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Leonard Rang'ala Lari, Dr. Lucy Jepchoge Rono and Prof. Philip Mulama Nyangweso

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DETERMINANTS OF TECHNICAL INEFFICIENCY OF SACCOS IN KENYA: LOAN OUTPUT SLACK ANALYSIS

[*1]LEONARD RANG'ALA LARI
Moi University, Kenya
* Corresponding Author's Email: lariran@yahoo.com
[2]Dr. LUCY JEPCHOGE RONO
Moi University, Kenya

[3]Prof. PHILIP MULAMA NYANGWESO
Moi University, Kenya

ABSTRACT

Purpose: The purpose of this study was to evaluate the determinants of technical inefficiency of Saccos in Kenya.

Methodology: The study adopted a descriptive research design. This study 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 explanatory research design was used. The financial reports data collected from a census of 46 Saccos was analyzed at two levels. First involves estimation of technical inefficiency by employing non-parametric DEA method and second concerned determination of inefficiency using parametric SFA. The log truncated panel data was used for a period of 8 years (2007-2014). 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.

Findings: The study concludes that all predictors jointly influence inefficiency and that are significant given loan to members' output slack (LM) or loan output inefficiency. Further, LM slack regression reflects significant random normal error as indicated by Gamma (1.45E-32), and DEA result indicated 0.024 mean inefficiency.

Contribution to theory, policy and practice: The regulators or board may not utilize the output loan slack regression to specifically measure the management inefficiency impact on Saccos' operation while the Saccos predictor variables have significant influence on inefficiency. In addition, the random normal error indicates the influence of agency theory in Saccos is insignificant as the role of management influence given loan slack is minimal. The introduction of variables such as NPTA, MP, FLIB, CA, FI and LP in the financial reports of Saccos and inefficiency benchmarking using DEA and stochastic mechanism are important in regulation.

Keywords: *Saccos in Kenya, Technical Inefficiency, Stochastic Frontier, Data Envelopment Analysis (DEA), Members' Loan Output Slack.*

1.1 BACKGROUND OF THE STUDY

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 societies' (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 X-inefficiency or efficiency? These questions can be well understood by assessing a possibility of difference in inefficiency over the two eras of pre-regulation and regulation. This study seeks to find out an answer to these questions through the use of variables of inefficiency assessment, non-parametric linear programming approach, and parametric measures of evaluating financial institutions' relative inefficiency and benchmarking.

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 & Olweny, 2014). This behavior 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. Thus the sector is key financial channel in fostering access to credit.

Studies have indicated that co-operative banks 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 then 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.

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 & 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 efficiency of co-operatives during the second era of economic liberalization (1980s up to 2004) was initially absolutely poor due to the government *modus operandi* (Wanyama, 2009). Since the start of the 2nd 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 (such as increase in loans, increase in membership levels of

delinquent loans, and growth in number of co-operatives) 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 & Olweny, 2014;Tessfamariam *et al*.,2013; Marwa and Aziakpono, 2015; and Mirie,2014).

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).

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). 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.

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 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). These changes are aimed at enhancing efficiency. However, despite the existence of the prudential regulations, the deposit taking Saccos have continued to reveal mixed levels of management practices (SASRA, 2013). In addition, 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. This research therefore attempts to answer the question.

1.11 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. However, the regulator of deposit taking Saccos in Kenya advocates for the adoption of Camels Prudential Reporting Standards (Olweny & 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.

1.2 Statement of the Problem

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 and inefficiency understanding becomes necessary to ensure the stability of Saccos' sub-sector and guaranteed efficiency. This study is also an addition to ongoing inefficiency of Saccos' research in the Kenyan context.

A few past researchers in Kenya have studied Saccos without utilizing SFA and identifying benchmark Saccos , they based on 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, it 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.

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 & 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. The study like Mirie, (2014) in Kenya also suggested future study in the area of Saccos' technical efficiency using the SFA.

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 stars 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? These facts 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.

1.3 THE GENERAL OBJECTIVE

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.

1.4 THE SPECIFIC OBJECTIVES

The specific objectives of this study are as follows:

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

1.5 RESEARCH HYPOTHESES

The study also tests the hypotheses that:

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

2. H_{02}: There is no strong relationship between the Saccos' macro-economic variables and loan output inefficiency dependent variable.
3. H_{03}: There is no strong relationship between the Saccos' specific independent variables and loan output inefficiency dependent variable.
4. H_{04}: Pre-regulation and regulation eras have the same population of inefficiency mean scores.

2.1 THE CONCEPT OF TECHNICAL INEFFICIENCY

The conceptual framework model in figure 1 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 Saccos variance regressors and prime regressors. However, where a high correlation was discovered, such specific independent variable (prime regressor) was removed from the 2nd or final stage regression process. The estimation was actually internalized within the Stata14.1 software. Further, prime regressors are also assumed to be measurement errors free (Cooper *et al*., 2007).

3.1 RESEARCH METHODOLOGY

3.1.1 Design: This explanatory study used a balanced panel data. The explanatory study research design was employed in soliciting for secondary information from the audited annual reports and websites of the regulators on determinants of Saccos' inefficiency in Kenya. This study utilized a second stage data envelopment analysis by 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 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.

3.1.2 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 & Coelli,1995).

3.2 DEA RESULT

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 3.1. 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 percentage of technical efficiency 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. Majority of these Saccos exhibited constant returns to scale.

3.3 OUTPUT DESCRIPTION

Table 3.2 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. As reflected in the table 3.2 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 outputs.

3.4 DESCRIPTIVE STATISTICS

The descriptive statistics in table 3.3 presents specific variables that determine the inefficiency of Saccos in Kenya. As reflected in the table 3.3, 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). The average women on the board stood at 20 % with standard deviation of 12%.This is a low number and has little influence on Saccos' inefficiency (Higgs, 2003).

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. 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.

3.5 OPERATIONALIZATION OF THE STUDY VARIABLES

The study measurements used to operationalize the study specific variables are as indicated in table 3.4.

3.6 MODEL TESTING AND RANDOM EFFECTS ESTIMATION

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

3.6.1 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 3.5 which indicates that only two variables reflected p-values greater than 0.05 thus a possibility of heteroscedasticity. The data used also underwent natural logarithm transformation.

3.6.2 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. A second non observational method was utilized in testing for multicollinearity that is, variation inflation factor and the result for each dependent variable is as indicated in table 3.5a. This result indicates LM slacks regressed against all independent variables confirm nonexistence of multicollinearity. Studies have also indicated that a VIF above 20 is the one that should be categorized as challenging (Greene, 2012). Therefore goklb despite being 20.08 is deemed non problematic. Also a mean VIF of around 4 is not problematic (Stata, 2015).

3.6.3 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 is as indicated in table 3.5b. The result indicates that the unobserved random effect $\delta\mu = 0$ .495665 greater than δ_{error} = .0339501, suggesting that large portion total error variance is as a result of $U_{rjt,}$ idiosyncratic error. Therefore the fixed effects model and random effects model in the panel data are different and random effects model is preferred (that is, reject H_0). Meaning the OLS would give inconsistent result (Stata, 2015).

4.1 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 -0.4108 with LM slack. Similarly, for women on the board at -0.4917. This correlation is in compliance to a prior study which postulate that higher number of women on the board decreases inefficiency depending on the type of industry (Ferreira and Adams, 2009). Capital adequacy is also negatively correlated (-0.2739) to dependent variables of LM 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 LM output slack (or inefficiency) at -0.5477. This finding ties well with prior study which found out an existence of positive relationship between the size of Saccos and efficiency (Mirie, 2014).

4.1.1 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 as shown in table 3.5c. This lend to retention of all environmental predictor variables in the final model of this study.

This study finding also indicates that women on the board decrease results to increases in LM inefficiency. The influence of macroeconomic variables to dependent variable of LM slack with control variables is also significant.

A predictor variable of capital adequacy for instance had a strong negative effect on LM slack with coefficient of -1.43531 (p-value, 0.00). This result may be an indication of inefficient holding of excess funds available for dividends instead of toward a core objective of loan payment to Sacco members. A similar finding is seen with the relationship between loan provision with LM slack that is positive with coefficient of 0.059441(p-value 0.00). An indication that when LM slack increases, loan provision increases with respective unit magnitude holding other factors constant.

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

Table 3.6 utilizing 191 observations out of a total of 368, with Wald Chi square p-value of 0.00 indicates that specific Saccos' variables and environmental factors do jointly affect the inefficiency of Saccos at confidence level of 99%. The Gamma is not far away from zero. Therefore, hypothesis H_{01} is accepted, H_{02} is rejected while H_{03} is also rejected all at 99% level of confidence. The result indicates all predictors have strong influence except for the magnitude of coefficients.

Table 3.6 reflect log likelihood of 0.00 and its variances (u^2) is approaching zero thus this result prohibit need to conduct likelihood ratio test. The mean of truncated-normal distribution (m_u) value is 188.26 which is 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 the control variables except for the respective magnitudes (Famma, 1980;Magari 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. However, the influence of control variables on loan to members' slack variable is minimal.

5.0 CONCLUSIONS AND RECOMENDATIONS

5.1 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' predictors and two control variables against dependent variable of LM slack were evaluated. The dependent variable slacks were determined using data envelopment analysis model in Stata14.1. It was found that 13 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 both environmental and specific variables influence Saccos' inefficiency given LM slack at 99% level of confidence. A unique result to this study is that FI specific variable is negatively correlated to independent variable. FI indicate a strong negative coefficient of -0.52616 (p-value, 0.00); at 99% level of confidence given LM output slack with control variables. This direction of influence is not expected in an emerging sub-sector where investments are regulated and pegged at a certain percentage point while, the loaning to members is a core objective of all Saccos existence in Kenya.

The study further indicates that capital adequacy had significant positive effect on the LM slack with control variables, which is as per the expectation since high incidence of cash reserves increases LM inefficiency. However, the correlation between capital adequacy and LM slack variable was not as expected at -0.2739 (negatively correlated) at 95% level of confidence.

Generally, this study indicates that Saccos' specific and environmental variables given LM slack variable with control variables are significant determinants of the technical inefficiency of Saccos in Kenya, although at an aggregate loan to members' slack is not a good determinant of management inefficiency. Further, the inefficiency mean between the pre-regulation and regulation period was indicated by the study result that it was not different. Thus accepting H_{04} against the agency theory as improvement due to experts hired was expected.

5.2 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 LM slack with control variables is a key contributor in determining non-management inefficiencies as expressed by gamma factor. The study also concludes that large size Saccos exhibit less inefficiency characteristics and therefore the regulators should encourage merger of small or medium size Saccos in the economy. The result also indicates that financial investments strongly and negatively influences LM slack, which agrees with a short run expectation in practice, although Saccos have a core objective of issuing loans to members in both short and long run.

Introduction of variables such as NPTA, CA, FI and LP in the financial reports of Saccos and efficiency benchmarking using DEA and stochastic mechanism are important in regulation.

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Table 3.1 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: Researcher, (2015).

Table 3.2Descriptive Statistics of Predictor Variables

Descriptive Statistics of Predictor Variables

Variables	CA	Bond	NPTA	MP	W	MS	LP	GOKLB
Mean	0.21	5.33	0.22	0.02	0.20	21245	0.03	2.72
Standard Deviation	0.15	10.78	0.02	0.04	0.12	36063	0.09	1.37
Observations	368	368	368	368	368	368	368	368

Source: Researcher, (2015)

Table 3.3: 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: Researcher, (2015)

Table 3.4 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 > c	hi^{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: Researcher, (2015). Significance levels: 1%*, 5% and 10%***.**

APPENDIXES:

Table 3.5: 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)