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THE IMPACT OF CREDIT AND LIQUIDITY RISKS ON THE FINANCIAL PERFORMANCE OF SOUTH AFRICAN BANKS LISTED ON THE JSE A PRE- AND POST-COVID-19 ANALYSIS

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ABSTRACT

The paper aims to examine the impact of credit- and liquidity- risk on the profitability of five major South African banks listed on the Johannesburg Stock Exchange over a six-year period spanning 2017 to 2022. Data were sourced from Bloomberg. The methodology employed both t-test analysis and multiple regression. The paired t-test was utilised to account for any significant effects COVID-19 had on the sampled data, given that the period encompassed the pandemic. The results of the descriptive paired t-test statistics indicated statistically significant differences in means before and during the pandemic, and during and after the pandemic, for both Return on Assets and Return on Equity. Specifically, significant mean differences were observed for credit- and liquidity risk before and during the pandemic. Multiple regression revealed that both credit- and liquidity risk had a significant negative effect on the profitability of banks, as measured by Return on Equity. Conversely, credit risk showed an insignificant negative effect on Return on Assets while liquidity risk exhibited a positive but insignificant effect on Return on Assets.

Key Words: Credit Risk, JSE, COVID-19, Liquidity Risk, Multiple Regression, Paired t-test, Return on Assets, Return on Equity.

JEL Classifications: C1, C3, G2.

1. INTRODUCTION

Banking represents a financial intermediary tasked with the collection, mobilisation, and allocation of funds among the public (Badawi, 2017). Banks significantly contribute to economic growth and development in terms of essential finance (Saleh and Abu Afifa, 2020). Thus, its ability to profit is important as it represents good financial performance, vital to promote economic growth (Fahrul and Rusliati, 2016; Djebali and Zaghdoudi, 2020). Profitability in the banking sector is derived from various sources, these include bank fees charged to customers,

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interest earned on loans provided to clients and returns from investments and securities held by the bank (Imani and Pracoyo, 2018; Mercylynne and Omagwa, 2017). The paper analyses the effect of credit- and liquidity risk on the profitability of the five largest South African banks through 2017 to 2022, marked by significant economic changes in South Africa (SA).

In the broad spectrum of operational activities inherent to any business, risk invariably emerges, a reality not exempting the banking sector, which contends with industry specific risk of its own. These risks include credit-, strategic-, market-, operational-, reputation-, legal-, and liquidity risk (Fahrul and Rusliati, 2016; Badawi, 2017). This paper specifically analyses credit- and liquidity risk due to the fundamental role they play in a bank's survival (Djebali and Zaghdoudi, 2020; Hassan *et al.,* 2019; Ejoh *et al.,* 2014). Credit risk impacts the bank's assets, while liquidity risk impacts the bank's liabilities (Hassan *et.al.,* 2019). Within the banking contexts, credit risk denotes the probability of default, while liquidity risk includes the potential inability of a bank to fulfil timely payment oblations (Saleh and Abu Afifa, 2020).

The five banks include Absa Group Limited (ABSA), Capitec Bank Holdings Limited (Capitec), FirstRand Limited, (FirstRand), Nedbank Group Limited (Nedbank) and, Standard Bank Group Limited (Standard Bank), all of which listed on the Johannesburg Stock Exchange (JSE). The paper serves as an ongoing examination of the significant economic changes and their accompanying risks, underscoring the necessity for continuous monitoring.

The paper proceeds with Section 2 which presents the literature review and defines the research objectives. Section 3 outlines the data and methodology, followed by the Paired t-test results in Section 4 and an in-depth analysis in Section 5. The paper concludes with Section 6 with a discussion of the limitations and recommendations for future research.

2. LITERATURE REVIEW

This section provides a review of theoretical- and empirical literature, synthesising findings from prior research on the influence of credit- and liquidity risk on bank profitability, while identifying limitations in existing literature. The analysis opens with an assessment of the significance of credit- and liquidity risk within the banking sector. This is followed by a scrutiny of the effects of credit- and liquidity risk on bank profitability, culminating in a thorough evaluation of the repercussions these risks posed to banks during the COVID-19 era.

2.1 Significance of Credit- and Liquidity Risk

The disparity in maturity between a bank's assets and liabilities exerts a substantial influence on its profitability (Arif and Nauman Anees, 2012). This relationship is further elucidated by Ghenimi *et al.* (2017) and Hassan *et al.* (2019), who support the notion that elevated loan default exacerbate liquidity risk due to diminished cash inflows. As credit- and liquidity risk have been recognised as the foremost risks within the banking sector, the proficient and strategic management of these risks is essential to substantially mitigate the probability of bank failure

(Saleh and Abu Afifa, 2020; Hassan *et al.,* 2019; Djebali and Zaghdoudi, 2020; Ejoh *et al.,* 2014).

2.2 Impact of Credit Risk on Bank Profitability

Within the banking sector, credit risk signifies the potential default of a borrower on their loan commitment (Saleh and Abu Afifa, 2020). Credit risk arises when borrowers assume substantial risk by obtaining large loans to invest in high-yield funds, which often lead to repayment failures. To mitigate such risks, banks must assess the impact of credit risk on profitability through the Non-Performing Loan (NPL) ratio, which reflects the proportion of NPLs relative to the total loan granted (Imani and Pracoyo, 2018).

Given the fundamental role of credit risk within the banking sector, key financial ratios should be integral to a bank's assessment of a client's probability of default (PD) and, by extension, the bank's profitability. Among these critical metrics are the Return on Assets (ROA) and Return on Equity (ROE) (Saeed, 2015; AI-Rdaydeh *et al.,* 2017; Abdesslem *et al.,* 2022). A comprehensive analysis of ROA and ROE is crucial for a nuanced understanding of how banks evaluate profitability. Notably, empirical findings reveal divergent perspectives, where some studies demonstrate a pronounced effect of credit risk on ROA without a corresponding impact on ROE and others observe the opposite relationship (Badawi, 2017; Mercylynne and Omagwa, 2017; Imani and, 2018; Saleh and Abu Afifa, 2020; Suryaningsih and Sudirman, 2020; AI-Husainy and Jadah, 2021; Tirwa *et al.,* 2022). The subsequent section undertakes a critical examination of these findings.

2.3 Analysis of Prior Research Findings

Saeed (2015), AI-Rdaydeh *et al.* (2017), and Abdesslem *et al.* (2022) found credit risk to have a significant effect on both ROA and ROE. Insights into the impact of credit risk on the profitability of conventional- and Islamic Jordian banks reveal a pronounced negative correlation with both ROA and ROE, underscoring that elevated credit risk substantially impairs profitability across these metrics. The reduction in ROA is largely due to an increase in NPLs, which deplete asset returns and, thus, overall profitability. Similarly, the decline in ROE is associated with severe resource depletion within banks, driven by high-risk and imprudent funding strategies employed by management, culminating in significant financial losses and erosion of equity (AI-Rdaydeh *et al.,* 2017).

Abdesslem *et al.* (2022) confirmed that the managerial ability and credit risk of highly qualified bank managers positively correlate with default risk. These managers, often rewarded with significant stock-based compensation, are more likely to undertake higher risks and overlook expected loss negotiations, thereby increasing the default risk of the bank. Hence, credit risk influences profitability of banks as measured by both ROA and ROE. These results are in line with a study by Saeed (2015) for Malaysian banks, through the use of regression, which found credit risk effect both ROA and ROE. In contrast, some researchers identified a significant effect of credit risk on ROA but not on ROE, while other studies observed a significant effect of credit risk on ROE but not ROA (Badawi, 2017; Mercylynne and Omagwa, 2017; Imani and Pracoyo, 2018; Saleh and Abu Afifa, 2020; Suryaningsih and Sudirman, 2020; AI-Husainy and Jadah, 2021; Tirwa *et al.,* 2022). AI-Husainy and Jadah (2021) argued that GDP growth, inflation, and bank size are crucial factors in the analysis of credit risk's impact on bank profitability. Variations in economic conditions, whether favourable or adverse, impact banks differently depending on their size and the country of operation, therefore, these variables must be carefully considered in a comprehensive analysis.

Consistent with the findings of AI-Husainy and Jadah (2021), Suryaningsih and Sudirman (2020) observed that, in the context of Indonesia, credit risk exerts a pronounced negative impact on ROA of smaller banks relative to their larger counterparts. This disparity is attributed to the economies of scale benefits that larger banks are able to leverage, mitigating the adverse effects of credit risk profitability. Conversely, Suryaningsih and Sudirman (2020) discerned a markedly negative effect of credit risk on ROE of larger banks compared to their smaller counterparts. Supporting this perspective, a South African study examining credit risk from 2008 to 2017 posits that larger banks, endowed with more substantial resources such as capital reserves, are positioned to issue a higher volume of loans, thus securing enhanced income streams. As a result, credit risk exerts a comparatively greater influence on ROA of smaller banks, whereas its impact on ROE is more pronounced with larger banks (Lawrence *et al.,* 2020).

By way of contrast, Tirwa *et al.* (2022) found that credit risk exerts no significant influence on the profitability of banks in Bhutan. Ineffective credit risk management, especially amid a persistent rise in NPLs, exacerbates credit risk exposure and places considerable strain on profitability by heightening the risk of loss when borrowers default. This inability to recover loans directly undermines profitability metrics (Saleh and Abu Afifa, 2020). Conversely, other studies underscore a substantial impact of credit risk on bank performance, highlighting the critical roles of the loan application process and lending standards in shaping the relationship (Mercylynne and Omagwa, 2017; Ejoh *et al.,* 2014).

2.4 Liquidity Risk Effects on Bank Profitability

Liquidity risk arises when banks face potential losses due to an inability to fulfil payment obligations as they come due (Saleh and Abu Afifa, 2020). In recent years, liquidity risk has become a critical challenge within the banking sector, exerting substantial effects on both performance and viability (Arif and Nauman Anees, 2012; Hakimi and Zaghdoudi, 2017). Banks facing severe liquidity constraints are exposed to insolvency risks, potentially leading to collapse (Arif and Nauman Anees, 2012). Confronted with heightened liquidity pressures, banks may resort to risk-laden, high-return projects within minimal success probabilities (Hakimi and Zaghdoudi, 2017) or may be compelled to borrow from central banks at elevated interest rates to fulfil obligations amid a liquidity crisis. Further to this, signalling liquidity issues to the market may jeopardise a bank's competitive standing, leading to a forfeiture of valuable business opportunities (Arif and Nauman Anees, 2012). Cash reserves are essential for sustaining operations; however, excessive cash holdings may result in foregone investment opportunities and increased holding costs (Ejoh *et al.,* 2014; Arif and Nauman Anees, 2012). Consequently, banks maintain a strategic balance, retaining sufficient liquidity to manage obligations and mitigate risk without sacrificing potential returns.

Liquidity risk exerts a negative impact on bank profitability, as evidenced by an increase in the loan-to-deposit ratio, which corresponds to diminished profits (Saleh and Abu Afifa, 2020; Arif and Nauman Anees, 2012; Al-Rdaydeh *et al.,* 2017; Hakimi and Zaghdoudi, 2017). The adverse effect emerges as larger financial gaps compel banks to deplete liquid assets or secure external financing to meet their financial obligations, which, in turn, burdens profitability (Saleh and Abu Afifa, 2020). Arif and Nauman Anees (2012) further identified, in Pakistani banks, that a misalignment between liquidity levels and NPLs erodes profitability, as delayed or defaulted repayments constrain cash flow. Consistent with this finding, research on Tunisian banks revealed a significant negative correlation between liquidity risk and performance, as measured by ROA, underscoring that insufficient liquidity directly reduces income from lending activities (Hakimi and Zaghdoudi, 2017).

Further evidence underscores the detrimental impact of liquidity risk on profitability in Malaysian banks, where heightened liquidity risk is shown to significantly reduce ROE. This reduction is attributed to the bank's constrained ability to sustain adequate liquid assets, thereby impairing profitability (Saeed, 2015). In contrast, Saeed (2015) observed that liquidity risk exerts an insignificant effect on ROA, which may be attributed to increased bank liabilities and an expanding liquidity gap that collectively stifle performance. Al-Rdaydeh *et al.* (2017) offer complementary insights, demonstrating that while liquidity risk significantly impairs profitability as measured by ROA, it bears no discernible effect on ROE. This inverse impact on ROA may be attributed to bank's limited capacity to liquidate assets as needed, ultimately diminishing income from lending activities.

Contrary to prior studies, some research (Fahrul and Rusliati, 2016) reveals a positive association between liquidity risk and bank profitability, particularly among smaller banks. Evidence suggests that heightened liquidity risk may substantially increase profitability for small banks, as rising liquidity risk aligns with improved profit margins. This outcome is attributed to the challenges small banks face in meeting short-term obligations, however, a subsequent increase in loan issuance ultimately bolsters their profitability.

AI-Husainy and Jadah (2021) also observed a positive association between liquidity risk and ROA, suggesting that elevated liquidity risk may bolster bank performance. However, they note that a higher proportion of liquidity assets mitigates exposure to liquidity risk, indicating that substantial liquid asset holdings may serve as a buffer against liquidity pressures. In contrast, Djebali and Zaghdoudi (2020) reported no significant effect of liquidity risk, attributing this finding to heightened competition, which compels banks to increase credit provision and take on greater risks without fully accounting for solvency considerations. Similarly, Badawi (2017) found no impact of liquidity risk on ROE in Indonesian banks, attributing this variability to differences in liquidity needs based on each bank's size and operational capacity.

2.5 Banking Sector Resilience to COVID-19 Risks

The 2008 Financial Crisis highlighted the vital role of effective credit- and liquidity risk management in sustaining bank stability. Similarly, the COVID-19 pandemic served as a profound reminder of this need, as it intensifies the impact of these risks amid economic disruptions (Harb *et al.,* 2022). The COVID-19 pandemic's repercussions on the banking sector exhibited significant variation across countries (Fotso *et al.,* 2022). In particular, COVID-19 weakened banks' financial performance, disrupting both capital inflows and fund disruption processes, thereby exacerbating challenges related to liquidity and profitability (Pratiwi and Masdupi, 2021).

During the COVID-19 pandemic, credit risk exerted a significant negative effect on ROA on commercial banks (Pratiwi and Masdupi, 2021). Interestingly, the incidence of COVID-19 cases did not alter the impact of credit- and liquidity risks on bank profitability, underscoring the predominance of economic conditions in driving these effects (Pratiwi and Masdupi, 2021). Economic decline further exposed banks to elevated liquidity risk, with NPLs increasing during the economic downturn and diminishing in periods of economic growth (Kesraoui *et al.,* 2022).

A recent study by El-Chaarani *et al.* (2023) evaluated the effects of the COVID-19 pandemic on banking performance across nine MENA countries, including Saudi Arabia, Oman, Egypt, Qatar, Tunisia, Kuwait, Bahrain, Morocco, and the UAE. The findings indicated a decline in bank performance, as measured by ROA and ROE, throughout the first year of the COVID-19 pandemic, followed by a modest recovery in 2021. Notably, Morocco continued to experience a downturn in performance, while other countries indicated signs of improvement. Credit- and liquidity risk escalated across all regions, although Egypt and Bahrain displayed greater resilience, with reduced risk levels during the first year of the pandemic. Credit risk also surged in 2020 for Morocco, Qatar, Egypt, and Saudi Arabia, whereas other countries experienced a decline. These findings are consistent with Word Bank observations, which underscores the uneven impact of the pandemic across different countries and regions. Key factors such as bank size, Gross Domestic Product (GDP), and managerial efficiency were found to have significantly influenced the banks' performance during the pandemic (El-Chaarani *et al.,* 2023; Mateev *et al.,* 2022).

During the COVID-19 pandemic, South African banks faced significant challenges in recovering loans from customers, largely due to widespread job losses and reduced income levels. Consequently, banks were compelled to borrow from the South African Reserve Bank (SARB) to sustain lending activities for business and households. In an effort to support the banking sector and stimulate economic activity, the SARB reduced the repo rate to 3.6%, which in turn lowered the prime lending rate to make borrowing more accessible for both businesses and households. Nevertheless, these interventions proved insufficient to bolster bank performance, with remained subdued and contributed to a broader economic recession. The pace of recovery during the pandemic was closely linked to improvements in the Gross Domestic Product (GDP) and subsequent increases in the repo rate, and by default, the prime lending rate (Fotso *et al.,* 2022).

2.6 Summary and Research Objective

The preceding literature review highlights the diverse and often contradictory findings that surround the impact of credit- and liquidity risk on bank profitability, especially in times of economic turbulence. While numerous studies underscore these risks' critical role in shaping bank performance, their effects have been shown to vary significantly depending on factors such as bank size, regional economic conditions, managerial efficiency, market volatility, and the time period under analysis. The COVID-19 pandemic further intensified these uncertainties, spotlighting the need for comprehensive research to comprehend these risks within a contemporary South African context.

Given the banking sector's foundational role in supporting economic stability, this paper seeks to analyse how credit- and liquidity risk impact profitability for five major South African banks listed on the JSE over the period 2012 to 2022. This timeframe encompasses the pre-COVID-19, COVID-19, and post-COVID-19 phases, allowing for a comprehensive analysis of risk impacts across different economic conditions. The insights derived aim to inform risk management practices, offer stakeholders a nuanced perspective on financial stability, and contribute to existing research on risk resilience in banks.

To examine these objectives, the paper advances eight hypotheses, centred on assessing variations in ROA, ROE, credit risk, and liquidity risk across three distinct time frames. The hypotheses tested are as follows:

H1: There exists a statistically significant difference in the Return on Assets (ROA) between the period preceding the COVID-19 pandemic and the period during the COVID-19 pandemic.
H2: There exists a statistically significant difference in the Return on Assets (ROA) between the period during the COVID-19 pandemic and the period following the COVID-19 pandemic.
H3: There exists a statistically significant difference in the Return on Equity (ROE) between the period preceding the COVID-19 pandemic and the period during the COVID-19 pandemic.
H4: There exists a statistically significant difference in the Return on Equity (ROE) between the period during the COVID-19 pandemic and the period following the COVID-19 pandemic.
H5: There exists a statistically significant difference in liquidity risk between the period preceding the COVID-19 pandemic and the period during the COVID-19 pandemic.
H6: There exists a statistically significant difference in liquidity risk between the period during the COVID-19 pandemic and the period following the COVID-19 pandemic.
H7: There exists a statistically significant difference in credit risk between the period preceding the COVID-19 pandemic and the period during the COVID-19 pandemic.

H8: There exists a statistically significant difference in credit risk between the period during the COVID-19 pandemic and the period following the COVID-19 pandemic.

3. RESEARCH METHODOLOGY

The following section will discuss the data, data collection and sources, metrics used for the analysis and the model used.

3.1 Data Sample

The paper analysed the impact of credit- and liquidity risk on the profitability of South Africa's five largest banks listed on the Johannesburg Stock Exchange (JSE) from 2017 to 2022. The sample comprised ABSA, Capitec, First Rand, Nedbank and, Standard Bank. The analysis was confined to these prominent, traditional banks, deliberately excluding smaller and non-traditional banks to mitigate potential biases arising from differences in economies of scale, operational structure, and cost of efficiency. In total, 30, observations, representing five banks across six years, provided a robust dataset for evaluating the influence of these risk factors on profitability within a competitive banking environment marked by significant operational expenses, including those associated with maintaining extensive physical branch networks.

3.2 Data Collection and Sources

The paper drew data from Bloomberg to obtain all necessary variables which included independent variables, credit- and liquidity risk, control variables, bank size, capital adequacy, and macroeconomic indicators, and dependent variables, specifically profitability metrics, ROA and ROE, for the years of 2017 to 2022. Bloomberg was selected as the primary data source for its comprehensive coverage and proven reliability, ensuring the data were precise, current, and consistently standardised across all variables. This dataset, encompassing financial- and market data for South Africa’s five largest banks listed on the JSE, facilitated a rigorous examination of the relationship between credit- and liquidity risk, and bank profitability.

3.3 Metrics/variables

Bank profitability was assessed using ROA and ROE. Credit risk was measured by the NPL ratio, while liquidity risk was evaluated using the Loan-to-Deposit Ratio (LDR). GDP served as an external control variable to capture macroeconomic conditions, and bank size was included as an internal control variable to account for operational scale. These metrics provided a robust framework for analysing profitability relative to credit- and liquidity risk.

Figure 1 underscores the direct impact of credit- and liquidity risk on bank profitability. The results indicated that increased credit risk, as represented by the NPL ratio, tended to reduce profitability as measured by ROA and ROE, aligning with the framework established in Figure 1. Similarly, liquidity risk indicated a significant association with profitability metrics, emphasising the importance of effective management in preserving financial stability.

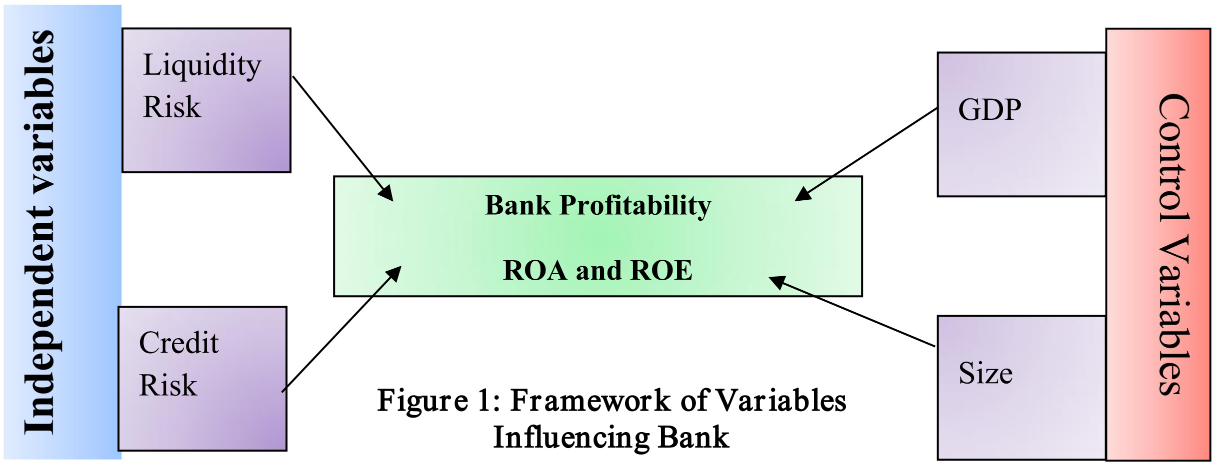

Figure 1: Framework of Variables Influencing Bank Profitability (*Author, 2024*).

3.3.1 Independent Variables

Credit risk was measured using the NPL ratio, which represents the ratio of NPLs to total loans extended (Fakhru and Rusticate, 2016; Imani and Precook, 2018). An increase in the NPL ratio indicate deteriorating credit quality and heightened financial risk arising from a rise in defaulted loans (Imani and Precook, 2018). Accordingly, the NPL ratio served as an independent variable to capture the level of credit risk, defined as:

$$NPL\ ratio = \frac{Non\text{--}Performing\ Loans}{Total\ Loans} \quad (1)$$

The ratio provides a quantifiable measure for credit risk, capturing the proportion of impaired loans and thereby reflecting fluctuations in credit quality throughout the sample period.

Liquidity risk was measured by the LDR ratio, which reflects the proportion of a bank's deposits allocated to loans (Imani and Precook, 2018; El-Chaarani *et al.,* 2023). A higher LDR ratio indicates a substantial lending of deposits, potentially constraining liquid reserves and elevating liquidity risk by limiting funds for withdrawals (Imani and Pracoyo, 2018). Accordingly, the LDR ratio was used as an independent variable to represent liquidity risk, expressed as:

$$LDR\ ratio = \frac{Total\ Loans}{Total\ Deposits}\ x\,100 \quad (2)$$

The ratio provides a quantifiable measure of liquidity risk, capturing the share of deposits allocated to loans and thereby reflecting the bank's liquidity capacity across the sample period.

3.3.2 Dependent variables

ROA measures a bank's profitability relative to its total assets, with a higher ratio indicating more effective use of assets to generate profit (Suryaningsih and Sudirman, 2020). ROA served as a dependent variable to quantify profitability, expressed as:

$$ROA = \frac{Net\ Income}{Total\ Assets} x\ 100 \tag{3}$$

This metric provides a standardised measure of operational efficiency, capturing the extent to which asset resources contributed to profit generation over the sample period.

ROE measures a bank's capacity to generate profit from its shareholders' equity, where a higher ROE signifies more efficient management of equity in producing profit (El-Chaarani *et al.,* 2023). ROE served as a dependent variable and is defines as:

$$ROE = \frac{Net\ Income}{Sharehoder's\ Equity} x\ 100 \tag{4}$$

This ratio provides a standardised indicator of profitability relative to equity, reflecting management's effectiveness in levering shareholder investments across the study period.

3.3.3 Control Variables

GDP served as an external control variable to account for macroeconomic conditions potentially affecting bank profitability, given than GDP reflects the broader economic environment. Banks size (SIZE) was included as an internal control variable to capture the effect of scale on profitability, measured by total assets. To fit the regression model, the natural logarithm of total assets was calculated to standardise the data and address potential skewness, expressed as:

$$SIZE = Natural\ Logarithm\ of\ Total\ Assets \tag{5}$$

3.4 Paired t-Test Analysis

To account for market fluctuations over the study period, a paired t-test was employed as an initial analytical approach to assess shifts in key financial metrics. The paired t-test, a robust statistical method, detects significant mean differences across related time periods, operating under the assumption of normality in paired differences. This test, valued for its rigor in identifying statistically meaningful changes within repeated measurements, enables a focused examination of temporal variations in performance metrics. The t-statistic for the paired t-test is calculated as follows:

$$t = \frac{\overline{D}}{s_D / \sqrt{n}} \tag{6}$$

This methodology aligns with approaches adopted in a comparable study, such as El-Chaarani (2023), which assessed the impact of the COVID-19 pandemic on banking performance in the MENA region. In this paper, the paired t-test was utilised to test the hypothesis that significant changes, whether increases or decreases, occurred in bank performance, as well as in credit- and liquidity risk metrics, across the pre-COVID, COVID, and post-COVID periods. This approach provided an empirical foundation for understanding how each phase of the pandemic influenced the financial stability and risk exposure of the banking sector.

3.5 Multiple Regression Model

This paper employs a multiple regression model to examine the impact of credit- and liquidity risk on the profitability of banks from 2017 to 2022. Multiple regression is a robust statistical method to analyse the relationship between a continuous dependent variable and multiple predictors (Chhetri, 2023) and is widely applied in financial research to assess risk impacts on profitability (Fahrul and Rusliati, 2016), and Kesraoui *et al.,* 2022). The general form of the model is:

$$Y = \beta_0 + \beta_1 + \beta_2 + \beta_3 + \beta_4 + \varepsilon \tag{7}$$

Where Y represents the dependent variable, either ROA or ROE, capturing profitability. The intercept β_0 denotes baseline profitability, while β_1 through β_4 indicate the effect of each predictor, with each coefficient representing the expected change in Y for a one-unit increase in its corresponding variable.

The independent variables include the NPL ratio for credit risk and the LDR ratio for liquidity risk. Control variables comprise GDP, reflecting macroeconomic conditions, and SIZE, representing bank size measured as the natural logarithm of total assets of standardise scale differences. The multiple regression equations specific to ROA and ROE are as follows:

$$ROA = \beta_0 + \beta_1\, LDR + \beta_2 NPL + \beta_3 GDP + \beta_4 SIZE + \varepsilon \tag{8}$$

$$ROE = \beta_0 + \beta_1\, LDR + \beta_2 NPL + \beta_3 GDP + \beta_4 SIZE + \varepsilon \tag{9}$$

Here ε represents the error term, capturing unexplained variance in profitability. By incorporating both macroeconomic and bank-specific factors, this model provides a comprehensive view of how credit- and liquidity risks impact profitability across the study period.

4. RESULTS AND ANALYSIS

This section presents the results of the multiple regression analysis, examining the effects of credit risk (NPL), and liquidity risk (LDR), and control variables, SIZE and GDP, on bank profitability, measured by ROA and ROE. Multiple regression, a method for quantifying relationships between variables (Imani and Pracoyo, 2018), was applied to determine the significance of each predictor. Additionally, a paired t-test was conducted to assess any significant changes in mean profitability across the section period.

4.1. Descriptive Analysis for COVID-19

The descriptive analysis furnishes a comprehensive overview of trends in essential financial ratios, ROA, ROE, NPL, and LDR, over the 2017 to 2022 period, encapsulating the ramifications of the COVID-19 pandemic on profitability as well as credit- and liquidity risk. Summary statistics for each variable elucidate shifts in bank performance across the pre-pandemic, pandemic, and post-pandemic phases, thereby providing a contextual framework for the ensuing regression analysis. These descriptive insights construct a foundational scaffold for interpreting the intricate interdependencies examined within the multiple regression model.

Table 1 delineates the mean differentials in principal financial ratios across the five-year observation period, accentuating the comparative performance of banks preceding and during the COVID-19 pandemic. This evaluative analysis seeks to elucidate fluctuations in credit risk (NPL) and liquidity risk (LDR), and profitability metrics (ROA and ROE) that are ostensibly attributable to pandemic-included disruptions. By systematically examining these temporal variances, this paper endeavours to furnish a nuance understanding of the pandemic's ramifications on the banking sector's financial resilience and operational efficacy.

Table 1: Financial Resilience and Vulnerability in Banks Pre- and Mid Pandemic

Ratio	*Period*	*Mean*	*Mean Difference*
ROA	Pre-COVID	2.28	-0.66
	During COVID	1.62	-0.66
ROE	Pre-COVID	18.67	-5.33
	During COVID	13.34	-5.33
NPL	Pre-COVID	4.47	1.51
	During COVID	5.97	1.51
LDR	Pre-COVID	86.80	-6.16
	During COVID	80.65	-6.16
SIZE	Pre-COVID	1209091.26	287048
	During COVID	1496139.11	287048

The data presented in Table 1 delineate a comparative analysis of key financial ratios for banks in the pre-COVID-19 and during COVID-19 periods, highlighting the substantial shifts in performance metrics, credit- and liquidity risk, and operational scale due to the pandemic. Each ratio's mean and corresponding mean difference offer insights into the pandemic's pervasive impact on the banking sector.

ROA registered a marked decline, with the mean decreasing from 2.28% pre-pandemic to 1.62% during the COVID-19 pandemic, yielding a mean difference of 0.66%. This reduction suggests a significant contraction in asset utilisation efficiency, implying that banks struggled to maintain profitability relative to their asset bases under pandemic conditions. The decreased ROA reflects a reduction in the productive capacity of assets, such as loans, which became less effective in generating income as economic uncertainty and borrower constraints intensified.

ROE, another key profitability measure, exhibited an even sharper downturn, with the mean ROE declining from 18.67% in the pre-pandemic period to 13.34% during COVID-19. The mean difference of 5.33% underscores a substantial erosion in the profitability derived from shareholders' equity, indicative of diminished operational efficiency and profit margins. This significant contraction in ROE likely reflects constraints on revenue growth due to the economic disruption caused by the pandemic, as well as the regulatory relaxation of capital adequacy requirements by the SARB, which may have impacted the relative scale of equity available for returns.

The NPL ratio, which captures credit risk, escalated significantly during the pandemic, with the mean rising from 4.47% pre-COVID-19 to 5.97% during COVID-19. The mean difference of 1.51% indicates an increase in the proportion of loans that fell into non-performing status, highlighting the adverse impact of the pandemic on borrowers' repayment capacities. This rise in NPLs directly correlates with heightened credit risk, as an increasing share of loans underperformed, generating minimal interest income and exerting downward pressure on profitability.

The LDR ratio, a critical indicator of liquidity risk, also declined markedly, with the mean decreasing from 86.80% pre-pandemic to 80.65% during the pandemic, yielding a mean difference of -6.16%. This reduction in LDR indicates a strategic shift towards retaining liquidity, as banks loaned out a smaller proportion of their deposits during the pandemic. While a lower LDR suggests decreased liquidity risk, as the bank maintains higher reserves to meet withdrawal demands, it also implies a potential trade-off in the form of forgone interest income, as fewer deposits were allocated to revenue-generating loans.

SIZE, measured by total assets, expanded notably during the pandemic, with the mean rising from approximately 1.21 million pre-pandemic to 1.50 million during COVID-19, reflecting a mean difference of 287,048. This growth in asset base could be attributed to an accumulation of liquidity reserves, driven by lower lending activity and increased asset holdings as a buffer against economic instability. While an expanded asset base suggests an attempt to bolster financial resilience, it concurrently points to an underutilisation of assets for income-generating activities, as evidenced by the declines in ROA and LDR.

The data in Table 2 reveal a comprehensive assessment of shifts in bank performance metrics, comparing periods during the COVID-19 pandemic and post the COVID-19 pandemic. Each metric is analysed in detail, illuminating the evolving financial stability and operational adjustments within the banking sector as it transitioned out of the pandemic.

Table 2: Financial Resilience and Vulnerability in Banks During- and Post Pandemic

Ratio	*Period*	*Mean*	*Mean Difference*
ROA	During COVID	1.62	0.05

	Post-COVID	2.12	0.05
ROE	During COVID	13.34	5.03
	Post-COVID	18.38	5.03
NPL	During COVID	5.97	-1.06
	Post COVID	4.91	-1.06
LDR	During COVID	80.65	-1.96
	Post-COVID	78.69	-1.96
SIZE	During COVID	1496139.11	127371
	Post-COVID	1623510.36	127371

ROA rose substantially post-pandemic, increasing from a mean of 1.62% during COVID-19 to 2.12% in the post-pandemic period, with a mean difference of 0.50%. This improvement reflects a restoration in asset utilisation efficiency, suggesting that banks regained their capacity to leverage assets for income generation as economic conditions stabilised. The increase in ROA implies an uptick in profitability and operational effectiveness, likely attributable to recovering market conditions and renewed lending activity.

ROE exhibited a robust recovery, rising from a mean of 13.34% during the pandemic to 18.38% post-pandemic, with a mean difference of 5.03%. This substantial improvement in ROE indicates a resurgence in profitability relative to shareholders' equity, underscoring the banks' enhanced capacity to generate returns on equity capital following the crisis. The rebound in ROE suggests a marked improvement in revenue generation and operating margins, as banks navigated out of pandemic-induced economic contraction.

The NPL ratio demonstrate a notable decrease, with the mean declining from 5.97% during COVID-19 to 4.91% post-pandemic, resulting in a mean difference of 1.06%. This reduction in the NPL ratio signals an improvement in loan portfolio quality, indicating enhanced borrower repayment capacity as economic conditions stabilised. A lower NPL ratio is favourable for profitability, as it signifies a reduction in credit risk, thus augmenting interest revenue streams and improving the overall financial health of banks.

The LDR, decreased slightly from a mean of 80.65% during COVID-19 to 78.69% post-pandemic, showing a mean difference of -1.96%. This reduction in the LDR suggests a cautious liquidity stance, where banks continued to prioritise deposit reserves over aggressive lending, perhaps as a residual effect of the heightened uncertainty from the pandemic period. While a lower LDR generally reduces liquidity risk, it may also reflect missed opportunities for interest income, as banks allocated a smaller proportion of deposits to loan generation.

SIZE, expanded from a mean of approximately 1.50 million during the pandemic to 1.62 million post-pandemic, showing a mean difference of 127,371. This growth in assets is indicative of strategic asset accumulation, potentially fuelled by an increase in deposit inflows and a resurgence in lending. The expansion of the asset base suggests strengthened financial resilience, as banks positioned themselves to capitalise on the post-pandemic economic recovery.

4.2. Paired t-Test Analysis

The results in Table 3 present a comprehensive assessment of the shifts in Return on Assets (ROA) across the pre-COVID-19, during COVID-19, and post-COVID-19 periods, providing insights relevant to the proposed hypotheses. Specifically, these results address **H1** (which posits a statistically significant difference in ROA between the period preceding the COVID-19 pandemic and the period during the COVID-19 pandemic) and **H2** (which posits a statistically significant difference in ROA between the period during the COVID-19 pandemic and the period following the COVID-19 pandemic).

Table 3: Paired t-Test for ROA before, during, and after COVID-19

	Pre-COVID	*During-COVID*	*During-COVID*	*Post-COVID*
Mean	2.2784	1.6233	1.3233	2.119
Pearson Correlation	0.9968		0.9968	
t-Stat	3.1245		-4.2572	
P(T<=t) two tail	0.0353		0.0130	
t Critical two-tail	2.7764		2.7764	

The mean ROA declined significantly from 2.28% in the pre-COVID-19 period to 1.62% during the pandemic, indicating a 0.66% reduction in asset utilisation efficiency. This decrease reflects the constraining effect of the pandemic on banks' ability to generate returns on their assets, underscoring the substantial economic disruptions that impaired profitability. The comparison between pre-COVID-19 and during COVID-19 ROA yields a Pearson correlation coefficient of 0.9969, signifying a robust positive correlation. This high level of correlation suggests that, while absolute levels of ROA declined, the general trend and relative performance among banks remained largely consistent across these periods. The t-statistic for this comparison is 3.12, which exceeds the critical threshold of 2.78, indicating statistical significance at a high confidence level. Additionally, the p-value of 0.035, which is below the conventional threshold of 0.05, further supports the statistical significance of this decline in ROA. Based on these results, **H1** can be accepted, affirming that the pandemic had a statistically significant adverse impact on asset efficiency and overall profitability.

In the transition from the during COVID-19 to the post-COVID-19 period, the mean ROA rose to 2.12%, marking a recovery of 0.50%. This increase signifies a return to improved asset utilisation as banks began to restore profitability in response to stabilising economic conditions. The Pearson correlation coefficient for ROA between the during COVID-19 and post-COVID-19 periods is similarly high at 0.9968, which implies that, despite fluctuations in mean profitability, underlying trends and relative rankings remained stable across timeframes. The t-statistic for the comparison between these two periods is -4.26, which also exceeds the critical t-value of 2.78 (in absolute terms), confirming the statistical significance of this increase in ROA. The p-value of

0.013 supports this conclusion, lying well below the 0.05 threshold and indicates that the observed recovery in ROA is not due to random variation. Consequently, **H2** is accepted, indicating that the post-pandemic period brought a statistically significant resurgence in profitability as banks adjusted to improved macroeconomic conditions.

The acceptance of **H1** and **H2** underscores the profound influence of the COVID-19 pandemic on banking performance, characterised by an initial contraction in profitability followed by a measurable rebound in the post-pandemic phase.

The paired t-test results in Table 4 provide a detailed examination of the changes in ROE across the pre-COVID-19, during COVID-19, and post-COVID-19 periods, thereby allowing an evaluation of **H3** (which posits a statistically significant difference in ROE between the period preceding the COVID-19 pandemic and the period during the COVID-19 pandemic) and **H4** (which posits a statistically significant difference in ROE between the period during the COVID-19 pandemic and the period following the COVID-19 pandemic).

Table 4: Paired t-Test results for ROE before, during, and after COVID-19

	Pre-COVID	*During-COVID*	*During-COVID*	*Post-COVID*
Mean	18.6688	13.3426	13.3426	18.3768
Pearson Correlation	0.96824		0.9813	
t-Stat	8.9659		-11.1952	
P(T<=t) two tail	0.0008		0.0003	
t Critical two-tail	2.7764		2.7764	

The mean ROE declined sharply from 18.67% in the pre-COVID-19 period to 13.34% during COVID-19, reflecting a mean difference of -5.33%. This considerable drop indicates a significant reduction in the efficiency with which banks utilised shareholders' equity to generate profit, underscoring the adverse impact of the pandemic on profitability. The Pearson correlation coefficient between the pre-COVID-19 and during COVID-19 ROE is 0.9682, showing a strong positive correlation, which suggests that while profitability levels dropped, the relative ranking and trends among banks were preserved across these periods. The t-statistic for this comparison is 8.97, which far exceeds the critical threshold of 2.78, indicating statistical significance at a high confidence level. Furthermore, the p-value of 0.00086 is well below the conventional threshold of 0.05, confirming that the observed decline in ROE is statistically significant. Consequently, **H3** is accepted, validating the significant impact of the COVID-19 pandemic on banks' equity-based profitability. In the transition from the during COVID-19 to the post-COVID-19 period, the mean ROE increased from 13.34% to 18.38%, marking a recovery of 5.03%. This substantial rebound in ROE suggests that banks were able to restore their capacity to generate returns on equity as economic conditions began to stabilise in the post-pandemic phase. Based on these results, **H4** is accepted, confirming that the transition to post-COVID-19 conditions led to a statistically significant enhancement in profitability.

The acceptance of **H3** and **H4** underscores the transformative impact of the COVID-19 pandemic on banking sector profitability, evidenced by a pronounced initial contraction in ROE followed by a substantial recovery as economic conditions normalised.

The paired t-test results in Table 5 provide a comprehensive analysis of shifts in Liquidity Risk, measured by the LDR, across the pre-COVID-19, during COVID-19, and post-COVID-19 periods. These results address **H5** (which posits a statistically significant difference in liquidity risk between the period preceding the COVID-19 pandemic and the period during the COVID-19 pandemic) and **H6** (which posits a statistically significant difference in liquidity risk between the period during the COVID-19 pandemic and the period following the COVID-19 pandemic).

Table 5: Paired t-Test results for LDR before, during, and after COVID-19

	Pre-COVID	*During-COVID*	*During-COVID*	*Post-COVID*
Mean	86.80378	80.64841	80.64841	78.69
Pearson Correlation	0.935773		0.979522	
t-Stat	3.763280		2.014257	
P(T<=t) two tail	0.019714		0.114242	
t Critical two-tail	2.776445		2.776445	

The mean LDR decreased from 86.80% in the pre-COVID-19 period to 80.65% during COVID-19, reflecting a mean difference of -6.16%. This substantial reduction suggests that banks adopted a more conservative approach to liquidity management, retaining a larger portion of deposits as a protective measure in response to heightened economic uncertainty. The Pearson correlation coefficient between the pre-COVID-19 and during COVID-19 LDR values is 0.9358, indicating a strong positive correlation. This consistency in relative liquidity management strategies across banks implies that, while overall liquidity levels decreased, the ranking of banks by liquidity risk remained largely stable. The t-statistic for this comparison is 3.76, exceeding the critical t-value of 2.78, indicating a statistically significant reduction in LDR. The p-value of 0.019 supports this result, as it lies below the conventional 0.05 threshold, further reinforcing the statistical significance of the change in LDR. These findings lead to the acceptance of **H5**, which confirms that liquidity risk declined significantly from the pre-COVID-19 to the during COVID-19 period.

Comparing the during COVID-19 and post-COVID-19 periods, the mean LDR declined further from 80.65% to 78.69%, marking an additional decrease of -1.96%. This continued reduction suggests an ongoing conservative stance toward liquidity management as banks adjusted to lingering uncertainties in the post-pandemic environment. The p-value of 0.114 is above the 0.05 threshold, confirming that the observed difference between the during COVID-19 and post-COVID-19 LDR values is not statistically significant. Therefore, **H6** is rejected, as the results do not support a statistically significant difference in liquidity risk between the during COVID-19 and post-COVID-19 periods.

Thus, **H5** is accepted, validating the significant reduction in LDR as a response to the pandemic, while **H6** is rejected due to the lack of a statistically significant change in liquidity risk from the during COVID-19 to post-COVID-19 periods. These findings indicate that banks responded proactively to the onset of the pandemic by reducing liquidity risk, though the post-pandemic adjustments did not yield further statistically significant changes.

The paired t-test analysis in Table 6 offers an examination of shifts in Credit Risk, as measured by the NPL ratio, across the pre-COVID-19, during COVID-19, and post-COVID-19 periods. This analysis is pertinent to **H7** (which posits a statistically significant difference in credit risk between the period preceding the COVID-19 pandemic and the period during the COVID-19 pandemic) and **H8** (which posits a statistically significant difference in credit risk between the period during the COVID-19 pandemic and the period following the COVID-19 pandemic).

Table 6: Paired t-Test results for NPL before, during, and after COVID-19

	Pre-COVID	*During-COVID*	*During-COVID*	*Post-COVID*
Mean	4.467333	5.974	5.974	4.914
Pearson Correlation	0.847773		0.030431	
t-Stat	-4.144291		1.443617	
P(T<=t) two tail	0.014326		0.222334	
t Critical two-tail	2.776445		2.776445	

The mean NPL ratio rose from 4.47% in the pre-COVID-19 period to 5.97% during COVID-19, marking an increase of 1.51%. This rise in the NPL ratio suggests a heightened level of credit risk as a larger portion of loans became non-performing, likely a consequence of the financial strain imposed on borrowers during the pandemic. The Pearson correlation coefficient for the NPL ratio between the pre-COVID-19 and during COVID-19 periods stands at 0.8477, indicating a moderately strong positive relationship. This correlation implies that, although the level of non-performing loans increased overall, the general trend in credit quality among banks was maintained across these periods. The t-statistic for this comparison is -4.14, which exceeds the critical t-value of 2.78 in absolute terms, confirming that the observed increase in NPL is statistically significant. The corresponding p-value of 0.014 is well below the 0.05 significance threshold, affirming that this rise in credit risk is not likely due to random fluctuation. Thus, **H7** is accepted, validating the significant escalation in credit risk from the pre-COVID-19 to the during COVID-19 period. In contrast, when comparing the during COVID-19 period to the post-COVID-19 period, the mean NPL ratio decreased from 5.97% to 4.91%, indicating a reduction of 1.06%. This decline suggests a partial recovery in loan performance as borrowers gradually regained financial stability in the post-pandemic phase. The t-statistic for this comparison is 1.44, which does not meet the critical value of 2.78, suggesting that the decrease in NPL is not statistically significant. Additionally, the p-value of 0.222 exceeds the 0.05 threshold, confirming that this reduction in credit risk cannot be considered statistically significant. As a result, **H8** is rejected, as the data do not support a statistically significant difference in the NPL ratio between the during COVID-19 and post-COVID-19 periods.

4.3. Descriptive analysis for the period 2017 to 2022

The descriptive analysis for the period from 2017 to 2022 offers a detailed examination of key financial variables, incorporating data that span both the pre-COVID-19 and COVID-19-impacted periods without isolating specific years. This aggregated approach allows for a broader understanding of general trends across the six-year timeframe, encompassing the fluctuations that banks experienced during the pandemic and in surrounding years.

Table 7 presents the summary statistics for the main variables under consideration: LDR, NPL, GDP, SIZE, ROA, and ROE. Each of these variables offers insights into different aspects of bank performance, risk exposure, and economic conditions. In the following discussion, these statistics are analysed in terms of their means, standard deviations, and ranges to identify prevailing trends and variations, thus providing a foundational understanding of the data set prior to further inferential analysis.

Table 7: Descriptive Variables

Variable	*Mean*	*Standard Error*	*Standard Deviation*	*Minimum*	*Maximum*
NPL	5.044	0.325572	0.797486	4.064	6.258
LDR	83.39979	1.856125	4.546559	78.6906	90.672
GDP	3.435	1.255345	3.074955	-1.4	6.61
SIZE	0.07323	0.024752	0.060628	0.011666	0.178994
ROA	2.016657	0.143218	0.350813	1.54812	2.31672
ROE	16.67637	1.1322771	2.773501	11.77866	18.61414

The NPL ratio, has a mean value of 5.04% and a standard deviation of 0.80, reflecting relatively stable credit risk levels with limited fluctuation. The minimum and maximum NPL values range from 4.06% to 6.26%, indicating a slight variation in loan performance and the overall health of bank loan portfolios.

The LDR shows a mean of 83.40% with a standard deviation of 4.55, indicating moderate variability in liquidity management across banks. The LDR ranges from a minimum of 78.69% to a maximum of 90.67%, suggesting that while most banks maintained a relatively high proportion of loans to deposits, some banks were more conservative in lending.

GDP averages at 3.44 with a relatively high standard deviation of 3.07, ranging from -1.4 to 6.61. This wide range reflects the economic volatility during this period, which includes both growth and recessionary phases, likely influenced by the COVID-19 pandemic's impact on economic output.

SIZE, measured by the natural logarithm of total assets, has a mean of 0.073 with a standard deviation of 0.06. The range from 0.0117 to 0.1790 suggests substantial variation in the scale of operations among the banks studied, indicative of differences in market share and asset base across the sample.

The ROA has a mean of 2.02% with a standard deviation of 0.35, suggesting some variability in asset utilisation efficiency. ROA ranges from a minimum of 1.55% to a maximum of 2.32%, indicating that while bank profitability relative to assets fluctuated, it remained within a narrow range.

The ROE, with a mean of 16.68% and a standard deviation of 2.77, reflects the banks' ability to generate profit from shareholders' equity. The range from 11.78% to 18.61% suggests variation in profitability relative to equity, with some banks demonstrating higher efficiency in generating returns for shareholders.

4.5. Correlation Matrix

This section examines the interrelationships among key financial variables, including profitability measures (ROA and ROE), risk indicators (Liquidity Risk and Credit Risk), and control variables (GDP and Bank Size). By analysing the correlation matrix, this paper aims to clarify how these variables interact and influence one another within the banking sector's operational and economic context.

The correlation matrix provides insights into underlying patterns and interdependencies that define bank performance and risk management strategies. Table 8 presents these associations between dependent variables, independent variables, and control variables, and is followed by a discussion of the implications for the sector's financial resilience and adaptability.

Table 8: Correlation Matrix of Profitability, Risk, and Control Variables

	ROA	*ROE*	*LDR*	*NLP*	*GDP*	*SIZE*
ROA	1					
ROE	0.892	1				
LDR	0.612	0.362	1			
NLP	-0.955	-0.741	-0.649	1		
GDP	-0.585	-0.741	-0.463	0.508	1	
SIZE	-0.359	-0.695	0.022	0.508	0.507	1

ROA and ROE exhibit a strong positive correlation (0.892), indicating that higher asset utilisation efficiency (ROA) is closely associated with enhanced returns on equity (ROE). This suggests a cohesive profitability trend where improvements in overall asset returns translate into increased equity returns.

LDR shows a moderate positive correlation with ROA (0.612) and a weaker positive correlation with ROE (0.362). This implies that higher loan-to-deposit ratios, often associated with higher liquidity risk, tend to support profitability up to a certain extent. However, the weaker relationship with ROE may indicate that while lending can enhance asset efficiency, its impact on returns to shareholders is less direct, potentially influenced by other factors like equity structure.

NPL has a very strong negative correlation with both ROA (-0.955) and ROE (-0.741), suggesting that as non-performing loans increase, overall profitability declines substantially. This indicates that credit risk directly undermines bank profitability, highlighting the importance of maintaining low levels of non-performing loans to sustain both asset and equity returns.

GDP, a proxy for economic conditions, has a moderate negative correlation with ROA (-0.585) and ROE (-0.525), suggesting that profitability measures tend to decline as economic growth fluctuates negatively. This correlation reflects the sensitivity of bank performance to broader economic cycles, where economic downturns may pressure profitability despite internal risk management efforts.

SIZE is negatively correlated with both profitability measures, with a weaker correlation with ROA (-0.359) and a stronger one with ROE (-0.695). This indicates that larger banks may face profitability constraints, especially in generating returns on equity. This could be due to increased operational complexity and higher cost structures in larger institutions, which may dilute the benefits of scale.

Notably, NPL is negatively correlated with LDR (-0.649), indicating that banks with higher liquidity risk (measured by higher LDR) tend to have fewer non-performing loans, possibly reflecting conservative lending practices. GDP and SIZE show a positive correlation (0.508), suggesting that larger banks operate in more robust economic environments, or that economic growth supports bank expansion.

Overall, this matrix highlights the complex interplay between profitability, risk factors, and economic variables. Profitability is strongly influenced by credit quality and economic conditions, while liquidity risk and bank size demonstrate varied effects on returns, underscoring the importance of tailored risk management strategies within the sector.

The regression results in Table 9 provide an analysis of the relationship between ROA and the independent variables. The model demonstrates a high explanatory power, with an Adjusted R-squared value of 96.24%, indicating that the independent variables account for most of the variability in ROA, though slightly less than the ROE model. The F-statistic of 33.01 and a significance level of 0.1297 suggest that, while the model is generally robust, its overall significance is not as strong as in the ROE analysis, potentially due to the different determinants influencing asset efficiency versus equity returns.

Table 9: Regression on ROA

	Coefficients	*Standard Error*	*t-stat*	*p-value*
Intercept	4.11	0.9305	4.4210	0.1416
NPL	-0.418	0.0529	-7.8844	0.0803
LDR	0.0014	0.0091	0.1535	0.9030
GDP	0.0073	0.0142	0.5176	0.6959
SIZE	-1.798	0.6095	-2.9500	0.2081
Multiple R	0.9962			
R Square	0.9924			
Adjusted R Square	0.9624			
Standard Error	0.0680			
Observations	30			
F Statistic	33.01			
Significance F	0.1297			

At 95% significant level

The Intercept has a coefficient of 4.11 with a p-value of 0.1416, which is not statistically significant. This suggests that the baseline ROA level, when all other variables are held constant, does not have a strong explanatory role, potentially reflecting the influence of other unmeasured factors on asset utilisation efficiency.

NPL shows a negative coefficient of -0.418 with a p-value of 0.0803, which is only marginally significant at the 10% level but does not meet the 5% threshold. This indicates a weak inverse relationship, where an increase in non-performing loans slightly reduces ROA, though the effect is not particularly strong. This result aligns with expectations, as credit risk typically affects profitability, but the marginal significance level suggests that ROA is less sensitive to credit quality than ROE, reflecting a broader asset-based measure rather than equity-focused returns.

LDR has a positive but insignificant coefficient of 0.0014, with a p-value of 0.9030. This lack of statistical significance indicates that liquidity risk, as measured by the loan-to-deposit ratio, does not have a meaningful impact on ROA. This finding suggests that, unlike ROE, ROA is not significantly affected by variations in liquidity risk, potentially due to ROA’s broader reflection of all assets rather than the equity base alone.

GDP exhibits a positive coefficient of 0.0073, but with a p-value of 0.6959, indicating that economic growth has an insignificant effect on ROA. This result suggests that macroeconomic conditions, while influential on ROE, may not directly impact banks’ asset efficiency, reflecting that ROA might be more resilient to economic fluctuations in comparison to profitability measures focused on equity returns.

SIZE has a negative coefficient of -1.798, with a p-value of 0.2081, which is also statistically insignificant. This indicates that larger banks do not experience significant impacts on ROA compared to smaller banks, possibly due to operational efficiencies that help maintain stable asset utilisation across institutions of different sizes.

Following the correlation analysis, the regression results in Table 10 provide an in-depth examination of the relationship between ROE and the independent variables. The model demonstrates an exceptionally high explanatory power, with an Adjusted R-squared value of 99.98%, indicating that nearly all variations in ROE are accounted for by the selected independent variables, even after adjusting for model complexity. The statistical significance of the model is underscored by an F-statistic of 6573.58 and a corresponding p-value of 0.0092, confirming the robust predictive strength of these variables in explaining ROE.

The Intercept coefficient is 39.12 (p = 0.0085), indicating a baseline ROE level when all independent variables are held constant. This intercept is statistically significant, demonstrating that, in the absence of changes in liquidity risk, credit risk, GDP, or bank size, banks could expect an average ROE of approximately 39.12%.

Table 10: Regression of ROE

	Coefficients	*Standard Error*	*t-stat*	*p-value*
Intercept	39.12	0.5232	74.76204	0.0085
NPL	-3.04	0.0298	-102.0087	0.0062
LDR	-0.0644	0.0051	-12.5265	0.0507
GDP	0.227	0.0079	28.4861	0.0223
SIZE	-34.39	0.3428	-100.3157	0.0063
Multiple R	0.9999			
R Square	0.9999			
Adjusted R Square	0.9998			
Standard Error	0.0384			
Observations	30			
F Statistic	6573.58			
Significance F	0.0092			

At 95% significant level

NPL has a substantial negative coefficient of -3.04 and a highly significant p-value of 0.0062. This finding confirms that increased credit risk, as measured by higher non-performing loans, has a strong adverse impact on ROE. The t-statistic of -102.01 further emphasises the robustness of this relationship, indicating that non-performing loans considerably erode banks' profitability by reducing the returns generated from lending activities. These results align with established literature, affirming the critical need for effective credit risk management to sustain profitability.

LDR exhibits a negative coefficient of -0.0644 with a p-value of 0.0507, which is marginally significant at the 95% confidence level. This coefficient implies that an increase in liquidity risk (higher LDR) is associated with a decrease in ROE, aligning with prior findings that heightened liquidity risk can undermine profitability. The t-statistic of -12.53 reinforces the strength of this inverse relationship, highlighting that banks with high LDR levels face reduced profitability as the cost of maintaining liquidity increases.

GDP displays a positive coefficient of 0.227 with a p-value of 0.0223, indicating a statistically significant and positive association with ROE. This suggests that economic growth, as represented by GDP, contributes positively to bank profitability. A t-statistic of 28.49 supports the strength of this positive impact, reflecting how favourable economic conditions can enhance banks' ability to generate returns on equity by supporting lending activities and lowering default risks in periods of economic expansion.

SIZE reveals a negative coefficient of -34.39 with a p-value of 0.0063, signifying a significant inverse relationship with ROE. This suggests that larger banks, which may have higher operating costs and increased complexity, tend to exhibit lower ROE. The t-statistic of -100.32 underscores the robustness of this relationship, indicating that, despite their size, larger banks may face challenges in maintaining high returns on equity, potentially due to inefficiencies associated with larger operational scales.

6. CONCLUSION

This study examined the impact of credit and liquidity risks on the profitability of major South African banks listed on the Johannesburg Stock Exchange from 2017 to 2022, with a focus on the COVID-19 pandemic. Profitability, measured by ROA and ROE, was assessed against credit risk, liquidity risk, GDP, and bank size across pre-, during, and post-COVID periods. Eight hypotheses tested the significance of changes in ROA, ROE, LDR, and NPL across these periods.

Descriptive analysis in Tables 1 and 2 shows a notable decline in ROA and ROE during COVID-19, highlighting pandemic-driven reductions in profitability. The rise in NPL signals increased credit risk, while a lower LDR reflects conservative liquidity management. Post-COVID data indicates partial recovery in ROA and ROE, with minimal improvement in credit risk levels.

Paired t-test results in Table 3 confirm **H1** and **H2**, indicating significant changes in ROA, with a decline during COVID-19 and recovery afterward. Table 4 validates **H3** and **H4**, showing ROE's decline during the pandemic and recovery post-COVID. Table 5 supports **H5** with a significant drop in LDR during COVID, though **H6** is rejected as LDR remained unchanged post-COVID. Table 6 confirms **H7**, indicating elevated NPL during COVID-19, while **H8** is rejected due to non-significant changes in NPL post-pandemic.

Descriptive statistics in Table 7 and the correlation matrix in Table 8 emphasise the strong relationships between ROA, ROE, and NPL, underscoring the negative impact of increased credit risk. Regression analysis in Table 9 for ROE shows GDP positively impacts profitability, while LDR, NPL, and SIZE have negative effects. Table 10's regression results suggest ROA is less affected by these factors, indicating its potential as a stable performance measure under economic fluctuations.

Taking into account the methodological findings it can be concluded that the COVID-19 pandemic significantly impacted South African banks' profitability, liquidity-, and credit risk. The acceptance of **H1, H2, H3, H4, H5, and H7** underscores these shifts, while **H6** and **H8** reflect areas of ongoing caution. These findings highlight the importance of adaptive risk management to bolster bank resilience during economic disruptions.

REFERENCES

Al-Husainy, N.H.M. and Jadah, H.M., 2021. The Effect of Liquidity Risk and Credit Risk on the Bank Performance: Empirical Evidence from Iraq. iRASD Journal of Economics, 3(1), pp.58-67. https://doi.org/10.52131/joe.2021.0301.0025

Al-Rdaydeh, M., Matar, A. and Alghzwai, O., 2017. Analyzing the effect of credit and liquidity risks on profitability of conventional and Islamic Jordanian Banks. International Journal of Academic Research in Business and Social Sciences, 7(12), pp.1145-1155. http://dx.doi.org/10.6007/IJARBSS/v7-i12/3745

Abdesslem, R.B., Chkir, I. and Dabbou, H., 2022. Is managerial ability a moderator? The effect of credit risk and liquidity risk on the likelihood of bank default. International Review of Financial Analysis, 80, p.102044. https://doi.org/10.1016/j.irfa.2022.102044

Ahmed, H.M., El-Halaby, S.I. and Soliman, H.A., 2022. The consequence of the credit risk on the financial performance in light of COVID-19: Evidence from Islamic versus conventional banks across MEA region. Future Business Journal, 8(1), p.21. https://link.springer.com/article/10.1186/s43093-022-00122-y

Arif, A. and Nauman Anees, A., 2012. Liquidity risk and performance of banking system. Journal of Financial Regulation and Compliance, 20(2), pp.182-195. https://doi.org/10.1108/13581981211218342

Badawi, A., 2017. Effect of credit risk, liquidity risk, and market risk banking to profitability bank (study on devised banks in Indonesia stock exchange). European Journal of Business and Management, 9(29), pp.1-8. https://core.ac.uk/download/pdf/234628074.pdf

Chhetri, S.B., 2023. Credit risk, liquidity risk and profitability in Nepalese commercial banks. International Journal of Finance and Commerce, 5(1), pp. 24-31. https://www.researchgate.net/publication/369763084

Djebali, N. and Zaghdoudi, K., 2020. Threshold effects of liquidity risk and credit risk on bank stability in the MENA region. Journal of Policy Modeling, 42(5), pp.1049-1063. https://doi.org/10.1016/j.jpolmod.2020.01.013

Ejoh, N.O., Okpa, I.B. and Egbe, A.A., 2014. The impact of credit and liquidity risk management on the profitability of deposit money banks in Nigeria. International Journal of Economics, Commerce and Management, 2(9), pp.1-15. [suspicious link removed]

Ejoh, N., Okpa, I. and Inyang, E., 2014. The relationship and effect of credit and liquidity risk on bank default risk among deposit money banks in Nigeria. Research Journal of Finance and Accounting, 5(16), pp.142-150. https://core.ac.uk/download/pdf/234630112.pdf

El-Chaarani, H., Skaf, Y., Roberto, F., Hamdan, A. and Binsaddig, R.O., 2023. Assessing the Direct and Moderating Effect of COVID-19 on the Performance of the Banking Sector in the MENA Region. FIIB Business Review, p.23197145221137962. https://journals.sagepub.com/doi/abs/10.1177/2319714522113796

El-Chaarani, H., 2023. The Impact of COVID-19 on the Performance of Islamic Banks in the MENA Region. ISRA International Journal of Islamic Finance, 15(1), pp.109-129. https://doi.org/10.55188/ijif.v15i1.488

Fahrul, M. and Rusliati, E., 2016. Credit risk, market risk, operational risk and liquidity risk on profitability of banks in Indonesia. Trikonomika, 15(2), pp.78-88. https://doi.org/10.23969/trikonomika.v15i2.387

Fotso, G.B., Edoun, E.I., Pradhan, A. and Sukdeo, N., 2022. A framework for economic performance recovery in South Africa during the Corona Virus Disease 2019 (COVID-19) pandemic. Technium Soc. Sci. J., 27, p.401. https://heinonline.org/hol-cgi-bin/get_pdf.cgi?handle=hein.journals/techssj27&section=39

Ghenimi, A., Chaibi, H. and Omri, M.A.B., 2017. The effects of liquidity risk and credit risk on bank stability: Evidence from the MENA region. Borsa Istanbul Review, 17(4), pp.238-248. https://doi.org/10.1016/j.bir.2017.05.002

Haider, J. and Mohammad, K.U., 2022. The Effect of COVID-19 on Bank Profitability Determinants of Developed and Developing Economies. iRASD Journal of Economics, 4(2), pp.187-203. https://doi.org/10.52131/joe.2022.0402.0072

Harb, E., El Khoury, R., Mansour, N. and Daou, R., 2022. Risk management and bank performance: evidence from the MENA region. Journal of Financial Reporting and Accounting. https://www.emerald.com/insight/content/doi/10.1108/JFRA-07-2021-0189/full/html

Hassan, M.K., Khan, A. and Paltrinieri, A., 2019. Liquidity risk, credit risk and stability in Islamic and conventional banks. Research in International Business and Finance, 48, pp.17-31. https://doi.org/10.1016/j.ribaf.2018.10.006

Hakimi, A. and Zaghdoudi, K., 2017. Liquidity risk and bank performance: An empirical test for Tunisian banks. Business and Economic Research, 7(1), pp.46-57. https://www.researchgate.net/publication/313825418

Imani, A. and Pracoyo, A., 2018. Analysis of the effect of capital, credit risk, and liquidity risk on profitability in banks. Jurnal Ilmu Manajemen and Ekonomika, 10(2), pp.44-50. https://pdfs.semanticscholar.org/62d6/7a9ec29a8e5b2b4d409cf1117e2b681ec2ae.pdf

Imbierowicz, B. and Rauch, C., 2014. The relationship between liquidity risk and credit risk in banks. Journal of Banking and Finance, 40, pp.242-256. https://doi.org/10.1016/j.jbankfin.2013.11.030

Kesraoui, A., Lachaab, M. and Omri, A., 2022. The impact of credit risk and liquidity risk on bank margins during economic fluctuations: evidence from MENA countries with a dual banking system. Applied Economics, 54(35), pp.4113-4130. https://doi.org/10.1080/00036846.2021.2022090

Lawrence, B., Doorasamy, M. and Sarpong, P., 2020. The Impact of Credit Risk on Performance: A Case of South African Commercial Banks. Global Business Review, p.0972150920969927. https://doi.org/10.1177/0972150920969927

Mateev, M., Sahyouni, A. and Al Masaeid, T., 2022. Bank performance before and during the COVID-19 crisis: Does efficiency play a role? Review of Managerial Science, pp.1-54. https://link.springer.com/article/10.1007/s11846-022-00611-y

Mercylynne, M.W. and Omagwa, J., 2017. Credit risk management and financial performance of selected commercial banks in Kenya. Journal of Business and Management (IOSR-JBM), 19(11), pp.92-98. http://ir-library.ku.ac.ke/bitstream/handle/123456789/18103/Credit%20risk%20mgmt%20and%20Performance.pdf

Pratiwi, E. and Masdupi, E., 2021. Effect of credit risk, market risk and liquidity risk on return on assets of conventional commercial banks registered in the financial services authority during the COVID. Financial Management Studies, 1(4), pp.29-46. https://jkmk.ppj.unp.ac.id/index.php/fms/article/view/42

Saleh, I. and Abu Afifa, M., 2020. The effect of credit risk, liquidity risk and bank capital on bank profitability: Evidence from an emerging market. Cogent Economics and Finance, 8(1), p.1814509. https://doi.org/10.1080/23322039.2020.1814509

Saeed, M.H., 2015. Examining the relationship between operational risk, credit risk and liquidity risk with performance of Malaysia Banks (Doctoral dissertation, Universiti Utara Malaysia). https://etd.uum.edu.my/4631

Suryaningsih, N.P.R. and Sudirman, I.M.S.N., 2020. The influence of credit risk, liquidity risk, and operational risk on profitability in rural banks in Bali province. American Journal of Humanities and Social Sciences Research, 4(3), pp.258-265. http://www.ajhssr.com/wp-content/uploads/2020/03/ZI2043258265.pdf

Schutte, D.P., Sello, T.M. and Van Romburgh, D., 2022. AN ANALYSIS OF THE IMPACT OF COVID-19 ON THE BANKING SECTOR IN SOUTH AFRICA AND THE UNITED KINGDOM. Economic and Social Development Book of Proceedings, pp.21-34. https://search.proquest.com/openview/ffec5a826a2dac6dc407154c954990e2/1

Tirwa, I.P., Bhuyan, U., Magd, H. and Khan, S.A., 2022. Implications of Liquidity Risk and Credit Risk on the Bank of Bhutan's Financial Performance (BOB). Global Business and Management Research, 14. https://www.researchgate.net/publication/365059114