



The Impact of Risk Management on Banks' Profitability: A South African Perspective

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Received: 10 February 2024

Accepted: 16 May 2024

DOI: <https://doi.org/10.32479/ijefi.16195>

ABSTRACT

Global research has shown that different risk management practices in banks and companies, in general, may significantly influence their profitability. This research paper investigates the impact of credit risk, liquidity risk and market risk in the banking sector in South Africa. It adds to the literature by improving the existing models and by exploring the impact of the coronavirus on the profitability of the same banks through the lens of risk management. The research used quantitative data collected from the six largest commercial banks in South Africa during the period (2013-2020), before Covid-19. Several panel regression models were developed to incorporate credit, liquidity, and market risks. The results showed that the primary determinant of bank profitability was the management of non-performing loans, implying that other financial risks may already be appropriately managed or diversified away in the South African context. However, banks and regulators should place more importance on evaluating the creditworthiness of their current and prospective customers.

Keywords: Risk Management, Banks Profitability, Credit Risk, Liquidity Risk, Market Risk

JEL Classifications: G2, G21

1. INTRODUCTION

The nature of financial institutions makes them vulnerable to risks as they are managing assets and liabilities continuously. Banks are integral to our economic and financial systems. As they venture into new markets and expand their operations in more complex areas, they become increasingly exposed to various risks. Although there are many types of risks, the most prevalent risks include credit risk, liquidity risk and market risks as they can hinder a bank's lending capability (Aluko et al., 2019). Firstly, credit risk substantially affects banks as interest-earning assets are generally the major contributor to a bank's revenue. Secondly, liquidity risk may put a bank in a situation that would not allow it to meet its financial obligations as they come due, leading to a shortage of funds and potentially lower profitability. Finally, market risks form part of the systematic risk that banks face and may affect their profitability in different manners.

There are limited studies on the impact of risk management on the profitability of banks in South Africa, such as Mafu (2017), and Munangi and Bongani (2020). Additionally, no studies have been conducted on the impact of the coronavirus pandemic on the banking system in South Africa. This paper thus aims to investigate the impact of risk management on banks' profitability in recent years and in the wake of the coronavirus pandemic. The rest of the paper is organized as follows: A literature review is provided followed by the methodology used, the data and the analysis adopted; the results are presented and discussed. Finally, conclusions are drawn, and recommendations are made based on the results obtained.

2. LITERATURE REVIEW

This section starts by defining what is meant by risk at a general level, and in the financial and banking industry, focusing mainly

on credit risk, liquidity risk and market risk. Subsequently, it outlines a theoretical framework for managing risks as well as measuring them. A critical analysis of the empirical results found on the topic is then presented and concludes with contemporaneous views regarding the outlook held by scholars on the impact that the coronavirus pandemic had or will have on the banking industry.

2.1. Risk in the Banking Environment

Risk encompasses two components: Exposure and uncertainty and can therefore be defined as the “exposure to a proposition of which one is uncertain” (Holton, 2004). Although they come with shortcomings, the common risk metrics come in useful when trying to model risks in a financial environment (Munangi and Bongani, 2020). In the investment environment, risk presents itself in two-fold: Systematic risk and non-systematic risk (Alqisie, 2018). Systematic risk refers to risk that affects a broad class of assets and that cannot be diversified away and is also commonly referred to as market risk and is related to macroeconomic variables (Alqisie, 2018). Non-systematic risk however relates to industry-specific or firm-specific risk; this type of risk can be reduced through diversification. In the banking sector, the prevalent risks are credit risk, liquidity risk and market risk.

2.1.1. Credit risk management

Credit risk originates from the uncertainty regarding losses that can occur when debtors fail to service their loan payment whether intentionally or because of financial inability (Coyle, 2000). It is also referred to as “counterparty risk” and can drive banks into major substantial financial distress if not well managed (Singh, 2013). Adequate credit risk management helps in keeping exposure within reasonable limits and therefore contributes to maximising the risk-adjusted rate of return of banks (Kolapo et al., 2012). It has been recognised that inappropriate credit risk management in the banking sector has yielded significant banking problems (Mafu, 2017). Loans constitute a vast proportion of credit and customarily account for 10-15 times a bank's equity (Kitua, 1996) and improper credit management can cause credit defaults that would strain the bank's liquidity and erode the firm's asset (Alqisie, 2018).

Credit risk management involves assessing creditworthiness to gauge the extent to which loans can be approved (Munangi and Bongani, 2020). This assessment is guided by the first Basel committee submission on risk assessment and must include both financial and non-financial information that would allow a thorough evaluation of the counterparty risk.

The objective of the Basel Accord was to promote fairness in competition among banks which started by requiring a minimum capital ratio of capital to risk-weighted assets of 8% (Zou and Li, 2014). The Accord has been amended several times as the banking industry and the nature of its risk evolved. Following Basel 1, Basel II was implemented to account for the new financial instruments that appeared in the wake of the 21st century but kept the minimum capital ratio to be held at 8%. It incorporated Minimum Capital Requirements, supervisory review, and market discipline. Finally, after the global financial crisis of 2008, Basel III was created and imposed a much stricter capital requirement as well as new rules (Zou and Li, 2014).

It started by defining capital requirements more precisely and divided into six parts as follows: Capital requirement and definition, conservation buffer on capital, countercyclical buffer, liquidity ratio, leverage ratio, and counterparty credit risk (Zou and Li, 2014).

The new Basel III introduced a global liquidity standard using two liquidity ratios that had to be maintained by the bank's signatories of the accord; Liquidity Coverage ratio [LCR] and Stable Funding Ratio [NSFL] (Zou and Li, 2014).

The South African Reserve Bank [SARB] oversees banking regulation at a macroprudential level and has the responsibility to ensure an effective application of international regulatory and supervisory principles is maintained within the local industry. Other than SARB, the Financial Service Board, the Financial Intelligence Centre [FIC] and the National Credit Regulator [NCR] contribute to the financial stability and risk management in the banking sector (Sadien, 2017).

2.1.2. Liquidity risk management

Liquidity risk is associated with the bank's ability to meet its financial obligations to depositors as well as provide funds to borrowers when demand is present, and liquidity is achieved through the ability to transform assets into cash quickly and without friction or significant losses (Alqisie, 2018). Losses can arise from liquidity risk if depositors try to claim their cash altogether simultaneously, leading to a run-on bank (Alqisie, 2018). Alternatively, a liquidity hazard can occur if “borrowers decide to draw on their loan commitments” (Alqisie, 2018). In other words, liquidity risk arises from the difference in maturities of long-term assets that are used to finance short-term liabilities. Loans granted by banks typically have long-term maturities whereas deposits by customers are short-term in general; so liquidity risks involve the management of this mismatch and ensuring that withdrawals by depositors are attended to in time (Kumar and Yadav, 2013). Another type of liquidity risk occurs when banks are rolling over their interbank loans (Goodhart, 2008). Liquidity risk can result in forcing the bank to liquidate assets to meet their obligations such as short-term deposit withdrawals or margin calls (Alqisie, 2018).

Liquidity risk management involves maintaining liquidity through the appropriate management of cash reserves as well as other short-term assets that can be a source of liquidity such as government securities that can be employed as collateral to borrow liquidity (Goodhart, 2008). Ratios that are used to measure liquidity contain a short-term asset component coupled with different variations of long and short-term assets or liabilities to estimate different aspects of the liquidity position of a bank. Current asset to total asset is a common measure of liquidity position and depicts the extent of available liquid assets (Kumar and Yadav, 2013). Prepayment of loans, premature terminations of deposits and the exercise of options are other aspects that banks need to monitor to adequately manage their liquidity position (Kumar and Yadav, 2013). Liquidity and credit risks are often interlinked as defaults occurring in the banking system can lead to illiquidity problems.

2.1.3. Market risk

Market risk represents the “risk of capital loss resulting from adverse market price movements related to commodity, equity, fixed interest and commodity markets” (World Bank Charter [WBC], 2009). Furthermore, according to Adeusi et al. (2014), banks are particularly vulnerable to interest rate changes. Macroeconomic factors such as GDP, the currency exchange, interest rate, CPI and stock exchange variability have significant impacts on a bank's risk and profitability and are highly correlated with a bank's performance (Warue, 2013; Kiganda, 2014).

Risk management involves reducing the volatility of earnings as well as avoiding large losses for an entity (Zou and Li, 2014). According to Van Gestel and Baensens (2008:41), appropriate risk management generally follows a five-step process, starting from identification, measurement, treatment, implementation and finally evaluation. Firstly, the risks must be identified and measured. Practitioners typically use standard deviation to measure risks. Then, a means of mitigating or at least keeping the risk measure within acceptable boundaries is devised and subsequently implemented in the organization. Finally, risk management measures must be evaluated and updated as required.

2.2. Empirical Findings on Risk Management

The studies on risk management focus on the diverse aspects of credit risks and their impact on profitability. A study in Europe by Zou and Li (2014) investigated the impact of credit risk management on the profitability of Europe's 47 largest banks by market capitalization, period 2008-2012. Two main variables were used: the capital adequacy ratio [CAR] which measures the banks' capital as a percentage of its risk-weighted assets, and the nonperforming loan ratio [NPLR] which relates to loans that are more than 90 days overdue as a percentage of total loans (Zou and Li, 2014). Zou and Li (2014) found no significant correlation between CAR and Return on Equity [ROE] and between CAR and Return on Asset [ROA] of commercial banks in Europe. Although the relationship was not significant at the 5% level, Zou and Li (2014) found a negative correlation coefficient between CAR for ROA and ROE. This may suggest that in the wake of Basel III, banks were overly capitalized in Europe.

The strict provisions imposed by Basel III may have led banks to restrict their activity so much that it impeded their expansion and growth (Zou and Li, 2014). However, Zou and Li (2014) found the relation between NPLR and ROA and ROE to be significant and negative for their sample of European banks, meaning that the increase in NPLR was negatively impacting the financial performance of the banks in their sample, a similar finding was achieved by Mafu (2017) and Aluko et al. (2019). Bhatti et al. (2019) conducted a similar study using three Pakistani Banks as a sample and accounting for credit risk, liquidity risk, operational risk, and market risk. Their empirical findings showed that there was no significant relationship between financial performance as proxied by ROA and the chosen variables to represent credit risk, liquidity risk, operational risk, and market risk.

Research by Aluko et al. (2019) examined the impact of financial risks on the profitability of systematically important banks [SIB],

that is, the banks that have the largest impact on the economy of Nigeria over the period 2010-2016. The study focused on liquidity risk, interest rate risk (proxy market risk) and credit risk. They used the loans-to-deposit ratio to proxy liquidity risk and evaluated it against ROA and ROE. Aluko et al. (2019) found a significant positive relationship between liquidity risk (as proxied by loans to deposit) and profitability, therefore implying that increased liquidity exposure was associated with higher profitability for Nigerian SIBs. They found no relationship between interest rate risk and SIB's profitability. This result is different from the findings by Zou and Li (2014), who found that lower credit risk was associated with better financial performance; which may also indicate that banks are affected differently by risk management depending on their geographic location and the environment in which they operate.

In a study by Mafu (2017) on the relationship between financial risk and the profitability of banks, a fixed effect panel regression based on the Hausman test was used on the largest 5 South African banks during the period 2006-2015. Mafu (2017) found a significant relationship between bank profitability and credit risk proxied by nonperforming loans and the leverage ratio. The nonperforming loan-to-loan ratio was negatively correlated with profitability whereas the liquidity ratio was positively correlated with profitability (Mafu, 2017). Another key finding from Mafu (2017) includes the significance of the liquidity risk -- measured by loans and advances to total deposit -- which has been found to have a significant and positive correlation with the profitability of South African Banks at the 1% level.

Moreover, Munangi and Bongani (2020) conducted an empirical analysis of the impact of credit risk on the financial performance of South African banks for the period 2008-2018 with a larger sample of 18 banks compared to the study from Mafu (2017). The key findings were that credit risk had a negative relationship with financial performance. Additionally, Munangi and Bongani (2020) observed that capital adequacy had a positive relationship with financial performance and bank leverage was negatively related to financial performance. This result is broadly following what has been found by Mafu (2017) although here, the focus is mainly on credit risks and not on overall risk.

Also, concerning market risk, Mafu (2017) found a significant negative relationship between GDP and ROE as well as the exchange rate for South African Banks. Bhatti et al. (2019) on the other hand found no significant relationship between the same variables and ROA.

In summary, the empirical literature shows differing results between countries and locations concerning the impact of risk on the profitability of banks. There is a scarcity of research on the impact of overall financial risks on the financial performance of banks. Therefore, researching the impact of risk management on the profitability of South African banks would bring an updated figure of the current risk profile of the afore banks. As shown by the empirical literature, the impact of risk management on the profitability of banks varies depending on the geographical locations where the study is conducted as well as the period.

2.3. The Impact of the Coronavirus Pandemic on the Banking Industry

Studies conducted by Wu and Olson (2020) in China have revealed the increase in liquidity requirement that the COVID-19 pandemic has developed for the banking system. With increasing defaults and delays in credit repayments by customers banks' profit margins were found to be reduced (Wu and Olson, 2020). The ongoing supply and demand shocks that the pandemic has engendered may have led to liquidity stress, including limited access to credit for both institutions and individuals (Baret et al., 2020). In the United States, private debt reached record levels as of March 2020 which posited increased risks of default (Baret et al., 2020).

In South Africa, the COVID-19 pandemic and the lockdown policies consequently imposed by the government on the population have caused negative repercussions on the overall economy, with the GDP contracting by 6.98% in 2020 (World Bank, 2021). While studies have been conducted on the economic impacts of the pandemic in the world and South Africa, there is currently no research report focusing on the impact that risk management had on the profitability of South African banks within the coronavirus pandemic context.

3. METHODOLOGY

This section outlines the methodology adopted in this research, including data source, variables and the assumptions made, the reasons behind the choice of each variable and the types of analyses adopted. This method has adopted similar analysis techniques used by various researchers to evaluate the impact of financial risks on the profitability of banks, such as Alshatti (2015); Mafu (2017), and Bhatti et al. (2019). To conduct the analysis, EVIEWS 12 and Stata 15 were used.

The model is an improvement of previous studies conducted on the same topic in South Africa as it considers both the ROA and ROE as a measure of profitability, adds another bank (Investec Limited) to the sample chosen by Mafu (2017) and improves the model by adding additional measures of risks in the regressions, therefore reducing the risk of omitted variable bias. This allows us to have a more holistic approach to the impact of the various types of risks on the profitability of South African Banks.

3.1. Data Source

The sample chosen for this research comprises six of the largest commercial banks in South Africa by market capitalization, namely, ABSA Group Limited, Capitec Bank Holdings Limited, FirstRand Limited, Investec Limited, Nedbank Group Limited, and Standard Bank Group Limited. Group-specific data were collected from Bloomberg whereas country-specific data were collected from the World Bank for the period 2013-2020. The choice of the period studied is motivated by the start of the implementation of Basel III regulations in South Africa, and for the sake of providing insights on the latest available data.

3.2. Analysis

The following specification of the panel data regression, as used by Park (2011) is defined as follows:

$$y_{it} = \alpha + X'_{it}\beta + \varepsilon_{it} \quad (u_i = 0)$$

Where:

Y_{it} is the dependent variable for bank i in time t

i is the number of observations from 1 up to n

t is the Time, ranging from 1 to t

α is the constant

X'_{it} is the explanatory variable vector bank i in time t

β is the coefficient representing the slope of variables

ε_{it} is the error term

u_i is the cross-sectional or time-specific effect.

The Hausman test was a best-fitting statistical test that helps determine whether the fixed or random effect is more appropriate for the regression model (Zulfikar, 2018). To perform the test, the following hypotheses are formulated (5% significance level):

H1: The random effect regression is appropriate

H2: The fixed effect regression is appropriate.

With regards to our sample of data, we have 8 time periods and 6 banks, hence the Fixed Effect model is preferred when performing tests on this basis.

A descriptive statistics table gives us the mean, median, maximum, and minimum performance of the sample studied. To test the multicollinearity of the dataset, a correlation matrix was generated. In the correlation matrix, having a positive coefficient indicates a positive relationship between the explanatory variable and a negative coefficient indicates a negative relationship (Mafu, 2017).

Finally, to be able to conclude that risk management affects the performance of banks, it is important to assess if the explanatory variables that are used in the model affect the dependent variable. Mafu (2017) uses the F-test to establish this relationship and the following hypotheses are formulated:

H0: The model is not appropriate if the explanatory variables do not affect the dependent variable

H1: The model is appropriate if the explanatory variables do affect the dependent variable.

If the F-statistic is $>5\%$ we fail to reject the null hypothesis, if it is smaller than 5% , we reject the null hypothesis.

The risk measurement variables were evaluated to establish if they were significantly affected by the covid 19 pandemic or not, using paired t-tests for the means of the selected variables which proxy the risk measures.

3.3. Variables

Profitability was measured using ROE and ROA, as used by Zou and Li (2014).

Return on equity is a ratio that represents the overall profitability of the fixed income per dollar of equity (Saunders, 2011). The ROE is defined as:

$$ROE = \frac{\text{Net income}}{\text{Total Equity Capital}}$$

In contrast, Return on Asset depicts the profitability of banks as well as the efficiency of a bank's management of their total asset (Guru et al., 2002). ROA can be represented by the following equation:

$$ROA = \frac{\text{Net income generated per dollar of total operating income}}{\text{Interest and noninterest income generated per dollar of total assets}}$$

3.3.1. Regression parameters

To perform the panel regression analysis, independent variables have to be regressed against our profitability measures which are ROE and ROA.

3.3.1.1. Credit risk regression

To evaluate the impact of credit risk management on the profitability of our sample, the following panel regressions were performed:

$$ROE_{i,t} = \alpha_i + \beta_{i,t}NPLR + \beta_{i,t}CAR + \beta_{i,t}loanprovloan + \beta_{i,t}Log(TA) + \epsilon_{i,t}$$

$$ROA_{i,t} = \alpha_i + \beta_{i,t}NPLR + \beta_{i,t}CAR + \beta_{i,t}loanprovloan + \beta_{i,t}Log(TA) + \epsilon_{i,t}$$

3.3.1.2. Liquidity risk regression

To evaluate the impact of liquidity risk management on the profitability of our sample, the following panel regressions are performed:

$$ROE_{i,t} = \alpha_i + \beta_{i,t}NPLR + \beta_{i,t}loans_to_deposit + \beta_{i,t}Eq_As + \beta_{i,t}Log(TA) + \epsilon_{i,t}$$

$$ROA_{i,t} = \alpha_i + \beta_{i,t}NPLR + \beta_{i,t}loans_to_deposit + \beta_{i,t}Eq_As + \beta_{i,t}Log(TA) + \epsilon_{i,t}$$

3.3.1.3. Market risk regression

To evaluate the impact of market risk on the profitability of our sample, the following panel regressions were performed:

$$ROE_{i,t} = \alpha_i + \beta_{i,t}GDP_g + \beta_{i,t}INFLATION + \beta_{i,t}forex + \beta_{i,t}int_rate + \beta_{i,t}MKT_C + \epsilon_{i,t}$$

$$ROA_{i,t} = \alpha_i + \beta_{i,t}GDP_g + \beta_{i,t}INFLATION + \beta_{i,t}forex + \beta_{i,t}int_rate + \beta_{i,t}MKT_C + \epsilon_{i,t}$$

Two T-tests were performed using Stata 15 to evaluate if the difference in means of our variables was significant. In the student t-test, it is assumed that the difference is normally distributed (Hsu and Lachenbruch, 2014). The following hypothesis is formulated: H0: The means of the two groups are not different. H1: The means of the two groups are different.

The first T-test was performed by comparing the means of our variables of interest between the pre-COVID and the post-COVID era. The following variables are integrated in the model: Return on Equity, Return on Assets, Nonperforming Loans Ratio, Capital Adequacy Ratio, Provision for Loan Loss Ratio, Total Assets, Loans to Deposits Ratio, Equity to Total Asset Ratio, GDP Growth, Inflation, USD/ZAR exchange rate, Repo Rate, and Average Market Capitalization.

The results are arranged into a table and significant results are interpreted. Secondly, another T-test is performed between best performers and worst performers in terms of financial performance during the post-COVID covid-era (2020).

4. RESULTS AND DISCUSSION

This section discusses the descriptive statistics and the statistical analyses.

Table 1 depicts the average performance of the six banks in our sample for the period 2013-2020.

A correlation matrix was generated to evaluate the correlation between our parameters. In Table 2 below, the correlation coefficient between each variable in the models is computed. Overall, there do not seem to be severe cases of multicollinearity present in the dataset.

4.1. Regression Output

The regression outputs are presented in Tables 3 and 4 using ROE and ROA as dependent variables, respectively. Each table reports the regression coefficients of three separate tests: credit risk, liquidity risks and market risks. Key statistics of each regression are also reported, including the F-statistic and the P-value of the F-statistic and the Hausman test.

The following section provides a discussion of Tables 1-4.

4.1.1. Credit risk regression

From Table 1, ROE on average was 16.57% across all banks studied over the period 2013-2020. This figure is relatively low if it is compared to the maximum value of 26.51% which was realised by Capitec in 2020. For the ROA, the average performance for the banks studied over the period 2013-2020 was 1.93%. This is low compared to the ROE but is expected given the fact that financial institutions do not derive the majority of their revenue from assets and capital expenditures but rather from interest income and expenses. The

Table 1: Descriptive statistics table

Banks	ROE	ROA	Nonperforming loans ratio	CAR	Provision for loan loss ratio	Total assets	Loans to deposit ratio
Mean	16.571	1.935	3.850	0.482	108.014	943800	94.397
ABG SJ	13.664	1.179	4.911	0.558	97.034	1198567	107.098
CPI SJ	25.075	5.364	5.426	0.530	10.680	74339	107.993
FSR SJ	22.326	1.896	2.796	0.206	118.340	1295676	92.221
INL SJ	11.013	0.933	2.43	0.872	179.060	51036	79.271
NED SJ	13.1975	1.14	3.364	0.340	139.509	981171	94.978
SBK SJ	14.154	1.099	4.173	0.384	103.460	2062012	84.821
	GDP growth	Inflation	ZAR/USD	Equity/asset	Average market CAP.	Interest rate	
Mean	0.162	5.006	13.281	10.192	137673.000	3.953	
Median	0.991	4.845	13.392	8.095	124529.400	3.715	
Maximum	2.485	6.595	16.580	22.100	370652.100	5.930	
Minimum	-6.982	3.224	9.716	6.960	3519.750	2.210	
Std. Dev.	2.821	1.064	2.068	4.997	101927.700	1.399	
Observations	48	48	48	48	48	48	

Table 2: Correlation matrix

Variables	NPLR	CAR	Provision for loan losses ratio	Log of total assets	Loans to dep. ratio	GDP growth	Inf.	ZAR/USD	Equity/asset	Average market Cap.	Lending interest rate
Nonperforming loans ratio	1.000										
CAR	0.045	1.000									
Provision for loan losses ratio	0.694	0.172	1.000								
Logarithm of total assets	0.030	0.724	0.074	1.000							
Loans to deposit ratio	0.453	0.128	0.304	0.060	1.000						
GDP growth	0.252	0.111	0.145	0.094	0.259	1.000					
Inflation	0.198	0.105	0.031	0.100	0.260	0.689	1.000				
ZAR/USD	0.085	0.119	0.047	0.107	0.314	0.781	0.564	1.000			
Equity/asset	0.495	0.084	0.625	0.566	0.367	0.053	0.032	0.022	1.000		
Average market Cap.	0.086	0.783	0.023	0.782	0.151	0.040	0.138	0.133	-0.29837	1	1.000
Lending interest rate	0.109	0.033	0.354	0.047	0.120	0.292	0.263	0.146	0.042	0.212	1.000

Source: Author's estimation using Eviews 12and formatted using excel

Table 3: Panel regression output with ROE as a dependent variable

ROE as a dependent variable	Panel least squares regression		
	Credit risk (F)	Liquidity risk (R)	Market risk (F)
Nonperforming loans ratio	-1.866390 ** (0.713014)	-2.372612 *** (0.551284)	
CAR	-4.855469 (8.268420)		
Provision for loan losses ratio	0.020683 * (0.011919)		
Logarithm of total assets	-7.760056 (6.324747)	-1.383465 (7.230680)	
Loans to deposit ratio		-0.009224 (0.043292)	
Equity/asset		1.940335 ** (0.951165)	
GDP growth			0.620691 (0.792540)
Inflation			0.104076 (1.228361)
ZAR/USD			0.263493 (0.701397)
Average market Cap.			3.17E-05 * (1.84E-05)
Lending interest rate			-0.334055 (0.947514)
C	67.85130 (36.97441)	14.64287 (47.72224)	9.408046 (7.062320)

Source: Authors' estimation using EViews, and results formatted with Excel. (F) means that the regression has been estimated using fixed effects whereas (R) means it has been estimated using random effects. Regression coefficients are reported for each variable and standard errors are in parentheses. *, **, ***, mean significant at 10%, 5% and 1% level

Capital Adequacy Ratio had a mean of 0.48, with a maximum of 0.87 and a minimum of 0.34. The loan provision for loan loss ratio had a mean of 108.01, which means that on average, the sample could cover their lost loans 108.01 times with their healthy loan book. The minimum value was 8.47, and the maximum value was 376.52.

According to Studenmund (2011), a substantial issue of multicollinearity arises if the absolute value of a correlation

coefficient exceeds 0.8. Table 2 features no correlation that exhibits such feature when it comes to the credit risk regression as the maximum correlation coefficient is between the logarithm of total assets and CAR, amounting to 0.7235. Performing the Hausman test on the fixed and random effects with this regression resulted in a $P < 0.05$: Concluding that the fixed effect model is preferred to the random effect model to model this category of risk.

Table 4: Panel regression output with ROA as a dependent variable

ROA as a dependent variable	Panel least squares regression		
	Credit risk (F)	Liquidity risk (R)	Market risk (F)
Nonperforming loans ratio	-0.124421* (0.064709)	-0.185148 *** (0.044909)	
CAR	-1.070607 (0.750396)		
Provision for loan losses ratio	0.002279** (0.001082)		
Logarithm of total assets	-0.719823 (0.573999)	0.145816 (0.589026)	
Loans to deposit ratio		-0.003703 (0.003527)	
Equity/asset		0.300438 *** (0.589026)	
GDP growth			0.054468 (0.070299)
Inflation			0.014668 (0.108956)
ZAR/USD			0.036185 (0.062214)
Average market Cap.			2.16E-06 (1.63E-06)
Lending interest rate			0.002046 (0.084045)
C	6.763896* (3.355591)	-0.891354 (3.887553)	1.066300 (0.626430)

Source: Authors' estimation using Eviews, and results formatted with Excel. (F) means that the regression has been estimated using fixed effects whereas (R) means it has been estimated using random effects. Regression coefficients are reported for each variable and standard errors are in parentheses. *, **, ***, mean significant at 10%, 5% and 1% level

Referring to the regression outputs in Tables 3 and 4, the following insights are derived.

Tables 3 and 4 reveal a significant positive relationship between nonperforming loan ratio (NPLR), proxied against ROA and ROE. With ROE as a dependent variable, NPLR is significant at 5%, supported by previous studies by Zou and Li (2014) and Mafu (2017). Additionally, the coefficient for NPLR is significant at 10% with ROA as a dependent variable, similar to the findings by Zou and Li (2014), Aluko et al. (2019), Bhatti et al. (2019), indicating that an increase in NPLR would decrease the profitability of the bank, as proxied by ROE and ROA; particularly due to the banks deriving most of their revenue from interests received on loans. Thus, an increase in NPLR led to a decrease in the banks' performance.

The Capital adequacy ratio (CAR) reveals a non-significant, negative relationship between CAR and ROE and ROA respectively. The negative coefficient signifies that an additional capital buffer reduces the profitability of banks; supporting the findings by Zou and Li (2014) and refuting the results of Munangi and Bongani (2020) who found a significant relationship between CAR and ROE.

There is a significant positive relationship between the loan loss provision ratio and ROE (10% significance) and ROA (5% significance). The positive coefficient implies that having a greater buffer over the loan loss provision increases the profitability of the bank, which fosters prudential measures in terms of credit risk management. This result is similar to the findings by Alqisie (2018) who also found a positive, but non-significant relationship between Loan loss provision ratio and Bank profitability.

The F-test was used to determine the suitability of the research model. The following hypotheses are formulated: H0: The model is not appropriate: the independent variable does not affect the dependent variable. H1: The model is appropriate: the independent variable affects the dependent variable. From Tables 3 and 4, the probability of the F-Statistic is <0.05 and therefore we can reject the null hypothesis and conclude that credit risk, as proxied by our variables, affects the financial performance of our sample.

4.1.2. Liquidity risk

Table 1 provides the descriptive statistics for the variables used in our liquidity risk regression. On average, our sample had a loan-to-deposit ratio of 94.40% between 2013 and 2020. This suggests that on average, banks were loaning out R94,40 for every R100 that they received as deposits. A higher loan-to-deposit ratio increases the propensity of liquidity risk that a bank faces. Generally, a ratio of 80-90% is deemed to be a healthy loan-to-deposit ratio, thus on average, the South African banking sector was within the threshold. The maximum value for this ratio was 178,46% and the minimum value was 71.79%.

The regression output reveals a negative, non-significant relationship between loans to deposit ratio and the performance of banks. The negative relationship with ROE - meaning that banks taking on more liquidity risk would decrease their profitability - was not expected given the results obtained by other scholars, such as Mafu (2017), and Aluko (2018). Additionally, the fact that the relationship is not significant may imply that banks in South Africa were not greatly affected by liquidity risks, due to the South African banks being above the recommended threshold for loans to deposit ratio, possibly under good management of this liquidity measure.

The common equity to total assets is a reflection of the capital structure and capital adequacy of a firm. Because firms are either funded by Equity or Liabilities, a large value of this ratio indicates a less leveraged firm, and therefore a safer bank. The average Equity/Asset ratio was 10.19%, with a maximum of 22.10% and a minimum figure of 6.96%.

In choosing the appropriate Panel regression using the Hausman Test, the results showed a P-value that is >0.05 as per Tables 3 and 4. Therefore, we fail to reject the null hypothesis and conclude that the random effect model is more appropriate for this regression.

Tables 3 and 4 reveal significant relationships between their respective profitability measure and NPLR as well as the Equity/Asset ratio.

NPLR is significant at the 1% level for both ROE and ROA as a dependent variable. Furthermore, the regression coefficient is

negative, implying that an increase in NPLR would reduce the performance of banks, both in terms of ROE and ROA. Again, this was expected given that banks derive most of their revenue from interest on loans.

Common equity to total asset revealed a positive, significant relationship between Equity to Asset and bank performance, ROA at 5% significance and ROE at 1% significance, refuting the findings by Mafu (2017) who found a negative, insignificant relationship between the ratio and ROE. However, the positive relationship may imply that profit after tax is affected by changes in the capital structure of banks.

4.1.3. Market risks

From Table 1, it was noted that real GDP growth has been 0.16% on average for South Africa between 2013 and 2020. The negative growth was mostly imputable to the covid 19 pandemic which caused large economic losses across the world, including South Africa. Inflation was 5.0% on average for the years 2013-2020. The maximum value was 6.6% whereas the minimum value was 3.2%, the monetary policy committee has an inflation-centred policy which leads to inflation targets being monitored. The foreign exchange rate was on average R13,2811/USD between 2013 and 2020. The maximum average value of the foreign exchange rate

was R16,5801/USD for the year 2020, with a low of R9,7160 for the year 2013. The lending interest rate had an average of 3.95% during the period studied, the maximum was 5.93% and the minimum was 2.21%.

The average historical market capitalization has displayed a significant relationship with ROE at the 10% level. The coefficient is positive meaning that larger banks by market capitalization had a larger ROE, holding all other factors equal.

GDP growth, inflation rate, foreign exchange rate and lending interest rates all had positive relationships with both ROA and ROE, although they were all insignificant. This may imply that the performance of banks is more related to industry-specific and firm-specific factors as opposed to macroeconomic factors. Similar findings were found by Bhatti et al. (2019) regarding inflation and lending interest rates. However, Mafu (2017) found a significant relationship between the logarithm of GDP (which proxied GDP growth) and ROE.

4.2. T-Test

As outlined in the previous section, the research is also interested in evaluating the significance of the impact of the coronavirus pandemic on the profitability of South African banks. The results

Table 5: T-test by Covid-19 era status

T-test by Covid-19 era status			
	ABG SJ CPI SJ FSR SJ INTL SJ NED SJ SBK SJ		
	All	Pre-Covid	During Covid
Individual level characteristics			
Return on equity	16.571	17.036	13.32
Return on assets	1.935	1.978	1.635
Nonperforming loans ratio	3.85	3.702	4.885
Capital adequacy ratio	0.482	0.489	0.426
Provision for loan loss ratio	108.015	113.362	70.583
Total assets	943800.18	902346.348	1233977
Loans to deposits ratio	94.397	95.824	84.407
Equity to total asset ratio	10.192	10.298	9.451
GDP growth	0.162	1.183	-6.982
Inflation	5.006	5.261	3.224
Forex	13.281	12.810	16.58
Lending rate	3.953	4.189	2.3
Average market capitalization	137672.95		135264.9
Number of observations	48	42	6

Table 6: T-test by Best-performing status

T-test by Best-performing status			
	ABG SJ CPI SJ FSR SJ INTL SJ NED SJ SBK SJ		
	All	Worst performers	Best performers
Individual level characteristics			
Return on equity	13.32	5.270	21.37
Return on assets	1.635	0.460	2.81
Nonperforming loans ratio	4.885	6.330	3.44
Capital adequacy ratio	0.426	0.422	0.43
Provision for loan loss ratio	70.583	54.961	86.205
Total assets	1233977	1764065.667	703888.27
Loans to deposits ratio	84.407	89.987	78.826
Equity to total asset ratio	9.452	7.463	11.44
Average market capitalization	135264.9	114153.454	156376.34
Number of observations	6	3	3

of the T-test comparing the means of our selected variables are presented in Tables 5 and 6 below.

The table below presents t-tests for a selected sample of SA Banks for pre-covid (2013-2019) and post covid era (2020). The sample consists of banks with ticker symbols ABG SJ, CPI SJ, FSR SJ, INTL SJ, NED SJ and SBK SJ. Significant differences are starred. * Implies $P < 0.10$, ** implies $P < 0.05$, and *** implies $P < 0.01$. Tables were created using asdoc, a Stata program written by Shah (2018). Data Source: Bloomberg and World Bank.

From Table 5, the NPLR was significantly (5% level) larger during the Covid era compared to pre-covid era. It can be inferred that nonperforming loans increased overall in the banking sector in South Africa during the COVID-19 pandemic. Additionally, Table 5 reveals that the macroeconomic variables were all significantly different at the 1% level, except for GDP growth. However, it has been noted in the market risk analysis that banks on average were not significantly affected by market factors.

Table 6. shows a significant difference between the best and worst-performing ROE and NPLR. ROE was significantly higher for the best performing and NPLR was significantly lower for the same group. It can be inferred from this table that credit risk management, and in particular the management of nonperforming loans was the major cause of declining financial performance in banks in 2020, given that other risk measures did not display significant differences according to the t-test.

5. CONCLUSIONS AND RECOMMENDATIONS

The research aimed to uncover the impact of credit risk, liquidity risk and market risk on the financial performance of the six major banks listed on the JSE in South Africa for the period 2013-2020.

To assess the impact of credit risk, the study used the nonperforming loan ratio, capital adequacy ratio and loan provision for loan loss as the main dependent variables. The findings revealed a negatively significant relationship between nonperforming loans with ROA and ROE. In contrast, loan provision for loan loss was positively significant with ROA and ROE. However, the capital adequacy ratio and size of the banks did not have a significant relationship with the banks' financial performance.

To assess the impact of liquidity, the study used loans to deposit ratio and common equity to total assets ratio. The regression output revealed a non-significant negative relationship between loans to deposits concerning ROA and ROE, suggesting that the liquidity position of our banks was not a major driver of financial performance. However, the equity-to-asset ratio had a significant positive relationship with ROA suggesting that the capital structure of banks plays a role in their financial performance.

To assess market risks, GDP growth, inflation, the ZAR/USD exchange rate, and the lending interest rate were used. The variables were all non-significant as per the model output.

However, the average market capitalization of the banks was also included in the model as a control variable for the size of the banks, the latter revealed a positive and significant relationship with ROE, suggesting that larger banks by market capitalization were more affected by macroeconomic events, compared to smaller banks.

The main finding of this study is that NPLR was the major deciding factor in banks' financial performance. Therefore, it is suggested that banks concentrate more effort on credit screening in strengthening their loan underwriting process. To do so, they may reinforce their client profiling but also create persona models and develop an internal risk rating model to define at what interest rates loans should be issued. The banks may also have a specialised analyst to analyse the financial statements of their commercial customers to increase the chance that the loan will be repaid. This would allow the bank to reduce its nonperforming loan book, thereby increasing its profitability.

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