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Influence of Capital Prudential Requirement on Technical Efficiency of Deposit Taking SACCOs in Kenya

Moses Biwott
Ph.D. Student, School of Business,
Jomo-kenyatta University of Agriculture, Science & Technology, Kenya
Willy Muturi
Senior Lecturer, Department of Economics, Finance & Accounting,
Jomo-kenyatta University of Agriculture, Science & Technology, Kenya
Dr. Irungu Macharia
Lecturer, School of Business,
Jomo-kenyatta University of Agriculture, Science & Technology, Kenya

Abstract:
The objective of introducing a regulatory framework for the Deposit Taking SACCOs in Kenya was to not only protect members deposits, but was also intended to promote efficiency and performance. The period upon which all DTS were expected to have achieved full compliance lapsed in 2016. The extent to which the regulatory framework and specifically the regulation of capital has achieved its initial goals remains unassed. The purpose of this study was to assess the influence of capital adequacy requirements on technical efficiency of DTS in Kenya. Data on selected inputs and outputs from 95 DTS were used in estimating their technical efficiencies based on data Envelopment Analysis (DEA). In the second stage, A fixed effect regression model was used to determine the influence of DTS compliance on capital adequacy ratio on the resulting bias corrected technical efficiencies. From our findings, it was evident that compliance with the set capital adequacy ratios by DTS was efficiency disenhancing and is negatively influencing allocative decisions of DTS managers. The study recommends for a review of the existing capital ratio with a view of establishing an optimal capital structure that facilitates better efficiency among the DTS in Kenya.

Keywords: *Capital adequacy, technical efficiency, Data Envelopment Analysis (DEA), deposit taking SACCOs*

1. Background of Study

The growth of the cooperative movement in the 21st centuary has herald a new frontier in the economic transformation of households and communities across the globe. Globally, the magnitude of the growth remains unparalleled with over 68,000 Credit Unions (SACCOs), spread across 109 countries and 6 continents. The movement boasts of a combined savings of over $ 1.5 trillion (US dollars) and an asset base of over $ 1.8 trillion (US dollars) out of which more than $ 1.2 trillion (US dollars) constituted an active loan portfolio by the close of 2016. The SACCO concept might not have gained much prominence in the developed world, but in third world countries and especially in sub Saharan Africa, SACCOs have emerged as among the leading drivers of national economic growth and household empowerment. In the last two decades alone, the SACCO movement in Sub-Sahara Africa has seen unprecedented growth in popularity, membership, asset holding and outreach, providing financial services to close to 10% the population in Sub-Sahara Africa. Despite these positive achievements in popularity and outreach, their performance especially in sub Saharan Africa remains below par. Evidence of inadequate technical and management skills, low capitalization, dependence on government subsidies, low net worth of its members and inability to meet members' financial demands are evident (Chibanda et al (2009), Seleke and Lekorwe (2010), Ademba, (2010)).

The Kenyan Cooperative sector is ranked among the best performers in Africa and in the world with a total of 4.2billion USD in saving & shares, 5.177 billion USD in loans, 6.324 billion USD in assets and 13.28% penetration(WOCCU, 2016). Since its emergence as a definitive financial arm in the economy, the sector has continued to play a significant role in the wider financial sector making it among the center of most economic policies (SASRA, 2014). The sector is structured on a two-tier system: The traditional Savings and Credit Cooperative Societies, currently categorized as Non-Deposit Taking Saccos, licensed to provide a limited range of savings and credit products to its shareholding members only, and are supervised under the Cooperative Services Act, Cap 490. The second tier consists of Deposit Taking SACCOs (DTS) who, besides the basic savings and credit products, also provide basic 'banking' services including demand deposits, payment services and channels such as quasi banking services commonly known as ATMs and Front Office Service Activity (FOSA). This category are supervised under the SACCO Societies Act of, 2008 (SASRA, 2013).

The original legal framework for regulating SACCOs' in Kenya was provided by the Co-operative Societies Act of 1966 that gave government powers to be involved in the day to day management of co-operatives. The act was amended in 1997 removing much of the control of the government initially vested on Commissioner of Cooperatives under the Co-operative Societies Act 1966. With the push for liberation of the financial sector in the 1990s, a new act was necessary leading to the enactment of the current SACCOS act 2008. The new act was intended to provide a policy framework for cooperative development in Kenya by delineating cooperatives from the control of the government who was expected subsequently to assume a supervisory role (Republic of Kenya, 1997). The objective was to make co-operative societies autonomous, self-reliant, self-controlled and commercially viable institutions. From this act, the initial role of the government was redefined from being a control orientation, to one that sought to regulate and facilitate their autonomy. Consequently, the freeing up SACCOs from government control saw unprecedented growth in the sector leading to a strong influence on the mainstream financial systems and the economic fundamental indicators such an interest rate and inflation levels (Carilus, 2011).

The rapid growth and influence of the sub sector on the financial and monetary systems from early to mid-2000's, called for a new way for monitoring and controlling their operations. The sector's unique operating principles could not be effectively covered by the mainstream commercial banking regulatory framework and hence the drafting of a SACCO Specific legislation leading to the enactment of the SACCO Societies Act (2008). The SACCO Societies Regulatory Authority (SASRA), a creation of the Act, was constituted and inaugurated in 2009 with the prime responsibility of licensing, supervising and regulating all deposit taking SACCO Societies in Kenya (SASRA, 2011). The reform process in the sector was centered on two objectives; protecting the interests of SACCO members and building confidence among the public towards the sector as a means of spurring countries' economic growth through the mobilization of domestic savings (Carilus, 2011).

With the enactment of the act, all operating DTSs in Kenya were required to review and align their policies and systems in line with the new regulatory standards demanding prudence in the management of business risks attendant to them namely credit, operational, market and legal (SASRA, 2012). With its implementation, radical changes on the core operational and financial elements relating to capital, investments, assets and liquidity were to be realigned in conformity with the new standards and operational benchmarks set by SASRA (Mbogo, 2010). As a result, DTSs was forced to carry out drastic changes in liquidity management strategies, realign their capital structure, reorganize their asset portfolio, restructure their debt/loan management and upgrade their operating system. With this came increased operating costs, opening up SACCO membership to previously excluded groups, increased risk exposure, disposal of previously considered core assets and elaborate reporting, all of which has a direct bearing on different areas of their performance.

The capping of interest rates on both loans and deposits of commercial banks by the coming into force of the Banking amendment Act 2016 in Kenya, potent a key challenge for most DTS going forward. Decline in interest rates on credit facilities offered by commercial banks, a key source of funding to majority of DTS, potent access to low cost capital for financial their operations. On the other hand, increased interest on deposits by commercial banks raises competition for deposits, a position that is likely to reverse the DTSability to attract deposits from the public.Between 2013 and 2016,the average core capital to total assets ratio has increased from 7.74% to 12.17%, suppressing the recommended minimum of 8% (SASRA 2016). This points towards unfavourable trend in performance putting the Multibillion shilling sector at risk. A study by Ochola (2016b) reveals an even worsening efficiency levels with only 24% DTS in Kenya attaining over 80% technical efficiency in 2013 down from 46% in 2011. The average technical efficiency declining from an average of 81% in 2011 to 51% in 2013 are just but a few of the existing empirical evidence indicating turbulence in the sector.

The implementation period upon which all DTS should have attained full compliance lapsed in June 2014, four years later, the effects of compliance to the stringent capital requirements on their inherent efficiency still remains un-assessed. Many questions still abound on whether the intention of regulating capital as a means to improved improve efficiency has been achieved. Existing scholarly works have consistently focused on the banking sector, and where SACCOs are examined as noted by Kivuvo & Olweny (2014) and Otieno et al (2013) they are limited to establishing the institutions' levels of efficiency with little or no effort to explain the underlying determinants. The absence of insight into the influence of the current DTS capital regulatory requirements on the performance of such a key sector in the economy will mean a continued operation of the DTSs in a regulatory framework whose effects remains uncertain and in a performance trajectory whose end results and outcomes are not known.

The purpose of this paper is to provide empirical evidence on the influence of capital adequacy requirements on efficiency of deposit taking Cooperatives Societies in Kenya. This paper makes two significant contributions; First, by adopting a different approach to measuring performance. The assessment of performance of SACCOs and financial institutions in general have greatly relied on financial ratios, in this paper we explored the underlying financial performance from an al locative efficiency perspective through the use of Data Envelopment Analysis (DEA). Compared to financial ratios, DEA efficiency score provides a multifactor and a significantly robust measure of performance (Feroz et al., 2008; Hsiao et al., 2010). Secondly, we reveal the influence of capital restriction on the allocative decisions on SACCO as a decision making unit that has remained unexplored despite the continued implementation of a regulatory framework in a sector that plays significant in the Kenyan financial sector.

2. Literature Review

2.1. The Capital Structure Theory and Capital Regulation

Linking the restriction that comes with the use of regulatory ratios to resource allocation decisions in a SACCO context can be limiting due to their unique operating model. The Trade-off theory provides a close frame work on which we can explain the relationship between firm's capital and managerial al locative decisions and a basis on which optimal debt financing as part of the overall capital can be justified. The classical version of the theory is based on a call for firms to maintain a balance between the tax saving benefit of debt and the dead weight cost of bankruptcy. It recognizes that the marginal benefit of using additional debt capital increases at a decreasing rate to an optimum level where decrease will set in. In such a context, for a firm to optimize its cost of capital, it must strike a balance between the levels of equity and debt in its capital (Bradley et al (1984).The empirical relevance of the trade-off theory has been a subject of intense debate. One such argument is found in Miller (1977) as quoted in Murray & Vidhan (2011) questioning whether it is justifiable to compare tax and bankruptcy cost. He argues that taxes are large and must be paid while bankruptcy cost is avoidable given prudent management. Accordingly, he challenges the deviation of the theory's recommendation from the reality, suggesting that firms ought to have much higher debt levels than we observe in reality. Despite this criticism, the trade-off theory remains the most preferred theory by scholars in explaining the firm's capital structure.

Ordinarily, it is expected that SACCOs, in their quest to lower their cost of capital, would seek to leverage by borrowing to a limit that is dependent on the management's risk attitude. Viewed from the agency theory perspective, the management and board of DTS would be expected to act in a manner that promotes their interest by taking on more risks through acquiring more debt than risk tolerance levels of the shareholders. Seen from a static trade-off theory point of view, firms with a greater exposure to financial distress risks tend to borrow less than firms with a strong asset base. Moreover, financial distress costs are not the same for all firm due to their unique asset strength and the flexibility in which asset ownership can be transferred. The choice of limiting the capital levels rests on the premise that unless managers are restrained, their appetite for debt will be unlimited consequently increasing the chances and cost of bankruptcy. In the current context, if DTS managers are not restrained through a regulatory framework putting caps on capital levels, they will likely incur more debt, or more so maintain optimal capital structure.

The concern for adequacy of capital in financial institution rests in its critical role of providing a cushion to fluctuations in earnings so that firms can continue to operate in periods of unfavorable earnings. Maintaining adequate capital is not only a strategic decision for growth, but also as a protection against insolvency. According to Chortare as et al. (2011), a two pronged justification for the need for firms to maintain adequate capital exists: First, higher capital levels have a potential of reducing the probability of bankruptcy. Secondly, by the fact that equity does not bear interest payments, a higher proportion of equity lowers business risks. However, Altunb as et al (2007), cautions that any justification of regulating capital based on the relationship between capital and credit risk needs to take account of firm's efficiency, a consequence of the tradeoffs between the two approaches.

The link between capital adequacy and firm's efficiency continues to be a key area of interest in research with mixed outcomes. Regulating financial institutions through stringent capital requirements have been found to improve efficiency, lower both capital and asset risk, reduce non-performing loans and minimize exposure to liquidity risk (Chortareas et al (2011). He however, cautions on generalization of the relationship. In his study a positive correlation between capital requirements and efficiency was found to hold in developing countries, while an inverse correlation was found in developing countries. Excessive government interference in developing countries, leading to inefficient credit allocation, increased barriers to entry and reduced incentive to improve on operating efficiency was postulated as the root cause (Chortareas et al, 2011).

Existing empirical evidence on the relationship between capital adequacy and efficiency of financial institutions is dominated by those carried out in commercial banking. A study carried out in Odunga et al (2013) found that Capital adequacy measures alone had no effect on operation efficiency of banks in Kenya and warns that regulatory agencies should not concentrate on capital adequacy alone but should integrate all aspects of a firm's operations if significant improvements in efficiency are to be achieved. Amer et al. (2011) in their study of determinants of operating efficiency for lowly and highly competitive banks in Egypt found out that operating efficiency is positively affected by the capital adequacy of banks. In concurrence with this finding, Nyamsogoro, (2010) found out that capital structure affects efficiency and sustainability of SACCO in rural Tanzania. In a regulatory context, Ketkar and Ketkar (2008) found out that the efficiency scores of all banks in India, in general, improved regardless of their ownership during a reform period and the introduction of a regulatory framework. Das and Ghosh (2006) while exploring the association between capital adequacy and bank's efficiency noted that there was a strong positive correlation based on the justification that adequately capitalized banks were more likely to report higher profitability, attract more customers, create more deposits, have higher lending and are more efficient in their intermediation activities. Similarly, Pasiouras (2007) reports a positive association between technical efficiency and capital requirements with a caveat that it may not be statistically significant in all cases.

In a regulated framework, efficiency among commercial banks, MFI and SACCOs continues to post mixed results across the globe. Hassan & Sanchez, (2009) in their investigation of technical efficiency and scale efficiency of MFI in Latin America, Middle East and North Africa and South Asia countries found out that technical efficiency was higher in formal and regulated MFIs than those not subject to any form of regulation. In India, Jaffry et al. (2007) found strong evidence to support a conclusion that technical efficiency increased and converged across the Indian subcontinent in response to introduction of reforms and regulation. Pasiouras (2008) while investigating the impact of several regulations on banks'

technical efficiency in 615 publicly quoted commercial banks operating in 74 countries across the globe during the period 2000-2004 provides evidence based on Basel II that strict capital adequacy, powerful supervision and market discipline power promote technical efficiency. To the contrary Berger et al., (2008) based on the same pillars of Basel II regulations finds that heavier capital requirements, powerful supervisions by monetary authorities, excessive private monitoring and regulatory restrictions on bank activities are associated with greater banking system inefficiency.

Within the African continent, mixed finding remains evident. Cihak and Hesse (2007), in their study on East African banking sector reforms, found that the banking systems of Kenya, Tanzania, and Uganda were inefficient despite the introduction of the regulatory reforms. Kablan (2010) while investigating regulation and efficiency of banks in sub Saharan Africa found out that better regulation aiming at improving the quality of the bank credit environment, encouraging law enforcement and better information had a significant positive effect on bank efficiency. Despite being the frontier in SACCO growth in Africa, research examining the link between efficiency and capital regulation across East Africa remains nonexistent.

2.2. SACCO Regulation

The introduction of the prudential capital adequacy regulation in Kenya was driven by the need to safeguard the interest of depositors and shareholders through minimizing the credit and liquidity risks among DTS. Statutory minimum levels were set for four key capital measures and ratios: a Minimum of 10 Million shillings in core capital, a 10% minimum for Core capital/total assets ratio, a minimum of 8% for both Institutional capital/Total assets and Core capital/total deposit ratios (SASRA, 2010). According to SASRA (2013), by the close of the 2013 financial year, DTS in Kenya had a combined core capital of 2.28 million USD against a required 0.12 Million USD. The ratio of core capital to total assets stood at 15% compared to the required 10%, while core capital to total deposit liabilities stood at 17% against the prudential minimum of 8%. If the prudential capital ratios are taken as the most optimal levels then, SACCOs in Kenya are over capitalized.

As set out by SASRA the SACCCO regulating agency in Kenya, core capital represents the sum of; share capital, statutory reserves, retained earnings/accumulated losses, the net surplus after tax, capital grants (Equity in nature), general reserves (include all loss) and other reserves, less deductions, investments in subsidiary and equity instruments of other Institutions, and other deductions. Total deposits was measured as the sum of deposits from members, including interest and deposits from all other sources including interest. The core capital to total deposit requirements has a potential of impeding the ability of the DTS to aggressively pursue a savings mobilization strategy. Once the minimum 8% threshold has been achieved, it becomes imperative that any additional savings must be accompanied by an equivalent proportionate increase in the levels of core capital if the DTS is to remain in compliance. The prudential regulations places stringent capital requirements, placing a cap of a minimum 10 million core capital amount, a 10% minimum ratio of core capital to total assets, a minimum of 8% of institutional capital to total assets, and a similar ratio of core capital to total deposits (SASRA, 2013). Due to its restrictive nature to the fulfillment of the DTS intermediation role, the requirement on core capital to total deposit was used as an independent variable.

It is important to recognize that, SACCOs differ from the conventional banking calling for a careful consideration in modeling their efficiency. Unlike commercial banks, SACCO's economic objective is to maximize the members' welfare/benefits who are also users of their service(s) and hence they take up a dual role of producer co-operative when accepting savings from the members, and as consumer co-operative when providing loans to the members (Marwa & Aziakpono, 2015). In their current state DTS as currently modelled in Kenya, are both producer and consular cooperatives allowed to receive deposits and issue loans to both members and nonmembers (SASRA, 2010).

2.3. Efficiency Measurement

While there is a strong case to support the use of traditional financial measures in analysis such as profitability, financial Ratios and Return on Investments (ROI) in evaluation MFIs and SACCO's performance, they suffers from a number of limitations. Ho and Zhu (2004), argues that traditional approaches have failed in estimating the true firm performance and efficiency because of; (1) their univariate nature which limits the sphere of assessing firm performance, (2) they present a single unit that cannot capture the complete picture of performance of an entire organization over the breadth of its activities, (3) lacks objective standard for selecting a measure that would satisfy the needs of all users) and (4) they can only be used when a firms manages a single input to generate a single output.

The introduction of Frontier analysis by Aigner et al (1977) has revolutionized the efficiency analysis by overcoming key limitations associated with the traditional approaches. Its superiority lies in the usage of the programming or the statistical techniques in obtaining better estimates of the underlying performance of DMUs while removing the effects of the input price differences and other exogenous market factors affecting the standard performance ratios (Mousa, 2015). Data Envelopment Analysis (DEA), introduced by Charnes, Cooper, and Rhodes (1978) is one of the non-parametric mathematical programming technique that measures the efficiency of a Decision Making Unit (DMU) relative to other similar DMUs with a simple restriction that all DMUs lie on or below the efficiency frontier, remains the most widely and extensively application in evaluating efficiency in financial institutions (Greene, 2008 & Mousa, 2015).

The choice of efficiency in measurement of performance has received prominence among scholars in the recent past due its ability to be decomposed in to different variations, each capturing a specific performance dimension. Technical efficiency, pure technical efficiency, scale efficiency, profit efficiency, cost efficiency, revenue efficiency, economic efficiency, and allocative efficiency remains to be the most preferred among scholars (Coelli et al., 2005). The type of efficiency adopted is predominantly influenced by the objectives of the study, availability and quality of available data

(Magalia & Pastory, 2013). In financial institutions, efficiency is decomposed into three components: Technical Efficiency (TE) assessing the overall efficiency in resources transformation; Scale Efficiency (SE) capturing the optimal scale of operation and Pure Technical Efficiency (PTE) that examines the managerial effectiveness of the decision making unit (DMU).

According to Marwa & Aziakpono (2015), Technical efficiency estimates the ratio of the distance between a selected reference to the Constant Returns to Scale (CRS) frontier and an inefficient firm's distance from the same frontier. This means that a firm is technically efficient if an increase in an output requires a reduction in at least one other output or an increase in at least one input, and if a reduction in any input requires an increase in at least one other input or a reduction in at least one output (Marwa & Aziakpono, 2015). There are two main approaches in determination of Technical efficiency: (1) The Input approach examining the ability to avoid waste by generating output as much as input usage allows, that is, the ability to minimize inputs keeping outputs fixed and (2), the Output approach where the ability to avoid waste by using as little input as output production allows, in a nutshell, the ability to maximize outputs keeping inputs fixedis considered. Morita & Avkiran (2009), notes that the resulting efficiency score are directly affected by the input and output variables used, a call for caution in the selection process. Not only should the selected inputs and outputs directly express the core performance of DMUs, but also be founded on a particular theory, expert knowledge or accepted practices that are empirically sound. Additionally, Coelli et al.,(2005) cautions that the choice of orientation must be made taking into consideration the nature and quantity of inputs and outputs based on manager's control domain.

3. Research Methodology

3.1. Sample Selection

A descriptive design was adopted for this study considering that efficiency analysis has to be an after effect with no researchers' interventions or influence in its determination. As a unit of our analysis, SACCOs licensed to offer services in Kenya and were in operation at the beginning of 2011 a time when SACCO regulations came into force and remained in operation up to the end of 2016 were included. Going by this criteria, data form 109 SACCOs were available for analysis.

3.2. Measurement of the Dependent and Testing Variables

In analyzing the influence of capital regulation on efficiency of DTSs, a two stage analysis process was adopted. In the first stage, efficiency score was estimated using DEA based on a set of three inputs and two outputs and corrected for estimation bias as recorded by Casu and Molyneux (2003). In the second stage, a fixed effect regression analysis was used to explore the influence of complying with capital adequacy ratio on biased corrected efficiency scores.

3.2.1. Measurement of Efficiency

Assuming that the number of DTS in the sample are s and each DTS uses m inputs and produces n outputs. If $DTS_k$is assumed tobe one of s DTS, $1 \le k \le s$ and taking m inputs which are marked with $X^k{}_i$(i = 1… m), and n outputs marked with $Y^k{}_j$ (j = 1… n). Taking efficiency the ratio of total outputs divided by total inputs, the efficiency of $DTS_k$was computed as:

$$\text{Efficiency of } DTS_k = \frac{\sum_{j=1}^{n} u_j Y_j^k}{\sum_{i=1}^{m} v_i X_i^k} \quad \text{.....(1)}$$

$X_i^k, Y_j^k \ge 0$, i = 1,..., m, j = 1,....n, k = 1,...,s

$u_j, V_i \ge 0$, i =1,..., m, j = 1,....n

Where V_i, $U_j$are virtual multipliers (weights) for the i th input and the j th output. When the CCR model is considered, constant returns to scale (CRS) are assumed to apply; meaning that one unit of input delivers a fixed value of output. The BCC model on the other hand, assumes variable returns to scale (VRS). In this study, the CCR dual model for estimating Overall Technical Efficiency (OTE) takes the following form;

Minimize

$$\theta - \varepsilon\left[\sum_{i=1}^{m} S_i^- + \sum_{k=1}^{n} S_j^+\right] \quad \text{..... (2)}$$

Subject to:

$$\sum_{i=1}^{s} \lambda_r X_i^r \_ \theta X_i^k + S_i^- = 0 \qquad i = 1, \dots, m$$

$$\sum_{i=1}^{s} \lambda_r Y_j^r - S_i^+ = Y_j^r \qquad j = 1, \dots, n$$

$$\lambda_r \ge 0 \quad r = 1,\dots, s$$

$$S_i^- \ge 0 \quad i = 1,\dots, m$$

$$S_j^+ \ge 0 \quad j = 1,\dots, n$$

Where

θ = Efficiency of DTS

Si^- = A slack variable representing the input excess value

Sj^+ = Surplus variable representing the output shortfall value
ε = A non-Archimedean number representing a very small constant
λ_r = Proportion of referencing DTS $_r$when measuring the efficiency of DTS_k
To estimate the efficiencies under VRS, the CCR dual model above was subjected to the following additional constraint;

$$\sum_{r=1}^{s} \lambda_r = 1 \quad \text{..... (3)}$$

The above constraint frees the CCR model from a CRS assumption and introduces a VRS orientation to the efficiency estimation. Efficiency scores obtained from CCR model represents the overall technical efficiency (OTE) scores and are confounded by scale efficiencies while those that are obtained from the BCC model are pure technical efficiency (PTE) scores and devoid of scale efficiency effects. Consequently, Scale efficiency (SE) for each DMU was determined by a ratio of OTE score to PTE score.

Based on an input-output suitability test, Total Deposits, Core Capital and Labour Cost were selected as inputs while Total Loans and Financial Investments were used as outputs in the efficiency estimation. It is important to recognize that DEA efficiency score are relative efficiency index and violates the independence within the sample assumption required by regression analysis. To overcome this limitation, bias corrected technical efficiency scores were generated based on a bootstrapping technique advocated by Simar and Wilson (1998). The entire efficiency estimation process was done using the Benchmarking package embedded in R software.

In the second phase, fixed effect regression model were fitted using the bias corrected efficiency estimates obtained from DEA as the dependent variable and the compliance status on prudential requirements indicators as independent variable as modelled in equation (4):

$$\theta_{it} = \beta o + \beta_1 X_{1it} + \varepsilon_{it} \quad \text{.....(4)}$$

Where i = 1,2, ...,95, and t = 1,2,3,4,5,6

Where:

θ_{it} = Bias Corrected Technical efficiency scores of DTS i at time t
β_i = Coefficients to be estimated
X_{1it} = Capital requirement Compliance of DTS i at time t
ε_{it} = Error Term

4. Discussion

4.1. Response Rate

Out of 110 SACCOs that were fully licensed and were fully in operation at the beginning of the acts implementation in 2011, One (1) DTS lost its FOSA operating license in 2015, Eight (8) SACCOs were found to have incomplete financial records while financial statements for another six (6) DTSs were in accessible during the data collection period due to annual inspection, leaving only 95 SACCOs available for analysis, constituting 87.2% response rate.

4.2. Descriptive Statistics for Inputs & Outputs

The choice of orientation and the selection of suitable inputs and outputs in efficiency analysis is of significant importance.

Different sectors operate under unique input out framework upon which the selection of inputs and outputs must be considered. In financial institutions, deposits, capital, labour and managerial efforts are the primary inputs while loans, investments, interest incomes and members are closely identified as outputs. Despite SACCOs being membership organization intended solely to service its members, the liberation of the Deposit taking SACCOs in Kenya, bringing with it an open policy where nonmembers can access their financial services, their operating model mirrors those of commercial banks. In recognition of this similarity, total deposits, total capital and labour costs were used as inputs while gross loans and investments were used as outputs in the efficiency estimation process. The growth of inputs and outputs during the review period was notable significant as seen in Figure 1 & 2.

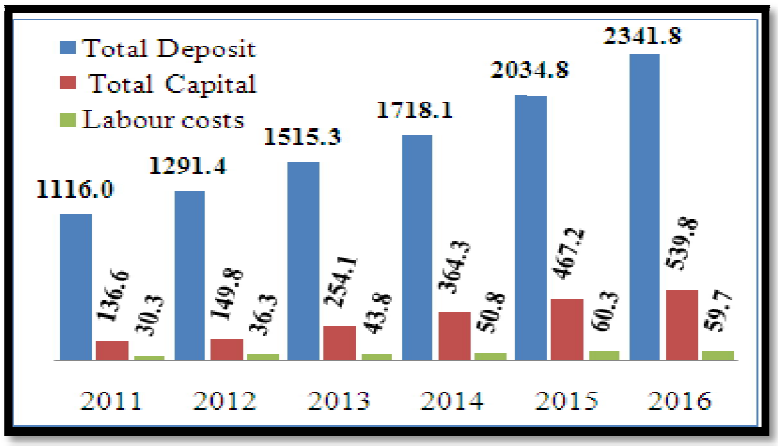

Figure 1: Growth in Inputs between 2011_ 2016

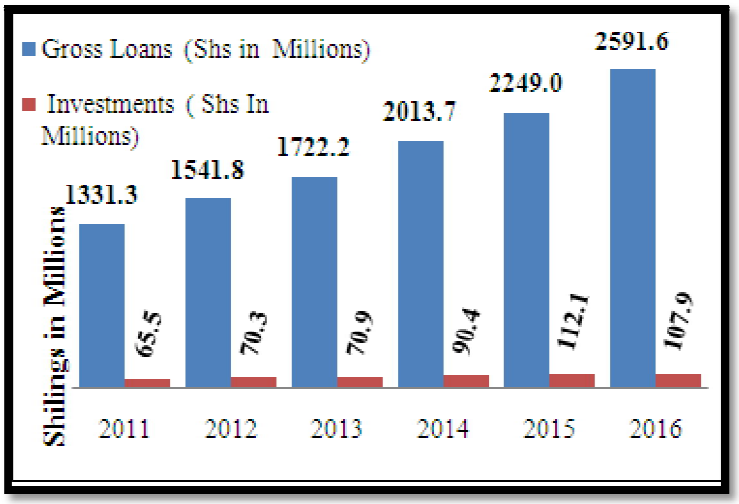

Figure 2: Growth in Outputs between 2011_ 2016

Between 2011 and 2016, the mean annual deposits increased 109%.This ishighly attributable to the buildup with the radical move by the regulator to allow previously excluded non-members to operate deposit accounts in DTS FOSA sections, raising membership from an initial 2.6 million in 2011 to 3.6 million members in 2016 (SARSA, 2011, 2016). The mean annual labour costs increasing by 97%, while mean annual core capital more than tripled over the same period. Gross loans and investments grew by 64% and 94% respectively over the same period, an indication that inputs grew faster than the outputs.

4.3 .Technical Efficiency Estimation

Data Envelopment Analysis, a non-parametric efficiency estimation technique was used in estimating DTS efficiency based on an input orientation. The choice of the input orientation was anchored on the recognition that in financial intermediation managers have relatively higher influence over inputs allocation that than the resulting outputs. Among recent studies that have opted for the same orientation in analyzing efficiency in financial institutions included Gulati, (2015), Kamau (2011), Nasieku (2014) and Karuki (2016). For thesix-year period under review, the mean Technical efficiency of all the sampled DTSs was 72.9%. A year to year review shows that the technical efficiency significant dropped in 2012 by 2.4% compared to 2011, followed by a consistent increase between 2013 and 2015. Notably, there was also a 19% drop in 2016 to a mean of 59.2% compared to 78.2% mean efficiency in 2015. The two year where significant decrease in efficiency were noted are pre-election periods, an indication that political dynamics could be influencing allocative decisions in the sector.

YEAR	TE Eff	Bias Corrected
2011	0.753	0.583
2012	0.729	0.464
2013	0.744	0.478
2014	0.773	0.603
2015	0.782	0.653
2016	0.592	0.481
Mean	0.729	0.544
Max	1	0.957
Min	0.1195	0.099
SD	0.234	0.175

Table 1: Technical and Biased Corrected Efficiency Scores Distribution by Size
Note: Size based on Total Assets Large DTS > 1 billion KSHs, Small DTs < 1 billion KHS

4.4. Capital Regulation and DTS compliance levels

Financial prudential regulations are predominantly denoted as a ratio of two financial indicators or a minimum or a maximum limit upon which compliance is judged. SASRA in defining the regulatory framework on which all DTS are regulated, has set out a minimum core capital amount of 10 million shilling in addition to other three capital adequacy ratios; core capital to total deposits (Minimum 10%), core capital to total assets (Minimum 8%), and institutional capital to total assets set at a minimum of 8%. From the four capital ratios, the 10 million minimum core capital did not potent a major challenge for DTS due to the open membership model. Core capital to total deposits ratio was less a burden for most DTS with the majority meeting the required 10% levels in their first three years after the coming into force of the regulatory framework in 2010. Potential inconsistencies in the reporting of institutional capital due to lack of clarity in its determination would potent possible estimation errors, increasing the risk of biased estimators and inferential results and hence was consequently dropped. Core capital to total assets ratio was evidently a challenge to more than a third of the licensed DTS during the six year period under review, a factor that lead to its consideration for analysis.

The mean annual ratio of core capital to total assets maintained a steady increase over the six years from a low of 22% in 2011 to 28.7% in 2016 an indication that more DTS were maintaining a relatively higher capital adequacy ratio that the prescribed 10% minimum. While this could be an indicator of a sound financial position for DTS sub sector, 21.5% of the licensed DTS had not met this regulatory requirement by the end of 2016 (SASRA, 2016). This could be a pointer to a significant number of large DTS holding higher core capital exposing them to potential in efficiency

The accuracy of the inferences derived from a regression analysis is influenced by the strength of relationships that exist between the selected independent variables and the predicted variable. A correlation analysis to establish the direction and the strength of the relationship does not only provide a basis for assessing the suitability of the independent variables, but also sets out a framework for interpreting the results of the regression model. Being cognizant of the fact that compliance status is binary, a point-biserial correlation was used to assess the association between bias corrected TE scores and the DTS compliance status on the capital adequacy ratio.A negative correlation (r_{bp} = -0.398, $p < 0.05$) was evident between Bias corrected TE score and capital ratio compliance status. This can be justified by the fact that capital ratios are often intended to cushion members from losing their investments, higher capital ratio however locks up funds that would otherwise be lent out or invested for increased returns, negatively affecting intermediation efficiencies of the DTS.

4.5. Capital Ratio Compliance and Efficiency

The influence of compliance with minimum capital ratio, set at a minimum 10% ratio of core capital to total assets by SASRA, was predicted to have a positive influence on technical efficiency of DTS, a hypothesis that was tested before arriving at a definitive conclusion. Contrary to the theories supporting capital adequacy and existing empirical evidence where a positive influence was expected, compliance with the minimum capital requirements ratio had a statistically significant negatively influence the technical efficiency of DTS as indicated in Table 2. DTSs that were maintaining core capital to total assets ratio greater than 10% on average were 6.63% ($p< 0.000$) less efficiency than their non-compliant counterparts holding all other factors constant. With the test (t) statistic p-values of less than 0.05, the null hypothesis was rejected, to infer that meeting or exceeding the set compliance ratio of 10% was an impediment to the ability of DTS management to optimally allocate their limited inputs in areas that would generate higher returns ceteris paribus.

BC EFF Scores	Coefficient	Robust Std Errors	t	P>|t|
Constant	0.5923	0.0229	25.91	0.000
Capital Compliance	-0.0663	0.0128	-5.16	0.000

Table 2: Fixed Effect Estimation Results

The current findings lends support to the finding of Kariuki (2017) where a negative relationship between capital ratios and DTS efficiency was found despite the failure of the estimated coefficient to attain statistical significance. It is however contrary to the evidence found in Lari, Rono & Nyangweso (2016) where low capital adequacy ratios were associated with high inefficiency among DTS in Kenya. In the banking sector, Odunga et al (2013) found out that capital adequacy measures alone had no effect on operation efficiency of commercial banks in Kenya, a position that was contrary to the findings of Jackson & Fethi (2011) who reported a significantly negatively relationship between capital adequacy and technical efficiency among Turkish commercial banks. While the intent of capping the ratio of core capital to assets by the regulator was to facilitate risk sharing and reduce of shareholder's moral hazard, maintaining the ratio beyond 10% could be counterproductive and efficiency disenhancing. The degree of regulatory scrutiny is often more on DTS that are either non-compliant or those that barely meet the set minimum capital limits and less for highly capitalized entities that have shown consistency in compliance, (VanHoose, 2007). Consequently, managerial allocation decisions are more likely to be subject to critical evaluation, robust and potentially efficiency enhancing among non-compliant DTS, compared to those that are in compliance.

5. Conclusions & Recommendation

From our finding, there is evidence to support the preposition that compliance with the regulatory capital ratio set out by SASRA has a negative influence on the al locative decisions of DTS managers and hence driving in-efficiency. Consequently, maintaining core capital to total assets ratio greater than 10% bears a significant negative influence on the allocation decisions of DTS managers leading to lower technical efficiencies. Seen from the current findings, the current capital ratio was an impediment to efficient allocation decisions among the DTS managers. This calls for a review by the regulator in view of critical re-examination of the capital adequacy ratio in the interest of establishing the most optimal levels that guarantee's safety of members deposits while optimizing on growth and allocation efficiency.

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