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Effect of Liquidity and Credit Risk on Banking Performance: Evidence from Sub Saharan Africa

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ABSTRACT

Risk is a great impediment confronting the performance of banks in Sub Saharan Africa. Liquidity and credit risk are the dominant form of risk affecting banking performance. This study seeks to examine the effect of liquidity risk and credit risk on the performance of banks in Sub Saharan Africa. The study used a sample of fifty (50) banks drawn across six Sub Saharan African countries that include Nigeria, Ghana, South Africa, Zambia, Kenya, and Tanzania. The two-step system generalized method of moment is the analysis tool used in the study. The findings from the study revealed that liquidity risk and credit risk are separately and jointly significant and negatively contribute to the performance of banks in Sub Saharan Africa. Banks management and practitioners are therefore encouraged to employ all the necessary measures to manage these risks under a single control as proposed in the Basel III regulatory provisions.

ملخص

تشكل المخاطر عائقا كبيرا يعترض أداء المصارف في أفريقيا جنوب الصحراء الكبرى. وتعتبر مخاطر السيولة والائتمان الشكل السائد للمخاطر التي تؤثر على الأداء المصرفي.وتسعى هذه الورقة إلى دراسة أثر مخاطر السيولة والائتمان على أداء المصارف في أفريقيا جنوب الصحراء الكبرى. وقد استخدمت الدراسة عينة تتكون من خمسين بنكا تم اختبارها من ست دول أفريقية تقع في جنوب الصحراء الكبرى تشمل كل من نيجيريا وغانا وجنوب أفريقيا وزامبيا وكينيا وتنزانيا.ويعتبر أسلوب اللحظات المعمم (GMM)-على خطوتين أداة التحليل المستخدمة في الدراسة. وقد كشفت النتائج التي خلصت إليها الدراسة أن مخاطر السيولة والائتمان تتسم بأهمية منفصلة ومشتركة وتساهم سلبا في أداء

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المصارف في أفريقيا جنوب الصحراء الكبرى. ولذلك تشجع إدارة المصارف والممارسين على استخدام جميع التدابير اللازمة لإدارة هذه المخاطر تحت رقابة واحدة على النحو المقترح في الأحكام التنظيمية لاتفاقية بازل الثالثة. الكلمات الرئيسية: مخاطر السيولة، ومخاطر الائتمان، ونظام أسلوب اللحظات المعمم (GMM)، هامش صافي الفائدة (NIM)، والعائد على الأصول (ROA)، أفريقيا جنوب الصحراء الكبرى (SSA)،

ABSTRAITE

Le risque est un obstacle majeur à la performance des banques en Afrique subsaharienne. Le risque de liquidité et le risque de crédit sont les formes dominantes de risque qui affectent la performance des banques. Cette étude vise à examiner l'effet du risque de liquidité et du risque de crédit sur la performance des banques en Afrique subsaharienne. L'étude a utilisé un échantillon de cinquante (50) banques réparties dans six pays d'Afrique subsaharienne, à savoir le Nigeria, le Ghana, l'Afrique du Sud, la Zambie, le Kenya et la Tanzanie. La méthode des moments généralisés du système à deux étapes est l'outil d'analyse utilisé dans l'étude. Les résultats de l'étude ont révélé que le risque de liquidité et le risque de crédit sont séparément et conjointement significatifs et contribuent négativement à la performance des banques en Afrique subsaharienne. La direction des banques et les praticiens sont donc encouragés à employer toutes les mesures nécessaires pour gérer ces risques sous un contrôle unique comme le proposent les dispositions réglementaires de Bâle III.

Keywords: Liquidity risk, Credit risk, system GMM, ROA, NIM, SSA
JEL Classification: F3, G21. 016, 053

1. Introduction

The global financial crisis of 2007-2009 had exposed banking performance to different forms of risks. The banking sector is among the most important industry in the economy and it is a known fact that banks have many peculiarities compared to industrial firms. Banks ensure mobilisation and efficient allocation of funds from surplus to deficit units Fama, (1980). According to Cecchetti and Schoenholtz, (2011), banks are faced with several financial risks comprise of the probability that deposits will suddenly be withdrawn by depositors (liquidity risk), non-repayment of loans on time by borrowers (credit risk), change in interest rates (interest-rate risk), the collapse of banking structures or failures of their computer system (operational risk). The activities of banks are usually

affected by the two most important in the sector that includes liquidity and credit risk (Ghenimi, Chaibi, & Omri, 2017).

In an attempt to identify the functions of banks, Richard, (2016), traces three banking theories. The first theory of banking according to him sees a bank as an institution that receives from savers and gives it to investors. The reserve theory of banking is the second; it believes that money in banks is created through multiple deposit expansion as a collective banking system. It sees the bank as a financial intermediary. The argument for the third banking theory believes that bank has the authority for money creation and credit through new loan extension, it rejects the financial intermediary role of banks. All the theories, particularly, the financial intermediation theory, impliedly proved that there is some association between credit risk and liquidity risk.

Empirical and theoretical results are supported during the global financial crisis by anecdotal evidence from bank failures. Office of the Comptroller of the Currency (OCC) and Federal Deposit Insurance Corporation (FDIC) reports that credit and liquidity risk contributed to a large number of failures among commercial banks during the global financial crisis. Liquidity risk is attributed to profit-lowering cost, a default in loan raises liquidity due to depreciation it caused and lowered cash inflow (Dermine, 1986). Therefore, based on the literature, the relationship between credit and liquidity risk is positive. Meanwhile, at the time of the crisis, there is a movement of risk among banks, from bank runs or deposit withdrawal risk to a risk of other funding sources dry up, particularly, interbank market (Borio, 2010; Huang & Ratnovski, 2011). As a result of asymmetries information in the loan market, on the other hand, credit risk affects a large number of banks (Heider, Hoerova, & Holthausen, 2009). Hence, bank failures are experienced following a mutual reinforcement between liquidity and credit risk.

Moreover, Following, the global financial crisis, large number of literature make on the positive association between liquidity and credit (Allen, and, Carletti, 2008; Cornett, McNutt, Strahan, & Tehranian, 2011; Gefang, Koop, & Potter, 2011; Imbierowicz & Rauch, 2014). The association between credit risk and liquidity risk among US banks is examined between 1998 and 2010 (Imbierowicz & Rauch, 2014). Their findings revealed a weak positive interrelationship of credit and liquidity

risk using bank-specific attributes, but they indicate a positive and robust association with bank external credit risk and internal liquidity.

Equity capital and deposits constitute the main sources of banks' funding and must meet the standard of capital adequacy ratio for the banks to be safe (Broll, Welzel, & Wong, 2018). Moreover, Cornett, et al., (2011), posits that liquidity from the market is affected by the financial crisis. They classified banks into two classes; i.) banks with equity capital finance and deposits as the main funding source, continue lending more with other banks, and ii.) banks, with increase illiquid assets, minimize their lending to contribute to their liquidity. Finally, in monitoring their liquidity, banks compelled them to minimize the supply of credit, which lead to minimizing the credit risk. This as well exhibits copositive movement.

Acharya, Shin, and Yorulmazer,(2011); Tirole, (2011), clearly proposed regulations of liquidity. Although, depending heavenly on the interbank market by banks, a rise in the requirements of capital can be explained as a suitable measure of both liquidity risk and insolvency. Despite that Acharya and Viswanathan, (2011) and Heider et al., (2009), have already revealed that liquidity and credit risks collectively influence and interact with the performance of banks. Part of the contribution of the work of Imbierowicz and Rauch, (2014), among commercial banks in the US, revealed that liquidity and credit risk collectively influence the performance of the bank. Moreover, Vazquez and Federico, (2012), in their study among American and European banks conclude that a joint exposure to liquidity and credit risk increases the challenges of the banks. The focus of our paper is on the post-global crisis effect of liquidity and credit risk on the performance of Sub Saharan African region.

Our study analyzes the effect of liquidity and credit risks on banking performance in a post-financial crisis. Previous studies largely focus on the effect of both liquidity and credit risk during a financial crisis. As a first step, the study would look at the separate impact of liquidity and credit risk on bank performance. In the second aspect, the study will also analyze the joint effect of liquidity and credit risk on bank performance.

The limited researches from Sub Saharan Africa on the effect of liquidity and credit risk on banking performance motivated this study. Most of the attention of global scholars is focused on developed countries, Asia and

MENA region, with limited attention given to Sub Saharan African region, despite the continued problems and threat posed by these risks on the banking sector and the economy of the region at large. Moreover, the region is seen to have vast investment opportunities and the prospect of their banking sector is likely to attract investors and bankers worldwide. With the scarcity of studies in this area, our focus will be on the examination of the effect of liquidity and credit risk on banking performance in the context of Sub Saharan Africa.

The study is expected to make the following contributions. The study found that each liquidity risk and credit risk is significant and negatively affects the performance of banks in Sub Saharan Africa. Their interaction effect is also significant and negatively affects the performance of banks in the region.

The remainder of the paper is organized as follows. Section 2 presents the review of related literature. Section 3 discusses the data and methodology used. Section 4 reports results and discussions. Section 5 explains the conclusion and policy implication.

2. Literature Review

2.1 Concept of Liquidity risk

Liquidity risk is the future loss affecting an established institution emanating from either increase funding in an asset as they become due without incurring unacceptable losses or cost, or its inability to meet its obligation (Arif & Anees, 2012). According to the Comptroller of the Currency, (2001), liquidity risk is a risk emanating from a bank's inability to satisfy its obligations as they become due without incurring unacceptable losses. This risk can wreak havoc on both the capital and bank's earnings. This therefore must be treated with urgency by bank management to make funds available to satisfy potential requests of borrowers and providers at affordable cost. Liquidity is simply defined according to Muranaga and Ohsawa, (2002), as a risk of being unable to liquidate a position timely at a reasonable price. Two components of liquidity risk are emphasized here. Liquidating an asset when required and at a fair market value.

Based on the opinion of Goodhart, (2008), liquidity risk consists of two basic components: the inherent liquidity of a bank's asset (the degree to which asset can be deposed without incurring an important value loss under any market condition) and maturity transformation (the maturity of a bank's asset and liabilities). In reality, these two components of a bank's liquidity are interlinked. Banks need not panic about the maturity transformation if they own an asset that can be sold without incurring any loss. Whereas, banks may have less need to maintain the liquid assets if they hold assets that are maturing in a shorter period. Aside from the issue of maturity mismatch, liquidity risk may be caused by recessional economic conditions, which affect resource generation. This raises depositors to demand leading to liquidity risk. A particular bank or even the entire banking system may fail due to this, as a result of the contagion effect (Diamond & Rajan, 2005).

2.2 Concept of Credit Risk

Credit risk may be seen as the uncertainty related to future loss of a value on a fixed income either interest or principal in the event of default, widening, or downgrade of credit spreads (Jacobs Jr, Karagozoglu, & Layish, 2016). BCBS, (2001), posits that credit risk is the dominants risk in the banking sector. According to Jorion, (2009), credit risk is the economic loss from the failure of the counterparty to meet its contractual obligations. Credit risk is mainly caused by non-compliance of debtors with their commitments scheduled, which exist in their contractual terms (Ferhi, 2018). Credit is often seen as the process of lending and borrowing money. Simply put, it refers to a financial instrument that involves predetermined fixed payment, which is effected over a certain period or a loan given to a borrower.

On the other hand, Anita, (2008), defined credit risk as the future loss of valuable assets caused by likely deterioration in the creditworthiness of the counterparty or its inability to meet contractual obligations. Moreover, firms involved in a securities transaction may be confronted with credit risk as well due to their commitment to the derivatives market, lending or borrowing securities, and marking margin loans to customers. Credit risk depends on the ability of borrowers to generate sufficient cash flow earnings, operations, and sales of assets to meet their future principal and interest payment of the outstanding debt (Manab, Theng, & Md-Rus, 2015).

2.3 Determinant of Liquidity and Credit Risk

2.3.1 Micro Determinants

Determinants of liquidity and credit can be seen from the perspective of bank-specific factors as well as from macroeconomic factors. With regards to bank-specific factors of credit risk, the literature revealed many determinants that include a low level of capital, low efficiency, poor management, and surplus lending undertaken by high-risk banks. In particular, low-cost efficiency banks are mishandled with weak loan underwriting, poor control, and monitoring which leads to the rising level of credit risk (Berger & Humphrey, 1997; Podpiera & Weill, 2008). In contrast, high cost could mean that banks fail in distributing sufficient resources to manage risks and due to that, credit risk increases whereas certain performance ratios are indirectly related to credit risk. Moral hazard hypothesis posits that high-risk banks are usually associated with low capital and higher credit risk chance (Keeton & Morris, 1987). However, low liquidity banks, measured by loan to their asset ratio or deposit ratio are more exposed to a high level of credit risk due to their inability to contain funding gaps. The surge in the presence of Islamic bank in the Malaysian banking sector, minimize the risk within it, hence raising the efficiency-risk tradeoff (Ibrahim, 2020).

On the other hand, a bank's deposit loan loss provision is also an important determinant of the liquidity risk of banks. Kwal, Lee, and Eldridge, (2009), reveal that DLLP is associated positively with the securities gain realized, external financing demand, and prior year taxes. The dominance of withdrawal and high liquidity risks in banking motivates a rise in scrutiny over banks' loan provision decisions, (Hasan & Dridi, 2011; Olson & Zoubi, 2008). Liquidity risk is significantly affected by the capital adequacy of banks. Acharya et al., (2011), show that banks may take more risk due to their capital position and create liquidity by giving out more loans. Distinguin, Roulet, and Tarazi, (2013), evaluate the association between bank liquidity and regulatory bank capital, findings indicate that the regulatory capital of banks is minimized when they are largely involved in the creation of liquidity and confront with a less net stable funding ratio.

Liquidity risk is also affected by bank size. A study on Saudi and Jordan banks' liquidity risk between 2007 to 2011, by Abdel Karim, (2013),

reveals that Saudi bank size is negatively associated with liquidity risk. Choon et al., (2013), indicate a significant association between liquidity risk and bank size. Some studies explore the relationship between bank liquidity and profitability ratios (Choon et al., 2013; Lartey, Antwi, & Boadi, 2013). The association of liquidity risk and performance at the time of the global financial crisis had been examined, and findings indicate that performance and liquidity risk are negatively associated (Ariffin, 2012). Abdel Karim, (2013), shows that return on equity and liquidity risk are negatively associated, while return on asset is associated positively with liquidity risk. Delechat, Henao Arbelaez, Muthoora, and Vtyurina, (2012), find that profitability affects bank liquidity negatively.

2.3.2 Macro Determinants

At a macro level, both credit risk and liquidity risk are affected by macro-economic factors, comprising mainly of gross domestic product and inflation. A stable macroeconomic atmosphere offers chances for hedging risks and provides varieties of choice of monetary, fiscal, and exchange rate policies (Ehigiamusoe & Lean, 2017). A study by Sulaiman, Mohamad, and Samsudin,(2013), revealed that GDP and liquidity risk are inversely related. Choon et al., (2013), in their study, reveal a positive effect of GDP on bank liquidity while Aspachs, Nier, and Tiesset, (2005), show that UK banks seem to maintain a smaller amount of liquidity when there is a decrease in GDP. On the other hand, Lassoued, (2017), reports that GDP has a significant negative association with credit risk. This implies that in a period of economic growth credit risk decreases. Ahlin, Lin, and Maio, (2011), show that economic growth boosts financial sustainability by reducing defaults. In contrast, Fonseca and Gonzalez, (2008), indicate that growth and portfolio risk have a positive relationship.

Inflation is another macroeconomic factor that affects both liquidity and credit risk. According to Ashraf, Rahman, Rahman, and Zheng, (2018), showed a positive impact of inflation on liquidity risk. This is in line with the results of Sulaiman et al., (2013). In contrast, Yacoob, Abdul Rahman, and Abdul Karim, (2016), revealed that liquidity positions of banks are increase in an inflationary environment to safeguard depositors, and necessary precautions are taken against a bank run risk. On the other hand, Lassoued, (2017), maintains that an increase in inflation rates affects borrowers' solvency because an increase in price leads to a

decrease in the real income of households. His findings reveal that inflation has a positive relationship with credit risk.

2.4 Relationship between Liquidity and Credit Risk on Banks Performance

Some empirical studies are conducted either on liquidity risk, credit risk, or a study with the interaction of liquidity and credit risk. Each of the studies affects banking performance in one way or the other. A few studies are reported below; Arif and Anees, (2012), in their study, examine liquidity risk in Pakistan banks and analyze its effects on bank's profitability. The study employed 22 banks between 2004 to 2009, using multiple regression techniques. The findings indicate that profitability is significantly affected by liquidity risk, with the non-performing loan and liquidity gap as the two factors exacerbating the liquidity risk. They have a negative association with bank performance. They have a negative association with bank performance.

Elbadry, (2018) in his study, investigate the effect of Saudi bank's financial stability on risk management. The results of the study revealed a significant and negative impact of capital adequacy ratio on credit risk. Moreover, the leverage ratio has a significant positive effect on credit risk. Furthermore, the findings show a significant negative impact of leverage, provisions, bank size, the ratio of loan to deposit on liquidity risk. Varotto, (2011), the study evaluated the association between credit risk and liquidity risk, and the result is used to find the incremental risk charge (IRC), the recent credit risk capital, the latest credit capital add-on for banks trading books introduced by the Basel Committee. The result revealed that despite the (incremental) credit risk may be seen as an option in the trading book, the capital requirements to sustain associated losses of market risk in a highly volatile condition can be more than ten times.

Fatemi and Fooladi, (2006), investigate credit risk management contemporary practice by the U.S based largest financial institutions. Findings revealed tracing counterparty default is one of the most crucial aims served by the models of the credit risk utilized. Apanga, Appiah, and Arthur, (2015), the study evaluates practices of credit risk management within Ghana financial institutions. The research makes a comparison on practices of credit risk management of listed Ghana banks with Basel II

(1999). The result of the study shows that credit risk management practices within listed banks in Ghana are in line with sound practice.

Ko, Lee, and Anandarajan, (2019), the paper analyses the relationship between credit risk, operational risk, corporate governance, and performance of the firm. Results from the study show that a higher probability of credit default is linked to a higher level of operational risks incident and to poor performance. The study revealed, more importantly, that higher-quality corporate governance is related to low-level operational risk incidents, improved performance, and less probability of credit fault.

Other empirical literature focuses on looking at the joint effect of liquidity and credit risk on banks. A study by Imbierowicz and Rauch, (2014), examines the association between credit risk and liquidity risk. The study used all the sample U.S commercial banks from 1998 to 2010. Results of the study reveal both risks separately increase the probability of default, and the effect of their interaction depends on the overall level of bank risk and can either increase or minimize default risk. In the study, Hassan, Khan, and Paltrinieri, (2018), the study evaluated the association between liquidity and credit risk through an assessment of Islamic banks and conventional banks from the selected organization of Islamic cooperation countries for the period of 2007-2015. The findings indicate that liquidity and credit risk has a negative relationship. The results finally confirmed Islamic banks to be better in terms of risk management than conventional banks.

Ghenimi et al., (2017), in their study that assesses the effect of liquidity risk and credit risk on banking stability. The study used a sample of 49 banks operating in the MENA region throughout 2006-2013. Results from the study show that credit risk and liquidity risk do not have time-lagged or any economically reasonable association. Although, the risk individually influence the stability of bank and bank instability is enhanced with their interaction. Based on the above empirical evidence, the following hypothesis are developed.

H_{01}: There is a significant negative relationship between liquidity risk and bank performance in SSA

H_{02}: There is a significant negative relationship between credit risk and bank performance in SSA

H_{03}: There is a significant positive relationship between the interaction of liquidity risk and credit i.e they jointly increase or decrease.

3. Data and Methodology

3.1 Data

The study employed panel data with 450-year observation. Fifty banks are drawn from six Sub Saharan African countries that include Nigeria, Ghana, South Africa, Zambia, Kenya, and Tanzania, over 9 years starting from 2010 to 2018. The selection of the countries was based on the report by the international institute of finance in 2016 that classified those countries as the largest financial market in the Sub Saharan African region. The data are sourced from the Thomson and Reuters data stream and annual financial reports of the individual banks, while the World bank open data source supplements, the data for the macroeconomic level data. The paper aim at examining the effect of liquidity and credit risk on the performance of banks in the Sub Saharan region. The study model is given below and developed based on the study of (Ghenimi et al., 2017).

$$PER_{ijt} = PER_{ijt-1} + \beta_0 + \beta_1 LQR_{ijt} + \beta_2 CRD_{ijt} + \beta_3 DEP_{ijt} + \beta_4 CAS_{ijt} + \beta_5 LEV_{ijt} + \beta_6 BSZ_{ijt} + \beta_7 LQRCRD_{ijt} + \beta_8 DISdummy_{ijt} + \beta_9 INF_{jt} + \beta_{10} GDP_{jt} + \eta_i + \lambda_t + \varepsilon_{ijt}$$

The study will employ a dynamic panel data model due to the nature of the data. Meanwhile, the major problem of endogeneity has to be addressed in this kind of study, through the methodology, due to the possibility of reverse causality as the dependent variable can predict the independent variables on the right-hand side of the model Baltagi, (1995). Moreover, previous year bank performance ($PER_{ijt-1)}$ can affect current year performance (PER_{ijt}) which justifies the use of dynamic panel model specification. The subscript i, j, and t stand for bank, country, and time respectively. The study would use the two-step system GMM in making statistical inferences of the analysis due to the nature of the data and its advantages over the ordinary least square technique of providing more

consistent findings and capable of addressing endogeneity problems among the variables (Yahaya, Mahat, & Matemilola, 2020).

3.2 Variable Description

The study aim at assessing the joint effect of credit and liquidity risk on banks' performance in Sub Saharan Africa. Two measures of bank performance are employed in the study, that is return on Asset (ROA) and net interest margin (NIM). The main independent variables are liquidity risk (LQR), credit risk (CRD), and the interaction term between liquidity and credit risk (LQRCRD). Other bank-specific variables included in the study are deposit ratio (DEP), capital asset ratio (CAS), leverage ratio (LEV), bank size (BSZ), and a deposit insurance scheme (DIS dummy). The macroeconomic variables include inflation (INF) and gross domestic product (GDP). The variables are defined in the below table;

Table I: Variable Description and Definition

Variable	Definition	Code
Dependent		
Return on Asset	The bank's net profit after tax divided by total asset	ROA_{ijt}
Net Interest Margin	Net interest margin is the net interest income to total asset ratio	NIM_{ijt}
Independent		
Liquidity Risk	Loan to Deposit Ratio	LQR_{ijt}
Credit Risk	Proportion of Non-Performing Loans to Total Loans	CRD_{ijt}
Bank Specific		
Deposit Ratio	Proportion of total deposit to total asset	DEP_{ijt}
Capital Asset Ratio	Proportion of Total Capital to Total Asset	CAS_{ijt}
Leverage	Total Debt to Total Capital	LEV_{ijt}
Bank Size	log of Total Asset	BSZ_{ijt}
DISdummy	1, if it explicit deposit insurance scheme, 0 otherwise	$DISdummy_{ijt}$
Macro Economic Level		
Inflation	Annual consumer price index percent	INF_{jt}
Gross Domestic Product	GDP growth rate in percent	GDP_{jt}

Source: Author Compilation, 2020

4. Result and Discussion

4.1 Descriptive Statistics

This study covers a period of 9 years from 2010-2018, comprising a total of 450-year observations. ROA and NIM are the two dependent variables with a mean of 2.7078 and 8.9569, with a standard deviation of 1.7007 and 7.0302 respectively. LQR has the highest mean and standard deviation value with 82.0814 and 25.6191 respectively. The mean distribution of other variables that include CRD, DEP, CAS, LEV, and BSZ is 5.3045, 66.1834, 19.6047, 39.9072, and 18.6784 respectively. The macroeconomic variable that includes GDP and INF has a mean value of 9.2171 and 4.7577 with a standard deviation of 3.9851 and 2.9088 respectively.

Table II: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA_{ijt}	450	2.7078	1.7007	-2.5218	9.9701
NIM_{ijt}	450	8.9569	7.0302	-0.5600	91.3510
LQR_{ijt}	450	82.0814	25.6191	-0.6486	150.347
CRD_{ijt}	450	5.3045	6.3047	0.0200	69.3302
DEP_{ijt}	450	66.1834	17.6976	4.8110	158.7518
CAS_{ijt}	450	19.6047	5.9976	3.6901	42.8710
LEV_{ijt}	450	39.9072	23.3794	-171.8700	170.5221
BSZ_{ijt}	450	18.6784	2.7082	12.5874	22.6219
INF_{jt}	450	9.2171	3.9851	3.4945	17.8697
GDP_{jt}	450	4.7577	2.9088	-1.6169	14.0471

Source: STATA 15 Result

4.2 Correlation Matrix

The relationship between the two dependent variables in the study that is ROA and NIM is 0.2246. The main independent variable that comprises LQR and CRD both maintain a negative association with the dependent variable. LQR maintains a negative association with ROA and NIM with the coefficient of -0.1568 and -0.0562. CRD maintains a co-efficient of -0.0.570 and -0.1257 for ROA and NIM respectively. The relationship between the two independent variables, that is LQR and CRD is -0.1637.

Other bank-specific maintains both negative and positive relationship with the dependent as well as the independent variables. DEP and CAS maintain a negative association with ROA with 0.1933 and 0.1276 respectively, while the relationship between DEP and NIM is negative while that of CAS and NIM is positive. Likewise, LEV and BSZ maintain a negative association with ROA and NIM. The interaction term LQRCRD maintains a negative relationship with both ROA and NIM with -0.1742 and -0.0889, whereas it maintains a positive relationship with the main independent variable, with 0.2681 and 0.7921 for LQR and CRD respectively.

The macroeconomic variable maintains both positive and negative relationships with the dependent and independent variables in the study. INF maintains a negative association for both ROA and NIM with -0.0060 and -0.0427 respectively. It maintains a co-efficient of -0.2661 and 0.1712 for LQR and CRD respectively. The interaction term has a positive association with INF with 0.0981. GDP also maintain both positive and negative relationship with other variables in the study. GDP maintains a positive association with ROA and NIM with 0.2719 and 0.04226 respectively. The relationship between GDP and LQR is negative with -0.2941 while it maintains a 0.0066 co-efficient with CRD. The interaction term maintains a negative association with a coefficient of -0.0777 with GDP.

Table III: Correlation Matrix

	ROA_{ijt}	**NIM_{ijt}**	**LQR_{ijt}**	**CRD_{ijt}**	**DEP_{ijt}**	**CAS_{ijt}**	**LEV_{ijt}**	**BSZ_{ijt}**	**$LQRCRD_{ijt}$**	**INF_{jt}**	**GDP_{jt}**
ROA_{ijt}	1										
NIM_{ijt}	0.2246	1									
LQR_{ijt}	-0.1568	-0.0562	1								
CRD_{ijt}	-0.0570	-0.1257	-0.1637	1							
DEP_{ijt}	0.1933	-0.0573	-0.1370	0.0259	1						
CAS_{ijt}	0.1276	0.1611	0.2372	0.0494	-0.1038	1					
LEV_{ijt}	-0.2004	-0.1269	0.1862	-0.0172	-0.1659	-0.0555	1				
BSZ_{ijt}	-0.3008	-0.0082	0.2681	-0.0265	0.1359	0.0831	0.0883	1			
$LQRCRD_{ijt}$	-0.1742	-0.0889	0.2361	0.7921	-0.0689	0.1881	0.0553	0.1092	1		
INF_{jt}	-0.0060	-0.0427	-0.2661	0.1712	-0.0201	0.1899	-0.0188	-0.0908	0.0981	1	
GDP_{jt}	0.2719	0.0426	-0.2941	0.0066	0.0496	-0.0044	-0.1747	-0.3350	-0.0777	-0.1637	1

Source: STATA 15 Result

4.3 Multicollinearity Test

The distribution of the data shows the absence of multicollinearity among the variables because the mean VIF is less than 10. In other words, the VIF and the tolerance value of the explanatory variables show that all the variables have less than 5, and the tolerance level greater than 0.10 respectively.

Table IV: Multicollinearity test

Variable	**VIF**	**1/VIF**
$LQRCRD_{ijt}$	4.47	0.223817
CRD_{ijt}	4.25	0.235482
LQR_{ijt}	2.15	0.465637
GDP_{jt}	1.37	0.732269
INF_{jt}	1.32	0.756728
BSZ_{ijt}	1.25	0.799181
CAS_{ijt}	1.21	0.823661
DEP_{ijt}	1.11	0.897283
LEV_{ijt}	1.1	0.911741
$DISdummy_{ijt}$	1.09	0.921118
Mean VIF	1.93	

Source: STATA 15 Result

4. 4 Regression Result

4.4. 1 First Regression Result

The study evaluates the joint effect of liquidity and credit risk on the performance of banks from Sub Saharan Africa region. The regression presents four models; the pooled OLS, fixed effect, differenced, and system GMM. The inference for the study will be based on the system GMM due to its ability to address the endogeneity problem found in the ordinary least square estimates and the provision of consistent findings.

The lagged dependent of all the models are significant at 1 percent. This confirms that our model is dynamic and our choice for the system GMM is appropriate. LQR is significant at 1 percent and negatively associated

with ROA. This indicates that an increase in the rate of LQR decreases the ROA, this is consistent with the findings of (Ali & Puah, 2019). CRD is significant at 1 percent and negatively associated with ROA. An increase in the credit risk rate decreases the performance of banks in terms of their return on asset, this is in line with the result obtained by (Partovi & Matousek, 2019). DEP is positively significant at 1 percent. This implies that the deposit ratio moves in the same direction as the performance of banks. A rise in deposit ratio leads to a corresponding increasing in the banking performance, this confirms the findings of (Hoffmann, 2011). CAS is significant at 1 percent and positively associated with ROA. An increase in capital asset ratio increases the bank's ROA.

LEV is significant at 1 percent and positively correlates with the performance of banks, this is consistent with the result obtained by (Aebi, Sabato, & Schmid, 2012; Varotto & Zhao, 2018). BSZ is negatively associated with the performance of banks and significant at 1 percent. This indicates, that an increase in the size of banks negatively affects their performance, this is in line with the findings obtained by (Kasman, Tunc, Vardar, & Okan, 2010; Luo, Tanna, & Vita, 2016). The interaction term LQRCRD is significant at 1 percent and negatively correlates with the performance of banks in terms of their ROA in Sub Saharan Africa. DIS that represents deposit insurance scheme is positive and significant at 1 percent. This shows that the presence of deposit insurance scheme improves banking performance in Sub Saharan African region, this is consistent with the result obtained by (Anginer, Demirguc-Kunt, & Zhu, 2014; Bonner, Lelyveld, & Zymek, 2014).

The macroeconomic variable in the study comprising of INF and GDP are positively associated with banking performance and significant at 1 percent. This shows that an increase in either INF or GDP, or both increase the performance of the banks in terms of their return on asset, this confirms the result obtained by (Dietrich & Wanzenried, 2011; Goddard, Liu, & Molyneux, 2010).

Table V: First Regression Result

	(1)	ROA (2)	(3)	(4)
VARIABLES	**Pooled OLS**	**Fixed Effect**	**Differenced GMM**	**System GMM**
ROA_{ijt-1}	0.8880***	0.6462***	0.5161***	0.6160***
	(0.02051)	(0.03592)	(0.01160)	(0.00561)
LQR_{ijt}	0.0025	-0.0035	-0.0017***	-0.0111***
	(0.00181)	(0.00340)	(0.00012)	(0.00120)
CRD_{ijt}	0.0181*	0.0049	-0.0016*	-0.0037***
	(0.00979)	(0.01170)	(0.00091)	(0.00061)
DEP_{ijt}	0.0021	0.0080*	0.0072***	0.0075***
	(0.00187)	(0.00425)	(0.00159)	(0.00095)
CAS_{ijt}	0.0053	0.0155*	0.0193***	0.0328***
	(0.00586)	(0.00913)	(0.00183)	(0.00224)
LEV_{ijt}	-0.0007	0.0005	0.0031*	0.0065***
	(0.00142)	(0.00175)	(0.00157)	(0.00044)
BSZ_{ijt}	-0.0005	-0.1240**	-0.3271***	-0.1290***
	(0.01340)	(0.05791)	(0.05750)	(0.00667)
$LQRCRD_{ijt}$	-0.0005***	-0.0001	-0.0016***	-0.0002***
	(0.00017)	(0.00020)	(0.00011)	(0.00007)
$DISdummy_{ijt}$	-0.1881**	-0.1100	0.0318*	0.0644***
	(0.07890)	(0.09461)	(0.01910)	(0.02181)
INF_{jt}	-0.0093	0.0104	-0.0102***	0.0209***
	(0.00926)	(0.01270)	(0.00260)	(0.00234)
GDP_{jt}	0.0159	0.0426**	0.0283***	0.0865***
	(0.01330)	(0.01792)	(0.00656)	(0.00365)
Constant	0.0122	2.434*		
	(0.361)	(1.285)		
Observations	400	400	350	400
R-squared	0.869	0.567		
Number of code		50	50	50
Diagnostic Test				
Mean VIF	1.91			
No. of Instrument			38	45
AR(1): *P*-Value			0.1056	0.1058
AR(2): *P*-Value			0.8050	0.6927
Sargan test: *P*-Value			0.1944	0.1902

Source: STATA 15 Result Robust Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The post estimation test is conducted. The Arellano and Bond test for first and second-order autocorrelation is conducted. The result revealed an absence of an autocorrelation problem in both the first-order AR [1] and the second-order AR [2]. The Sargan test of instrument validity revealed an insignificant P-value, which implies that the instrument used in the study are valid.

4.4.2 Second Regression Result

The regression result examines the joint effect of liquidity and credit risk on banking performance. Four models are also presented here that include; pooled OLS, fixed effect, differenced, and system GMM. The inference of the study is based on the system GMM. The lagged dependent of all the models are significant at 1 percent, this indicates that our model is dynamic and the choice of the system GMM is relevant. The main independent variables, comprising of LQR and CRD, are both negative and significantly associated with the performance of banks in SSA. An increase in each rate of liquidity risk or credit risk decreases the banks return on asset, this finding is consistent with that of (Ghenimi et al., 2017).

Other bank-specific variables are also explained. DEP is not significant in this model. CAS is negative and significant at 1 percent, this is consistent with the result obtained by (Varotto & Zhao, 2018). LEV is positive and significant at 1 percent, this is in line with the result obtained by (Bostandzic & Weiß, 2018). BSZ is significant and negatively associated with banking performance. This implies that an increase in the size of the banks, decreases the performance of the banks, this confirms the findings of (Ghenimi et al., 2017; Waemustafa & Sukri, 2015). Our interaction term LQRCRD is significant at 1 percent and negatively related to the performance of banks in the SSA region. DIS is positive and significant. This indicates that an increase in bank performance if there is a presence of deposit insurance scheme practice in the country, this is consistent with (Ioannidou & Fabiana, 2010). The macroeconomic variables, INF and GDP are both positive and significant. This implies improve performance of banks with every increase in either or both of the macroeconomic variables in the model, this result is in line with what is obtained (Albertazzi & Gambacorta, 2009; Molyneux & Thornton, 1992).

Table VI: The Second Regression Result

	(1)	NIM (2)	(3)	(4)
VARIABLES	**Pooled OLS**	**Fixed Effect**	**Differenced GMM**	**System GMM**
NIM_{ijt-1}	0.8140***	0.6381***	0.8030***	0.5633***
	(0.03330)	(0.04220)	(0.07450)	(0.00730)
LQR_{ijt}	-0.0034	-0.0009	-0.0016***	-0.0203**
	(0.01311)	(0.02590)	(0.00010)	(0.00849)
CRD_{ijt}	-0.0115	0.0629	0.0423	-0.0697***
	(0.07000)	(0.08990)	(0.04391)	(0.01442)
DEP_{ijt}	0.0010	-0.0321	-0.0402***	0.0132
	(0.01300)	(0.03281)	(0.01520)	(0.00893)
CAS_{ijt}	0.0502	0.0201	0.0849***	-0.0629***
	(0.04116)	(0.06905)	(0.02510)	(0.01031)
LEV_{ijt}	0.0036	0.0178	0.0176***	0.0084***
	(0.01011)	(0.01350)	(0.00210)	(0.00218)
BSZ_{ijt}	-0.0046	-0.8790**	0.2081**	-0.9452***
	(0.09161)	(0.4460)	(0.10000)	(0.07390)
$LQRCRD_{ijt}$	-0.0012	-0.0020	-0.0022***	-0.0037***
	(0.00119)	(0.00151)	(0.00076)	(0.00038)
$DISdummy_{ijt}$	-0.0004	-0.2350	1.2821***	0.3610***
	(0.56201)	(0.72800)	(0.16611)	(0.13701)
INF_{jt}	-0.0346	-0.1120	0.1230***	0.0623***
	(0.06641)	(0.09930)	(0.02271)	(0.01740)
GDP_{jt}	0.0173	-0.2100	-0.1191***	0.0832***
	(0.09421)	(0.14000)	(0.03750)	(0.01181)
Constant	1.700	23.54**		
	(2.574)	(9.981)		
Observations	400	400	350	400
R-squared	0.648	0.438		
Number of code		50	50	50
Diagnostic Test				
Mean VIF	1.91			
No. of Instrument			38	45
AR(1): *P*-Value			0.2285	0.0083
AR(2): *P*-Value			0.1927	0.3117
Sargan test: *P*-Value			0.2342	0.3302

Source: STATA 15 Result Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The diagnostic test is conducted and reported. The Arellano and Bond first and second-order test for autocorrelation is conducted. The result revealed a presence of first-order AR [1] and absence of second-order AR [2] autocorrelation, in overall, an absence of autocorrelation problem is confirmed in the model. The Sargan test of instrument validity reported an insignificant P-value, which implies that the instrument used in the study are valid.

4.5 Discussion of the Main Findings and Hypotheses testing

The study's main objective is to evaluate the interaction or joint effect of liquidity risk and credit risk on the performance of banks in Sub Saharan Africa region. The interaction term LQRCRD shows a negative and significant relationship with the performance of banks in the SSA region. This implies that an increase in the rate of LQRCRD decreases the performance of banks in the region. The result further revealed a significantly negative association with bank performance in the SSA region. Moreover, the result of credit risk shows a significant and negative association with bank performance. Each of the risks affects bank performance negatively.

The hypotheses postulated are all supported by the result of the study. The first hypothesis which states a significant negative relationship between liquidity risk and bank performance in the SSA region is supported by the result. This confirms that liquidity risk negatively affects bank performance. The second hypothesis is also supported. This also confirms a significant negative relationship that exists between credit risk and bank performance. The third hypothesis is also supported. The relationship between liquidity risk and credit risk is positive, this means they move in the same direction either increase or decrease. In this case, they jointly decrease.

4.6 Robustness Check

The robustness model adjusts the baseline model. First, the dependent variable that is earnings per share (EPS), is different from the ones used in the main models, as used by (Al-Sartawi, 2018). Another adjustment made is the replacement of CAS with CAR, and RC dummy replaces DIS dummy. The aim is to test for the robustness of the result in our main models. The analyses present four models that include the pooled OLS,

fixed effect, differenced GMM, and system GMM. The study object is to test the influence of the interaction effect of liquidity and credit risk on the performance of banks in Sub Saharan Africa. All lagged dependent in the model are significant, this implies the dynamic nature of our models and the justification in using the system GMM approach for the inference.

LQR is found to be significant at 1 percent and negatively relates to EPS. Likewise, CRD is significant at 1 percent and negatively associate with EPS. This means that both risks are negatively significant and their increase, decreases the performance of banks. Other bank-specific variables are also explained. DEP is positive and significant 1 percent, this is consistent with the result obtained by (Hoffmann, 2011). CAR is positive and significant at 1 percent, this is consistent with the findings obtained by (Abou-El-Sood, 2016). Likewise, LEV is positive but significant at 5%, this confirms the result obtained by (Ippolito, Peydró, Polo, & Sette, 2016). This indicates that a rise in the rate of each DEP, CAR, and LEV lead to an increase in the performance of banks in the Sub Saharan African region. BSZ is significant at 1 percent and negatively relates with EPS. This implies that an increase in the size of banks in the SSA region decreases the performance of the banks, this is consistent with the findings of (Ghenimi et al., 2017; Kasman et al., 2010).

The interaction term LQRCRD is significant at 1 percent and negatively associated with the performance of banks in the SSA region. Risk committee is found to be positively significant, which means the presence of risk committee increase the banks performance rate in the region, this is consistent with the result obtained by (Azim, Jubb, & Nahar, 2016; Battaglia & Gallo, 2015). The macroeconomic variables also have some impact on the performance of banks. INF is positively significant affects banking performance positively, this is in line with the findings of (Doumpos, Gaganis, & Pasiouras, 2015). GDP is equally found to be significant and positively related to the performance of banks in the SSA region, this is consistent with the result obtained by (Dewandaru, Nagayev, Ng, Nizam, & Nkoba, 2019).

Table VI: Regression Result for Robustness Check

VARIABLES	(1) Pooled OLS	EPS (2) Fixed Effect	(3) Differenced GMM	(4) System GMM
EPS_{ijt-1}	0.8192***	0.4160***	0.8981***	0.1430***
	(0.03280)	(0.04761)	(0.00136)	(0.00175)
LQR_{ijt}	0.0176	-0.0151	-0.0384***	-0.0513***
	(0.01470)	(0.02721)	(0.00382)	(0.00226)
CRD_{ijt}	0.0547	0.0295	-0.0360**	-0.1121***
	(0.07981)	(0.09590)	(0.01451)	(0.01150)
DEP_{ijt}	0.0137	-0.0241	0.0004	0.0740***
	(0.01490)	(0.03410)	(0.00457)	(0.00316)
CAR_{ijt}	-0.0039	-0.0439	-0.0023	0.0626***
	(0.01371)	(0.02832)	(0.00245)	(0.00234)
LEV_{ijt}	-0.0115	0.0008	0.0017	0.0031**
	(0.01150)	(0.01451)	(0.00253)	(0.00142)
BSZ_{ijt}	0.1560	1.1561**	0.8870***	0.3881***
	(0.10900)	(0.49501)	(0.24800)	(0.01971)
$LQRCRD_{ijt}$	-0.0019	-0.0019	-0.0019***	-0.0048***
	(0.00137)	(0.00161)	(0.00018)	(0.000179)
$RCdummy_{ijt}$	-1.0461	-1.1512	-0.1631**	-0.9932***
	(0.83301)	(0.90110)	(0.07271)	(0.0606)
INF_{jt}	-0.1841**	-0.2700**	0.0767***	0.3011***
	(0.07791)	(0.11801)	(0.01200)	(0.00862)
GDP_{jt}	-0.1000	-0.3001*	0.1300***	0.3210***
	(0.11510)	(0.17500)	(0.01721)	(0.01260)
Constant	0.278	-8.595		
	(3.279)	(10.43)		
Observations	400	400	350	400
R-squared	0.706	0.269		
Number of code		50	50	50
Mean VIF	1.91			
No. of Instrument			39	46
AR(1): *P*-Value			0.1120	0.0705
AR(2): *P*-Value			0.3297	0.3739
Sargan test: *P*-Value			0.1655	0.1542

Source: STATA 15 Result Robust standard errors in parenthese
*** p<0.01, ** p<0.05, * p<0.1

The diagnostic test was conducted and reported the findings. The Arellano and Bond test for first and second-order autocorrelation was conducted. The result revealed the presence of first-order AR[1] and absence of second-order AR[2] autocorrelation. The Sargan test of instrument

validity reported an insignificant p-value, which indicates that the instrument used in our study is valid.

5. Conclusion and Policy Implications

The paper explains the dominant risk factors in the banking sector and the threat they posed on the banking sector either separately or jointly. The study evaluates the joint effect of liquidity and credit risk on the performance of banks in Sub Saharan Africa. The study employed a two-step generalized method of moment estimation technique to analyze panel data of 50 banks across six SSA countries for 9 years (2010-2018). Both the liquidity risk and credit risk have a negative impact on banks in SSA, so also their joint effect. However, the association between liquidity and credit is positive. The two risks are the major threat to the banking sector of SSA particularly with their interaction effect indicating a negative coefficient that tends to decrease with an increase in banking performance. This underscores the need for the banks to employs all strategies possible to improve their performance in order to keep those threat within the barest minimum.

Findings from the study have many policy implications to the various stakeholders of the banking sector that include; policymakers, bank practitioners, society, and academics. The policymakers learned from the experience of the effect of those risk factors in the banking sector. They are encouraged to come up with sound policies that will minimize the effect of those risks on the overall performance of banks. Bank practitioners have better knowledge of the happenings in the banking sector; they, therefore, feed the policymakers with all the practical solutions that needed to be embraced to have a more resilient banking sector. Society may also find the study useful because it helps them to know the bank to invest to avoid loss of their investment because of the risk affecting banks. The study will also add new knowledge to existing ones, through the new data set coming from developing nations with more investment prospects in the future.

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