International Journal of Economics, Commerce and Management
United Kingdom Vol. IV, Issue 10, October 2016
http://ijecm.co.uk/ ISSN 2348 0386

DETERMINANTS OF TECHNICAL INEFFICIENCY OF THE SAVINGS AND CREDIT CO-OPERATIVES IN KENYA: A DIVIDEND OUTPUT SLACK ANALYSIS

Leonard Rang'ala Lari
Moi University, Kenya
lariran@yahoo.com

Lucy Jepchoge Rono
Moi University, Kenya
jepchoge@yahoo.com

Philip Mulama Nyangweso
Moi University, Kenya
philoe2000@gmail.com

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 reports of the licensed deposit taking Saccos and macro-economic indicators sources over the research period. It focuses on environmental and specific Saccos' predictors affecting inefficiency of Saccos and measured the pure technical inefficiencies of Saccos during a period of pre-regulation and regulation. The cross-sectional time series research design was used. The study was designed to address general objective of establishing the technical inefficiency, the macro-economic and specific Saccos variables determining the technical inefficiency of Saccos. Statistical methods employed include non-parametric and parametric using DEA and SFA Stata14.1, respectively. These methods were subjected to a purposive census of 46 Saccos' panel data to determine the inefficiency during the combined eight years (2007-2014). The study concludes that all predictors were significant given dividend slack as hypothesized in

agency, efficiency and intermediation theories. The W, NPTA, and CA predictors, had a strong negative influence on dividends slack without the control variables. Further, dividend slack regression with control variables explain the management inefficiency as indicated by Gamma (0.994841). DEA result indicated 0.976 mean efficiency.

Keywords: Saccos in Kenya, Technical Inefficiency, Stochastic Frontier, Data Envelopment Analysis (DEA), Dividend Output Slack

INTRODUCTION

The efficiency of an organization is an overriding aspect in financial management. A well-managed savings and credit co-operative society is expected to increase the shareholders' 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 liberalizations 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 efficiency assessment, non-parametric linear programming approach, and parametric measures of evaluating financial institutions' relative inefficiency and benchmarking.

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.

The 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 (Beasley, 1996).

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 transformations 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 model application in a Sacco sub-sector therefore creates a chain of savings and credit co-operatives as summarized under appendix AP3.1. Under the third phase reflected in the appendix, 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 Nino - 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 Nino-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 co-operative 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 beingthe 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 period, 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; Emerson 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.

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.

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*., 2007). 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, (2008) 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.

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 (Olweny and Kivuvo, 2014).Further, this study utilized the BCC analysis based on inefficient results of DEA as dependent variables (Banker *et al*., 1984), which were

used to identify the variables that best measure the pure technical inefficiency of the Saccos by running a truncated- normal regression.

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 efficiency 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 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 in 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).

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 facts described above then point to the need to measure and determine the Kenyan Saccos' pure technical inefficiency or efficiency. This study sets deliberate standards on how Saccos in Kenya can be monitored and peers emulated to ensure efficiency in their operations.

The General Objective

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

The Specific Objectives

1. To determine the effect of specific predictor variables on Saccos' inefficiency.
2. To establish the effect of macro-economic variables on the Saccos' inefficiency.
3. To measure the extent of management inefficiency over the pre-regulation and regulation eras.

Research Hypotheses

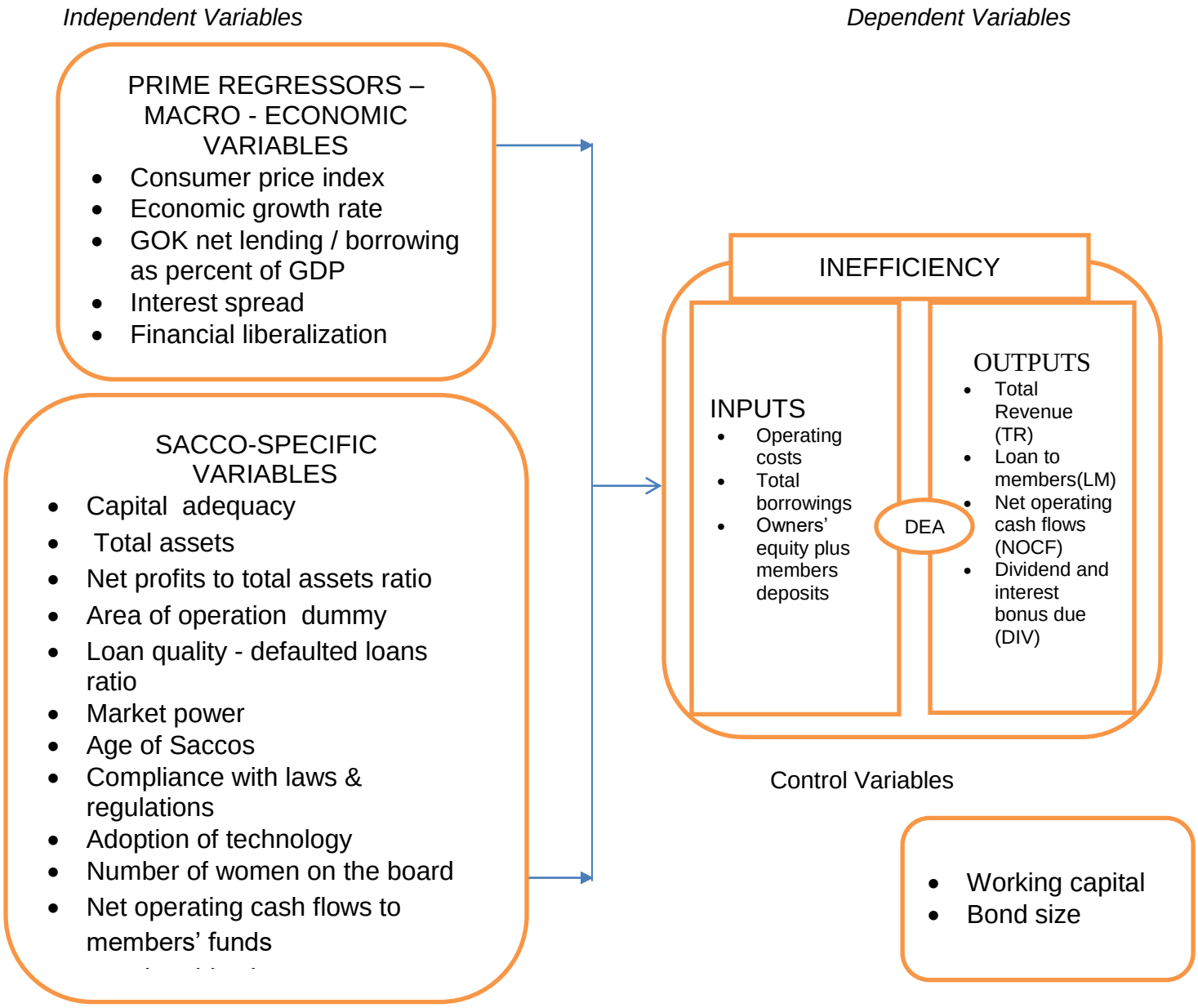
H_{01}: There is no strong relationship between the Saccos' specific independent variables and the inefficiency dependent variable.

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

H_{03}: The Saccos operation is not influenced by management inefficiency effects as measured by Gamma (Y) over the two eras.

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

Figure 1. Conceptual Framework



The Concept of Technical Inefficiency

The conceptual framework model above 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 specific independent variable (prime regressor) is removed from the 2nd or final stage regression

process. The estimation was internalized within the Stata14.1 software. Further, prime regressors are also assumed to be measurement errors free (Cooper *et al*., 2007).

RESEARCH METHODOLOGY

Research Design

This explanatory study used a balanced panel data. The cross-sectional research design was employed in soliciting for secondary information on determinants of Saccos' inefficiency in Kenya. This study utilized a second stage data envelopment analysis before subjecting data to SFA.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 type of method used in efficiency or inefficiency study can have significant conclusion (Mirie, 2014). The panel data has benefit of assisting in studying the behavior of each Sacco on cross-sectional and time-series or year basis (Ongore and Kusa, 2013). In addition, this study utilized a census technique whereby 46 licensed Saccos under the regulator's control within the two periods of study running from 2007 to 2010 and 2011 to 2014(span of 8 years) were picked. Secondary data was collected from the audited annual reports and websites of the regulators.

Model Specification

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 was assumed Coelli*et al*., (2005) and Cooper *et al*., (2011). Stata 14.1 was used to decompose errors (Pascoe *et al.,*2003; Jondrow *et al.,* 1982). The SFA was based on Cobb-Douglas logarithmic model $\ln y^{*} = \beta_0+\sum_1^k \beta r \ln Z_{kjt}+V_{rjt}+U_{rjt}$, 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 , y^{*} is the first stage optimal slack(normalized) in output r of DMU_j , βo is the intercept of output slack equation, 'ln' is natural logarithm, and Z has k(k=1,…,k) observable environmental factors (Battese and Coelli,1995).

EMPIRICAL FINDINGS

DEA Results

The study examined the inefficiency and efficiency census of 46 Saccos using a non-parametric variable return to scale (VRS) - BCC or 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 decision making units (DMUs) is as shown in table 1. It also indicates that a total of 24 Saccos were strongly efficient and exhibited zero slacks across all output variables. Large Saccos had the highest % 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, & 2014), 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.

Table 1. Strong Efficient Saccos (Years 2007-14)

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%

Output Description

The table 2 below presents the mean output as expressed in TR(total revenue slack), LM(loan to members slack), NOCF(net operating cash flows slack), and DIV(dividend slack) in Kshs. Million for years 2007 to 2014.

Table 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

As reflected in the table above 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 outputs.

Descriptive Statistics

The descriptive statistics in table 3 below presents specific variables that determine the inefficiency of Saccos in Kenya. As reflected in the table, the mean capital adequacy (CA) 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 (NPTA) is high at 22%, an indication of mixed result pointing to the direction of inefficiency (Brown, 2006). The market power (MP) 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 average women on the board (W) stood at 20 % which is approximately one woman per Sacco.

The table also reflect mean defaulted loans (LP) 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 (W) of Saccos is at 20% with standard deviation of 12%. This is a low number and has little 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.

Table 3. 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

Operationalization of the Study Variables

The study measurements used to operationalize the study specific variables are as indicated in table 4 below.

Table 4. Study Variables

Study 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	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

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 (Stata, 2015). The result obtained is as shown in table 5 below indicates that only two variables reflected p-values greater than 0.05 thus a possibility of heteroscedasticity.

Table 5. Testing Study Variables for Normality

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

However, a truncated distribution frontier can 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.

Multicollinearity Test

The possibility of strong relationship between predictor variables was checked using the correlation coefficient- Spearman rho as shown in the table AP.1 in the Appendix. The result indicates a few scores of higher than or equal to 0.8, thus reflecting lack of serious multicollinearity among variables. Thus coefficients computed were considered reliable.

Correlation and other Key Findings

The results of the correlation in AP.1 below indicate that the working capital or insolvency measure had weak negative correlation of -0.249 with dividend slack. Similarly for consumer price index at -0.1737. Another key finding is that the number of women on the board is negatively related to the loan to members and dividend slacks at -0.3934. 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 (Ferreira and Adams, 2009). High correlation of above 0.7 is observed significant considering environmental factors of GOKLB, INSP, and FLIB against predictors of age and number of women in this study. Capital adequacy is also negatively correlated to dependent variables of dividend slack in line with the expectation of the agency, financial intermediation and efficiency theories (Famma, 1980; Magali and Pastory, 2013). The correlation also indicates that there is a negative relationship between log of total assets (size measure) and the dividend output slacks or inefficiency at -0.5179. This finding ties well with prior study which found out an existence of positive relationship between the size of Saccos and efficiency (Mirie, 2014).

OLS Regression Correlation and Stochastic Frontier Analysis Results

The correlation between environmental factors (prime regressors) and specific predictor variables was tested for purpose of eliminating highly correlated prime regressor(s). The results indicated are mixed with only one significant variable of compliance with regulation having R^2 adjusted of 0.868. This lend to retention of all environmental predictor variables in the final model of this study.

This study finding also indicate that women on the board decrease results to increases in slack or inefficiency and the effect is strong for dividend indicator at 95% levels of confidence. The influence of macroeconomic variables to dependent variable of dividend slack without control variables was also strong similarly for all specific Sacco variables.

A predictor variable of Atech for instance had a strong positive effect on DIV slack with coefficient of 5.581752(p-value, 0.00). This result may be an indication of how increase in techno cost can act as an opportunity cost to loans issue to members while at the same time

denying them reasonable dividend payment. A similar and critical finding is also seen with the relationship between NPTA with DIV slack that is negative with coefficient of -70.1823(p-value 0.00). An indication that when DIV slack decreases, NPTA increases with respective unit magnitude holding other factors constant. This influence is in compliance with the efficiency theory, agency theory and financial institutions intermediation theory that states: efficiency is positively related to profitability and the opposite being true.

Dividend Output Slack to Predictor Variables: With Control Variables

Table 6 below utilizing 290 observations out of a total of 368, indicates that specific Saccos variables and environmental factors do not jointly affect the inefficiency of Saccos at confidence level of 95% and Wald chi square of 27.81 given weak Wald p-value of 0.114. The only significant specific Saccos variable that is negatively related to dividend output slack is clr, with a p-value of 0.011. All environmental variables have no significant influence on div slack except for goklb that is positively related to div slack with a p-value of 0.036. Therefore, H_{01} hypothesized that there exist no strong relationship between the Saccos' specific independent variables and div slack is rejected at 95% level of confidence while the second hypothesis (H_{02}) that there is no strong relationship between the Saccos' macro-economic variables and the inefficiency dependent variable div slack is also rejected at 95% level of confidence. Further, despite the weak Wald p-value of 0.114 and Gamma of 0.994841 that is next to value one; the hypothesis (H_{03}) that the Saccos operation is not influenced by management inefficiency effects as measured by Gamma (Y) is rejected. These positions apply when the control variables are not excluded.

Table 6. Time Varying Inefficiency Model-Regression of Dividend Output Slack to Predictor Variables: With Control Variables

Obs=290				**Wald** χ^2	**(20) =**	**27.81**
Log likelihood	-919.373			Prob> χ^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

Table 6...

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

Significance levels: 1%*, 5%** and 10%***

Dividend Output Slack to Predictor Variables: Without Control Variables

When the control variables are omitted as indicated in table 7 below, at 95% level of confidence the Wald p-value move from weak form as shown in table 6 to strong form at p-value of 0.00. Further, all variables become strongly significant while Gamma a management influence oriented as shown in table 7 reflect a random error dominant type since its value is very close to zero. Therefore like in the previous position of table 6 hypothesis (H_{01}) that there exist no strong relationship between the Saccos' specific independent variables and div slack is rejected at 99% level of confidence while the second hypothesis (H_{02}) that there is no strong relationship between the Saccos' macro-economic variables and the inefficiency dependent variable div slack is also rejected at 99% level of confidence.

Similar to previous case under table 6 above 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. The hypothesis (H_{03})that the Saccos' operation is not influenced by management inefficiency effects as measured by Gamma (Y) is accepted (Pascoe*et al*., 2003).

Table 7. 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> c hi^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	.			. .

Significance levels: 1%*, 5%** and 10%***

CONCLUSION

The general objective of this study was to establish the technical efficiency level, the macro-economic and specific Saccos variables determining the technical inefficiency and efficiency 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 specific Saccos' predictor variables and two control variables against dependent variable of dividend slack was 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 of 0.976 for the whole census of the study.

It was also found that specific variables significantly influence Saccos' inefficiency given dividend slack. The correlation coefficient of women on the board for instance given dividend slack was -0.393 at 95% level of confidence respectively which indicates 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 dividend slack given coefficient of -1.71133(p-value,0.00) at 99% level of confidence respectively. The relationship was negative. In addition, the influence of environmental factors of interest spread (insp) and consumer price index(cpi) are significant with coefficients of -715.274(p-value 0.00) at 99 % level of confidence and -166.038(p-value 0.00) at 99% level of confidence; without control variables, given dividend slack.

Another unique result to this study is that market power specific variable is negatively correlated to independent variable. Market power indicate a strong negative coefficient of -60.6857(p-value, 0.00); at 99% level of confidence given dividend output slack without control variables. This direction of influence is expected in an emerging Saccos sub-sector where competition is taking shape. For instance dividend payout will decrease where dominating Saccos emerge and start setting levels of dividend rate as they eat into the market of non-dominant Saccos. 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 dividend slacks. The result revealed that compliance had negative correlation of -0.3746 with dividend slack, this is in line with the expectation.

The study further indicates that capital adequacy had significant negative effect on the dividend slack without control variables which is as per the expectation while on the contrary the influence of capital adequacy with control variables positive and insignificant thus inconclusive. However, the correlation between capital adequacy and dividend slack variable was as expected negatively correlated.

Generally, this study indicates that Saccos specific, macro-economic and control variables given dividend slack variable are significant determinants of the technical inefficiency of Saccos in Kenya. Further, the inefficiency mean between the pre-regulation and regulation period was indicated by the study result that it was not different. The influence of management inefficiency was also high under dividend slack with control variables. This signifies that in the Saccos sub-sector- dividend is key item subject to management influence or even manipulation

and therefore its monitoring should be enhanced. The result therefore supports the intermediation, agency and efficiency theories.

Contribution to Theory

This study conclusion is in line with efficiency theory which states that inefficiency of decision making unit decreases as cost reduces 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 (or low management influence) are strongly determined by dividend slack without control variables presence as indicated by the levels of Gamma. Thus supporting the position that liquid asset is the most risky asset subject to misusing. Random errors in Sacco operating environment may include 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.

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, bond among others verses independent variables of inefficiency has bridged the gap in earlier similar study (Mirie, 2014) carried out in Kenya .

Contribution to Practice and Recommendations

It can be concluded that the identification of strong Saccos in efficiency 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 dividend slack with control variables is a key contributor in determining management inefficiencies as expressed by gamma factor, and variables of CLR and GOKLB. In the Saccos sub-sector the likely management inefficiencies may include factors such as shortage of employees and information technology equipment, and management incompetence. The study also concludes that large size Saccos exhibit less inefficiency characteristics and therefore the regulators should encourage merger of medium or small size Saccos in the economy. The result also indicates that computer expenditure (atech) strongly and positively influences dividend slack which agrees with a short run expectation in practice.

There is also another key finding which point to the direction of dividends being highly abused (earnings management possibility) given the significance of their slacks. Therefore,

there is a need for vigilant monitoring both internally and externally by the management and regulators respectively. Introduction of ratios or variables such as NPTA, MP, CA,FI and Atech in financial reports of Saccos and efficiency benchmarking using DEA and stochastic mechanism will go a long way in assisting the regulator monitor better.

Suggestions for Further Research

The identified limitation to this study is in the area of drilling down to specific 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 remained constant. Reasons as to why there is no change in inefficiency despite the regulators' interventions should also be explored in future research.

An example of a gap expected to be bridged was to determine the influence of environmental variables: consumer price index, financial liberalization and gross domestic product; in addition to the specific variables such as 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 and the square of age (age^2).

REFERENCES

Adams, R.B., & Ferreira, D. (2008). Women in the board room and their impact on governance and performance. Journal of Financial Economics Vol.94,pp.291-309.

Banker, R. D., Charnes, A., & Cooper, W. W.(1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. Management Science, 30(9),pp.1078-1092.

Battese, G.E,.& Coelli,T.J.(1995). A model for technical inefficiency effects in a stochastic frontier production function for panel data. Empirical Economics Vol.20,pp.325-332.

Beasley, J .E. (1996). Operation research notes: used at Imperial College.Http://people.brunel.ac.uk/-mastijb/jeb/or/dea.Htm:accessed on 10 February 2013.

Brealey, R.A., and Myers, S. C. (1981). Principles of Corporate Finance, McGraw-Hill Book Company, New York.

Brown, R. (2006). Mismanagement or mis-measurement? Pitfalls and protocols for DEA studies in financial services sector. European Journal of Research 174,pp.1100-1116.

Brown, R. & O'Connor, I. (1999). Efficiency- bond of association and exit patterns in credit unions: Austrialian evidence. Annals of Public and Co-operative Economics,70(1),5-23.

Coelli, T., Rao, P., & Battese, G. (1997). An introduction to efficiency and productivity analysis. Kluwer,Boston.

Coelli, T., Rao, P., O'Donnel, C.J, & Battese, G. (2005). An introduction to efficiency and productivity analysis, Spring Science and Business Media, New York .

COK.(2010). " The Constitution of Kenya," 4th Schedule.

Cooper, W.W., Seaford, L.M., & Tone.K. (2007). Data envelopment analysis: A Comprehensive Text Models Application References and DEA-Solver Software, 2nd Edition.

Cooper, W.W., Seaford, L.M., & Zhu,J. (2011). Data envelopment analysis: History, Models and Interpretations-Handbook on Data Envelopment Analysis. International series in Operations Research and Management Science, US:Springer, Vol.164,pp.1-39.

Emerson,S., and Wiren, K.,2005. Malawi Union of Savings and Credit Cooperatives,CGAP working group on micro insurance: good and bad practices, Case Study,8.

Evans, A.C. (2002). The unpaved road ahead: HIV/AIDS and microfinance. An explanation of Kenya credit unions (Saccos).Research Monograph Series,21, Winconsin,Woccu.

Famma. (1980). Agency problems and theory of the firms. Journal of Political Economy, 288-307.

Ferreira, D., & Adams, R.B. (2009). Women in the boardroom and their impact on governance and performance. Journal of Finance of Finance and Economics,Vol.94 (2),pp.291-309.

Gompers, P., Ishii, J., & Metrick, A.(2003). Corporate governance and equity prices. Quarterly Journal of Economics Vol.118,pp.107-155.

Higgs, D. (2003). Review of the role and effectiveness of non-executive directors. On-line: www.dti.gov.uk/cld/non- execs- review.

ILO.(2013).International Labor Organization. NATLEX records. http:/www.ilo.org/dyn/natlex browse?Pland=en&p country=KEN &p classisfication = 11&p origin=SUBJECT, accessed on 12 February 2013.

IMF.(2014). International Monetary Fund, World Economic Outlook Database, http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/weorept.aspx? accessed on November 4, 2014.

Johnson, S., & Nino-Zarazua M.(2008). A report prepared for the decentralized financial services project, Kenya and Financial Sector Deepening (FSD),Kenya. Centre for Development Studies, Univeristy of Bath.

Jondrow, J.,Lovell, C.A.K,Materov I.S, & Schmidt,P.(1982). "On estimation of technical inefficiency in the stochastic frontier production function model." Journal of Econometric Vol.19,pp233-238.

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

Karanja, J. N.(2013). The relationship between size and cost efficiency of Saccos with front office service activity in Kenya. Unpublished MSc. Finance Project, Univeristy of Nairobi.

Kivuvo, M.R & Olweny, T. (2014). Financial analysis of Kenya's Sacco sector using Altman Z- score model of corporate bankrupty. International Journal of Business and Social Sciences, JKUCAT University, Kenya.

Magali J.J. (2014). Variables for modelling Saccos in Tanzania.Asian Journal of Finance and Accounting, Vol.6,No.1.

Magali .J.J., & Pastory .D. (2013).Technical efficiency of rural savings and credits co-operatives in Tanzania. A DEA Approach.International Journal of Management Sciences and Busienss Research, Vol.2 (12),pp.49-61,

Marwa, N., & Aziakpono,M.(2015). Technical and scale efficiency of savings and credit cooperatives: Evidence from Tanzania, Univeristy of Stellenbosch Businsss school, South Africa. ERSA, Working Paper No.510.

Mirie, M.(2014).The influence of members' income and conduct of Saccos in the relationship between characteristics and efficiency of Saccos in Kenya. PhD Thesis presented at University of Nairobi.

MOCDM, (2013). Ministry of Cooperative Development and Marketing website, Kenya. Cooperative Marketing Strategy 2009-2013.

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

Njagi, G. M., Kimani, E. M., & Ngugi, N. N. (2013). The impact of front office Sacco activity on Sacco performance in Kenya; A case study of Meru South and Maara district in Tharaka Nithi County in Kenya. Global Advanced Research Journal of Management and Business Studies, Vol.2(5) pp.285-290.

Nyambere, F. K. (2013). Effect of credit risk management on financial performance of deposit taking savings and credit co-operative societies in Kenya.Unpublished MBA Project, University of Nairobi.

Ogebe, J.O, Ojah.P, & Alewi, K.(2013).The impact of capital structure on firm performance in Nigeria. St. Augustine College of Educations. MPRA Paper No.45986.

Okibo, B. & Karagu, J. M. (2014). Financial factors influencing performance of Savings and Credit Co-operative Organization in Kenya.International Journal of Academic Research in Accounting, Finance and Management Sciences, Vol.4(2),pp.295-206.

Olando, C.O., Jagongo, A., & Martin., (2012). Financial practice as a determinant of growth of savings and credit co-operative societies wealth.International Journal of Business and Social Science, Vol.3 (24).

Ozcan, Y.A. (2008). Health care benchmarking and performance evaluation. An Assessment using data envelopment analyis.HttP://.springer.com/978-0-387-75447-5, accessed on 17 February 2013.

Pascoe, S, Kirkley J.E., Greboral, D., & Paul, M.C.J.(2003). "FAO, measuring and assessing capacity in fisheries." FAO Fisheries Technical Paper No.433/2.

Petrie, R.(2002). Rwanda credit unions member and non-member survey. Woccu Inc. Research Monorgraph Series, 20.

SASRA.(2011). The Sacco Society Regulatory Authority, Kenya. Sacco Supervision Report for Deposit Taking Saccos, year 2011.

SASRA.(2013). The SASRA leaders' forum.http://sasra.go.ke/index.php/new-udated/speeches/55, accessed on 30 October, 2014.

SSA.(2008). Sacco Societies Act, 2008. Kenya Gazette No.14. Revised in 2012.http://www.kenyalwa.org, accessed on 18 February, 2015.

SSR.(2010). Sacco Societies Regulation,2010. Kenya Gazette Supplement No.39.http://sasra.go.ke/index.php/regulation/regulatory-framewok, accessed on 11 March, 2015.

Stata.(2015). Statistics/Data Analysis 14.1. Statacorp LP. http://www.stata.com

Tesfamariam, K., Tesfay, H., & Tesfay, A. (2013).Relative efficiency of rural saving and credit co-operatives: An application of Date Envelopment AnalyisIs.International Journal of Co-perative Studies Vol.2(1),pp.16-25.

Wanyama, F.O.(2009). Surviving liberalization: the cooperative movement in Kenya. ILO; The co-operative Facilty for Africa Working Paper,10.

Wanyama,F.O., Develtere, P., & Pollet, I.(2009). Reinventing the wheel? African co-operative in a liberalized economic environment. The Co-operative Facilities for Africa Working Paper 1.

Woccu.(2009). World Council of Credit Unions, 2009 Survey.www.woccu.org/functions/view document.php?id=2009, accessed on 10 February, 2013.

Zvi,G.(1998). Credit co-operatives and co-operative banks. Co-operative Dialogue, 8(1),pp.31-39.

APPENDICES

Table AP.1 :Predictor Variables Correlation Coefficient

	Correlation	Coefficient			
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	-0.5272
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	-0.3591	-0.342	-0.4779	-0.1026
insp	0.7793	-0.6754	-0.4788	-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	-0.5533	-0.5193	-0.3701	0.4086
fi	0.6583	0.7	0.9167	0.3833	0.414	-0.1667

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

insp	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: Researcher, (2015)

AP.2: Operational Definition of Terms

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 (Researcher, 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) (Pagano *et al*., 1997).

Credit and Savings Co-operatives: Saccos relying too much on external source of funds than share capital, reserves and member deposits (Researcher, 2015).

DEA: Data envelopment analysis

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 (FL): Measured by monetary aggregate (money supply or M3XT) to GDP (Researcher, 2015; Cooper *et al*., 2007).

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).

Heteroscedasticity: Sub-populations that have differing variability from others. Indicate absence of homoscedasticity-where modeling of errors are 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 (LP): Era of economic reforms specifically 1980s-1990s and after (Researcher, 2015).

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).

Post-Liberalization: After amendment of Co-operatives Act, 2004 (Researcher, 2015).

Pre-Regulation Period: 2010 and before SASRA time-from 2007 (Researcher, 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 (*one*) (Jondrow*et al*.,1982).

Regulation Period: During SASRA from 2011 and after - to 2014 (Researcher, 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.,* 2007).

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

Stochastic Frontier Analysis (SFA): 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 (ε_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).

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

Urban Areas: Local Authorities and/or Townships and Municipalities area**.**

AP.3: Transformation of Savings and Credit Co-operatives

Source: Adopted from Zvi, 1998.