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# Effect of Capital Adequacy on the Profitability of Selected Commercial Banks in Rwanda

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***Abstract:*** *This study examined the effect of capital adequacy on the profitability of selected commercial banks in Rwanda. Specifically, the study aimed to assess the effect of Capital Adequacy Ratio on bank profitability, examine the influence of Tier 2 Capital Ratio on bank profitability, and analyze the effect of Internal Capital Quality Ratio on bank profitability, while controlling for non-performing loans. The research adopted an explanatory research design using panel data methodology to analyze secondary data from eight commercial banks operating in Rwanda from 2018 to 2024. Bank profitability was measured using the Return on Assets (ROA) and Return on Equity (ROE) as key performance indicators. Data analysis employed data transformation from annual data to quarterly (Q1-Q4) data. Rigorous diagnostic tests were conducted, including the Im-Pesaran-Shin (IPS) test for stationarity, Pedroni test for cointegration, correlation matrix, Breusch-Pagan test for heteroscedasticity, Wooldridge test for autocorrelation, and the Durbin-Wu-Hausman test for endogeneity. The findings revealed that Capital Adequacy Ratio had a statistically significant negative effect on bank profitability ($\beta$ = - 0.1176, $p$ = 0.000). Conversely, Tier 2 Capital Ratio demonstrated a statistically significant positive effect on profitability ($\beta$ = 0.1677, $p$ = 0.000). Internal Capital Quality Ratio, a proxy, measured as retained earnings to total equity, also exhibited a statistically significant positive effect on profitability ($\beta$ = 0.0427, $p$ = 0.000). The control variable, non-performing loans ratio, showed a negative and statistically significant relationship with profitability ($\beta$ = -0.1124, $p$ = 0.000).*

***Keywords:*** *Capital adequacy, Tier 2 capital, Internal capital quality, Bank profitability, Commercial banks, Rwanda, Panel data analysis*

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## 1. Introduction

The global financial crisis of 2007 to 2009 exposed critical vulnerabilities in banks that, despite appearing solvent, possessed insufficiently resilient capital buffers. The Basel Committee on Banking Supervision (2017) reported that these vulnerabilities prompted international regulatory authorities to implement enhanced capital standards under the Basel III framework, which significantly raised minimum capital requirements, established capital conservation buffers, and formalized the distinction between Tier 1 core capital and Tier 2 supplementary capital, a distinction that directly informs the sub-variable structure of the present study. The World Bank (2020) further noted that the reforms represented a fundamental shift in how regulators conceptualize capital adequacy, moving beyond a single aggregate ratio toward a more layered, quality-conscious framework.

Research conducted on a global scale has produced varied findings regarding the connection between capital adequacy and profitability. Nguyen (2020) reviewed panel data from 22 commercial banks in Vietnam from 2010 to 2018 and found a positive and statistically significant effect of capital adequacy on return on assets (ROA) for smaller

banks; however, this effect was not significant for larger banks. Nguyen concluded that the relationship between profitability and capital adequacy is affected by factors like bank size and market structure. In contrast, Thakur (2019) studied 10 commercial banks in Nepal employing Pearson correlation and multiple regression analysis. He identified a statistically significant negative correlation between the capital adequacy ratio (CAR) and several profitability metrics, including ROA, return on equity (ROE), and spread ratio. Thakur suggested that the banks in his study held capital reserves that significantly exceeded optimal levels, leading to opportunity costs that impeded their operational efficiency.

The banking sector in Rwanda has undergone numerous reforms and is now a well-regulated financial system that complies with international banking prudential standards. According to the National Bank of Rwanda (NBR, 2024), the minimum Capital Adequacy Ratio (CAR) is 15%, which is higher than the global minimum requirement of 8% established by the Basel III accord. In 2024, the industry posted an overall CAR of about 21%, a testament to the strong capital base of the nine licensed commercial banks, including Bank of Kigali, Equity Bank Rwanda, and I&M Bank Rwanda. According to the Rwanda Bankers Association, the banking sector has remained resilient despite the challenges brought about by the post-COVID-19 recovery and the rising global inflation, which increased both credit risk and operational costs. Furthermore, according to the International Monetary Fund (2024), the capital buffers in Rwanda's banking sector are stable, but improving profitability requires a greater focus on the efficient utilization of capital.

Research on the relationship between capital adequacy and profitability in Rwanda remains limited, despite the existence of strong regulatory frameworks. Existing studies have also not examined the specific sub-variables that are central to this analysis. According to Musafiri and Twesige (2024), capital structure has a significant impact on the financial performance of selected Rwandan commercial banks, including Bank of Kigali, Equity Bank Rwanda, and I&M Bank Rwanda. However, their study relied on broad leverage ratios rather than detailed regulatory capital adequacy measures, leaving the individual effects of CAR, T2CR, and internally generated capital on profitability unexamined. In addition, Harelimana and Uwibambe (2022) found that regulatory compliance from the National Bank of Rwanda has a positive correlation with the financial performance of commercial banks. Their study, however, did not break down capital adequacy into its individual tiers, making it difficult to determine which specific components of capital structure drove the observed performance outcomes.

According to local research, capital adequacy is a significant factor influencing bank profitability in Rwanda. However, no studies have analyzed the independent impacts of Capital Adequacy Ratio (CAR), Tier 2 Capital Ratio (T2CR), and the quality of internally generated capital on profitability within a comprehensive multi-year panel framework. This research addresses that oversight.

## 1.1 Problem Statement

The relationship between capital adequacy and bank profitability has been widely studied globally, yet findings across different studies remain inconsistent and at times contradictory. According to Nguyen (2020), who analyzed 22 commercial banks in Vietnam using a fixed-effects model, the Capital Adequacy Ratio (CAR) had a positive and significant effect on Return on Assets (ROA) for smaller banks but did not significantly influence larger institutions. This indicates that the profitability effects of capital adequacy vary depending on bank size and context. However, Nguyen (2020) focused solely on aggregate CAR, without examining the distinct effects of Tier 2 capital and internally generated capital on profitability. Similarly, according to Gautam (2019), who examined 9 commercial banks in Nepal using multiple regression analysis, CAR had a statistically significant negative relationship with all profitability measures, including ROA and Return on Equity (ROE). This implied that over-capitalization incurs opportunity costs that hinder operational efficiency. Like Nguyen (2020), Gautam's study relied entirely on total CAR without disaggregating capital into its regulatory components, suggesting that the profitability effects of supplementary and internally generated capital are still unmeasured. Yusuf and Shikur (2023) studied 9 Ethiopian commercial banks using a fixed effects regression model. They found that while capital adequacy had a positive and significant impact on ROA, minimum capital requirements negatively affected performance, indicating that different aspects of capital can lead to varying profitability outcomes. This highlights the limitations of relying on a single capital measure. Bitar, Pukthuanthong, and Walker (2018) researched 1992 banks across 39 OECD countries and established that higher-quality Tier 1 and common equity components were more consistently linked to enhanced efficiency and profitability compared to Tier 2 instruments. Their study highlighted the importance of quality and composition beyond aggregate volume, but it was confined to developed OECD markets without considering the context of emerging African banking systems.

Empirical research in the African and Rwandan contexts remains notably scarce. In their study, Adegbie, Ogundajo, and Adebayo (2025) examined listed deposit money banks across selected Sub-Saharan African nations and discovered that capital adequacy significantly affects financial sustainability. They highlighted the need for regulatory frameworks to take into account the distinct

market conditions of individual countries; however, their research did not separate the various tiers of regulatory capital or internally generated capital, as it concentrated on overall capital adequacy. Musafiri and Twesige (2024) analyzed the relationship between capital structure and financial performance in several Rwandan commercial banks. Their findings revealed a significant impact of capital structure on performance; nevertheless, they relied on broad leverage ratios instead of detailed regulatory capital adequacy metrics such as CAR and T2CR, thus leaving the specific influence of capital composition on profitability unexplored. Harelimana and Uwibambe (2022) investigated how NBR regulations affected the performance of commercial banks in Rwanda, finding a positive link between regulatory compliance and profitability. However, they did not break down capital adequacy into its component tiers, which made it challenging to determine the specific aspects of the capital structure that influenced performance. Sekibibi, Gashema, and Nkurunziza (2020) identified a significant negative correlation between non-performing loans and profitability in three Rwandan banks, emphasizing the need to control for credit risk in capital-profitability analyses; an approach that was often not rigorously applied in previous studies conducted in Rwanda.

The existing body of literature reveals four converging gaps that this study seeks to address. Firstly, empirical evidence on the capital adequacy-profitability relationship is globally mixed and context-dependent, with no consensus applicable to Rwanda's specific regulatory and market environment. Secondly, prior studies, both internationally and locally, have predominantly relied on aggregate CAR as the sole measure of capital adequacy, concealing the distinct profitability effects of Tier 2 supplementary capital and internally generated capital. Thirdly, no study in Rwanda has introduced or tested a measure specifically designed to assess the quality of internally generated capital from retained earnings, leaving the relationship between this capital component and profitability unexamined. Lastly, many studies in Rwanda have not adequately controlled for credit risk as measured by the Non-Performing Loans ratio, making it difficult to separate the direct effects of capital adequacy on profitability from those associated with declining asset quality.

## 1.2 General Objective

The main objective of this study was to investigate the effect of capital adequacy on the profitability of selected commercial banks in Rwanda.

### 1.2.1 Specific Objectives

The study aimed at achieving the following specific objectives:

1. To assess the effect of capital adequacy ratio on the profitability of selected commercial banks in Rwanda.
2. To examine the effect of tier 2 capital ratio on the profitability of selected commercial banks in Rwanda.
3. To analyze the effect of internal capital quality ratio on the profitability of selected commercial banks in Rwanda.
4. To determine the influence of non-performing loan ratio on the profitability of selected commercial banks in Rwanda.

# 2. Literature Review

As a core regulatory requirement under the Basel framework, the Capital Adequacy Ratio has been widely examined as a determinant of bank performance. However, empirical studies suggest that its effect on profitability is context-specific and may exhibit non-linear characteristics.

Nguyen (2020) examined how capital adequacy affects bank profitability by analyzing panel data from 22 commercial banks in Vietnam. The study used a fixed-effects regression model, measuring profitability with Return on Assets (ROA) and using the Capital Adequacy Ratio (CAR) as the main explanatory variable, along with bank-specific control factors including bank size, liquidity, and loan quality. Results indicated that CAR has a positive and statistically significant effect on ROA for smaller banks, while the impact is minimal and not statistically significant for larger banks. The study concluded that smaller banks benefit more from stronger capital positions, as adequate capital tends to increase depositor confidence and reduce funding costs.

Gautam (2019) investigated the impact of capital adequacy and bank operational efficiency on the profitability of commercial banks in Nepal, using secondary data from nine commercial banks. The study employed multiple regression analysis, with ROA and ROE as profitability measures. The findings show a statistically significant negative relationship between CAR and all profitability indicators, including ROA, ROE, and the spread ratio, indicating that the sampled banks were maintaining capital reserves significantly above optimal levels, thereby incurring opportunity costs that constrained operational efficiency. The study concluded that commercial banks should calibrate their capital reserves to an optimal level that balances financial stability with profit generation.

Empirical studies specifically examining the relationship between the Tier 2 Capital Ratio and bank profitability remain limited, partly because many studies focus on

aggregate capital adequacy rather than decomposing capital into its constituent parts.

Thapa (2024) analyzed the impact of capital adequacy components on bank profitability, drawing on secondary data from 11 commercial banks in Nepal. The study employed correlation coefficients and multiple regression analysis, with ROA and earnings per share as dependent variables, and CAR, Tier 1 capital, Tier 2 capital, NPL, liquidity, and total deposits as independent variables. The study found that capital adequacy ratio had a positive impact on ROA and earnings per share, while Tier 2 capital, classified as supplementary capital, was negatively linked with both profitability measures, implying that greater dependence on Tier 2 instruments coincided with reduced profitability. The results suggest that supplementary capital may be less effective than core capital in driving profit performance in Nepal's banking environment.

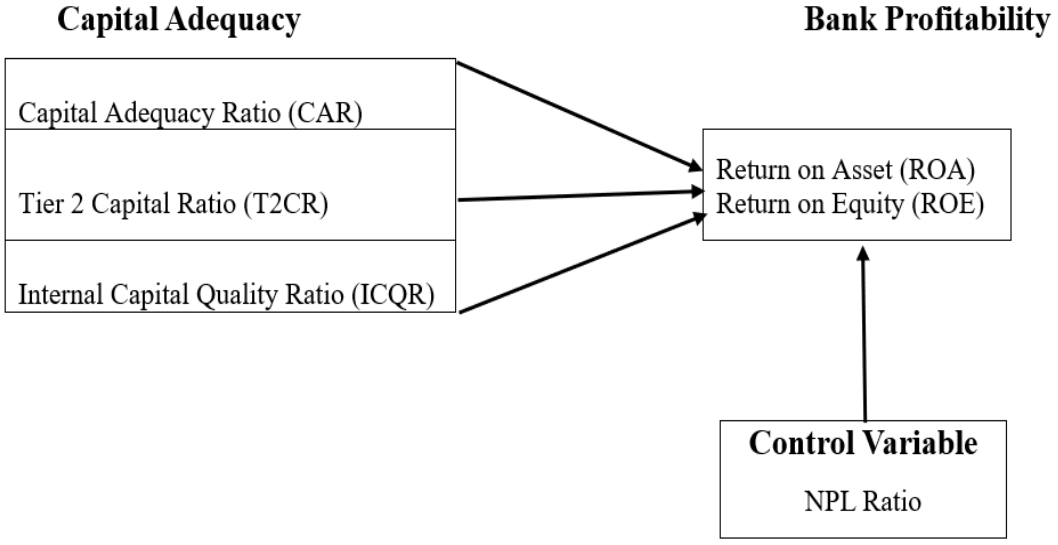
Empirical evidence suggests that the quality and internal generation of capital, rather than regulatory capital ratios alone, play a critical role in shaping bank profitability, particularly during periods of financial stress and in emerging market contexts.

Alkhazali et al (2024) examined the influence of capital quality on bank performance during the COVID-19 crisis, analyzing panel data from 819 banks in 26 emerging markets. Using panel regression models, they assessed profitability through Return on Assets (ROA) and Return on Equity (ROE), while controlling for bank size, liquidity, asset quality, and macroeconomic conditions. The results showed that banks with stronger capital bases, especially those drawing more heavily on internally generated capital, achieved higher profitability and demonstrated greater resilience throughout the crisis. The study concluded that during systemic disruptions, the quality of capital and internal financial buffers are more critical than mere capital volume.

While non-performing loans (NPL) are not the central focus of this research, the empirical relationship between asset quality and bank profitability remains important.

Sekibibi, Gashema, and Nkurunziza (2020) examined the influence of non-performing loans on bank profitability by analyzing the audited annual reports of 3 Rwandan commercial banks: Bank of Kigali, COGEBANQUE, and I&M. The study employed multiple regression analysis to evaluate the strength of the link between credit defaults and key financial performance indicators, including ROE and net profit. The findings showed a significant negative relationship between non-performing loans and both ROE and net profit, confirming that rising loan defaults erode bank profitability. The study recommended the adoption of more cautious lending practices, including borrower cash flow verification.

### 2.1 Conceptual Framework




# 3. Methodology

## 3.1 Research Design

This study employed an explanatory research design to examine the effect of capital adequacy on the profitability of commercial banks in Rwanda. The explanatory approach was intended to identify the underlying causal

dynamics connecting capital adequacy and bank profitability. This framework enables statistical hypothesis testing and facilitates causal inferences about the effect of the independent variable on the dependent variable.

## 3.2 Study Population

The study population comprises all licensed commercial banks operating in Rwanda. As of 2024, there are 9 commercial banks licensed and supervised by the National Bank of Rwanda. However, the study excluded Kigali Business Centre (KBC) Bank due to its merger with Bank Populaire du Rwanda (BPR) in 2021, resulting in limited data availability covering only 2022 to 2024, which did not adequately cover the study period timeframe. Therefore, the effective study population consists of eight commercial banks that maintained continuous operations throughout the study period.

**Table 1: Target population**

| Local Rwandan Banks | Subsidiaries of Foreign Banking Groups |
|---|---|
| Bank of Kigali Plc | I&M Bank Rwanda |
| | Guaranty Trust Bank Rwanda |
| | Ecobank Rwanda |
| | Access Bank Rwanda |
| | Equity Bank Rwanda |
| | Bank of Africa Rwanda |
| | NCBA Rwanda |
| **Total:** 1 | **Total:** 7 |
| **Total population:** 8 commercial banks | |

## 3.3 Sample Size

This research employed a census methodology, covering all eight Rwandan commercial banks that had complete audited financial statements for the study period. Several factors justify the decision to include the entire population rather than selecting a sample. First, the population size was relatively small and manageable, making it feasible to collect and analyze data from all banks. Second, using the complete population eliminates sampling error and ensures that the findings are representative of the entire commercial banking sector in Rwanda.

## 3.4 Data Collection Instruments

This study relied exclusively on secondary data extracted from publicly available and officially published financial documents. The primary data collection instrument was a structured data extraction template on Excel designed to record all study variables for each of the 8 sampled commercial banks across 7 years from 2018 to 2024.

### 3.4.1 Financial Statements Used

Two types of financial statements were used as primary source documents for data extraction in this study. Each statement serves a distinct and complementary role in providing the financial information necessary to construct the study variables.

**Statement of Financial Position (Balance Sheet)**

The Statement of Financial Position, commonly referred to as the Balance Sheet, is the most critical source document for this study.

**Income Statement (Profit and Loss Statement)**

The Income Statement presents a bank's revenues, operating expenses, provisions for loan losses, and net profit or loss over a given financial year. It is the primary source document for measuring bank profitability in this study.

## 3.5 Data Analysis

The strategy for data analysis was a comprehensive method that integrated financial ratio analysis, descriptive statistics, diagnostic testing, and advanced econometric modeling appropriate for panel data analysis. This layered analytical framework ensured a robust investigation of the connection between capital adequacy and bank profitability, while also accounting for pertinent variables.

$$ROA_{it} = \beta_0 + \beta 1CAR_{it} + \beta 2T2CR_{it} + \beta 3ICQR_{it} + \beta 4NPL_{it} + U_i + \varepsilon_{it}$$

## 3.6 Ethical Considerations

Ethical considerations are essential for upholding integrity, credibility, and social responsibility associated with academic research. This study adhered to established ethical principles and guidelines for business and financial research, ensuring that all aspects of the research process met the highest standards of academic and professional ethics.

**Public Data Sources:** All data were obtained exclusively from publicly available sources, including audited annual reports, regulatory filings, stock exchange publications, and official government databases. No confidential, proprietary, or insider information was accessed or used in any aspect of the research.

**Data Integrity:** The study maintained complete fidelity to the original data sources without any manipulation, fabrication, or selective reporting of data. All calculations and transformations are transparently documented and follow established accounting and statistical principles.

# 4. Results and Discussion

## 4.1 Sample Description

The study employed a strongly balanced panel dataset of 8 commercial banks in Rwanda over the period 2018Q1 to 2024Q4, yielding 224 observations. Annual data were converted into quarterly frequency by expanding each year into four quarters to increase the number of observations. Given that we are using financial ratios, their values were carried forward across quarters to preserve their economic meaning.

## 4.2 Descriptive Statistics

Descriptive statistics were computed to summarize the basic characteristics of the study variables.

**Table 2: Summary Statistics**

| Variables | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ROA | 224 | 1.782857 | 2.730202 | -12.53 | 4.21 |
| CAR | 220 | 25.36491 | 9.10573 | 16.67 | 74.69 |
| T2CR | 220 | 1.298545 | 1.362377 | 0.1 | 9 |
| ICQR | 224 | 18.97357 | 53.11445 | -136.19 | 79.95 |
| NPL | 220 | 3.921091 | 2.360836 | 0.3 | 11 |

**Source: Secondary data processed by the author**

Table 2 presents the descriptive statistics for all variables used in this study, covering observations drawn from the eight sampled commercial banks over the period 2018Q1 to 2024Q4.

Return on Assets (ROA) is the primary dependent variable in this study, measuring how efficiently a bank generates net profit from its total asset base. As shown in Table 2, ROA recorded a mean value of 1.78%, indicating that on average, the sampled Rwandan commercial banks generated approximately 1.78% of net profit for every 100 Rwandan francs of total assets held during the study period. The standard deviation of 2.73% reflects considerable variation in profitability performance across banks and years, suggesting that while some institutions performed strongly, others struggled to generate consistent returns. The minimum value of -12.53% confirms that certain banks experienced significant net losses in specific years, while the maximum value of 4.21% represents the highest level of asset efficiency recorded among the sampled institutions.

Capital Adequacy Ratio (CAR) is the primary independent variable, measuring total regulatory capital relative to risk-weighted assets. The National Bank of Rwanda (NBR) uses CAR as a prudential safeguard to ensure that commercial banks maintain sufficient capital buffers to absorb unexpected credit losses and operational shocks, thereby protecting depositors and preserving systemic stability (NBR, 2024). Table 2 shows that the average CAR across the sampled banks was 25.36%, with a standard deviation of 9.11%. The minimum CAR recorded was 16.67% and the maximum was 74.69%. The mean CAR of 25.36% is substantially above the NBR's regulatory minimum of 15% and more than three times the Basel III global minimum of 8%, indicating that Rwanda's commercial banking sector is significantly over-capitalized relative to international benchmarks. This persistent over-capitalization is consistent with the Trade-off Theory argument that holding capital well above the optimal level imposes opportunity costs that may constrain profitability, and constitutes a key contextual motivation for this study.

Tier 2 Capital Ratio (T2CR) is the second independent variable, capturing the proportion of supplementary regulatory capital relative to risk-weighted assets. T2CR recorded a mean of 1.30% and a standard deviation of 1.36%. The minimum value was 0.1% and the maximum was 9.0%. The low mean value of T2CR relative to total CAR confirms that Rwandan commercial banks rely predominantly on Tier 1 core capital rather than supplementary instruments to meet their regulatory capital

requirements. The wide range between the minimum and maximum values suggests that individual banks differ substantially in their reliance on supplementary capital, making T2CR a meaningful dimension of capital adequacy to examine in relation to profitability.

Internal Capital Quality Ratio (ICQR) is the third independent variable and a proxy measure introduced in this study to capture the proportion of a bank's capital financed through retained earnings. ICQR recorded a mean of 18.97% and a notably high standard deviation of 53.11%, reflecting extreme heterogeneity in internally generated capital across the sampled institutions. The minimum value of -136.19% indicates that certain banks experienced periods of accumulated losses severe enough to completely erode paid-up capital, while the maximum value of 79.95% represents institutions with a strong track record of earnings retention.

Non-Performing Loans Ratio (NPL) serves as the control variable in this study, measuring the proportion of a bank's gross loan portfolio classified as non-performing. NPL recorded a mean of 3.92% with a standard deviation of 2.36%. The minimum NPL ratio was 0.3%, and the maximum was 11.0%. The mean NPL of 3.92% is below the NBR's prudential threshold of 5%, suggesting that the sector maintained broadly acceptable asset quality over the study period, though the maximum of 11% confirms that individual banks experienced significant credit stress in specific years.

## 4.3 Diagnostic Test

### 4.3.1 Panel Unit Root Test

To determine the stationarity of the panel data, a panel unit root test was applied on the study variables.

**Table 3: Im-Pesaran-Shin (IPS) Test Results**

| Variables | Statistics (Z-t-tilde-bar) | p-value | Statistics (Z-t-tilde-bar) | p-value |
|---|---|---|---|---|
| | Level | Level | Difference | Difference |
| ROA | -0.2428 | 0.4041 | -7.9205 | 0.0000* |
| CAR | -0.5680 | 0.2850 | -7.8254 | 0.0000* |
| T2CR | -0.2151 | 0.4148 | -7.7491 | 0.0000* |
| ICQR | 1.2650 | 0.8971 | -8.2771 | 0.0000* |
| NPL | -0.9404 | 0.1735 | -7.6109 | 0.0000* |

**Stationary at first difference, **stationary at second difference*
***Source:*** *Secondary data processed by the author.*

Table 3 displays the outcomes of the Im-Pesaran-Shin (IPS) panel unit root tests, which were employed to assess the stationarity properties of the variables. The findings revealed that all principal variables, specifically Return on Assets (ROA), Capital Adequacy Ratio (CAR), Tier 2 Capital Ratio (T2CR), Internal Capital Quality Ratio (ICQR), and Non-Performing Loans (NPL), exhibit p-values below the 0.05 significance threshold following first-order differencing.

This indicates that although the series are non-stationary in their levels, they become stationary after first differencing, confirming an integration of order one, I(1). Establishing this property is a fundamental prerequisite for valid econometric modeling, as it mitigates the risk of spurious regression. Achieving stationarity effectively controls persistent macroeconomic fluctuations, thereby enabling a robust analysis of the long-run equilibrium relationship.

### 4.3.2 Cointegration Test

To examine potential long-run equilibrium relationships among the variables, a panel cointegration test was applied, given that all variables were found to be stationary at first difference.

**Table 4: Pedroni Test for Cointegration Results**

| | Statistic | p-value |
|---|---|---|
| Modified Phillips-Perron t | 3.2412 | 0.0006 |
| Phillips-Perron t | 2.6874 | 0.0036 |
| Augmented Dickey-Fuller t | 2.8996 | 0.0019 |

**Source: Secondary data processed by the author.**

Table 4 displays the results of the Pedroni residual-based cointegration test, which was employed to assess whether a long-term equilibrium relationship exists among the variables under study. The test examines the null hypothesis of no cointegration against the alternative of a stable long-run association.

The results showed that the Modified Phillips-Perron (3.2412), Phillips-Perron (2.6874), and Augmented Dickey-Fuller (2.8996) statistics all produced p-values below 0.01. These highly significant results led to the rejection of the null hypothesis at the 1% level, suggesting that capital adequacy and bank profitability tend to move together in the long run, despite short-term deviations. This supports the application of an Error Correction Term (ECT) in further analysis.

### 4.3.3 Autocorrelation Test

The autocorrelation test was conducted to detect the presence of serial correlation in the panel data.

**Table 5: Wooldridge Test Result**

| Model Specification | Chi-Square Statistic | p-value |
|---|---|---|
| Panel Model 1 | 51.62 | 0.0000 |

**Source: Secondary data processed by the author**

Table 5 presents the results of the Wooldridge test for autocorrelation, which was conducted to detect the presence of serial correlation in the panel data. The test yielded a Chi-Square Statistic of 51.62 with a statistically significant p-value of 0.0000.

Since the p-value is significantly below the 0.05 threshold, the null hypothesis of no first-order autocorrelation is rejected. This suggests that a bank's profitability or capital levels in one year are significantly related to its performance in the previous year, a common trait in banking due to multi-year loan cycles and persistent management policies. To address this autocorrelation the Panel-Corrected Standard Errors were applied in the final regression model.

## 4.4 Panel Model Regression

The study hypothesis was tested using panel regression analysis of ROA. The estimation results show the coefficients between the independent and dependent variables as presented in Table 6. Based on these results, the regression equation is as follows:

**ROA** = 0.0171 - 0.1176 CAR + 0.1677 T2CR + 0.0427 ICQR - 0.1124 NPL - 0.0522 ECT + ε

**Table 6: Prais-Winsten regression, (PCSEs) (Dependent variable: ROA)**

| **Model ROA** | Coef. | Panel-corrected Std. Err. | z | p-value |
|---|---|---|---|---|
| Constant | 0. 0171395 | 0. 0198247 | 0.86 | 0.387 |
| CAR | -0.1175824 | 0. 01023 | -11.49 | 0.000*** |
| T2CR | 0.1677232 | 0. 0422841 | 3.97 | 0.000*** |
| ICQR | 0. 0426722 | 0. 0044245 | 9.64 | 0.000*** |
| NPL | -0. 1124014 | 0. 0266299 | -4.22 | 0.000*** |
| ECT | -0. 0521828 | 0. 0254982 | -2.05 | 0.041** |

*The asterisks ***, **, * represent significance at 1%, 5%,10% levels respectively.*

*a. Dependent Variable: ROA*

***Source:*** *Secondary Data processed by the author*

Table 6 shows the results of the final panel regression, estimated with Panel-Corrected Standard Errors. The results indicate that the Capital Adequacy Ratio (CAR) has a negative and statistically significant effect on ROA, with a coefficient of -0.1176 (p = 0.000). Conversely, the Tier 2 Capital Ratio (T2CR) and the Internal Capital Quality Ratio (ICQR) both exhibit positive and statistically significant effects on profitability, with coefficients of 0.1677 (p = 0.000) and 0.0427 (p = 0.000), respectively. Non-Performing Loans (NPL) exhibit a negative and statistically significant relationship with ROA (-0.1124, p = 0.000). Furthermore, the Error Correction Term (ECT) is negative and statistically significant (-0.0522, p = 0.041), confirming a long-run equilibrium relationship among the variables. This implies that approximately 5.22% of short-run deviations are corrected within one year.

## 4.5 Discussion of the Findings

**Influence of Capital Adequacy Ratio (CAR) on Bank Profitability**

The primary finding of this study indicates that the Capital Adequacy Ratio (CAR) exerts a negative and statistically significant influence on the profitability of commercial banks in Rwanda, as measured by Return on Assets (ROA) (β = -0.1176, p = 0.000). While initial hypotheses in banking literature often find a positive relationship where higher capital reduces insolvency risk, the results in the Rwandan context reveal that an increase in regulatory buffers corresponds to a decline in earnings. This finding provides strong empirical support for the Trade-off Theory, which posits that firms determine their optimal capital structure by balancing the benefits of holding capital against its associated costs. While adequate capitalization lowers expected distress costs, the theory predicts that excess capital reduces leverage and constrains asset expansion, ultimately generating diminishing returns.

This result is consistent with a state of inefficient over-capitalization, where Rwandan banks maintain a mean CAR of 25.4%, far exceeding the National Bank of Rwanda's (NBR) 15% threshold and more than three times the Basel III global minimum of 8%. The evidence suggests that the traditional benefits of capital are outweighed by the opportunity costs of holding large amounts of non-income-generating assets to ensure extreme regulatory compliance. This interpretation is further reinforced by Gautam (2019), who confirmed that banks holding capital well above minimum requirements experience reduced earnings due to these high opportunity costs.

**Influence of Tier 2 Capital Ratio (T2CR) on Bank Profitability**

The second research objective aimed to investigate the influence of the Tier 2 Capital Ratio (T2CR) on the profitability of commercial banks in Rwanda. The findings reveal a positive and statistically significant relationship between T2CR and bank profitability (β = 0.1677, p = 0.000), suggesting that a higher level of Tier 2 capital increases Return on Assets (ROA). While total capital volume (CAR) was found to be a drain on earnings due to over-capitalization, these results reveal that supplementary capital plays a critical role in enhancing performance.

Theoretically, this finding provides strong support for the Pecking Order Theory. As established by Myers and Majluf

(1984), firms prioritize financing sources to minimize adverse selection and signaling costs. In the Rwandan context, where access to external equity is costly and often limited, Tier 2 instruments, specifically subordinated debt, act as a preferred mechanism for capital adjustment. Unlike core capital, Tier 2 capital is relatively flexible and less expensive, enabling institutions to support growth in risk-weighted assets without the immediate dilutive costs or the overvaluation signal often associated with fresh equity issuance. This aligns with the observations of Raja (2022), who confirmed that banks strategically increase their reliance on Tier 2 instruments to meet regulatory buffers at a minimal expense.

**Influence of Internal Capital Quality Ratio (ICQR) on Bank Profitability**

The third objective of this research was to assess the influence of the Internal Capital Quality Ratio (ICQR) on the profitability of commercial banks in Rwanda. The regression analysis indicates that ICQR exerts a positive and statistically significant influence on bank profitability ($\beta = 0.0427$, $p = 0.000$). This suggests that institutions maintaining a greater share of internally generated capital, specifically retained earnings, demonstrate enhanced financial performance relative to their peers. This finding underscores the conceptual argument that the quality and source of capital are vital for profitability, rather than merely the aggregate level of regulatory buffers.

Theoretically, this result is strongly consistent with Pecking Order Theory, which argues that firms prioritize internal financing over external sources due to information asymmetry costs. As noted by Myers and Majluf (1984), retained earnings represent the most information-efficient and least costly form of capital. In the Rwandan context, where capital markets are relatively shallow and external equity is expensive, reliance on internally generated capital enhances financial flexibility and avoids the dilutive signaling effects associated with fresh equity issuance.

**Influence of Non-Performing Loans (NPL) on Bank Profitability**

The final finding concerning the control variable reveals that the Non-Performing Loan (NPL) ratio exhibited a negative and statistically significant influence on profitability among Rwandan commercial banks ($\beta = -0.1124$, $p = 0.000$). This result provides strong empirical support for Credit Risk Theory, which posits that asset quality deterioration is a primary driver of earnings volatility, as loan defaults directly erode net interest income and increase the burden of provisioning costs. This relationship also aligns with Asset Quality Management Theory, which holds that the systematic monitoring of loan performance is essential for sustaining profitability and protecting a bank's capital base.

While theoretical frameworks anticipate that impaired loans should substantially erode earnings, this research indicates that the Rwandan banking sector maintained an average NPL ratio of 3.93% from 2018 to 2024, which is comfortably beneath the 5% conventional prudential threshold set by the National Bank of Rwanda (NBR). Such stability suggests that the NBR's stringent supervisory framework and effective institutional risk management practices have been successful in containing credit risk. Consequently, although the negative impact of NPLs is statistically significant, the relatively low level of defaults implies that profit determination in this sector has transitioned from simple risk containment toward more complex internal capital optimization.

# 5. Conclusion and Recommendation

## 5.1 Conclusion

This research aimed to examine the impact of capital adequacy on the profitability of selected commercial banks in Rwanda from 2018 to 2024, focusing on specific aspects involved. The study was driven by the notable discrepancy observed: Rwandan commercial banks maintain capital adequacy ratios well above the National Bank of Rwanda's required minimum of 15%, yet their profitability has been inconsistent and occasionally below expectations during this period. To analyze this, capital adequacy was divided into three main components: the Capital Adequacy Ratio (CAR), the Tier 2 Capital Ratio (T2CR), and a new Internal Capital Quality Ratio (ICQR) developed by the researcher while also considering credit risk through the Non-Performing Loans ratio.

For the first objective, the findings indicate that CAR negatively and significantly affects bank profitability in Rwanda, leading to the dismissal of the initial null hypothesis. This suggests that the sector's excess capitalization is not beneficial but rather a limitation; holding capital substantially above the regulatory minimum results in opportunity costs that hinder earnings. This aligns with the Trade-off Theory, which posits that returns on capital decrease beyond an optimal level. Thus, it appears that the banking sector in Rwanda faces inefficiencies in utilizing its existing capital rather than a lack of it.

In relation to the second objective, the study reveals that T2CR positively and significantly influences bank profitability, which also leads to rejecting the second null hypothesis. Unlike total capital, supplementary capital tools provide a cost-effective means of meeting regulatory requirements, thereby maintaining lending capacity and enhancing net interest margins. This underscores the importance of capital structure as well as volume, validating the National Bank of Rwanda's inclusion of Tier

2 instruments in the regulatory framework as a tool compatible with profitability.

For the third objective, the analysis concludes that ICQR has a positive and statistically significant impact on bank profitability, rejecting the third null hypothesis. This represents the study's most important contribution: banks that enhance their capital through retained earnings tend to be more profitable than those reliant on external capital sources. Internal capital generation lowers financing costs, aligns managerial incentives with long-term results, and signals sustainable earning potential to depositors and regulators, creating a self-reinforcing cycle that positions earnings retention as the most effective strategy for regulatory compliance and profitability.

Regarding the control variable, the study finds that credit risk, assessed through the NPL ratio, negatively and significantly affects profitability, which is consistent with previous evidence from Rwanda and broader empirical studies. This supports the methodological choice to control asset quality, ensuring that the results regarding capital adequacy accurately reflect the effects of capital composition and quality on earnings, separate from loan portfolio performance.

## 5.2 Recommendation

Based on the empirical findings of this study, recommendations are directed to one principal stakeholder: Bank Management.

1. Bank management should prioritize capital optimization over maintaining excessively high capital buffers. The findings revealed that a higher Capital Adequacy Ratio (CAR) negatively affects profitability, suggesting that holding capital far above the regulatory minimum leads to underutilization of funds. Management should therefore align capital holdings more closely with the 15% regulatory threshold by reallocating excess capital into income-generating assets such as loans and other productive investments.

2. Furthermore, bank management should actively expand the use of Tier 2 capital as a strategic financing tool. The positive and significant effect of the Tier 2 Capital Ratio (T2CR) on profitability indicates that supplementary capital supports asset growth at a relatively lower cost. Banks should therefore increase the use of subordinated debt and other Tier 2 instruments to finance lending activities, while ensuring that such expansion remains within prudent risk limits.

3. In addition, management should strengthen internal capital generation through improved profit retention strategies. The study found that Internal Capital Quality Ratio (ICQR) positively influences profitability, indicating that retained earnings enhance financial performance. Banks should therefore adopt conservative dividend payout policies, particularly during periods of strong earnings, in order to build internal capital reserves and reduce dependence on costly external financing.

4. Finally, bank management should strengthen credit risk management practices to minimize the adverse impact of non-performing loans on profitability. Given that non-performing loans were found to have a negative and statistically significant effect on return on assets, banks need to enhance the quality of their loan portfolios by implementing more rigorous credit appraisal procedures, continuous borrower monitoring, and early warning systems to detect potential defaults.

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