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*Credit Risk, Liquidity, and Lending Intensity: Evidence
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Salome Chebet SUGUT

Dr. Joab OOKO

Dr. Ismael ODUOR

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Credit Risk, Liquidity, and Lending Intensity: Evidence from Deposit-Taking SACCOs in Nandi County, Kenya

By: Salome Chebet SUGUT¹, Joab OOKO (PhD,CPA)² and Ismael ODUOR (PhD)³

Abstract

Profitability is central to the sustainability of deposit-taking Savings and Credit Cooperative Societies (SACCOs), yet the relationship between loan default indicators and profitability may depend on liquidity conditions and the intensity with which mobilized deposits are transformed into loans. This study examined the relationship between non-performing loans, delinquent loans, liquidity, loan-to-deposit ratio and profitability among deposit-taking SACCOs in Nandi County, Kenya. The study used an explanatory design and census approach, drawing on secondary panel data for 11 licensed deposit-taking SACCOs over 2019–2024. Profitability was measured using return on assets (ROA). The analysis combined descriptive statistics, Pearson correlations, diagnostic tests, the Hausman specification test, and a fixed-effects panel model incorporating interaction terms. The analysis was based on 62 SACCO-year observations. Non-performing loans and delinquent loans were not significantly associated with ROA at the direct bivariate level ($r = .059$, $p = .651$ and $r = .044$, $p = .735$, respectively). Liquidity ratio was positively associated with ROA ($r = .390$, $p = .002$), as was loan-to-deposit ratio ($r = .460$, $p < .001$). The Hausman test supported fixed effects, $\chi^2(4) = 13.87$, $p = .0076$. The overall interaction model was statistically significant, $F(6, 55) = 12.952$, $p < .001$. Two interaction effects were significant: non-performing loans $\times$ loan-to-deposit ratio ($F = 8.749$, $p = .005$) and liquidity ratio $\times$ loan-to-deposit ratio ($F = 5.364$, $p = .024$). The findings indicate that the profitability of the SACCOs in the study was associated not simply with loan defaults in isolation, but with the interaction between credit quality, liquidity management and lending intensity. The results provide county-specific evidence for SACCO managers and regulators concerned with credit risk, liquidity and sustainable lending.

Keywords: SACCOs; loan defaults; non-performing loans; delinquency; liquidity; loan-to-deposit ratio; profitability; return on assets.

1. INTRODUCTION

Savings and Credit Cooperative Societies (SACCOs) occupy an important position in financial intermediation because they mobilize members' savings and convert those resources into credit. In Kenya, deposit-taking SACCOs combine cooperative ownership with financial intermediation functions, making the quality of their loan portfolios important to institutional sustainability. The underlying study situates this role within the wider international cooperative movement, noting the

¹MBA Student, Koitalel Samoei University College, Email: salomechebet84@yahoo.com, ORCID: 0009-0007-3494-3145

²Lecturer, Koitalel Samoei University College, Email: salomechebet84@yahoo.com, ORCID: 0000-0001-7755-9062

³Senior Lecturer, Koitalel Samoei University College, Email: salomechebet84@yahoo.com, ORCID: 0009-0006-3904-4504

large membership and asset base of credit unions and financial cooperatives globally. Within such institutions, profitability is not only an accounting outcome but also a condition for maintaining operations, strengthening the capital position, supporting member services and continuing to provide credit. The central financial management challenge is therefore to generate income from lending while controlling the risks that arise when borrowers delay or fail to repay.

Loan default creates several potential channels through which financial performance can be affected. When borrowers fail to meet contractual obligations, an institution may lose expected interest income, incur monitoring and recovery costs, increase loan-loss provisions and experience reduced cash inflows. For a deposit-taking SACCO, these effects can extend beyond the individual loan because repayment flows support the institution's ability to meet member withdrawals and finance additional lending. The study's theoretical framing draws on credit risk theory, agency theory and asymmetric information theory. Credit risk theory treats default as a fundamental source of potential loss; agency theory highlights managerial decisions concerning appraisal, monitoring, recovery and resource deployment; and asymmetric information theory emphasizes the information gap between borrowers and lenders that can contribute to adverse selection and moral hazard (Akerlof, 1970; Jensen & Meckling, 1976; Stiglitz & Weiss, 1981). Together, these perspectives suggest that the relationship between loan quality and profitability should be examined in the context of institutional decisions rather than through a single default indicator.

The Kenyan SACCO environment provides a relevant empirical setting because the quality of loan portfolios has remained an important supervisory concern. The source study reports that the average non-performing-loan ratio among deposit-taking SACCOs rose to 8.86% in 2023, above the 5% ceiling cited in the study from sector regulatory reporting (SASRA, 2024). At the same time, national sector statistics showed substantial growth in both deposits and gross loans. The study reports gross loans increasing from KSh 586.0 billion in 2022 to KSh 759.0 billion in 2023, while deposits increased from KSh 522.4 billion to KSh 677.8 billion. Such growth increases the importance of how SACCOs balance loan expansion, liquidity and asset quality. A high loan-to-deposit ratio may increase the proportion of funds deployed into income-generating assets, but it can also increase exposure to repayment problems if lending standards and monitoring are weak.

The issue is particularly relevant to SACCOs in Nandi County because the institutions operate in an economic setting in which agricultural and other member incomes may fluctuate. Variability in members' cash flows can influence repayment capacity and consequently the movement of loans between performing, delinquent and non-performing categories. The underlying study therefore distinguishes between non-performing loans and delinquent loans while also considering liquidity and the loan-to-deposit ratio. Delinquency captures repayment problems that may precede full non-performance, whereas the non-performing-loan ratio captures loans that have deteriorated sufficiently to be classified as non-performing. Liquidity reflects the capacity to meet short-term obligations, while the loan-to-deposit ratio captures the extent to which mobilized deposits are transformed into loans. Examining the four measures together allows profitability to be considered within a broader credit-intermediation process.

Existing empirical evidence does not provide a uniform account of the relationship between loan defaults and SACCO profitability. The study reviewed evidence from Kenya and other African settings reporting adverse associations between default or poor loan management and financial performance. Salaton et al. (2020), for example, reported an inverse relationship between loan default and profitability among SACCOs in Narok County, while Nyabwari and Kimutai (2024) examined credit risk and liquidity in relation to SACCO profitability. Njeru et al. (2019) reported that rising non-performing loans could reduce return on assets and increase debt-collection costs. Evidence from Uganda also suggested that SACCOs with stronger credit-risk management could experience lower default rates and better profitability (Tumwesigye & Musasizi, 2021). Other Kenyan studies have considered loan delinquency, provisioning and liquidity, but much of the evidence is drawn from different counties, institutional categories or single dimensions of performance.

The contextual nature of these findings creates a specific empirical gap. Evidence from Nairobi, Narok, Kiambu, Kirinyaga, Western Kenya and other settings cannot automatically be assumed to describe deposit-taking SACCOs operating in Nandi County. Institutional size, membership composition, governance arrangements, loan portfolio characteristics and the local economic environment may differ across counties. In addition, evidence that focuses only on the direct relationship between a default indicator and profitability may overlook the possibility that the

profitability effect of credit risk depends on lending intensity or liquidity. The underlying study addresses this gap by examining four indicators simultaneously and extending the analysis to interaction effects involving loan-to-deposit ratio and liquidity.

The study examined the effect of loan defaults on profitability among deposit-taking SACCOs in Nandi County, with return on assets as the measure of profitability. Specifically, it evaluated non-performing loans, delinquent loans, liquidity ratio and loan-to-deposit ratio. The study also examined how these financial conditions interacted in explaining profitability. The empirical question was therefore not simply whether defaults exist, but whether the association between credit quality and profitability changes when SACCOs differ in liquidity positions and in the intensity with which deposits are converted into loans.

The study makes a contextual contribution by providing evidence from all licensed deposit-taking SACCOs identified within Nandi County over a six-year period. It also contributes analytically by moving beyond isolated ratios to examine selected interactions among credit risk, liquidity and lending intensity. This approach is consistent with the broader banking literature, which recognizes that profitability can be shaped by bank-specific characteristics, industry conditions and macroeconomic factors rather than by one indicator considered independently (Athanasoglou et al., 2008). The article therefore presents empirical results in a form suitable for assessing the joint financial-management relationships observed in the study period.

2. METHODOLOGY

The study adopted an explanatory research design because its purpose was to examine relationships between selected loan-management indicators and profitability. The population comprised 11 licensed deposit-taking SACCOs operating in Nandi County, Kenya. A census approach was used, meaning that the study sought to include all SACCOs within the defined population rather than selecting a smaller sample. The observation period covered six financial years, from 2019 through 2024. The resulting panel structure provided repeated observations for the institutions across the study period, although the usable inferential dataset contained 62 SACCO-year observations.

Data was obtained from secondary financial information, including SACCO financial statements and annual reports and regulatory information from the SACCO Societies Regulatory Authority (SASRA). The study did not collect personal information from borrowers or SACCO members. A data-collection sheet was used to extract the financial variables required for analysis. The use of secondary financial data was intended to provide consistent institution-level measures over time and to allow the analysis to focus on observable financial indicators. The study's ethical considerations therefore concerned responsible access, accurate extraction, confidentiality and faithful representation of institutional information.

Profitability was operationalized using return on assets (ROA), reflecting the ability of a SACCO to generate earnings from its asset base. The explanatory variables were non-performing loans ratio (NPLR), delinquent loans ratio (DLR), liquidity ratio (LR) and loan-to-deposit ratio (LDR). NPLR represented the proportion of non-performing loans, while DLR represented the extent of delinquent loans. LR captured the institution's ability to meet short-term obligations and LDR represented the proportion of deposits transformed into loans. These measures were selected because they jointly capture loan quality, repayment problems, liquidity conditions and lending intensity.

The empirical analysis proceeded in stages. Descriptive statistics were first used to summarize the financial scale and dispersion of the observations. Pearson correlation coefficients were then calculated to assess bivariate associations among ROA and the principal explanatory variables. Diagnostic procedures included normality assessment, multicollinearity assessment and examination of residual dispersion. The multicollinearity diagnostics were based on tolerance and variance inflation factor (VIF) statistics. The study treated VIF values substantially below conventional thresholds as evidence that the explanatory variables did not present problematic collinearity (Hair et al., 2022).

Because the dataset had repeated observations for the same SACCOs, panel estimation was used. The initial panel specification was expressed as $ROA_{it} = \beta_0 + \beta_1 NPLR_{it} + \beta_2 DLR_{it} + \beta_3 LR_{it} + \beta_4 LDR_{it} + \mu_i + \varepsilon_{it}$, where μ_i captures unobserved institution-specific effects and ε_{it} represents the idiosyncratic error term. The Hausman specification test was used to determine

whether fixed effects or random effects provided the more appropriate treatment of the unobserved institutional component. The test produced $\chi^2(4) = 13.87$ with $p = .0076$, supporting the fixed-effects specification.

The final analytical framework extended the fixed-effects approach to examine selected interaction terms among non-performing loans ratio (NPLR), delinquent loans ratio (DLR), liquidity ratio (LR) and loan-to-deposit ratio (LDR). Return on assets remained the dependent variable. The interaction model included $NPLR \times DLR$, $NPLR \times LR$, $NPLR \times LDR$, $DLR \times LR$, $DLR \times LDR$ and $LR \times LDR$. The purpose of these terms was to examine whether the relationship between one financial condition and profitability varied with another condition. The analysis was conducted using a normal probability distribution and identity link in the generalized linear modelling framework reported in the source study. Statistical significance was evaluated at the 5% level.

The study's interpretation is deliberately restricted to the evidence supported by the reported analyses. A non-significant direct correlation is not treated as evidence that a variable is economically irrelevant under every circumstance, while a significant interaction is not interpreted as proof of a causal mechanism beyond the observational panel design. The fixed-effects approach improves control for time-invariant institutional heterogeneity, but the study remains based on secondary observational data and therefore does not establish experimental causality. These considerations are important when interpreting the results and their implications.

3. RESULTS

The 62 usable SACCO-year observations show substantial variation in the financial scale of the institutions. Mean total assets were approximately KSh 3.566 billion, with a standard deviation of KSh 5.833 billion. Mean deposits were KSh 2.432 billion (SD = KSh 4.153 billion), while the mean loan portfolio was KSh 2.747 billion (SD = KSh 4.750 billion). Average net income was KSh 555.161 million, with a standard deviation of approximately KSh 957.724 million. The dispersion indicates that the institutions differed considerably in size, savings mobilization, lending capacity and earnings. Non-performing loans averaged KSh 226.989 million, while delinquent loans averaged KSh 469.034 million. The large standard deviations relative to the means indicate considerable heterogeneity in loan quality and financial scale across the observations.

Table 1. Descriptive statistics for the study observations, 2019–2024

Variable	N	Minimum (KSh)	Maximum (KSh)	Mean (KSh)	SD (KSh)
Total assets	62	50,000,000	24,580,000,000	3,565,967,741.94	5,833,087,493.25
Total deposits	62	20,000,000	17,990,000,000	2,432,258,064.52	4,152,766,969.87
Total loans	62	20,000,000	19,750,000,000	2,746,935,483.87	4,750,294,758.31
Net income	62	10,000,000	4,170,000,000	555,161,290.32	957,723,978.74
Non-performing loans	62	1,680,000	1,690,600,000	226,989,387.10	399,479,321.75
Delinquent loans	62	0	8,830,050,000	469,034,306.45	1,388,472,605.91

The bivariate results provide a more direct view of the relationships among the study variables. ROA had a weak positive correlation with NPLR ($r = .059$, $p = .651$) and a very weak positive correlation with DLR ($r = .044$, $p = .735$); neither relationship was statistically significant. In contrast, ROA was positively and significantly associated with liquidity ratio ($r = .390$, $p = .002$) and loan-to-deposit ratio ($r = .460$, $p < .001$). The correlation matrix also indicates low correlations among the explanatory variables themselves. NPLR was weakly related to DLR ($r = .199$), almost unrelated to liquidity ($r = .001$), and negatively but weakly related to LDR ($r = -.109$). DLR was weakly related to liquidity ($r = .012$) and LDR ($r = .133$), while liquidity and LDR had a modest positive correlation ($r = .107$).

Table 2. Pearson correlation matrix (N = 62). ** $p < .01$, two-tailed.

Variable	ROA	NPLR	DLR	LR	LDR
ROA	1	.059	.044	.390**	.460**
NPLR	.059	1	.199	.001	-.109
DLR	.044	.199	1	.012	.133
LR	.390**	.001	.012	1	.107
LDR	.460**	-.109	.133	.107	1

The diagnostic results did not indicate problematic multicollinearity. Tolerance values exceeded .90 for all four explanatory variables and VIF values were close to 1. Specifically, the VIF values were 1.062 for NPLR, 1.068 for DLR, 1.012 for LR and 1.050 for LDR. These values are substantially below commonly used thresholds for concern and support retention of the four

explanatory variables in the model. The normality results were mixed: the source study reported non-normal distributions for several variables, while LDR met the reported normality criteria. The heteroscedasticity assessment based on the residual scatter did not show an obvious systematic pattern. These diagnostics were considered before the panel model was estimated.

Table 3. Multicollinearity Diagnostics

Predictor	Tolerance	VIF
Non-performing loans ratio	.942	1.062
Delinquent loans ratio	.936	1.068
Liquidity ratio	.988	1.012
Loan-to-deposit ratio	.952	1.050

The choice between fixed and random effects was informed by the Hausman specification test. The reported test statistic was $\chi^2(4) = 13.87$ with $p = .0076$. The null hypothesis that the difference between the fixed- and random-effects coefficients was not systematic was rejected at the 5% level. The fixed-effects estimator was therefore retained. The source analysis reports that the fixed-effects specification produced a within R^2 of .712, a between R^2 of .645 and an overall R^2 of .689 for the preliminary panel model. The corresponding random-effects model had an overall R^2 of .701. The Hausman result, rather than the relative R^2 values, was used to select the estimator.

The fixed-effects interaction model was statistically significant overall, $F(6, 55) = 12.952$, $p < .001$. The result indicates that the set of interaction terms considered jointly was associated with variation in ROA after accounting for the fixed-effects structure. However, the individual interaction effects were not uniformly significant. $NPLR \times LDR$ was significant, $F = 8.749$, $p = .005$, with an estimated coefficient of .007 and a 95% confidence interval from .002 to .011. $LR \times LDR$ was also significant, $F = 5.364$, $p = .024$, with an estimated coefficient of approximately 9.6225×10^{-5} . The remaining interactions— $NPLR \times DLR$, $NPLR \times LR$, $DLR \times LR$ and $DLR \times LDR$ —were not statistically significant.

Table 4. Fixed-effects interaction results for ROA.

Interaction term	F	df1	df2	p	Coefficient	95% CI
NPLR × DLR	.248	1	55	.620	−.003	[−.017, .010]
NPLR × LR	1.037	1	55	.313	−.002	[−.005, .001]
NPLR × LDR	8.749	1	55	.005	.007	[.002, .011]
DLR × LR	.585	1	55	.447	.000	[.000, .001]
DLR × LDR	.193	1	55	.662	.000	[−.001, .001]
LR × LDR	5.364	1	55	.024	0.0000962	[0.0000300, ~0.000]
Corrected model	12.952	6	55	<.001	—	—

The coefficient estimates provide additional detail about the direction of significant interactions. The NPLR × LDR coefficient was positive (.007) and statistically significant, while the LR × LDR coefficient was also positive and statistically significant. By contrast, the coefficients for NPLR × DLR and NPLR × LR were negative but not significant. The coefficients for DLR × LR and DLR × LDR were close to zero and not significant. The model also reported statistically significant year-specific residual variance for 2019 ($p = .046$) and 2024 ($p = .024$), whereas the corresponding estimates for 2020, 2021, 2022 and 2023 were not statistically significant. These results indicate that some variation in profitability remained associated with time-specific factors not captured by the financial interaction terms.

Table 5. Reported year-specific residual variation.

Year	Residual variance estimate	SE	Z	p
2019	11.432	5.735	1.993	.046
2020	9.452	5.133	1.841	.066
2021	1.150	.754	1.525	.127
2022	.201	.264	.761	.447
2023	.522	.326	1.601	.109
2024	4.796	2.130	2.251	.024

4. DISCUSSION

The results present a more differentiated picture of loan defaults and profitability than would be obtained from the assumption that higher default levels necessarily produce an immediate and statistically significant reduction in ROA. The direct correlations between ROA and both NPLR and DLR were weak and statistically insignificant, whereas liquidity and LDR were positively and significantly associated with ROA. More importantly, the fixed-effects interaction model identified significant interactions involving LDR: $NPLR \times LDR$ and $LR \times LDR$. The combined evidence therefore suggests that the financial performance observed among the SACCOs during 2019–2024 was related to the way credit risk, liquidity and lending intensity operated together rather than to default indicators considered in isolation.

The non-significant association between NPLR and ROA is particularly important because the conventional credit-risk expectation is that deterioration in loan quality should reduce profitability. Credit risk theory provides a clear mechanism: loans that cease to perform can reduce interest income and increase provisions and recovery costs. The underlying study nevertheless found $r = .059$ with $p = .651$. This result means that the data did not provide evidence of a statistically significant direct linear relationship between NPLR and ROA over the observed period. It should not be interpreted as evidence that non-performing loans have no financial consequences in general. Rather, within this county-specific panel and the variables used, variation in NPLR alone was not sufficient to explain contemporaneous variation in ROA.

One possible interpretation offered by the source study is that loan recovery and provisioning practices may cushion the immediate effect of problem loans on reported profitability. Another possibility is that NPLs represented only one component of the institutions' broader revenue and cost structures. The study did not directly measure recovery effectiveness, provisioning adequacy, operating efficiency or alternative revenue streams, so these mechanisms cannot be tested from the reported model. This limitation is important when comparing the finding with studies such as Njeru et al. (2019), Salaton et al. (2020) and other empirical work that reported adverse effects of loan defaults on financial performance. Differences in institutional setting, measurement, study period and model specification can produce different estimates.

The finding for delinquent loans is similar in direction of statistical interpretation. DLR had a very weak positive correlation with ROA ($r = .044$, $p = .735$), indicating no statistically significant bivariate association. The absence of significance is consistent with the possibility that delinquency does not necessarily become an accounting loss in the same period in which repayment is delayed. A loan can be overdue and subsequently recovered without becoming non-performing. The source study therefore treats delinquency as an early warning condition rather than an automatic determinant of current profitability. This interpretation is compatible with credit-risk management logic, although the present data does not allow the researchers to establish the proportion of delinquent loans that were subsequently recovered or reclassified.

The finding differs from evidence cited in the thesis from studies in which weak loan follow-up, poor appraisal or delinquency was associated with lower financial performance. For example, the source review identifies work by Kamau and Mutua (2017) and Otieno and Cheruiyot (2021) that connects loan delinquency with financial outcomes. The difference may reflect contextual variation across SACCOs or differences in the way delinquency is measured. It may also reflect the fixed-effects framework used in the present study, which controls for time-invariant institutional characteristics. The important empirical point is that delinquency did not have a statistically significant independent or interaction effect in the reported Nandi County model.

Liquidity presents a different result. ROA was positively associated with liquidity ratio at $r = .390$ ($p = .002$), and liquidity also entered a statistically significant interaction with LDR. This suggests that the capacity to maintain liquid resources and the intensity of lending were connected to profitability in the study observations. The result is consistent with the proposition that an institution needs enough liquidity to meet withdrawals and other short-term obligations while still deploying resources into income-generating loans. Bordeleau and Graham (2010) describe liquidity as involving a profitability trade-off: resources held in liquid form can provide stability but may generate lower returns than productive lending. The Nandi County results do not establish an optimal liquidity level, but they indicate that liquidity conditions were relevant to profitability. The positive correlation between LDR and ROA ($r = .460$, $p < .001$) is also consistent with the central intermediation role of SACCOs. Deposits that are transformed into performing loans can generate interest income and contribute to earnings. This result accords with the broader

profitability literature, which recognizes the importance of asset composition and funding strategies in financial performance (Athanasoglou et al., 2008). At the same time, a high LDR cannot automatically be interpreted as desirable because lending creates credit and liquidity exposures. The significant LDR interactions in the present study are therefore more informative than the simple positive correlation alone.

The significant $NPLR \times LDR$ interaction provides the clearest evidence that lending intensity conditioned the relationship between loan quality and profitability. The coefficient was positive (.007) and statistically significant ($p = .005$). The finding indicates that the association between NPLR and ROA differed according to the level of LDR in the fixed-effects interaction model. The underlying study interprets this as suggesting that balanced and adequately funded lending may influence the way credit-quality problems translate into profitability. The positive interaction should, however, be interpreted carefully. It does not mean that non-performing loans improve profitability, nor does it establish that increasing LDR would eliminate the consequences of poor loan quality. Rather, it demonstrates statistical dependence between the two variables in explaining ROA.

This result can be related to agency theory because lending decisions involve managerial choices about risk, growth and the use of member funds. Managers may seek to increase loan income by expanding lending, but such decisions must be accompanied by credit appraisal, monitoring and recovery. Agency theory therefore draws attention to the quality of decisions surrounding the LDR rather than treating the ratio as an isolated target (Jensen & Meckling, 1976). From a credit-risk perspective, the interaction is also consistent with the idea that the effect of problem loans depends partly on the composition and funding of the loan portfolio. Berger and DeYoung (1997) similarly demonstrate the importance of the relationship between problem loans and bank efficiency, although their setting is commercial banking rather than Kenyan SACCOs.

The second significant interaction, $LR \times LDR$, reinforces the importance of considering liquidity and lending jointly. The coefficient was positive and statistically significant ($p = .024$). The result indicates that the relationship between liquidity and ROA varies with lending intensity. This is substantively plausible because the same liquidity position can have different profitability

implications depending on how much of the institution's deposit base is deployed in loans. If funds remain excessively liquid, the institution may sacrifice some lending income; if too much is committed to loans, the institution may have less flexibility to meet withdrawals and unexpected cash needs. The present model does not estimate a specific threshold at which this balance becomes optimal, so such a threshold should not be inferred from the coefficient.

The non-significance of the remaining interactions further narrows the interpretation. $NPLR \times DLR$ was not significant ($p = .620$), $NPLR \times LR$ was not significant ($p = .313$), $DLR \times LR$ was not significant ($p = .447$), and $DLR \times LDR$ was not significant ($p = .662$). Thus, the evidence does not support a broad claim that every dimension of loan default interacts with every liquidity or lending variable. Instead, the statistically detectable interactions were concentrated in combinations involving LDR and either NPLR or LR. This pattern is useful because it directs attention toward lending intensity as a common dimension linking credit quality and liquidity to profitability.

The results also speak to asymmetric information theory. SACCO lending decisions are made under imperfect information about borrower income, repayment capacity and future economic conditions. The resulting information gap can create adverse selection and moral hazard (Stiglitz & Weiss, 1981). Liquidity and lending policies can provide institutional buffers against some of the consequences of repayment uncertainty, but they do not eliminate the underlying information problem. The non-significant direct NPL and delinquency relationships may therefore reflect institutional mechanisms that intervene between repayment problems and reported profitability. However, because the study did not directly measure information quality, borrower screening or governance effectiveness, these mechanisms remain theoretical interpretations rather than tested causal explanations.

The results are broadly consistent with the study's use of three complementary theoretical perspectives. Credit risk theory helps explain why NPLs and delinquency should matter for financial performance. Agency theory highlights the role of management in choosing lending intensity, monitoring loans and maintaining liquidity. Asymmetric information theory explains why loan quality cannot be understood independently of the information environment surrounding

credit decisions. The significant interaction effects provide empirical support for examining these dimensions together. At the same time, the non-significant direct effects caution against assuming that a theoretically plausible mechanism will necessarily appear as a statistically significant coefficient in a particular institutional and temporal setting.

The findings have practical implications for SACCO management, but these implications should be grounded in the observed relationships rather than extrapolated beyond the study. First, the results indicate that monitoring NPLs and delinquency remains relevant even though their direct associations with ROA were not statistically significant. Loan quality can deteriorate over time, and a non-significant contemporaneous relationship does not imply absence of future risk. Second, the positive associations involving liquidity and LDR suggest that lending and liquidity decisions should be considered together. Third, the significant $NPLR \times LDR$ interaction indicates that management attention to credit quality should be accompanied by attention to the structure and intensity of lending. These are integrated financial-management considerations rather than recommendations to maximize any single ratio.

For regulators and sector stakeholders, the evidence suggests that isolated indicators may provide an incomplete picture of institutional performance. A SACCO can report a particular NPL level while its profitability is simultaneously shaped by liquidity, lending intensity, institutional characteristics and time-specific conditions. The year-specific residual results reinforce this point: residual variance was statistically significant for 2019 and 2024 but not for the intervening years. The source study interprets this as evidence that time-specific influences remain after accounting for the financial interaction terms. The data does not identify the precise macroeconomic or regulatory events responsible, so these residual differences should not be attributed to a particular external factor without additional evidence.

The study's limitations define the appropriate scope of its conclusions. Profitability was measured only through ROA, which does not capture every dimension of financial performance. The geographical focus on Nandi County limits direct generalization to SACCOs in other counties, especially where institutional scale, membership, governance and economic conditions differ. The study also relied on secondary financial data and therefore had no control over the original data-

generation and classification processes. In addition, the model focused on NPLR, DLR, LR and LDR and did not include other possible profitability determinants such as capital adequacy, operating efficiency, institutional size, governance quality, interest rates and macroeconomic conditions. Finally, the observational design and the use of interaction terms do not establish causal effects.

Future research can build on these results by extending the analysis across counties and comparing deposit-taking with non-deposit-taking SACCOs. Larger panels could also incorporate macroeconomic variables such as inflation, interest rates and economic growth, as suggested in the underlying study. Further work could examine non-linear or threshold relationships to determine whether the profitability implications of liquidity or LDR change beyond particular levels. Research that directly measures recovery effectiveness, provisioning practices, borrower screening, digital credit monitoring and governance could also help explain why default indicators were not directly significant while selected interactions were significant. Such extensions would provide a stronger basis for distinguishing short-term accounting effects from longer-term consequences of loan-quality deterioration.

Overall, the findings show that the profitability relationships observed among deposit-taking SACCOs in Nandi County during 2019–2024 were multidimensional. NPLR and DLR did not show statistically significant direct associations with ROA, whereas liquidity and LDR were positively associated with profitability. The fixed-effects interaction model further showed that $NPLR \times LDR$ and $LR \times LDR$ were statistically significant. The evidence therefore supports an interpretation in which credit quality, liquidity and lending intensity operate as connected elements of SACCO financial management. The contribution of the study lies less in establishing a universal effect of loan defaults than in showing, within the Nandi County context and the observed period, that the profitability implications of credit risk depend in part on the institutional lending and liquidity environment.

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