Liquidity And Deposit Insurance: The Case Of Deposit-Taking Microfinance Institutions In Low-Income Sub-Saharan Africa

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ABSTRACT

This study aimed to examine the relationship between liquidity and deposit insurance of Deposit-taking Microfinance Institutions (DTMFIs) in Low-Income Sub-Saharan Africa (LISSA). Several DTMFIs in the region defaulted in meeting withdrawals on deposits and collapsed with depositors' funds. The failure of DTMFIs to be liquid has dire consequences, such as contagion risk due to the sudden and unexpected deposit runs and oblivion of depositors' funds, which further condemn the small savers to extreme poverty levels. Panel data from the Microfinance Information Exchange for 2006 to 2017 of 64 DTMFIs sampled across 18 LISSA countries was utilized. The estimated random effects results showed that explicit deposit insurance is positive and significantly related to liquidity. Additionally, the capital adequacy ratio and the Basel implementation dummy are positive and significant determinants of liquidity. The study concluded that designing and implementing explicit deposit insurance schemes mitigates liquidity risk in depository microfinance and maintaining adequate capital adequacy levels and implementation of Basel recommendations improves the liquidity positions of the LISSA DTMFIs. The study recommended the formulation of deposit insurance policies that embrace microfinance deposits of all types. Adherence to the Basel capital adequacy standards complements deposit protection in hedging liquidity risk.

KEYWORDS: Liquidity, Deposit Insurance, Depositors, Deposit-Taking, DTMFIs, LISSA.

1. INTRODUCTION

According to the Sustainable Development Goals of the United Nations, the provision of microfinance products such as microcredit, microinsurance, diaspora remittances and deposit-taking is an esteemed tool for eradicating extreme poverty amongst the poor and low-income households by the year 2030. The providers of microfinance, the Microfinance Institutions (MFIs)[1], advance credit lines obtained from commercial sources until they reach a point where the debt-to-equity ratios become unacceptable. At this point, the MFIs consider financing the loan portfolios through deposit-taking [1]. However, operating with adequate levels of liquidity has become a challenge for Deposit-Taking Microfinance Institutions (DTMFIs) [2]. The DTMFIs face the risk that at any point in time, they may not have sufficient liquid assets to meet their customers' withdrawals, interest on deposits and loan requests, a financial risk called liquidity risk [3]. Thus, operating with adequate levels of liquidity is a prerequisite for the DTMFIs to easily cover the short-term financial needs of their existing and potential clients, which is directly linked to their working capital policies [4].

Liquidity problems in deposit-taking microfinance are caused by factors such as focusing more on the asset (loans) side than on the liabilities (deposits) side [1] and overborrowing [5]. A total of 29 DTMFIs in the West African Economic and Monetary Union (WAEMU) and the Economic and Monetary Community of Central African States (CEMAC) sunk into oblivion with depositors' funds between 2001 and 2011 [2]. Amongst the ailing WAEMU and CEMAC DTMFIs that struggled to repay depositors' funds were some from Low-Income Sub-Saharan African (LISSA)[2] countries such as Benin (2)[3], Burkina Faso (1), Mali (3), Niger (2) and Togo (3). One DTMFI was placed under curatorship in Zimbabwe in 2019 [6]. 50 DTMFIs from Ghana defaulted in paying depositors' withdrawals in 2013 [7]. Moreover, it has been found that if liquidity positions in

[1] Microfinance Institutions are either DTMFIs accepting deposits for intermediation into loans or Credit-Only Microfinance Institutions advancing credit only.

[2] According to World Development Indicators of the World Bank (2017), LISSA countries are countries in Sub-Saharan Africa whose Gross National Income per capita is US$1025 or less.

[3] The numbers in parenthesis after a country name indicate the number of illiquid DTMFIs in that country.

deposit-taking microfinance are not assessed periodically, large withdrawals during the last quarter of each year cause acute shortages in the first quarter of each subsequent year [8].

According to Brom [9], "an MFI can be unprofitable for one quarter and still be in business, but it could not survive being illiquid". Hence, it has been argued that the adoption of explicit deposit insurance schemes could be one of the plausible solutions for mitigating liquidity challenges for deposit-taking financial institutions [10]. However, the most recent deposit insurance database [11] shows that out of the 27 LISSA countries, only 5 have implemented explicit deposit insurance schemes and 22 have not [12]. Implicitly, national governments are de facto insurers, but this is not always the case because it is not guaranteed that national governments can always bail out failing deposit-taking institutions with ease. Furthermore, protection of deposits through the Basel framework on capital adequacy standards has only been implemented in 7 LISSA countries [13]. Thus, the LISSA micro-depositors' funds are highly at risk should the DTMFIs fail to contain their panic or untimely withdrawals on demand and term deposits.

The failure of DTMFIs to be liquid has dire consequences, such as contagion risk due to the sudden and unexpected deposit runs and the oblivion of depositors' funds [10]. This further condemns the small savers to extreme poverty levels [2] and systemic risk as the whole financial sector is disturbed by the loss of depositors' confidence [14]. In this context, the objective of the study was to examine the relationship between liquidity and explicit deposit insurance in the LISSA's depository microfinance sector. Thus, the study will answer the question: what is the relationship between liquidity and deposit insurance in the depository microfinance sector of the LISSA countries?

To the best of the researchers' knowledge, this is the first study that examines the relationship between the liquidity of the LISSA DTMFIs and deposit insurance. Therefore, this study contributes to the existing literature in two ways. Firstly, the present study looks at the relationship between liquidity and explicit deposit insurance as a macro-institutional factor that affects the microfinance deposit-taking subsector. Previous microfinance studies only looked at the relationship between liquidity and depositor-specific factors [15], firm-specific factors [16] and macroeconomic factors [17]. A related study to the aforementioned ones only looked at how liquidity affects other performance measures in the microfinance sector [18]. Secondly, this study also accounts for the implementation of the Basel Accords' framework in assessing the liquidity of the LISSA DTMFIs. Microfinance literature is scanty in this research focus.

The study has the policy and practical implications that are significant to the regulators and managers of DTMFIs. The study is significant to the regulators of DTMFIs as it encourages them to design and implement custom-made explicit deposit insurance packages that curb panic and unanticipated withdrawals on deposits in the depository microfinance sector. Thus, deposit insurance helps the regulators to be reactive when faced with deposit runs involving loss of funds from poor and low-income households. The study is significant to the managers of DTMFIs as it encourages them to revise their asset and liability management structures to minimize liquidity risk by ensuring an even supply of withdrawals on deposits and loan disbursements. Adherence to the capital adequacy standards of the Basel framework compliments deposit insurance schemes in ensuring that the LISSA DTMFIs are hedged against liquidity risk. The study is also significant to micro-depositors in bolstering their confidence in MFIs that mobilize deposits for financial intermediation.

The rest of the paper is organized as follows: the literature review is discussed, followed by an exposition of the research methodology that leads to the discussion of the empirical findings. Lastly, the conclusions drawn from the study are highlighted, including the recommendations for policy formulation.

2. LITERATURE REVIEW

This study is premised on the provision of the liquidity arm of the theory of financial intermediation and the deposit insurance theory. The provision of the liquidity arm of the theory of financial intermediation was originated by von Mises (1912) and Keynes (1936) and is one of the main functions of financial intermediaries [19]. Financial intermediaries exist to provide liquidity to depositors whenever they require their funds in the form of withdrawals [10]. Thus, deposits are a liability to a financial intermediary, which must be repaid should the need arise. Financial institutions also provide liquidity to borrowers in the form of loans, one of the assets of financial institutions [20]. Therefore, financial intermediaries meet their short-term financial obligations through a system of asset and liability management.

The origin of the deposit insurance theory is traced back to Diamond and Dybvirg [10]. According to this theory, deposit-taking financial institutions seek insurance coverage against panic and unexpected runs on deposits to preserve liquidity [21]. In addition, deposit insurance cover helps to curb contagion risk in the financial system when one deposit-taking financial institution fails [2] and also helps to attract new deposits since the potential. Existing depositors would trust that their funds are safe [21]. Despite these benefits, deposit insurance schemes may alter the behavior of deposit-taking financial institutions, thereby igniting the moral hazard problem [14]. On the liabilities side, moral hazard occurs when deposit-taking financial institutions take an excessive risk using depositors' funds by seizing arbitrage opportunities in deposit insurance pricing [22]. Excessive risk-taking exposes deposit-taking financial institutions to liquidity risk [21]. On the assets side, moral hazard arises when depositors become reluctant to monitor their savings due to deposit insurance.

McCoy [20] argued that the absence or presence of deposit insurance schemes tends to influence the behavior of depositors differently. In the absence of deposit insurance, depositors discipline deposit-taking financial institutions from

excessive risk-taking as they know they do not have a fallback. Thus, depositors punish deposit-taking financial institutions by withdrawing their funds, which depletes liquidity or demands high returns on their deposits. Where deposit insurance coverage is present, depositors can hardly punish banks as they trust their deposits are protected. Therefore, Calomiris and Jaremski [21] wrote that "deposit insurance reduces liquidity risk by removing the incentives of depositors to withdraw from banks when concerned about insolvency risk".

On the empirical front, several factors influence the microfinance sector's liquidity. Of these factors, the first category relates to the behavior of the depositors in lodging and withdrawing their deposits; the second relates to institutional specifics, and the third relates to macroeconomic factors. In the same realm, empirical studies looked at how liquidity affects the performance of MFIs.

The behavior of depositors influences liquidity in deposit-taking microfinance. Mata [15] considered 7828 deposit contracts for 2002 to 2008 drawn from 12 village banks in the Malian Rural Microfinance Network, PASECA-Kayes. The distribution of withdrawals was calculated through the bootstrapping technique. The study concluded that migrants' deposits expose DTMFIs to liquidity risk as the migrants withdrew their time deposits before maturity. Furthermore, it was concluded that the level of deposits at risk is higher for migrants than locals. Maxwell *et al*. [8] examined the liquidity risk faced by 6 mature MFIs in the Greater Accra Region and how it can be managed. The findings were that large withdrawals by depositors during the last quarter of each year cause acute shortages of liquid resources in the first quarter of each subsequent year. Maxwell et al. [8] also found that Ghanaian MFIs do not periodically assess their liquidity positions.

Institution-specific factors also influence liquidity in microfinance businesses. Kipesha [23] studied the efficiency of 35 MFIs that report to the Microfinance Information Exchange (MIX) that were sampled across 5 countries in East Africa using data for the years 2009 to 2011. Using the data envelopment analysis approach, that study reported that reliance on donations, grants and subsidies creates liquidity problems for MFIs, thereby crippling their operations. Kimathi *et al*. [24] conducted a survey of 96 employees selected across 6 MFIs in Kenya on the factors affecting the liquidity risk management practices of MFIs. They found that the institutions' internal controls, policies, risk monitoring systems and board management oversight affect the liquidity risk management practices. The study of Kimathi *et al*. [24] also showed that top-level managers of financial institutions have a greater task of formulating and implementing effective liquidity strategies and policy frameworks.

Murage and Muiru [25] studied the effect of credit risk on the liquidity of 5 DTMFIs in Kenya using data for the years 2010 to 2013. Using multiple linear regression, the estimated results indicated that managing credit risk is positively related to liquidity. Similar findings were found when using the gross loan portfolio to total assets, efficient management of operating expenses and financial leverage variables. However, the portfolio at risk was found to be negatively related to liquidity. Laureti and Szafarz [16] investigated the liquidity premium of 28 banking institutions and 5 MFIs in Bangladesh using data for the year 2012. The Ordinary Least Squares (OLS) method was used in the estimation process. Of the explanatory variables, the MFI and public ownership dummies were negative and significant with the liquidity premium. The religious orientation, also a categorical covariate, showed that Islamic institutions were significant contributors towards liquidity premium while the log of total assets was insignificant. The study also concluded that liquidity premium is lower in MFIs than in banks due to the time inconsistences of the poor clientele served by the MFIs.

Mamathi *et al*. [26] surveyed the 12 microfinance banks in Nairobi County in Kenya proxied liquidity using the working capital ratio. After applying the multiple linear regression techniques, the study found that liquidity stress testing measured using a 5-point Likert scale positively affects the liquidity of microfinance banks. Profitability, as measured by the return on assets and return on equity ratios, and the loans to deposits ratios were found to have negative effects on the liquidity of microfinance banks. Cecchi *et al.* [5] conducted an experiment on 271 members of an MFI in the Coroico Municipality in Bolivia to examine the effects of progressive lending and liquidity defaults. The results indicated that multiple borrowings associated with progressive lending threaten liquidity due to defaults.

Adusei [3] utilized 2010 to 2018 data from a worldwide sample of 532 MIX-reporting MFIs from 73 countries to examine the relationship between liquidity risk and financial performance. The Least Squares Dummy Variable method was adopted. The findings revealed that the liquidity proxies (cash and cash equivalents/total assets and non-earning liquid assets/total assets) are negatively related to financial performance as measured by operational self-sufficiency. However, the interaction between liquidity risk and credit risk positively affects financial performance.

Liquidity in the microfinance sector is also subject to macroeconomic factors. Chikoko and Kwenda [17] looked at the challenges that crippled 100 MFIs in Zimbabwe during the 1999 to 2008 hyperinflationary period. They discovered that hyperinflation stifled economic activity and choked liquidity in the microfinance sector through the setting of withdrawal limits by the Zimbabwean central bank. The negative repercussions of withdrawal limits on the microfinance businesses were that disbursements were slowed down due to limited cash available, and collection problems were very common. Hyperinflation also led to the erosion of the capital of the MFIs, and the institutions also faced high operating costs, which further dwindled their liquid resources. Yusuff [27] looked at the effect of macroeconomic factors on the liquidity of microfinance banks in Nigeria using data from 1992 to 2017. A vector autoregressive model was adopted. The findings revealed that macroeconomic factors such as real interest rate, inflation rate and real gross domestic have no significant influence on liquidity, but they should be closely monitored.

The last category of studies on the liquidity of MFIs focuses on a study that looked at how liquidity affects other performance measures in the microfinance sector. Hadizatou [18] sampled 19 MIX reporting MFIs from the West African Monetary Union (UMOA) zone and utilized data from 2002 to 2015. The objective was to find the effect of a change in the prudential capital and liquidity ratios on financial performance (return on assets and return on equity) and social performance (number of borrowers and the average loan balance). The findings showed that the regulatory changes in capital and liquidity requirements did not affect the financial and social performance of UMOA MFIs.

After considering the above empirical studies, this study noted that none of them considered how deposit insurance is a determinant of liquidity in the depository microfinance sector of Low-Income Sub-Saharan Africa. Thus, there is a paucity of literature on deposit insurance in deposit-taking microfinance, but there are few empirical studies on deposit insurance in the conventional banking stream.

Ngalawa [14] examined banking instability and deposit insurance in 118 countries using deposit insurance data from 1980 to 2004. Banking instability (bank runs and insolvency) was the dependent variable captured as a dummy variable; hence a logit model was adopted. The findings were that deposit insurance is an insignificant coefficient in explaining banking instability, indicating that the trade-off between the costs and benefits of adopting deposit insurance is neutral. Based on this finding, the study of Ngalawa [14] concluded that the deposit insurance effects on banking stability must be country specific. Furthermore, the study did not find strong evidence that the banking sector in low-income countries is more prone to banking instability than the banking system in high-income countries. Low real gross domestic product levels per capita were found to increase the probability of banking instability. In contrast, the inflation rate was found to have no significant impact on banking instability.

Anginer *et al*. [28] looked at how deposit insurance affects bank risk and stability following the 2008 global financial crisis using data from the Bankscope database for 2004 to 2009 of 4109 banks sampled across 96 countries. Bank risk was captured using two measures; the log value of the bank's z score and bank stock return volatility. Bank stability or systemic risk was proxied using the marginal expected shortfall measure. Deposit insurance was incorporated in the OLS regressions in two ways; firstly, as a dummy variable indicating whether a country had adopted explicit deposit insurance or not and whether the insurance cover was effective the last time a bank failed; secondly, as a full coverage dummy that indicated whether a country offered full cover or not. Anginer et al. [28] found that the adoption of deposit insurance schemes in the pre-crisis era led to increased bank risk and systemic risk, thereby catalyzing the moral hazard problem. During the financial crisis, bank risk was lower while the systemic risk was higher, indicating deposit insurance's stabilization effect. After consolidating the pre-crisis sample and the during-crisis sample, the findings were that the net effect of deposit insurance was negative as the destabilizing effect during the normal period outweighed the stabilizing effect during the financial crisis, but this can be reduced by effective and enabling bank supervision.

Calomiris and Jaremski [21] examined the effect of deposit insurance on risk-taking, bank behavior and market discipline in early 20th-century banks in the United States. The study's conclusions were that implementing deposit insurance schemes reduced market discipline as the depositors became reluctant to monitor banks, thereby increasing the insolvency risk of the insured banks. In addition, the insured banks were found to rush for deposits in direct competition, with the uninsured banks using the insurance cover as their competitive edge.

3. RESEARCH METHODOLOGY

3.1 DATASET

Three sources of data were used in this study. Panel data for the years between 2006 and 2017 of 64 DTMFIs sampled across 18 LISSA countries was obtained from the MIX. The selected DTMFIs were included in the sample on the basis of their high information disclosure, as reflected by their high scores on the five-point diamond scale of the level of transparency in the MIX database. The selected countries were included on the basis of the completeness of the data of their self-reporting DTMFIs[4]. The World Development Indicators of the World Bank were the data source for the country-specific variable; the inflation rate. Data on explicit deposit insurance was sought from the deposit insurance databases of [11,12,29] and the 2016 International Monetary Fund (IMF) Sub-Saharan Africa Regional Economic Outlook.

Since the data is a panel, diagnostic tests were carried out to check for heteroscedasticity, multicollinearity and endogeneity. The problem of heteroscedasticity was found using the Breusch-Pagan test. Hence, the variables used (except the deposit insurance and Basel dummies) were transformed into a logarithm form to deal with this problem [30]. Moreover, heteroscedasticity was solved by making adjustments for White's robust standard errors. The multicollinearity test was conducted using the Variance Inflation Factor analysis, and the test scores ranged from 1.10 to 2.60, indicating that multicollinearity levels were low. The endogeneity problem is dealt discussed in the next subsection.

[4] DTMFIs with 3 to 5 diamonds have very high levels of information disclosure unlike their counterparts with 1 or 2 diamonds.

3.2 ECONOMETRIC METHOD AND VARIABLES

The study employed a panel data econometric framework to analyze the relationship between liquidity and explicit deposit insurance in the LISSA's depository microfinance sector. According to Brooks [31], the general panel data model is shown as follows:

$$Y_{it} = \alpha + \beta X_{it} + \mu_{it} \quad (1)$$

where: Y_{it} is the regressand factor; α is the intercept term, β is a K x 1 vector of parameters to be estimated on the regressors; X_{it} is a 1 x K vector of regressors, for i = 1, … N and t = 1, … T. μ_{it} is decomposed into, u_i, the error term that represents the unobserved effects or individual DTMFI heterogeneity and v_{it}, the idiosyncratic error term.

$$\mu_{it} = u_{it} + v_{it} \quad (2)$$

The idiosyncratic error term is assumed to be identically and independently distributed with a zero mean and constant variance; $v_{it} \sim IDD(0, \sigma_{v^2})$. Panel data models pool data on the individual DTMFI dimensions represented by subscript i collected over time, represented by subscript *t*. According to Greene (2012), panel data econometrics has the advantage of pooling both the time series and cross-sectional components of datasets than pure time series and cross-section data econometrics. In a similar vein, Brooks [31] added that with panel data econometrics, more complex problems could be addressed "than would be possible with pure time series or cross-sectional data" econometrics. Hence, panel data methods are able to exert controls on the heterogeneity across individuals and over time. Amongst other benefits of panel data econometrics, Baltagi [32] and Hsiao [33] cited the following: highly informative datasets, reduction in multicollinearity, increased degrees of freedom and increased efficiency.

The study considered two main panel data econometric methods, the fixed effects and the random effects, after noticing that panel data methods facilitate accounting for the heterogeneity of the DTMFIs under study. Park [34] distinguished the fixed effects approach from the random effects approach based on the treatment of dummy variables. The fixed effects model combines the dummy variable with the intercept, as shown in equation 3:

$$Y_{it} = (\alpha + u_i) + X'_{it}\beta + v_{it} \quad (3)$$

The random effects model combines the dummy variable with the error component, as shown in equation 4:

$$Y_{it} = \alpha + X'_{it}\beta + (u_i + v_{it}) \quad (4)$$

Deciding on adopting either the fixed effects approach or the fixed effects approach is mainly based upon answering the question; is the unobserved effect, u_i, correlated with the regressors X'_{it}? While assuming that the explanatory variables X'_{it} are not correlated with the error term u_i, the random effects method accommodates time-variant features. However, it does not allow for the characteristic differences in the selected DTMFIs.

The random effects approach uses a common mean value for the intercept for the selected DTMFIs. In marked contrast, the fixed effects method assumes that the error term u_i is correlated with the regressors X'_{it} and allows for time-invariant characteristics of the sampled DTMFIs in the estimation process. In addition, the fixed effects method allows the intercept to differ across the DTMFIs and not to vary over time. The Hausman Specification Test favored the random effects model, which was an aid in choosing between the random effects and the fixed effects models. Additionally, the random effects model was preferred to the fixed effects model as it does not drop the main independent variable, deposit insurance which was expressed as a dummy variable in the estimated model. Equation 5 specifies the log-linear model estimated:

$$lnNELATA_{it} = \beta_0 + \beta_1 D_{it}^{DEPINSU} + \beta_2 lnCAR_{it} + \beta_3 D_{it}^{BASEL} + \beta_4 lnDTL_{it} + \beta_5 lnGLP_{it} + \beta_6 lnYoGP_{it} + \beta_7 lnLLR_{it} + \beta_8 lnTETA_{it} + \beta_9 lnCPI_{it} + \mu_{it} \quad (5)$$

where for DTMFI *i* at time *t*: the dependent variable (liquidity) is non-earning liquid assets to total assets *(lnNELATA)*. Liquid assets mainly represent cash on hand and demand deposits held with the regulators of the DTMFIs [35]. Suppose these liquid assets held by the DTMFIs are non-earning. In that case, they are not investable assets. Therefore, they are readily available to provide liquidity in the form of withdrawals on deposits, loan requests and paying off other financial and operational commitments of the DTMFIs. The main explanatory variable is deposit insurance *(DEPINSU)* which is captured as a dummy variable that takes the value of 1 if a DTMFI operates in a country where there is explicit deposit insurance and 0 otherwise.

The DTMFI-specific control variables are capital adequacy *(lnCAR*), representing the extent to which depository and non-depository financial institutions can absorb expected and unexpected losses which, among other things, include sudden and unexpected withdrawals on demand deposits [2,7], operational risks and other forms of liquidity risks [36]. Basel implementation *(BASEL)* is a dummy variable that takes the value of 1 if a DTMFI operates in a country where Basel II or III implementation is in progress or has been partly or fully implemented and 0 otherwise. The recommendations of the Basel

Accords of the Bank of International Settlements require that financial institutions compare the level of their equity to the level of their total assets in the determination of capital adequacy.

The deposits to loans *(lnDTL*) variable is a financing measure that reflects the extent to which deposits mobilized by the DTMFIs finance their gross loan portfolios [19]. Size measured by the logarithm of the gross loan portfolio *(lnGLP)* is an indicator of how well the DTMFIs can strategically locate themselves in the midst of competitors and the rapidly changing business environment using their asset base [37]. The yield on the gross loan portfolio *(lnYoGP)* represents income that accrues to the financial revenue base of the DTMFIs in the form of interest and non-interest income after they have delivered financial services and products [38]. The loan loss rate *(lnLLR)* is a risk measure that provides insight into the impairment of loan losses due to irrecoverable debts and also considers the value of the loans recoverable [35,39]. Due to the size of the transactions and the type and location of the clientele served by MFIs, the total expenses *(lnTETA)* of running an MFI tend to be very high [35]. Inflation *(lnCPI)* was included as a macroeconomic control to account for the general increase in the price level, which may distort the cash flows of DTMFIs [36]. β_0, is the constant; β_1 ... β_9, are model parameters to be estimated; and μ_{it}, is the error term. Table 1 provides a summary of the variables used.

Table 1: Summary of variables used.

Variable	Description/Measurement	Predicted Effect	Data Source
Liquidity: non-earning liquid assets/total assets *(lnNELATA)*	The logarithm of adjusted cash and bank/adjusted total assets		MIX
Deposit protection: deposit insurance *(DEPINSU)*	The dummy variable took a value of 1 if a country had an explicit deposit insurance scheme and 0 otherwise	+	[11,12]
Capital adequacy: Capital to Assets *(lnCAR)*	The logarithm of total equity/total assets	+	MIX
Basel implementation: Basel *(BASEL)*	The dummy variable took a value of 1 if a country is implementing or has implemented Basel II/III and 0 if otherwise	+	[12]
Financing: Deposit to loans *(lnDTL)*	The logarithm of voluntary deposits/adjusted gross loan portfolio	+	MIX
Risk: Loan loss rate *(lnLLR)*	The logarithm of (adjusted write-offs – the value of loans recovered)/average gross loan portfolio	-	MIX
Size: Logarithm of the gross loan portfolio *(lnGLP)*	The logarithm of the gross loan portfolio	+	MIX
Financial revenue: Real yield on gross loan portfolio *(lnYoGP)*	The logarithm of the adjusted yield on gross loan portfolio (nominal) – inflation rate/(1 + inflation rate)	+	MIX
Expenses: Total expenses to total assets *(lnTETA)*	The logarithm of financial + credit impairment + operating expenses/total assets	-	MIX
Inflation: Consumer Price Index *(lnCPI)*	The logarithm of the annual percentage change in the Consumer Price Index	-	WDI

Source: Authors' compilation

Since the random effects model was adopted as the baseline model, the unobserved individual effects captured in the error term are not correlated with any explanatory variables, suggesting no endogeneity problem. Thus, this exogeneity assumption must hold if the random effects model is a consistent and efficient estimator. The random effects model can be consistently estimated using the OLS or Generalised Least Squares (GLS) methods. The GLS method is more efficient than the OLS method. However, in the presence of endogeneity, both methods are biased and inconsistent due to their assumption that the explanatory variables are exogenous. Therefore, to ensure that endogeneity was not a problem in the estimation process, the study employed the Two-Stage Least Squares (2SLS) technique as a testing technique using the ivregress command in Stata. The results of the ivregress command also enabled the study to identify the correct model (2SLS or the OLS method) for checking the robustness of the random effects model results. In the presence of endogeneity, the 2SLS method is preferred to the OLS method, and in the absence of endogeneity, the OLS method is superior to the 2SLS method. The present study treated size *(lnGLP)* as an endogenous variable, as this variable was suspected to be influenced by financing revenue *(lnYoGP)* and risk proxied by the loan loss rate *(lnLLR)*. The latter variables were treated as instrumental variables. The results of the 2SLS method indicated that endogeneity was not a problem suggesting that the OLS method was more appropriate than the 2SLS method. Therefore, the study adopted the OLS method as a robustness check for the baseline random effects model.

4. RESULTS AND DISCUSSION

The estimated regression results are shown in Table 2. The baseline random effects model results are shown in column (2), and the robustness check OLS results are shown in column (3).

Table 2: Estimated results.

Variables	Baseline Random Effects Results	Robustness Check OLS Results
Deposit insurance *(DEPINSU)*	0.5787688*** [0.208]	0.6180795*** [0.193]
Capital adequacy *(lnCAR)*	0.2202193** [0.106]	0.3881079*** [0.099]
Basel implementation *(BASEL)*	0.3948125* [0.205]	0.4138962** [0.187]
Financing *(lnDTL)*	0.0196915 [0.107]	0.124481 [0.121]
Size *(lnGLP)*	-0.0194004* [0.055]	-0.0732644* [0.040]
Financial revenue *(lnYoGP)*	-0.0289048 [0.185]	0.0533835 [0.163]
Risk *(lnLLR)*	0.0753728 [0.065]	0.0036274 [0.051]
Expenses *(lnTETA)*	-0.1667738 [0.230]	-0.0620286 [0.210]
Inflation *(lnCPI)*	0.0130675 [0.041]	-0.0017448 [0.053]
Constant	3.790338*** [1.231]	1.873315 [1.245]
sigma_u	0.49151681	
sigma_e	0.60018813	
Rho	0.40143391	
R-squared	0.1638	0.1883
Wald statistic: chi(7)	31.00	
Prob>chi2	0.0003	0.0000
Root MSE		0.81364
F Statistic		7.70

***, ** and * denote statistical significance at 1%, 5% and 10% levels, respectively. The figures in parenthesis [ ] are robust standard errors.
Source: Authors' compilation

The baseline results show that at the 1% level of significance, deposit insurance is a positive and highly significant determinant of liquidity for the LISSA DTMFIs. Intuitively, deposit insurance boosts liquidity or guarantees the short-term survival of DTMFIs when faced with deposit runs. This finding is consistent with the traditional theory of deposit insurance, which states that the presence of deposit insurance schemes can stimulate the confidence of the depositors in encouraging them to lodge their savings with deposit-taking financial institutions [10].

Assured safety of deposits through insurance cover ensures continual cash inflows that improve liquidity as new depositors are attracted, the run-away depositors are called back, and the existing depositors are maintained. This way, deposit insurance benefits the DTMFIs and the depositors, as their liquidity preferences will not be threatened. In addition, it means that the LISSA DTMFIs will be able to even out the supply of liquidity, meeting withdrawals and interest on deposits and extending lines of credit in line with the provision of the liquidity arm of the theory of financial intermediation. On the contrary, Ngalawa [14] found that the vulnerability of the banking systems to bank runs and insolvency in low-income countries where deposit insurance schemes are minimal is not so marked as the vulnerability of the counterpart banking systems in non-low-income countries. Furthermore, that study also found that the effects of deposit insurance schemes are country specific.

The findings of this study on the positive relationship between liquidity and deposit insurance are supported by Anginer *et al*. [28], who found that the adoption of deposit insurance minimizes banking institutions' exposure during financial crises. On the contrary, Anginer *et al*. [28] found that the adoption of deposit insurance during the pre-crisis era resulted in increased bank risk. After combining the pre-crisis and the during-crisis results, the net effect of deposit insurance was negative. This means that deposit insurance cover has the potential to expose DTMFIs to liquidity risk to the detriment of the depositors, especially when moral hazard outweighs the benefits of the insurance cover [40]. Hence, empirical writers

warn that deposit-taking institutions trigger moral hazard problems when they abuse deposit insurance schemes by engaging in high-risk transactions leveraging the insurance cover as the fallback [22].

The capital adequacy ratio and the BASEL dummy are positive determinants of liquidity of the LISSA DTMFIs at the 5 % and 1 % levels of significance, respectively. These results show that with adequate equity to total assets levels, the LISSA DTMFIs can withstand liquidity risk. This finding is consistent with Hessou *et al*. [35], who found that capital adequacy shields MFIs from risks associated with loan loss provisions, thereby improving their liquidity and guaranteeing their short-term survival. Zamore [36] found that by absorbing risks faced by MFIs, capital adequacy guarantees their survival in the long term. On the contrary, Hadizatou [18] found that capital adequacy requirements have no bearing on the financial and social performance of MFIs. Nonetheless, the non-implementation of the Basel framework capital adequacy standards in many LISSA countries exposes the DTMFIs to liquidity risk, which thwarts their ability to honor their obligations to depositors.

The deposits to loans coefficient that measures the extent to which the mobilized deposits finance the loan portfolio are positive but statistically insignificant despite the fact that the deposits outweigh the loans in the LISSA countries. Internal funding through deposits to finance the loan book positively influence liquidity due to the fewer conditions attached to them, their comparatively low cost and the fewer managerial implications. However, Kipesha [23] found that reliance on external funding than internal funding to finance loan portfolios and other operations erodes liquidity.

The size coefficient is statistically significant but negatively related to liquidity at the 10% level of significance. It indicates that size proxied using the loan book volume is a negative determinant of liquidity due to diseconomies of scale associated with the huge establishment and operational costs of expanding the gross loan portfolios as the LISSA DTMFIs spread their wings through extensive branch networks. Contrary to the findings of this study, Murage and Muiru [25] found that the liquidity of microfinance banks in Kenya is positively affected by the intensity of their loans. Laureti and Szafarz [16] found no evidence of size influencing the liquidity premium of deposit-taking financial institutions in Bangladesh.

Financial revenue is negative and insignificant, with liquidity suggesting that interest earned does not significantly contribute to cash availability. Contrary to Murage and Muiru [25], who found that losses on the loan portfolio erode the liquidity of MFIs, the present study found that the loan loss rate coefficient is negative but statistically insignificant in explaining liquidity. Nonetheless, the negative sign may indicate that impairment of loans and unrecovered bad debts erode liquidity due to a reduction in cash inflows.

The inflation rate coefficient is positive but statistically insignificant in explaining the liquidity of the LISSA DTMFIs. Similarly, one recent study did not find any significant relationship between macroeconomic factors and Nigeria's liquidity of microfinance banks. This finding is contrary to the study of Chikoko and Kwenda [17], who found that inflation has an influence on liquidity in the microfinance sector. The results of this study may indicate that the poor and the low-income households in LISSA are borrowing less from the DTMFIs as the inflation premium raises the repayment interest rates. Less borrowing results in the reduction of cash outflows and, ultimately, improvement in the liquidity position. On the deposit-taking side, the positive inflation rate coefficient may reflect that the DTMFIs guard against withdrawals of deposits by offering high returns or that their deposit portfolios mainly consist of term deposits largely withdrawn upon maturity. It keeps the liquidity position immune from inflationary pressures.

The results in column (3) of table 2 for the OLS robustness check method corroborated the baseline random effects regression results in column (2) of table 2 in terms of the significant variables and their signs, except for the magnitude of the coefficients.

5. CONCLUSION

The objective of this study was to analyze the relationship between liquidity and deposit insurance using panel data obtained from the MIX for the years 2006 to 2017 of 64 DTMFIs drawn across 18 LISSA countries. The random effects model was used in the estimation of results. Deposit insurance was found to be positive and significantly related to liquidity. Intuitively, this implies that the adoption of explicit deposit insurance schemes positively affects the liquidity of the LISSA DTMFIs. Thus, deposit protection augments the financial inclusion of small and poor savers from the low-income countries of Sub-Saharan Africa as it provides a safety net for their microdeposits. Maintaining adequate capital adequacy levels and implementing Basel recommendations were also found to spur liquidity. Nonetheless, the loan book size embedded with deteriorating loan portfolio quality constrains liquidity. The deposits to loans, inflation rate, loan loss rate and financial revenue coefficients were found to be insignificant determinants of liquidity.

Based on the findings, the study came up with policy recommendations. Firstly, the LISSA regulators should design and implement explicit deposit insurance schemes that embrace depository microfinance. The schemes should include the extent and amount of coverage, the types of deposits and how the insurance pools are to be funded [41]. Since deposit insurance ignites the moral hazard problem, proactive measures have to be taken to minimize this unwanted deterrent. This implies that the regulators must educate the depositors through the core client protection principles to protect themselves and be guided on how they can hold or move their savings within the insured DTMFIs. However, in the design and implementation of explicit deposit insurance schemes, the LISSA regulators have to strike a balance between stifling business innovations and allowing the DTMFIs to seize opportunities that yield high returns using the insured depositors' funds based on tolerable levels.

The second recommendation is that explicit deposit insurance packages have to be reinforced by adherence to the Basel Committee's principles for supervising non-banking financial institutions that tap deposits: principle 6 covers the capital adequacy standards, and principle 14 highlights the importance of liquidity risk management strategies and contingency plans [42]. Active liquidity management practices set by the asset and liability management committees of the LISSA DTMFIs are also encouraged to be proactive in dealing with liquidity risk.

For further research, there is a need to investigate whether it is possible to establish an inter-microfinance market where the LISSA DTMFIs can borrow and lend to each other to satisfy their funding and liquidity needs using a typical benchmark interest rate. Moreover, there is a need for the LISSA regulators to assess if their DTMFIs can also be included as part of the domestic, systematically important banks, as their failure can also cause problems such as loss of depositor confidence.

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CONFLICT OF INTEREST

None.

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