. G., & Waweru, K. M. (2017). Liquidity Risk and Financial Performance of Commercial Banks in Kenya. *International Journal of Economics and Finance*, *9*(3), 256

Murillo-Zamorano, L. R. (2004). Economic efficiency and frontier techniques. *Journal of Economic surveys*, *18*(1), 33-77.

Muriuki, K. M. & Ragui, M. (2013). Impact of the SACCO Societies Regulatory Authority (SASRA) legislation on corporate governance in Co-operatives in Kenya. *Public Policy and Administration Research*, *3*(6), 65-70.

Mwangi, M. (2014). The influence of members'income and conduct of saccos in the relationship between characteristics and efficiency of saccos in Kenya. *Unpublished PhD thesis. Nairobi: University of Nairobi*.

Mwega, F. (2011). The competitiveness and efficiency of the financial services sector in africa: A case study of kenya. *African Development Review*, *23*(1), 44-59.

Nadiri, M. I. (1970). Some approaches to the theory and measurement of total factor productivity: a survey. *Journal of Economic Literature*, *8*(4), 1137-1177.

Nag, R. Hambrick, D. C. & Chen, M. J. (2007). What is strategic management, really? Inductive derivation of a consensus definition of the field. *Strategic management journal*, *28*(9), 935-955.

Narasimhan, V. K. VK, & Goel, M.(2013). Capital adequacy and its relevance to the Indian banking sector: A study of four Indian banks. *International Research Journal of Social Sciences*, 2(11).

Nasieku, T., & Togun, O. R. (2014). Corporate Governance And firm's Earnings Quality. *Economics and Finanacial Review*, *3*(12), 01-10.

Ng'etich Joseph & Wanjau W (2011). The effects of interest rate spread on the level of non-performing assets: A case of commercial banks in Kenya. *International Journal of Business and Public Management (ISSN: 2223-6244) Vol*, *1*(1), 58-65.

Nikoo, S. F. (2015). Impact of Capital Structure on Banking Performance: Evidence from Tehran Stock Exchange. *International Research Journal of Apllied and Basic Sciences*, 9(6), 923-927.

Ningi, S. I. & Dutse, A. Y. (2008). Impact of bank consolidation strategy on the Nigerian economy. *African Economic and Business Review*, *6*(2), 26-45.

Nyangeri, F. O. (2014). The Effect of Firm Characteristics on the Financial Performance of Pension Schemes in Kenya. *African Journal of Business Management*, 7(30), 2938-2950.

Ochei, I. (2013). Capital adequacy , management and performance in the Nigerian commercial bank (1986 - 2006). *African Journal of Business Management*, *7*(30), 2938–2950.

Ochola, P.(2016) A two-stage study on efficiency of saving and credit cooperative societies in kenya *International Journal of Economics Commerce and Management*

Odunga, R. M., Nyangweso, P. M., Carter, D. A., & Mwarumba, M. (2013). Credit Risk,"Capital Adequacy and Operating Efficiency Of Commercial Banks in Kenya". *International Journal of Business and Management Invention*, *2*(9), 6-12.

Okafor, C., Ikechukwu, K., & Adebimpe, U. (2010). The Effect of Capital Adequacy on Banks' Performance: Evidence from Nigeria. *Journal of Business Research*, *4*(1-2).

Olalekan, A. & Adeyinka, S. (2013). Capital adequacy and banks' profitability: An empirical evidence from Nigeria. *American International Journal of Contemporary Research*, *3*(10), 87-93.

Omisore, I., Yusuf, M., & Christopher, N. (2011). The modern portfolio theory as an investment decision tool. *Journal of Accounting and Taxation*, *4*(2), 19-28.

Ongore, V. O. & Kusa, G. B. (2013). Determinants of financial performance of commercial banks in Kenya. *International Journal of Economics and Financial Issues*, *3*(1), 237.

Osei-Assibey, E. & Asenso, J. K. (2015). Regulatory capital and its effect on credit growth, non-performing loans and bank efficiency: Evidence from Ghana. *Journal of Financial Economic Policy*, *7*(4), 401-420.

Owen, G. R. (2007). *Rural outreach and financial Cooperatives: SACCOs in Kenya*. Agriculture and Rural Development Department, World Bank.

Pan, E. J. (2010). Challenge of international cooperation and institutional design in financial supervision: beyond transgovernmental networks. *Chicago Journal of International Law*, *11*, 243-284.

Pessarossi, P., & Weill, L. (2013). Do capital requirements affect bank efficiency? Evidence from China.

Pfaff, B. (2012). Modern portfolio theory. *Financial Risk Modelling and Portfolio Optimization with R*, 46-53.

Pi, L. & Timme, S. G. (1993). Corporate control and bank efficiency. *Journal of Banking & Finance*, *17*(2), 515-530.

Podpiera, A., Weill, L., & Schobert, F. (2007). *Market Power and Cost Efficiency in the Czech Banking Sector* (No. 7). Czech National Bank Working Paper.

Qayyum, A. (2006). *Financial Sector Reforms and the Efficiency of Banking in Pakistan*. Paper presented at the 2007 8th Annual Conference of the South Asian Network of Economic Research Institutes (SANEI)

Rani, A. (2012). The modern portfolio theory as an investment decision tool. *International Journal of Management Research and Reviews*, *2*(7), 1164.

Razali, N. & Wah, B. (2011). "Power comparisons of Shapiro–Wilk, Kolmogorov–Smirnov, Lilliefors and Anderson–Darling tests" . *Journal of Statistical Modeling and Analytics (1): 21–33.* Accessed on 2015-06-30.

Rime, B. (2001). Capital requirements and bank behaviour: Empirical evidence for Switzerland. *Journal of Banking & Finance*, *25*(4), 789-805.

Roman, D., & Mitra, G. (2009). Portfolio selection models: A review and new directions. *Wilmott Journal*, *1*(2), 69-85.

Roman, A., & Şargu, A. C. (2013). Analysing the Financial Soundness of the Commercial Banks in Romania: An Approach based on the Camels Framework. *Procedia Economics and Finance, 6,* 703-712. doi:10.1016/s2212-5671(13)00192-5

Sang, P. K., & Kimani D.N. (2016). Influence of Credit Information System on loan default Rate in deposit taking Saccos In Kericho County, Kenya. *IOSR Journal of Business and Management, 18*(10), 37-44.

Saunders, M., Lewis, P., & Thornhill, A. (2009). Formulating the research design. *Research methods for business students,* 130-161.

Schneider (2008). Financial Sector Development and Total Factor Productivity Growth. *Financial Development, Institutions, Growth and Poverty Reduction,* 231-259.

Schulmerich, M., Leporcher, Y. M., & Eu, C. H. (2015). Modern Portfolio Theory and Its Problems. In *Applied Asset and Risk Management* Springer Berlin Heidelberg.

Schwab, D. (2005). *Research Methods for Organizational Studies*, 2nd Ed., Lawrence Erlbaum Associates, London.

Seccareccia, M. (2012). Financialization and the transformation of commercial banking: understanding the recent Canadian experience before and during the international financial crisis. *Journal of Post Keynesian Economics, 35*(2), 277-300.

Sekaran,U. & Bougie, R. (2011). *Research Methods for Business*: A Skill Building Approach. 5th Edition. Delhi.Aggarwal Printing Press.

Shipway, I. (2009). Modern portfolio theory. *Trusts & Trustees, 15*(2), 66-71.

Shoaib, A. (2011). Measuring performance through capital structure: Evidence from banking sector of Pakistan. *African Journal of Business Management, 5*(5), 1871-1879.

Soboh, R.A.M.E., Lansink, A.O., Giesen, G. & Van Dijk, G. (2009). Performance measurement of the agricultural marketing cooperatives: the gap between theory and practice. *Review of Agricultural Economics*, 31(3):446-469.

Spence, M. (1973). Job Market Signaling. *Quarterly Journal of Economics, 87*, 355–374

Stolz, S. M. (2007). Bank capital and risk-taking: The impact of capital regulation, charter value, and the business cycle. *Springer Science & Business Media*

Sufian, F. (2009). Determinants of bank efficiency during unstable macroeconomic environment: Empirical evidence from Malaysia. *Research in International Business and Finance*, *23*(1), 54-77.

Swamy, V. (2017). Determinants of Bank Asset Quality and Profitability

Taylor, R.A. (2001). Credit unions and economic efficiency. *Rivista Internazionale di Scienzes Economicale e Commerciali,* 24:239-47.

Teece, D. J. (1982). Towards an economic theory of the multiproduct firm. *Journal of Economic Behavior & Organization*, *3*(1), 39-63.

Teece, D. J. (2010). Business models, business strategy and innovation. *Long range planning*, *43*(2), 172-194.

Tesfay, H. & Tesfay, A. (2013). Relative efficiency of rural saving and credit cooperatives: An application of data envelopment analysis. *International Journal of Cooperative Studies*, *2*(1), 16-25.

Thanassoulis, E. (2001). *Introduction to the theory and application of data envelopment analysis*. Dordrecht: Kluwer Academic Publishers.

Usman, G & Zahid, M. (2011). Factors Influencing Performance Of Microfinance Firms In Pakistan: Focus On Market Orientation International. *Journal of Academic Research* Vol. 3. No. 5.

Verbeek, M. (2012). *A Guide to Modern Econometrics (Fourth ed.).* Chichester: John Wiley.

Were, M., & Wambua, J. (2014). What factors drive interest rate spread of commercial banks? Empirical evidence from Kenya. *Review of Development Finance*, 4(2), 73-82.

Wheelock, D. C., & Wilson, P. W. (2011). Are credit unions too small? *The Review of Economics and Statistics*, *93*(4), 1343–1359.

Whisman, M. A., & Mc Clelland, G. H. (2005). Designing, Testing, and Interpreting Interactions and Moderator Effects in Family Research. *Journal of Family Psychology*, 19 (1), 111 – 120

Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.

WOCCU. (2014). Worldwide Credit Unions. World Council of Credit Unions. Available online at http://www.woccu.org/ Accessed on 25 March 2014.

Zhang, Y. (., Cheng, Z., & Harvie, C. (2013). The Roles of Size and Size Difference in Australian and Chinese Inter-firm Collaborations. *Australasian Accounting, Business and Finance Journal*, *7*(2), 47-62.

APPENDICES

APPENDIX I: List of Deposit Taking SACCOS in Kenya as at 31st December 2012

1. Afya
2. Airport
3. Asili
4. Bandari
5. Baraka
6. Bi-high
7. Biashara
8. Bingwa
9. Boresha
10. Centenary
11. Chai
12. Chuna
13. Cosmopolitan
14. County
15. Daima
16. Dhabiti
17. Dimkes
18. Dumisha
19. Egerton
20. Enea
21. Fortune
22. Fundilima
23. Githunguri dairy
24. Gusii
25. Harambee
26. Hazina
27. Imarisha
28. Imenti
29. Jamii
30. Jumuika
31. Kenpipe
32. Kenversity
33. Kenya achievas
34. Kenya bankers
35. Kenya highlands
36. Kenya canners
37. Kenya police
38. Kimbilio
39. Kingdom
40. Kite
41. Kitui teachers
42. Kmfri
43. Konoin
44. K-unity
45. Lengo
46. Mafanikio
47. Magadi
48. Magereza
49. Maisha bora
50. Mentor
51. Metropolitan national
52. Mm
53. Mombasa ports
54. Mudete
55. Mwalimu national
56. Mwito
57. Nacico
58. Nafaka
59. Nandi farmers
60. Nassefu
61. Nation
62. Ndege chai
63. Ndosha
64. New fortis
65. Ngarisha
66. Nrs
67. Nyambene
68. Nyamira
69. Ollin
70. Patnas
71. Prime time
72. Qwetu
73. Safaricom
74. Shoppers
75. Sheria
76. Simba
77. Siraji
78. Skyline
79. Smartlife
80. Solution

81. Sotico
82. Southernstar
83. Stake kenya
84. Stima sukari
85. Sukari
86. Supa
87. Tai
88. Taifa
89. Taraji
90. Tembo
91. Tenhos
92. Thamani
93. Times u
94. Tower
95. Transnation
96. Transnation times
97. Ukulima
98. Unaitas
99. United nations
100. Universal
101. Vision point
102. Wakenya pamoja
103. Wakulima commercial
104. Wanaanga
105. Wananchi
106. Wanandege
107. Washa
108. Waumini
109. Winas
110. Yetu

Source: SACCO Societies Regulatory Authority (2017)

Appendix II: Document Review Guide I

	Name of DTS							
Year	Total staff cost	Other operating expenses	Total deposits	Interest on member deposits	Total Loans	Dividends to members	Interest income	Other Income
2012								
2013								
2014								
2015								
2016								

Appendix III: Document Review Guide II

Name of DTS											
	Years	Short term liabilities	Liquid assets	Earnings before interest and tax	NPL Value	Core Capital Value	Earning assets	Core Capital Value	Total Deposits Value	Total Assets	Share holders Equity
	2012										
	2013										
	2014										
	2015										
	2016										

APPENDIX IV: List of DTS and the efficiency scores

SACCO	year	CRSTE	VRSTE	CRSTE Bias corrected scores
1	2012	0.6147	0.5690	0.4680
1	2013	0.7561	0.6640	0.6090
1	2014	0.6560	0.5910	0.5230
1	2015	0.7827	0.9730	0.6750
1	2016	0.8063	0.6310	0.6310
2	2012	0.5860	1.0000	0.3510
2	2013	0.7547	1.0000	1.0000
2	2014	0.6839	0.7390	0.4550
2	2015	0.7588	1.0000	0.6880
2	2016	0.8344	0.9410	0.7930
3	2012	0.5448	0.5790	0.5430
3	2013	0.7780	0.7640	0.7360
3	2014	0.6622	0.6860	0.6860
3	2015	0.7614	0.7480	0.7460
3	2016	0.8094	0.8410	0.8380
4	2012	0.6074	1.0000	1.0000
4	2013	0.7567	1.0000	1.0000
4	2014	0.6695	1.0000	1.0000
4	2015	0.7913	1.0000	0.9120
4	2016	0.7944	1.0000	1.0000
5	2012	0.5880	1.0000	0.6770
5	2013	0.7712	0.7890	0.7190
5	2014	0.6949	1.0000	0.7020
5	2015	0.7571	0.8310	0.8170
5	2016	0.8192	0.9920	0.8870
6	2012	0.5741	0.7280	0.5080
6	2013	0.7552	0.6720	0.5960
6	2014	0.7050	0.6690	0.5230
6	2015	0.7823	0.8160	0.7110
6	2016	0.8316	0.8010	0.7220
7	2012	0.5783	0.5620	0.4790
7	2013	0.7243	0.7180	0.7140
7	2014	0.7221	0.5640	0.5630
7	2015	0.7778	0.9700	0.9590
7	2016	0.8058	0.7210	0.7210
8	2012	0.5615	0.8290	0.7450
8	2013	0.7746	0.7180	0.6480

8	2014	0.6850	0.6720	0.5690
8	2015	0.7759	0.6430	0.5340
8	2016	0.7844	0.7440	0.6260
9	2012	0.5938	1.0000	0.6300
9	2013	0.7573	1.0000	1.0000
9	2014	0.6555	0.5900	0.4320
9	2015	0.7947	0.6920	0.6610
9	2016	0.8233	0.7340	0.6800
10	2012	0.6137	0.6960	0.3960
10	2013	0.7580	0.6050	0.5580
10	2014	0.6821	0.5630	0.5580
10	2015	0.8067	0.7360	0.7160
10	2016	0.8166	0.8220	0.8130
11	2012	0.5704	1.0000	0.6110
11	2013	0.7501	1.0000	0.8590
11	2014	0.6532	1.0000	1.0000
11	2015	0.7807	0.9700	0.9040
11	2016	0.7987	0.9750	0.9200
12	2012	0.5806	0.5830	0.5500
12	2013	0.7707	0.8230	0.8180
12	2014	0.6695	0.5340	0.5310
12	2015	0.7757	0.7770	0.7770
12	2016	0.7923	0.5910	0.5790
13	2012	0.6141	0.9170	0.6060
13	2013	0.7468	1.0000	1.0000
13	2014	0.6686	1.0000	0.5800
13	2015	0.7673	1.0000	1.0000
13	2016	0.8055	0.9600	0.5500
14	2012	0.5552	0.7510	0.6270
14	2013	0.7563	1.0000	1.0000
14	2014	0.6426	1.0000	1.0000
14	2015	0.7876	0.8910	0.8120
14	2016	0.8066	0.9590	0.8550
15	2012	0.5729	0.9050	0.5700
15	2013	0.7366	1.0000	0.8490
15	2014	0.6580	1.0000	0.7810
15	2015	0.7795	1.0000	0.8770
15	2016	0.7874	1.0000	0.9200
16	2012	0.5823	1.0000	0.6450
16	2013	0.7638	1.0000	1.0000
16	2014	0.6698	1.0000	1.0000
16	2015	0.7980	1.0000	0.5620

16	2016	0.7997	1.0000	0.6540
17	2012	0.5850	1.0000	1.0000
17	2013	0.7432	0.7780	0.7610
17	2014	0.6883	1.0000	1.0000
17	2015	0.8079	1.0000	0.8730
17	2016	0.7986	1.0000	0.9160
18	2012	0.5838	0.6900	0.2720
18	2013	0.7536	0.6320	0.4880
18	2014	0.6659	0.6320	0.5010
18	2015	0.7939	0.6920	0.6060
18	2016	0.7746	0.6930	0.6540
19	2012	0.5749	0.8400	0.4350
19	2013	0.7838	0.8810	0.7370
19	2014	0.6813	0.8560	0.5770
19	2015	0.8143	1.0000	0.8350
19	2016	0.8044	0.8320	0.7930
20	2012	0.5575	0.7800	0.6710
20	2013	0.7578	0.8430	0.8410
20	2014	0.6769	0.7750	0.7470
20	2015	0.7750	1.0000	1.0000
20	2016	0.8039	0.8950	0.8900
21	2012	0.5480	0.4280	0.1980
21	2013	0.7532	0.6880	0.6510
21	2014	0.7078	0.6930	0.5700
21	2015	0.7961	0.7500	0.7200
21	2016	0.7886	0.8170	0.7250
22	2012	0.5531	0.4920	0.2690
22	2013	0.7505	0.8770	0.8210
22	2014	0.6766	0.8150	0.7780
22	2015	0.8061	1.0000	1.0000
22	2016	0.8031	1.0000	1.0000
23	2012	0.6162	0.9500	0.9480
23	2013	0.7667	1.0000	1.0000
23	2014	0.6606	1.0000	1.0000
23	2015	0.7809	0.7333	0.7320
23	2016	0.8013	0.7333	0.7320
24	2012	0.5559	0.6520	0.3740
24	2013	0.7699	0.7350	0.5780
24	2014	0.7143	0.7030	0.5260
24	2015	0.7933	0.7290	0.6400
24	2016	0.7875	0.8760	0.7730
25	2012	0.5862	0.1370	0.0000

25	2013	0.7833	0.9660	0.7640
25	2014	0.6521	0.3570	0.3370
25	2015	0.7679	0.4310	0.3200
25	2016	0.8203	0.4760	0.4670
26	2012	0.6032	0.5620	0.4910
26	2013	0.7746	0.6790	0.6330
26	2014	0.6500	0.6030	0.4830
26	2015	0.7882	0.9910	0.9040
26	2016	0.7981	1.0000	0.8730
27	2012	0.5639	1.0000	0.6000
27	2013	0.7600	0.8250	0.5970
27	2014	0.6630	0.4740	0.4730
27	2015	0.8101	1.0000	0.7660
27	2016	0.7885	1.0000	1.0000
28	2012	0.5419	0.5530	0.2230
28	2013	0.7786	1.0000	0.9760
28	2014	0.6884	0.9760	0.7110
28	2015	0.7723	0.8940	0.7980
28	2016	0.7993	0.7940	0.6610
29	2012	0.5817	0.7060	0.6750
29	2013	0.7542	1.0000	0.9900
29	2014	0.7074	0.6790	0.6430
29	2015	0.7938	0.7440	0.7430
29	2016	0.8099	0.7690	0.7660
30	2012	0.6221	1.0000	0.8650
30	2013	0.7741	1.0000	1.0000
30	2014	0.6624	1.0000	1.0000
30	2015	0.7895	1.0000	1.0000
30	2016	0.8118	1.0000	1.0000
31	2012	0.5797	0.6310	0.3830
31	2013	0.7571	1.0000	1.0000
31	2014	0.6883	1.0000	0.8130
31	2015	0.7972	1.0000	0.7510
31	2016	0.8028	0.6230	0.6200
32	2012	0.5716	0.2300	0.2210
32	2013	0.8058	0.6840	0.6040
32	2014	0.6592	0.5770	0.5510
32	2015	0.7665	0.5970	0.5100
32	2016	0.7925	0.5240	0.5240
33	2012	0.5948	1.0000	1.0000
33	2013	0.7728	1.0000	1.0000
33	2014	0.6786	1.0000	1.0000

33	2015	0.8004	1.0000	1.0000
33	2016	0.8155	1.0000	1.0000
34	2012	0.5650	0.8360	0.4860
34	2013	0.7642	0.7800	0.7140
34	2014	0.6926	0.9970	0.6290
34	2015	0.7722	1.0000	1.0000
34	2016	0.7892	1.0000	1.0000
35	2012	0.5996	0.4930	0.4620
35	2013	0.7774	0.5930	0.5540
35	2014	0.6615	0.5810	0.5530
35	2015	0.7683	0.8530	0.8420
35	2016	0.7992	0.9550	0.9220
36	2012	0.5410	0.7420	0.6580
36	2013	0.7587	1.0000	1.0000
36	2014	0.6945	1.0000	1.0000
36	2015	0.7848	1.0000	1.0000
36	2016	0.7982	1.0000	1.0000
37	2012	0.5975	0.6180	0.4470
37	2013	0.7650	0.7330	0.7120
37	2014	0.6638	0.7800	0.6930
37	2015	0.8013	0.9730	0.8460
37	2016	0.8231	0.9140	0.8520
38	2012	0.5224	0.5210	0.4420
38	2013	0.7717	0.4330	0.4150
38	2014	0.6594	0.5950	0.5870
38	2015	0.8145	0.6510	0.6360
38	2016	0.8175	0.8040	0.7870
39	2012	0.5725	0.9900	0.5280
39	2013	0.7362	0.8510	0.6270
39	2014	0.7037	0.7110	0.4820
39	2015	0.7853	0.8360	0.5650
39	2016	0.7875	0.8080	0.5420
40	2012	0.5638	1.0000	0.6620
40	2013	0.7567	1.0000	1.0000
40	2014	0.6978	1.0000	0.8310
40	2015	0.7688	1.0000	1.0000
40	2016	0.8049	1.0000	1.0000
41	2012	0.6194	1.0000	0.2920
41	2013	0.7746	1.0000	0.4750
41	2014	0.6978	1.0000	0.3480
41	2015	0.7761	1.0000	0.8170
41	2016	0.8214	1.0000	0.7910

42	2012	0.5332	0.4940	0.4910
42	2013	0.7590	0.6980	0.6790
42	2014	0.7095	0.6450	0.6380
42	2015	0.7977	0.7780	0.7780
42	2016	0.7853	0.7710	0.7430
43	2012	0.5635	0.3270	0.1850
43	2013	0.8004	0.7560	0.7090
43	2014	0.6715	0.7260	0.5580
43	2015	0.7963	1.0000	1.0000
43	2016	0.7906	0.8830	0.6940
44	2012	0.6103	0.7280	0.4630
44	2013	0.7958	0.6030	0.3150
44	2014	0.6705	0.6620	0.4380
44	2015	0.7974	0.9460	0.8690
44	2016	0.8252	1.0000	0.9610
45	2012	0.5641	1.0000	0.3220
45	2013	0.7852	0.8170	0.4350
45	2014	0.6886	0.8530	0.4060
45	2015	0.7607	0.9280	0.7760
45	2016	0.8053	0.9220	0.6680
46	2012	0.5961	0.4170	0.4020
46	2013	0.7717	1.0000	1.0000
46	2014	0.6813	1.0000	1.0000
46	2015	0.7950	0.8620	0.8370
46	2016	0.8213	1.0000	1.0000
47	2012	0.5662	0.4280	0.4180
47	2013	0.7811	0.6740	0.6740
47	2014	0.6916	0.5610	0.5600
47	2015	0.7740	0.7090	0.7070
47	2016	0.8398	0.8160	0.8050
48	2012	0.5393	1.0000	0.7170
48	2013	0.7714	0.9460	0.9180
48	2014	0.6859	0.9990	0.9080
48	2015	0.7683	0.9150	0.9040
48	2016	0.8388	0.9200	0.9180
49	2012	0.5844	0.8140	0.5850
49	2013	0.7763	0.5940	0.5040
49	2014	0.7299	0.4370	0.3490
49	2015	0.8133	0.5170	0.4390
49	2016	0.7813	0.6070	0.4880
50	2012	0.5798	0.9180	0.7700
50	2013	0.7678	0.7750	0.7670

50	2014	0.6937	1.0000	1.0000
50	2015	0.7967	1.0000	0.9400
50	2016	0.7937	0.7970	0.7640
51	2012	0.5891	1.0000	1.0000
51	2013	0.7606	1.0000	1.0000
51	2014	0.6141	0.7970	0.4540
51	2015	0.8302	1.0000	0.6790
51	2016	0.7945	1.0000	0.7660
52	2012	0.5727	0.5810	0.5810
52	2013	0.7286	0.7400	0.7220
52	2014	0.6645	0.8050	0.7870
52	2015	0.7871	0.9710	0.9170
52	2016	0.7941	1.0000	0.9210
53	2012	0.5828	0.3750	0.2060
53	2013	0.7695	0.5680	0.5510
53	2014	0.6947	0.5710	0.5480
53	2015	0.7776	0.6520	0.6470
53	2016	0.8113	0.6630	0.6620
54	2012	0.5536	1.0000	0.4890
54	2013	0.7739	0.8780	0.6970
54	2014	0.6796	0.9450	0.5360
54	2015	0.7926	1.0000	0.6960
54	2016	0.8095	1.0000	0.7630
55	2012	0.6186	0.8050	0.7930
55	2013	0.7629	0.7690	0.6250
55	2014	0.6580	0.5200	0.5020
55	2015	0.7968	0.7100	0.7080
55	2016	0.8219	0.7620	0.7540
56	2012	0.5716	0.4310	0.4280
56	2013	0.7530	0.5060	0.5060
56	2014	0.6741	0.5830	0.5790
56	2015	0.7854	1.0000	1.0000
56	2016	0.8117	1.0000	1.0000
57	2012	0.5395	1.0000	0.9860
57	2013	0.7585	0.7440	0.7000
57	2014	0.6625	0.7150	0.6810
57	2015	0.7756	0.7550	0.7340
57	2016	0.7916	0.7220	0.6880
58	2012	0.6117	0.9870	0.3520
58	2013	0.7725	0.8710	0.6890
58	2014	0.6738	0.6160	0.4080
58	2015	0.7937	0.5080	0.4070

58	2016	0.7537	0.5440	0.4790
59	2012	0.5669	0.4900	0.4670
59	2013	0.7831	0.4670	0.4610
59	2014	0.7044	0.5810	0.5700
59	2015	0.8257	0.7180	0.7180
59	2016	0.8200	0.7160	0.6960
60	2012	0.5927	0.5840	0.5300
60	2013	0.7742	1.0000	0.9710
60	2014	0.6849	0.6070	0.5970
60	2015	0.7859	0.5550	0.5420
60	2016	0.7804	0.5980	0.5860
61	2012	0.5559	0.4570	0.3130
61	2013	0.7711	0.5480	0.4550
61	2014	0.6613	1.0000	1.0000
61	2015	0.7709	0.9820	0.9280
61	2016	0.8071	1.0000	1.0000
62	2012	0.5962	1.0000	0.3790
62	2013	0.7778	1.0000	1.0000
62	2014	0.6991	1.0000	0.6740
62	2015	0.7737	1.0000	0.7850
62	2016	0.7833	0.8150	0.7000
63	2012	0.5353	0.8600	0.8240
63	2013	0.7398	0.7610	0.7570
63	2014	0.7082	0.7780	0.7000
63	2015	0.8076	0.9210	0.9170
63	2016	0.7914	0.9120	0.8890
64	2012	0.5356	0.7610	0.7530
64	2013	0.7628	0.6290	0.5920
64	2014	0.6962	0.4950	0.4460
64	2015	0.7936	0.9710	0.9440
64	2016	0.7731	0.8040	0.7810
65	2012	0.6016	0.7770	0.7720
65	2013	0.7716	1.0000	1.0000
65	2014	0.6949	0.7220	0.7190
65	2015	0.7808	0.8130	0.8130
65	2016	0.7997	0.8150	0.7800
66	2012	0.5644	0.7020	0.5330
66	2013	0.7331	0.7870	0.7800
66	2014	0.6721	1.0000	1.0000
66	2015	0.8002	1.0000	1.0000
66	2016	0.8018	0.9910	0.9740
67	2012	0.5351	0.4370	0.4070

67	2013	0.7609	0.5890	0.5620
67	2014	0.6709	0.5090	0.4910
67	2015	0.7809	0.7540	0.7470
67	2016	0.7874	0.9090	0.9040
68	2012	0.5521	1.0000	1.0000
68	2013	0.7223	0.8440	0.6340
68	2014	0.6923	0.8640	0.5970
68	2015	0.8097	0.7890	0.6310
68	2016	0.8125	0.8760	0.6630
69	2012	0.6054	0.5220	0.3920
69	2013	0.7721	0.5920	0.5000
69	2014	0.6867	0.5650	0.4770
69	2015	0.7487	0.8410	0.8260
69	2016	0.7956	0.7570	0.7010
70	2012	0.5989	0.6070	0.5320
70	2013	0.7391	0.8450	0.8330
70	2014	0.6517	0.6280	0.5450
70	2015	0.8063	0.7430	0.6960
70	2016	0.8246	1.0000	1.0000
71	2012	0.6328	1.0000	1.0000
71	2013	0.7691	1.0000	1.0000
71	2014	0.7046	1.0000	1.0000
71	2015	0.8086	1.0000	1.0000
71	2016	0.7939	1.0000	1.0000
72	2012	0.5700	1.0000	0.3030
72	2013	0.7741	1.0000	0.7950
72	2014	0.6483	1.0000	0.5200
72	2015	0.8047	1.0000	0.7540
72	2016	0.8107	1.0000	0.8120
73	2012	0.5589	1.0000	1.0000
73	2013	0.7519	1.0000	0.8950
73	2014	0.6848	1.0000	0.6820
73	2015	0.7802	0.9510	0.7870
73	2016	0.8076	0.8880	0.7150
74	2012	0.6164	1.0000	0.8190
74	2013	0.7857	1.0000	1.0000
74	2014	0.6259	1.0000	1.0000
74	2015	0.7941	0.6980	0.6910
74	2016	0.8170	0.6970	0.6940
75	2012	0.6232	0.9840	0.7380
75	2013	0.7430	0.6460	0.6390
75	2014	0.6662	0.5460	0.5430

75	2015	0.7535	0.8490	0.8020
75	2016	0.8060	0.8120	0.8100
76	2012	0.5842	0.8380	0.3480
76	2013	0.7478	0.8210	0.4940
76	2014	0.6782	0.8920	0.5200
76	2015	0.7967	0.9210	0.7890
76	2016	0.8226	0.9680	0.8240
77	2012	0.5688	1.0000	0.4500
77	2013	0.7533	1.0000	0.8750
77	2014	0.6771	0.9210	0.6700
77	2015	0.7944	0.8930	0.8430
77	2016	0.8085	1.0000	0.9640
78	2012	0.5293	0.3910	0.3730
78	2013	0.7707	1.0000	1.0000
78	2014	0.6983	0.7360	0.6580
78	2015	0.7775	0.8480	0.8400
78	2016	0.7981	0.9380	0.9200
79	2012	0.5452	1.0000	0.4800
79	2013	0.7366	1.0000	0.8690
79	2014	0.6593	1.0000	0.6510
79	2015	0.8004	0.9900	0.7600
79	2016	0.8022	1.0000	0.7830
80	2012	0.5779	1.0000	1.0000
80	2013	0.7874	1.0000	1.0000
80	2014	0.6617	0.9880	0.5830
80	2015	0.7834	1.0000	0.6410
80	2016	0.7953	1.0000	0.6470
81	2012	0.5969	1.0000	0.4470
81	2013	0.7832	0.5260	0.4810
81	2014	0.6916	1.0000	0.5660
81	2015	0.7798	1.0000	0.9450
81	2016	0.8037	1.0000	1.0000
82	2012	0.5991	1.0000	1.0000
82	2013	0.7441	1.0000	1.0000
82	2014	0.6320	1.0000	1.0000
82	2015	0.7691	1.0000	1.0000
82	2016	0.8043	1.0000	1.0000
83	2012	0.5642	0.1430	0.0760
83	2013	0.7833	0.7750	0.7150
83	2014	0.7021	0.6640	0.6080
83	2015	0.7459	0.7620	0.6860
83	2016	0.8087	0.9440	0.8960

84	2012	0.6006	0.2540	0.1520
84	2013	0.7567	0.7690	0.6460
84	2014	0.7179	0.6270	0.5850
84	2015	0.7930	0.5990	0.5500
84	2016	0.8059	0.5430	0.4960
85	2012	0.5417	1.0000	1.0000
85	2013	0.8220	1.0000	0.8390
85	2014	0.7022	1.0000	1.0000
85	2015	0.7990	1.0000	0.9020
85	2016	0.8076	1.0000	0.7500
86	2012	0.6116	0.7720	0.7170
86	2013	0.7955	0.8720	0.8350
86	2014	0.6481	0.6180	0.5790
86	2015	0.8012	0.7010	0.6400
86	2016	0.8132	0.7340	0.7080
87	2012	0.5498	0.2720	0.2560
87	2013	0.7640	0.4170	0.4020
87	2014	0.6869	0.3950	0.3830
87	2015	0.7807	0.5180	0.5040
87	2016	0.7915	0.5200	0.5130
88	2012	0.5890	1.0000	0.3670
88	2013	0.7828	1.0000	1.0000
88	2014	0.6699	1.0000	1.0000
88	2015	0.7768	1.0000	1.0000
88	2016	0.8000	1.0000	1.0000
89	2012	0.5978	1.0000	1.0000
89	2013	0.7758	1.0000	1.0000
89	2014	0.7011	1.0000	0.7690
89	2015	0.7762	0.7000	0.4320
89	2016	0.8212	0.7430	0.6190
90	2012	0.5990	0.6330	0.4940
90	2013	0.7255	0.6980	0.6950
90	2014	0.6775	0.4990	0.4530
90	2015	0.7586	0.6640	0.6390
90	2016	0.8286	0.8910	0.8900
91	2012	0.6430	1.0000	0.6170
91	2013	0.7661	1.0000	0.9010
91	2014	0.6581	1.0000	0.8960
91	2015	0.7941	1.0000	1.0000
91	2016	0.7871	1.0000	1.0000
92	2012	0.5819	1.0000	1.0000
92	2013	0.7805	0.9150	0.7110

92	2014	0.6549	0.7010	0.6960
92	2015	0.7775	0.8790	0.7690
92	2016	0.8030	0.7860	0.7840
93	2012	0.5540	1.0000	1.0000
93	2013	0.7733	0.8030	0.6070
93	2014	0.7201	0.7580	0.5390
93	2015	0.7879	0.8890	0.6500
93	2016	0.7864	1.0000	0.9150
94	2012	0.5945	1.0000	0.6960
94	2013	0.7564	0.9810	0.9000
94	2014	0.6716	0.8770	0.7910
94	2015	0.8055	0.8850	0.8120
94	2016	0.7850	1.0000	0.8950
95	2012	0.5831	0.9340	0.7220
95	2013	0.7655	1.0000	1.0000
95	2014	0.7079	1.0000	1.0000
95	2015	0.7899	1.0000	1.0000
95	2016	0.8204	1.0000	1.0000
96	2012	0.5997	1.0000	1.0000
96	2013	0.7549	1.0000	1.0000
96	2014	0.6788	1.0000	1.0000
96	2015	0.7516	1.0000	1.0000
96	2016	0.8113	1.0000	1.0000
97	2012	0.6167	1.0000	1.0000
97	2013	0.7440	0.8850	0.8740
97	2014	0.6764	1.0000	0.9730
97	2015	0.7928	1.0000	1.0000
97	2016	0.8044	1.0000	1.0000

Appendix V: Unit Root Test Results

```
. xtunitroot fisher biasefficiencyscores, dfuller lags(0)

Fisher-type unit-root test for biasefficiencyscores
Based on augmented Dickey-Fuller tests
------------------------------------------------------
Ho: All panels contain unit roots           Number of panels  =     97
Ha: At least one panel is stationary        Number of periods =      5

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(194)  P      1164.6101       0.0000
 Inverse normal            Z       -15.3856       0.0000
 Inverse logit t(449)      L*      -30.3967       0.0000
 Modified inv. chi-squared Pm       49.2753       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.

. xtunitroot fisher assetquality, dfuller lags(0)

Fisher-type unit-root test for assetquality
Based on augmented Dickey-Fuller tests
------------------------------------------------------
Ho: All panels contain unit roots           Number of panels  =     97
Ha: At least one panel is stationary        Number of periods =      5

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(194)  P       835.9665       0.0000
 Inverse normal            Z       -10.7406       0.0000
 Inverse logit t(484)      L*      -19.3314       0.0000
 Modified inv. chi-squared Pm       32.5909       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

```
. xtunitroot fisher capitaladequacy, dfuller lags(0)

Fisher-type unit-root test for capitaladequacy
Based on augmented Dickey-Fuller tests
-----------------------------------------------

Ho: All panels contain unit roots           Number of panels  =     97
Ha: At least one panel is stationary        Number of periods =      5

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(194)  P       678.6483       0.0000
 Inverse normal            Z        -3.0900       0.0010
 Inverse logit t(479)      L*      -11.3343       0.0000
 Modified inv. chi-squared Pm       24.6043       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.

. xtunitroot fisher liquidity, dfuller lags(0)

Fisher-type unit-root test for liquidity
Based on augmented Dickey-Fuller tests
-----------------------------------------

Ho: All panels contain unit roots           Number of panels  =     97
Ha: At least one panel is stationary        Number of periods =      5

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(194)  P       757.0364       0.0000
 Inverse normal            Z        -7.8446       0.0000
 Inverse logit t(489)      L*      -16.0148       0.0000
 Modified inv. chi-squared Pm       28.5838       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

```
. xtunitroot fisher earningsrating, dfuller lags(0)

Fisher-type unit-root test for earningsrating
Based on augmented Dickey-Fuller tests
-------------------------------------------

Ho: All panels contain unit roots           Number of panels  =     97
Ha: At least one panel is stationary        Number of periods =      5

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(194)  P       758.7670       0.0000
 Inverse normal            Z        -8.4673       0.0000
 Inverse logit t(479)      L*      -16.8715       0.0000
 Modified inv. chi-squared Pm       28.6717       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.


. xtunitroot fisher saccosize, dfuller lags(0)

Fisher-type unit-root test for saccosize
Based on augmented Dickey-Fuller tests
-------------------------------------------

Ho: All panels contain unit roots           Number of panels  =     97
Ha: At least one panel is stationary        Number of periods =      5

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(194)  P       860.6624       0.0000
 Inverse normal            Z       -11.9420       0.0000
 Inverse logit t(489)      L*      -20.7843       0.0000
 Modified inv. chi-squared Pm       33.8447       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

```
. xtunitroot fisher biascorrectedefficiencyscores, dfuller lags(0)

Fisher-type unit-root test for biascorrectedefficiencyscores
Based on augmented Dickey-Fuller tests
------------------------------------------------------------------
Ho: All panels contain unit roots           Number of panels  =     97
Ha: At least one panel is stationary        Number of periods =      5

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(194)  P       641.9943       0.0000
 Inverse normal            Z       -15.6839       0.0000
 Inverse logit t(489)      L*      -17.1868       0.0000
 Modified inv. chi-squared Pm       22.7435       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

.
```

```
. xtunitroot fisher assetquality, pperron lags(0)

Fisher-type unit-root test for assetquality
Based on Phillips-Perron tests
----------------------------------------------

Ho: All panels contain unit roots          Number of panels  =     97
Ha: At least one panel is stationary       Number of periods =      5

AR parameter:    Panel-specific            Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included
Newey-West lags: 0 lags
------------------------------------------------------------------------------
                                 Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(194)  P       684.4630       0.0000
 Inverse normal            Z       -10.4965       0.0000
 Inverse logit t(484)      L*      -15.9826       0.0000
 Modified inv. chi-squared Pm       24.8995       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
Fisher-type unit-root test for capitaladequacy
Based on Phillips-Perron tests
----------------------------------------------

Ho: All panels contain unit roots          Number of panels  =     97
Ha: At least one panel is stationary       Number of periods =      5

AR parameter:    Panel-specific            Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included
Newey-West lags: 0 lags
------------------------------------------------------------------------------
                                 Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(194)  P       767.7533       0.0000
 Inverse normal            Z       -10.5934       0.0000
 Inverse logit t(489)      L*      -18.0716       0.0000
 Modified inv. chi-squared Pm       29.1279       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

.
```

```
. xtunitroot fisher liquidity, pperron lags(0)

Fisher-type unit-root test for liquidity
Based on Phillips-Perron tests
----------------------------------------

Ho: All panels contain unit roots          Number of panels  =     97
Ha: At least one panel is stationary       Number of periods =      5

AR parameter:    Panel-specific            Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included
Newey-West lags: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(194)  P       880.0875       0.0000
 Inverse normal            Z       -12.6123       0.0000
 Inverse logit t(489)      L*      -21.3537       0.0000
 Modified inv. chi-squared Pm       34.8308       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------


. xtunitroot fisher earningrating, pperron lags(0)

Fisher-type unit-root test for earningrating
Based on Phillips-Perron tests
------------------------------------------

Ho: All panels contain unit roots          Number of panels  =     97
Ha: At least one panel is stationary       Number of periods =      5

AR parameter:    Panel-specific            Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included
Newey-West lags: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(194)  P       736.0483       0.0000
 Inverse normal            Z       -10.9724       0.0000
 Inverse logit t(489)      L*      -17.3435       0.0000
 Modified inv. chi-squared Pm       27.5183       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

.
```

```
. xtunitroot fisher saccosize, pperron lags(0)

Fisher-type unit-root test for saccosize
Based on Phillips-Perron tests
-----------------------------------------

Ho: All panels contain unit roots           Number of panels  =     97
Ha: At least one panel is stationary        Number of periods =      5

AR parameter:    Panel-specific             Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included
Newey-West lags: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(194)  P       861.4022       0.0000
 Inverse normal            Z       -11.9472       0.0000
 Inverse logit t(489)      L*      -20.8057       0.0000
 Modified inv. chi-squared Pm       33.8822       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

Appendix VI: Research Permit

THIS IS TO CERTIFY THAT:
MS. CAROLYNE JEBIWOTT KIMUTAI
of KENYATTA UNIVERSITY, 4117-200
NAIROBI,has been permitted to conduct
research in *All Counties*

on the topic: *FINANCIAL SOUNDNESS INDICATORS AND EFFICIENCY OF DEPOSIT TAKING SAVINGS AND CREDIT COOPERATIVE SOCIETIES IN KENYA*

for the period ending:
4th December,2018

Permit No : NACOSTI/P/17/22609/20142
Date Of Issue : 4th December,2017
Fee Recieved :Ksh 2000

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation

NATIONAL COMMISSION FORSCIENCE, TECHNOLOGY ANDINNOVATION

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0713 788787,0735404245
Fax: +254-20-318245,318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/17/22609/20142**

Date: **4th December, 2017**

Carolyne Jebiwott Kimutai
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Financial soundness indicators and efficiency of deposit taking Savings and Credit Cooperative Societies in Kenya,"*** I am pleased to inform you that you have been authorized to undertake research in **all Counties** for the period ending **4th December, 2018.**

You are advised to report to **the County Commissioners and the County Directors of Education, all Counties** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GP Kalerwa

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioners
All Counties.

The County Directors of Education
All Counties.