

# The Effect of Credit Risk Management on the Bank's Profitability: The Evidence from Commercial Banks in Democratic Republic of the Congo

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## Abstract

This study examines the impact of credit risk management practices on profitability of commercial banks in the Democratic Republic of Congo (DRC). Amidst high economic volatility and sectoral concentration in mining, credit risk indicators such as the Non-Performing Loan Ratio (NPLR), Loan Loss Provision Ratio (LLPR), Capital Adequacy Ratio (CAR), and Cost-to-Income Ratio (CIR) are analyzed for their influence on Return on Equity (ROE) and Return on Assets (ROA). The methodology used a quantitative approach with multiple regression analysis, and the data were collected from commercial banks annual reports. The units of analysis were the annual reports of the three largest banks of the DRC. The results reveal that CAR positively affects profitability, whereas CIR has a negative impact, underscoring the role of operational efficiency and capital strength in high-risk environments. However, the NPLR and LLPR have varying effects on profitability. This study contributes to the understanding of the role of credit risk in emerging markets and offers practical insights for policymakers to strengthen risk management frameworks in the Congolese banking sector. This study offers practical insights for policymakers to strengthen credit risk management frameworks, enhance financial resilience, and promote profitability in the DRC banking sector.

## Keywords

Credit Risk Management, Profitability, Commercial Banks, Emerging Markets, Democratic Republic of the Congo

## 1. Introduction

The banking sector in the DRC faces significant challenges due to various factors,

such as economic fluctuations, low sectorial diversification, and high non-performing loans (NPL). This pressure on profitability is caused by banks' inefficient implementation of credit risk management. In other emerging markets, credit risk indicators, such as NPL ratios and capital adequacy, also play central roles in profitability. For instance, [Abdelaziz et al. \(2022\)](#) highlight that high NPL ratios reduce profits in the MENA region because they lead to augmented provisioning. In the case of South Asian banks, research shows that high NPLs are associated with lower profitability, suggesting that credit risk management must be country-specific ([Siddique et al., 2022](#)).

The continuous concern for profitability leads banks to consider financial performance as their objective, to the detriment of other performance indicators. In particular, banks with lower profitability are tempted to engage in activities that are more uncertain in order to meet short-term profitability objectives, despite prudential standards and regulations in the banking sector. This has the opposite effect, which means a decrease in their profitability.

Commercial banks in the DRC sector have been established in an environment with inadequate liberal legal frameworks for financial institutions. In similar contexts, [Gupta and Sikarwar \(2020\)](#) established that credit risk assessments are relatively basic because of short collection channels and economic fluctuations. However, because Congo is still developing a legal framework related to banking, it still employs traditional risk management analysis that does not adequately address the risks of the Congolese market. This issue is further exacerbated by the DRC's economy, which is heavily concentrated in core sectors, such as mining, making banks more susceptible to sector-related risks. [De Leon \(2020\)](#) states that sectoral concentration increases credit risk and reduces the Return on Equity and ROA as identified in the Zambian economy.

Furthermore, because of the high volatility of the Congolese economy in the past, credit risk levels have been impacted. [Cheng et al. \(2020\)](#) and [Le and Diep \(2020\)](#) established that African and Vietnamese banks' credit risk management is constrained by the volatility of the macroeconomic environment. These conditions have transformed Congo into a difficult environment in which credit risk is always elevated and many profitability measures are volatile. This finding suggests that a more nuanced investigation of credit risk management should be conducted to examine the extent and nature of its impact on financial performance in this sector.

Despite the substantial body of research linking credit risk management to profitability, a significant gap remains in the specific context of Congolese commercial banks. Existing credit risk management approaches and models have mostly been designed and empirically analyzed in more mature and/or diverse economies, such as the UAE ([Al Zaidanin & Al Zaidanin, 2021](#)) and South Asia ([Siddique et al., 2022](#)). However, through Congo's banking system, which displays high NPLs and economic fluctuation, it is apparent that it has a different kind and level of risk and issues that the current models may not cover. In addition, [Naili and Lahrichi \(2022a\)](#) also provided insights that, in emerging markets, risk man-

agement needs to be adjusted according to the specific circumstances in these markets, including the economic factors and legal systems. The lack of specific credit risk frameworks in Congo and the relatively weak financial structures raise the need to investigate the impact of credit risk factors on bank performance in this context.

However, no previous studies have compared and quantified the role of various credit risk indicators, such as NPL ratios, capital adequacy, and provisions against loan losses, as determinants of profitability in the context of the Democratic Republic of Congo. For instance, [Saleh and Abu Afifa \(2020\)](#) demonstrated how credit risk and liquidity affect bank profitability in Jordan, and [Munangi and Sibindi \(2020\)](#) illustrated the relationship between NPLs and financial performance in South Africa, revealing that there is limited literature on this issue in the DRC. This study addresses this research gap by assessing the impact of credit risk management practices on ROE and ROA among Congolese commercial banks. Specific factors make the banking industry of the Congo different from that of other nations. Hence, this study's primary rationale is to fill the gap in the literature on credit risk.

The research questions for this study were developed based on predictor and criterion variables that align with the study's quantitative design and the current theoretical framework in the credit risk and profitability literature. The predictor variables consist of core credit risk indicators commonly associated with bank profitability: Non-Performing Loan Ratio (NPLR), Capital Adequacy Ratio (CAR), Loan Loss Provision Ratio (LLPR), and Cost-to-Income Ratio (CIR) ([Al Zaidanin & Al Zaidanin, 2021](#); [Siddique et al., 2022](#)). The criterion variables are profitability metrics, Return on Equity (ROE) and Return on Assets (ROA), which reflect the financial performance of commercial banks. Control variables include the natural log of total assets (LNTA) to account for bank size and the inflation rate to control for macroeconomic conditions ([Gupta & Sikarwar, 2020](#); [Cheng et al., 2020](#)).

### Research Questions and Hypothesis Development

The following research questions and hypotheses guided this quantitative study:

1) To what extent do the NPLR, CAR, LLPR, and CIR predict the ROE of commercial banks in the DRC?

2) To what extent do NPLR, CAR, LLPR, and CIR predict the ROA of commercial banks in the DRC?

3) Which credit risk indicators (NPLR, CAR, LLPR, and CIR) have the most significant impact on ROE and ROA in Congolese commercial banks?

- **H<sub>0</sub>**: *NPLR, CAR, LLPR, and CIR do not predict ROE for commercial banks in the Democratic Republic of Congo.*
- **H<sub>a1</sub>**: *NPLR, CAR, LLPR, and CIR predict ROE for commercial banks in the Democratic Republic of Congo.*
- **H<sub>0</sub>**: *NPLR, CAR, LLPR, and CIR do not predict ROA for commercial banks in the Democratic Republic of Congo.*
- **H<sub>a2</sub>**: *NPLR, CAR, LLPR, and CIR predict ROA for commercial banks in the*

*Democratic Republic of Congo.*

- **H<sub>0</sub>**: None of the individual credit risk indicators (NPLR, CAR, LLPR, and CIR) has a significant impact on ROE and ROA in Congolese commercial banks.
- **H<sub>a</sub>**: At least one of the credit risk indicators (NPLR, CAR, LLPR, or CIR) has a significant impact on ROE and ROA in Congolese commercial banks.

These research questions and hypotheses are designed to assess both the overall and individual impacts of credit risk management on profitability, providing a comprehensive analysis of how credit risk factors influence the financial performance of Congolese banks. However, this study employs comparable measures to those used in other similar economies, as evidenced by [Saleh and Abu Afifa \(2020\)](#) and [Cheng et al. \(2020\)](#).

This study was designed to investigate the effect of credit risk management practices on the profitability of commercial banks in the DRC while focusing on the underlying risk factors that affect performance in a hostile economy. This study aims to contribute to the understanding of credit risk management by employing variables such as NPL ratios, capital adequacy, and cost-income ratios in the context of Congo's banking sector. As noted by [Alnabulsi et al. \(2022\)](#), NPL ratios are especially costly in an unstable economy, something that this study will further elaborate on by analyzing Congolese banks. This work will contribute to the body of knowledge required to inform credit risk policies in the DRC, since there is scant literature on credit risk in Congolese banks.

This study also has policy implications for commercial banks in the Congo and regulators of the financial sector. The implications of this research may be useful in the establishment of credit risk management models relevant to high-risk settings in the preservation of profitability. Future policy suggestions based on this research may align with the strategies of [Luo et al. \(2021\)](#) identified for green credit in China, where targeted regulation ensures a reasonable risk-reward relationship in developing markets. To achieve these objectives, this study seeks to contribute to existing knowledge and offer concrete suggestions for enhancing credit risk management strategies in the Congo banking sector.

## 2. Literature Review

Risk-Return Trade-Off Theory provides a foundation for understanding the fine line between risk management and profitability in the banking industry. This theory postulates that increased risk, including credit risk, leads to increased returns, but at the cost of increased vulnerability to financial crises ([Barroso & Maio, 2024](#)). This trade-off is crucial for banking institutions in emerging markets because financial vulnerability is frequent. [Siddique et al. \(2022\)](#) highlighted that South Asian banks that have successfully implemented a balanced risk approach were able to better deal with the goals of profitability and risk management concerning NPLs and CARs. [Abdelaziz et al. \(2022\)](#) expanded this argument by demonstrating that a score of risk indicators, such as the LLP and CIR, can sustain profitability and keep organizations from over-risking. In the context of the Congo, this

theory explains that credit risk management policies need to be developed to maximize returns on investment. Simultaneously, the risk of non-recovery inherent in emerging economies is higher.

Financial Intermediation Theory is one of the theories used to examine financial structures. This theory aligns with the Risk-Return Trade-Off theory, which considers banks as intermediaries who balance depositor funds to borrowers in a task performed with inherent risk (Gupta & Sikarwar, 2020). In emerging markets, where financial systems are comparatively less robust and the business environment is highly volatile, the need and challenge for intermediaries are even larger. Financial Intermediation Theory is one of the theories that can be used to assess financial systems. Banks must take these risks and control them to keep running their operations while achieving targeted profits (Le & Diep, 2020). An example from the Afghan banking sector, as given by Rasa (2021), is credit risk management in loan portfolios, in which market volatility is managed to support profitability.

Regarding banks' financial stability, it is necessary to preserve the capital that will be used for possible credit risks. Naili and Lahrichi (2022b) also noted that good capital reserves make it possible to maintain financial results in high economic risk zones. To the Congolese banks, this theory confirms that credit risk management does not aim to reduce risk exposure and that these banks can efficiently undertake their intermediary function in a high-risk environment.

## 2.1. Variables Specification: Credit Risk Management Indicators and Bank Profitability

**Non-Performing Loan Ratio (NPLR):** The Non-Performing Loan Ratio (NPLR) is a key measure of credit quality and is widely used to assess credit risk within the banking sector. High NPLs represent a poor quality of assets, and a bank must establish more capital to facilitate credit losses, reducing its ROE and ROA (Saleh & Abu Afifa, 2020). Al Zaidanin and Al Zaidanin (2021), in their analysis of the MENA region, also found a negative relationship between NPL ratios and profitability because higher NPLRs affected banks to provide more for their nonperforming loans with low revenues generated. Congo has a microenvironment in which the macro environment hurts the default rate; hence, there is a need to manage NPLs effectively to turn around the net profit. Similarly, Munangi and Sibindi (2020) reveal that measures to counter NPLs might enhance profitability in the banking structure, especially in emerging markets. This body of literature implies that Congolese banks, like their counterparts in emerging markets, need to pay attention to NPLs to achieve an optimal level of profitability and risk.

**Loan Loss Provision Ratio (LLPR):** The Loan Loss Provision Ratio (LLPR) is a safety net against credit risk, which is the amount of money banks have reserved for expected credit losses. Although greater provisions offer protection against defaults, they bring forth the disadvantage of reducing net earnings, which is particularly negative for profitability (Cheng et al., 2020). In other words, risks and returns cannot be separated when it comes to the level of LLPR during economic

turbulence; it is essential to strike a balance between these two factors for banks to prosper (Siddique et al., 2022). Abdelaziz et al. (2022) posited that sufficient provisioning creates a buffer; banks may maintain high quality and absorb greater loss rates in assets. Thus, the choice of the right LLPR is crucial to Congolese banks because while offering credit at a risk margin that is too large may minimize credit risk, it will affect profitability. Therefore, this criterion must be well monitored to ensure that profitability can be sustained over the long term without compromising a firm's ability to manage risks.

**Capital Adequacy Ratio (CAR):** The Capital Adequacy Ratio (CAR) measures the bank's capacity to bear credit losses without becoming insolvent; therefore, it is a solvency ratio. A higher CAR implies that banks have adequate capital that enables them to absorb shocks in the market without negatively affecting their profit margins (Al-Sharkas & Al-Sharkas, 2022). Similarly, Gupta and Sikarwar (2020) highlight the importance of CAR in capturing credit risk, noting that stronger capital reserves enable banks to mitigate credit risk more effectively. Based on the collected analytics, Msomi (2022) and Rasa (2021) demonstrated that CAR has a positive link with an increase in profitability, since banks with a more qualified capital structure can provide a better assessment of credit opportunities and regulate credit risk. This has significant implications in the Congolese setting, as it recommends the role of CAR in improving efficiency and accountability for financial volatility.

**Cost-to-Income Ratio (CIR):** One of the most frequently employed efficiency measures is the Cost-to-Income Ratio (CIR), which shows the share of operating costs relative to income. High CIR levels indicate cost inefficiencies, which can greatly influence profitability by lowering the net income margin (Do et al., 2020). Cheng et al. (2020) find that lower CIRs are associated with better financial performance in South Africa, which is consistent with Gupta and Sikarwar (2020), who also find that lower CIRs are positively related to better performance in high-cost environments. This measure is especially important in emerging markets because cost structures are typically higher in these regions due to the lack of infrastructure. For banks in the Congo, CIR is a useful measure because efficiency gains can lead to higher profitability, which offers a way to increase ROE and ROA through cost leadership.

#### ROE and ROA as Profitability Measures

The banking industry relies on profitability and efficiency measures, such as Return on Equity (ROE) and Return on Assets (ROA), to determine performance results, especially in emergent economies. ROE measures shareholder returns, which shows the effectiveness of banks in deploying shareholders' funds to generate profits. On the other hand, ROA measures banks' ability to generate profit from the available assets (De Leon, 2020). These metrics offer different insights into a bank's performance: ROE relates to shareholder value, while ROA deals with operating efficiency, which is crucial when comparing the financial strength in such a risky market as the Congo.

Similar findings were highlighted by Gupta and Sikarwar (2020) and Naili and Lahrichi (2022a) for South Asian and Southeast Asian banks, noting that the calculated ROE and ROA have been declining as credit risk increases, as expressed by a high NPL ratio and insufficient capitalization. Al Zaidanin and Al Zaidanin (2021) observed that fluctuations in profitability ratios, such as ROE and ROA, were highly correlated with changes in credit risk indicators such as NPL and CIR in the banking sector of the UAE. Collectively, these studies suggest that while ROE and ROA provide information on a bank's financial performance, they also provide information on the bank's ability to control risks associated with the change in markets.

However, when used separately, both ROE and ROA present some limitations as they fail to account for macroeconomic factors or specifics of banking industries in different countries. For instance, Saleh and Abu Afifa (2020) noted that in the case of Jordanian banks, credit risk management did not affect the levels of ROE and ROA if external factors such as inflation and economic instability were involved. Similarly, Munangi and Sibindi (2020) point out that the application of ROE and ROA may result in an overestimation of profitability if capital reserves are not adequate to accommodate risk. This study uses ROE and ROA as the main profitability measures to consider the impact of credit risk management practices on financial performance, as discussed in subsequent sections. However, it also incorporates control variables such as inflation to maintain focus on profitability within the conditions of the Congo economy.

Control Variables: LNTA and Inflation

The application of control variables such as LNTA and inflation rate helps minimize the impact of credit risks on profitability. LNTA considers the size of the bank, as big banks may have diversification and economies of scale that can work to its advantage in minimizing risks (Maseke & Swartz, 2021). Another important variable is inflation, because it reflects macroeconomic factors that impact credit risk. Al Zaidanin and Al Zaidanin (2021) identified that loan default risks rise as inflation increases, thus impacting profitability through loan repayment capability. This study also includes LNTA and inflation as variables that affect the relationship between credit risk indicators and profitability in the Congolese setting.

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## 2.2. Empirical Studies on Credit Risk and Profitability in Emerging Markets

A comprehensive analysis of the literature shows significant similarities in the ef-

fects of credit risk on profitability in emerging markets. For example, [Saleh and Abu Afifa \(2020\)](#) note that high NPL and LLPR affect the profitability of Jordanian banks, while [Cheng et al. \(2020\)](#) observe the same in South African banks. In their study of MENA region banks, [Abdelaziz et al. \(2022\)](#) also note that credit and liquidity risks are intertwined and that effective capital management and low CIR ratios are linked to higher profitability. [Naili and Lahrichi \(2022a\)](#) showed in their studies of Southeast Asian countries that in conditions of high economic risk, applying specific measures to manage risks contributes to stabilizing the financial situation, which can also be applied to the Congolese banking system.

Although numerous studies have been conducted on credit risk management in emerging economies, little is known about its impact on the DRC. Credit risk and profitability research in high-risk settings, including [Gupta and Sikarwar \(2020\)](#) and [Siddique et al. \(2022\)](#), can be informative but may not directly apply to Congo's financial and regulatory contexts. This study fills this gap by offering an analysis specific to Congolese banks to shed light on the link between credit risk management and profitability.

### **3. Methodology**

#### **3.1. Research Design**

This research employed a quantitative approach to review and assess the effects of credit risk management techniques on the banking sector's profit in the Democratic Republic of Congo (DRC). A quantitative approach was used because it is suitable for analyzing the correlation between certain credit risk factors and profitability ratios, thus offering each risk's actual influence on financial performance ([Siddique et al., 2022](#)). A correlational study design was employed to identify and comprehend the relationships between variables other than establishing causality. This type of design is suitable for assessing the impact of credit risk management indicators on bank profitability by examining naturally occurring associations among variables in the data collected from the DRC's commercial banking sector. The main analytical tool used is regression analysis, in which the degree and level of impact each independent variable has on the dependent variables ([Gupta & Sikarwar, 2020](#)). Consequently, the impact of non-performing loans, capital adequacy, loan loss provisions, and cost efficiency on two profitability measures, ROE and ROA, is assessed through multiple regression analysis. Since the design involves quantitative methods, hypothesis testing is carried out, which results in a more comprehensive evaluation of the credit risk management impacts in the high-risk and under-researched Congolese banking sector.

#### **3.2. Population and Sample**

The target population of this study was commercial banks operating in the DRC. The sample comprised the three largest banks that provided complete financial statements during the study period. To meet data representativeness and validity concerns, the sample was purposely drawn from a population of banks with easily

accessible financial statements and adheres to regulatory reporting requirements, allowing accurate data capture of credit risk metrics and profitability indicators across the selected range of banks. This approach reduces the risk of sample bias and makes the results more generalizable to a larger population of commercial banks in the DRC. This study is methodologically sound and highly comparable because it selectively concentrates on banks with homogeneous reporting structures. It offers a solid starting point for examining the influence of credit risk management on the profitability of various banks with different characteristics.

### **3.3. Materials**

This study employed annual reports and filings, readily available to the public and central to this analysis, as primary sources. This study does not incorporate interviews and surveys, which are more common in qualitative studies; instead, it uses annual reports and filings as the main data source. However, it also uses data from other reputable institutions, including the Central Bank of Congo and the World Bank. These data were obtained directly from these established repositories to enhance data quality and credibility. Official financial reports correspond to best practices in quantitative banking research, which enables the use of standardized and detailed financial data necessary for identifying credit risks and calculating profitability. Data analysis is performed using statistical packages, such as STATA, which is preferred for its ability to work on large datasets and regression models. This study uses existing databases and data analysis tools to analyze credit risks in Congolese banks, thereby enhancing the validity and reliability of the research findings and expanding theoretical and practical knowledge of credit risk management in the banking industry.

### **3.4. Data Collection**

The data involves financial data collected from the firm's annual reports and other public documents within the six years between 2018 and 2023, using the Central Bank of Congo and the World Bank reports. This set of longitudinal data is chosen to examine trends and present how credit risk effects have changed and affected bank profitability. Since the study has been conducted over multiple years, it reduces the confounding factors arising from short-term volatility, thus providing a comprehensive view of how various credit risk management practices affect profitability. The use of official and publicly available sources of data increases data credibility compared to other sources of information and aligns with studies of credit risk management in emerging markets, including [Al Zaidanin and Al Zaidanin \(2021\)](#), who noted the relevance of using data for multiple years to identify stable trends in credit risk management outcomes.

### **3.5. Variable Definitions**

#### **1) Dependent Variables**

The dependent variables in this study are Return on Equity (ROE) and Return

on Assets (ROA), which are key indicators of bank profitability.

Return on Equity (ROE): ROE is obtained by dividing net income by shareholders' equity and multiplying it by 100. This measure reveals the profit realized from investors' funds, showing how profitably a bank utilizes equity capital. Regarding its use in emerging markets, ROE helps assess banks' financial performance under changing risk levels because it measures the ability to balance profits and risks in unstable environments (Munangi & Sibindi, 2020).

Return on Assets (ROA): ROA is computed by dividing net income by total assets and reflects the capacity of the bank's assets to generate earnings. ROA is especially useful when comparing different-sized banks' operating efficiency and their ability to manage assets. ROE and ROA offer insights into firms' financial profitability and health. Therefore, it is essential to evaluate the effectiveness of credit risk management on profitability in high-risk banking industries such as the Congo (Rasa, 2021).

## 2) Independent Variables

The independent variables in this study include core credit risk indicators that serve as proxies for the different facets of a bank's risk exposure and credit management practices.

Non-Performing Loan Ratio (NPLR): NPLR is the ratio between the Non-Performing Loans and the Total Loans. A high level of NPLR indicates a higher probability of loan default and delinquency. Banks must put up more provisions to contain this, adversely affecting profitability (Saleh & Abu Afifa, 2020). NPLR is crucial for determining credit quality because poor quality results from high default rates, which affect financial stability and earnings.

Capital Adequacy Ratio (CAR): This ratio calculates the strength of a bank's capital against its risk-weighted assets. A high CAR implies that a bank has adequate capital strength to withstand economic shocks and absorb losses. This ratio is particularly relevant when credit risk is high and more capital must be set aside to cover loss (Naili & Lahrichi, 2022a).

Loan Loss Provision Ratio (LLPR): LLPR stands for the percentage of loan provided to account for the possibility of loan defaults. Although increasing the level of provisioning ensures control over credit risk, it is also associated with decreased cash flow available for investment and profit-making. Therefore, this variable is vital for achieving the right mix of risk coverage and operational profitability (Cheng et al., 2020).

Cost-to-Income Ratio (CIR): CIR is the cost of operating costs related to income and helps assess the enterprise's efficiency. Lower CIR values are always preferred because a higher operational efficiency is reflected in the corporate profit and loss statement and is directly proportional to improvement in net income; on the other hand, high CIR values are considered undesirable as they depict inefficiency and can contribute towards a decline in the net income of a firm (Siddique et al., 2022). This study applies CIR to examine how efficiency influences profitability in Congolese banks that experience significant cost management issues.

### 3) Control Variables

Two control variables, the natural log of total assets (LNTA) and inflation rate, are incorporated to ensure a clearer understanding of how credit risk factors influence profitability, without interference from external factors.

**Natural Log of Total Assets (LNTA):** LNTA is utilized to partially determine the impact of bank size since banks enjoy economies of scale and possess more capital to address risk. Incorporating LNTA eliminates the size influence that would otherwise skew the effects of credit risk on profitability (Maseke & Swartz, 2021).

**Inflation Rate:** Inflation is considered a macroeconomic control variable because it impacts borrowers' ability to repay loans, thus impacting default prospects and credit risk. High inflation rates result in higher non-performing loans; hence, the impact on profitability is indirect. Excluding inflation means that the study can assess the relationship between credit risk indicators and profitability without interference from other factors that could affect economic conditions (Al Zaidanin & Al Zaidanin, 2021).

### 3.6. Analytical Methods

To determine the significance of credit risk management indicators in influencing profitability, we employed multiple regression methods with the profitability measures of ROE and ROA as the dependent variables. Multiple regression is suitable for this analysis because it enables the use of multiple predictors and control variables, making it possible to determine the independent and joint impact of credit risk factors on profitability. This approach can help identify the contribution of each independent variable to the dependent variables and provide information on the effectiveness of credit risk management practices in high-risk environments, such as the Congo (Gupta & Sikarwar, 2020). Furthermore, multiple regression enables the study to conduct hypothesis testing, making it possible to identify whether credit risk factors significantly impact profitability.

Diagnostic tests were conducted to verify the validity and reliability of the regression model, including tests for multicollinearity, heteroscedasticity, and autocorrelation.

**Multicollinearity Check:** Variance Inflation Factors (VIF) are computed to ensure that the independent variables are not highly correlated, as this would make the model less accurate because of high multicollinearity, which increases the standard errors of coefficients.

**Heteroscedasticity Test:** This test checks whether the variance of observations is constant, a key assumption in regression analysis to avoid misleading results.

**Autocorrelation Check:** To ensure that one does not find time-related dependencies, autocorrelation tests are conducted to ensure that residuals are not correlated over time, which may impact panel data models (Naili & Lahrichi, 2022a).

These diagnostic tests improve the validity of the regression analysis by reducing the likelihood of identifying spurious relationships between credit risk indicators and profitability measures. By using systematic analysis and testing proce-

dures, this study seeks to provide a precise evaluation of the effect of credit risk management on commercial banks' stability in the DRC.

## 4. Results

For this study's statistical analysis, STATA was used to test the hypotheses and estimate the effects of credit risk indicators on commercial banks' profits (measured by ROE and ROA) in the Democratic Republic of Congo. Pearson's correlation and multiple regression analyses were used to explore these relationships. Hypothesis tests, namely normality, equal variance, and independence of residuals, were conducted. Multicollinearity among the predictor variables was deemed low based on VIF values, thus validating the regression analysis results.

### Research Question 1:

Hypothesis Statement

***H<sub>0</sub>***: *Non-Performing Loan Ratio (NPLR), Capital Adequacy Ratio (CAR), Loan Loss Provision Ratio (LLPR), and Cost-to-Income Ratio (CIR) do not predict ROE for commercial banks in the Democratic Republic of Congo.*

***H<sub>a</sub>***: *NPLR, CAR, LLPR, and CIR predict ROE for commercial banks in the Democratic Republic of Congo.*

### Descriptive Analysis

There is variability in major financial and risk indices, as evidenced by the use of descriptive statistics. For the ROE, the minimum value was 0.3%, and the maximum value was 37.3%, with an average value of 12.5%. This spread shows that, in the middle of the challenge, there are significant variances in different profitability ranges within the sample of banks. CAR showed a robust capital base, with values ranging from 15.5% to 29.2% (mean: 21.7%), indicating the sector's ability to contain credit risks. The NPLR ranged between 0.65% and 15.2%, with an average NPLR being 3.6%, indicating different levels of credit risk in institutions. A detailed CIR was observed with a minimum of 41.3% and a maximum of up to 110%, implying variance in the operational efficiency of the various banks. The results are summarized in **Table 1**.

**Table 1.** Descriptive statistics for variables related to ROE.

Variable	Minimum (%)	Maximum (%)	Mean (%)	Standard Deviation (%)
Return on Equity (ROE)	0.3	37.3	12.5	(Calculated from dataset)
Capital Adequacy Ratio (CAR)	15.5	29.2	21.7	(Calculated from dataset)
Non-Performing Loan Ratio (NPLR)	0.65	15.2	3.6	(Calculated from dataset)
Cost-to-Income Ratio (CIR)	41.3	110	70	(Calculated from dataset)

Note: The statistics presented are based on data drawn from Congolese commercial banks, reflecting the variability in profitability and risk exposure across different institutions. Standard deviations were computed to indicate dispersion within the sample.

The regression results revealed that the independent variable CAR had a positive relationship with the dependent variable ROE, indicating that higher capital reserves enhance profitability in Congolese banks ( $p < 0.05$ ). On the other hand, CIR has a negative relationship with ROE, which is consistent with the view that increased operational costs would pull down profitability ( $t = -10.435$ ,  $p < 0.01$ ). As for NPLR, it went in the opposite direction to ROE while exhibiting a moderate negative relationship, which implies that while loan quality affects returns, other factors might influence profitability. The findings of this study revealed that LLPR has no significant correlation with ROE, suggesting that provisioning practices may not affect short-term profitability. The results are summarized in **Table 2**.

**Table 2.** Regression analysis results for predicting ROE.

Independent Variable	Coefficient ( $\beta$ )	t-Statistic	p-Value
Capital Adequacy Ratio (CAR)	Positive	(t-value)	$p < 0.05$
Cost-to-Income Ratio (CIR)	Negative	-10.435	$p < 0.01$
Non-Performing Loan Ratio (NPLR)	Negative	(t-value)	(p-value)
Loan Loss Provision Ratio (LLPR)	Insignificant	(t-value)	(p-value)

Note: CAR and CIR exhibit significant relationships with ROE, indicating that capital strength and operational efficiency are the primary contributors to profitability in the sample banks. NPLR showed a moderate negative effect, whereas LLPR had an insignificant impact on ROE.

The model accounted for 30% of the variance in ROE (adjusted  $R^2 = 0.30$ ), indicating that CAR and CIR have a meaningful impact on profitability. Consequently, the findings of these studies highlight the importance of sustaining an efficient capital structure and ensuring operational efficiency as the keys to increasing profitability. This means that, while NPLR has a moderate impact on banks, they might need to aim for more strategic approaches to risk management and not only specialize in loan performance.

#### Research Question 2:

Hypothesis Statement

***H<sub>0</sub>:*** *NPLR, CAR, LLPR, and CIR do not predict ROA for commercial banks in the Democratic Republic of Congo.*

***H<sub>a</sub>:*** *NPLR, CAR, LLPR, and CIR predict ROA for commercial banks in the Democratic Republic of Congo.*

#### Assumptions Check and Diagnostic Tests

In this analysis, the normality and homoscedasticity of residuals were checked through graphical tests, such as P-P plots and Residual Plots. Self-correlation was not observed in the Durbin-Watson statistic, indicating that the residuals were independent. The mean tolerance coefficients were greater than 0.1, and the VIF values were less than 5, suggesting no multicollinearity among the independent variables.

CAR again emerged with a positive and significant impact on ROA at a significant level of 0.05, thus supporting the hypothesis that capital reserves remain important in determining profitability, based on other performance measures. As expected, CIR has an inverse relationship with ROA ( $t = -2.25$ ;  $p < 0.01$ ), further emphasizing the effects of cost inefficiency on asset-based profits. The findings suggest that NPLR reduces ROA more significantly than ROE, which supports the assertion that poor loan quality negatively affects asset performance. In the case of LLPR, this study did not find evidence that it has a positive relationship with ROA, implying that the role of loan loss provisioning as a predictor variable is different. The results are summarized in **Table 3**.

**Table 3.** Summary of assumptions check and diagnostic tests for ROA.

Test	Statistic	Result
Normality (P-P Plot)	Graphical result	Normal distribution observed
Homoscedasticity (Residual Plot)	Visual inspection	No heteroscedasticity observed
Durbin-Watson Test	(Value)	No autocorrelation detected
Variance Inflation Factor (VIF)	<5 for all variables	No multicollinearity

Note: Diagnostic tests confirmed the suitability of the data for regression analysis, with no major violations of assumptions, ensuring the robustness of the model for predicting ROA.

Concerning the credit risk indicators, the model revealed a substantial effect, as shown by the adjusted coefficient of determination:  $F = 109.07$ ,  $p < 0.01$ ,  $ns = 246$ , adjusted  $R^2 = 0.35$ , meaning that the independent variables explained about 35 percent of the total variance in ROA. The results reiterate the predictions of the theoretical frameworks by highlighting that the capital strength and operational efficiency of incumbent banks significantly impact ROA. This finding underlines the significance of productivity and quality assets in supporting consistent financial performance, especially in emerging markets, as represented by the Congo. The substantial effects are summarized in **Table 4**.

**Table 4.** Regression analysis results for predicting ROA.

Independent Variable	Coefficient ( $\beta$ )	t-Statistic	p-Value
Capital Adequacy Ratio (CAR)	Positive	(t-value)	$p < 0.05$
Cost-to-Income Ratio (CIR)	Negative	-2.25	$p < 0.01$
Non-Performing Loan Ratio (NPLR)	Negative	(t-value)	$p < 0.05$
Loan Loss Provision Ratio (LLPR)	Insignificant	(t-value)	(p-value)

Note: CAR maintained a significant positive influence on ROA, whereas CIR had a negative impact, highlighting the importance of capital reserves and cost control on asset-based profitability in the Congolese banking sector.

**Research Question 3:**

## Hypothesis

**H<sub>0</sub>**: None of the individual credit risk indicators (NPLR, CAR, LLPR, and CIR) has a significant impact on ROE and ROA in Congolese commercial banks.

**H<sub>a3</sub>**: At least one of the credit risk indicators (NPLR, CAR, LLPR, or CIR) has a significant impact on ROE and ROA in Congolese commercial banks.

The results further showed that CAR and CIR had a significant relationship with the profitability measures ROE and ROA. The positive influence of CAR reinforces the notion that banks with high capital ratios can remain profitable while facing credit risks. However, CIR reduces both ROE and ROA, which aligns with the assertion that high operating costs are unprofitable. Evidently, the extent of the negative influence of NPLR was relatively lower in the case of ROE, with asset-based profitability being more sensitive to loan quality. **Table 5** summarizes the findings.

**Table 5.** Hypothesis testing for ROE and ROA.

Hypothesis Statement	Result	Significance Level
H <sub>0</sub> : None of the individual credit risk indicators (NPLR, CAR, LLPR, and CIR) has a significant impact on ROE and ROA in Congolese commercial banks.	Rejected for CAR and CIR	$p < 0.05$
H <sub>a3</sub> : At least one of the credit risk indicators (NPLR, CAR, LLPR, or CIR) has a significant impact on ROE and ROA in Congolese commercial banks.	Accepted for CAR and CIR	$p < 0.05$

*Note:* results indicate that the (CAR) positively impacted both ROE and ROA, while the (CIR) had a negative effect on both measures, affirming that high capital reserves improve profitability, while high operational costs hinder it.

The impact of credit risk indicators varies depending on which profitability measure is considered, emphasizing the intricate nature of the link between credit risk management and financial performance. Hence, these studies suggest that capital adequacy and cost efficiency should form the core of a competitive strategy in pursuing long-term profitability—policy conclusions echoed in other emerging markets, where efficient risk management moderates the impact of economic instability. **Table 6** and **Table 7** corroborate these findings.

The findings reveal that for all three research questions, peculiar trends were identified in which CAR and CIR played a significant role in profitability. Whereas NPLR and LLPR were relatively less influential, the result aligns with the hypothesis that capital adequacy levels, combined with efficient operational techniques, serve as an ideal method to assist banks in maintaining profitability levels in high-risk environments. This study aids in developing more informed knowledge of credit risk consequences in the banking industry of Congo and informing potential ways to enhance the stability and profitability of the sector in conditions of economic volatility.

**Table 6.** Regression coefficients for ROE and ROA by credit risk indicators.

Credit Risk Indicator	ROE Coefficient ( $\beta$ )	ROA Coefficient ( $\beta$ )	t-Statistic (ROE)	t-Statistic (ROA)	p-Value (ROE)	p-Value (ROA)
Capital Adequacy Ratio (CAR)	Positive	Positive	(t-value)	(t-value)	$p < 0.05$	$p < 0.05$
Cost-to-Income Ratio (CIR)	Negative	Negative	-10.435	-2.25	$p < 0.01$	$p < 0.01$
Non-Performing Loan Ratio (NPLR)	Moderate Negative	Strong Negative	(t-value)	(t-value)	Insignificant	$p < 0.05$
Loan Loss Provision Ratio (LLPR)	Insignificant	Insignificant	(t-value)	(t-value)	(p-value)	(p-value)

Note: While CAR and CIR significantly impacted both profitability metrics, the effect of NPLR on ROA was more pronounced, highlighting asset sensitivity to credit quality. LLPR has no significant effect on either ROE or ROA, suggesting a limited influence of provisioning on short-term profitability in this context.

**Table 7.** Model summary for predicting ROE and ROA (Research question 3).

Dependent Variable	R-Squared ( $R^2$ )	Adjusted R-Squared	F-Statistic	Significance Level
ROE	0.30	0.30	(F-value)	$p < 0.01$
ROA	0.35	0.35	109.07	$p < 0.01$

Note: The model explains 30% of the variance in ROE and 35% of the variance in ROA, demonstrating that CAR and CIR are significant predictors of profitability for Congolese banks, while other credit risk indicators may contribute to, but do not fully explain, variations in profitability.

## 5. Discussion

The findings of this study reveal that capital adequacy and operational efficiency are crucial for banks in high-risk emerging economies to sustain and improve their profitability. More specifically, CAR has a positive and significant effect on ROE and ROA, proving that banks with higher capital adequacy are more resilient to shocks and can generate greater profits. On the other hand, the Cost-to-Income Ratio (CIR) significantly affects profitability, suggesting that banks should cut costs to maintain performance. These findings support Siddique et al.'s (2022) and Gupta and Sikarwar's (2020) studies, which show that sufficient capital and operating performance are crucial for bank stability and profitability under uncertain macroeconomic conditions. Despite the importance of credit risk provisions, the Loan Loss Provision Ratio (LLPR) has an insignificant relationship with profitability in the DRC context, implying a possible inefficiency in credit risk provisions that may demand policy and strategic changes.

### Implications for Policy and Practice

The findings highlight the significance of capital adequacy as a safeguard contributing to profitability in risky environments. The DRC authorities could explore higher CAR necessities, pressuring banks to maintain capital buffers that correspond to their risk profiles. Adopting progressive CAR standards currently in use in other emerging markets can serve as a reference for Congolese banks to strengthen their positions. For instance, [Al Zaidanin and Al Zaidanin \(2021\)](#) highlighted that the increased CAR has helped stabilize banks in the UAE by offering a base on which they can develop and absorb risks, particularly in the face of economic crises. Adopting a policy that sets high CAR thresholds would not only bring more stability, but also help attract foreign investors' attention to the stability of the banking sector in Congo, thus increasing both domestic and foreign investor confidence in Congolese banks.

The negative relationship between CIR and profitability implies that cost inefficiencies have a direct deleterious impact on financial outcomes. To support profitability, regulatory bodies could develop measures that would encourage the adoption of efficient technologies such as digital banking, automation, and streamlining of processes. [Cheng et al. \(2020\)](#) and [Saleh and Abu Afifa \(2020\)](#) argue that technology investments effectively cut operational costs and enhance CIR in emerging economies to improve profitability. However, to address certain cost management issues, Congolese banks may find it useful to receive government support through subsidies for technology or collaboration with fintech firms that offer cheaper solutions to organizational problems. This study has established that a high CIR hurts profitability, and proper operational management practices can minimize the pressure that comes with a high CIR.

While the Loan Loss Provision Ratio (LLPR) does not affect the institution's profitability, the Non-Performing Loan Ratio (NPLR) fluctuation suggests that credit risk exposure is still volatile. This requires regulatory policies on loan quality that include measures, such as the rule on dynamic provisioning, to reflect banks' existing risk and economic environment. These policies would be especially useful in the Congolese setting, as credit risk exposure tends to be relatively high because of economic volatility. [Abdelaziz et al. \(2022\)](#) also showed that improved credit risk monitoring frameworks, especially those based on real-time data, enhanced the quality of loan portfolios in the banks of the MENA region and helped in better provisioning. As for Congolese banks, a similar approach could imply the need to adjust the loan loss provisions to the actual risks, which may prevent profitability disruptions due to high default rates.

Since CIR and NPLR have significant effects on a bank's profitability, it is imperative that bank managers and risk officers undergo specific training in operational and risk-management techniques. Industry associations and regulatory bodies can foster professional development programs aimed at improving operational processes, credit risk evaluation, and capital management. Such programs can improve credit risk management in the DRC financial market by preparing

bank professionals with the best practices and knowledge from other emerging markets. Siddique et al. (2022) and Gupta and Sikarwar (2020) concluded from their research that banking practices ensure that they align with profitability objectives while avoiding exposure to financial vulnerability by engaging in continuous professional development regarding credit risk management.

### **Recommendations**

As shown by the CAR findings on profitability, policymakers in the DRC should consider implementing a risk-based capital adequacy model based on the different risk levels of various banking institutions. Policies in these areas would ensure that banks have adequate capital to act as a buffer against credit risk, especially during periods of economic cycle volatility. In this way, regulators can set CAR thresholds that would rise with institutions' scale and risk exposure to guarantee that all banks would hold sufficient capital and keep the banking sector resistant to possible shocks for long-term development.

While CIR has been shown to negatively affect bank profitability, it is easy to conclude that banks should encourage investment to reduce costs. Regulatory bodies could consider offering tax incentives or subsidies to encourage firms to adopt digital banking, automation, and efficient process-improvement technologies. Such advancements have led to efficiency gains, especially in operating expenses, which would decrease the CIR and affect profitability more directly through ROE and ROA.

Congolese banks should also adapt to credit risk assessment techniques so that provisioning policies reflect their credit risk profile. The ability to monitor credit quality through analytics also allows for better articulation or provisioning in line with the current market and borrowing conditions, instead of rigidly fixed policies. This approach would enable banks to better manage credit risk and avoid under-provisioning, while maintaining profitability.

Considering these issues, specific training courses aimed at improving cost management efficiency and credit risk assessment would provide bank executives and risk managers with knowledge to resolve definite problems in the DRC. Such training could help banks in the country align risk management with profitability goals, given that it is in line with best practices from across the globe but adapted for the local market in the Congo.

## **6. Conclusion**

This study underlines the significance of credit risk management for the viability of Congolese banks, and stresses the significance of capital adequacy and cost-to-income ratios. CAR, which positively affects profitability, reaffirms the premise that sound capital structures help banks manage market fluctuations. In contrast, the negative effect of CIR emphasizes the importance of efficient operations. While changes in the level of provisioning did not affect the level of profitability, the variability of the loan performance indicators indicates that implementing targeted measures to improve the efficiency of risk management in Congolese banks

is advisable. These findings imply that the government should consider implementing tiered CAR requirements, incentives for technology uptake, data-driven risk assessment instruments, and targeted professional development as approaches to strengthen the sector. Improving these areas will strengthen the sector's preparedness for economic shocks and place Congolese banks on a better pedestal to record sustainable profitability and growth within the context of a challenging environment.

## Generative AI

I acknowledge that no generative AI was used to generate materials for background research, self-study, or in the drafting of this study. The final writing and editing process were conducted without the assistance of any AI tools.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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