DETERMINANTS OF TECHNICAL INEFFICIENCY OF SAVINGS AND CREDIT CO-OPERATIVES IN KENYA

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DECLARATION

DECLARATION BY CANDIDATE

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ABSTRACT

The co-operatives sector in Kenya has gone through a historical development which is known for inefficiency. This study is based on the census collected secondary data analyzed from the audited financial statements of the licensed deposit taking Saccos and the macro-economic indicator data sources over the research period. It focuses on environmental and Saccos specific independent variables affecting inefficiency of Saccos. Further, it measured the technical (pure technical) inefficiencies of Saccos during a period of pre-regulation and regulation. The explanatory research design was used. The study was designed to address the following

objectives: to measure the extent of management inefficiency over a period of two eras, to determine the effect of Saccos specific predictor variables on Saccos' inefficiency, and establish the effect of macro-economic variables on Saccos' inefficiency. The specific financial institutions theories that guided this study include: the financial intermediation theory, x-inefficiency theory and agency theory. The econometric methods employed in measuring inefficiency include the non-parametric together with stochastic frontier analysis. These methods were subjected to a panel data census of 46 Saccos to determine the inefficiency during the combined eight years' period covering 2007-2014. The result of the study shows that all predictors (given loan to members, dividend, net operating cash flows and total revenue dependent variable slacks) were significant as hypothesized in agency, x-inefficiency and intermediation theories. The impact of control variables, reflected mixed results. The number of women on the board, net profit to total assets, and capital adequacy predictors for instance, had a strong negative influence on dividends and loan to members' slacks without the control variables effect (all these predictors reflected p-values of 0.00 at 1% level of significance). Further, the total revenue slack with control and without control variables regressions explain the significant management inefficiency as indicated by Gamma of 0.999956 and 0.999951 (with optimal of Gamma p-value of 0.00) respectively. Data envelopment analysis result of 368 observations indicated mean efficiency score of 0.976. The strong efficient Saccos with zero slacks across all output variables totaled 6.5% composed of small (1.4%), medium (0.8%) and large (4.3%) while, 26% (94 out of 368) were weak form efficient and the balance being inefficient. This study's contribution to practice is that total revenue is key output slack in detecting management inefficiency or influence on inefficiency. For contribution to theory, it strengthens the conflicting prior studies on the effect of gender on the board of companies as the result supports the theory that higher number of women on the boards of Saccos reduces inefficiency in line with both agency and intermediation theories. On the contrary the higher technical inefficiency mean difference during regulation period conflict with the agency theory. Further, the significance of inefficiency predictor variables such as net profit to total assets, market power, capital adequacy, financial investment and technology expenditure in financial reports of Saccos and efficiency benchmarking using data envelopment analysis and stochastic mechanism are apt for decision making and will assist the regulators monitor better. Vigilant monitoring of the trend of dividend rates and total revenue levels, and coherent merger of small to medium sized Saccos are also recommended in order to reduce or eliminate the management inefficiency. The age predictor not in support of the learning effect had positive influence on loan to members, net operating cash flows and dividend slacks. Also to be researched in the future studies is the comparative inefficiency study on deposit and non-deposit taking Saccos.

DEDICATION

I dedicate this research to my mother Arinda and wife Naomi

And my Brothers Mwanda and Odipo Peter

For encouragement, love and support

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LIST OF ABBREVIATIONS

BOSA: Back Office Service Activities

BCC: Banker *et al.* 1984- DEA model

CCR: Charnes *et al.* 1978- DEA model

DEA: Data Envelopment Analysis

DMUs: Decision Making Units

FLIB: Financial liberalization

FOSA: Front Office Service Activities

FSD: Financial Services Deepening

GDP: Gross Domestic Product

GOK: Government of Kenya

ILO: International Labor Organization

IMF: International Monetary Fund

INSP: Interest spread

MFI: Microfinance Institutions

MOCDM: Ministry of Co-operatives Marketing and Development

M3XT: Broad money supply measure in Kenya

NBFIs: Non-Banking Financial Institutions

NGOs: Non-Governmental Organizations

OLS: Ordinary Least Square with normal errors

PTE: Pure technical efficiency

ROA: Return on Assets

ROE: Return on Equity

SACCOS: Savings and Credit Co-operatives Societies, running FOSA

SASRA: Saccos Regulatory Authority

SFA: Stochastic Frontier Analysis

SSA 2008: Saccos Societies Act, 2008

SSR 2010: Saccos Societies Regulation, 2010

STATA14.1: Statistical Software Version 14.1

TE: Technical efficiency

WC: Working Capital

WOCCU: World Council of Credit Unions

OPERATIONAL DEFINITION OF TERMS

Allocative Efficient: A firm makes efficient allocation in terms of choosing optimal input and output combinations given input prices and output quantities. Further a firm is economically efficient when it is both allocative and technically efficient (Ozcan, 2008; Coelli, *et al.,* 1997; Leibenstein, 1966).

CAMELS MODEL: These are financial institutions rating system which originated from USA in 1979 and its components include: C=capital adequacy, A= assets quality, M= management and board's ability to ensure efficient operation, E=long run savings ability of a firm i.e. earnings on assets, L= liquidity, that is assets to short run liability- monitoring and control indicator, S= sensitivity to market risks (i.e.

hypothetical projection of future prices and rates movement) (Okibo and Karagu, 2014).

Capital Adequacy: Indicates sound capital of say a Sacco relative to potential risk. Aim at protection of members' deposits. It is calculated as core capital to total assets. Core capital = share capital + statutory reserves + retained earnings + irredeemable donations + general and other reserves excluding revaluation reserves (SSR, 2010).

Common Bond Size: Number of entities through which Sacco members contribute funds (or share common interest) to the Sacco where they own shares and deposits (Research, 2015).

Cost Inefficiency: Saccos' excessive cost relative to the frontier. It is the difference between a benchmark and achieved performance i.e. x-efficiency (or proxy of agency costs) (Hughes and Mester, 2008).

Earnings Management: In an organization when a governor fidgets with accounting numbers in order to report higher profits and subsequently pay high dividends is what is known as earnings management (Barth *et al.,* 2007).

Financial liberalization: Measured by monetary aggregate (money supply or M3XT) to GDP (Cooper *et al.* 2007b).

GOK Net Lending/Borrowing as % of GDP (**GOKLB):** Net lending (+) or borrowing (-) is computed as revenue less expenditures. It is a pointer to the financial effect of government activity on the economy. It measures the extent government is either putting financial resources at the disposal of other sectors in the economy (World Bank, 2014). This is a proxy for financial depth and innovative activities in Kenya.

Gross Domestic Product (GDP): Total money value of goods and services created in an economy expressed at year to year constant prices' percentage change (World Bank, 2014).

Heteroskedasticity: Sub-populations that have differing variability from others. Its existence is apparent in the for instance movement of shares where volatility of shares can't be predicted. It indicates absence of homoscedasticity-where modeling of errors is uncorrelated, constant in variance and normally distributed (Greene, 2012).

Inefficiency (**Management inefficiency):** The proportion by which the observed outcome or goal attainment fall short of optimum level. It is represented by one-sided error

term (U_{rjt}) with a non-zero mean. U_{rjt} is normally assumed to be truncated-normal (Greene, 2012; Aigner *et al.,* 1977).

Inflation Consumer Price Index (CPI): Expressed in annual means, not end of period data. CPI measures changes in prices of goods and services that households consume that affect the consumers' real purchasing power and their welfare in Kenya. CPI base price value is a unit of 100, a *proxy for market condition.* CPI and GDP deflator are cross-correlated (Reis and Mankiw, 2001).

Interest Spread (INSP): Average lending rate minus average borrowing rate (World Bank – LNDP, 2014). A proxy for risk pricing in Kenya.

Liberalization Period: Era of economic reforms specifically 1980s-1990s and after (Wanyama, 2009).

Money Supply (M3XT): M3XT is the currency in circulation measure in Kenya that is all-encompassing. It is equal to a summation of currency in circulation, demand deposits, savings deposits, time deposits, NBFIs deposits, foreign currency deposits and treasury bills less cash in bank tills (Khainga, 2014).

PEARLS MODEL: WOCCU ratios of measuring performance where: P=protection ratios, E= effective financial structure ratios, A= assets quality ratios, R= rates of return and costs, L= liquidity ratios, and S= signs of growth ratios (WOCCU, 2013).

Post-Liberalization: After amendment of Co-operatives Act, 2004 (SASRA, 2010).

Pre-Regulation Period: 2010 and before SASRA time-from 2007 (Research, 2015).

Random Effects and Errors: It stands for random noise or effects that include measurement errors. It is normally distributed conventional two-sided error term (V_{rjt}) with zero - mean. The error term is therefore decomposed into two components V_{rjt} and U_{rjt}. Under SFA truncated- normal models using Stata14.1 software, the heteroscedastic condition of V_{rjt} and U_{rjt} are deemed constant (Jondrow *et al.* 1982).

Regulation Period: During SASRA from 2011 and after - to 2014 (Research, 2015).

SASRA License: Saccos operating FOSA were required by Saccos Societies Regulation 2010 of the Sacco Societies Act, 2008 to have applied for license by 17 June 2011 (SSA, 2008).

Slack: Amount by which either an output or input fail to attain the optimal efficiency. It is an equivalent of *inefficiency* level (Cooper, *et al.,* 2007b).

Saccos specific Predictor Variables: Independent study variables i.e. variance regressors that exclude the macro-economic independent variables (Research, 2015).

Stochastic Frontier Analysis: A parametric method that can test hypotheses and can accommodate single output with multiple inputs. It also uses maximum likelihood econometric estimation and decomposes the error term (e_i) into two components as stated while deterministic part of a regression equation is the expected pattern in the absence of any kind of randomness or measurement error (stochastic) (Aigner *et al.,* 1977). Each Sacco is expected to buy or offer loans less than it might as a result of a degree of inefficiency.

Technically Efficient: A firm operates on the frontier of the production technology (Coelli, *et al.,* 1997; Greene, 2012).

Urban Areas: Town or Municipality area. The Urban Areas are separated from Cities according to Kenya Urban Areas and Cities Act, No.13 of 2011, revised in 2015, (KLR, 2015).

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CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter discusses the background to the study, research problem and objectives of the study, research hypotheses, the study significance and scope.

1.1 Background of the study

The inefficiency of an organization is an overriding aspect in financial management. A well-managed savings and credit co-operative society is expected to increase the members' wealth like any other firm in a well-managed industry. Since independence, the savings and credit co-operatives or Saccos' sub-sector has undergone a series of liberalization and prudential regulation aimed at improving its relative act (Wanyama, 2009). To what extent, have Saccos' inefficiency reduced due to the regulation and what determines their inefficiency or efficiency? These questions can be well understood by assessing a possibility of difference in efficiency over the two eras of pre-regulation and regulation. This study seeks to find out an answer to this question through the use of financial variables of inefficiency assessment, non-parametric linear programming approach, and parametric measures of evaluating financial institutions' relative inefficiency and benchmarking.

Inefficiency occurs when a firm (or Sacco) operates outside the frontier of the production technology (Coelli, *et al.*, 1997; Greene, 2012). However, according to Leibenstein, (1966) x-inefficiency is a foregone output due to management inefficiency, and efficiency is a subset of performance (Ozcan, 2008). An efficient organization identification assist in

identifying the managers' rewards and the kind of good practices employed or which can be copied by inefficient firms in the industry. Adeptness also aid in identifying profitable areas of organizations to invest their assets (Healy, 1988). An efficient measurement system is able to identify optimal resources allocation besides setting of targets.

Brealey and Myers , (1981) postulated that rationing of a firm's capital in more than one period call for application of linear programming or net present value methods as a capital budgeting decision making techniques instead of other methods such as marginal rate of return which depict prominence of linear programming in the field of finance theory. This study adopted DEA approach which is linear programming oriented based on a capital rationing argument, since the Saccos' external loan capital demand tend to fluctuate periodically (SASRA, 2011).

The Saccos in Kenya have high urge for shifting from savings and credit co-operatives to credit and savings co-operatives. They actually bend towards sourcing for external funds than relying on equity funding. Capital inadequacy and insolvency risks are key factors influencing performance of deposit taking Saccos (or FOSA) in Kenya (Kivuvo and Olweny, 2014). This behavior is a reflection of inadequate capital which scores them well as candidates of capital rationing. The shifting appetite come at an expensive interest charges from the lenders as the borrowed funds or credit facilities are meant for onward affordable lending to Saccos' members. According to SASRA, (2011), Saccos in Kenya total borrowings from banks in 2010 was estimated at Kshs.15 billion compared to Kshs. 5.6 billion in 2011. This is a clear indication that the sector is becoming an important financial channel that fosters access to credit.

Higher profit targets under a liberalization pricing policy period can only be maintained through a profits plough back guideline, increased management and operational costs. In addition, members

in the long run during a pricing policy time will not be charged lower interest rates on members' loans. This definitely kills the spirit of co-operative existence, as co-operatives will tend to transform to banks in a sequential way making it difficult to find a co-operative also known as front office services activities (FOSA) in Kenya, which exclusively, belong to its members or continuously adheres to co-operatives principles. As a result, co-operative banks or FOSA future in the long run is unknown as they will completely transform to banks, merge or just die, (Zvi, 1998). This chain of events is likely to impact negatively on the steady or focused efficiency growth of Saccos.

Another question that arises is: do co-operatives transformation to banks or FOSA exist for long term benefit of members? Zvi, (1998) states that credit co-operatives around the world do not exist to allocate credit to their shareholders as only 30% to 70% is allocated as loans and the rest is either in cash and cash equivalent. That means the balance fund is either in liquid form or deposited in the financial institutions. Zvi, (1998) model application in a Sacco sub-sector therefore creates a chain of savings and credit co-operatives as summarized under annex 1.1. Under the third phase reflected in the annex, the efficient operation of the Saccos does determine how fast they move from say FOSA to commercial banks or even cease operation altogether. This essentially, creates the Saccos' efficient survival paradox.

A study by Johnson and Zarazua, (2008) has shown that in Kenya 12.8% of the population save with Saccos and 4.1% borrow from them. In addition, Saccos in Kenya are principally either based on common bonds of farming or employment (Johnson and Zarazua, 2008). It is also worth noting that in Africa South of the Sahara, Kenyan Saccos movement has the second largest number of Saccos following Ethiopia (Woccu, 2009). For instance, in March 2013, the number of Saccos in Tanzania were 5,559 (Magali, 2014) while in Kenya the total number of registered Saccos was estimated at about 7,500 in August 2013 (SASRA, 2013).

The co-operatives sector in Kenya came into being in 1908, a pre-independence era, whereby membership was restricted to the white settlers who established the first co-operative at Lumbwa valley at Kericho. This pre-independence era ended in 1963, followed by post-independence co-operatives era. At this moment in time in 1967, the government realized its inability to fund co-operatives and its inadequacy in experienced manpower. Therefore the government of Kenya teamed up with the Nordic countries, World Bank, USA, and Germany with intentions of raising funding and capacity building for the co-operatives sector (MOCDM, 2013; ILO, 2013).

Later, the co-operatives liberalization period followed suit with effect from 1980 onwards. During this time co-operatives in Kenya were liberalized from the government control and subsequently in 1997 a policy was formed to ensure that autonomy and members controlled co-operatives for both Saccos and other type of co-operatives is a legally protected reality. The post liberalization period came into being after the enactment of the Co-operatives Act of 2004, which was later amended in 2008 leading to the creation of SASRA and SASRA Regulations, 2010 (MOCDM, 2013; ILO, 2013).

The co-operatives development in Kenya has evolved since 1908 through eras; the most prominent being the era of economic liberalization and the state control era, effective 1980s up to 2004. During the state controlled era, co-operatives were formed as instrument for putting in place government socio-economic policies and creating politically liberated co-operatives (Wanyama, 2009).

The efficiency of co-operatives during the era of economic liberalization was initially absolutely poor due to the government *modus operandi*. Since the start of the second era, co-operative development in the country is still not well understood. This is because there are a few studies in the area of co-operatives since 1990 (Evans, 2002; Petrie, 2002; Enarsson and Wiren, 2005). Further, these studies are basically based on absolute performance measures and interview responses from the stakeholders. The situation is slowly changing as other research are now coming up especially based on ratios, efficiency and multiple regression such as (Kivuvo and Olweny, 2014;Tessfamariam *et al.*,2013; Marwa and Aziakpono, 2015; and Mirie,2014). The absolute measures of performance commonly used according to Wanyama, (2009) includes: increase in loans, increase in membership levels of delinquent loans, and growth in number of co-operatives.

On the international front, the Regulatory Authorities and Standards Setting Committees have been able to come up with acceptable information on the financial institutions' efficient operations and risk management criteria (Cooper *et al.,* 2007e). World Council of Credit Unions is one similar body that offers related services. Caprio *et al.*, (2003) in their study in 44 countries, postulate that insignificant influence is experienced by banks due to regulation and supervision.

During the pre-regulation era in 2009, the world experienced a financial crisis that affected the efficiency of financial institutions over the period and this was amenably reflected in the levels of macro-economic indicators including GDP. In 2009 the global economy contracted by negative 0.6% (IMF, 2012). A good example of a macro-economic indicator that measures the financial deepening of Saccos and has an effect on performance of organizations is GDP, which was utilized as one of the variables in this study.

The GDP percent change in Kenya over the period of study starting 2008 is as follows: GDP in 2008 (1.53%); 2009 (2.74%); 2010 (5.76%) and 2011 (4.38%); over the whole period reflecting a fluctuating trend and the worst trend having been reported between 2008 and 2009 (IMF, 2014). In 2011 the country also experienced a down turn in the economy due to high fluctuation of the Kenya shilling against the hard foreign currencies (SASRA, 2011). In addition, the GDP percent change rate fluctuated to an average of 5.13% in 2012 before rising again to a mean of 5.62% in 2013 (IMF, 2014).

The down turn in an economy impairs the efficiency of commercial enterprises than it does to co-operatives. Co-operatives have shown their ability to provide services to their members even during the financial crisis. Further, in developing countries of Africa the co-operatives' resilience to financial crisis is not strong and this coupled with the internal political impact or mismanagement within co-operatives effect, the crisis gets worse (Wanyama *et al.*, 2009). This then raises a corporate governance or integrity problem in co-operative movement that was catered for, to some extent, in this study through the introduction of number of women on the board predictor variable.

In the forum for Sacco leaders in 2013, Sacco Societies Regulatory Authority representative reported that; inadequate corporate governance systems in Saccos sub-sector is one of the key challenges the sector in Kenya is struggling to correct (SASRA, 2013).

According to prior studies, there is a conflicting result on effect of gender diversity on the boards. Adams and Ferreira, (2009) argue that on average the presence of both gender on the boards in companies having no takeover prevention mechanism do experience inefficiency. On the contrary, Higgs, (2003) postulate that performance improvement result from gender diversity in the board

room while Gompers, Ishii and Metrick, (2003) conclude that gender is a good performance contributor in organizations with non-strong shareholder rights.

The government of Kenya enacted Co-operatives Societies Act Cap.490 in 1997.Through this legislation the Ministry of Co-operative Development and Marketing or MOCDM is able to co-ordinate the sector's development. To take advantage of the emerging market pricing policy, the government amended the Co-operative Societies Act 1997, in 2004. In addition, the second era co-operatives development involved enactment of prudential regulation of Saccos through the Saccos Act, 2008 which legally commenced in September 2009 and gave birth to Sacco Societies Regulatory Authority or SASRA with effect from October 2009 (MOCDM, 2013 and SSA, 2008).

The total number of licensed FOSA by the end of 2011 were 110 while the total assets for the deposit taking Saccos stood at Kshs.196 billion in December, 2011 compared to Kshs.171 billion in 2010. Further, the total disbursement of loans during the year 2011 stood at Kshs.148 billion being 75% of the combined total assets (SASRA, 2011). According SASRA, (2013) the total number of FOSA registered Saccos totaled 124 and 135 in years 2012 and 2013 respectively out of a total of 215 applications submitted to SASRA by the end of December 2013.

Fundamentally, the greatest contribution to social and economic development from the co-operatives sector comes from the Saccos while the combined assets of Saccos in Kenya were worth Kshs.200 billion (USD$2.7 billion) an estimated equivalent of 31% of the national savings in 2009 (MOCDM, 2013).

The latest liberalization of co-operatives is in the area of devolution of co-operatives regulations from the national level to county levels as enshrined in the Constitution of

Kenya 2010 (COK, 2010; MOCDM, 2013). In addition, despite the existence of the prudential regulations, the deposit taking Saccos have continued to reveal mixed levels of management practices (SASRA, 2013). A study by Chavez, (2006) indicates that the Kenya Sacco sub-sector reflects a seriously weak financial performance position that is pervasive.

Reiterating the earlier question that remains not answered, that is, to what extent is the level of efficiency during the second era different? It is worth noting that since 1990s Saccos have undergone a structural shift from the back office services account (BOSA) to FOSA operations and this research therefore attempt to answer the question.

1.2 Statement of the Problem

A few past researchers in Kenya have studied Saccos based on their performance: (Olando *et al.,* 2012; Nyambere, 2013; Njagi *et al.,* 2013; Karanja, 2013; and, Okibo and Karagu, 2014). These studies ignored the aspect of inefficiency measurement yet Saccos unlike other commercial enterprises, exist for purposes of service delivery to members and therefore are not profit oriented. A more recent study by Mirie, (2014) indicates Saccos' efficiency in Kenya being within a range of 0.56 and 1.0. However, this study failed to consider other Saccos specific variables of efficiency measurement such as the economic indicators, gender diversity on Saccos' boards, and net profit to total assets ratio beside the extent of management influence on Saccos' inefficiency. Further, the above stated prior studies in Kenya never utilized the stochastic frontier regression analysis in measuring efficiency. In addition, none of the above mentioned studies using the pure technical efficiency identified the benchmark Saccos in the economy.

Marwa and Aziakpono, (2015) studied technical and scale efficiency of Saccos in Tanzania using DEA and concluded that on average majority of Saccos scored 0.48 pure technical inefficiency and at least 75% of Saccos exhibited an increasing returns to scale. A study by Kipesha, (2012) arrived at an efficiency of between 0.145 and 0.69 for the Tanzanian micro finance bodies. Similar researches in banking industry in sub-Saharan Africa opine that technical efficiency falls between 0.6 and 0.9 (Kamau, 2011 and Moffat, 2008).

According to Tesfamariam *et al.,* (2013) efficiency of rural Saccos in Ethiopia indicated that efficiency is affected by both location and size of Saccos. They also opine that on average efficiency ranged between 0.213 and 0.259 for small Saccos, while larger Saccos recorded higher efficiency compared to smaller ones. This study like Mirie, (2014) in Kenya also suggested future study in the area of Saccos' technical efficiency using the stochastic frontier analysis method. This gap is also key to this study.

Magali, (2014) concludes that there is no prior studies on Saccos in East Africa that have assessed the influence of regulation on Saccos performance while at the same time considering the impact of rural and urban areas' location of Saccos on performance. He further argues that scholars should extend to econometrics to expand Saccos modeling. A few studies such as Marwa and Aziakpono, (2015) in Tanzania, and Tesfamariam *et al.*, (2013) in Ethiopia; have researched on the efficiency of Saccos in the African continent.

Considering the above mentioned gap of prior studies, this study examined whether Saccos were more inefficient during regulation era than pre-regulation era. The star Saccos were also identified. Essentially this study assessed the determinants of inefficiency in the FOSA. Specifically, the pure technical efficiency (a cost-efficiency measure) model was utilized (Coelli *et al.*, 1997).

According to Johnson and Zarazua, (2008) the co-operative Saccos' sub-sector in Kenya serves 13% of the population both in terms of offering savings and loans (credits) financial services facilities. As earlier mentioned in this research, the co-operatives sector in Kenya has gone through a historical development process popularly known for inefficiency record. The inefficiency is more prevalent during the liberalization period (Wanyama, 2009). As a result, the need for regulation becomes necessary to ensure the stability of Saccos' sub-sector and guaranteed efficiency and protection of socio-economic benefits to the members.

Further, referring to the research data available in this area in Kenya, little is known about past attempts to measure inefficiency of deposit taking Saccos using the combined non-parametric and parametric analysis methods, thus the need to bridge this knowledge gap.

The creation of SASRA as a regulator of Saccos has been necessitated by the challenges of a liberalized economy. The question that arises then is: to what extent has the Saccos' market become efficient? The aforementioned facts then point to the need to measure and determine the Kenyan Saccos' pure technical inefficiency. This study sets deliberate standards on how Saccos in Kenya can be monitored and peers emulated to ensure efficiency in their operations.

1.3 General Objective

The general objective of this study was to establish the technical inefficiency level, the macro- economic and Saccos specific variables determining the technical inefficiency of deposit taking Saccos in Kenya.

1.4 Specific Objectives

The specific objectives of this study were as follows:

1. Measure the extent of management inefficiency over the pre-regulation and regulation eras.
2. Determine the effect of Saccos specific predictor variables on Saccos' inefficiency.
3. Establish the effect of macro-economic variables on the Saccos' inefficiency.
4. Determine the inefficiency mean scores over the two regulation and pre-regulation eras.

1.5 Research Hypotheses

The study tested the hypotheses that:

1. H_{01}: The Saccos operation is not influenced by management inefficiency effects as measured over the two eras.
2. H_{02}: There is no strong relationship between the macro-economic variables and the inefficiency of Saccos in Kenya.
3. H_{03}: There is no strong relationship between the Saccos' specific independent variables and the inefficiency of Saccos in Kenya.
4. H_{04}: Pre-regulation and regulation eras have the same population of inefficiency mean scores.

1.6 Significance of the Study

In the area of Saccos' management, this study utilizing both the non-parametric and parametric measurement methods provides additional knowledge to literature existing pertaining to the efficiency of Saccos in Kenya. This means it is expected to provide

invaluable knowledge in this area of study. Other researchers and general readers will find this study a useful source of reference material. The study also makes suggestions that should be necessary in policy formulation in the area of Saccos' corporate governance and inefficiency measurement.

The stakeholders are expected to be enlightened about the best practices in the management of Saccos. Once this awareness is brought to knowledge of the general public say through capacity building, then the Saccos' shareholders always take a leading role in deterrence of management inefficiencies or malpractices. The use of this knowledge by management improves the quality of Saccos' management and therefore raising the confidence of public to the investment in the Saccos. Consequently, this results to good Saccos' bottom lines and economic growth.

In this study the influence of management inefficiency is depicted by the total revenue and dividend slacks thus agree with the theories of inefficiency and intermediation expectation. The result of the two sample paired t-test of means does not agree with the agency theory as the technical inefficiency mean is higher during regulation period.

In addition, on the theoretical contribution side, this study supports the theory of x-inefficiency and it is also observed that random error reflects insignificant management effect in Saccos operation thus giving room to shareholders to play a key role. This overrides the influence of agency problem in management of Saccos' cash flows and other resources.

1.7 The Study Scope

This study on the efficiency measurement of savings and credit co-operatives in Kenya was conducted using the panel of secondary data from audited financial statements for period ended 31 December 2007 to 31 December 2014 and other Saccos' records at SASRA and individual co-operatives. In addition, data from Central Banks and World Bank/IMF websites and resource centers was utilized.

The Saccos Societies Act commenced in 2009 and SASRA started serious deposit taking Saccos operationalization in the late 2010 (SASRA, 2010). Therefore, period of the four years ended 31 December 2010 is the pre-regulation period while the other four years ended 31 December 2014 is the regulation period. The initial data was collected covering 46 FOSA: identified as a total number of Saccos that were licensed and were fully operating during the inaugural period covering late part of the year ended 31 December 2010 as shown in annex 2.2. The study specifically identified the inefficiency position over the two eras' period of 8 years.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter covers the literature related to financial ratios and financial statements items such as operating expenses, equity capital, deposits and loans to members among others. It also to a less extent captures the non-structural factors such as gender diversity and common bond size. The review also discusses briefly the determinants of technical efficiency variables; data envelopment analysis efficiency results and ratios, the impact of earnings management on Saccos' efficiency, details of study theories, theoretical review, conceptual framework and the technical inefficiency dependent variables.

2.1 The Concept of Technical Inefficiency

The conceptual framework model in figure 2.2 reflects the dependent variables derived from the output inefficiency or slacks, and independent variables relationship. The frontier preliminary analysis involved determination of correlation between each of the Sacco-specific variables (variance regressors) and prime regressors, and if a high correlation is discovered, such independent variable (prime regressor) is removed from the 2nd or final stage regression process. The inefficiency estimation was internalized within the Stata14.1 software. However, prime regressors are assumed to be measurement errors free (Cooper *et al.*, 2007c).

De Alessi,(1983) postulated that X-inefficiency theory originated by Leibenstein, (1966) also known as technical inefficiency can be accommodated within the structure of agency theory as managers have ability to react to environmental states. On the other hand, the inefficiency (or efficiency) measurement helps commercial and non-commercial entities in identification of best practice, identification of poor practice, in setting targets, in resource allocation and in monitoring efficiency changes periodically (Sathye, 2001).

The technical inefficiency panel data model allows the effects of technical change of time - varying technical efficiency. In addition, the technical inefficiency effects stochastic model follows a truncated distribution (Battese and Coell, 1995). This stochastic model was initiated by (Kumbhakar, Ghosh and McGuckin,1991).

2.2 The Determinants of Technical Inefficiency Variables

This study adopted independent variables comprising of macro-economic variables and Saccos' variance regressors or specific variables similar to related prior research (Cooper *et al.,* 2007a). However, it also included other specific variables such as the adoption of technology, fraction of women on the board, bond size, market power and net operating cash flows to members' funds among others. Another similar study in Kenya Mirie, (2014) did not capture the influence of macro-economic factors. It regressed the frontier efficiency result as a dependent variable using the mathematical programming approach and not an econometric SFA approach.

According to Marwa and Aziakpono, (2015) pure technical efficiency measures how firms use inputs to create outputs under exogenous environmental condition. They also further argue that

firms' ranking is reported using a composite technical efficiency model as illustrated in annex 1.3 and that the major source of firms' inefficiency originates from pure technical inefficiency.

Further, Mvula, (2013) states that operation challenges faced by Saccos in Malawi include: inadequate capital, non-compliance with laws and regulations. The study also concluded that assets growth, governance, profitability and liquidity are all assessed as being poor in the country. This prior study by Mvula, (2013) therefore, points to the direction of the importance of laws and regulation, liquidity (working capital) and profitability (net profit to total assets), which were utilized as independent variables to this study. Gutierrez-Nieto *et al.*, (2007) postulate that efficiency level differences are affected by national location of the micro finance institutions. This relationship is also predicted in this study.

A study by Hermes *et al.*, (2011) concluded that age is positively related to inefficiency. They raised an argument that this scenario is basically caused by management of older microfinance organizations inability to cope with contemporary managerial practices without an application of trial and error method. The market power is expected to have negative effect on inefficiency. However, a prior study by Sathye, (2001) argues that market power has significant positive effect on inefficiency, that size of the Australian banking has insignificant negative influence on efficiency and that the technology is significant and positively related to efficiency. Sathye, (2001) also concludes that a concentrated (with high market power) banking industry exhibits a reduction in technical efficiency or an increase in technical inefficiency.

According to Berger and Humphrey, (1997) there is inadequate evidence pertaining to efficiency and market power. Mirie, (2014) also conclude that size and age are significantly and positively related to efficiency while inefficiency results from low adoption of technology and that technology is significantly and negatively related to efficiency.

The choice of the relevant inputs and outputs for demonstrating financial institutions behaviour is a known difficult task. However, more relevant variables are borrowed by researchers from past studies and existing ratio analysis concept in the field of finance (Sathye, 2003; Zawadi and Patel, 2014). In addition, the field of forensic accounting also play a role as issues of fiddled accounting numbers (earnings management) have impact on the reliability of financial information (Brown, 2006). Models from institutions such as WOOCU also play a key role in the choice of necessary outputs, inputs and other specific variables.

In this research the inputs and outputs were identified like in the previous literatures through the use of the intermediation approach (Sealey and Lindley, 1977), which treats financial institutions as intermediaries that transfer money between depositors and money lenders in the banking transactions. The loan to members, total revenue, dividend and interest bonus due and net operating cash flows are used as output, while operating costs, owners' equity plus members deposits, and total borrowings are inputs.

2.2.1 Ratio Analysis

The ratios measure the strength and weaknesses of firms' historical performance and existing financial conditions (Jain and Khan, 2006). They are the relative numbers reflecting relationship between variables that are similar. It involves trend analysis, inter-company comparison and comparison with industry mean. Further, the evolutions of financial ratios started from around 1968 (Lev and Sunders, 1979; and Wilcox, 1971).

The analytical reviews or ratio analysis is a traditional measure of performance that ignores the recent concept of multiple inputs and multiple outputs employed under the non-parametric approach (DEA) (Malik and Alkhathlan, 2008). SFA on the other hand is a multiple inputs and single output model that isolates the one sided error term (caused by the inefficiency of managers) from the two sided error term (Berger and Humphrey, 1997; and Aigner *et al.*, 1977).

Further, the financial ratios are defined as relative relationship of financial statements elements or items of an entity at a particular point in time. The ratios also act as indicators of organization's comprehensive performance. Traditionally, ratios are helpful as monitoring and supervisors' tools for management and regulations of various organizations despite their inadequacies. The key methods that are useful in measuring performance consist of: balanced scorecard, financial analysis, and data envelopment analysis among others (Chien-Taho, 1997). This study therefore made reference to the ratios in identification of the predictor variables.

2.2.2 Types of Ratios -WOCCU Model

According to the World Council of Credit Union the ratios endorsed for use in Saccos are categorized under six main classes: protection ratios, effective financial structure ratios, assets quality ratios, rates of return and costs, liquidity ratios and signs of growth ratios as explained below according to (WOCCU, 2013).

Protection ratios are used specifically to provide details to depositors on whether the Sacco is safe to keep the depositors' money or otherwise. Examples include: loan losses provision to delinquent loans of over 12 months old and the net value of assets to total shares plus deposits.

Next are effective financial structure ratios that determine the leverage profits of the organization. Internally generated funds are deemed less risky compared to external funds. Examples are net loans to total assets, institutional capital over total assets, financial investments over total assets and external credit to total assets.

Assets quality ratios being third type particularly measure the portfolio risk or delinquency of overdue loan balances over 30 days old. The organization or Sacco with higher level of defaulted loans and non-earning assets negatively impact on the profitability. Examples of these ratios are non-earning assets to total assets and total loan delinquency to gross loan portfolio.

Fourth are rates of return and costs whereas the rate of return is earned on the assets while the costs are paid on the liabilities by the institution. The higher return and lesser costs determine the optimum profitability and growth of the organization. The gross margin to average assets, net income to average assets, operating expenses to average assets and net loan income to average net loan portfolio are the remarkable type of ratios falling under this category.

Liquidity ratios are fifth category whereby the main target of these ratios is to ensure the institution maintains safety net to respond to immediate member’s disbursement and withdrawal demands. Important ratios are liquid assets net of short term payables over total deposits, and non-earning liquid assets over total assets.

Signs of growth ratios are the last type whereby the growth in total assets is function of the growth in savings and institutional capital which is the retained earnings plus the share capital. A balance between the growth in savings and institutional capitals creates an effective organizational capital structure. A few examples of these ratios include: net loans growth, savings deposits growth, total assets growth, external credit growth and institutional capital growth.

The six ratios model stated above measures financial institutions' performance using quantitative indicators from the financial statements. The Kenya Sacco sub-sector is collaborating with WOCCU and FSD with target to chart a resilient direction of the sector by helping Saccos meet the International Prudential Standards or adopt WOCCU model (WOCCU, 2014).

The quality of any institution financial indicator is directly related to the discipline or behavior of management in disclosure (including ratios disclosure) and the presentation of financial statements. Further any loss in the management discipline amounts to what is called earnings management or an integrity question. However, some specific predictor variables used in this study were derived from the WOCCU model such as working capital, capital adequacy, loan provision, and net profit to total assets.

2.3 The Earnings Management

In an organization when the governor fidgets with accounting numbers in order to report higher profits and subsequently pay high dividends is what is known as earnings management (Barth *et al.,* 2007). The directors' appetite for higher earnings may result from a number of factors such as: the fluctuation in economic performance, the target to continue being in directorship through influencing the owners' voting patterns in the annual general meetings and without any doubt, intentionally behaving fraudulently.

The specific cases of earning management may include factors like changing the depreciation method, changing the inventory controlling method of first-in-first out (FIFO) to last-in-first out (LIFO) or fraudulently manipulating the incomes beside the expenses. Earnings management revolves around both legitimate and illegitimate management actions. The action of management to reduce the bad debt provision in order to increase the net profit is legitimate although it may be a strategy to increase the company's earnings. On the contrary, when the expenses of say year one are accounted for in year two would illegitimately lead to overstated bottom-line and therefore fraudulent (Pobarditpanel, 2013). The application of loan provision and net cash flows from operation variables for instance in this study is thus connected to the concept of earnings management (Schilit, 2002).

2.4 Implication of Earnings Management on this Study

The quality of earnings determines to what extent the accounting numbers provide reliable performance measurement. In practice higher net profit increase without due regard to preferred Accounting Standards results in low quality earnings (Barth *et al.*, 2007). Such a scenario is a symptom of management performance being unfairly or erroneously measured irrespective of the empirical method applied.

The dilution of the efficiency measurement numbers because of factors like earnings managements was rechecked and considerably taken care of by an application of DEA model that intrinsically runs the simulations with the extreme factors in consideration. For instance, in a given sample of organizations under study where sizes vary; when using DEA to measure performance a variable return to scale is used to eliminate a bias or such extreme case of large size variation (Cooper *et al.*, 2007d).

In view of the expected difference between pre-regulation era and regulation era there was need to determine the best or inefficient Saccos using the DEA results, while isolating those Saccos exhibiting signs of earnings smoothing or mismanagement. A prior study by Barth *et al.*, (2007) identifies how earnings smoothing could be identified in a firm. However, the Saccos with suspecting ratio indicators in a particular year were not validated or rechecked for advance isolation from the census, that is: (i) if the net profit to total assets is greater than 5% or less than zero percentage; (ii) a case of net cash flows from operating activities being less than net profit after tax; and (iii) if the total assets growth is greater than 20% (Brown, 2006).The inappropriate management behavior is a factor that was to be empirically determined or be rechecked thus giving a better direction on organizations' performance despite the deviations.

2.5 The Inefficiency Measurement, Overview of the Saccos Sector and DEA Theory

2.5.1 The Inefficiency Measurement

The technical inefficiency(x-inefficiency) is defined as inputs wasting or a proportion by which goal attainment fall short of optimal level. It is also an output opportunity cost (Sathye, 2001; Greene, 2012; and Leibenstein, 1966). Majority of prior studies in the context of Kenya have either been based on efficiency or performance and not technical inefficiency measurement.

According to Ncube, (2009), the traditional method of measuring bank performance is the accounting method based on financial ratios analysis. Another method that is common and a best alternative is an econometric method called DEA together with the parametric stochastic frontier analysis (Berger and Humphrey, 1997).

Kumbirai and Webb, (2010), applied the following variables to measure performance and not efficiency-Profitability performance ratios that include: ROA, ROE, and cost to income ratio; Liquidity performance: liquid assets/customers deposits and short term borrowed funds, net loans/total assets, net loans/total deposits and short term deposits; and Credit performance: loan loss income/gross loans.

Another related study by Koetter, (2006) measured German Universe banks performance using the utility maximization model; known as generalized managerial preferences, represented by utility function. Koetter, (2006) postulate that best-practice firm's identification is not unique to

traditional efficiency measures. He suggested an alternative to an optimal level based on efficiently chosen risk-return tradeoffs. Various research for instance in United States of America used utility maximization model of bank behavior to monitor the extent of regulatory authority corrective actions, principal-agency problem at banks, risk-taking, bank defaults, and the deregulation effects (Park and Armah, 2001; De Young *et al.,* 2000).

Mahmoodi *et al.,* (2010) measured performance and efficiency of metal industries, quoted on Tehran Stock Exchange Corporation using DEA technique and financial variables of performance, that is; Return On Investment (ROI), Residual Income (RI),Return on Sales(ROS), Return On Share (EPS), Price Earnings Ratio (P/E), Return On Assets (ROA), and Operating Cash flows (OCF) to Owner's Equity (OE).

The study by Mahmoodi *et al.,* (2010) utilized operating expenses and owner's equity as inputs and net earnings and operating cash flows as outputs. Financial variables were considered as independent variables while efficiency results of DEA considered as dependent variables (the measure of relative efficiency). The multivariate regression was also employed to identify the relationship between financial variables and DEA. The result indicates three variables (ROS, EPS, and OCF) that measure the efficiency well.

A study by Mahmoodi *et al.,* (2010) arrived at return on sales, earnings per share and operating cash flow to owners' equity as being the best financial variables to assess efficiency of 24 metal industries quoted on Tehran stock exchange beside two companies identified as being efficient over a six year period (2003 – 2008). Another study (Kadoya *et al.,* 2008): a study of paradox investment strategies by DEA, confirmed DEA's ability to assess performance. Saranga and Phani, (2004) study of 44 pharmaceutical companies confirmed the relationship between DEA

and existing variables. This study concluded that firms which ignore internal inefficiencies have lower chances of survival and growth.

2. 5.2 DEA Theory

The applications of data envelopment analysis can be traced through the following models: The CCR ratio model (Charnes *et al.*, 1978) - Evaluation of overall efficiency & inefficiency; the BCC model (Banker *et al.*, 1984) - Technical & scale efficiency difference. It also defines pure technical efficiency and identifies the type of returns to scale; the multiplicative model (Charnes *et al.*,1983) that provide for a log-linear or piece wise Cobb-Douglas interpretation of the production process; and the additive model (Cooper *et al.* 2007a).

This study utilized the BCC analysis based on inefficient results of DEA as dependent variables which were used to identify the variables that best measure the pure technical inefficiency of the Saccos by running a truncated- normal regression. The DEA estimates the best relationship between the multiple outputs and multiple inputs. The result was also able to identify the number of efficient Saccos over the two eras.

Data envelopment analysis is a non-parametric method that measures the decision making units' efficiency. It also evaluates the comparative efficiency of decision making units in companies, including non-governmental organizations. Essentially the analysis measures the efficiencies relative to available inputs and outputs data (Charnes *et al.*, 1978). The result of this Charnes model is useful at the next level of parametric statistical analysis for the purpose of isolating the environmental, statistical noise, and managerial causes of inefficiencies in organization

operations. The data envelopment analysis is illustrated as shown in figure 2.1. DEA relative efficiency is therefore a maximum ratio among the weighted sum of the components of the vector of production and the weighted sum of the vector of inputs used in the production process (CarValho *et al.*, 2010).

According to Lee and Ji, (2013), the pure technical efficiency (PTE) can be estimated by dividing the variable return to scale efficient frontier by distance between inefficient points. Utilizing figure 2.1; this is equal to, vector **B_0B_2/B_0B** (an input oriented efficiency), while the technical efficiency (TE) is estimated as vector **B_0B_1/B_0B,** also an input oriented. This scenario is explained in a linear output and input setting as reflected in the graph below, else the multiple outputs and inputs require an application of DEA under the concept of linear programming. It is noteworthy that vector B_1B result to point B technical efficiency constant returns to scale, while vector B_2B results to point B technical efficiency variable returns to scale, and B_1B_2 is a scale efficiency vector. Point C is CCR-efficient. The BCC-efficiency (PTE) at point B is B_0B_2/B_0B, while CCR-efficiency (scale efficiency) at B is B_0B_1/B_0B_2. Further, the scale efficiency is also equal to TE/PTE.

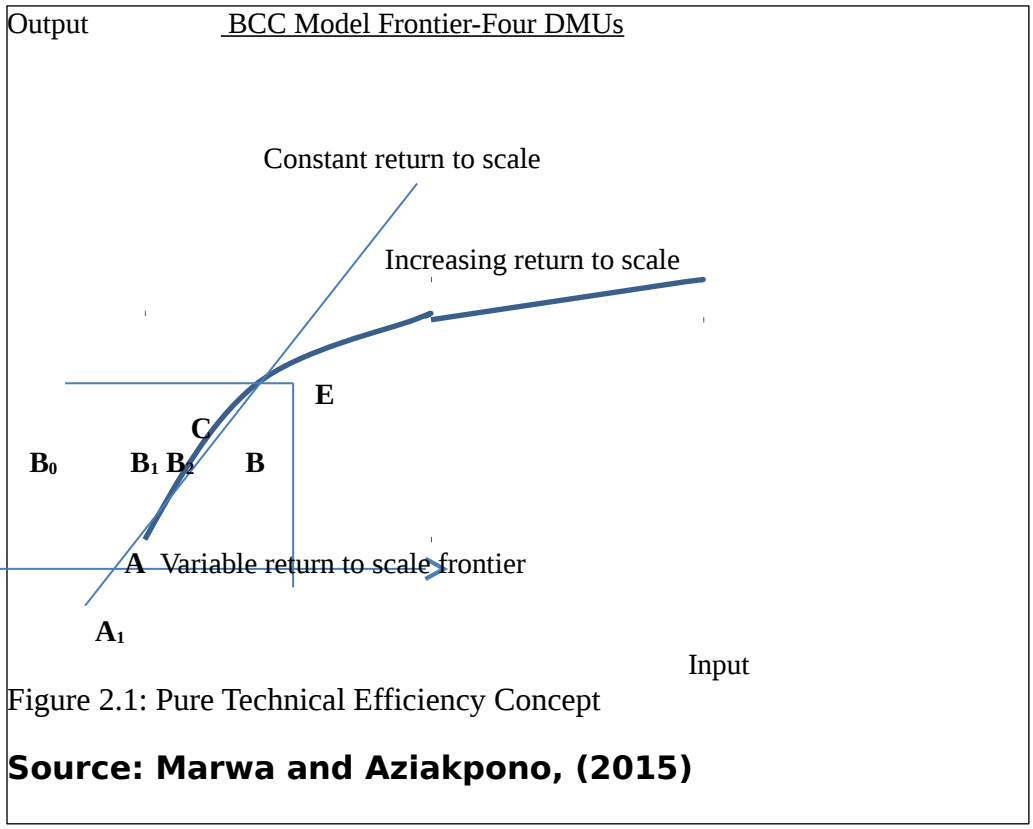


Figure 2.1: Pure Technical Efficiency Concept

Source: Marwa and Aziakpono, (2015)

Mathematically:

Efficiency = $\frac{\sum_{r=1}^{s} UrYr\,0}{\sum_{i=1}^{m} ViXi\,0}$, being an output-oriented model, while an alternative to it would be a reciprocal of this equation which is known as an input oriented model, where by holding current output level, the input amount are reduced by as much as feasible (Cooper *et al.*,2007a). The input oriented model is as demonstrated in figure 2.1.

On the other hand, inefficiencies arise when the optimality is not attained leading to demand for either input reductions slacks (S_i^-) or output augmentation slacks(S_i^+). This in essence call for an efficient output targets and an input targets that is, a proportion decrease in the efficiency level of a decision making unit less the slack value.

The variables $\mathbf{U_r^s}$ is output r weight; while $\mathbf{V_i^s}$ is input i weight; and $\mathbf{Yro^s}$ output r total ,utilized by $\mathbf{DMU_j}$; and $\mathbf{Xío^s}$ amount of input i utilized by $\mathbf{DMU_j}$ to be evaluated. **DMU** is a decision making unit while **'o'** denotes a pivotal point for each DMU, say at point C in figure 2.1.

The DEA model was utilized as a cost minimization mathematical linear programming decision making tool and the score of 1 or less, although greater than zero reflects a feasible technology (Charnes *et al.*, 1978). Methodically, data envelopment analysis utilizes two models: CCR model (constant return to scale-CRS) Charnes *et al.,* (1978) and the BCC model (variable return to scale-VRS) (Banker *et al.,* 1984). CCR (CRS) model assumes constant returns to scale while BCC (VRS) assumes variable returns to scale. BCC models are most frequently used DEA models as they do not assume proportionality between input and output. The shadow price of

maximization programming problem is minimization programming problem. The optional performing units are identified and assigned a score of 1; while inefficient have efficiency of less than one (1) but greater than zero, outside the efficiency frontier or data envelopment (Rios and Macada, 2006).

2.5.3 An Overview of the Saccos Sector

According to Johnson and Zarazua, *(*2008) the use of financial services in the Kenyan market per player in savings side are ranked as follows: The Rotating Savings and Credit Associations (ROSCA) rank first, at 29.3%; Hidden Savings (27.9%); Bank or Building Society (13.7%); and Saccos (12.8%) come fourth, in that order. On the side of demand for loans or credit issue side from these financial institutions: Saccos rank third in order of preference in the economy. The details are as indicated in annex 1.2. The lower number of Saccos players utilizing the financial services favorably explain the level of restrictions placed before a Sacco is registered and this in the long term, has a bearing on inefficiency and thus age was also picked as a variable.

Saccos are formed to serve the socio-economic needs of the poor or low income earners in a community. This being the case, any inefficiency means that the Sacco is not able to offer the basic objective of its existence; which is the ability to issue loans to members at usually below the market interest rate. Majority of Saccos common bonds are shareholders' employing companies and approximately 2.3 million Kenyans are served by these Saccos compared to banking industries at 2.5 million (FSD, 2007). Therefore, to guard the interest of at least 17.5% of the 20 million Kenyan adult populations which depend directly on Saccos (SASRA, 2013); the compliance with regulation of Saccos is judged as a priority to the economy. In addition, the

national Sacco-savings to gross national product recorded in 2013 was 47.59 percent (SASRA, 2013).

The Kenya population census of 2009 estimates the Kenyan population to be about 40 million people. It is also worth noting that in 2006 the co-operative sector as a whole mobilized savings of Kshs.300 billion, approximately 33% of the national savings (KIG, 2013).

The cooperative Saccos sub-sector in Kenya is ranked number one in Africa in terms of market share of assets estimated at 67 % (SASRA, 2010). Furthermore, after the enactment of Saccos Act, 2008, the corporate governance in Sacco sub-sector was envisioned to take an efficient management trend (Wanyama, 2009). On the contrary, mismanagement and underperformance has continued to be reported in the Saccos (MOCMD, 2013). This creates a discrepancy between the expectation from the Saccos' regulator and what is actually the case, thus complicating the ability of the co-operatives' ranking and survival in future.

2.6 Theoretical Review

This research was guided by the theory of agency and the financial institutions efficiency measurement theories; more precisely, the intermediation theory. Other discussed models relevant to this research are the financial institutions' prudential monitoring standards. The regulator of deposit taking Saccos in Kenya advocates for the adoption of Camels Prudential Reporting Standards (Kivuvo and Olweny, 2014). Zawadi and Patel, (2014) in their study of banking industry in Tanzania conclude that extensive literature on financial institutions using DEA exists mainly in developing countries and that inefficiency is caused by improper utilization of resources, that is, managerial inefficiency while assets quality (non-performing loans to total loans), management efficiency(non-interest expense to average assets) and liquidity(loans to

deposits) using a two-step DEA-Tobit regression were found to be key determinants of efficiency. The reference to prudential standards as earlier stated contributed to a greater extent in the identification of independent variables used in this research such as net profit to total assets and capital adequacy.

Esho, (2001) finding indicates that banks efficiency is best determined by ratio of equity to total assets. A study on N.S.W Credit Union industry established that nonexistence of scale economies and technology played a major role in cost advantage (Crapp, 1983). Oral and Yolalan, (1990) studied twenty branches of Turkish commercial bank and concluded that service efficient branches were also profitable and were also best measured by DEA as complementary to traditional ratio analysis.

2.6.1 Agency theory

Agency theory was first advanced by Stephen Ross and Barry Mitnick in 1972 and 1973 respectively. The theory states that institutions revolve around the relation between employer and worker according to Mitnick, whereas, Ross believed that this relation spins around Job motivations to the workers. In a research defended at the University of Pennsylvania in economic meeting in December 1972, Ross maintained that the agency problem and incentives are identified both as macroeconomic problems and microeconomic ones. Ross study launched the idea of agency theory while Mitnick a doctoral student in political science at the University presented a similar dissertation on agency in 1973. He believed that institutions and social mechanisms guide the agent as well as principal relationship or inclinations (Mitnick, 2006).

Jensen and Meckling, (1976) studied agency costs that come into being as result of existence of debt and external claims in a company; the study concludes that agency costs are the total of

bonding costs incurred by the agent, residual loss (a substitute for an agency cost or lost market x-inefficiency, according to Hughes and Mester, 2008), and monitoring costs incurred by the principal. The lost market x-inefficiency is a result of managerial inefficiency or agency costs (Leibenstein, 1966).

An agency conflicts, managerial compensation and firm variance study by Lippert, (1996) provide evidence that fixed management claim in a firm seeks to reduce volatility while residual claims seek to increase volatility. Further, Lippert, (1996) examined the agency conflict between managers and stockholders in expected: manager utility - shareholder profits maximization structure. He arrived at the following positions: Higher fixed wages makes manager reduce the variance of future cash flows; stock options compensation lowers the incentive of managers to expropriate wealth from shareholders while it increases incentive to expropriate wealth from bondholders. Further, higher equity-related securities compensation aligns manager's interests to those of shareholders. These arguments are the underlying factors in the choice of dividends, net cash flows and net profit to total assets as variables. According to Deeptee and Roshan, (2009) dividend is used as a tool in the reduction of agency costs incurred in monitoring managers.

A reward system that does not compensate performance prepares for manager's exit from such company. This is supported by the fact that companies are inclined to seeking new managers in an aggressive labor market (Famma, 1980). Further, a company that is managed solely by its owners is likely to avoid agency costs arising from the managers' conflict of interest.

The Kenya loan market is competitive (Johnson *and* Zarazua, 2008); and there exist, a general trend whereby experienced managers are being hired to ensure good performance and future survival of Saccos. Wanyoike, (2013), concludes that staff competence and quality of board members have high impact on the performance of Saccos.

Organizations performance can thus be categorized into two groups, which include: non-financial which involve non-quantitative variables including marketing, administrative and social factors; and the financial, whereby quantitative factors are captured such as financial ratios criteria (Spigelman, 1994). Agency costs as a factor that influence efficiency thus fit well under financial category as a Sacco without a non-owner employee incurs no conflict of interest costs (Hughes and Mester, 2008).

Furthermore, Hughes and Mester, (2008) suggested Q-ratio a representative for Jensen and Meckling agency costs, while Habib and Ljungquist, (2005) proposed alternative measurement variables of agency costs such as capital costs, advertising costs, financial leverage and size. This study adopted size(measured by total assets) of Saccos as a proxy for agency costs because of the difficulty in deriving market values of unquoted Saccos' shares in addition to the regulator's terms of investing in capital assets as stipulated in the statute.

2.6.2 The Technical Efficiency Definition and Efficiency(X-Inefficiency) Theory

The efficiency is defined as a ratio of outputs to inputs. A ratio of the (in)efficiency is most important function of technical, scale, price and allocative efficiency (Ozcan, 2008). Drucker, (2008) define efficiency as performing an act in best way possible. Further, according to the efficiency theory, the inefficiency of decision making unit decreases as cost reduces while the opposite is also true (Magali and Pastory, 2013).

Technical efficiency is capable of being decomposed into pure technical efficiency and scale efficiency by DEA. Pure technical efficiency occurs when a firm operates under variable return to scale aspect. However, cost efficiency include technical efficiency and allocative efficiency of a

DMU as decomposed by DEA, as illustrated in annex 1.3. Scale efficiency, involves alternative to constant returns to scale, determined at a point where average product has reached maximum, given a production curve (Coelli, *et al.*, 1997). Achieving the highest level of possible productivity on the frontier makes a firm technically efficient.

According to Jensen and Meckling (1976) the inefficiency of a firm is equivalent to incurred agency costs, which is caused by poor managerial incentives resulting to a shortfall of net income from reaching the frontier. In addition, Leibenstein, (1966) argues a sample of same risk firms' best-practice is an efficient firm and that x-inefficiency (technical inefficiency) which is the amount of forfeited output occurs as a result of motivation shortfalls within the firm's pecking order. However, the x-inefficiency theory can be accommodated within the structure of agency theory as managers have ability to react to state of the environment (De Alessi, 1983). The principal –agent relationship increases firm losses while inducing inefficiency in a firm, thus acting as an x-inefficiency source. In addition, the active participation of members in control of a firm affairs is a good source of reducing the level of x-inefficiency and the opposite is also true (Gorton and Schmid, 1999).

It should be noted from the annex 1.2 that competition for financial services in Kenya is a reality. In essence, survival of financial services providers is a function of efficient operations. To attain this objective, the regulator must utilize efficiency bench marks to separate efficient Saccos from inefficient ones for stability of the financial market. The best managed financial institutions in economy direct stakeholders on where to invest. Prior studies have indicated that majority of practitioners and even academics measure profit efficiency and cost efficiency for banks relative to a profit frontier and minimum cost respectively (Koetter, 2006).

The bottom line of any business entity is its earning which is a byproduct of the employed cost of production. The cost of production is a function of profits or capital employed. Further, the quality of the bottom line depends on the ability of the management to sacrifice the personal interest over the business interest as highlighted under agency theory. However, the higher the personal interests sacrifice, the higher the quality of the earnings.

A risk factor traditional measure by Modigliani and Miller, (1958) states that if agents are risk neutral, cost minimization and profit maximization are equivalent to value maximization although, the difference in risk preference leads to misleading efficiency rankings.

Kipesha, (2012) study concludes that size, age, and locations explain well the efficiency of micro finance, while Magali and Pastory, (2013) argue that socio-political and economic environment do influence the efficiency of Saccos in Tanzania. The reflections from the above prior studies indicate a strong relationship between efficiency and agency theory. Agency costs factor informed the adoption of variables such as net operating cash flows to members' funds and bond size. Essentially, the reliability of x-inefficiency theory or agency theory to this study is pursued.

2.7 The Applicable Study Theories

The financial institutions inefficiency measurement theories assist in the process of inputs and outputs identification. The approaches include profitability approach, intermediation approach and the production approach. The inputs and outputs are ordinarily utilized factors under the DEA measurement tool.

2.7.1 Financial (Bank) Intermediation Theory

The work of intermediation theory started around 1956. Gurley and Shaw, (1960) argues that the existence of financial intermediaries (institutions) is well explained by level of transaction costs, non-scanty information availability in useful time and the regulation method. In addition, banks transformed earnings of other firms into desirable form for investors. Diamond and Dybvig, (1983) postulate financial intermediaries as information asymmetries cure. However, in their study Leland and Pyle, (1977) consider financial intermediaries as information distribution alliances.

This theory postulates that banks' efficiency is positively related to profitability. Therefore higher profits come from banks that are more efficient and have large market share than their competitors (Demsetz, 1973). The theory is essentially in agreement with some prior studies where profitability is considered as an output. More often than not banks receive high earnings on deposits from customers when subsequently borrowed. In return banks pay very minimal returns on these deposits creating a wide interest spread.

Financial institutions play a key role of taking deposits from investors and transferring those savings into investments. In the process banks incur transactions costs like costs of carrying out due diligence before a loan is issued to potential borrower (Allen and Santomero, 1998). In this aspect, outputs include loans, interest paid and investment while inputs are composed of transactions costs and mutual funds or deposits and acceptances (Sealey and Lindley, 1977).The acceptances are the written undertaking to pay a given sum of funds at a coming date. Ordinarily the banks act as go between of the

savers and those who receive money Scholtens and Wensveen, (2003). The Sacco-intermediaries reduces the adverse effect costs arising from selection of borrowers, this informs the use of for instance NCFM and bond size variables in this study.

Ali, (2012) measured the efficiency of the Islamic banking using the intermediation approach and DEA, the result indicates that large Islamic banks are more efficient than small banks except during economic crisis time. Further, there was an increase of efficiency during economic crisis for Middle East category of Islamic banks.

2.7.2 Production Theory

This theory includes the structural approach of costs minimization, profits maximization and managerial utility maximization. More often the financial institution managers fight to operate within the production frontier. Managers also do target to balance between the risky projects and the expected earnings. This theory involves services rendering to depositors and borrowers whereby the inputs and outputs are measured in term of size of accounts and transactions respectively (Brown, 2006).

Furthermore, bankers under different or related environmental conditions do fight for best performance (Berge and Mester, 1997). The environmental structural characteristics may include organizations size, governance, regulatory ratings and market structures in place (De Young *et al.*, 2001).

Another element of production theory is a non-structural approach where performance is measured through the use of various accounting ratio such as return on assets or equity, the ratio of fixed costs to total costs, and arm's length (or market value) of assets to book value of assets (Mester, 2008). The managerial variables as postulated by Habib and Ljungquist, (2005) under this approach also include financial leverage, advertising costs, firm size and capital expenditures.

Principally, using the structural approach the inputs are considered under the combined production structure theory and intermediation theory to include labor, capital deposits, interest expense, operating expenses, borrowed funds and equity capital. In addition, outputs are the financial institutions' assets such as loans acquired by the borrowers or investors and the number of transactions or accounts (Hughes and Mester, 2008; 1993).

Contemporary studies also consider the study of financial institutions under a combined theory of financial intermediation and micro economics bank production theory (Hughes and Mester, 2008). Further, the choice of intermediation theory is preferred because the production theory is an efficiency measurement tool for branches of bank and not bank level (Berger and Humphrey, 1997).

2.7.3 Profitability Theory

Banks are considered optimizers with a main target of reducing loses and optimizing profits or revenues. Thus both interest and non-interest costs are considered as inputs while non-interest revenue and interest revenue are deemed as outputs (Ayrancie, 2010). This method was ignored since Saccos are not formed with main agenda of profit

making, but with the agenda of mobilization of funds for members' borrowing in form of loans.

2.8 Theoretical Framework

This research as earlier observed is partly based on agency theory originated by Ross and Mitnick in early 1970s. Ross argued that agency problems are both macro-economic and micro-economic in nature.

Davis *et al.,* (1997) argues that when agency utility and shareholders' wealth coverage is optimal, the agency problem is considered to be absent. Reiterating the earlier statement, Jensen and Meckling (1976) study concludes that agency costs are the total of bonding costs incurred by the agent; and residual loss and monitoring costs incurred by the principal.

The noted controversies surrounding agency theory are that the variables in the agent-principal relationship are not measurable (Bruton *et al.,* 2000; Busenitz *et al.,* 2001) and also the partial share ownership by the agent in a firm does not motivate the agent to replicate the principal's behavior (Pierce *et al.,* 1991). Nilsson, (2001) on the other hand, argues that members of many co-operatives leave management at liberty to make decision, short term investments are common and the investments in total are below the economic optimal level.

Another theory called stewardship is considered to fill the gaps left by agency theory. It suggests that once the principal has invested in a new venture, stewardship theory explains the behavior between the principal and the agent better than the agency theory would (Davis *et al.*, 1997).

Mahmoodi *et al.*, (2010) conclude that performance is a key financial aspect and that performance assessment is done subject to consideration of the investors' views. They argue that the performance assessment and agency theory cannot be separated.

Further, Mahmoodi *et al.*, (2010) also observe that different stakeholders have different views on performance assessments: for example, managers pay attention to operation analysis, resource management and making profits; while shareholders considers profitability, return on stocks and market feedback. On the other hand, the lenders consider liquidity and financial coverage of business firms.

Scrutinizing the effect of firms' agency theory, prior literatures indicate a conflicting effect of gender diversity on firms' performance. A recent US firms' study conclude that the mean effect of gender diversity on performance is not positive and that there exists a positive association between gender diversity and return on assets, holding industry type as a controlling variable (Adams and Ferreira, 2009). This study as earlier stated, given the dynamism of Saccos' sub-sector, also explored the impact of women fraction on the boards as an independent variable.

In addition, Ogebe *et al.*, (2013) conclude that the employment of equity is encouraged than debt for positive firm performance. This study thus introduced a common bond size as a financial

structure efficiency measurement variable. This variable in the prior study done in United States of America, was found to be positively associated with performance, as a common bond category of credit unions (Fried *et al.*, 1993).

Mirie, (2014) conclude that bond of association among Sacco members in Kenya is weakly and negatively associated with efficiency. Contrary to this study in Kenya, an Australian research confirmed the existence of a strong positive relationship between bond of association and efficiency of co-operative unions (Brown *et al.*, 1999). Further, the operationalization of the Saccos Act, in Kenya, permits the existence of multiple common bond contributors to a Sacco fund account (SSA, 2008).

Past studies have also shown that credit unions or Saccos even though they are formed with not-for-profit motive their behavioral models can't ignore the dual cost minimization objective due to competitive market environment they operate in. This feature therefore supports the use of net profits to total assets variable in this study, which is appropriate variable for evaluating performance in profit oriented financial intermediaries (Fried *et al.*, 1993).

Basically, like in the prior research by Mahmoodi *et al.*, (2010), this study considers the efficiency of Saccos to a greater extent as based on the views of the shareholders and these views are exhibited in the annual general meetings, while to a smaller extent on views of both managers and lenders.

A study in Nigeria on performance of 10 Nigerian banks using DEA established that technical inefficiency was a source of inefficiency (Ayadi and Hyman, 2006). Aikael, (2008) studied commercial banks in Tanzania and concluded that commercial banks experienced decreasing return to scale thus with an option to take advantage of economies of scale.

Kamau, (2011) studied efficiency of 40 commercial banks in Kenya during 1997 to 2009 using DEA. The result indicates that average technical efficiency was 0.47 for constant return to scale, 0.56 for variable return to scale and 0.84 for scale efficiency. Magali and Pastory, (2013) assessed the technical efficiency of various rural Saccos in Tanzania using DEA approach. The finding is that technical efficiency varied regionally and ranged between 0.46 and 0.62.

In conclusion, critically analyzing the foregoing discussion it is clear the studies are biased towards commercial banks especially in Africa and the use of non-parametric DEA method with efficiency focus and not inefficiency. This study therefore targets Saccos in Kenya from the inefficiency and factors determining inefficiency perspective using both parametric and non-parametric methods. A summary of selected study variables is as shown in table 2.1.

Table 2.1: Data Variables Selected for SFA & DEA Models

Variables	**Authors**
Advances (Outputs) Investments (Outputs) Operating expense (Inputs) Deposits (Outputs) Interest expense (Inputs) Areas of operation (IV) Capital adequacy (IV) Lending/advances (IV)	Bhattacharya *et al.*, (1997)
Interest & non-interest expenses (Inputs) Deposits (Inputs) Net interest and non-interest income (Outputs)	Sathye, (2003)

Net loans (Outputs)	
Return on sales (IV)	
Return on investment (IV)	
Return on assets (IV)	
Operating cash flow to owners' equity (IV)	Mahmoodi *et al.*, (2010)
Operating expenses (Inputs)	
Owners' equity (Inputs)	
Net earnings (outputs)	
Operating cash flows (outputs)	
Cost of production and selling (Inputs)	Saranga and Phani, (2004)
Cost of material (Inputs)	
Cost of labor (Inputs)	
Net sales (Output)	
Exports (Output)	
Trade margin (Outputs)	
Members' deposits & borrowings (Inputs)	
Interest/dividends on members' deposits & cost of borrowing (Inputs)	
Other operating expenses (Inputs)	
Loan to members and other earnings assets (Outputs)	Mirie.M, (2014)
Shares (Outputs)	
Interest income (Outputs)	
Other Income (Outputs)	
Bond of association among Sacco members (IV)	
Size of Sacco (IV)	
Adoption of technology (IV)	
Age of Sacco (IV)	
Loans (Output)	
Other productive assets (Output)	Zawadi and Patel, (2014)
Deposits (Outputs)	
Non-interest expenses (Inputs)	

Personal expenses (Inputs)	
Equity/total assets (IV)	
Bad loans/total loan (IV)	
Non-interest expenses/average assets (IV)	
Net interest/total assets (IV)	
Loans/deposits (IV)	
Interest expense (Inputs)	
Credit costs (Inputs)	
General administrative expenses (Inputs)	Cooper *et al.*, (2007d)
Interest accruing loans (Outputs)	
Lending revenues (Outputs)	
Monetary aggregate/ GDP (IV)	
Real GDP growth index (IV)	
Real land price index (IV)	
Long term risk spread (IV)	
Dummy of city banks (IV)	
Dummy of regional banks (IV)	
Real stock price index (IV)	
Short-term risk premium (IV)	
Short-term risk spread (IV)	
Insolvency dummy (IV)	
Japan premium (IV)	

Source: Constructed by researcher based on literature review Research, (2015).
Note: IV= Independent Variable

2.9 Conceptual Framework

2.9.1 Background

(In)efficiency is the ratio of results to resources. On the other hand performance importance arises from the feeling that it is often used to gauge management contribution to net worth of a functional unit in an organization. Performance is also the fact or action of doing a task well (Oxford, 2005). A key component of performance as stated above is the efficiency, which is the ratio of outputs to inputs (Ozcan, 2008).

2.9.2 Performance and Efficiency

Performance is broadly explained in two approaches: structural and non-structural approach. The structural relies on financial intermediaries' concept of optimization. It integrates the consumer theory in business production plan (Hughes and Mester, 2008). Hughes and Master, (2008) also indicates saving deposits not covered or covered are inputs for financial companies of all sizes. Magali and Pastory, (2013) identified inputs as follows: number of registered Saccos' members, total savings and deposits, and total expenses while their output involved loan to members as the only indicator.

The non-structural on the other hand comprises the performance among institutions beside performance correlation to investment strategies in addition to other qualitative factors such as: governance characteristics, investment strategies and quality of institutions governance variables (Gopalan, 2014).

The Saccos' efficiency or performance definition in this study is adopted from (Hughes and Mester, 2008) and (Ozcan, 2008). Essentially, an introduction of an additional independent variable of women presence on the board unlike in the related prior studies is a plus and therefore reflects the composite nature of this study in capturing both structural and non-structural variables.

The definition of the first stage DEA output and input variables based on the above explanation is superimposed in figure 2.1 while the SFA second stage in the same figure utilizing the DEA inefficiencies, specifies the ultimate model conceptual frame work. Cooper *et al.* (2007c), conclude that the banks' inputs depend on outputs since the lenders make lending decisions before sourcing for finance. Further, according to Hancock, (1989) the choices of inputs and outputs depend on likelihood of generating a net expenditure and revenue respectively.

Concisely, this study adopted an intermediation theory similar to other past studies: (Yue, 1992; Quey, 1996; Hughes and Mester, 2008; Ayrancie, 2010; Mahmoodi *et al.*, 2010), and applied an output oriented non-parametric model variables in figure 2.2 for the first stage measurement of Saccos' operations. Based on the non-profit orientation of Saccos, the profitability and production theories in this study are deemed fairly represented by the chosen intermediation theory.

According to Pencavel and Craig, (1994), and Dahl, (1957) they conclude that members of co-operatives are ever interested with end year cash payment. This behavior is closely observed true for Sacco members' appetite for cash dividend and interest bonus in Kenya. Members of Saccos prefer cash payment of dividends to capitalization of the same to grow the investment. Therefore, the inclusion of dividend and interest bonus liability as a model output is chiefly supported by this fact. Intrinsically, close observers believe that non provision of dividends in successive years triggers the incidence of members' exit from the Saccos. These features strengthen the treatment

of dividends as a component of outputs. Mirie, (2014) study on the contrary, considered dividend as part of inputs with mixed results.

The hypothesis of maximizing dividend rate for co-operatives was first argued by (Ward, 1958). It is also noteworthy that FOSA in Kenya are only expected to pay dividend when they are not undercapitalized, that is, reflecting a capital adequacy ratio of at least 4% (SSR, 2010). Like in the past study, Mahmoodi *et al.,* (2010), the net operating cash flows in this study was on the other hand adopted as an element of outputs while on the other side the net operating cash flows to members' funds was considered among the specific independent variables based on agency theory as earlier explained.

The exclusion of investment in the immovable assets dollar volume or costs under the outputs or inputs respectively is supported by statute restrictions as enshrined in the Co-operatives Act, which allows investment in specific fixed assets on authority from the regulator (SSA, (2008). In addition, Saccos' securities investments are always below the economic optimum level (Nilsson, 2001). This finding supports the exclusion of investments among the outputs as demanded under the intermediation theory. The close observers also indicate that acceptances as an element of inputs, are rear phenomena in the Kenyan Saccos and their exclusion from the inputs is thus supported by this existing circumstance.

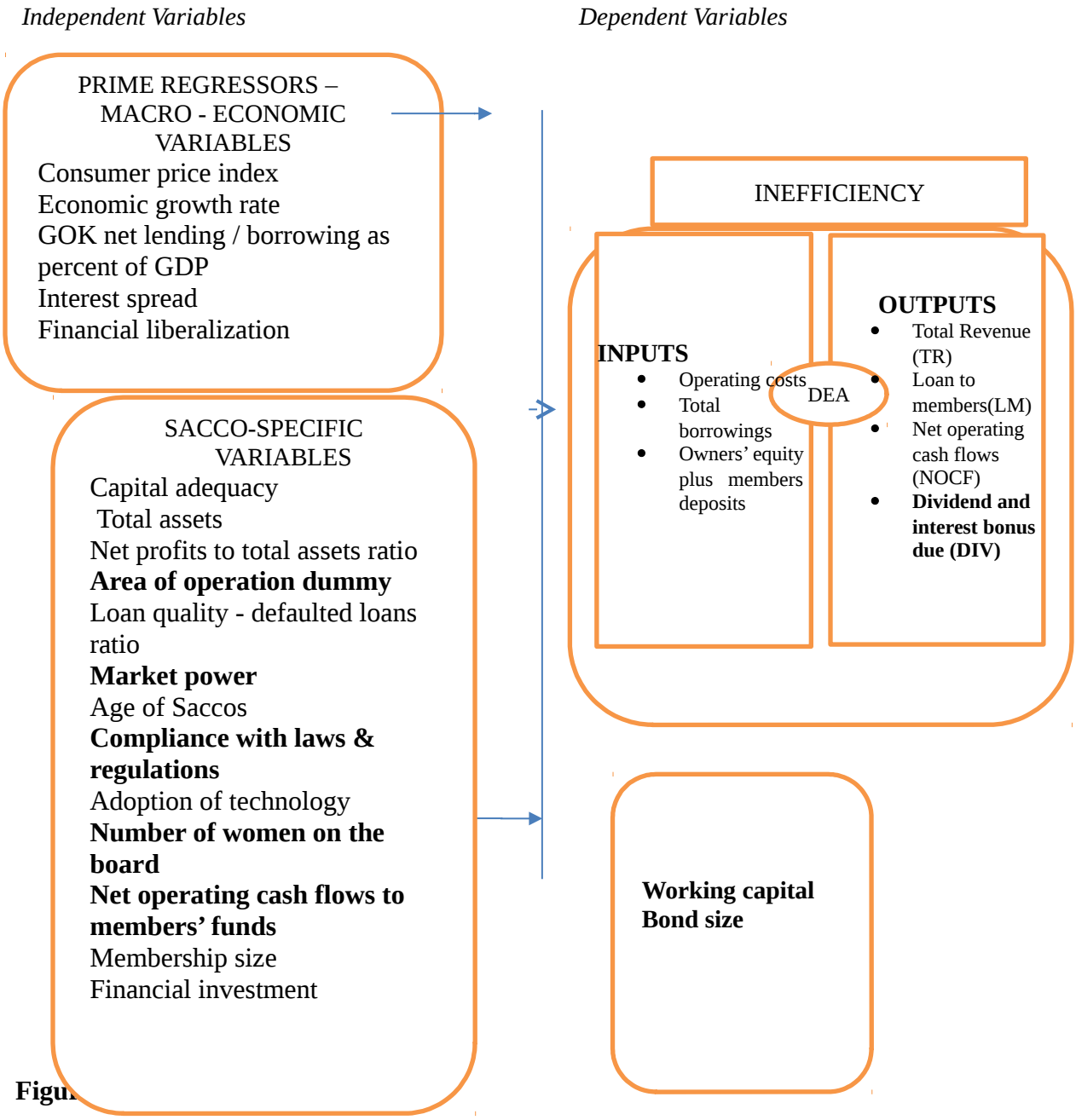
Past researchers have considered deposits as outputs (Berg *et al.,* 1990). This study opted for deposits as a component of inputs similar to prior studies: [(Sealey and Lindley, 1977); Hughes and Mester, (1993)] in compliance with the intermediation theory and Saccos' regulation. Ariff and Can, (2008); and Berger and Humphrey, (1997), on the other hand argues that under DEA, the variables of inputs or outputs picked can accommodate different measurement units. A summary of study theories explained in detail herein on outputs and inputs is analyzed as shown

in annex 2.1. However, the x-inefficiency theory (agency theory) aided in identification of predictor variables such as women on the board, capital adequacy, net profit to total assets ratio among others beside the employment of inefficiencies as a dependent variables. On the other similar to past studies, the environmental factors were identified as detailed in table 2.1 and the DEA inputs and outputs were grounded on intermediation theory.

2.9.3 Conclusion

This study was developed along the line of agency theory, x-inefficiency theory and the intermediation theory of financial institutions efficiency measurement theories as a basis; this is because Saccos' management experience principal-agency problem just like any other organizations. Ultimately, the Saccos operate in a regulated financial environment and for the purpose of the stability and competitiveness of the financial markets, the efficiency of Saccos in an economy like Kenya is vital.

To bridge the gap in the Saccos' inefficiency determinants, this study has utilized the stochastic frontier regression for panel data. Further, the regulator's control influenced the choice of census design data without isolation of any observation.



Figu

Source: Research, (2015)

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter highlights the methodology used in conducting the study. It explains the method, the models, target population, census design, data collection and analysis, quality control, study limitations and ethical considerations.

3.1 Research Design

In brief this research adopted a quantitative secondary data collection and measuring approach. It involved certain degree of researcher's independence, objectivity, use of statistical models for data analysis, logical approach of research activities and empirical theories testing in conformity with the philosophy of positivism (Carson *et al.*, 2001).

This explanatory study used a balanced panel data. The explanatory research design was employed in soliciting for secondary information on determinants of Saccos' inefficiency in Kenya. Type of method used in efficiency or inefficiency study can have significant conclusion (Mirie, 2014). An econometric approach in estimation of Saccos' inefficiency determinants was utilized since SFA stipulates the functional form of cost or production frontier (Cummins and Zi, 1998). The panel data has benefit of assisting in studying the behavior of each Sacco on cross-sectional and time-series or yearly basis (Ongore and Kusa, 2013).

Research design is a plan that guides a research and help in determination of data to be collected while its subset, the explanatory study is highly structured and is utilized when the target is to explain quantitatively the association between variables (Mirie, 2014; Williams, 2007).

3.2 The DEA Models

3.2.1 1st DEA Model

The DEA analysis is estimated using the identified outputs and inputs to derive the efficiency scores and the output slacks under the SBM (slack based method). Hiroshi *et al.* (2005) portend that SBM is good performance yardstick for inefficient DMUs. Further, SBM model jointly optimizes input excesses and output shortfalls (Cooper *et al.* 2007d). The SBM and output oriented variable return to scale or BCC procedure was adopted as an initial estimate for this research, as a result of work by (Fried *et al.*, 2002, Cooper *et al.* 2007d).

It is also closely observed in Kenya that the Saccos expenses are generally controlled by shareholders through strict expenditure budgetary control or approval voting in annual general meetings. This aspect thus supports the output oriented approach in addition to the Sacco-managers' susceptibility to making lending decisions before soliciting for funding.

3.2.2 2nd (Final) DEA Model

The second or final stage involves choice of prime regressor variables that identify variation in output slacks and another group which explains specific Sacco independent variables using the Stata14.1 cost model, SFA software. Under this stage, the observed 1st stage DEA output data was regressed against the effect of environmental variables and statistical noise using the SFA regression result. Here the DMUs experiencing unfavorable operating environments or statistical noise intrinsically had their outputs adjusted upward, for purpose of striking a balance between environmentally advantaged DMUs and disadvantaged DMUs (Avkiran and Rowlands, 2006).

The re-running DEA under the output orientation using adjusted value of outputs generate new radial scores that reflect inefficiency linked to management (Fried *et al.*1999). Further, the estimation of inefficiency was carried out utilizing the Cobb-Douglas cost frontier cross-sectional panel data of Saccos over two periods. Truncated-normal distribution as illustrated in figure 3.1 was assumed. Coelli *et al.,* (2005) and Cooper *et al.,* (2011) supports cost minimization approach. Frontier 4.1 and Stata14.1 are preferred to Limdep 10.0 as they decompose errors without need for extra levels of decomposition or programming as is the case with Limdep. These SFA software are also maximum likelihood oriented (Pascoe *et al.,* 2003).

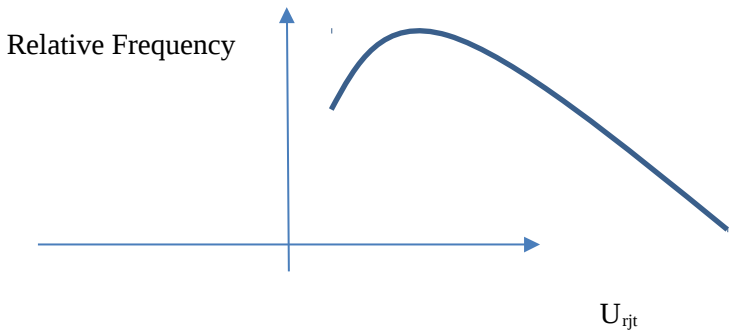


Figure 3.1: Truncated-Normal
Source: Jondrow *et al.,* 1982

The frontier variables are the decomposed V_{rjt} symmetric errors or size linked variables, that is, the random influences; while shortfall from the frontier U_{rjt} (one sided error term) are believed to be caused by management conflict of interest which are likely to be avoided through agency costs incentives. The U_{rjt} is estimated from the residuals while the stochastic model as developed by Aigner *et al.,* (1977) is of the form:

$\hat{y} = \beta_0 + \beta_1 Z_{111} + \ldots + \beta_k Z_{kjt} + Vrjt + Urjt$ and its essential form is based on Cobb-Douglas logarithmic

model: $In\hat{y} = \beta_0 + \sum_{1}^{k} \beta k \quad InZ_{kjt} + V_{rjt} + U_{rjt}$, (3.1)

where: β_r is the frontier deterministic component, V_{rjt} is stochastic part and U_{rjt} presents the shortfall observed individual fails to hit the optimum (frontier), j (j=1,…,n) is the cross-sectional identifier, t(t=1,…,t) is time identifier , $\hat{y}$ is the first stage optimal slack(normalized) in output r of DMU_j , βo is the intercept of output slack equation, 'In' is natural logarithm, and Z has k(k=1, …,k) observable environmental factors (Battese and Coelli,1995).

The specific forms of equation (1) estimated for research of determinants of technical inefficiency of Saccos is thus written as:

$$In(TR_{jt}) = \beta_0 + \beta_{1In}(age_{jt}) + \beta_{2\,In}(ca_{jt}) + \beta_{3\,In}(ta_{jt}) + \beta_4(ao_{jt}) + \beta_{5\,In}(lp_{jt}) + \beta_{6\,In}(mp_{jt}) + \beta_{7\,In}(clr_{jt}) + \beta_{8\,In}(atech_{jt}) + \beta_{9\,In}(w_{jt}) + \beta_{10\,In}(ncfma_{jt}) + \beta_{11\,In}(ms_{jt}) + \beta_{12\,In}(cpi_{jt}) + \beta_{13\,In}(goklb_{jt}) + \beta_{14\,In}(insp_{jt}) + \beta_{15\,In}(flib_{jt}) + \beta_{16\,In}(fi_{jt}) + \beta_{17\,In}(npta_{jt}) + \beta_{18\,In}(gdp_{jt}) + \beta_{19\,In}(wc_{jt}) + \beta_{20\,In}(bond_{jt}) + V_{jt} + U_{jt} \quad (3.2)$$

$$In(LM_{jt}) = \beta_0 + \beta_{1In}(age_{jt}) + \beta_{2\,In}(ca_{jt}) + \beta_{3\,In}(ta_{jt}) + \beta_4(ao_{jt}) + \beta_{5\,In}(lp_{jt}) + \beta_{6\,In}(mp_{jt}) + \beta_{7\,In}(clr_{jt}) + \beta_{8\,In}(atech_{jt}) + \beta_{9\,In}(w_{jt}) + \beta_{10\,In}(ncfma_{jt}) + \beta_{11\,In}(ms_{jt}) + \beta_{12\,In}(cpi_{jt}) + \beta_{13\,In}(goklb_{jt}) + \beta_{14\,In}(insp_{jt}) + \beta_{15\,In}(flib_{jt}) + \beta_{16\,In}(fi_{jt}) + \beta_{17\,In}(npta_{jt}) + \beta_{18\,In}(gdp_{jt}) + \beta_{19\,In}(wc_{jt}) + \beta_{20\,In}(bond_{jt}) + V_{jt} + U_{jt} \quad (3.3)$$

$$In(NOCF_{jt}) = \beta_0 + \beta_{1In}(age_{jt}) + \beta_{2\,In}(ca_{jt}) + \beta_{3\,In}(ta_{jt}) + \beta_4(ao_{jt}) + \beta_{5\,In}(lp_{jt}) + \beta_{6\,In}(mp_{jt}) + \beta_{7\,In}(clr_{jt}) + \beta_{8\,In}(atech_{jt}) + \beta_{9\,In}(w_{jt}) + \beta_{10\,In}(ncfma_{jt}) + \beta_{11\,In}(ms_{jt}) + \beta_{12\,In}(cpi_{jt}) + \beta_{13\,In}(goklb_{jt}) + \beta_{14\,In}(insp_{jt}) + \beta_{15\,In}(flib_{jt}) + \beta_{16\,In}(fi_{jt}) + \beta_{17\,In}(npta_{jt}) + \beta_{18\,In}(gdp_{jt}) + \beta_{19\,In}(wc_{jt}) + \beta_{20\,In}(bond_{jt}) + V_{jt} + U_{jt} \quad (3.4)$$

$$In(DIV_{jt}) = \beta_0 + \beta_{1In}(age_{jt}) + \beta_{2\,In}(ca_{jt}) + \beta_{3\,In}(ta_{jt}) + \beta_4(ao_{jt}) + \beta_{5\,In}(lp_{jt}) + \beta_{6\,In}(mp_{jt}) + \beta_{7\,In}(clr_{jt}) + \beta_{8\,In}(atech_{jt}) + \beta_{9\,In}(w_{jt}) + \beta_{10\,In}(ncfma_{jt}) + \beta_{11\,In}(ms_{jt}) + \beta_{12\,In}(cpi_{jt}) + \beta_{13\,In}(goklb_{jt}) + \beta_{14\,In}(insp_{jt}) + \beta_{15\,In}(flib_{jt}) + \beta_{16\,In}(fi_{jt}) + \beta_{17\,In}(npta_{jt}) + \beta_{18\,In}(gdp_{jt}) + \beta_{19\,In}(wc_{jt}) + \beta_{20\,In}(bond_{jt}) + V_{jt} + U_{jt} \quad (3.5)$$

Where: $TR_{jt,}$ $LM_{jt,}$ $NOCF_{jt}$, and DIV_{jt} – the total revenue, loan to members, net operating cash flows and dividend slacks or inefficiencies respectively for j^{th} DMU at time t.

Equations (3.2) to (3.5) assume that respective inefficiencies are affected by Saccos specific independent variables, and the macro-economic variables with or without control variables of bond (number of employers) and working capital (WC) while area of operation(AO) is a dummy variable in the empirical analysis.

Description of Saccos pure technical inefficiency measurement variables model

- *Total revenue slack (TR_{jt}).* This is used as one of the four dependent variables in the model. It includes the interest and non interest earnings of the Saccos.
- *Loan to members' slack (LM_{jt}).* A second dependent variable in the model consisting of loans issued to members.
- *Net operating cash flows($NOCF_{jt}$).* A third inefficiency dependent variable.
- *Dividend slack (DIV_{jt}).* A last inefficiency dependent variable.
- *Age*. A predictor variable that measures the age of the Sacco.
- Capital adequacy(ca). This variable measures soundness of capital relative to potential risk.
- Total assets(ta). Represents Saccos total assets value.
- Net profit to total assets(npta). A ratio that compares net profit to total assets value.
- Area of operation(ao). This variable takes value 0 for town or municipality (urban) and a dummy of 1 for a city location of Sacco.
- Loan provisions(lp). It represents loans defaulted and loan loss provision.
- Market power(mp). This variable represents each Saccos' deposits to total members' deposits.
- Compliance with laws or regulations(clr). This variable is calculated by considering the compliances with capital adequacy rate, dividends payout restrictions, tax laws and

whether the Sacco is under statutory management or not. The Likert scales scores were applied.

- Technology(atech). This is computerization expenditure as reflected in records of the Saccos.
- Women(w). The number of women on the board.
- Cash flows(ncfm). Net operating cash flows to members' funds. A representation of how cash flows affect the operation of the Saccos.
- Membership size(ms). Number of registered Saccos contributors.
- Working capital(wc). A control variable for the fact that different type of Saccos have differing working capital or same working capital yet differs in size. Table 3.1 depict this scenario.
- Bond. The size of contributing common bond employers. It is a control measure of the difference in amount of money that is being channeled to the Saccos as shares depending on the ability and number of contributors from such sources (employing organizations).
- Financial investments(fi). It represents the total financial investment of Saccos in other companies in form of shares and other securities.
- Macro-economic variables. These variables include consumer price index(cpi), economic growth rate(gdp), GOK net lending / borrowing as percent of GDP(goklb)- that represent the proxy of market condition, total money value created in an economy and a proxy for financial depth or innovativeness respectively. Other macro-economic variables include financial liberalization(flib) and interest spread(insp) that represent currency in circulation measure and a proxy for risk pricing in Kenya respectively.

Furthermore, the departure from frontier or closeness to frontier (validity of incentive variables) is defined by Gamma (ϒ) (Aigner *et al.*, 1977). As mentioned elsewhere in this study, the value of

ϒ shown in equation (3.6) is zero when the incentive variables fully explain the departure from the frontier.

This study adopted Aigner *et al.,* (1977) cost frontier model (cost minimization model) since the inefficiency or slacks (dependent variables) are equivalent to organizations' opportunity costs. Essentially, a major motive of Saccos in Kenya is to deliberately issue loans at affordable interest rate to their members while paying nil cost on member deposits except dividends or interest bonus payments at close of a financial year.

According to Berg, (2010), the type of inputs and outputs selected impact on the type of DEA results arrived at. In this study the inputs comparable to the prior study by Mahmoodi *et al.*, (2010) included the owners' equity, deposits and operating expenses, while the outputs consist of net earnings and loans to members beside other additional outputs; net operating cash flows, and dividend and interest bonus due.

The % of technology inefficiency from the equation is calculated as $\Upsilon = \frac{\sigma u^2}{\sigma u^2 + \sigma v^2}$ *(3.6)*;

when ϒ(Gamma) is more close to one the influence of management increases and as it moves to zero the random error dominate. $V_{rjt} \sim N(0, \sigma^2 v)$ is random error stochastic part that follows a symmetric normal distribution while $U_{rjt} \sim N(m, \sigma^2 u)$ is an inefficient management determined by deterministic variables, and $V_{rjt} + U_{rjt}$ are mixed error term for minimization problem (Cooper *et al.*, 2007b). Mean (m) and U_{rjt} are not equal to zero (when mean equal zero and U_{rjt} also equal to zero a truncated model moderates to a linear regression) while truncated at zero function utilizes a few analysis observations depending on the value of dependent variables and U_{rjt} is deemed to decrease over time, being a time-varying decaying model (Stata, 2016). Duality demands that

where optimum is a maximum then change to V_{rjt}-U_{rjt} instead of V_{rjt}+U_{rjt} (Aigner *et al.*, 1977). A situation where Gamma=1, is a reflection of technical inefficiency and a precursor of all capacity underutilization or deviation from the frontier (Pascoe *et al.*, 2003).

Furthermore, the random error section of the $\hat{Y}$ equation is separated from the composed error using Stata 14.1 or Frontier 4.1 software based on Jondrow *et al.*, (1982) method.
Normally statistical noise may include machinery breakdown, labor disputes and statistical errors; while shortages of employees, shortage of machinery and workers' incompetency are some examples of management inefficiency.

In addition, the control variables that are incorporated in this study include the insolvency measure and bond size based on the expectation that variability in dependent variables is also affected by these control variables and for purposes of avoiding spurious relationships. The residual error resulting from the random independent variables and inefficiency variables regression equation represent the management related inefficiency. In addition, the two sample test was used to confirm the inefficiency differences between the two periods of pre-regulation and regulation.

3.2.3 DMUs Strategic Decision Selection

As a rule DMUs may have same number of inputs and outputs, although with varying intensity. These variables should be homogenous able to perform same tasks, with the same goals. They should also be in the same market and able to take decision without intervention (Carvalho *et al.*, 2010). The number of DMUs has to be based on empirical model: $K \geq 2(n+ m)$, where: K = number of DMUs (logistic platform); n= number of inputs; m=number of outputs considered (Fitzsimmons and Fitzsimmons, 2006).

3.2.4 DEA Process

In the first stage, DEA is expected to be a function of *Inputs*: operating costs, total borrowings, , and owners' equity plus members deposits; while the other element of DEA is the *Outputs:* Saccos revenue, loans to members, dividends plus interest bonus due to members, and net operating cash flows. As earlier stated, in this study an intermediation theory was picked from a group of production, intermediation and profitability theories of identifying the inputs and outputs. Prior studies have mainly utilized specific financial institutions' measurement theory in identification of the inputs and outputs variables. Further, any input and output variables identification theory picked by a researcher depends on circumstances (Tortosa, 2002).

In the second or final stage application of stochastic frontier regression was applied using Cobb Douglas logarithm as above indicated. As a result, this study is an extension to a related prior studies of Japan banking industry by Cooper *et al.* (2007b), and [Avkiran and Rowlands, (2006), Fried *et al.*, (2002), Jondrow *et al.*, (1982) and (Bhattacharyya *et al.*, 1997)]. The Independent variables (IV) was represented by: 1.The prime regressors: the economic growth rate (GDP), consumer price index, GOK net lending/ borrowing to GDP, interest spread, financial liberalization(FLIB) and inflation rate (GDP deflator index); 2. The variance regressors (random influences): total assets; area of operation; capital adequacy ratio; net profit to total assets; fraction of women on the board; net operating cash flows to members' funds; compliance with laws or regulations (measured

by Likert scale); market power; age of Sacco; adoption of technology and credit risk that is measured by the defaulted loans ratio.

The use of net profit to total assets as one of the variable yet Saccos are not profit oriented is supported by the fact that some FOSA have a propensity to paying huge amount of dividends outside the regulator's limit (SASRA,2013). The desire for such huge cash dividends has indeterminate impact on efficiency since when looked at on either side; it motivates the owners and at the same time may deny them the key society intermediation objective of giving loans as and when demanded by them.

3.3 Population

This research utilized a census technique. The target being collection of focused secondary data from the 46 Saccos as indicated in annex 2.2 which were under the regulator's control within the period of study. The Saccos' isolation for purpose of quality outcome check was ignored because of the regulator control reason.

Essentially, the Saccos covered for purpose of analysis, are grouped into three basic categories: small size, medium size, and large size based on total assets or SASRA grouping criteria. The Saccos with total assets value of over Kshs.1billion per annum are grouped as large, ones with total assets value of Kshs.200 million per annum and below Kshs.1 billion are medium size and the others commanding total assets value below Kshs.200 million as a small sized (SASRA, 2011).

3.4 Quality Control

Under the second stage analysis the environmental variables consisting of prime regressors and heteroscedastic or two sided symmetric variables (random influences) as highlighted earlier, were intrinsically tested for correlation and high correlated environmental variables were delimited from the stochastic frontier analysis model. This test ensures validity and reliability of results. The number of inputs and outputs were also tested for compliance with conditions of DMUs strategic decision criteria (Fitzsimmons and Fitzsimmons, 2006).

3.5 Data Collection

The census data was purposively collected from the secondary source utilizing the gathering form shown under annex 3.2. This included financial statements of Saccos and data from World Bank websites. Both qualitative and quantitative data was gathered from the documents for the purpose of this research.

The secondary data was collected and analyzed from the reports and financial statements of the licensed deposit taking Saccos and macro-economic indicator data sources, during the research period of over the two eras totaling to eight years. This study data collection took an estimated period of three (3) months, using three research assistants with a background in business studies and/or a first degree. They worked under the close supervision of the researcher and the monetary cost of this study is estimated at Kenya shillings one hundred and fifty-seven thousand.

3.6 Data Analysis

The data was analyzed using the results of DEA - Stata14.1 and Stata14.1 SFA. SFA such as Limdep is powerful when it comes to panel data analysis (Myoung, 2009). It has also the ability

to separate the random error, environmental factors and management inefficiency. SFA is also used to estimate output slack regression equations (Cooper *et al.*, 2007b).

DEA was used to estimate the technical inefficiencies utilizing original logged data from which the summarized data shown in table 3.1 was derived. The 368 observations per each dependent variable were stochastically regressed against all independent variables with and without control effect. Globally table 3.1 reflect the following predictor variables; that is, working capital, total assets and financial investments having the highest logged values of 23.09, 20.54 and 16.48 respectively while on the dependent variables side logged total revenue slack was the smallest at 0.12 and dividend slack the highest at an average of 4.3. The analysis indicates the importance of these variables in determination of inefficiency as can be seen in the final regression results. Further, the overall average was calculated for two sets of periods that is, non-deposit taking Saccos (2007-2010) and deposit taking Saccos (2011- 2014) for purpose of hypothesis testing for a two-sample paired mean inefficiencies difference using Stata 14.1.

DEA method was specifically used since it allows usage of multiple inputs and outputs. It is also widely used method in inefficiency and efficiency studies (Sanchez *et al.*, 2013).

The correlation between variables was tested using spearman correlation coefficient. Correlation coefficient of 0.8 and above reflects presence of multicollinearity. However, the normality test due to size of the sample was also carried out using the Shapiro-Wilk normality test instead of Jarque-Bera test (JB) employed in related local context past study in Kenya (Okoth and Kusa, 2013). Multicollinearity test using variance inflation factor was also employed as post estimation procedure while Breusch-Pagan/Cook-Weisberg method was utilized in another testing of heteroscedasticity or normality test (Stata, 2015).

Table 3.1 Logged Annual & Overall Average Predictor Variables and Dependent Variables over the Study Period

	2007	2008	2009	2010	2011	2012	2013	2014	Overall Average
Predictor Variables:									
Age	3.06	3.11	3.16	3.21	3.25	3.29	3.33	3.37	3.22
CA	-1.71	-1.70	-1.84	-1.98	-1.86	-1.83	-1.77	-1.61	-1.79
TA	19.99	20.13	20.27	20.49	20.64	20.77	20.93	21.07	20.54
NPTA	-1.51	-1.53	-1.54	-1.50	-1.52	-1.54	-1.49	-1.49	-1.51
AO	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
LP	-12.26	-11.11	-10.58	-8.91	-5.96	-7.20	-5.43	-5.35	-8.35
MP	-5.09	-5.00	-4.89	-4.42	-4.73	-4.64	-4.70	-4.68	-4.77
CLR	0.72	0.72	0.72	0.73	0.77	0.75	0.77	0.00	0.65
Atech	9.04	10.80	10.14	11.90	13.57	11.78	13.40	13.78	11.80
W	-1.75	-1.79	-1.80	-1.80	-1.74	-1.70	-1.71	-1.71	-1.75
NCFMA	1.67	1.59	1.67	1.67	1.62	1.70	1.67	1.64	1.65
MS	8.78	8.91	8.99	9.23	9.29	9.54	9.70	9.73	9.27
CPI	-2.32	-1.34	-2.39	-3.22	-1.97	-2.36	-2.86	-2.67	-2.39
GDP	1.93	-1.61	1.19	2.13	1.81	1.53	1.74	1.67	1.30
GOKLB	1.59	1.37	1.09	1.06	1.16	0.82	0.46	-2.81	0.59
INSP	2.10	2.16	2.18	2.28	2.24	2.10	2.16	2.10	2.17
FLIB	-2.12	-1.08	-1.17	-1.08	-1.02	-1.05	-1.02	-0.99	-1.19
WC	23.06	23.05	22.98	23.11	23.12	23.13	23.13	23.14	23.09
BOND	1.11	1.15	1.11	1.22	1.28	1.20	1.38	1.39	1.23

FI	15.38	16.02	16.19	16.74	16.49	16.68	17.07	17.26	16.48
Dependent Variables:									
Slack TR	0.14	0.11	0.04	0.11	0.09	0.00	0.25	0.22	0.12
Slack LM	0.39	0.43	0.24	0.24	0.19	0.26	0.23	0.14	0.27
Slack NOCF	0.85	0.04	0.08	0.07	0.51	0.05	0.19	0.37	0.27
Slack DIV	4.13	4.78	4.29	4.12	5.22	3.42	4.02	4.42	4.30

Source: Research, (2015) Note: logged and transformed data.

3.7 Limitations

There was a risk of Saccos failure to comply with the International Financial Reporting Standards and therefore susceptible to omission of necessary financial and non-financial data in the annual reports. Another difficulty experienced was the lengthy calculation involving the use of SFA model. Also assumption of data accessed being free of any error was an expected limiting factor. Normally SFA may also not explain the behavior of inefficient Saccos while DEA assumes data being free of measurement errors which effectively may be impractical in the real world (Avkiran, 1999).

The Saccos in Kenya have in the recent past been directed by the regulator to embrace the International Financial Reporting Standards and therefore despite the shortcomings mentioned above, the regulator is known to accept the registration of audited financial statement that only comply with the law and directives. The utilization of quantitative data from the audited financial reports was therefore a credit to this study. The vigilance of periodical regulators inspections cannot be denied. Furthermore, the actual operationalization of final stage SFA and DEA requires high cost of calculation time (Fried *et al.*, 2002). Other specific limitations have been explained.

3.8 Ethical Considerations

The data collection from the regulator was through an official request and website search from the official regulators' domains. The regulators were officially informed in advance about the purpose of this academic research including the National Commission for Science, Technology and Innovation. The Saccos identified as being unable to meet criteria either due to poor book-keeping or earnings management possibility or otherwise were kept confidential.

3.9 Operationalization of the Study Variables

The study measurements used to operationalize the study specific variables are as indicated in table 3.2.

Table 3.2 Study Variables

Variable	Measurement
Capital adequacy	Core capital to total assets
Total assets	Natural log of total assets
NPTA	Net profit to total assets
Area of operation	Dummies 1-City ; 0 -Urban
Loan quality	Loans provision
Market power	Sacco deposit to total FOSA deposits
Age	Number of years in operation
CLR	Compliance with regulations(average scores)
Atech	Computerization expenditures
W	Number(fraction) of women on the board
NCFM	Net operating cash flows to members funds
MS	Number of members
WC	Current assets less current liabilities
Bond	Size of contributing common bond employers
FI	Financial investments total amount
2-Periods	Yrs.2007-2010 and Yrs. 2011-2014

Source: Research, (2015)

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.0 Introduction

This chapter presents the empirical findings of the study and their interpretation. This involves census characteristics, trend analysis, output description, descriptive statistics, discussion of the results, and hypotheses test.

4.1 Census Characteristics

This study is based on panel data obtained from published financial statements of Saccos in Kenya for eight years from 2007 to 2014. The unit of analysis targeted a census of 46 Saccos licensed by SASRA and that qualified to initially run FOSA. The resulting study observations totaled to 368. Each year had 46 observations alongside all available 20 predictor variables denoting that the panel data was actually balanced.

4.2 Trend Analysis

4.21 Saccos Inefficiency

The trend analysis is discussed in this section of inefficiency of Saccos in Kenya starting 2007 to 2014. Table 4.1, figures 4.1a and 4.1b illustrate the trend of Saccos' inefficiency for two pre regulation period running from 2007 to 2010 and regulation period running from 2011 to 2014 as

expressed by output slacks that is: loan to members(LM), total revenue(TR), net operating cash flows(NOCF) and dividend(DIV) derived by DEA

Table 4.1 Saccos Moving Mean Inefficiency Trend

Saccos Moving Mean Inefficiency Trend								
DV*	**TR(070010)**	**LM (070-010)**	**NOCF (07-10)**	**DIV (07-010)**	**TR (011- 014)**	**M (011-014)**	**CF (011-014)**	**DIV(011-014)**
Mean	0.0531	0.2204	0.1241	3.8699	0.0504	0.151	0.1072	3.989
Std. Dev.	0.1112	0.3107	0.5489	4.6816	0.1862	0.2134	0.3251	4.863

Source: Research, (2015) Note: DV*=Dependent Variables & Years in Parenthesis.

The inefficiency of Saccos over the two periods indicates a fluctuating trend. In the pre- regulation period the inefficiency moving mean was 0.0531, 0.220, 0.124 and 3.870 as expressed by LR, LM, NOCF and DIV respectively. During the regulation period the mean figures as shown above decreased to 0.0504, 0.151, 0.107 and 3.99 (an increase) respectively. On the contrary the standard deviations fluctuated from 0.111, 0.311, 0.549, and 4.62; to 0.186, 0.213, 0.325 and 4.86, as expressed by LR, LM, NOCF and DIV during the two periods respectively. The high size spread among the Saccos is reflected in higher standard deviation of variables than respective means. The increase in productivity is jointly followed by increased efficiency (Arrow, 2003). However, Arrow theory of learning by doing is inconsistent with a general trend in mean and standard deviation inefficiency fluctuation over the two periods. This signifies a possibility of diseconomies of scale and behavior of Saccos' directors ingratiating themselves in power through unreasonable high dividend payouts. An increase in div standard deviation slack by 3.8% compared to mean slack increase of 3.1%

over the two periods confirms this position. Higher decline in net cash flow from operating activities mean (13.7%) compared to total revenue mean decline (5.1%) over the two periods holding other factors constant, is also a good symptom of inefficiency (Brown 2006). However, the resultant large decrease in NOCF standard deviation slack of 41% over the two periods may be as a result of regulation period oversight activities' influence. Dividend slacks in figure 4.1b rank on top in determining the inefficient Saccos such as Kakamega Teachers, Kite, Nyamira Tea, Nacico and Wakenya during period 2011-2014.

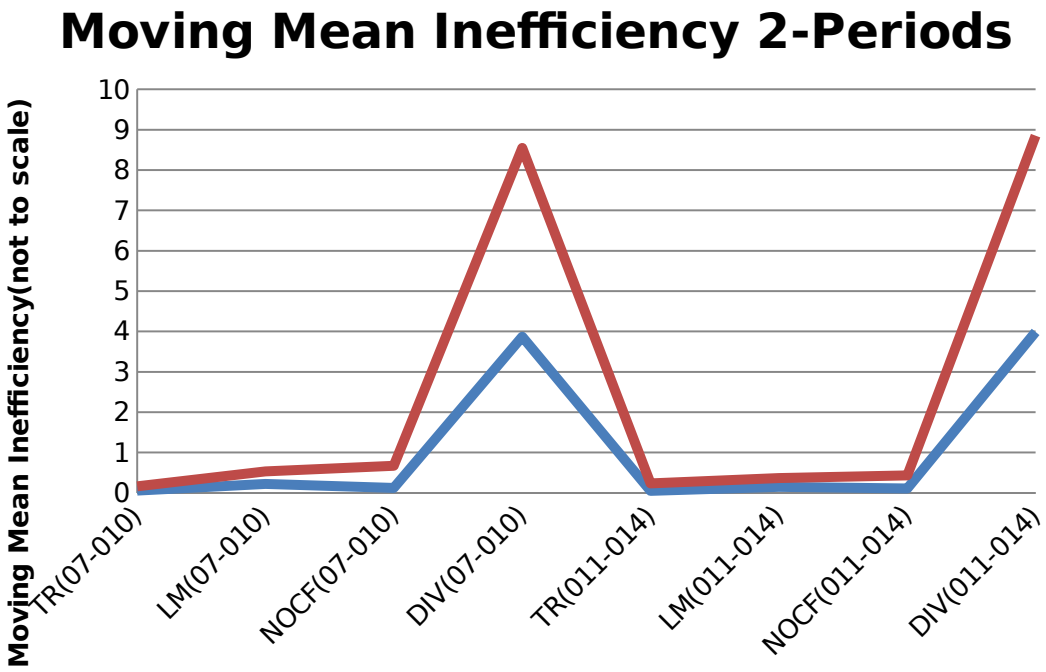


Figure 4.1a Moving Mean Inefficiency 2 Periods
Source: Research, (2015)

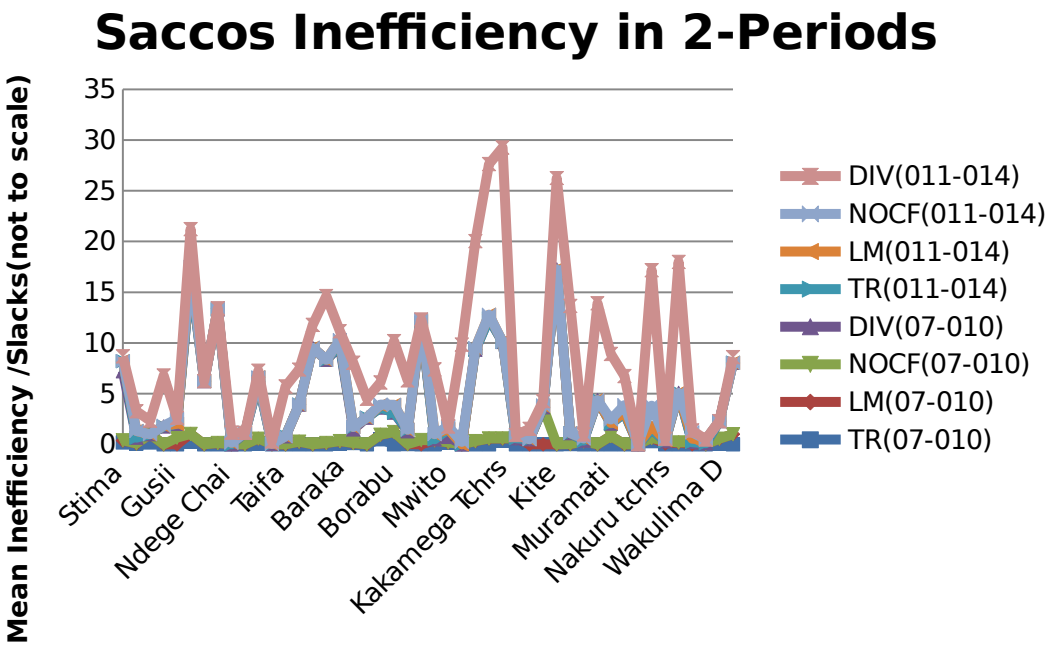


Figure 4.1b Saccos Inefficiency in 2- periods
Source: Research, (2015)

4.22 DEA Result

The study examined the inefficiency and efficiency census of 46 Saccos using a non-parametric variable return to scale (VRS) - BCC or pure technical efficiency model. The model utilized was output oriented whereby the output included: total revenue, loans to members, net operating cash flows, and divided plus interest on members deposits while inputs were: operating costs, total borrowings and owners' equity plus members deposits. The panel data model utilized using Stata DEA software was derived from 368 observations while technical efficiency was measured on scale of 0 up to a maximum of 1. The result of strong or super-efficient DMUs is as shown in table 4.1a. This table also indicates that a total of 24 Sacco years were strongly efficient and exhibited zero slacks across all output variables. Large Saccos had the highest percentage of technical efficiency (TE) followed by small Saccos. The Sacco that exhibited the highest frequency of technical efficiency occurrence over the period is Gusii (2009, 2010, 2012 & 2014)

followed by UN (2007, 2011, & 2012); Taifa (2010, 2012 & 2014); and Mwalimu National (2008, 2010 & 2011) all being large in size. This was attributed to net operating cash flows reported for the corresponding years. Return to scale exhibited by majority of Saccos regardless of size is constant with room to increase their volume of service through replication either by Saccos allowing in more capital or membership through increasing the bond size.

Table 4.1a Strong Efficient Saccos

Strong Efficient Saccos Yrs 2007-2014						
DMU	Year	Size	Rank	Theta (VRS TE)	Return to Scale(RTS)	Slacks
UN	2007	large	1	1	constant	0
Fariji	2007	large	1	1	constant	0
Dom	2007	small	1	1	constant	0
South Imenti	2007	medium	1	1	constant	0
Comoco	2008	medium	1	1	constant	0

Dom	2008	small	1	1	constant	0
Nandi_Hek	2008	small	1	1	constant	0
Mwalimu_Ntl	2008	large	1	1	constant	0
Gusii	2009	large	1	1	constant	0
Gusii	2010	large	1	1	constant	0
Taifa	2010	large	1	1	constant	0
Kericho_Tea	2010	medium	1	1	constant	0
Mwalimu_Ntl	2010	large	1	1	decreasing	0
Wakulima_D	2010	small	1	1	constant	0
UN	2011	large	1	1	constant	0
Mwalimu_Ntl	2011	large	1	1	decreasing	0
UN	2012	large	1	1	constant	0
Gusii	2012	large	1	1	constant	0
Taifa	2012	large	1	1	decreasing	0
Muhigia	2013	large	1	1	constant	0
Wakulima_D	2013	small	1	1	constant	0
Gusii	2014	large	1	1	constant	0
Taifa	2014	large	1	1	constant	0
Nakuru_Tchrs	2014	large	1	1	constant	0

	Size	**% of Strong Eff.**
	Large	66.70%
	Medium	12.50%
	Small	20.80%

Source: Research, (2015)

4.3 Output Description

Table 4.2 presents the mean output as expressed in TR, LM, NOCF, and DIV in Kshs. Million summed and averaged for years 2007 to 2014.

Table 4.2 Eight Years Mean Outputs of Saccos in Kenya

Eight Years Mean Outputs of Saccos in Kenya				
	TR	LM	NOCF	DIV
Mean score	427	2234	1038	148

Standard Deviation	1114	6720	1380	596
Mean as a % of Industry Sum	0.18	0.18	0.18	0.18
Observations	368	368	368	368

Source: Research, (2015)

As reflected in the table 4.2 the mean LR, LM, NOCF, DIV for the Saccos sub-sector (FOSA) was 427, 2234, 1038, and 148 respectively. The overall mean score as a percentage of the Saccos sub- sector sum was 0.18% across all respective outputs. The numbers also indicate the main activity of Saccos is in issuing loans to members.

4.4 Descriptive Statistics

The descriptive statistics in table 4.3 presents specific variables that determine the inefficiency of Saccos in Kenya.

Table 4.3 Descriptive Statistics of Predictor Variables

Descriptive Statistics of Predictor Variables									
Variables	**CA**	**Bond**	**NPTA**	**MP**	**W**	**MS**	**LP**	**GOKLB**	**Age-Yrs.**
Mean	0.21	5.33	0.22	0.02	0.20	21245	0.03	2.72	27.07
Standard Deviation	0.15	10.78	0.02	0.04	0.12	36063	0.09	1.37	9.30
Observations	368	368	368	368	368	368	368	368	368

Source: Research, (2015)

As reflected in the table 4.3, the mean capital adequacy of Saccos in Kenya was 21%. The percentage is above 10% set by SASRA (SSR, 2010). This indicates that Saccos in Kenya running FOSA hold more capital than required. This was an indication that Saccos running FOSA in Kenya were risk averse and in return earn less profit. On the contrary the ratio of net profit to total assets is high at 22%, an indication of mixed result pointing to the direction of inefficiency (Brown, 2006). The market power of 2% is far below 70% standard market share that indicates a few firms being in control of an industry (Ogebe *et al.*, 2013). This imply that Saccos in Kenya have not expanded to an extent that they can form barriers to entry thus resulting to competition that eat into their profits and effectively affecting their efficiency. Therefore, pointing to the direction of capital structure of Saccos in Kenya being irrelevant in determination of their inefficiency.

The table also reflect mean defaulted loans ratio being 3% which is below 4% according to census research on Saccos in Meru County Kenya (Olando *et al.*, 2012). This is an indication that the regulator role has played an impact in reducing the default risks to lower percentage and may point to the direction that in this sub-sector, loan guarantors carry next to 97% burden in case of any default thus lowering LP effect on inefficiency given loan slack.

According to Brown and O'Connor, (1999) higher default rate lowers the relative efficiency of a money market. On the other hand the percentage of women on the boards of Saccos is at 20% with standard deviation of 12%. This is a low number and point to the direction of moderate influence on Saccos' inefficiency (Higgs, 2003). The average age of Saccos is shown as 27 years with a standard deviation of 9 years, a reflection of a young industry. Mirie, (2014) posit that age and size are correlated in the same direction and that a rise in age of a small firm has a positive relation with efficiency.

4.5 Model Testing

The study test carried out to ensure that the data fits the linear regression assumptions include:

***Normality Test*:** The study tested for normality using Shapiro-Francia W test as the observations were less than 5000 and greater than 10 under log normality condition. The result obtained is as shown in table 4.4. It indicates that only two variables reflected p-values greater than 0.05 thus a possibility of heteroscedasticity. However a truncated normal distribution is truncated at value zero with mean (μ) and variance (δ^2), that is, N^+ (μ, δ^2). Further, frontier can also fit a conditional mean model that is linear (Stata, 2015). The data used also underwent natural logarithm transformation before frontier operation therefore reducing the effect of heteroscedasticity.

Table 4.4a Testing Study Variables for Normality

		Shapiro-Francia	W test for normal data		
Variable	Obs	W'	V'	z	Prob. > z
age	368	0.89443	29.112	7.251	0.00001
Ca	368	0.99163	2.307	1.798	0.03608
Ta	368	0.98818	3.259	2.541	0.00553
Npta	368	0.84112	43.814	8.13	0.00001
Ao	368	1	0	-58.997	1
Lp	368	0.74358	70.711	9.16	0.00001
Mp	368	0.93325	18.406	6.265	0.00001
clr	368	0.70719	80.744	9.445	0.00001
Atech	368	0.68281	87.468	9.617	0.00001
W	368	0.98012	5.482	3.66	0.00013
Ncfma	368	0.34704	180.06	11.171	0.00001
Ms	368	0.99448	1.522	0.904	0.1831
Cpi	368	0.95686	11.896	5.326	0.00001
Gdp	368	0.61534	106.072	10.032	0.00001
Goklb	368	0.62312	103.927	9.988	0.00001
Insp	368	0.90277	26.813	7.074	0.00001
Flib	368	0.53518	128.178	10.439	0.00001
Wc	368	0.13271	239.162	11.781	0.00001
Bond	368	0.92325	21.164	6.565	0.00001
Fi	368	0.80534	53.678	8.567	0.00001

Source: Research,(2015)

Key: tr(total revenue);ca(capital adequacy);ta(total assets);npta(net profit to ta);ao(area of operation);lp(loan provision);mp(market power);clr(compliance with laws & regulation);atech(adoption of technology);w(women number on board);ncfma(net operating cash flows to members funds);ms(membership size);cpi(consumer price index);gdp(gross domestic product);goklb(net lending/borrowing as% of gdp);insp(interest spread);flib(financial liberalization);wc(working capital); bond(number of employers);fi(financial liberalization).

Multicollinearity Test: The possibility of strong relationship between predictor variables was checked using the correlation coefficient- Spearman rho as shown in the annex 3.1. The result indicates a few scores of higher than or equal to 0.8, thus reflecting lack of serious multicollinearity among variables although with mixed result. Therefore, a second non observational method was utilized in testing for multicollinearity that is, variation inflation factor

and the results for each dependent variable is as indicated in tables 4.4b. The OLS was applied in each regression equation to arrive at respective VIF.

Table 4.4b Regress TR, LM, NOCF & DIV Slack & All Covariates

Predictor Variables	Variation Inflation Factor(VIF)-TR	Variation Inflation Factor(VIF)-LM	Variation Inflation Factor(VIF)-NOCF	Variation Inflation Factor(VIF)-DIV
goklb	46.13	20.08	42.58	20.93
clr	26.38	13.00	25.17	13.76
ta	20.49	8.44	9.97	7.00
mp	17.87	7.70	10.59	7.39
gdp	10.02	3.88	5.79	3.82
cpi	10.01	3.56	6.07	3.75
age	8.73	3.34	5.08	3.64
flib	7.89	4.51	5.38	4.09
ao	7.18	2.43	2.49	2.77
w	5.57	1.51	2.04	1.59
insp	5.44	2.92	3.85	2.66
ms	5.36	2.28	2.64	2.40
ca	4.44	2.76	3.88	2.63
fi	3.64	2.11	4.09	1.95
ncfma	2.47	1.35	1.46	1.14
lp	2.03	1.44	1.79	1.39
bond	1.99	1.18	1.54	1.22
npta	1.91	1.79	1.69	1.53
atech	1.86	1.31	1.63	1.21
wc	1.73	1.22	1.42	1.16
Mean VIF	9.56	4.34	6.96	4.3

Source: Research, (2015)

The total revenue slack result indicates a mean VIF of 9.56 far above a non-problematic average of values ranging from 1 to around 4. Further, the three worst variables, that is, GOKLB, CLR, and TA are each above acceptable level of 10 (Stata, 2015). This result indicates TR slack regressed against all independent variables confirm existence of multicollinearity. However, a reduction of the three variables with higher VIF resulted to lowest mean VIF being 4.23, which is an acceptable post estimation range (Stata, 2015). Further, the VIF means for LM, NOCF and DIV were 4.34, 6.96 and 4.3 respectively, all qualified except for NOCF with a value above 4.

Studies have also indicated that a VIF above 20 is the one that should be categorized as challenging (Greene, 2012). Goklb and clr being above 20 are the only two variables that are challenging, thus ignored, indicating an overall low possibility of multicollinearity.

Random Effects Estimation: The Hausman-Taylor estimator method was used to confirm that none of the covariates of the panel-level models are correlated with unobserved panel-level random effects (U_{rjt}), although some of the covariates may be associated with the unobserved individual-level random effect. The result of the estimation summary taking NOCF as an example is as indicated in table 4.4c. The result indicates that the unobserved random effect $\delta\mu = 2.5589$ greater than $\delta_{error} = .63966$, suggesting that large portion total error variance is as a result of $U_{rjt,}$ idiosyncratic (observed) error. Similar result is identified for other independent variable slacks equations. Therefore, the fixed effects model and random effects model in the panel data are different. Meaning the ordinary least squares (OLS) would give inconsistent result (Stata, 2015). In derivation of Hausmann Taylor estimation, the time invariant exogenous variable picked is area of operation while time varying exogenous were all environmental factors and bond leaving all other independent variables as time varying endogenous variables.

Table 4.4c : Hausmann Taylor Estimation Slacks and Covariates

Summary of Items	Result-NOCF Slack	Result-LM Slack	Result-DIV Slack	Result-TR Slack
Number of observations	88	191	290	54
Number of groups	36	44	46	23
Random effect	Urjt ~ iid	Urjt ~ iid	Urjt ~ iid	Urjt ~ iid
Wald chi sq.(20)	38.34	32.55	23.68	43.40

Prob.> chi sq	0.0081	0.0378	0.2568	0.0018
Sigma Urjt	2.5589	0.4957	6.9852	0.9562
Sigma error(Vrjt)	0.63966	0.3395	5.2966	0.0932
Rho*	0.9419	0.6807	0.6349	0.9906

Source: Research, (2015) Note*: fraction of value due to Urjt

4.6 Predictor Variables Correlation Coefficient

The results of the correlation in annex 3.1 indicate that the working capital or insolvency measure had weak negative relationship with total revenue slack. This relationship points toward negative direction, except for it being insignificant instead of strong as in a prior study (Cooper *et al.*, 2007a). In the same prior study land and stock price indexes had positive relationship with total loan revenue while in this study the consumer price index reflects a negative relationship. Another key finding is that the number of women on the board is negatively related to the loan to members and dividend slacks. This correlation is in compliance to a prior study which postulate that higher number of women on the board increases firms' performance depending on the type of industry (Adams and Ferreira, 2009).

Capital adequacy is also negatively correlated to all dependent variables in line with the expectation of the agency and efficiency theories (Famma, 1980; Magali and Pastory, 2013). The correlation also indicates that there is a moderate negative relationship between natural logarithm of total assets (size measure) and the four output slacks or inefficiency that ranged between r = -0.4108 and r = -0.5477 at 95% level of confidence. This finding ties well with prior study which found out an existence of positive relationship between the size of Saccos and efficiency (Mirie, 2014).

4.7 Regression (SFA) results

The frontier regression analyses result in tables: 4.5a-4.5g indicates the relationship between the Saccos' specific predictor variables and inefficiency dependent variables.

4.71 Total Revenue Output Slack to Predictor Variables: With Control Variables

H_{01}: The Saccos operation is not influenced by management inefficiency effects as measured over the two eras.

H_{02}: There is no strong relationship between the Saccos' macro-economic variables and the total revenue output slack inefficiency.

H_{03}: There is no strong relationship between the Saccos' specific independent variables and the total revenue output slack inefficiency.

As presented in table 4.5a, the specific and environmental factors jointly affect the inefficiency of Saccos with confidence level of 95% and Wald chi square of 36.34 given p-value of 0.014. The only significant specific variable that is positively related to total revenue slack(tr) is area of operation(op) though not very strong at 5% (p-value 0.053) level of significance. All environmental variables have no significant effect on total revenue slack for instance interest spread (insp) was insignificant at 10% (p-value 0.072). This regression equation utilized 54 observations and it also reflects a significant negative constant result that shows that the other variables left out are not important to this study. Therefore, based on Wald p-value of 0.014 and Gamma of 0.999956 which is next to value one; the hypothesis (H_{01}) that the Saccos operation is not influenced by

management inefficiency effects as measured by Gamma (ϒ) is rejected while the second hypothesis (H_{02}) that there is no strong relationship between the Saccos' macro-economic variables and the inefficiency dependent variable slack (tr) is accepted at the 95% level of confidence. H_{03} hypothesized that there exist no strong relationship between the Saccos' specific independent variables and the total revenue slack is rejected at 95% level of confidence. These positions apply when the control variables are not excluded. A prior research (Cooper *et al.* 2007e) for instance concluded that capital adequacy (ca) had positive insignificant influence on total revenue slack, similar result was arrived at as seen in table 4.5a.

The insignificant specific variables with positive influence included: capital adequacy, total assets, loan provision, market power, adoption of technology, and net cash flow from operation to members' funds while those with negative influence include; age, net profit to total assets, compliance with laws and regulations, women on the board, financial investments and membership size. These two categories of both positive and negative influence exhibited p-values ranging between 0.192 and 0.986. The negative influence for instance, women on the board are in compliance with the practice and prior studies, similarly for positive influence of the capital adequacy (Cooper *et al.* 2007e, Adams and Ferreira, 2009). The control variables were also insignificant with positive influence on total revenue slack.

In addition, insignificant environmental variables that reflected negative influence include gross domestic product and financial liberalization while government net

lending/borrowing and consumer price index indicated a positive influence on the total revenue slack. In practice gross domestic product has negative relationship with revenue inefficiency. On the contrary higher revenue streams in an economy are expected to create inflationary tendencies. This conflicts with the result of this study which indicates that consumer price index has a positive influence on inefficiency of the total revenue.

Table 4.5a Time Varying Inefficiency Model-Regression of Total Revenue Output Slack to Predictor Variables: With Control Variables

Observation=54				**Wald chi^2(20) =**	**36.34**
Log likelihood	53.1836			Prob > chi^2 =	0.014**
Slack tr	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	-0.09643	0.090336	-1.07	0.286	-0.27348	0.080628
ca	0.020402	0.037699	0.54	0.588	-0.05349	0.09429
ta	0.021491	0.028263	0.76	0.447	-0.0339	0.076886
npta	-0.26236	0.262064	-1	0.317	-0.77599	0.251278
ao	0.167405	0.086679	1.93	0.053**	-0.00248	0.337292
lp	0.000034	0.00191	0.02	0.986	-0.00371	0.003778
mp	0.013804	0.02036	0.68	0.498	-0.0261	0.05371
clr	-0.01868	0.24148	-0.08	0.938	-0.49197	0.454609
atech	0.00281	0.002263	1.24	0.214	-0.00162	0.007245
w	-0.08923	0.06838	-1.3	0.192	-0.22325	0.044795
ncfma	0.034894	0.088621	0.39	0.694	-0.1388	0.208588
ms	-0.02643	0.020443	-1.29	0.196	-0.06649	0.013641
cpi	0.014716	0.044597	0.33	0.741	-0.07269	0.102125
gdp	-0.01532	0.024155	-0.63	0.526	-0.06266	0.032021
goklb	0.005461	0.06479	0.08	0.933	-0.12153	0.132447
insp	0.678677	0.377107	1.8	0.072	-0.06044	1.417793

flib	-0.1093	0.090966	-1.2	0.23	-0.28759	0.068989
wc	0.062727	0.05055	1.24	0.215	-0.03635	0.161802
bond	0.026835	0.025506	1.05	0.293	-0.02316	0.076826
fi	-0.00476	0.005522	-0.86	0.388	-0.01559	0.006061
cons	-3.44586	1.88186	-1.83	0.067	-7.13424	0.242517
/mu	-289.902	.	.	.	.	.
/eta	-0.44029	0.154823	-2.84	0.004	-0.74374	-0.13685
/lnsigma^2	4.107683	0.011205	366.61	0.00	4.085723	4.129643
/ilgtgamma	10.02409	0.258082	38.84	0.00*	9.518262	10.52993
sigma^2	60.80566	0.681295			59.4849	62.15575
gamma	0.999956	1.14E-05			0.999927	0.999973
sigma_u^2	60.80297	0.681299			59.46765	62.13829
sigma_v^2	0.002695	0.000695			0.001333	0.004056

Source: Research, (2015). Significance levels: 1%*, 5%**

Key: tr(total revenue);ca(capital adequacy);ta(total assets);npta(net profit to ta);ao(area of operation);lp(loan provision);mp(market power);clr(compliance with laws & regulation);atech(adoption of technology);w(women number on board);ncfma(net operating cash flows to members funds);ms(membership size);cpi(consumer price index);gdp(gross domestic product);goklb(net lending/borrowing as% of gdp);insp(interest spread);flib(financial liberalization);wc(working capital); bond(number of employers);fi(financial liberalization).

4.72 Total Revenue Output Slack to Predictor Variables: Without Control Variables

H_{01}: The Saccos operation is not influenced by management inefficiency effects as measured over the two eras.

H_{02}: There is no strong relationship between the Saccos' macro-economic variables and the total revenue output slack inefficiency.

H_{03}: There is no strong relationship between the Saccos' specific independent variables and the total revenue output slack inefficiency.

When the control variables of working capital (wc) and bond size (bond) are omitted as indicated in table 4.5b and using also 54 observations, at 95% level of confidence, the Wald chi square of 30 slightly weaken to p-value of 0.0374 although it still remains

significant. Further, all variables become insignificant while Gamma moved from 0.999956 to 0.999951 a minor decrease. Therefore, like the previous position of table 4.5a hypothesis H_{01} is rejected, H_{02} is accepted and H_{03} is also accepted at 95% level of confidence. The result indicates significant influence of control variables since on exclusion of both control variables, all specific variables remained insignificant at 5% unlike in the scenario with control variables. However, the influence of macro-economic factors also remained insignificant at 5% level of significance.

The insignificant influence of all the specific Sacco variables and environmental factors indicates the same result direction except for the magnitude of influence for compliance with law and regulations, and government lending/borrowing variables as discussed above under time varying inefficiency model-regression of total revenue output slack to predictor variables with control variables. The compliance with law and regulations reflected a positive influence to total revenue slack with a p-value of 0.812, while government lending / borrowing indicates a negative influence to total revenue slack with a p-value of 0.891, this is theoretically expected (Coopers *et al.*,2007c).

Further, in practice, the monetary and fiscal policies adopted by any government pertaining to government lending / borrowing influences the circulation of money in an economy thus the working capital size of businesses tend to vary accordingly. That is, a government Treasury or Central Bank contractionary measures would wipe out the excess working capital in hand of businesses while the expansionary measures have the opposite effect (Ndungu, 2012).

The significance of control variables of working capital and bond size in eliminating spurious relationships is therefore observed.

Table 4.5b Time Varying Inefficiency Model-Regression of Total Revenue Output Slack to Predictor Variables: Without Control Variables

Observation=54			**Wald chi^2(18) =**		**30**
Log likelihood	52.3760		Prob > chi^2 =		0.0374**
Slack tr	Coef.	Std. Err. Z	P>|z|	[95% Conf.	Interval]
age	-0.06844	0.082043	-0.83	0.404	-0.22924	0.092361
ca	0.014966	0.037291	0.4	0.688	-0.05812	0.088055
ta	0.0198	0.029815	0.66	0.507	-0.03864	0.078236
npta	-0.27825	0.263897	-1.05	0.292	-0.79548	0.238976
ao	0.124761	0.075204	1.66	0.097	-0.02264	0.272157
lp	0.000223	0.00183	0.12	0.903	-0.00336	0.003809
mp	0.008793	0.021517	0.41	0.683	-0.03338	0.050966
clr	0.049905	0.210202	0.24	0.812	-0.36208	0.461894
atech	0.00334	0.002049	1.63	0.103	-0.00068	0.007357
w	-0.0741	0.061971	-1.2	0.232	-0.19556	0.047359
ncfma	0.012914	0.092653	0.14	0.889	-0.16868	0.19451
ms	-0.029	0.021789	-1.33	0.183	-0.0717	0.013708
cpi	0.004334	0.044891	0.1	0.923	-0.08365	0.092318
gdp	-0.01268	0.023328	-0.54	0.587	-0.0584	0.03304
goklb	-0.00796	0.058311	-0.14	0.891	-0.12225	0.106325
insp	0.442776	0.31982	1.38	0.166	-0.18406	1.069612
flib	-0.07932	0.084539	-0.94	0.348	-0.24502	0.086369
fi	-0.00525	0.005692	-0.92	0.356	-0.01641	0.005906
cons	-1.48545	1.083525	-1.37	0.17	-3.60912	0.638218
/mu	-285.44	.	.	.	.	.
/eta	-0.38258	0.100715	-3.8	0.00	-0.57998	-0.18518
/lnsigma^2	4.072836	0.011184	364.18	0.00	4.050916	4.094755
/ilgtgamma	9.92095	0.257795	38.48	0.00*	9.415681	10.42622
sigma^2	58.72324	0.65673			57.45008	60.02462
gamma	0.999951	1.27E-05			0.999919	0.99997
sigma_u^2	58.72036	0.656735			57.43318	60.00753
sigma_v^2	0.002885	0.000743			0.001429	0.004341

Source: Research, (2015). Significance levels: 1%*, 5%.**

Key:tr(total revenue);ca(capital adequacy);ta(total assets);npta(net profit to ta);ao(area of operation);lp(loan provision);mp(market power);clr(compliance with laws & regulation);atech(adoption of technology);w(women number on board);ncfma(net operating cash flows to members funds);ms(membership size);cpi(consumer price index);gdp(gross domestic product);goklb(net lending/borrowing as% of gdp);insp(interest spread);flib(financial liberalization);wc(working capital); bond(number of employers);fi(financial liberalization).

4.73 Loan to Members Output Slack to Predictor Variables: With Control Variables

H_{01}: The Saccos operation is not influenced by management inefficiency effects as measured over the two eras.

H_{02}: There is no strong relationship between the Saccos' macro-economic variables and the loan to members' output slack inefficiency.

H_{03}: There is no strong relationship between the Saccos' specific independent variables and the loan to members' output slack inefficiency.

The table 4.5c, utilizing 191 observations, indicates that the specific and environmental factors jointly affects the inefficiency of Saccos at a confidence level of 95% with a high Wald chi square given strong p-value of 0.00. All Saccos specific and environmental variables including a constant term are significantly related to loan to members' slack. The constant has a negative coefficient indicating other variables not identified are irrelevant in this regression. Therefore, based on Wald p-value of 0.00 and Gamma that has a value next to zero; the hypothesis (H_{01}) that the Saccos operation is not influenced by management inefficiency effects as measured by Gamma (Υ) is accepted (Pascoe *et al.,* 2003) while the second hypothesis (H_{02}) that there is no strong relationship between

the Saccos' macro-economic variables and the inefficiency dependent variable slack (lm) is rejected, both at the 95% level of confidence.

In addition, H_{03} hypothesized that there exist no strong relationship between the Saccos' specific independent variables and the loan to members slack (lm) is rejected at 95% level of confidence. These positions apply when the control variables are not excluded and thus indicate that random error dominate the management influence given loan to members' slack.

A past study by Cooper *et al.*, (2007d) indicated that real gross domestic product growth index had a strong negative influence on loan to members slack at a 1% level of significance while on the contrary this study indicates a strong positive influence at the same level of significance. Further, this study also indicates a strong positive influence of consumer price index on the loan to members at 1 % level of significance while a similar prior study had a weak positive influence of real stock price index on loan to members' slack Coopers *et al.*, (2007d).

Table 4.5c Time Varying Inefficiency Model-Regression of Loan to Members Output Slack to Predictor Variables: With Control Variables

Observation=191				**Wald chi ^{2}(20) =**		**5.11E+12**
Log likelihood	= 0.00			Prob > chi^2 =		0.00*
Slack lm	Coef.	Std. Err.	Z	P>|z|	[95% Conf.	Interval]
age	0.566076	1.37E-05	4.10E+04	0.00*	0.56605	0.566103
ca	-1.15047	-7.69E-06	1.50E+05	0.00*	-1.15049	-1.15046
ta	2.9168	6.68E-06	4.40E+05	0.00*	2.916787	2.916814

npta	-1.70365	-3.5E-05	4.90E+04	0.00*	-1.70372	-1.70358
ao	2.206069	1.25E-05	1.80E+05	0.00*	2.206045	2.206094
lp	0.059441	5.77E-07	1.00E+05	0.00*	0.059439	0.059442
mp	-2.88829	-5.50E-06	5.30E+05	0.00*	-2.8883	-2.88828
clr	19.89049	4.86E-05	4.10E+05	0.00*	19.89039	19.89058
atech	-0.17411	-5.99E-07	2.90E+05	0.00*	-0.17411	-0.1741
w	-1.43531	-7.52E-06	1.90E+05	0.00*	-1.43533	-1.4353
ncfma	-0.35861	-8.34E-06	4.30E+04	0.00*	-0.35863	-0.3586
ms	0.480176	4.13E-06	1.20E+05	0.00*	0.480168	0.480184
cpi	8.609705	1.15E-05	7.50E+05	0.00*	8.609682	8.609727
gdp	6.622955	5.70E-06	1.20E+06	0.00*	6.622944	6.622966
goklb	-2.89924	-1.2E-05	2.40E+05	0.00*	-2.89927	-2.89922
insp	-9.61248	-8.6E-05	1.10E+05	0.00*	-9.61265	-9.61231
flib	-9.38322	-1.9E-05	4.90E+05	0.00*	-9.38326	-9.38319
wc	-3.00933	-2.5E-05	1.20E+05	0.00*	-3.00938	-3.00929
Bond	0.320063	6.11E-06	5.20E+04	0.00*	0.320051	0.320075
fi	-0.52616	-2.04E-06	2.60E+05	0.00*	-0.52617	-0.52616
cons	-0.16071	0.000653	-246.12	0.00*	-0.16199	-0.15943
/mu	188.2629	.	.	.	.	.
/eta	-28.2461	.	.	.	.	.
/lnsigma^2	-70.0914	.	.	.	.	.
/ilgtgamma	-73.3107	-4.55E-16	1.60E+17	0.00*	-73.3107	-73.3107
sigma^2	3.63E-31	.			.	.
gamma	1.45E-32	6.60E-48			1.45E-32	1.45E-32
sigma_u^2	5.26E-63	.			.	.
sigma_v^2	3.63E-31	.			.	.

Source: Research,(2015). Significance levels: 1%*, 5%.**

Key: tr(total revenue);ca(capital adequacy);ta(total assets);npta(net profit to ta);ao(area of operation);lp(loan provision);mp(market power);clr(compliance with laws & regulation);atech(adoption of technology);w(women number on board);ncfma(net operating cash flows to members funds);ms(membership size);cpi(consumer price index);gdp(gross domestic product);goklb(net lending/borrowing as% of gdp);insp(interest spread);flib(financial liberalization);wc(working capital); bond(number of employers);fi(financial liberalization).

4.74 Loan to Members Output Slack to Predictor Variables: Without Control Variables

H_{01}: The Saccos operation is not influenced by management inefficiency effects as measured over the two eras.

H_{02}: There is no strong relationship between the Saccos' macro-economic variables and the loan to members' output slack inefficiency.

H_{03}: There is no strong relationship between the Saccos' specific independent variables and the loan to members' output slack inefficiency.

When the control variables are omitted as indicated in table 4.5d having used also 191 observations, at 95% level of confidence, the high Wald chi square remains strong at p-value of 0.00. Further, all other variables remain strongly significant while Gamma move very slightly away from zero compared to a situation with control variables. Therefore, similar to previous position of table 4.5c hypothesis H_{01} is accepted, H_{02} is rejected while H_{03} is rejected all at 95% level of confidence. The result indicates insignificant influence of control variables whereby all variables retained previous direction of influence as in the case under table 4.5c except for the magnitude of coefficients. Gamma's movement away towards zero signifies lack of management inefficiency.

Tables 4.5c and 4.5d reflect log likelihood of 0.00 and their variances (u^2) are both approaching zero thus these two results prohibit need to conduct likelihood ratio test. The mean of truncated-normal distribution (m_u) values are 188.26 and 172.98 respectively,

which are far from zero, thus a reflection of inability of this study data to reduce to OLS regression (Stata, 2015).

Further, as theoretically predicted, the direction of influence of all specific and environmental variables on loan to members' output slack are significant and remained constant with or without control variables except for the respective magnitudes (Famma,1980; Magali and Pastory, 2013). For instance age, market power, and consumer price index indicate coefficients of + 0.566076,-2.88829, and +8.609705 with control variables; and +0.294119, -1.30008, and +6.663619 without control variables respectively. This result also indicates that the influence of control variables on loan to members' slack variable is ineffective.

Table 4.5d Time Varying Inefficiency Model-Regression of Loan to Members Output Slack to Predictor Variables: Without Control Variables

Observations=191				**Wald chi**	**^{2}(18) = 1.86E+12**
Log likelihood	= 0.00			Prob >	chi^2 = 0.00*
Slack lm	Coef.	Std. Err.	Z	P>|z|	[95% Conf. Interval]
age	0.294119	1.36E-05	2.20E+04	0.00*	0.294093 0.294146
ca	-0.41328	-7.53E-06	5.50E+04	0.00*	-0.41329 -0.41326
ta	1.397558	6.54E-06	2.10E+05	0.00*	1.397546 1.397571
npta	-0.17827	-3.5E-05	5147.31	0.00*	-0.17834 -0.1782
ao	1.251176	1.22E-05	1.00E+05	0.00*	1.251152 1.2512
lp	0.016449	5.73E-07	2.90E+04	0.00*	0.016448 0.01645
mp	-1.30008	-5.37E-06	2.40E+05	0.00*	-1.30009 -1.30007
clr	11.02883	4.82E-05	2.30E+05	0.00*	11.02874 11.02893
atech	-0.14259	-5.94E-07	2.40E+05	0.00*	-0.14259 -0.14259
w	-0.6875	-7.48E-06	9.20E+04	0.00*	-0.68752 -0.68749
ncfma	-0.32266	-8.25E-06	3.90E+04	0.00*	-0.32267 -0.32264
ms	0.303791	4.08E-06	7.40E+04	0.00*	0.303783 0.303799
cpi	6.663619	1.14E-05	5.80E+05	0.00*	6.663597 6.663641

gdp	4.692527	5.59E-06	8.40E+05	0.00*	4.692516	4.692538
goklb	-1.36543	-1.2E-05	1.20E+05	0.00*	-1.36546	-1.36541
insp	-7.59749	-8.5E-05	8.90E+04	0.00*	-7.59766	-7.59732
flib	-3.31852	-1.9E-05	1.80E+05	0.00*	-3.31855	-3.31848
fi	-0.46017	-2.04E-06	2.30E+05	0.00*	-0.46018	-0.46017
cons	-17.2248	-0.00029	5.90E+04	0.00*	-17.2254	-17.2242
/mu	172.9606	.	.	.	.	.
/eta	-21.8471	.	.	.	.	.
/lnsigma^2	-68.8364	.	.	.	.	.
/ilgtgamma	-71.5471	-6.24E-16	1.10E+17	0.00*	-71.5471	-71.5471
sigma^2	1.27E-30	.			.	.
gamma	8.46E-32	5.28E-47			8.46E-32	8.46E-32
sigma_u^2	1.08E-61	.			.	.
sigma_v^2	1.27E-30	.			.	.

Source: Research,(2015). Significance levels: 1%*, 5%. Key: tr(total revenue);ca(capital adequacy);ta(total assets);npta(net profit to ta);ao(area of operation);lp(loan provision);mp(market power);clr(compliance with laws & regulation);atech(adoption of technology);w(women number on board);ncfma(net operating cash flows to members funds);ms(membership size);cpi(consumer price index);gdp(gross domestic product);goklb(net lending/borrowing as% of gdp);insp(interest spread);flib(financial liberalization);wc(working capital); bond(number of employers);fi(financial liberalization).**

4.75 Net Operating Cash Flows Output Slack to Predictor Variables: With Control Variables

H_{01}: The Saccos operation is not influenced by management inefficiency effects as measured over the two eras.

H_{02}: There is no strong relationship between the Saccos' macro-economic variables and the net operating cash flows output slack inefficiency.

H_{03}: There is no strong relationship between the Saccos' specific independent variables and the net operating cash flows output slack inefficiency.

As presented in table 4.5e, that used 88 observations, the specific and environmental factors jointly affect the inefficiency of Saccos with confidence level of 95% and Wald chi square of 47.78 given p-value of 0.0005. The significant Saccos specific variables that are positively related

to net operating cash flows output slack are capital adequacy (ca) with 95% level of confidence, financial investment (fi) with 95% level of confidence, and net profit to total assets (npta) with 95% level of confidence, at p-values of 0.028, 0.044, and 0.001 respectively. On the other had the Saccos specific variables that are significant and negatively related to net cash flow from operating activities (nocf) output slack is net profit to total assets at p-value of 0.001. Therefore, based on strong Wald p-value of 0.0005 and Gamma that is next to value zero, the hypothesis (H_{01}) that the Saccos operation is not influenced by management inefficiency effects as measured by Gamma (Υ) is accepted. All environmental variables have no significant influence on nocf slack, thus the second hypothesis (H_{02}) that there is no strong relationship between the Saccos' macro-economic variables and the inefficiency dependent variable slack nocf is accepted at 95% level of confidence. Further, H_{03} hypothesized that there exists no strong relationship between the Saccos' specific independent variables and the nocf slack is rejected. These positions apply when the control variables are not excluded. Further, the constant variable has a significant negative relationship indicating insignificance of other variables not considered in this study.

The joint significance of all independent variables in determining inefficiency as indicated by Wald chi-square p-value of 0.0005 confirms nocf as a significant tool of measuring misstated financial statements (Schilit, 2002). All specific and environmental variables, except for capital adequacy, net profit to total assets and financial investment, are insignificant and in line with theoretical predictions (Magali and Pastory, 2013; Famma, 2008; Coopers *et al.*, 2007c).

Note: Time Varying Inefficiency Model-Regression of Net Operating Cash Flows Output Slack to Predictor Variables: Without Control Variables at significance levels 5% and 1%. All iterations were rejected, pointing to the direction of lacking convergence of variables

or inconclusive results. This confirms the significance of control variables given the net operating cash flows output dependent variable slack.

Table 4.5e Time Varying Inefficiency Model-Regression of Net Operating Cash Flows Output Slack to Predictor Variables: With Control Variables

Observations =88				**Wald chi**	**^{2}(20) =**	**47.78**
Log likelihood	=0.00			Prob >	chi^{2} =	0.0005*
Slack nocf	Coef.	Std. Err.	Z	P>|z|	[95% Conf.	Interval]
age	0.157067	0.433208	0.36	0.717	-0.692	1.00614
ca	0.407726	0.185043	2.2	0.028**	0.045049	0.770403
ta	-0.03452	0.151889	-0.23	0.82	-0.33221	0.263181
npta	-2.85672	0.893375	-3.2	0.001*	-4.6077	-1.10573
ao	0.168374	0.301135	0.56	0.576	-0.42184	0.758589
lp	-0.02537	0.013373	-1.9	0.058	-0.05158	0.00084
mp	-0.02307	0.131165	-0.18	0.86	-0.28014	0.234012
clr	1.138453	1.380186	0.82	0.409	-1.56666	3.843569
atech	0.015717	0.012384	1.27	0.204	-0.00856	0.039988
w	-0.23711	0.191488	-1.24	0.216	-0.61242	0.138194
ncfma	-0.23542	0.146404	-1.61	0.108	-0.52237	0.051525
ms	-0.08677	0.107158	-0.81	0.418	-0.2968	0.123253
cpi	0.349355	0.297242	1.18	0.24	-0.23323	0.931938
gdp	0.169315	0.139593	1.21	0.225	-0.10428	0.442912
goklb	-0.39739	0.357685	-1.11	0.267	-1.09844	0.303663
insp	2.304661	2.155104	1.07	0.285	-1.91927	6.528587
flib	-0.78406	0.495805	-1.58	0.114	-1.75582	0.187702
wc	-0.04933	0.385944	-0.13	0.898	-0.80577	0.707104
bond	0.011092	0.116058	0.1	0.924	-0.21638	0.238562
fi	0.151101	0.07507	2.01	0.044**	0.003967	0.298235
cons	-27.8296	11.68292	-2.38	0.017**	-50.7277	-4.93146
/mu	17.60023	.	.	.	.	.

/eta	0.005481	0.00319	1.72	0.086	-0.00077	0.011733
/lnsigma^2	-0.88651	0.00544	-162.98	0	-0.89717	-0.87584
/ilgtgamma	-52.8397	.	.	.	.	.
sigma^2	0.412093	0.002242			0.407723	0.41651
gamma	1.13E-23	.			.	.
sigma_u^2	4.65E-24	.			.	.
sigma_v^2	0.412093	.			.	.

Source: Research,(2015). Significance levels: 1%*, 5%. Key: tr(total revenue);ca(capital adequacy);ta(total assets);npta(net profit to ta);ao(area of operation);lp(loan provision);mp(market power);clr(compliance with laws & regulation);atech(adoption of technology);w(women number on board);ncfma(net operating cash flows to members funds);ms(membership size);cpi(consumer price index);gdp(gross domestic product);goklb(net lending/borrowing as% of gdp);insp(interest spread);flib(financial liberalization);wc(working capital); bond(number of employers);fi(financial liberalization).**

4.76 Dividend Output Slack to Predictor Variables: With Control Variables

H_{01}: The Saccos operation is not influenced by management inefficiency effects as measured over the two eras.

H_{02}: There is no strong relationship between the Saccos' macro-economic variables and the dividend output slack inefficiency.

H_{03}: There is no strong relationship between the Saccos' specific independent variables and the dividend output slack inefficiency.

Table 4.5f, indicates that Saccos specific variables and environmental factors do not jointly affect the inefficiency of Saccos at all the three confidence levels with Wald chi square of 27.81 given weak Wald p-value of 0.114. The only significant Saccos specific variable that is negatively

related to dividend output slack (div) is compliance with regulations (clr), with a p-value of 0.011 at 95% level of confidence. Other environmental variables except government net lending/ borrowing as percentage of gross domestic product (goklb) were insignificant at 95% level of confidence. The goklb was positively related to div slack with a p-value of 0.036. Therefore, the result indicates weak Wald p-value of 0.114 and Gamma of 0.994841(p-value 0.556) that is next to value one; therefore, hypothesis (H_{01}) that the Saccos operation is not influenced by management inefficiency effects as measured by Gamma (ϒ) is accepted (Pascoe *et al.*, 2003) while the second hypothesis (H_{02}) that there is no strong relationship between the Saccos' macro-economic variables and the inefficiency dependent variable dividend slack is also rejected at 95% level of confidence. (H_{03}) hypothesized that there exist no strong relationship between the Saccos' specific independent variables and div slack is rejected at 95% level of confidence. These positions apply when the control variables are not excluded. This is also a frontier panel data result case that utilized the highest number of observations at 290 out of a total of 368 (over 78 % of all observations) and also had a negative constant coefficient.

All independent variables both in magnitude and direction of influence as shown in tables 4.5f and 4.5g are different except for age, total assets, net profit to total assets, loan provision, market power, number of women on the board, membership size and financial liberalization which retained the direction of influence both under DIV without control variables and with control variables. The age for instance indicated a significant coefficient of +102.3009(without control variables) and insignificant coefficient of + 0.280635(with control variables) while net profit to total assets reflected significant coefficient of -70.1823(without control variables) and insignificant coefficient of -3.65215(with control variables). The age and net profit to total assets influence on the dividend output slack is not as predicted and predicted respectively in this study (Fried *et al.,* 1993; Demsetz, 1973; Kipesha, 2012; Esho, 2001; Crapp, 1983)

The co-operatives study in Australia determined that age and total assets had a positive and negative relationship with efficiency respectively (Esho, 2001). Another USA study by Crapp, (1983) posit that inefficiency increases with size of assets. The finding by Esho, (2001) is contrary to this study result which indicates that age is positively correlated to inefficiency while Mirie, (2014) posit that older the Sacco lower the level of inefficiency, in support of the learning effect.

Table 4.5f Time Varying Inefficiency Model-Regression of Dividend Output Slack to Predictor Variables: With Control Variables

Observations=290				**Wald chi ^{2}(20) =**	**27.81**
Log likelihood	-919.373			Prob > chi^2 =	0.114
Slack div	Coef.	Std. Err.	Z	P>|z|	[95% Conf. Interval]
age	0.280635	1.595037	0.18	0.86	-2.84558 3.406851
ca	0.404473	0.882915	0.46	0.647	-1.32601 2.134954
ta	0.089506	0.716473	0.12	0.901	-1.31475 1.493767
npta	-3.65215	3.692929	-0.99	0.323	-10.8902 3.585854
ao	-1.55023	1.686041	-0.92	0.358	-4.85481 1.754352
lp	-0.04905	0.05817	-0.84	0.399	-0.16306 0.064967
mp	-0.14583	0.531818	-0.27	0.784	-1.18817 0.896518
clr	-12.8033	5.062525	-2.53	0.011**	-22.7257 -2.88097
atech	-0.02536	0.064822	-0.39	0.696	-0.1524 0.101692
w	-0.42427	0.895158	-0.47	0.636	-2.17875 1.330206
ncfma	0.373015	1.008971	0.37	0.712	-1.60453 2.350562
ms	0.300022	0.563331	0.53	0.594	-0.80409 1.40413
cpi	0.473067	1.166481	0.41	0.685	-1.81319 2.759327
gdp	0.102214	0.557794	0.18	0.855	-0.99104 1.195471

goklb	2.790547	1.32999	2.1	0.036**	0.183815	5.397279
insp	11.79886	8.397658	1.41	0.16	-4.66025	28.25797
flib	0.330275	1.891532	0.17	0.861	-3.37706	4.03761
wc	0.843995	1.043668	0.81	0.419	-1.20156	2.889547
bond	-0.74047	0.532907	-1.39	0.165	-1.78495	0.304013
fi	-0.22935	0.178255	-1.29	0.198	-0.57873	0.12002
cons	-42.5442	38.24783	-1.11	0.266	-117.509	32.42013
/mu	-1161.29	10480.67	-0.11	0.912	-21703	19380.45
/eta	-0.23557	0.136024	-1.73	0.083	-0.50217	0.031031
/lnsigma^2	8.62226	8.900405	0.97	0.333	-8.82221	26.06673
/ilgtgamma	5.261818	8.946826	0.59	0.556	-12.2736	22.79727
sigma^2	5553.925	49432.18			0.000147	2.09E+11
gamma	0.994841	0.04592			4.67E-06	1
sigma_u^2	5525.272	49432.18			-91360	102410.6
sigma_v^2	28.65333	2.545708			23.66383	33.64282

Source: Research,(2015). Significance levels: 1%*, 5%.**

Key: tr(total revenue);ca(capital adequacy);ta(total assets);npta(net profit to ta);ao(area of operation);lp(loan provision);mp(market power);clr(compliance with laws & regulation);atech(adoption of technology);w(women number on board);ncfma(net operating cash flows to members funds);ms(membership size);cpi(consumer price index);gdp(gross domestic product);goklb(net lending/borrowing as% of gdp);insp(interest spread);flib(financial liberalization);wc(working capital); bond(number of employers);fi(financial liberalization).

4.77 Dividend Output Slack to Predictor Variables: Without Control Variables

H_{01}: The Saccos operation is not influenced by management inefficiency effects as measured over the two eras.

H_{02}: There is no strong relationship between the Saccos' macro-economic variables and the dividend output slack inefficiency.

H_{03}: There is no strong relationship between the Saccos' specific independent variables and the dividend output slack inefficiency.

When the control variables are omitted as indicated in table 4.5g, at 95% level of confidence the large Wald value move from weak form as shown in table 4.5f to strong form at p-value of 0.00. Further, all variables become strong and significant while Gamma a management influence oriented at table 4.5f move to random error dominant type since its value moves very close to zero. Therefore, hypothesis (H_{01}) that the Saccos' operation is not influenced by management inefficiency effects as measured by Gamma (Υ) is accepted (Pascoe *et al.*, 2003). The second hypothesis (H_{02}) that there is no strong relationship between the Saccos' macro-economic variables and the inefficiency dependent variable-divided slack is rejected at 95% level of confidence.

Similar to previous case under table 4.5f this frontier panel utilized 290 observations while its influence of control variables was very significant pointing to importance of control variables in eliminating spurious relationships. Therefore, similar to previous position of table 4.5f hypothesis (H_{03}) that there exists no strong relationship between the Saccos' specific independent variables and div slack is rejected at 95% level of confidence.

The result confirms theoretical prediction whereby the directions of influence of all specific and environmental variables on dividend output slack are significant without the control variables (Famma, 1980; Magali and Pastory, 2013; Deeptee and Roshan, 2009). Deeptee and Roshan, (2009) argues that companies have long term dividend payout ratios and that future profits of any company are conveyed by changes in dividends information since dividends have a signaling effect. For instance, an influence of net profit to total assets is negative and significant with a p-value of 0.000 and coefficient of -70.1823 at 5% level of significance which confirms the mechanism of signaling. This result also indicates that the influence of control variables on dividends output slack variable is fairly effective.

Table 4.5g Time Varying Inefficiency Model-Regression of Dividend Output Slack to Predictor Variables: Without Control Variables

Observations=290				**Wald chi**	**^{2}(18)**	**= 3.41E+15**
Log likelihood	=0.00			Prob >	chi^2	= 0.00*
Slack div	Coef.	Std. Err.	Z	P>|z|	[95% Conf.	Interval]
age	102.3009	1.15E-05	8.90E+06	0.00*	102.3008	102.3009
ca	-23.6661	-6.29E-06	3.80E+06	0.00*	-23.6661	-23.6661
ta	44.60751	4.96E-06	9.00E+06	0.00*	44.6075	44.60752
npta	-70.1823	-2.9E-05	2.40E+06	0.00*	-70.1824	-70.1823
ao	149.8554	9.55E-06	1.60E+07	0.00*	149.8554	149.8554
lp	-4.53453	-4.51E-07	1.00E+07	0.00*	-4.53453	-4.53453
mp	-60.6857	-4.07E-06	1.50E+07	0.00*	-60.6857	-60.6857
clr	176.0819	3.68E-05	4.80E+06	0.00*	176.0819	176.082
atech	5.581752	5.01E-07	1.10E+07	0.00*	5.581751	5.581753
w	-1.71133	-5.76E-06	3.00E+05	0.00*	-1.71134	-1.71132
ncfma	-13.4365	-8.19E-06	1.60E+06	0.00*	-13.4366	-13.4365
ms	40.90354	3.32E-06	1.20E+07	0.00*	40.90354	40.90355
cpi	-166.038	-9.75E-06	1.70E+07	0.00*	-166.038	-166.038
gdp	-43.0994	-4.61E-06	9.30E+06	0.00*	-43.0994	-43.0994
goklb	-37.9296	-8.95E-06	4.20E+06	0.00*	-37.9297	-37.9296
insp	-715.274	-6.8E-05	1.10E+07	0.00*	-715.274	-715.274
flib	83.34909	1.63E-05	5.10E+06	0.00*	83.34906	83.34912
fi	14.10781	1.38E-06	1.00E+07	0.00*	14.1078	14.10781
cons	-118.352	-0.00023	5.10E+05	0.00*	-118.352	-118.351
/mu	1613.605	.	.	.	.	.
/eta	3.468284	1.90E-20	1.80E+20	0.00	3.468284	3.468284
/lnsigma^2	-230.031	.	.	.	.	.
/ilgtgamma	-160.862	-5.29E-36	3.00E+37	0.00*	-160.862	-160.862
sigma^2	1.30E-100	.			.	.
gamma	1.38E-70	7.30E-106			1.38E-70	1.38E-70
sigma_u^2	1.70E-170	.			.	.
sigma_v^2	1.30E-100	.			.	.

Source: Research, (2015). Significance levels: 1%*, 5%.**

Key: tr(total revenue);ca(capital adequacy);ta(total assets);npta(net profit to ta);ao(area of operation);lp(loan provision);mp(market power);clr(compliance with laws & regulation);atech(adoption of technology);w(women number on board);ncfma(net operating cash flows to members funds);ms(membership size);cpi(consumer price index);gdp(gross domestic product);goklb(net lending/borrowing as% of gdp);insp(interest

spread);flib(financial liberalization);wc(working capital); bond(number of employers);fi(financial liberalization).

4.8 Means Inefficiency Difference Result

H_{04}: Pre-regulation and regulation eras have the same population of inefficiency mean scores.

The mean result is as shown in the table 4.6 where, the 95% confidence interval of the difference is (**-.00811, -.00146**), the interval does not cross zero indicating that the mean slacks for the two periods of pre-regulation and regulation period are not equal. The large t-value provide evidence against the null hypothesis, meaning that technical inefficiency during regulation period exceeds the pre-regulation technical inefficiency. Therefore, hypothesis (H_{04}) that pre-regulation and regulation eras have the same population of inefficiency mean scores is rejected at p-value of **t= -2.8363,** (p-value of 0.0051), while the one sided alternative hypothesis indicates that technical inefficiency in years 2010 to 2014 is higher than pre-regulation period with a p-value of 0.0025. However, the mean x-inefficiency difference was expected to be lower in regulation period due to hiring of experienced managers to handle front office banking services, therefore reducing the inefficiency. This finding does not agree with agency theory or x-inefficiency expectation. It should also be observed that the paired t-test was utilized since this method fits the pre-post situations (Myoung, 2009a).

In checking for robustness of the result, testing of the unpaired independent sample t-test after confirmation of equal variance aspect, resulted to the same conclusion at degree of freedom equal to 366 instead of 183 reflected in table 4.6. The technical inefficiency

mean result of the regulation period similarly remained higher than the one for pre-regulation period.

Table 4.6: Two-Sample Paired t - Test: Pre-regulation Yrs.07- 010 and Regulation Yrs.011- 014 Mean Inefficiency Difference

Variable	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
Pre-Reg.07-010	184	.02133	.00128	.01738	.01880	.02386
Reg.11-014	184	.02611	.00127	.01721	.02361	.02862
Difference	184	-.00478	.00169	.02287	-.00811	-.00146

Difference = Mean (p.reg 07-010) - Mean (reg 011-014) **t = -2.8363**

H_o: difference = 0 **degrees of freedom = 183**

H_a: difference < 0 **H_a: difference! = 0** **H_a: difference > 0**

Pr (T <t) = 0.0025 **Pr (T >t) = 0.0051** **Pr (T >t) = 0.9975**

Source: Research, (2015) Note: Independent unpaired sample t-test approach considered for deposit taking and non-deposit taking Saccos produced similar result.

4.9 OLS Regression Correlation Result

As indicated in table 4.7 OLS regressing of dependent variables against all environmental predictors in logarithmic form resulted to only one significant regression equation of compliance with regulation (clr) with R^2 adjusted of 0.868. All other regression equations have very low R^2 adjusted indicating that environmental independent variables have no major influence on dependent variables at confidence level of 95%. These post estimation results indicate that no environmental variable was eliminated due to the low correlation. For the formulation of linear relationship for panel data, see (Greene, 2012; Cooper *et al.*,

2007d). When the mean of truncated-normal distribution (m_u) value is far from zero this points to inability of study data to reduce to linear regression while when its variances (u^2) is approaching zero the results prohibit necessity to conduct likelihood ratio test (Stata, 2015).

Table 4.7: Regress Predictors: CPI, GDP, GOKLB, INSP, & FLIB

Dependent Variables	Adj. R^2	Prob. > F	OBS. (95% Conf.Int.)
Age	0.04	0.0011	368
Ca	0.01	0.122	368
Ta	0.06	0.0001	368
Npta	0.012	0.097	368
Ao	-0.014	1.000	368
Lp	0.118	0.000	368
Mp	-0.0005	0.439	368
Clr	**0.868**	0.000	368
Atech	0.046	0.0005	368
W	-0.010	0.93	368
Ncfma	-0.006	0.699	368
Ms	0.065	0.000	368
Wc	-0.0005	0.441	368
Bond	-0.0000	0.419	368
Fi	0.0371	0.0022	368

Source: Research, (2015)

Key: tr(total revenue);ca(capital adequacy);ta(total assets);npta(net profit to ta);ao(area of operation);lp(loan provision);mp(market power);clr(compliance with laws & regulation);atech(adoption of technology);w(women number on board);ncfma(net operating cash flows to members funds);ms(membership size);cpi(consumer price index);gdp(gross domestic product);goklb(net lending/borrowing as% of gdp);insp(interest spread);flib(financial liberalization);wc(working capital); bond(number of employers);fi(financial liberalization).

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents a summary of study findings, conclusion, contribution to theory, contribution to practice and recommendations. Included are the outcomes of the frontier panel data regression analysis that H_{01}: There is no strong relationship between the Saccos' specific independent variables and the inefficiency dependent variable; H_{02}: There is no strong relationship between the Saccos' macro-economic variables and the inefficiency dependent variable; and H_{03}: The Saccos operation is not influenced by management inefficiency effects as measured (by Gamma, ϒ) over the two eras.

5.1 Summary of Key Findings

The summary of key findings discusses the results of stochastic frontier analysis (SFA), OLS regression correlation results, and predictor variables correlation coefficient results.

5.11 Regression (SFA) results

The frontier regression analyses result in tables: 4.5a-4.5g shows the relationship between the Saccos' specific predictor variables and inefficiency dependent variables. This finding answers the first hypothesis $H_{01,}$ hypothesized that there exist no strong relationship between the Saccos' specific independent variables and the slack; second hypothesis H_{02}, hypothesized that there is no strong relationship between the Saccos' macro-economic

variables and the inefficiency dependent variable; and third hypothesis $H_{03,}$ hypothesized that the Saccos operation is not influenced by management inefficiency effects as measured by Gamma (ϒ).

This study finding indicates that women on the board decrease results to increases in slacks or inefficiencies and the influence is significant for loan to members and dividend indicators at 99% levels of confidence. The relationship of macroeconomic variables to dependent variables of dividend slack without control variables and loan to members slack with or without control variables was also strong similarly for all specific Sacco variables at 99% level of confidence (p-value 0.00). This finding reflects a significant and strong role of loan to members and dividend slacks as dependent variables in the study of Saccos' inefficiency.

Further, the influence of all macro-economic variables did not influence the total revenue dependent variable slack, for instance an interest spread (insp) was positively related and was weakly insignificant at 95% level of confidence. Interest spread as a measure of pricing in an economy if high, it discourages the propensity of investors to invest and thus its positive relationship with total revenue inefficiency confirms this economics argument.

A predictor variable of computerization expenditure (atech) had a strong negative effect on loan to members slack with coefficients of -0.14259 (p-value of 0.00) and -0.17411(p-value 0.00) without consideration of control variables and with consideration of control

variables respectively. On the contrary this same predictor variable had a strong positive effect on dividend slack with coefficient of 5.58175 (p-value, 0.00) without control variables effect. This result is an indication of how increase in techno costs can act as an opportunity cost or constraint to loan issues to members while at the same time denying them optimal dividend payment.

As aforementioned, a similar and critical finding is also seen among the relationship between net profit to total assets(npta) with dividend slack that is negative with coefficient of -70.1823(p-value 0.00) without control variables, while net operating cash flows(nocf) and loan to members(lm) slacks relationship with npta variable also reflect negative relationship coefficients of -2.8567(p-value 0.001) and -0.17827(p-value 0.00) without control variables, at 99% levels of confidence respectively.

The above analyses are an indication that when dividend, loan to members and net operating cash flows slacks decreases; net profit to total assets (npta) increases with respective unit magnitude holding other factors constant; these relationships are in compliance with the efficiency theory, agency theory and financial institutions intermediation theory that states: inefficiency is negatively related to profitability, the opposite being also true. The relationship of npta with total revenue slack although weak is also negative as expected in practice.

Another key finding is that net operating cash flows without control variables has no identified relationship with both environmental and Saccos specific variables at

significance levels of 1%,5%, and 10%. This finding indicates likelihood of a global impact of the control and operating cash flows variables in determination of inefficiency in Saccos and consequently their effect on Saccos' going concern or earnings management position.

The negative influence of constant variables across all stochastic regression results is an indication that other related factors or specific variables left out of this study do not strongly influence the inefficiency of Saccos in Kenya. Further, the result of all regression equations reflect a significant Wald chi-square values except for regression equation of dividend output slack to all predictor variables with control variables, which had a Wald chi-square probability or p-value of 0.114. This is also a confirmation that all independent variables as a group are important in determination of the Saccos' inefficiency.

Another finding was that Gamma was next to 1 under the regressions of dividend output slack to predictor variables and total revenue slack to predictor variables with Gamma equal to 0.994841 and 0.999956(or 0.999951), with optimization inverse logit of gamma p-value of 0.556 and 0.00 respectively. These indicate a general possibility of management influence being higher than the random error in determining the inefficiency of the Saccos in Kenya.

5.12 OLS Regression Correlation Results

The correlation between environmental factors (prime regressors) and specific predictor variables were tested for purpose of eliminating highly correlated prime regressor (s). The results indicated are mixed with very low R^2 adjusted values except for compliance with regulation (clr) as a dependent variable reflected a high R^2 adjusted value of 86.8% against all environmental predictor variables. This situation lend to the retention of all environmental predictor variables in the final model of this study.

5.13 Predictor Variables Correlation Coefficient Results

This study utilized Spearman correlation in the analysis of correlation coefficient. The result indicates that majority of variables correlations were below correlation coefficient of 0.8 thus ruling out a possibility of multicollinearity among variables. Among the independent variables capital adequacy reflect a negatively correlated relationship at 95% level of confidence with dependent variables at r = -0.4108, r = -0.2739, r = -0.4108, and r = -0.2988 for total revenue, loan to members, net operating cash flows and dividend slacks respectively in line with the expectation of the agency, intermediation and efficiency theories. As hypothesized there is a moderate negative relationship between total assets (size) and inefficiencies or slacks ranging between r =- 0.4108 and r = -0.5477 at 95% level of confidence. A zero correlation between loan to members slack and net profit to total assets, similarly for adoption of technology to total revenue slack were not expected.

5.2 Conclusion

The general objective of this study was to establish the technical inefficiency level, the macro-economic and Saccos specific variables determining the technical inefficiency of deposit taking Saccos in Kenya. To attain this objective eight years panel data for 46 Saccos was analyzed by the help of data envelopment analysis and stochastic frontier model using Stata14.1 software. Therefore, the effect of five macro-economic variables, thirteen Saccos specific' predictor variables and two control variables against dependent variables of total revenue, loan to members, net operating cash flows and dividend slacks were evaluated. The dependent variable slacks were determined using data envelopment analysis model in Stata14.1. It was found that 13(being 28% of the census) out of 46 Saccos scored strong technical efficiency of 1 with an average technical efficiency and inefficiency of 0.976 and 0.024 respectively for the whole census of the study.

It was also found that specific variables significantly influence Saccos' inefficiency given total revenue, loan to members, net operating cash flows and dividend slacks. The dependent variables of net operating cash flows reflected inconclusive results. The correlation coefficient of women on the board for instance given total revenue, loan to members, net operating cash flows, and dividend slacks were 0.562, -0.492, 0.562, and -0.393 at 95% level of confidence respectively which indicate moderate significant relationship. On the other side of regression frontier analysis without control variables presence, women on the board significantly influence the inefficiency of Saccos expressed by loan to members, and dividend slacks with -0.6875 (p-value,0.00); and -1.71133 (p-value,0.00) coefficients at 99% level of confidence respectively.

The relationship was negative for both indicators. In addition, the influence of environmental factors of interest spread (insp) and consumer price index(cpi) are insignificant and significant respectively with coefficients of 0.6787 (p-value 0.072) with control variables; and 6.6637(p-value 0.00) at 99% level of confidence without control variables, given total revenue slack and loan to members slack respectively.

Another unique result to this study is that market power specific variable is negatively correlated to all four independent variables. In addition market power indicate a strong negative coefficient of -60.6857(p-value, 0.00); -1.30008(p-value, 0.00) at 99% level of confidence given dividend output and loan to members' slacks without control variables respectively. This direction of influence is expected in an emerging Saccos' sub-sector where competition is taking shape. For instance loan to members will decrease where dominating Saccos emerge and start dictating terms of loan issues. However, at 2 % average level of market power, the Saccos sub- sector in Kenya is yet to acquire a dominance influence.

Essentially, strict compliance with laws and regulations is expected to have a negative correlation with loan to members and dividend slacks. The result revealed that compliance had negative correlation of – 0.2117 and -0.3746 with loan to members and dividend slacks respectively, this is in line with the expectation.

The study further indicates that capital adequacy had significant negative effect on the loan to members and dividend slacks which is as per the expectation while on the contrary the influence of capital adequacy on the net operating cash flows inefficiency was significant and positive thus inconclusive. However, the correlation between capital adequacy and all dependent variables was as expected negatively correlated.

Generally, this study indicates that Saccos specific, macro-economic and control variables given total revenue, loan to members, net operating cash flows and dividend slack variables are significant determinants of the technical inefficiency of Saccos in Kenya. Further, the technical inefficiency mean between the pre-regulation and regulation period was indicated by the study result that it was higher during the regulation period. The influence of management inefficiency was also high given total revenue slack with (or without) control variables and under dividend slack with control variables. This signifies that in the Saccos sub-sector - dividends and total revenue are the key items subject to management influence or even manipulation and therefore their monitoring should be enhanced and to this extent therefore, supports the intermediation, agency and efficiency theories.

5.21 Contribution to Theory

This study conclusion is in line with x-inefficiency theory which states that inefficiency of decision making unit decreases as cost come down and banks' intermediation theory that postulates that banks' efficiency is positively related to profitability. The study further strengthens the conflicting prior studies on influence of gender on the boards of

companies. It supports the theory that higher number of women on the boards of Saccos in Kenya reduces inefficiency.

Further, it can be concluded that random errors (insignificant management influence on inefficiency) are strongly determined by dividend, loan to members and net cash flows slacks presence as indicated by the levels of Gamma moving to toward zero values. Thus supporting the position that, liquid asset is the most risky asset subject to misusing. Random errors in Sacco operating environment may include unavoidable aspect like labor disputes, information systems breakdown and statistical errors. This random error contribution in a way weakens the influence of agency theory in Saccos. This position is due to the active participation of members in the annual general meetings. However, the influence of management inefficiency is strongly depicted by the total revenue (and weakly by dividend slacks with control, given Gamma p-value of 0.556) variables presence, thus agree with the theories of inefficiency and intermediation expectation.

The result of the two sample paired t-test of mean difference does not agree with the agency or x-inefficiency theory as the inefficiency mean difference in regulation period was higher, yet the theory demands that the reduction in inefficiency was expected resulting from experienced managers hired to manage Saccos with FOSA. This imply that Saccos must explore better means of supervising with aim of reducing management wastage of resources or costs.

An application of econometric stochastic frontier analysis and panel data in this study to establish the relationship between predictor variables of age, technology, area of operation, size, and bond among others verses independent variables of inefficiency has bridged the gap in earlier similar study on Saccos in Kenya. Essentially, the higher technical inefficiency during regulation time conflict with agency x-inefficiency theory.

5.22 Contribution to Practice

It can be concluded that the identification of strong Saccos inefficiency over different years can be used as benchmark. Those Saccos' unique features can be adopted as the best management practices. Further, another key contribution to practice is the evidence showing that total revenue (or weakly dividend with controls) slack with or without control variables is significant contributor in determining management inefficiencies as expressed by Gamma factor. In the Saccos sub-sector the likely management inefficiencies may include factors such as shortage of employees and information technology equipment, and management incompetence. This study result also indicates that computer expenditure (atech) strongly and positively influences dividend slack without controls which agrees with a short run expectation in practice. It is also observed that net operating cash flows, dividend and loan to members' output slacks are not relevant in identifying management inefficiency or agency problem. Essentially, members' active transaction monitoring of their loan balances, dividend rates and Sacco cash flows (loan repayments and issuing) is a reason behind failure of these slacks to detect management inefficiency.

5.3 Recommendations, Further Research and Limitations

There is also another key finding which point to the direction of dividends and total revenues being highly abused (earnings management possibility) in Saccos given the significance of these slacks in management inefficiency determination. Therefore, there is need for vigilant monitoring of these indicators both internally and externally by the management and regulators respectively. The study also concludes that large size Saccos exhibit less inefficiency characteristics than small and medium ones, therefore the regulators should encourage merger of medium or small size Saccos in the economy to reduce inefficiency. The importance of all predictors in this study should be researched in future at individual category of small, large or medium size Saccos to see whether the influence remains constant or not.

Further, the introduction of ratios or variables such as net profit to total assets, market power, capital adequacy, financial investment level, percentage of women on board and loan provision level in the financial reports of Saccos beside periodical efficiency benchmarking using DEA combined with stochastic mechanism will go a long way in assisting the regulator monitor better or identify technical inefficiency. Subsequently, the reduction in the Saccos' x-inefficiency will be guaranteed.

The identified limitation to this study is in the area of drilling down to specific inefficient or efficient Saccos using a similar approach of study to find out at micro level what actually influences the individual efficient and inefficient Saccos in the sector. It is

expected that this will invite more researches in this area as the inefficiency of Saccos over the two eras reflected higher inefficiency during regulation period. Reasons as to why there is higher technical inefficiency despite the regulators' interventions should also be explored in future research.

Other specific limitations experienced in this study include the aspect of DEA assumption that data being free from measurement errors and also its inability to derive absolute inefficiency of a decision making unit. Further, there was difficulty in deriving ratios or numbers due to some Saccos' failure to comply fully with the International Financial Reporting Standards. However, there could be a change in the impact of predictors if another panel study is carried out over a longer period or longitudinal panel study say of more than eight years. This study also ignored a possibility of any Sacco exhibiting an accounting information manipulation over period of the study.

One of the gaps estimated to be bridged was for instance to determine the influence of environmental variables such as consumer price index, financial liberalization and gross domestic product; in addition to the specific variables including age, capital adequacy, net profit to total assets, market power, loan provision, adoption of technology, membership size and total assets; on dividend output slack with control variables. However, the effect of all these variables was found insignificant. It is thus suggested that further studies should be carried out on other predictor variables. It may be essential to consider other predictor variables such as stock price real index, growth domestic product real index, income of individual members, GDP deflator and square of the age (age^2).

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LIST OF ANNEXURES

Annex 1.1: Transformation of Savings and Credit Co-operatives

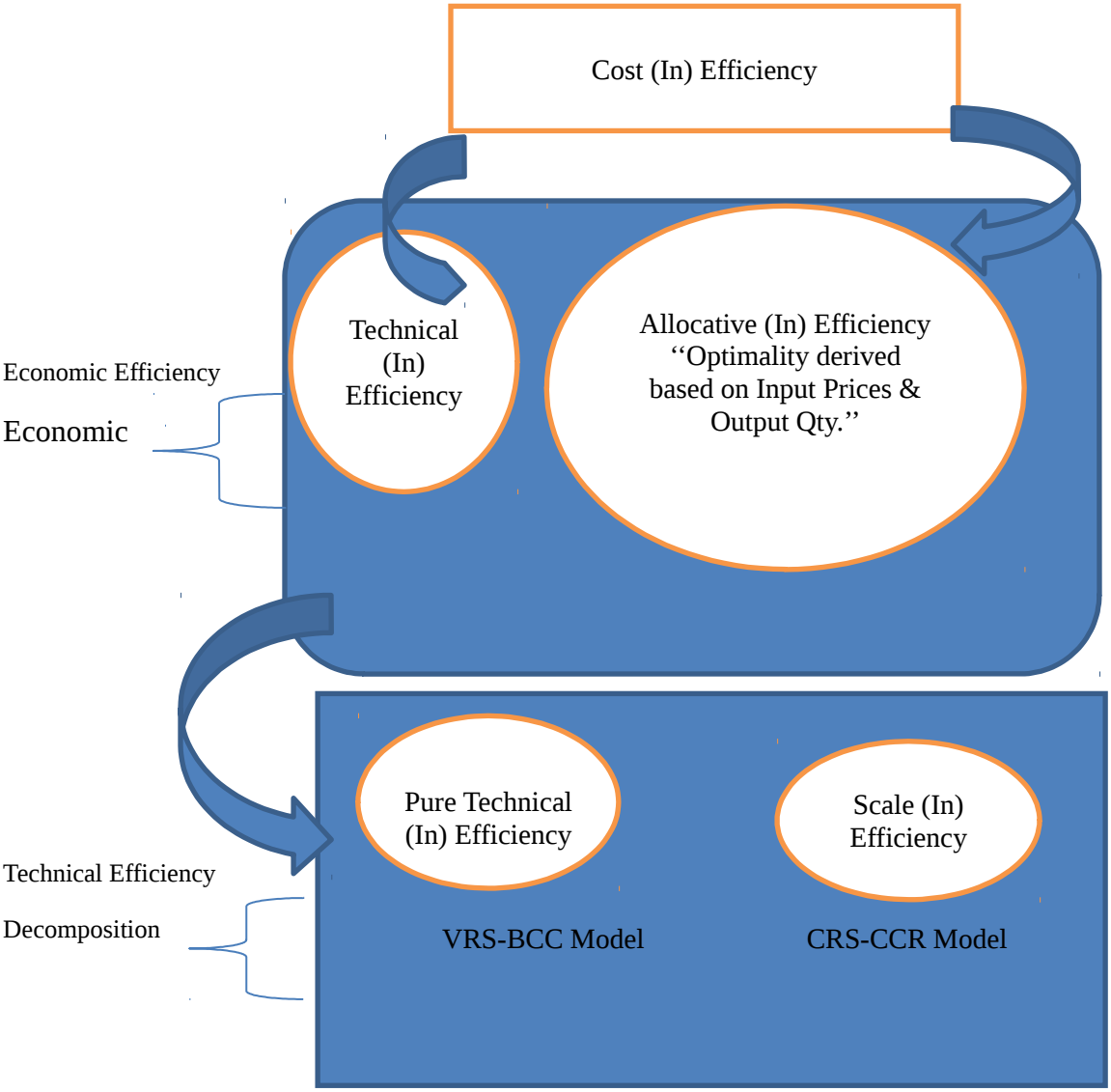
Source: Research, (2015); Zvi, (1998) adopted

ANNEX 1.2. FINANCIAL SERVICES USE IN KENYA

Type	**Savings**	**Loans**
	%(weighted)	**%(weighted)**
Bank/Building Society	13.7	2.1
Post Bank	5.6	-
Sacco	12.8	4.1
MFI (Microfinance Institutions)	1.5	0.8
ROSCA (Rotating Savings and Credit Associations)	29.3	-
ASCA (Accumulating Savings and credit Associations)	5.4	1.7
Local stop	-	22.8
Family or friend	5.7	12.6
Hidden savings	27.9	-
Group of friends	10.9	-
Government	-	1.1
Employer	-	0.9
Buyer	-	0.9
Internal money lender	-	0.7

Source: Johnson *and* Zarazua, (2008): Financial Services Deepening (FSD), Kenya.

ANNEX 1.3: COST INEFFICIENCY CHART



Source: Research, (2015)

ANNEX 2.1: SUMMARY OF STUDY THEORIES

Study theories	Outputs	Inputs
Production structure theory	• Assets acquired by an institution in dollar volume • Number of accounts • Number of transactions	• Labor costs • Capital costs • Operating costs (exclude interest expenses)
Intermediation theory	• Loans issued • Interest earned • Investments return	• Transaction costs • Mutual funds or deposits • Operating costs (including interest expenses) • Acceptances
Profitability theory	• Interest revenue • Non-interest revenue	• Interest costs • Non-interest costs

Source: Hughes and Mester, (1993, 2008); Ayrancie, (2010); Sealey and Lindley, (1977); Pencavel and Craig, (1994); Brown, (2006); Berg *et al.*, (1990); Mahmoodi *et al.*, (2010); and Mirie, (2014).

ANNEX 2.2: LIST OF SASRA LICENSED SACCOS BY JUNE 2011

Type	Area	Size	Type	Area	Size

1.	Stima Sacco	City	Large	23. Nakuru Teachers Sacco	Urban	Large
2.	UN Sacco	City	Large	24. Nyeri Teachers Sacco	Urban	Large
3.	Bandari Sacco	City	Large	25.Tai/Kiambu Tea Sacco	Urban	Medium
4.	Gusii Mwalimu Sacco	Urban	Large	26.Wakenya Pamoja Sacco	Urban	Medium
5.	Kitui Teachers Sacco	Urban	Large	27.Meru South Farmers Sacco	Urban	Medium
6.	Ndege Chai Sacco	Urban	Larg e	28.Comoco Sacco	City	Medium
7.	Chai Sacco	City	Large	29.Universal Traders Sacco	Urban	Medium
8.	Taifa Sacco	Urban	Large	30.Wananchi Sacco	Urban	Medium
9.	Fariji Sacco	Urban	Large	31.Kericho Tea/ K. Highland Sacco	Urban	Medium
10.	Baringo Farmers Sacco	Urban	Large	32.Kite Sacco	City	Medium
11.	Baringo Teachers Sacco	Urban	Large	33. Mombasa Port Sacco	City	Medium
12.	Bingwa/Kirinyaga Farmers Tea Sacco	Urban	Large	34. Mombasa Teachers Sacco	City	Medium
13.	Embu Teachers Sacco	Urban	Large	35. South Imenti T.G. Sacco	Urban	Medium
14.	Muhigia Sacco	Urban	Large	36. Mungeria T.G. Sacco	Urban	Medium

15. Tharaka Nithi Teachers Sacco	Urban	Large	37.Mwito Sacco	City	Medium
16. Kakamega Teachers Sacco	Urban	Large	38.Tenhos Sacco	Urban	Small
17. Kilifi Teachers Sacco	Urban	Large	39..Baraka Sacco	Urban	Small
18. Kipsigis Teachers Sacco	Urban	Large	40. Irianyi Tea Sacco	Urban	Small
19. Muramati Sacco	Urban	Large	41.Kmfri Sacco	City	Small
20.Muranga Teachers Sacco	Urban	Large	42. Nyamira Tea Farmers Sacco	Urban	Small
21. Mwalimu National Sacco	City	Large	43. Wakulima Dairy Sacco	Urban	Small
22.Nacico Sacco	City	Large	44.Borabu Farmers Tea Sacco	Urban	Small
			45.Diocese of Meru Sacco	Urban	Small
			46.Nandi Hekima Sacco	Urban	Small

Source: SASRA, (2011).

ANNEX 3.1: PREDICTOR VARIABLES CORRELATION COEFFICIENT

Statistics/Data	Analysis					
Spearman,	(rho)					
	age	ca	ta	npta	ao	lp
age	1					
ca	0.8186	1				
ta	0.7933	0.6833	1			
npta	0.5654	0.45	0.5667	1		
ao	0.5241	0.1035	0.6211	0.414	1	
lp	0.1772	0.0667	-0.4167	-0.6	-0.5175	1
mp	0.3967	0.25	0.8167	0.3833	0.6211	-0.65
clr	0.0957	0.1632	0.0344	-0.1288	0.0533	0.1546
atech	0.5466	0.3598	0.3096	0.6109	0.5717	-.5272
w	0.4979	0.2907	0.4189	0.1966	0.7434	0.094

ncfma	0.3713	-0.0333	0.5	0.2833	0.5175	0.7333			
ms	0.5739	0.65	0.8667	0.2667	0.414	0.0833			
cpi	0.3463	-0.1624	0.0171	0	0.3717	0.3762			
gdp	0.4762	0.2821	0.1197	-0.0171	0.4779	0.342			
goklb	0.7966	-0.5215	-.3591	-0.342	.04779	-0.1026			
insp	0.7793	-0.6754	-.4788	-0.3762	0.2655	0.1026			
flib	0.8226	0.4873	0.4446	0.3249	0.5841	0.0342			
wc	0.9283	0.9333	0.75	0.5667	0.414	-0.0833			
bond	0.8405	-0.6299	-.5533	-0.5193	-0.3701	0.4086			
fi	0.6583	0.7	0.9167	0.3833	0.414	-1667			
Slack tr	-0.3467	-0.4108	-0.4108	-0.4108	0.189	0.4108			
Slack lm	-0.5547	-0.2739	-0.5477	0	-0.6614	0.1369			
Slack nocf	-0.3467	-0.4108	-0.4108	-0.4108	0.189	0.4108			
Slack div	-0.2017	-0.2988	-0.5179	0.1594	-0.3093	-0.1295			
	mp	Clr	atech	w	ncfma	ms	cpi	gdp	goklb
mp	1								

clr	0.2147	1							
atech	0.1506	0.0561	1						
w	0.1453	0.1542	0.4507	1					
ncfma	0.6833	-0.3177	0.2176	-0.1111	1				
ms	0.6833	0.1889	0.0251	0.436	0.1333	1			
cpi	0.2992	-0.163	-0.3391	-0.7193	0.2137	0.1197	1		
gdp	-0.1453	0.2952	0.4164	0.7807	-0.1453	0.0513	-0.9474	1	
goklb	0.1111	0.2687	-0.5881	-0.6842	-0.0769	-0.1881	0.6842	-0.7368	1
insp	-0.1111	0.2247	-0.5538	-0.2982	-0.1624	-0.4104	0.0526	-0.2456	0.7193
flib	0.0256	-0.2687	0.5624	0.7105	0.1966	0.2736	-0.6316	-0.7193	0.9825
wc	0.3167	0.1288	0.5941	0.5386	0.1	0.6167	-0.3762	-0.4959	0.7182
bond	-0.2894	0.2105	-0.671	-0.1528	-0.5703	-0.1788	0.2183	-0.3057	0.655
fi	0.7167	0.1116	0.0753	0.3676	0.2333	0.9833	0.1624	-0.0085	0.2308
Slack tr	-0.4108	0.1411	0	0.562	-0.5477	-0.1369	-0.4215	0.4215	-0.1405
Slack lm	-0.5477	-0.2117	-0.275	-0.4917	-0.4108	-0.5477	0.1405	-0.4215	0.4215
Slack nocf	-0.4108	0.1411	0	0.562	-0.5477	-0.1369	-0.4215	0.4215	-0.1405

Slack div	-0.5179	-0.3746	0.18	-0.3934	0.0697	-0.8367	-0.1737	-0.0511	-0.0307
	insp	flib	wc	bond	fi	slacktr	Slack lm	slacknocf	slackdiv
nsp	1								
flib	-0.7368	1							
wc	-0.7182	0.7011	1						
bond	0.69	-0.655	-0.7406	1					
fi	-0.4873	0.3163	0.6667	-0.2979	1				
Slack tr	0.1405	0.1405	-0.2739	0.5595	-0.2739	1			
Slack lm	0.562	-0.562	-0.4108	0.3497	-0.5477	-0.125	1		
Slack nocf	0.1405	0.1405	-0.2739	0.5595	-0.2739	1	-0.125	1	
Slack div	0.2453	-0.0818	-0.249	-0.2086	-0.757	-0.2455	0.6547	-0.2455	1

Source: Research, (2015)

ANNEX 3.2: DATA COLLECTION FORM

SACCO NAME:……

YEAR OF SACCO REGISTRATION……

CODE	DETAIL	2007	2008	2009	2010	2011	2012	2013	2014
Variables	**SOURCE: CERTIFIED ACCOUNTS** (Amount in Kshs.)								
CA	Core capital								
	Total assets								
	Financial investments								
NPTA	Net profits								
LP	Loans defaulted(loan loss provisions)								
	Total Loans to members								
MP	Sacco total member deposits								
	Aggregate (total) Saccos deposits								
OC	Total operating costs								
A TECH	Computer expenditure (additions and expensed)								
TB	Total external borrowings								
OEMD	Owners' equity								
R	Total revenue								
LM	Loan to members								
NOCF	Net operating cash flows								
DIV	Dividend and interest bonus provision for the year								

	SOURCE: REGULATOR,MINISTRY AND SACCO DATA								
RU	City dummy (C=1)								
	Urban dummy (U=0)								
COMPL*	Tax law (average score)								
***Note: derived from compliance section below**	Capital adequacy (average score)								
	Under statutory management(average score)								
	Dividend paid(average score)								
CODE	DETAIL	2007	2008	2009	2010	2011	2012	2013	2014
W	Women on the board (number)								
	Men on the board(number)								
BOND	Number of employers contributing the members(number)								
M	Number of members(number)								
	SOURCE: CENTRAL BANK OF KENYA RECORDS, IMF AND WORLD BANK DATA								
CPI	Market condition index								
FLIB	GDP(average in Kshs)								
	Money supply (M3XT average in Kshs.)								
GK-LB-GDP	Net lending/borrowing as % of GDP by GOK								
INSP	Interest spread rate								
GDP	GDP rate								
	***COMPLIANCE**								

	MEASUREMENT DATA: TICK {include Likert Scale value } **as applicable**								
Four Indicators- Source: (SSR,2010)	**Detail**	2007	2008	2009	2010	2011	2012	2013	2014
1.Capital adequacy (CA)	Undercapitalized: CA is below 4% :Scale = 0 and 4% :Scale=1	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }
	Capitalized for registration purpose: CA lies,4% - 10% :Scale = 2	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }
	Necessary condition: CA is, 10% and above: Scale = 3	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }
	Minimum core capital(mandatory): Kshs.10,000,000: Scale = 0 or 1	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }
	Financial investments to total members' deposits: minimum (target) 5%: Scale = 0 or 1	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }
2.Dividends proposed	As reflected in final accounts: Scale = 0 or 1	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }
3.Under statutory management	Due to noncompliance with various SASRA rules: Scale = 0 or 1	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }
4. Tax & other penalties	Due to noncompliance with regulations - as reflected in Saccos records or accounts: Scale = 0 or 1	{ }	{ }	{ }	{ }	{ }	{ }	{ }	{ }

Source: Research, (2015)