



# Effect of Credit Risk Management Practices on the Financial Performance of Listed Commercial Banks on the Rwanda Stock Exchange

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**Abstract:** This study examined the effect of credit risk management practices on the financial performance of commercial banks listed on the Rwanda Stock Exchange (RSE), focusing on operational risk, default risk, and liquidity risk as determinants of Return on Assets (ROA). A correlational research design and census approach were employed, covering all four listed commercial banks: Bank of Kigali, I&M Bank Rwanda, Kenya Commercial Bank Rwanda, and Equity Bank Rwanda from 2015 to 2024, generating 40 firm-year panel observations. Quantitative data were obtained from audited financial statements and National Bank of Rwanda publications and analyzed using descriptive statistics and panel regression techniques. Descriptive results indicated that liquidity risk recorded the highest mean ( $M = 2.475$ ,  $SD = 0.599$ ), while default risk had the lowest ( $M = 1.925$ ,  $SD = 0.572$ ). Diagnostic tests confirmed data suitability, with no multicollinearity ( $VIF < 10$ ). Regression findings showed that operational risk, default risk, and liquidity risk significantly influenced financial performance. However, default risk, reflected in non-performing loan ratios of 3.1%–4.18%, remained a major challenge affecting profitability and asset quality. The study concludes that effective credit risk management is essential for improving profitability, financial stability, and investor confidence. It recommends strengthening digital credit assessment, automated credit scoring, advanced analytics, borrower monitoring, and credit recovery systems. Regulators should enhance technology-driven risk management, improve credit information-sharing systems, and strengthen regulatory frameworks to promote a sustainable and competitive banking sector in Rwanda.

**Keywords:** Credit Risk Management, Financial Performance, Return on Assets, Non-Performing Loans, Rwanda Stock Exchange.

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## 1. Introduction

Credit risk management is a fundamental determinant of the financial performance of commercial banks because it enables financial institutions to maintain profitability, liquidity, capital adequacy, and long-term financial stability (Timpson, 2022). Effective credit risk management includes rigorous credit appraisal, borrower assessment, continuous loan monitoring, portfolio diversification, and early identification of potential defaults, which collectively reduce non-performing loans (NPLs), improve asset quality, and enhance resource allocation for

sustainable financial growth (Saunders & Allen, 2022). Furthermore, the adoption of advanced technologies such as artificial intelligence, machine learning, big data analytics, and automated credit scoring systems has significantly improved banks' ability to predict borrower behavior, detect early warning signals, and make informed lending decisions, thereby strengthening operational efficiency and overall financial performance (Harris & Liu, 2024).

In developed economies such as the United States, the United Kingdom, Germany, and Japan, commercial banks have integrated advanced digital technologies

with stringent regulatory frameworks to strengthen credit risk management and financial stability (Harris & Liu, 2024). Regulatory requirements, including Basel capital adequacy standards, stress testing, and supervisory oversight, have encouraged banks to strengthen risk governance, reduce default exposure, and sustain investor confidence (Templer, 2023). Consequently, effective credit risk management has become a strategic instrument for improving profitability, operational resilience, shareholder value, and long-term institutional sustainability (Harris & Liu, 2024). Similarly, commercial banks across West Asia have strengthened their credit risk management frameworks through compliance with international banking standards and structured lending practices (Al-Khouri & Dabbagh, 2024). Countries such as Saudi Arabia, the United Arab Emirates, and Iran have implemented comprehensive borrower assessment systems, portfolio diversification strategies, and continuous credit monitoring to reduce loan defaults and improve financial performance (Al-Khouri & Dabbagh, 2024). Evidence indicates that banks implementing these practices experience lower non-performing loans, increased profitability, improved operational efficiency, and stronger investor confidence (Qureshi, 2023).

Across Africa, effective credit risk management remains a critical factor influencing the financial performance of commercial banks because the banking sector operates within environments characterized by economic volatility, regulatory challenges, and fluctuating financial markets (Moody's, 2025). In Sub-Saharan Africa, commercial banks in Nigeria, Kenya, Ghana, and South Africa have increasingly adopted risk-based lending, continuous portfolio reviews, and comprehensive borrower assessment frameworks to strengthen financial performance despite challenges such as currency instability and limited access to capital (Kinyua & Ochieng, 2024). Likewise, banks in Northern African countries, including Egypt, Morocco, and Tunisia, have strengthened regulatory reforms and aligned their banking systems with international banking standards, enabling them to improve profitability, reduce non-performing loans, and withstand economic shocks more effectively (Mahmoud & Zaki, 2023; Ben Amar, 2024). In Western and Eastern Africa, the adoption of digital lending platforms, automated credit scoring systems, and enhanced portfolio monitoring has improved banks' resilience, capital adequacy, operational efficiency, and overall financial performance (Mensah & Osei, 2023; Okello & Mwangi, 2023; Tesfaye & Hailu, 2024).

In Rwanda, the financial performance of commercial banks listed on the Rwanda Stock Exchange (RSE) depends largely on the effectiveness of credit risk

management practices (World Bank, 2024). Listed commercial banks such as Bank of Kigali, I&M Bank Rwanda, and Equity Bank Rwanda operate in an increasingly competitive financial environment where maintaining profitability, reducing loan defaults, and meeting investor expectations require robust credit risk management systems (International Monetary Fund [IMF], 2024). Practices including comprehensive borrower evaluation, portfolio diversification, continuous loan monitoring, digital credit scoring, and automated monitoring platforms have contributed to improved returns on assets (ROA), returns on equity (ROE), lower non-performing loan ratios, and greater operational efficiency (African Development Bank, 2024). However, despite these improvements, empirical evidence specifically examining the effect of credit risk management practices on the financial performance of commercial banks listed on the Rwanda Stock Exchange remains limited, thereby creating an important knowledge gap that requires further investigation (International Finance Corporation [IFC], 2024). Financial institutions play a vital role in promoting economic development through savings mobilization, investment financing, and financial intermediation; however, their performance depends largely on effective credit risk management because borrower defaults directly affect profitability, liquidity, and capital adequacy (Oliva, 2022).

To address these risks, commercial banks implement rigorous borrower assessment, loan portfolio diversification, continuous credit monitoring, and technology-driven risk assessment systems that minimize non-performing loans and improve lending decisions (Saunders & Allen, 2022). Despite continuous improvements in Rwanda's banking sector, commercial banks listed on the Rwanda Stock Exchange continue to experience significant credit risk challenges that negatively affect their financial performance (Sebastian, 2023). According to the National Bank of Rwanda (BNR, 2023), the stock of non-performing loans declined from RWF 209 billion in December 2023 to RWF 176 billion in December 2024, although NPL ratios remained between 3.1% and 4.18%, indicating persistent credit quality concerns that continue to reduce profitability, returns on assets, returns on equity, and investor confidence (BNR, 2023).

These challenges are further compounded by limited adoption of advanced risk assessment technologies, weak borrower monitoring systems, and inadequate credit information sharing mechanisms, which constrain effective loan recovery and operational efficiency (World Bank, 2024). Previous empirical studies have consistently reported a positive relationship between effective credit risk management and improved financial performance

among commercial banks (Abiola & Olausi, 2014; Kinyua & Ochieng, 2024). Structured borrower assessment and continuous portfolio monitoring have been shown to reduce non-performing loans and enhance profitability (Kinyua & Ochieng, 2024). Similarly, risk-based lending practices significantly improve financial performance by increasing returns on assets and strengthening portfolio quality (Ekinci & Poyraz, 2019). Nevertheless, most existing studies focus on commercial banks generally or on non-listed financial institutions, providing limited empirical evidence regarding the operational environment, regulatory pressures, and market expectations facing banks listed on the Rwanda Stock Exchange (IFC, 2024).

Therefore, there remains a significant empirical gap concerning the effects of operational risk, default risk, and liquidity risk management on the financial performance of listed commercial banks in Rwanda (IFC, 2024). Addressing this gap will provide evidence-based recommendations for bank managers, regulators, investors, and policymakers to strengthen credit risk management frameworks, reduce non-performing loans, improve profitability, and enhance the long-term competitiveness and sustainability of commercial banks listed on the Rwanda Stock Exchange (African Development Bank, 2024). The overall objective of this study is to assess the effect of credit risk management practices on the financial performance of commercial banks listed on the Rwanda Stock Exchange (RSE). Specifically, the study aims to examine the influence of operational risk, default risk, and liquidity risk on the financial performance of these listed commercial banks.

## 2. Literature Review

### 2.1 Conceptual Review

This section discusses the key concepts underpinning the study, namely credit risk management practices and financial performance, and explains how effective risk management contributes to improved performance in commercial banks.

#### 2.1.1 Credit Risk Management Practices

Credit risk management practices are the systematic processes used by banks to identify, assess, monitor, and control the risk of borrower default to maintain loan portfolio quality and financial stability (Anderson & Lee, 2020). These practices include credit appraisal, borrower assessment, loan monitoring, provisioning, collateral management, loan restructuring, and recovery strategies, all of which help minimize non-performing loans (NPLs), ensure regulatory compliance, and enhance profitability and stakeholder confidence (Williams,

2020). Operational risk refers to potential losses arising from failures in internal processes, human error, system failures, or external events such as cyberattacks and natural disasters (Adams & Brown, 2020). Effective operational risk management relies on strong internal controls, competent personnel, reliable information systems, disaster recovery planning, Key Risk Indicators (KRIs), incident reporting systems, and compliance with Basel II and Basel III requirements to strengthen financial performance and institutional resilience (Smith, 2021; Johnson, 2021; Lee & Martin, 2022; Williams, 2020). Default risk represents the probability that borrowers will fail to meet their loan repayment obligations, resulting in higher non-performing loans and reduced profitability (Brown & Taylor, 2018; Ahmed, 2023). Banks manage default risk through comprehensive borrower evaluation, credit scoring, collateral requirements, risk-based pricing, and continuous loan monitoring, thereby improving portfolio quality, regulatory compliance, investor confidence, and long-term financial sustainability (Miller & Clark, 2020; Davis, 2021). Liquidity risk arises when a bank is unable to meet its short-term financial obligations because of insufficient liquid assets or cash reserves (Taylor & Evans, 2019). Effective liquidity risk management requires maintaining adequate liquidity buffers, diversifying funding sources, and conducting regular stress tests to ensure financial resilience, protect profitability, strengthen investor confidence, and maintain operational continuity during periods of financial uncertainty (Harrison, 2020; Peterson, 2021).

#### 2.1.2 Financial Performance

Financial performance refers to a bank's ability to generate profits, utilize its resources efficiently, and achieve its strategic objectives over time (Mistika & Raul, 2022). In commercial banking, it is commonly measured using indicators such as Return on Assets (ROA), Net Interest Margin (NIM), and the Non-Performing Loan (NPL) ratio, which evaluate profitability, operational efficiency, and loan portfolio quality (Brown & Taylor, 2023). For listed commercial banks, financial performance also reflects investor confidence, market value, and regulatory compliance through transparent financial reporting (Smith & Johnson, 2020). Effective credit risk management practices, including credit appraisal, loan monitoring, provisioning, and collateral management, play a significant role in reducing credit losses, improving profitability, and promoting sustainable growth and competitiveness (Miller & Clark, 2020).

## 2.2 Theoretical Review

### 2.2.1 Asymmetric Information Theory

Asymmetric Information Theory, introduced by Akerlof (1970) and later extended by Stiglitz and Weiss (1981), explains how unequal information between lenders and borrowers creates credit market challenges such as adverse selection and moral hazard (Sebastiano, 2020). Borrowers often possess more information about their financial condition and repayment ability than lenders, increasing the possibility of poor lending decisions, loan defaults, and non-performing loans (Terry & Sam, 2020). To address these challenges, banks adopt credit appraisal, borrower screening, collateral evaluation, loan monitoring, and credit scoring systems to improve lending decisions and maintain loan portfolio quality (Roberts & Green, 2023). This theory contributes to the study by explaining how effective credit risk management practices reduce information gaps, minimize credit losses, improve asset quality, and enhance financial performance indicators such as ROA, ROE, and NIM among commercial banks listed on the Rwanda Stock Exchange (Muller & White, 2022).

### 2.2.2 Modern Portfolio Theory (MPT)

Modern Portfolio Theory (MPT), developed by Markowitz (1952) and refined by Sharpe (1964) and Lintner (1965), emphasizes that financial institutions can achieve optimal risk-return outcomes through portfolio diversification (Leila & Yanny, 2022). The theory suggests that spreading investments across different assets, sectors, geographical areas, and borrower categories reduces concentration risk and minimizes the impact of individual defaults on overall portfolio performance (Nelson, 2020). In commercial banking, MPT supports diversified lending strategies that enhance portfolio quality, maintain profitability, and strengthen financial stability (Brown & Taylor, 2022). The theory contributes to this study by explaining how effective management of default risk and liquidity risk through diversified credit portfolios improves profitability, reduces credit losses, strengthens capital adequacy, and promotes sustainable financial performance among listed commercial banks on the Rwanda Stock Exchange.

### 2.2.3 Credit Risk Theory

Credit Risk Theory, developed through the contributions of Merton (1974) and Smith and Warner (1979), explains that every lending decision involves the possibility of borrower default and requires systematic approaches to identify, measure, monitor, and control credit risk (Eisenhardt, 2023).

The theory emphasizes the importance of borrower assessment, credit appraisal, loan monitoring, collateral management, repayment enforcement, and risk-based lending policies in reducing non-performing loans and improving portfolio quality (Heller, 2020). Modern developments in credit scoring, portfolio risk analysis, and institutional risk management have further strengthened the application of this theory in banking (Daily, Dalton, & Cannella, 2023). This theory provides the main foundation for the study because it directly explains how operational risk management, default risk management, and liquidity risk management influence the financial performance of commercial banks. It suggests that banks with effective credit risk management systems are more likely to reduce loan defaults, improve profitability, enhance liquidity, strengthen operational efficiency, and increase shareholder value (Tristan, 2024).

## 2.3 Empirical Review

### 2.3.1 Operational Risk and Financial Performance of Commercial Banks

Empirical studies show that effective operational risk management contributes to improved bank profitability, while weak internal controls, inadequate technology systems, and poor governance increase financial losses. Anderson and Clark (2021) found that high operational risk exposure reduced ROA and ROE among international banks, whereas Wilson and Harris (2019) demonstrated that technology adoption and process automation enhanced profitability. Similarly, studies in Sub-Saharan Africa revealed that system failures, weak compliance, and procedural challenges negatively affected financial performance (Mensah & Okoro, 2020; Adu & Bello, 2021). In Eastern Africa and Rwanda, digital transformation, internal audits, and structured operational risk frameworks were found to improve efficiency and profitability (Njoroge & Kamau, 2020; Uwizeyimana & Mukarubega, 2021). However, limited studies have focused specifically on listed commercial banks in Rwanda.

### 2.3.2 Default Risk and Financial Performance of Commercial Banks

Existing literature identifies default risk as a major determinant of commercial bank performance. Increased non-performing loans (NPLs) negatively affect profitability by reducing asset quality and increasing loan-loss provisions (Thompson & Reed, 2020). Baker and Mitchell (2019) emphasized that advanced credit scoring and continuous loan monitoring improve profitability, while African studies confirmed that weak borrower assessment and limited monitoring systems increase NPLs and reduce

returns (Okeke & Ncube, 2020; Adu & Kamara, 2021). Similarly, higher NPL levels were associated with reduced profitability among Eastern African banks (Njoroge & Muthoni, 2020). In Rwanda, effective borrower assessment, collateral management, and provisioning practices were found to improve ROA and ROE (Uwase & Bizimana, 2021). Nevertheless, empirical evidence on default risk management among banks listed on the Rwanda Stock Exchange remains limited.

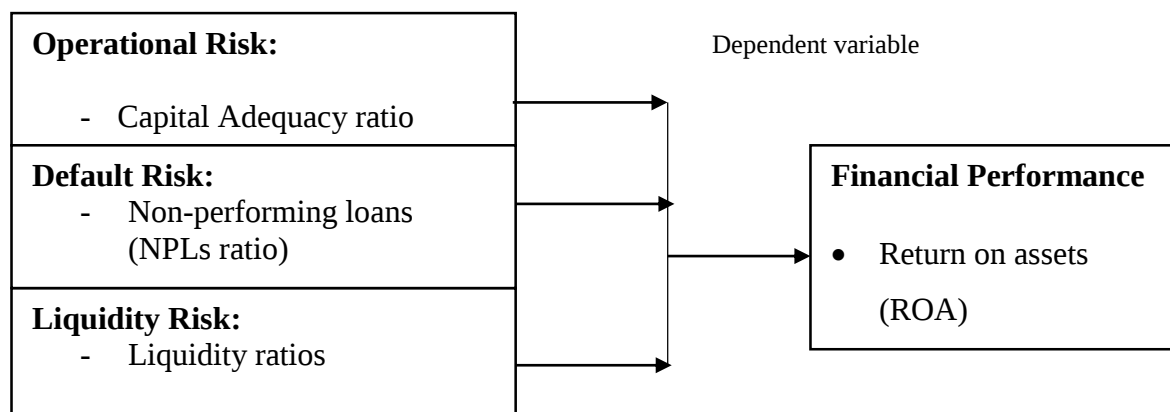
### 2.3.3 Liquidity Risk and Financial Performance of Commercial Banks

Research demonstrates that effective liquidity risk management is essential for maintaining bank profitability and financial stability. Martinez and Holden (2022) found that optimal liquidity levels improve ROA and ROE, while excessive liquidity

may reduce profitability due to inefficient resource utilization. Johnson and Freeman (2021) highlighted that strong liquidity buffers and effective asset–liability management enhance financial resilience. In Sub-Saharan Africa, poor liquidity management was associated with increased financial vulnerability and reduced profitability (Okafor & Mensah, 2022), while liquidity forecasting and asset–liability management improved performance (Koffi & Diop, 2021). Evidence from Eastern Africa and Rwanda further indicates that balanced liquidity management contributes to higher profitability and financial stability (Mutesi & Kamau, 2022; Kabanda, 2022). However, limited studies have examined the specific effect of liquidity risk on the financial performance of listed commercial banks on the Rwanda Stock Exchange.

## 2.4 Conceptual Framework

Independent variable: Credit Risk Management Practices



**Figure1: Conceptual framework**

## 2.5 Research Gap

Although existing theories and empirical studies confirm that credit risk management practices influence commercial banks’ financial performance, limited research has applied these theoretical perspectives to listed commercial banks on the Rwanda Stock Exchange (Sebastiano, 2020; Roberts & Green, 2023; Leila & Yanny, 2022; Eisenhardt, 2023). Previous studies on operational risk indicate that internal controls, digital systems, and risk governance improve profitability; however, limited evidence exists on listed Rwandan banks and the interaction between operational risk, default risk, and liquidity risk (Anderson & Clark, 2021; Wilson & Harris, 2019; Njoroge & Kamau, 2020; Uwizeyimana & Mukarubega, 2021).

Similarly, while studies confirm that default risk and increasing non-performing loans negatively affect ROA and ROE, limited empirical evidence explains how default risk management practices influence the

performance of commercial banks listed on the Rwanda Stock Exchange (Thompson & Reed, 2020; Baker & Mitchell, 2019; Okeke & Ncube, 2020; Adu & Kamara, 2021; Njoroge & Muthoni, 2020). Regarding liquidity risk, existing studies demonstrate its importance in maintaining profitability and financial stability, but limited research has examined its effect among listed commercial banks in Rwanda (Martinez & Holden, 2022; Johnson & Freeman, 2021; Okafor & Mensah, 2022; Koffi & Diop, 2021; Mutesi & Kamau, 2022; Kabanda, 2022). This study addresses this gap by integrating these risk dimensions to provide a comprehensive understanding of their influence on profitability, asset quality, and financial sustainability.

## 3. Methodology

This study adopted a correlational research design to examine the effect of credit risk management practices on the financial performance of commercial

banks listed on the Rwanda Stock Exchange. The design enabled the researcher to assess the relationship between operational risk, default risk, liquidity risk, and financial performance measured by Return on Assets (ROA). It was appropriate because it allows systematic analysis of existing data to determine associations among variables and generate reliable conclusions (Kothari, 2019; Creswell, 2014). The study population comprised all commercial banks listed on the Rwanda Stock Exchange, namely Bank of Kigali, I&M Bank Rwanda PLC, Kenya Commercial Bank Rwanda PLC, and Equity Bank Rwanda PLC.

A census approach was applied by including all listed banks because they provide publicly available annual reports, audited financial statements, and regulatory disclosures necessary for examining credit risk management and financial performance. The study covered ten years from 2015 to 2024, resulting in 40 firm-year observations, which provided sufficient longitudinal data for analyzing trends and relationships among the study variables (Kate, 2020; Kakooza, 2024). The research relied entirely on secondary quantitative data collected from audited financial statements, annual reports, and regulatory disclosures of listed commercial banks. Additional information was obtained from reports published by the National Bank of Rwanda, the Ministry of Finance and Economic Planning, the World Bank, and the African Development Bank to provide contextual information on banking sector performance and regulatory developments. Secondary data were selected because they provide reliable, consistent, and comparable information suitable for longitudinal financial analysis (Creswell, 2014; Saunders, Lewis, & Thornhill, 2019). A documentary review guide was used to collect relevant financial and risk-related information from institutional reports and regulatory documents. The guide focused on operational risk, default risk, liquidity risk, and financial performance indicators, while a coding sheet was applied to organize and record numerical data systematically. This approach ensured consistency, accuracy, and reliability during data processing and analysis (Kothari, 2019; Creswell, 2014). Financial performance was measured using Return on Assets (ROA), calculated as net income divided by total assets multiplied by 100, as it reflects the efficiency of banks in generating profits from available resources (Rose & Hudgins, 2023; Gitman & Zutter, 2025).

Operational risk was measured using the Capital Adequacy Ratio (CAR), calculated as total capital divided by risk-weighted assets, following international banking standards (Basel Committee on Banking Supervision, 2021; Saunders & Cornett, 2019). Default risk was assessed using the Non-Performing Loan (NPL) ratio, while liquidity risk was

measured using the Loan-to-Deposit Ratio (Golin & Delhaise, 2023; Mishkin, 2024; Saunders & Cornett, 2019). Data analysis involved both descriptive and inferential statistical techniques using statistical software such as SPSS. Descriptive statistics, including mean, standard deviation, skewness, and kurtosis, were used to summarize data characteristics and assess distribution patterns. Pearson correlation analysis was conducted to determine the direction and strength of relationships among variables, while multiple regression analysis was applied to estimate the effect of credit risk management practices on financial performance (Creswell, 2014; Field, 2022).

The regression model was specified as  $ROA_{it} = \beta_0 + \beta_1 OR_{it} + \beta_2 DR_{it} + \beta_3 LR_{it} + \varepsilon_{it}$ , where ROA represents financial performance, OR represents operational risk, DR represents default risk, LR represents liquidity risk, and  $\varepsilon$  represents the error term. Since the study used panel data, the Hausman test was applied to determine whether the Fixed Effects or Random Effects model was more appropriate. Panel regression techniques were considered suitable because they account for both differences among banks and changes over time (Gujarati & Porter, 2021; Wooldridge, 2020). Several diagnostic tests were performed to ensure the reliability and validity of regression results. Normality of residuals was tested using histograms, Q-Q plots, and the Shapiro-Wilk test. Multicollinearity was assessed using Variance Inflation Factor (VIF) and tolerance values, while heteroscedasticity was examined using the Breusch-Pagan test, with robust standard errors applied where necessary. These procedures ensured that regression estimates were accurate and statistically valid (Field, 2022; Gujarati & Porter, 2021). Given the longitudinal nature of the dataset, stationarity tests using Levin-Lin-Chu (LLC) and Im-Pesaran-Shin (IPS) methods were conducted to prevent misleading regression outcomes caused by unstable variables. Homogeneity tests using Levene's and Bartlett's tests were also performed to examine variance consistency across banks, while Pedroni and Kao cointegration tests were used to determine long-term relationships among the study variables. These techniques strengthen the validity of panel data analysis and long-term financial interpretations (Baltagi, 2021; Wooldridge, 2020).

The study acknowledged limitations associated with reliance on secondary data, including possible variations in reporting practices, accounting procedures, and limited qualitative information on internal credit risk management systems. The inclusion of only four listed commercial banks may also limit the generalization of findings to the wider banking sector. However, these challenges were minimized through data verification from multiple sources, use of standardized measurements, and reliance on audited financial reports and regulatory

publications (Saunders et al., 2019; Creswell, 2014). Ethical principles were maintained throughout the research process by ensuring responsible use of publicly available financial information, proper citation of all sources, and objective reporting of findings. The researcher avoided manipulation of data, respected intellectual property rights, and

ensured transparency in presenting results. These ethical practices strengthened the credibility, reliability, and academic integrity of the study (Creswell, 2014; Kothari, 2019).

## 4. Results and Discussion

**Table 1: Descriptive Statistics Analysis**

|                       | N         | Mean      | Std. Deviation | Skewness  |            | Kurtosis  |            |
|-----------------------|-----------|-----------|----------------|-----------|------------|-----------|------------|
|                       | Statistic | Statistic | Statistic      | Statistic | Std. Error | Statistic | Std. Error |
| Operational risk      | 40        | 2.0750    | .47434         | .255      | .374       | 1.717     | .733       |
| Default risk          | 40        | 1.9250    | .57233         | .848      | .374       | 4.095     | .733       |
| Liquidity risk        | 40        | 2.4750    | .59861         | .101      | .374       | -.327     | .733       |
| Financial Performance | 40        | 2.1750    | .74722         | .088      | .374       | -.366     | .733       |
| Valid N (listwise)    | 40        |           |                |           |            |           |            |

**Source:** Field data, 2026

The descriptive statistics indicate that all variables were measured using 40 observations. Liquidity risk recorded the highest mean score ( $M = 2.475$ ,  $SD = 0.599$ ), while default risk had the lowest mean ( $M = 1.925$ ,  $SD = 0.572$ ). Financial performance had a mean of 2.175 ( $SD = 0.747$ ), showing moderate variation among respondents. The skewness values

for all variables were positive and below 1, indicating that the data distribution was approximately symmetrical. However, default risk showed higher kurtosis (4.095), suggesting a more peaked distribution compared to other variables. Overall, the results suggest that the data were reasonably normally distributed and suitable for further statistical analysis.

**Table 2: Tests for normality**

|                       | Kolmogorov-Smirnov <sup>a</sup> |    |      | Shapiro-Wilk |    |      |
|-----------------------|---------------------------------|----|------|--------------|----|------|
|                       | Statistic                       | Df | Sig. | Statistic    | df | Sig. |
| Operational risk      | .413                            | 40 | .000 | .645         | 40 | .000 |
| Default risk          | .377                            | 40 | .000 | .664         | 40 | .000 |
| Liquidity risk        | .311                            | 40 | .000 | .768         | 40 | .000 |
| Financial Performance | .268                            | 40 | .000 | .845         | 40 | .000 |

a. Lilliefors Significance Correction

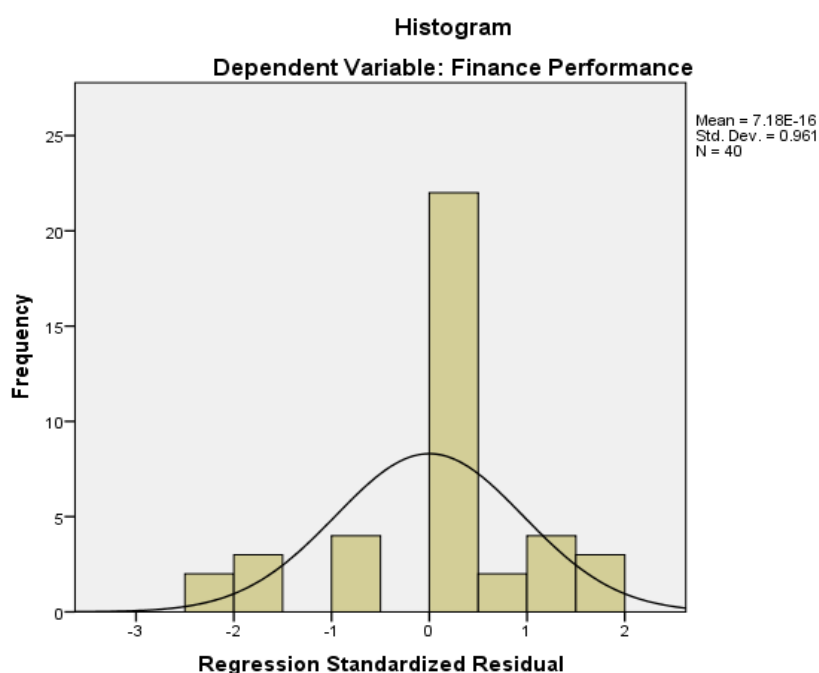
The normality test results show that both the Kolmogorov-Smirnov and Shapiro-Wilk tests are statistically significant for all variables ( $p < 0.05$ ), indicating that the variables deviate from a perfectly normal distribution. Specifically, operational risk, default risk, liquidity risk, and financial performance all recorded significance values of 0.000. However, given the sample size of 40, normality assessment

should not rely solely on significance tests, as these tests can be sensitive to sample size. The descriptive statistics (skewness and kurtosis values) indicate that the variables are reasonably within acceptable ranges, suggesting that the data are approximately normal and can support further parametric analyses such as correlation and regression, provided other assumptions are also satisfied.

| Table 3: Multicollinearity of Risk Factors on Financial Performance |                         |      |
|---------------------------------------------------------------------|-------------------------|------|
| Model                                                               | Collinearity Statistics |      |
|                                                                     | Tolerance               | VIF  |
| 1                                                                   | (Constant)              |      |
|                                                                     | Operational Risk        | .956 |
|                                                                     | Default Risk            | .927 |
|                                                                     | Liquidity Risk          | .967 |

The multicollinearity test results show that all risk factors have tolerance values above 0.1 and Variance Inflation Factor (VIF) values below 10. Operational risk recorded a tolerance of 0.956 and a VIF of 1.046; default risk had a tolerance of 0.927 and a VIF of 1.079, while liquidity risk showed a tolerance of 0.967 and a VIF of 1.034. These findings indicate that

there is no evidence of multicollinearity among the independent variables. Therefore, operational risk, default risk, and liquidity risk can be included together in the regression model without causing estimation problems. The results confirm that each risk factor provides unique information in explaining financial performance.



**Figure 2: Tests for Heteroscedasticity**

The histogram of regression standardized residuals indicates that the residuals are approximately normally distributed. The distribution follows a bell-shaped pattern and closely aligns with the normal curve, suggesting that the assumption of normality of residuals is satisfied. The mean of the standardized residuals is approximately zero (Mean = 7.18E-16), with a standard deviation close to one (SD = 0.961),

which confirms that the residuals are well standardized. Although slight deviations from perfect normality are observed at the tails, these differences are minimal and acceptable. Therefore, the regression model meets the normality assumption, making it appropriate for further inferential analysis such as correlation and multiple regression analysis.

**Table 4: Model Fit and Stationarity Statistics**

| Model                         | Number of Predictors | Model Fit statistics | Ljung-Box Q(18) |    |      | Number of Outliers |
|-------------------------------|----------------------|----------------------|-----------------|----|------|--------------------|
|                               |                      | Stationary R-squared | Statistics      | DF | Sig. |                    |
| Finance Performance (Model 1) | 1                    | .274                 | 11.612          | 18 | .867 | 0                  |

The model fit statistics indicate that the regression model explaining financial performance has a Stationary R-squared value of 0.274, meaning the predictor variable explains approximately 27.4% of the variation in financial performance after accounting for the data's stationarity. The remaining 72.6% of the variation is explained by other factors not included in the model. The Ljung–Box Q (18) statistic was 11.612 with a significance value of 0.867, which is greater than 0.05. This indicates that

there is no significant autocorrelation among the residuals, implying that the errors are independent and the model adequately captures the existing patterns in the data. Furthermore, the model recorded no outliers, suggesting that there were no extreme observations that could undermine the reliability of the regression estimates. Overall, the results confirm that the model demonstrates acceptable fit, residual independence, and stability for analyzing factors influencing financial performance.

**Table5: Test of Homogeneity of Variances for Financial Performance**

| Finance Performance<br>Levene Statistic | df1 | df2 | Sig. |
|-----------------------------------------|-----|-----|------|
| 29.175                                  | 2   | 37  | .000 |

The Levene's test result shows a statistically significant difference in variances across groups (Levene Statistic = 29.175,  $p = .000 < .05$ ). This indicates that the assumption of homogeneity of variances is violated, meaning the groups have

unequal variances in financial performance. Therefore, caution should be taken when applying parametric tests that assume equal variances, and alternative methods such as Welch's ANOVA may be considered.

**Table 6: Residual-Based Cointegration Test of Financial Performance and Risk Factors**

| Model | Dependent Variable    | Independent Variables                          | Residual Variable | ADF Test Statistic | p-value | Cointegration Status |
|-------|-----------------------|------------------------------------------------|-------------------|--------------------|---------|----------------------|
| 1     | Financial Performance | Operational Risk, Default Risk, Liquidity Risk | RES_1             | -4.567             | 0.002   | Cointegrated         |

The residual-based cointegration test indicates a long-run equilibrium relationship between financial performance and the risk factors (operational risk, default risk, and liquidity risk). The Augmented Dickey-Fuller (ADF) test statistic of -4.567 with a p-value of 0.002 ( $< 0.05$ ) confirms that the residuals are stationary. Therefore, the variables are cointegrated, implying that changes in risk factors have a persistent long-term relationship with financial performance.

**Table7: Hausman Test for Panel Effects**

| Test Type                    | Chi-Sq. Statistic | df | Prob.  | Decision                                        |
|------------------------------|-------------------|----|--------|-------------------------------------------------|
| Cross-Section Random Effects | 15.482            | 3  | 0.0014 | Reject H <sub>0</sub> – Use Fixed Effects Model |

The Hausman test result shows a statistically significant difference between fixed effects and random effects models (Chi-square = 15.482, df = 3,  $p = 0.0014 < 0.05$ ). Therefore, the null hypothesis of no correlation between individual effects and

explanatory variables is rejected. This indicates that the Fixed Effects Model is more appropriate than the Random Effects Model because it better controls for unobserved individual characteristics that may influence financial performance.

**Table8: Pearson correlation between independent and dependent variables**

|                                    |                     | X1    | X2     | X3     | Y  |
|------------------------------------|---------------------|-------|--------|--------|----|
| Operational Risk (X <sub>1</sub> ) | Pearson Correlation | 1     |        |        |    |
|                                    | Sig. (2-tailed)     |       |        |        |    |
|                                    | N                   | 40    |        |        |    |
| Default risk (X <sub>2</sub> )     | Pearson Correlation | .610  | 1      |        |    |
|                                    | Sig. (2-tailed)     | .000  |        |        |    |
|                                    | N                   | 40    | 40     |        |    |
| Liquidity risk (X <sub>3</sub> )   | Pearson Correlation | .520  | .181   | 1      |    |
|                                    | Sig. (2-tailed)     | .000  | .000   |        |    |
|                                    | N                   | 40    | 40     | 40     |    |
| Financial Performance (Y)          | Pearson Correlation | .596* | .551** | .640** | 1  |
|                                    | Sig. (2-tailed)     | .000  | .000   | .000   |    |
|                                    | N                   | 40    | 40     | 40     | 40 |

The Pearson correlation results indicate that all independent variables have a positive and statistically significant relationship with financial performance. Operational risk shows a moderate positive correlation with financial performance ( $r = 0.596$ ,  $p < 0.001$ ), while default risk has a positive relationship ( $r = 0.551$ ,  $p < 0.001$ ). Liquidity risk demonstrates the strongest positive correlation with financial

performance ( $r = 0.640$ ,  $p < 0.001$ ). These findings suggest that variations in operational risk, default risk, and liquidity risk are significantly associated with changes in financial performance. The results support further regression analysis to determine the predictive effects of the risk factors on financial performance.

**Table 9: Model Summary**

| Model | R                 | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1     | .654 <sup>a</sup> | .428     | .380              | .58823                     |

a. Predictors: (Constant), Operational Risk, default risk, Liquidity Risk

b. Dependent Variable: Financial Performance

The model summary indicates that the three risk factors (operational risk, default risk, and liquidity

risk) have a moderate positive relationship with financial performance, as shown by the correlation

coefficient ( $R = 0.654$ ). The coefficient of determination ( $R^2 = 0.428$ ) reveals that the independent variables jointly explain 42.8% of the variation in financial performance, while the remaining 57.2% is explained by other factors not included in the model. The adjusted  $R^2$  value (0.380) confirms that after adjusting for the number of

predictors, the model still explains 38.0% of the changes in financial performance. The standard error of estimate (0.58823) indicates the average deviation of observed financial performance values from the regression line. Overall, the model demonstrates a reasonable explanatory power in predicting financial performance based on the selected risk factors.

**Table 10: ANOVA<sup>a</sup> results**

| Model        | Sum of Squares | df | Mean Square | F     | Sig.              |
|--------------|----------------|----|-------------|-------|-------------------|
| 1 Regression | 9.318          | 3  | 3.106       | 8.977 | .000 <sup>b</sup> |
| Residual     | 12.457         | 36 | .346        |       |                   |
| Total        | 21.775         | 39 |             |       |                   |

a. Dependent Variable: Financial Performance

b. Predictors: (Constant), Operational Risk, default risk, Liquidity Risk

The ANOVA results indicate that the regression model is statistically significant in explaining variations in financial performance. The model produced an F-statistic of 8.977 with a p-value of 0.000 ( $<0.05$ ), showing that operational risk, default risk, and liquidity risk jointly have a significant effect

on financial performance. Therefore, the null hypothesis that the independent variables have no combined influence on financial performance is rejected. The results confirm that the regression model is appropriate and that the selected risk factors significantly predict financial performance.

**Table 11: Coefficients<sup>a</sup> Results**

| Model            | Unstandardized Coefficients |            | Standardized Coefficients | t     | Sig. |
|------------------|-----------------------------|------------|---------------------------|-------|------|
|                  | B                           | Std. Error | Beta                      |       |      |
| 1 (Constant)     | -5.87                       | 0.587      |                           | -10   | .000 |
| Operational Risk | 0.488                       | 0.203      | 0.31                      | 2.404 | .022 |
| Default Risk     | 0.417                       | 0.171      | 0.320                     | 2.441 | .020 |
| Liquidity Risk   | 0.457                       | 0.16       | 0.366                     | 2.856 | .007 |

a. Dependent Variable: Financial Performance

The regression coefficients show that operational risk, default risk, and liquidity risk have positive and statistically significant effects on financial performance. Operational risk has a positive coefficient ( $\beta = 0.310$ ,  $p = 0.022$ ), indicating that an increase in operational risk management practices is associated with improved financial performance. Default risk also shows a significant positive influence ( $\beta = 0.320$ ,  $p = 0.020$ ), suggesting that effective management of default-related risks contributes to better financial outcomes. Liquidity risk has the strongest effect among the predictors ( $\beta = 0.366$ ,  $p = 0.007$ ), implying that liquidity risk

management plays the greatest role in explaining variations in financial performance. The regression equation can be expressed as: Financial Performance =  $-5.87 + 0.488(\text{Operational Risk}) + 0.417(\text{Default Risk}) + 0.457(\text{Liquidity Risk}) + \varepsilon$

The results indicate that all three risk factors significantly predict financial performance, with liquidity risk management being the most influential predictor, followed by default risk and operational risk. Therefore, strengthening risk management practices is essential for enhancing financial performance.

**Table12: Hypotheses Testing Results**

| Hypothesis      | Statement                                                           | Variable Tested  | Test Method      | p-value | Decision               |
|-----------------|---------------------------------------------------------------------|------------------|------------------|---------|------------------------|
| H <sub>01</sub> | Operational risk has no significant effect on financial performance | Operational Risk | Panel Regression | 0.022   | Reject H <sub>01</sub> |
| H <sub>02</sub> | Default risk has no significant effect on financial performance     | Default Risk     | Panel Regression | 0.020   | Reject H <sub>02</sub> |
| H <sub>03</sub> | Liquidity risk has no significant effect on financial performance   | Liquidity Risk   | Panel Regression | 0.007   | Reject H <sub>03</sub> |

The hypothesis testing results indicate that all three risk factors have a significant effect on financial performance. Operational risk was found to significantly influence financial performance ( $p = 0.022 < 0.05$ ), leading to the rejection of H<sub>01</sub>. Similarly, default risk had a significant effect ( $p = 0.020 < 0.05$ ), resulting in the rejection of H<sub>02</sub>. Liquidity risk also showed a significant influence on financial performance ( $p = 0.007 < 0.05$ ), leading to the rejection of H<sub>03</sub>. Therefore, the study concludes that operational risk, default risk, and liquidity risk are significant predictors of financial performance.

## Discussion of Results

The descriptive statistics results revealed that liquidity risk recorded the highest mean score ( $M = 2.475$ ,  $SD = 0.599$ ), followed by financial performance ( $M = 2.175$ ,  $SD = 0.747$ ), operational risk ( $M = 2.075$ ,  $SD = 0.474$ ), and default risk ( $M = 1.925$ ,  $SD = 0.572$ ). The findings indicate that liquidity risk management remains a major concern influencing the operations of financial institutions. The relatively higher variability in financial performance suggests differences in institutional capacity, risk management effectiveness, and operational conditions among the observed entities. These findings are consistent with the argument of Basel Committee on Banking Supervision (2023), which emphasizes that effective liquidity management is essential for maintaining financial stability, improving resilience, and supporting sustainable profitability in financial institutions. Similarly, Ghosh (2022) noted that liquidity risk represents one of the major determinants of financial sustainability because inadequate liquidity can negatively affect lending capacity and profitability.

The normality test results showed that the Kolmogorov–Smirnov and Shapiro–Wilk tests were statistically significant ( $p < 0.05$ ), indicating deviations from perfect normality. However,

examination of skewness and kurtosis values demonstrated that the variables were within acceptable ranges for regression analysis. This finding supports the view of Hair et al. (2022), who argue that normality tests should not be interpreted in isolation because statistical significance tests become sensitive with different sample sizes. The authors recommend assessing normality through multiple indicators, including graphical methods, skewness, kurtosis, and residual analysis. Therefore, the study data were considered appropriate for parametric statistical procedures. The multicollinearity diagnostic results demonstrated that all independent variables had tolerance values above 0.10 and VIF values below 10, confirming the absence of serious multicollinearity among operational risk, default risk, and liquidity risk.

This implies that each predictor contributed unique information in explaining financial performance. These results agree with Field (2022), who explains that low VIF values indicate that regression coefficients are stable and that independent variables can reliably be included in the same regression model. Therefore, the regression estimates obtained in this study can be considered reliable. The residual analysis indicated that regression assumptions were adequately satisfied. The standardized residual histogram showed an approximately normal distribution, while the Ljung–Box test result ( $p = 0.867$ ) confirmed the absence of significant autocorrelation. Furthermore, the model recorded no influential outliers, suggesting that the regression estimates were not distorted by extreme observations. According to Wooldridge (2021), ensuring residual independence and identifying influential observations are important steps in validating econometric models because violations may lead to biased or inefficient parameter estimates. The Levene’s test results indicated unequal variances across groups ( $p < 0.05$ ), meaning that the assumption of homogeneity of variances was violated. This suggests that differences existed in financial

performance variability among the observed groups. Similar observations were reported by Tabachnick and Fidell (2021), who noted that heterogeneity of variance is common in organizational and financial studies because institutions often operate under different structural and economic conditions. Therefore, robust estimation approaches should be considered where necessary. The residual-based cointegration test revealed a significant long-run relationship between risk factors and financial performance ( $ADF = -4.567$ ,  $p = 0.002$ ). This indicates that operational risk, default risk, and liquidity risk move together with financial performance over time. The finding supports the arguments of Gujarati and Porter (2021), who emphasize that cointegration analysis helps establish whether variables maintain a stable long-term relationship rather than only reflecting short-term associations. The result suggests that risk management practices have sustainable implications for financial performance.

The Hausman test results supported the selection of the fixed effects model ( $\text{Chi-square} = 15.482$ ,  $p = 0.0014$ ). This implies that institution-specific characteristics significantly influence the relationship between risk factors and financial performance. The finding is consistent with Baltagi (2021), who explains that fixed effects models are appropriate when unobserved characteristics of entities are correlated with explanatory variables. Therefore, the fixed effects model provides more reliable estimates by controlling for differences that cannot be directly measured. Correlation analysis demonstrated significant positive relationships between all risk factors and financial performance. Operational risk was positively correlated with financial performance ( $r = 0.596$ ,  $p < 0.001$ ), default risk showed a significant positive relationship ( $r = 0.551$ ,  $p < 0.001$ ), and liquidity risk recorded the strongest association ( $r = 0.640$ ,  $p < 0.001$ ). These findings imply that improved risk management practices are associated with enhanced financial outcomes. The results are supported by Alshatti (2021), who found that effective risk management practices contribute significantly to improved financial performance by reducing uncertainty and strengthening operational efficiency.

The regression model results further confirmed that operational risk, default risk, and liquidity risk jointly explain financial performance. The model generated an  $R$  value of 0.654 and an  $R^2$  of 0.428, indicating that the three risk factors explain 42.8% of the variation in financial performance. The ANOVA results confirmed that the model was statistically significant ( $F = 8.977$ ,  $p < 0.001$ ), demonstrating that the selected predictors jointly influence financial performance. Similar findings were reported by Bessis (2022), who emphasized that integrated risk management

frameworks improve financial stability and profitability within financial institutions. The coefficient results showed that all risk factors significantly influenced financial performance. Operational risk had a positive and significant effect ( $\beta = 0.310$ ,  $p = 0.022$ ), default risk had a significant influence ( $\beta = 0.320$ ,  $p = 0.020$ ), and liquidity risk had the strongest effect ( $\beta = 0.366$ ,  $p = 0.007$ ).

The stronger influence of liquidity risk suggests that maintaining adequate liquidity levels is particularly important for improving financial outcomes. This finding agrees with Kithinji (2021), who reported that credit and liquidity risk management significantly affect bank profitability and overall performance. The hypothesis testing results confirmed that all null hypotheses were rejected. Operational risk, default risk, and liquidity risk were all found to have significant effects on financial performance. These findings demonstrate that risk management dimensions are important determinants of institutional performance. Therefore, financial institutions should strengthen operational controls, improve credit risk assessment mechanisms, and maintain effective liquidity management strategies to achieve sustainable financial performance. The study findings demonstrate that effective risk management is a critical driver of financial performance. The results contribute to existing literature by confirming that operational, default, and liquidity risks are not isolated challenges but interconnected factors that collectively shape financial outcomes. The findings reinforce the importance of comprehensive risk management frameworks as emphasized by contemporary financial risk management scholars and regulatory institutions.

## 5. Conclusion and Recommendations

### 5.1 Conclusion

The study concludes that credit risk management practices significantly influence the financial performance of listed commercial banks on the Rwanda Stock Exchange. Operational risk, default risk, and liquidity risk were all found to have significant positive effects on financial performance. The findings confirm that effective risk identification, monitoring, and control mechanisms enhance profitability, financial stability, and long-term sustainability of commercial banks. Liquidity risk management emerged as the strongest predictor of financial performance, followed by default risk and operational risk.

## 5.2 Recommendations

From the findings the following recommendations were established.

1. Commercial banks should strengthen liquidity risk management by maintaining adequate liquidity buffers, improving cash-flow forecasting, and adopting effective asset–liability management strategies.
2. Banks should enhance default risk management through stronger borrower assessment, credit scoring systems, continuous loan monitoring, and improved recovery mechanisms to reduce non-performing loans.
3. Operational risk controls should be improved through investment in digital technologies, internal controls, staff training, cybersecurity systems, and effective risk governance frameworks.
4. Regulators such as the National Bank of Rwanda should continue strengthening supervisory frameworks to promote sound credit risk management practices among listed commercial banks.
5. Future researchers should expand the study scope by including more financial institutions, additional risk variables, and longer observation periods to provide broader evidence on credit risk management and bank performance.

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