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Evaluating the Credit Risk and Macroeconomic Interaction
in South African Banks

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Abstract: Banks are the backbone of a country's financial system, and they play an essential role in providing liquidity in the market economy. However, in doing so, they experience a great challenge of credit risk, which is primarily influenced by macroeconomic factors that directly affect borrowers' behaviour. This study examined the co-integrating relationship between credit risk and macroeconomic interactions on South African banks in the long-term and short–term. To also provide additional knowledge to the already existing information on factors that drive credit risk for the top 5 South African commercial banks, looking at the influence of macroeconomic factors from 2009 to 2018/19. Previous research has confirmed the relationship between macroeconomic factors and non-performing portfolios or credit risks. Results obtained indicate no significant long-run relationship between market rates (interest rates) and GDP growth rates and a positive relationship between unemployment and money supply. On the other side, the exchange rate and inflation rate share a negative relationship. Thus, this study found a long-run relationship between credit risk and the observed significant macroeconomic variables. This article will examine the influence of structural factors or macroeconomic interaction on credit risk that affects bank loans portfolio (banks assets) /profitability in the South African context. Previous scholars focused on data before the financial crisis using mainly stress testing econometric models. However previous studies have left some research questions unanswered. For instance, has the global debt increased and is more than what was in 2008/2009, and is the world economy sleepwalking into a future/next financial crisis? Will there be another global financial crisis? And if so, how will it affect South Africa? Will it emanate from credit risk again? Therefore, the underlying study will identify possible causes or factors of credit risk for the South African banking sector. This study made use of both a literature review and an empirical study, using

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secondary data. For the empirical analysis, a statistical analysis was carried out using the latest version of Eviews. The study will employ recent aggregate available data on SARB and StatsSA from 2009 – 2018/1 The results of this study found that the is a negative relationship between credit risk, ROA and ROE, which shows strong statistical significance on the relationship of the variables. The study then followed a second model which was aimed at finding long-run relations between credit risk and macroeconomic factors. A negative relationship was then found on the Inflation rate, Exchange rate and GDP growth rate, whereas a positive relationship was established between the Unemployment rate, Market/leading rate, and Money supply. However, for the GDP growth rate and the Market/lending rate, the results confirmed an insignificant relationship, meaning that the is no significant long-run relationship between these two macroeconomic factors and credit risk. Bank managers or the monetary authorities need to effectively supervise or manage the selection and previous of credit to borrowers and create banking models that will account for macroeconomic aspects that may cause future changes in the behaviour of borrowers. In all things considered, this article implies that the South African Reserve Bank, along with financial authorities need to create a guideline that will give rise to the improvement of credit risk control measures and reduce the flow of expanding non-performing loans within the South African banks. **Value** This study aims to examine the co-integrating relationship between credit risk and macroeconomic interactions on South African banks in the long-term and provide additional knowledge to the already existing information on factors that drive credit risk.

Keywords: Non-Performing loans (NPL); Credit risk; Global Financial Crisis (GFC); Return on Assets (ROA); Return on Equity (ROE)

JEL Classification: G24

1. Introduction

The 2008/2009 global financial crisis (GFC) has brought on the importance of financial stability on countries' economic system worldwide -, with fear of its act on countries like Ukraine, Argentina, and Jamaica (Eftychia & Sofoklis, 2017). Financial stability in emerging and developing countries is imperative. It forms the foundation of present-day macroeconomic policy and concurrently serves as a prerequisite for stable economic growth to ensure a balanced macroeconomic environment (Poudel, 2013).

According to Yurdakul (2013), financial stability can be defined as a country's financial system's ability to withstand economic shocks and smoothly facilitate essential intermediation functions of financial institutions. Therefore, it is necessary to acknowledge financial institutions' role, particularly banks, to stabilise a country's financial system. As the banks facilitate the supply and creation of money in the economy, channelling money from savers (households/individuals or investors) and redirecting it to the borrowers of money (government, businesses and individuals) (Pesaran, Schuermann, Treutler & Weiner, 2006). Through this process, banks profit by lending money to borrowers and charging interest; this is one of the significant and primary activities for banks to earn profits (Pesaran *et al*., 2006). However, as profitable as this is, it also creates excellent credit risk exposure for banks, which is one of the significant risks banks are exposed to (Sari, Priyarsono & Anggraeni, 2015).

Credit risk impacts the banks' operating loans portfolio (assets of the bank), which might negatively affect profitability. Credit risk is the possibility of financial loss due to non-payment or default on financial obligation or failure to meet contractual obligations for debt settlement (Moorad, 2018, p. 65). More often than not, this can reach high levels that don't just affect the banking sector but the entire financial system and the economy (Souza & Feijó, 2011). Therefore, in this unstable and constantly changing global economy, financial institutions, particularly banks in developing countries, experience a more rapidly declining quality of credit due to country-specific and unsafe economic conditions. This creates a society of unreliable borrowers/debtors that are a default risk to banks, and this is due to their weak and unstable socio-economic environment (Afifa, 2018). Furthermore, Fofak (2009) stresses developing countries' importance and identifying the key drivers of credit risk to ensure proper loan quality assessment and financial stability.

According to Pesaran, Treutler, Schuermann, and Weiner (2003), the key drivers of credit risk consist of two economic aspects: structural (macroeconomic) and idiosyncratic (microeconomic) factors. When analysing credit risk and developing countries' financial stability, it is essential to look at structural elements. They play a vital role in explaining borrowers' behaviour that leads to default. Factors include unemployment rate, GDP growth, inflation rate, market interest rate, money supply, and exchange rate (Poudel, 2013).

This article will examine the influence of structural factors or macroeconomic interaction on credit risk that affects bank loans portfolio (banks assets) /profitability in the South African context. The study will employ recent aggregate available data on SARB and StatsSA from 2009 – 2018/19. A similar study conducted by Olena (2010) in the South African context focused only on data from 2001 – 2008 using a stress testing econometric model. The study further looked at the African banking sector's capitalisation and their position to withstand adverse financial market collapse during the global financial crisis. Olena (2010) states that South Africa's macroeconomic shocks significantly impact credit losses based on data collected 11 years ago.

However, the South African banking sector's resiliency to severe economic shocks was due to capitalisation strategies implemented at the time. However, Yurdakul (2014) found a positive relationship between credit risk and macroeconomic factors. Moreover, the study was based on the measurement of damage or outcome after the impact/event and not on the event's anticipation, highlighting unresolved questions. For instance, has the global debt increased and is more than what was in 2008/2009, and is the world economy sleepwalking into a future/next financial crisis? Will there be another global financial crisis? And if so, how will it affect South Africa? Will it emanate from credit risk again? (Business Maverik, 2019). Therefore, the underlying

study will identify possible causes or factors of credit risk for the South African banking sector.

Profitability in the banking sector is primarily influenced by the quality and amount of loans provided to the public (Poudel, 2013). The failure to fulfil financial commitments by the public/borrowers, especially in paying back a loan, decreases banks' income, exposing them to credit risk and weakening their financial institutions. Wiryono and Effendi (2018) define credit risk as to the possibility that a debtor may fail to fulfil their contractual obligations to make expected payments on interest and principal amount on borrowed funds. Thus, keeping a portfolio of performing loans and granting quality loans is considered to be an essential prerequisite for financial stability and success for banks in an economy (Sari *et al.,* 2015). Though this is crucial for banks and the economy, it is challenging for banks to achieve this, especially in developing countries, which is attributable to the changing global environment that affects economic outcomes.

Excessive provision of subprime mortgages - loans were given to non-credit worthy individuals, resulting in the 2008/2009 GFC; this painted a clear picture of the effect of credit risk on the global economy (Poudel, 2013). In developing countries like South Africa, individuals' creditworthiness is primarily influenced by their country's economic factors, such as the unemployment rate, money supply, GDP growth, inflation rate, market interest rate, and exchange rates (Olena, 2010). Therefore, analysing these factors as potential key drivers of credit risk and as the roots or cause of income loss for banks would assure South Africa's banking sector's stability. By providing a head view for the banking sector to anticipate what will happen to the profitability of banks if South Africa experiences economic shocks that have a significant influence on these factors, which will, in turn, affect the behaviour of borrowers and their financial commitments (Ahmad & Mohamad, 2020).

This study aims to examine the co-integrating relationship between credit risk and macroeconomic interactions on South African banks in the long-term and provide additional knowledge to the already existing information on factors that drive credit risk.

2. Literature Review

Numerous countries worldwide have increased concern about the stability of their financial system (Ahmad, 2020). Therefore, owing to the increase of available data and unresolved questions from researchers, there has been an increase in the number of similar studies, where empirical findings from Souza and Feijó (2011) confirms the hypothesis that macroeconomic processes have an influence on credit risk for the period of 2000 to 2006 in Brazil.

Fofack (2005), Souza and Feijo (2011) and Castro (2013) found a positive relationship between interest rates and credit risk. An increase in interest rates will mean an increase in borrowing costs. This, in turn, will then affects the borrower's ability to make interests payments to the lender. Berk and Bikker (1995) investigated the international interdependence of business cycles in the manufacturing industry also found a positive relationship between economic growth and credit risk, which was primarily affected by an increased money supply and a reduction in interest rates. This positive relationship entails a decrease in banks NPL since the interest rate is declining; thus, there is a positive relationship between interest rates and credit risk (NPL) (Bucur & Dragomirescu, 2014). There is little evidence contrary to this hypothesis. However, Ail and Daly (2010) found no significant correlation between these factors.

Besides the evidence on interest rates having a significant influence on credit risk, other factors greatly influenced loan losses, such as unemployment, confirmed by Croupy, Gala and Mark (2000). Notwithstanding the impact of unemployment on credit risk, it displayed a positive relationship. A rise in the unemployment rate increases the likelihood that borrowers who lost their jobs will have problems making interest payments on funds borrowed (Croupy, Gala & Mark, 2000).

According to Louzis, Vouldis and Metaxas (2012), unemployment affects the banks quality of loans or loan portfolio quality by exposing the financial institution to unreliable borrowers. Other studies (Yurdakul, 2013 & Castro, 2013) examined the effect of unemployment on the banks' loan quality/credit risks confirmed and found a positive relationship. However, Washington (2014), Garr (2013), and Wiryono and Effendi (2018) found that there is no significant relationship between unemployment rates and credit risk.

Depreciation of a country's currency, for instance, the South African rand, has dramatically influenced banks' loan portfolios, especially if they allow loan provisions to firms in foreign currency. Therefore, exchange rates are a prerequisite to determining economic vulnerabilities (Schmidt-Eisenlohr & Schmidt-Eisenlohr, 2017). In acknowledgement of this, Bucur and Dragomirescu (2014), Washington (2014) and Vogiazas and Nikolaidou (2011) confirms the influence of exchange rates on credit risk or bank's loan portfolio and finds a negative relationship between the two. A weaker domestic currency will increase the price of imported goods, and firms will demand more money in foreign currency to compensate for the increase in prices. Therefore, exchange rate fluctuations will affect the borrower's ability to settle interest payments due and, as a result, increases the banks' non-performing loans.

The banking sector is also affected by inflation; however, according to Bucur and Dragomirescu (2014), this is dependent on the rate at which Banks expenses increase relative to the inflation rate during a cyclical downturn. Therefore, an increase in the

inflation rate will affect the bank's profitability and signifies a positive relationship between inflation and credit risk (Rinaldi & Sanchis-Arellano, 2006; Yurdakul, 2014; Wiryono & Effendi, 2018). However, Vogiazas and Nikolaidou (2011) found a negative relationship between credit risk/non-performing loans and the Romanian Banking sector's inflation rate. Similar results were found by Castro (2013), who found a negative relationship with the Slovenian banking system.

3. Research Methodology

The following methodology components will layout the empirical parts of this study:

3.1. Target Population, Sampling Frame and Sample Size

This study's targeted population comprises 14 locally controlled commercial banks in South Africa. The sample frame includes the top five commercial banks as they hold the largest market share in terms of clientele and total asset value (Norreststad, 2020). The top five commercial banks include Standard Bank, Capitec Bank, Nedbank, Amalgamated Banks of South Africa (ABSA group), and the First National Bank (FNB).

3.2. Measuring Instruments and Data Collection

Quantitative data is used to assess the relationship between credit risk and macroeconomic interactions, obtained from the collection of aggregate macroeconomic time-series data on factor influencing systematic credit risk. This includes the unemployment rate, inflation rate, foreign exchange rate, and GDP growth rate. All these factors greatly influence borrowers' behaviour and their likelihood to settle or repay their debts, looking in terms of their income source and factors affecting their economic participation (Kumar, Umashankar, Kim & Bhagwat, 2014). These factors will be used as the independent/explanatory variables for the underlying study, as previous studies (Fofack, 2005; Vogiazas & Nikolaidou, 2011; Castro, 2013; Garr, 2013; Yurdakul, 2014; Waemustafa & Sukri, 2015; Wiryono & Effendi, 2018; Munangi & Sibindi, 2020) have widely used them to provide a clear understanding of influences of economic shocks on non-performing loans (assets) and banks profitability. The proxy for the dependant variable, credit risk, is represented by a ratio between the allowance for loan losses and the selected banks' total loans. This ratio explains the banks risk exposure and quality of loans portfolio due to the element losses and credit provision that emanates from borrowing (Trenca & Bozga, 2018).

Non-performing loans ratio:

$$Credit\ risk = \frac{Allowence\ for\ loan\ loss}{Total\ loans\ granted}$$

- A greater ratio means greater exposure to credit risk, which is coupled with a loss of income for banks.

Therefore, in the pursuit to find the relationship and influence of macroeconomic interactions on credit risk the study makes use of a Panel Cointegration econometric model for a period of 10 years (2009 to 2019). This period signifies South Africa's timeline of economic turn around coming from the 2008 GFC, the period of great political and economic instabilities (Munangi & Sbindi, 2020). This will allow the study to examine cointegrating long-run relationships between credit risk and macroeconomic interaction and their impact on South African banks (Nkoro & Uko, 2016).

3.3. The Model Specification

The function of this regression is to determine the long-term correlation between various time series of the dependent and independent variable with a method of cointegration. This method is a statistical element used to gather time-series data (Nkoro & Uko, 2016). Therefore, with the use of cointegration methods on the regression presented above this study aims to achieve the relationship of these variables to find the short- and long-term impact on non-performing loans for the sampled banks.

Model 1

$$Y_t = \beta_0 + \beta_1\ NPL_t + e_t$$
$$Y_{t1} = \beta_0 + \beta_1\ NPL_t + e_t$$

Where dependent variable:

● Y_t = **ROA** → Return on total assets (profit on banks assets - loans)

● Y_{t1} = **ROE** → Return on equity

Independent variable:

● **NPL** → Ratio on Non-Performing loans on banks total loans granted

Model 2

$$Y_t = \beta_0 + \beta_1\ Uner_t + \beta_2\ Gdpg_t + \beta_3\ Inr_t + \beta_4\ Mr_t + \beta_5\ M4_t + \beta_6\ Exr_t + \mu_t$$
$$(NPLs) = \boldsymbol{Y}$$

Dependent variable:

● NPLs = Credit risk

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Independent variable:

●UNER = Unemployment

●GDPG = GDP growth.

●CPI = Inflation rate.

●MR = Market/lending interest rate.

●M3 = Money supply.

●EXR = Exchange rates

4. Results and Findings

Table 1 represents a summary of descriptive statistics for non-performing loans, Banks ROA and macroeconomic variables. According to the descriptive stats, the variables GDPG, EXR and UNER, mirror a normally distributed data series as their skewness values are less than 1.88% and for Kurtosis it's less than 3% which signifies a normal distribution on the three variables.

4.1. Descriptive Statistics

Variables	Range (%)	Min (%)	Max(%)	Mean (%)	Std. Deviation (%)	Measure of normality	
						Skewness (%)	Kurtosis (%)
NPL	15.930	0.990	16.920	3.284	2.942	2.218	8.863
M3	22.170	1.761	23.931	9.373	6.373	1.363	3.605
GDPG	4.066	-1.538	5.603	2.102	1.894	0.186	2.678
EXR	7.938	6.771	14.709	10.166	2.873	0.350	1.505
CPI	6.811	3.244	10.055	5.598	1.643	1.180	4.510
MR	6.625	8.500	15.125	10.488	1.776	1.307	4.064
ROA	13.813	0.960	14.773	3.354	3.959	1.998	5.586
ROE	28.791	10.909	39.700	20.276	7.623	1.000	3.069
UNER	6.061	22.407	28.468	25.600	1.704	0.082	2.256

Moreover, looking at the context of this research paper, the results showed a significant increase in the banks NPLs ranging at 15.93% from a minimum of 0.99% to a maximum of 16.92% and an average value of 3.28%, such a drastic increase is not desired for the wellbeing of the bank's loans portfolio.

4.2. Correlation Analysis

The results from Table 2 and 3 represent the correlation between the observed variables in model 1 and model 2.

Table 2. Correlation of Variables in Model 1

Correlation Probability	NPL	ROA	ROE
NPL	1		
ROA	-0.312571	1	
	0.0256		
ROE	-2.115517	0.161138	1
	0.0086	0.0000	

Table 3. Correlation of Variables in Model 2

Correlation	NPL	CPI	EXR	GDP	M3	R	UNP
NPL	1						
CPI	-0.318149	1					
	0.0060						
EX	-0.949290	-0.756953	1				
	0.0001	0.0211					
GDP	-0.103137	-0.13632	-0.656256	1			
	0.3550	0.2605	0.0000				
M3	0.294343	0.222632	-0.461467	0.844384	1		
	0.0125	0.0112	0.0001	0.0000			
MR	0.300558	0.629929	-0.254973	0.238363	0.549488	1	
	0.0086	0.0000	0.0332	0.0469	0.0000		
UNER	0.125215	-0.702204	0.420411	0.111227	0.257739	-0.183255	1
	0.00221	0.0000	0.0003	0.3593	0.0312	0.1289	

4.3. Regression Analysis

Looking at the results, about 87.93% of the ROA variables are explained by the NPL ratio in this model while only 33.33% of the ROE variables is explained by the NPL ratio.

Table 4. Regression Analysis between NPL, ROA and ROE for Model 1

Variables	Regression Coefficient	R-Squared	Significance		Coefficient	
			P-Value	Hypothesis (expected)	Regression outcomes	Correlation
NPL on ROA	-0.312571	0.879292	0.0256*	Negative	Negative	Negative
NPL on ROE	-2.115517	0.333333	0.0086*	Negative	Negative	Negative
Regression analysis between NPL and Independent variables (Macroeconomic variables) for Model 2						
M3	0.294343	0.534346	0.0125*	Negative	Positive	Positive
GDPG	-0.103137	0.635552	0.3550	Negative	Negative	Negative
EXR	-0.949290	0.835652	0.0000*	Positive	Negative	Negative
CPI	-0.318149	0.541015	0.0160*	Positive	Negative	Negative
MR	0.300558	0.054786	0.0860	Positive	Positive	Positive
UNER	0.125215	0.37479	0.0022*	Positive	Positive	Positive
*Significance						

Moreover, the results of the banks' ROA and ROE shows that the independent variables have an impact on bank's profitability, with the dependent variable 'non-performing loans' having a negative relationship with the bank's profitability and performance. As such, this implies that a significant increase in the bank's Non-performing loans ratio will lead to a decrease in profitability and cause a slight decline in their performance.

4.4. Results of Unit Root Test

Before running the regressions, it is imperative to first check for the existence of stationarity to examine how the stochastic process of generating the series, behaved over time to avoid possible spurious results from the models (Breitung & Pesaran, 2005).

Therefore, this study applied the following unit root tests: Individual root - Fisher (ADF and PP test), common root – Levin, Lin, Chu and Breitung test. This is because of the precondition of running a panel cointegration model, which requires that

variables must be non-stationary at levels, but after converting all the variables to first difference then they become stationary. Based on the unit root tests done on the study, the sampled variables are found to be stationary after applying the first difference at all levels. This study has fulfilled the conditions of panel data modelling, making the observed data suitable to be used for the cointegration method.

Model 1

Impact of non-performing loans/credit risk on banks profitability

To analyse the impact of non-performing loans on the profitability of banks, the paper looks at establishing and testing a hypothesis that is based on the expectations that loan losses will have a negative relationship with the banks ROA and ROE. As both these performance ratios are positively associated with banks profitability, any impact on the ROA and ROE of the bank's profitability will be affected. The hypothesis is stated below as:

H_0: *No impact or relationship between non-performing loans and the banks' performance (in terms of its profitability) in the long-term;*

H_A: *There is an impact or relationship between non-performing loans and the banks' performance (in terms of its profitability) in the long-term.*

Table 5. Panel Cointegration Test using Kao (Engle-Granger based) Test

	Probability	Significant	Reject or Accept Null Hypothesis
NPL on ROA	0.0000	Yes	Reject
NPL on ROE	0.4244	No	Accept

Table 5 and 6 are showing the two methods that were used to estimate long-run cointegration using the Johansen Cointegration Test that apply Kao and Pedroni tests based on the Engle-Granger tests. Therefore, from the results, this study found that there is a significant long-run relationship between the banks NPL and ROA and that is based on the above-mentioned null hypothesis. The results show that the model has a p-value of 0.000 which is less than 5% significant level and proves the significance of the long-run relationship between NPLs and ROA. However, on the other hand, the results on the ROE shows a p-value of 0.4244% which that this variable is insignificant and there is no long-run relationship between the banks NPL and the ROE and which is based on the Kao-test.

Table 6. Panel Cointegration Test using Pedroni (Engle-Granger based) test

		Individual Intercept	Intercept and trend	No trend and intercept	Average total number of significant outcomes (out of 11)	Reject or Accept Null Hypothesis
NPL on ROA	Scenario 1 (Within-dimension)	4	4	6		
	Scenario 2 (between-dimension)	2	2	2		
	Total outcomes	6	6	8	6.67	Reject
NPL on ROE	Scenario 1 (Within-dimension)	6	4	6		
	Scenario 2 (between-dimension)	2	2	2		
	Total outcomes	8	6	8	7.33	Reject

However, when looking at the Pedroni test in Table 6 for further confirmations of the long-run relationship, banks NPLs have proven to have a long-term effect on both the ROA and ROE. This is bases on the estimation method that the Pedroni test use and this method apply two scenarios (data within-dimension and data between-dimension) consisting of seven tests that provide 11 statistical outcomes based on a 5% significance level. When confirming the long-run relationship (cointegration) the data has to meet a majority of the 11 outcomes at a proven significant level that is less than 5%. Therefore, this study will reject the null hypothesis that there is no existence of a significant cointegration relationship between banks NPLs and their ROA and ROE, as the data series has met the majority of the 11 outcomes from all levels of trend specifications (individual intercept, individual intercept and individual trend, and no intercept or trend). This study finds a significantly negative long-term relationship between the NPLs and the banks' performance (profitability). Even though the results for the estimation on the ROE showed an insignificant outcome on the impact of NPL base on the Kao-test, there is an existence of cointegration. This is because banks profitability (return on assets) and equity capital does not only consist of loans and advances, it involves Hybrid instrument, General provision, common and preferred stock (Saad & Bhagat. 2017). Issued loans and the portfolio of non-performing loans are the major determinants of the bank's asset quality and hence the results on ROE shown that it is insignificant.

Model 2

The Cointegration relationship between credit risk and macroeconomic factors

$H_0 1$: *There **is** no existence of any significant cointegration relationship between*

credit risk and macroeconomic variables

$H_A 2$: *There is a cointegrating relationship between credit risk and macroeconomic variables*

The following Table 7 and Table 8 shows results of three testing methods for a long-term relationship (cointegration) between macroeconomic variable and credit risk using the Panel Fully Modified Least Square and the Panel Cointegration Tests (Kao-test and Pedroni-test.

Table 7. Panel cointegration Test using Kao (Engle-Granger based) test

	Probability	Significant	Reject or Accept Null Hypothesis
Inflation (CPI)	0.0041	Yes	Reject
Exchange Rate (EXR)	0.0014	Yes	Reject
Gross Domestic Products (GDP)	0.0050	Yes	Reject
Money supply (M3)	0.0000	Yes	Reject
landing rate (MR)	0.0039	Yes	Reject
Unemployment rate (UNER)	0.0087	Yes	Reject

Table 8. Panel Cointegration Test using Padroni (Engle-Granger based) test

		Individual Intercept	Intercept and trend	No trend and intercept	Average total number of significant outcomes (out of 11)	Reject or Accept Null Hypothesis
CPI	Scenario 1 (Within-dimension)	6	3	8		
	Scenario 2 (between-dimension)	1	1	2		
	Total outcomes	7	4	10	7.00	Reject
EXR	Scenario 1 (Within-dimension)	5	3	7		
	Scenario 2 (between-dimension)	2	1	2		

	Total outcomes	7	4	9	6.67	Reject
GDP	Scenario 1 (Within-dimension)	2	2	1		
	Scenario 2 (between-dimension)	1	1	1		
	Total outcomes	3	3	2	4.00	Reject
M3	Scenario 1 (Within-dimension)	4	2	2		
	Scenario 2 (between-dimension)	2	4	2		
	Total outcomes	6	6	4	5.33	Reject
MR	Scenario 1 (Within-dimension)	3	3	8		
	Scenario 2 (between-dimension)	2	1	1		
	Total outcomes	4	4	10	6.00	Reject
UNER	Scenario 1 (Within-dimension)	6	3	8		
	Scenario 2 (between-dimension)	2	1	2		
		8	4	10	7.33	Reject

From the estimated results above, this study that there is a significant effect between all variables and thus supports the alternative null hypothesis that there is a significant long-run relationship between credit risk and macroeconomic. Looking at both the Kao and Pedroni tests, these variables are significant and thus because all the variables significantly meet the majority of the significance tests, this study considers both these variables cointegrate with credit risk.

5. Conclusion

Macroeconomic factors play an important role in defining a country's future economic performance and the future behaviour of its economic entities. The behaviour of borrowers is affected by these factors and they also place significant pressure on the banking sector, as it produces a society of under qualifying borrowers that exposes banks to credit risk and a decline in profitability.

This study examined the impact of macroeconomic factors on South African banks profitability, looking through the impact of these factors on credit risk. The study firstly looked at the impact that credit risk (proxied by non-performing loans ratio) have on the bank's profitability as our first model, documenting ROA and ROE as our profitability ratios. The results of this study found that the is a negative relationship between credit risk, ROA and ROE, which shows strong statistical significance on the relationship of the variables. The study then followed a second model which was aimed at finding long-run relations between credit risk and macroeconomic factors. A negative relationship was then found on the Inflation rate, Exchange rate and GDP growth rate, whereas a positive relationship was established between the Unemployment rate, Market/leading rate, and Money supply. However, for the GDP growth rate and the Market/lending rate, the results confirmed an insignificant relationship, meaning that the is no significant long-run relationship between these two macroeconomic factors and credit risk.

Therefore, looking at the empirical findings of this study, bank managers or the monetary authorities need to effectively supervise or manage the selection and previous of credit to borrowers and create banking models that will account for macroeconomic aspects that may cause future changes on the behaviour of borrowers. Other studies prescribe that banks need to direct and focus more on creating powerful credit risk control techniques. Facilitating thorough credit assessment in the loan provision process, which will not only just contribute towards restricting banks from the presentation of credit risks but improve the bank's loan execution. Moreover, in all things considered, the South African Reserve Bank, along with financial authorities need to create a guideline that will give rise to the improvement of credit risk control mesures and reduce the flow of expanding non-performing loans within south African banks.

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