AN INVESTIGATION INTO THE INFLUENCE OF CREDIT RATINGS ON CREDIT RISK OF THE SOUTH AFRICAN BANKING INDUSTRY

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Declaration

I, Kgapyane Samuel Choenyana declare that this dissertation entitled “An investigation into the influence of credit ratings on credit risk in South African banks” is my own work and that all the sources that I have used or quoted have been cited and acknowledged by means of complete references.

Signed: K.S Choenyana Date: 02 March 2020

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Abstract

The financial stability of banks is crucial if they are to fulfil their role in facilitating transactions between borrowers and lenders. The purpose of this study was to investigate the effect of credit risk on the South African banking industry following a movement in credit ratings by rating agencies. Data from a sample of 11 banks were collected from 2006 to 2015. Econometric regression analysis was used to analyse the data. The results show that inflation, credit ratings, exchange rate, gross domestic product, unemployment rate, capital adequacy ratio and size of the bank are significant factors that determine "non-performing loans". Therefore, it is imperative that banks continuously monitor these factors and adapt their credit policies on "non-performing loans". This action would prepare banks for any adverse effects and ensure that the banking industry remains a sound and efficient contributor to the growth of the South African economy.

Keywords: Credit ratings, information asymmetry, credit risk management, non-performing loans, bank-specific variables and macro-economic.

List of Acronyms

ABS	Asset-Backed Securities
BCA	Baseline Credit Assessment
CAR	Capital Adequacy Ratio
CG/LG	Credit Growth/ Loan Growth
CRAs	Credit Rating Agencies
CRM	Credit Risk Management
EXR	Exchange Rate
FEM	Fixed Effects model
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GMM	Generalised Method of Moments
LLPs	Loan Loss Provisions
NPLs	Non-Performance Loans
NPLR	Non-Performing Loan Ratio
PWC	PriceWaterhouse Coopers
REM	Random Effects Model
ROA	Return on Assets
ROE	Return on Equity
SACP	Standard-Alone Credit Profile
S&P	Standard and Poor's
SRF	Support Floor Rating
UNE	Unemployment Rate

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CHAPTER 1: Introduction and background

1.1. Introduction and background

The banking industry is a key stakeholder in any economy. Hence, the sustainability of this industry is vital, as it is the main provider of credit to different industries in the economy. Credit risk management in this sector is important because of the number of prevailing factors arising from the real economy (Asamoah & Adjare, 2015). These factors have attracted interest from regulators, rating agencies and investors regarding the ability of banks to absorb losses arising from credit risk and other types of risks.

Credit ratings are assigned by rating agencies based on the creditworthiness of a specific bank. There are three main international rating agencies, namely, Fitch Ratings, Moody's, and Standard and Poor's (S&P). These agencies use a combination of internal and external information to assign credit ratings to banks (Erdem & Varli, 2014). The rating agencies express their opinions about the bank's creditworthiness through credit ratings. According to Ntsalaze, Boako and Alagidede (2017), expert opinions are essential in corporate financing decisions, risk management and investment decisions. Credit ratings are important in assessing the financial stability and obligations for a bank (Kisgen, 2006).

Al-Sakka and Gwilym (2009) highlight the importance of external credit ratings introduced by Basel II, which require that such ratings be considered when evaluating credit risk and determining the capital adequacy ratio for banks. Therefore, it is imperative for managers to maintain a good credit rating in order to influence rating agencies' perceptions about a bank's creditworthiness. A good credit rating can also improve a bank's capacity to attract new investors and generate external equity. According to Mutezo (2015), "a poor credit rating suggests that investors would demand a higher risk premium whereas a good credit rating would encourage borrowers to generate external equity at the lower interest rate." It is therefore important for the banking sector to consider the extent of credit ratings and their influence on credit risk.

Rating agencies provide an important service to the financial market by enabling the transfer of risk information between investors and borrowers (Frost, 2007). They collect and evaluate the information to assess creditworthiness and then distribute the results to the multiple external stakeholders (Frost, 2007). Another benefit is that rating agencies facilitate the process of contracting since the ratings are widely recognised as efficient creditworthiness benchmarks (Frost, 2007). For example, the ratings are useful in drawing up loan contracts or bond covenants. Therefore, it is essential for rating agencies to remain independent third parties in the borrower and investor rapport.

According to Standard and Poor's (2009), the rating agencies use a combination of qualitative analysis and quantitative simulations to assess credit quality. The qualitative aspect ensures that factors such as institutional strength and the financial strategy and credibility of management are sufficiently analysed. The quantitative analysis, on the other hand, focuses on factors such as capital structure, cash flows and financial stability. The rating process includes the evaluation of credit risk by analysing the individual bank's credit information, the industry within which it operates and its economic environment (Standard & Poor, 2009). Frost (2007) points out that both business risk and financial risk are important in the rating process. The business risk includes the industry characteristics, the company's competitive position and management quality while financial risk involves factors such as financial policy, capital structure, cash flow protection and financial flexibility. It is evident, therefore, that credit ratings play an important role in the financial markets because they are widely used as creditworthiness benchmarks. In addition, credit rating agencies remain fully responsible for reducing the information asymmetry problem faced by borrowers and investors in the financial market.

The critical role of credit rating agencies should be to create an environment where lenders will have access to adequate information about borrowers' creditworthiness. According to Christopher, Kim and Wu (2012:1071), the problem of information asymmetry is high in emerging markets. Therefore, credit ratings serve as an important tool in emerging economies because risk could be greater compared to developed economies. Christopher *et al.* (2012:1071) indicate that rating agencies help reduce information asymmetry problems between banks and external stakeholders. According to Dierkens (1991:183), information

asymmetry is created through the manager-investor relationship. Dierkens (1991:183) argues that managers have in-depth knowledge about the bank, which may not be the case for investors. In the financial market, multiple stakeholders use credit ratings for a variety of purposes; hence, the information asymmetry is reduced.

According to Laryea, Ntow-Gyamfi and Alu (2016:464), the information asymmetries and the banks' capability to manage risks could influence the efficiency with which banks provide services. Theory suggests that information asymmetry problems and the ensuing credit market failures can impede the efficiency of both the economy and the banking environment, for instance, efficiency can be affected through the misallocation of resources (Bernanke & Gertler, 1989). Information asymmetry is the inability of lenders to access sufficient information about the borrower's actions and potential risks, which is important for lenders to evaluate the borrower's creditworthiness (Stiglitz & Weiss, 1981). It is therefore difficult for external stakeholders to access information on the creditworthiness of the bank. As a result, the rating agencies fulfil their role by managing the lack of information between banks and external stakeholders.

In the banking industry, the problems of information asymmetry between borrowers and investors could result in adverse selection and moral hazard (Stiglitz & Weiss, 1981). Stiglitz and Weiss (1981) explain that the problem of adverse selection exists before the contract or transaction is concluded between the parties whereas moral hazard refers to the situation after the conclusion of the contract or transaction. The banks provide the important service of extending loans and are therefore well aware of the adverse selection and moral hazard generated by the problem of information asymmetry. Hence, banks strive to manage the high possibility of information asymmetry through credit risk management tools.

Credit risk is one of the oldest risks in banking activities (Soyemi, Ogunleye & Ashogbon, 2014). According to Soyemi *et al*. (2014), loans are the key source of credit risk in baking institutions. Lending activities are the core business of banks (Bekhet & Eletter, 2014:20), particularly in emerging economies such as South Africa. Smit, Swart and van Niekerk (2003:41) describe credit risk as a risk that arises when one party to a financial obligation defaults on making payments as agreed. In lending activities, according to Young (2009:2),

credit risk arises through the provision of loans and contracts to support the client's obligations, which is the core business of banking institutions.

According to Smit, Swart and van Niekerk (2003:41), credit risk is the possibility of loss due to a counter party's inability or unwillingness to fulfil its financial obligations. It is evident from the above, that credit risk arises from the bank's lending activities. Therefore, there exists the possibility of borrowers defaulting on financial commitments, which would lead to moral hazard and an increase in credit risk for the bank. The most widely used measures of credit risk management are "non-performing loans" (NPLs) and loan loss provisions (LLPs) (Noman, Pervin, Chowdhury & Banna, 2015; Kolapo, Ayeni & Oke, 2012; Boahane, Dasah & Agyei, 2012; Havrylchyk, 2010). The "non-performing loan" ratio refers to "non-performing loans" against total gross loans granted to various economic sectors (Laryea *et al*., 2016; Ghosh, 2015; Abid, Quertani & Zouari-Ghorbel, 2014). These loans do not generate income for a minimum period of 90 days.

Loan loss provisions (LLPs) are raised against total loans granted to different sectors of the economy (Havrylchyk, 2010). According to Ozili and Outa (2017:145), loan loss provisions refer to an amount set aside to absorb expected losses resulting from the loan portfolio. Based on the measures mentioned above, this study uses "non-performing loans" as a measure of credit risk. According to Richard, Chijoriga, Kaijage, Peterson and Bohman (2008), "non-performing loans" are one of the main driving factors of failures in the financial system. For example, the global financial crisis that erupted in 2007-2009 due to borrowers defaulting on sub-prime mortgages/loans in the USA. Several banks were in trouble during the global financial crisis in 2007-2009 because they failed to effectively manage "non-performing loans" (Ghosh, 2015).

The South African Reserve Bank (2015) notes that the impact of the global financial crisis on the South African banking industry was minimal. However, the crisis had an unprecedented effect on the global financial system (Batten & Wanger, 2014). For example, Angola, Malawi and Nigeria were among the African countries with the highest credit risk in their banking system in the post-crisis period.

The growth and innovations in universal banking have also brought about major challenges for the management of banks. The downturns in the economy and credit rating downgrades have put the banking industry under a new spotlight. These events could undermine the industry and call for research on the relationship between credit ratings, "macro-economic" variables and credit risk in the banking sector. These undesirable events may have a detrimental impact on the banks return on equity, return on assets, but more importantly, it may result in a higher incidence of "non-performing loans" in the banking industry.

Several empirical studies have been conducted internationally on the impact of "macro-economic" and "bank-specific" factors on credit risk in the banking industry (Ghosh, 2015; Messai & Jouini, 2013; Shingjergji, 2013; Mwaurah, 2013). However, these studies focused only on the impact of "macro-economic" variables and "bank-specific" factors. To bridge this gap, this study examines the effects of credit risk when there is a movement in the credit ratings by rating agencies in the South African banking industry from 2006 to 2015.

1.2. Problem statement

The banking industry is an important stakeholder in both international and local economies. The sustainability of this industry is essential to economic development because it remains the main provider of credit to different industries. According to the South African Reserve Bank (2016), the South African banking industry is profitable and well capitalised compared to other countries in Africa. However, the problems arising from the economy, for example, rising inflation, increasing unemployment and a higher rate of defaulting borrowers could render the banking sector more vulnerable.

According to the World Bank (2016), on average, South African banks' "non-performing loans" were 3.2% for the period 2014 to 2015. This trend emphasises the importance of credit risk in South African banks. Several studies have been conducted internationally on the determinants of "non-performing loans" (Ghosh, 2015; Akinlo & Emmanuel, 2014: Messai & Jouini, 2013; Shingjergji, 2013; Mwaurah, 2013). However, these studies focused on the impact of "macro-economic" and "bank-specific" factors. The research problem can be

articulated as a study to examine the effects of credit risk on South African banks when there is a movement in the credit ratings by the rating agencies.

1.3. Research objectives

The next section provides the primary objective, secondary objectives and research questions.

1.3.1. Primary objective

The primary objective of this research is to empirically investigate the significance of credit ratings on the credit risk of South African banks during the period 2006 to 2015. In order to achieve this purpose, the following secondary objectives are formulated.

1.3.2. Secondary objectives

The following secondary objectives have been formulated:

- To test the effects of each credit rating level on the level of "non-performing loan ratio" (NPLR) in selected South African banks during the period 2006 to 2015.
- To examine the effects of each credit rating level on "non-performing loans" in selected South African banks during the period 2006 to 2015, taking into consideration the effects of the global financial crisis of 2007-2009.
- To examine the effects of "macro-economic" variables and "bank-specific" factors on credit risk in the South African banking industry during the period 2006 to 2015.

1.3.3. Research questions

In order to achieve the objectives of this study, the following research questions were formulated:

- What are the effects of each credit rating level on the level of "non-performing loan ratio" (NPLR) in selected South African banks during the period 2006 to 2015?

- What are the effects of credit rating levels on "non-performing loans" in selected South African banks during the period 2006 to 2015, taking into consideration the effects of the global financial crisis of 2007-2009?
- What are the effects of "macro-economic" variables and "bank-specific" factors on credit risk in the South African banking industry during the period 2006 to 2015?

1.4. Significance of the study

It is envisaged that this study will be of benefit to the South African banking industry, as the findings may prove useful in understanding the possible effects of credit rating changes on banks' credit risk. The contribution of this study is to inform the banking industry of the potential influence of the identified determinants on their credit risk when there is a movement in the credit ratings by the rating agencies. As such, it is imperative that banks take note and continuously monitor these potential influences and adapt their credit policies on "non-performing loans" accordingly. Therefore, it is hoped that the results of this study could ensure that banks are prepared for any adverse implications and ensure that the banking industry remains a sound and efficient contributor to the growth of the South African economy. The findings of this research may also be used as basic guidelines for policymakers, regulators and credit providers in the banking sector. For academic purposes, the findings also highlight areas for future research on this topic.

1.5. Research methodology

This section provides a brief overview of the research methodology.

1.5.1. Research design

According to Saunders, Lewis and Thornhill (2009:119), there are different research designs, namely, qualitative, quantitative and mixed methods. Qualitative analysis is applied when new theories are to be generated, which is a research based on an inductive. Quantitative research, on the other hand, is based on the deduction, where the researcher attempts to

use data to test a theory rather than developing a new one (Saunders *et al.*, 2012). Mixed methods research is a combination of both qualitative and quantitative methods.

Quantitative descriptive research seeks to obtain an accurate profile of events, persons, or situations (Saunders *et al*., 2009:140). According to Babbie (2013), this method primarily expresses information numerically, in terms of quantities and statistical controls. In line with the above discussion, quantitative descriptive design was used in this study to empirically examine the relationship between credit risk and the explanatory variables in the South African banking industry during the period 2006 to 2015. The study also sought to explain and confirm the effects of credit ratings, "macro-economic" variables and "bank-specific" factors on the dependent variable. The next section discusses population and sampling used in this study.

1.5.2. Population and sample size

This section discusses the population and sample size that are used in this study.

1.5.2.1. Population

According to Bryman (2011:187), "a population is the universe of units from which the sample is to be selected." Burns and Grove (2005:40) "define a population as all the elements, individuals and objects that meet the criteria specified for a study." In 2017, 18 banks were locally registered in South Africa; however, two new banks Tyme Digital Commonwealth Bank of South Africa and Discovery Bank were excluded from the population because both banks only began formally trading after the period 2006 to 2015.

The population of this study thus comprised 16 locally registered commercial banks over a period of ten years, from 2006 to 2015. The reason for this selection is that the study focuses on locally registered South African banks, hence the exclusion of both mutual and foreign-controlled banks.

1.5.2.2. Sampling technique and sample size

Sampling is described as a sub-set of organisations or people chosen from a target population. According to Saunders *et al.* (2012), either probability or non-probability sampling can be used. With probability sampling, each element has an equal chance of being selected. There are five forms of probability sampling namely, sample random, stratified, systematic, and cluster sampling (Salkind, 2012). In non-probability sampling, each sample is drawn from non-randomised methods. Non-probability sampling is structured in terms of voluntary, convenience or purposive (Saunders *et al*. 2012).

In this study, non-probability purposive sampling was used to select commercial banks. Only commercial banks were selected, excluding mutual banks and other banks. A sample of the following 11 banks was chosen for this study; Absa Bank Limited, Bidvest Bank Limited, Albaraka Bank Limited, Capitec Bank Limited, FirstRand Bank Limited, Grindrod Bank Limited, Investec Bank Limited, Mercantile Bank Limited, Nedbank Limited, Sasfin Bank Limited, and Standard Bank of South Africa Limited. The reason for selecting these banks was based purely on the accessibility of data for the variables chosen for this study during the period 2006 to 2015. Therefore, the exclusion of five smaller banks was due to lack of data on credit ratings and "non-performing loans" for the period under investigation.

1.6. Data collection

Data can be collected from two types of sources primary or secondary (Sekaran & Bougie, 2013). According to Gill and Jackson (2002:450), "data collection refers to the process of gathering information from selected respondents to answer the research questions, using different data collection instruments such as interviews or questionnaires." According to Sekaran and Bougie (2013), primary data is information obtained for the specific purpose of a study by the researcher whereas secondary data is information obtained from sources that already exist namely, annual financial reports and various databases. For the purpose of this study, secondary data was used.

1.7. Data analysis

Sreejesh, Mohapatra and Anusree (2009) explain that researchers can use different statistical analysis methods to transform raw data into useful information that can be used in decision-making. The data obtained from the databases and annual financial reports were cleaned and entered into an Excel spreadsheet. The Econometrics Views 10 (Eviews) software package was then used to analyse the data. The statistical methods that were used include descriptive analysis, correlation analysis and panel regression analysis.

1.8. Panel data model specification

Several statistical estimation techniques can be used for secondary data analysis. For panel regression, a fixed-effects model (FEM) or a random-effects model (REM) can be used, based on the Hausman test approach. Hausman's (1978) estimation test is utilised to select between FEM and REM for panel data. Hahn, Ham and Moon (2011) state that the FEM can be used if there is a correlation between the individual-specific effects and independent variables. However, Kouassi, Kamdem, Mougoue and Brou (2014) disagree, contending that the REM is based on the assumption that there is no correlation between the individual specific effect and the independent variables.

Based on the above discussion, a system Generalised Method of Moments (GMM) model was applied in this research. There are previous empirical studies that used the system GMM model (Nadeem, Sidra & Yuanheng, 2016; Ghosh, 2015; Alhassan, Kyereboah-Coleman & Andoh, 2014). The system GMM model was preferred over others because it solves the problem of endogeneity (Arellano & Bond, 1991).

1.9. Limitations

The study is limited to locally registered South African banks and only covers the period 2006 to 2015. The main limitation of the study was the unavailability of credit ratings and bank-specific data for some of the smaller banks. These banks were thus excluded from the analysis because of difficulty in obtaining their annual financial statements covering the

period 2006 to 2015. Although these banks were small based on their total asset base, they could nonetheless have shed some light on credit risk and bank size. Furthermore, it would have been interesting to discover how the global financial crisis affected those banks. Lastly, the study only focuses on commercial banks, therefore mutual banks and other types of banking institutions were excluded.

1.10. Structure of the study

In summary, this chapter is an introductory part of the study that outlined the background to the study. The problem statement was clearly explained and the research objectives, research question, and the significance of the study were also detailed. This chapter introduced a brief overview of the research methodology and the limitation of the study. Chapter two provides a literature review pertaining to the main concepts of credit ratings and on credit risk management in a banking environment. Chapter three describes the research methodology used in the study, the type of data and the research instruments were also detailed herein. The chapter also stated and explained the selection of the dependent variable, as well as the independent variables that are used as the determinants of NPLs. Chapter four presents the descriptive statistics and econometric data analysis, as well as the interpretation of the main findings. Chapter five concludes with a summary of the study, proposes recommendations based on the findings and makes suggestions for future research.

CHAPTER 2: Literature review

2.1. Introduction

Chapter 1 provided the background information and problem statement on which this study is based. The purpose of this chapter is to review the credit rating agencies and their role in the South African economy and banking sector. The chapter examines the literature on important concepts linked to rating agencies. Firstly, there is a discussion of the important role played by credit rating agencies and the process, which they follow when assessing creditworthiness. This is followed by a discussion of the role and importance of credit ratings in solving the problem of information asymmetry between lenders and borrowers in the financial market.

Lastly, the determinants of credit risk from "macro-economic" and "bank-specific" variables are discussed.

2.2. Credit rating agencies

Credit rating agencies (CRAs) play a critical role in financial markets by compiling creditworthiness information on corporates and disseminating this information to the financial markets (Parbhoo, 2015:27). The rating agencies express their perceptions through credit rating reports that are freely published. Investors and regulators take into consideration these reports when assessing credit risk and making their ultimate decisions. In addition, CRAs also help to reduce the problem of information asymmetry in the financial markets between lenders and borrowers.

To date, there are three international rating agencies, namely, Fitch Ratings, Moody's Investor Service and Standard and Poor’s. These rating agencies take into consideration both internal and external factors when determining a bank's credit rating. However, it appears that the rating agencies are not only concerned about credit risk when determining a bank's credit rating. According to Standard and Poor’s (2009), the rating process involves an analysis of publicly disclosed corporate information on a bank's creditworthiness. The

agencies evaluate the credit risk by analysing the individual bank's credit information, the industry within which it operates and its economic environment (S&P, 2009).

The rating agencies express their opinions about the banks' creditworthiness through credit ratings. According to Ntsalaze *et al.* (2017:126), expert opinions are essential in corporate financing decisions, risk management and investment decisions. Credit ratings play an important role in the bank's credit risk decisions (Kisgen, 2006). Al-Sakka and Gwilym (2009) also highlight the importance of external credit ratings introduced by the Basel II Accord. According to Basel II, external credit ratings must be integrated into the process of evaluating credit risk and determining capital adequacy in banking institutions. Given the critical role of external credit ratings, it is imperative for managers to maintain a good credit rating in order to influence rating agencies' perceptions about the bank's creditworthiness. A higher credit rating could also increase the capacity of banks by attracting new investors and generating external equity (Bae, Kang & Wang, 2015).

The rating agencies use rating scales to reflect their perceptions about a bank's credit quality. The rating scales indicate the risk associated with the bank's ability and willingness to satisfy its debt obligations. Table 2.1 below shows credit ratings awarded by Fitch Rating, Moody's Investor Service and Standard and Poor's agencies.

Table 2.1: Rating scale descriptions

Investment Grade	Description
AAA/Aaa	Denotes the lowest expectation of credit risk and is assigned in cases of exceptionally strong capacity for payment of financial commitments. This capacity is highly unlikely to be adversely affected by foreseeable events.
AA/Aa2	Indicates very low expectation of credit risk, very strong capacity for payment of financial commitments. This capacity is not significantly exposed to foreseeable events.
A/A2	Indicates high credit quality and the strong capacity for payment of financial commitments. However, a borrower may be exposed to adverse economic conditions than higher ratings.
BBB/Baa2	Good credit quality and current expectations for credit risk are low. Adequate capacity for payment of financial commitments. However, changes in economic conditions are more likely to impair the ability to meet financial commitments.
Speculative Grade	**Description**
BB/Ba2	Indicates the possibility of credit risk, especially in cases of adverse changes in economic conditions. However, the financial alternative may be available to allow financial commitments to be met.
B/B2	Highly speculative and significant credit risk is existent, but a limited margin of safety available. Financial commitments are being met, however, the capacity for payment is at risk due to worsening economic conditions.
CCC/Caa1	High possibility of default.
CC/Caa2	High levels of credit risk. The default seems probable.
C/Caa3	Default is inevitable.
D	Indicates that the entity has defaulted on all its financial obligations.

***Source**: S&P (2016), Fitch (2017), Moody's (2017)*

Table 2.1 above shows the highest credit rating quality at the top, from AAA to BBB. This category implies that a bank is able to service its debt obligations (investment grade). On the

other hand, BB+ to D implies a poor credit rating (speculative grade). The lowest credit quality rating indicates the agency's view about the probability of the bank defaulting (Fitch Ratings, 2016). It is important, however, to distinguish between investment-grade and speculative-grade ratings used in classifying the ratings. Given the regulation in the financial markets, institutional investors are often restricted to invest in a debt rated below investment grade (Ntsalaze *et al.,* 2017). In modern financial markets, ratings are classified into two main categories (S&P, 2016:10):

i. *Investment-grade ratings:* Regulatory bodies use the term to indicate obligations eligible for investment by institutions such as banks use the term and corporates originally used investment grade. However, over the years, the term gained popularity throughout the investment domain. It is now widely used to indicate a rating status with high levels of creditworthiness.

ii. *Speculative grade ratings* or 'junk status': This refers "to a debt borrower who has the ability to repay but faces significant uncertainties, such as adverse business or financial circumstances that could affect credit risk." The risk is far greater under speculative-grade rating.

These rating categories are separated based on the type of financial obligation (local or foreign currency) and the time to maturity of the obligation. The three rating agencies assign credit ratings by using an ordinal scale and each symbol in one agency is equivalent in the other agencies, therefore, it enables for a comparison across the ratings assigned by other agencies (Gaillard, 2009).

Table 2.2 below shows summarise the long and short-term credit ratings assigned by Fitch, Moody's and S&P rating agencies.

Table 2.2: Rating agencies scales

Moody's		**S&P**		**Fitch**		**Description**
Long-term	***Short-term***	***Long-term***	***short-term***	***Long-term***	***short-term***	
Aaa Aa1 Aa2	P-1	AAA AA+ AA	A-1+	AAA AA+ AA	F1+	**Investment Rating**
Aa3		AA-		AA-		
A1 A2		A+ A	A-1	A+ A	F1	
A3	P-2	A-	A-2	A-	F2	
Baa1		BBB+		BBB+		
				BBB	F3	
Baa2	P-3	BBB				
Baa3		BBB-	A-3	BBB-		
	Not Prime		B		B	**Speculative Rating**
Ba1 Ba2 Ba3		BB+ BB BB-		BB+ BB BB-		
B1 B2 B3		B+ B B-		B+ B B-		
Caa1 Caa2 Caa3		CCC+ CCC CCC-		CCC+ CCC CCC-	C	
Ca		CC	C	CC		
		C		C		
C		RD SD	D	DDD DD	D	
		D		D		

***Source**: Moody's (2016); S&P (2016); Fitch (2017)*

2.2.1. Moody's Investor Service

John Moody and Company first published Moody's Manual in 1900, which provided information about statistics on stocks and bonds for various sectors. The publication business became widely recognised until the stock market crashed in 1907, which also caused the publication to collapse. In 1909, John Moody returned to the financial market by offering analyses of stocks and bonds and began publishing Moody's Analyses of Railroad Investments. In 1914, he expanded his business idea, leading to the establishment of Moody's Investor Services (Moody's, 2016).

Moody's evaluates banks based on their standalone creditworthiness by analysing the financial profile and operating environment. Baseline credit assessment (BCA) is performed by considering the system-wide factors that are believed to predict the probability of banks to fail. These macro factors involve economic and institutional strength, susceptibility to event risk, credit and funding conditions and industry structure. Furthermore, the financial profile is analysed to measure the solvency and liquidity ratios of banks and adjusts the financial profile to reflect non-financial qualitative judgments. Secondly, support and structural analysis are performed to adjust the BCA to capture the likelihood of external support.

2.2.2. Fitch Ratings

Fitch Ratings initiate their analysis by first assigning viability ratings, and secondly, support floor ratings (SFR). According to Fitch Ratings (2016), viability ratings measure the intrinsic creditworthiness of a bank in order to reflect the likelihood of the entity defaulting on its obligations. The viability rating of a bank based on standalone strength involves analysing the operating environment, company profile, management and strategy, risk profile and financial profile. Lastly, Fitch's assign support ratings based on both the ability and propensity of the country/ or sovereign to provide support (on sovereign support). SFR reflects or captures the country's propensity to support the banking industry or specific bank in the event of failure.

Evidently, these rating agencies seem to follow more or less the same criteria when assessing and assigning credit ratings to the banks. However, the rating scales assigned by

the three agencies can differ slightly. Van Leare, Vantieghem and Beasens (2012) confirmed that Moody's and Standard and Poor's assign different standards of creditworthiness for a specific rating scale.

2.2.3. Standard and Poor's

Standard and Poor's analyses the banks' creditworthiness in the absence of external support. The standalone credit profile (SACP) is assessed based on the macro factors where economic and industry risk is considered in order to capture the creditworthiness of a bank. SACP is adjusted to account for "micro" (bank-specific) factors, which involve business position, capital and earnings, risk position, funding and liquidity. Secondly, an assessment is carried out to capture the probability of extraordinary government support.

2.3. Credit rating process

For the rating agencies to undertake the task of evaluating corporates, they need to have a set of standardised procedures in place. These procedures appear to be similar across the rating agencies (S&P, 2017; Moody's, 2017 & Fitch, 2017). Hence, the similarities in the procedures are to ensure a globally consistent approach in their rating process. According to the National Treasury (2015), the ratings should be reviewed at least every six months. All the analysis and judgements associated with the ratings are managed by a rating committee, which consists of a minimum of five analysts. The committee follows a strict code of conduct when assigning ratings (Fitch Ratings, 2016:1). The purpose of credit ratings is to capture long-term creditworthiness, which implies that the rating decisions do not incorporate the short-term effect. Figure 2.1 below illustrates the general credit rating process followed by the three rating agencies.

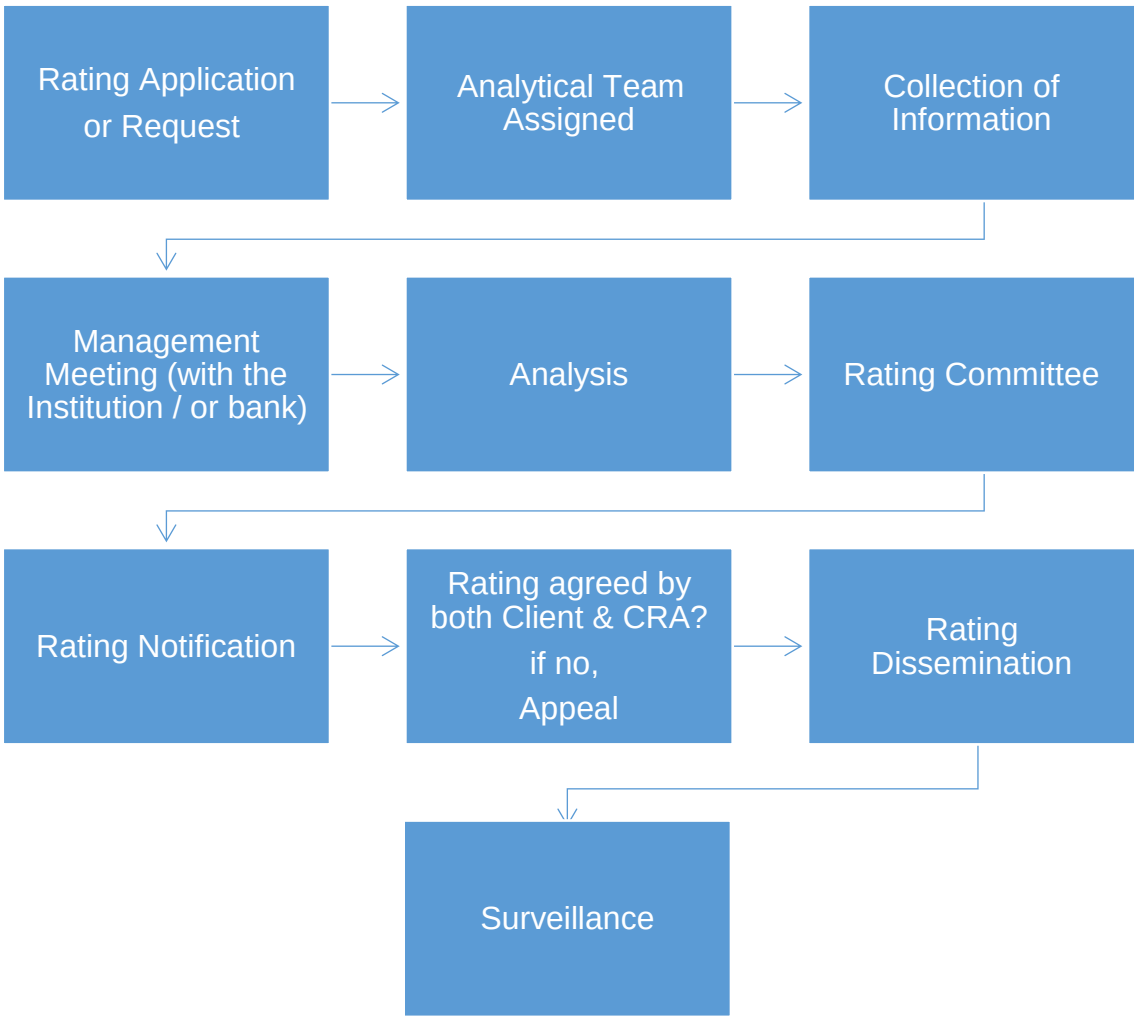

Figure 2.1: The credit rating process adapted from Moody's (2017)

Each component is discussed in more detail in the following sections.

2.3.1. Rating application

The relationship between the rating agency and the institution begins with a credit rating application or a request from the institution that will be rated, which can be in the form of a meeting or teleconference call. This step is important as it serves as an introduction between the agency and institution. This is where the agency provides important information regarding their rating process and products. Subsequently, when the parties have agreed and ready to proceed, a formal rating application form is signed and returned to the rating agency. The agency will then begin the rating process by appointing a team of analysts.

2.3.2. Analytical team assigned

The rating agency assembles a team of analysts to review all the relevant information on the institution. Moody's (2017) states that analysts assigned to a particular institution should clear any possible conflicts of interest prior to beginning the analysis. The analysts must conduct their analyses in accordance with the principles applicable to the institution or sector (Fitch, 2016:1-2). Therefore, the analysts should begin their credit analysis by collecting all relevant information pertaining to the institution from publicly available sources.

2.3.3. Collection of information

In addition to the initial, publicly available information, the institution that is to be rated is requested to provide relevant financial and non-financial information. This information may include the institution's financial and operational statistics, reports filed with regulatory bodies and industry as well as economic reports. According to Moody's (2017), the precise list of information may differ according to the sector or market information. The next step for the analysts is to meet with the senior management team of the institution that is to be assessed.

2.3.4. Management meeting

The analysts meet with the senior management team of the institution and discuss the information assembled from all relevant sources. These meetings are intended to help the analysts develop their assessment of management and corporate strategy, which are some of the qualitative factors incorporated in the rating actions (S&P, 2017:2). The review and discussion will revolve around the quantitative and qualitative factors that could be important during the rating process. The analysts then evaluate the information gathered in order to propose a rating to a committee in the agency.

2.3.5. Analysis

According to S&P (2017:2), Moody's (2017) and Fitch (2015:1-2), the analysis is a crucial stage whereby the information gathered will be analysed by applying the relevant credit rating methodologies. The analysts address the risk, in particular, credit risk, which stems from both quantitative and qualitative factors. The factors that are covered include profitability, capitalisation, funding and liquidity, management and strategy and corporate governance. Once the information has been analysed, the lead analyst will propose a rating to a rating committee in the agency.

2.3.6. Rating committee

The rating committee plays a critical role in the process as it reviews the lead analyst's rating recommendation and rationale for the proposed rating. The committee serves as a mechanism that promotes the quality, consistency and integrity of the rating process (Moody's, 2017; S&P, 2016). Hence, the rating is finalised only through rating committees by a majority vote of the members. Once the rating committee has made its decision, an appropriate rating is assigned according to the rating scales mentioned previously. The next step is for the rating committee to provide the institution with a pre-publication rationale for its credit rating.

2.3.7. Rating notification

Once the rating committee has reached a decision, the bank is informed of this decision. The committee's decision is conveyed through a draft report, which explains the key elements underlying their credit rating action (Moody's, 2017: S&P, 2016; Fitch, 2015). The report also allows a bank's management to review the agency’s credit rating action as well as a chance to identify any confidential information that should not be included in the draft. The report also gives the bank’s management an opportunity to appeal the credit rating action.

2.3.8. Appeal

Once the bank has reviewed the credit rating action, the bank's management can request an appeal if not satisfied with the rating. However, there is no specific recourse to appeal against the rating decision. A credit rating action may only be appealed if the bank is able to provide new information that would have an impact on the rating (S&P, 2017; Fitch, 2015). Therefore, where an appeal is successful, a rating committee will convene to reconsider the rating decision based on the new information.

2.3.9. Rating dissemination

Once the rating committee has reached the final rating decision and officially informed the bank, the report and credit ratings are disseminated to the agency's subscribers, and investors and is released to the public through announcements published on the agency's website as well as through major financial newswires (Moody's, 2017; Fitch, 2015).

2.3.10. Surveillance of ratings

The final step in the process is surveillance or monitoring of the rating to keep the rating relevant by detecting factors that may cause either an upgrade or a downgrade. Once the credit ratings have been published, the rating agency monitors the credit ratings periodically. Hence, the ratings are modified and updated where necessary in response to changes in the creditworthiness of the bank. The credit ratings, especially for the private sector, are reviewed at least once every twelve months whereas the sovereign ratings are reviewed at least every six months (Moody's, 2017; Fitch, 2015).

Based on the review of the literature in this section, it can be concluded that although each rating agency has its own rating system, the process is largely similar across the rating industry. In this process, the rating agencies attach a great deal of importance to the consistency of their rating product across the world. The process is initiated after the receipt of the formal request from a bank seeking to be assessed by a credit rating agency. Once the ratings have been assigned, a rating agency constantly monitors all the ratings to ensure

that they remain current as they are updated according to new political, economic or financial developments and industry trends.

2.4. Information asymmetry

Banks play an important role in the economy by facilitating transactions between investors and borrowers. By offering intermediation services between investors and borrowers, banks experience various transaction costs. The presence of information asymmetries between investors and borrowers and the banks' capability to manage risks could influence the efficiency of a banking institution (Laryea *et al*., 2016:464). Theories indicate those information asymmetry problems and the ensuing credit market failures can hinder the economy and banking environment. Efficiency can, for example, be affected through the misallocation of resources (Bernanke & Gertler, 1989). It is therefore difficult for external stakeholders to access information on the creditworthiness of the bank. As a result, the rating agencies provide an important service by managing the lack of information between banks and the external stakeholders.

According to Christopher *et al.* (2012:1071), credit ratings are widely recognised as an important credit risk assessments tools especially in emerging markets because of the problem of information asymmetry. Christopher *et al (*2012:1071) indicate that rating agencies help reduce information asymmetry problems between banks and external stakeholders. According to Dierkens (1991), information asymmetry is created through the manager-investor relationship. Dierkens (1991:183) argues that managers have in-depth knowledge about the bank, which may not be the case for investors. In the banking industry, the problems of information asymmetry between borrowers and lenders result in ‘adverse selection’ and a moral hazard (Stiglitz & Weiss, 1981). Adverse selection refers to the difficulty lenders face when distinguishing creditworthy companies from those that are riskier. The problem of adverse selection exists before the contract or transaction are concluded. Moral hazard occurs after the conclusion of the contract or transaction (Stiglitz & Weiss, 1981).

The rating agencies thus provide an important service as the third parties with access to private credit information, which they disseminate to the financial market. The lenders are

the parties that lack information; hence, they search for such information in the financial market. This information friction can impede investors from distinguishing between good and bad investments. Given the importance of credit rating information, most investors rely on this information when evaluating the risk of a company (Ntsalaze *et al.,* 2017).

Information asymmetry can also arise due to the problem of moral hazard (Laryea *et al.*, 2016:464). Moral hazard occurs because, unlike the investor, the borrower has in-depth information about their activities and their actions may influence the profits of both parties (Mutezo, 2015). To protect itself against moral hazard, a bank can use collateral after granting a loan to a borrower. Because banks cannot control borrowers' behaviour, it is imperative for banks to have loan contracts that protect their interests in terms of reducing default risk and appealing to low-risk borrowers (Stiglitz & Weiss, 1981). Collateral thus plays an important role in the banking environment.

According to Jimenez and Saurina (2004:2193), collateral can be used to manage or eliminate the problem of adverse selection arising from information asymmetry between borrowers and the bank when issuing loans. Jimenez and Saurina (2004:2194) point out that the bank creates loan agreements that enable it to differentiate between good and bad borrowers. This is because higher interest rates would generally attract high-risk borrowers with no collateral. Thus, to alleviate the problems of adverse selection and moral hazard arising from information asymmetry, lenders design loan contracts, which induce borrowers not to engage in activities that would affect the returns of the lenders (Stiglitz & Weiss, 1981). Because it is difficult for banks to distinguish between good and bad borrowers, collateral should be used to ensure the good behaviour of borrowers (Jimenez & Saurina, 2004). It is therefore important that information asymmetry is effectively managed because failure to prevent them may ultimately affect the credit risk in the banking sector.

The life cycle consumption model of Lawrence (1995) introduced the probability of default. This model assumes that borrowers with low disposable income are likely to default on their financial obligations; hence, they face the possibility of unemployment. Lawrence (1995) notes that individual consumption depends on both current and future income. According to Ghosh (2015), banks charge higher interest rates on higher risk borrowers. Therefore, the

probability of default depends on current income and unemployment rate. This theory is linked to the "non-performing loans" in the banking sector. Hence, the default rate depends on the economic environment. The next chapter focuses on credit risk management concepts and the risks associated with bank lending activities.

2.5. Credit risk management

A robust financial system is important as it contributes to a well-functioning economy in developing and developed countries alike (Hermes & Lensink, 2013). A stable and robust banking industry thus plays a vital role as its failure could undermine the economic development of the country (Richard *et al.,* 2008). However, the banking industry is exposed to various types of risk, which reinforce the importance of risk management. The risks include credit risk, market risk and operational risk. It is widely understood that credit risk cannot be eliminated because it is one of the banks largest profit drivers, hence the management of credit risk should be fundamental in a bank’s credit management process.

According to (Young, 2009:2), credit risk arises through the provision of loans and contracts to supports a client's obligations. Jin, Yu and Mi (2012:387) state that credit risk is the risk where a bank borrower or counterparty fails to meet obligations on agreed terms. According to Smit *et al.* (2016:41), credit risk is the possibility of loss due to a counter party's inability or unwillingness to fulfil its financial obligations. It is therefore evident that credit risk exists in the bank's activities. Castro (2013:673) defines credit risk as to the possibility of non-payment on loan interest or principal (partially or totally) to the lender. Such exposure means that credit risk is a fundamental risk of banking intermediation.

Bohachova (2008) indicates that the business cycle is the main driver in the evolution of credit risk. In periods of higher economic growth, banks tend to accumulate more risks, which may materialise during subsequent recessions (Castro, 2013). Risk management processes are therefore essential in maintaining credit risk at a minimum level in the banking industry. Credit risk management can be understood as a framework for managing losses and minimising the potential effects of credit risk. This is vital in banking institutions as credit risk forms an integral part of the loan process (Abila & Olausi, 2014). Kolapo *et al.* (2012:32)

elaborate that, “credit risk management maximises a bank's risk-adjusted rate of return by maintaining credit risk exposure within acceptable parameters”.

Brown and Moles (2014:17) define credit risk management as a process that identifies and controls credit loss exposure faced by banks. The management of credit risk in the banking institution includes phases such as credit risk identification, measurement, evaluation, monitoring and control. According to Brown and Moles (2014:3), credit risk management identifies the potential risk factors, evaluates their consequences, monitors the identified risk and puts control measures into place to minimise or prevent the risk exposure. It is important for credit risk management to be a continuous process that forms an integral part of the bank's risk management strategy.

Credit risk policies and procedures should be clearly specified in the overall risk management of the banking institution (Richard *et al.,* 2008). Therefore, such policies should determine the bank's credit risk and serve as a framework on how to manage credit risk exposure. The global financial crisis of 2007-2009 has shown that a banking crisis can have a profound impact on the economy. Castro (2013) contends that banking crises may arise because of changes in the economic environment. This means that negative economic growth may increase the risk of credit default in the banking industry. Several studies have investigated the influence of "macro-economic" and "banking industry-specific" factors on credit risk. Examples of "macro-economic" factors include the gross domestic product, inflation, the exchange rate and unemployment rate. "Bank-specific" factors include capital adequacy ratio, loan growth and bank size in terms of the asset base. The identified determinants can influence credit risk when there is a movement in the credit rating by the rating agencies.

It is evident that credit risk is embedded in loans, however, there are other types of financial products from which this risk can arise, for example, derivatives, asset-backed securities (ABS), foreign exchange transactions and hedging in equities and futures (Mendoza & Rivera, 2017). The global financial crisis has indicated the importance of credit risk in the banking industry and the overall economy. Credit risk was recognised as one of the dominant contributing factors to the 2007-2009 financial crisis (Ghosh, 2015).

Monokroussos, Thomakos and Alexopoulos (2016:16) indicate that a "high level of non-performing loans tends to increase operating costs in terms of their monitoring and management, which results in requiring higher provisions". The authors maintain that this situation often deters capital adequacy and lending terms for a bank. However, if a bank is to mitigate credit risk, it is required by regulators to set aside loan loss provisions (LLPs) in order to absorb any expected losses (Ozili & Outa, 2017). Loan loss provisions are an important facility implemented by banks against losses resulting from a bank's loan portfolios. According to Ozili and Outa (2017), there is no set minimum percentage to constitute adequate LLPs. Therefore, tightening lending criteria and loan loss provisions should be considered as the main tools to manage credit risk. Figure 2.2 illustrates the identified "macro-economic" and "micro-economic" determinants.

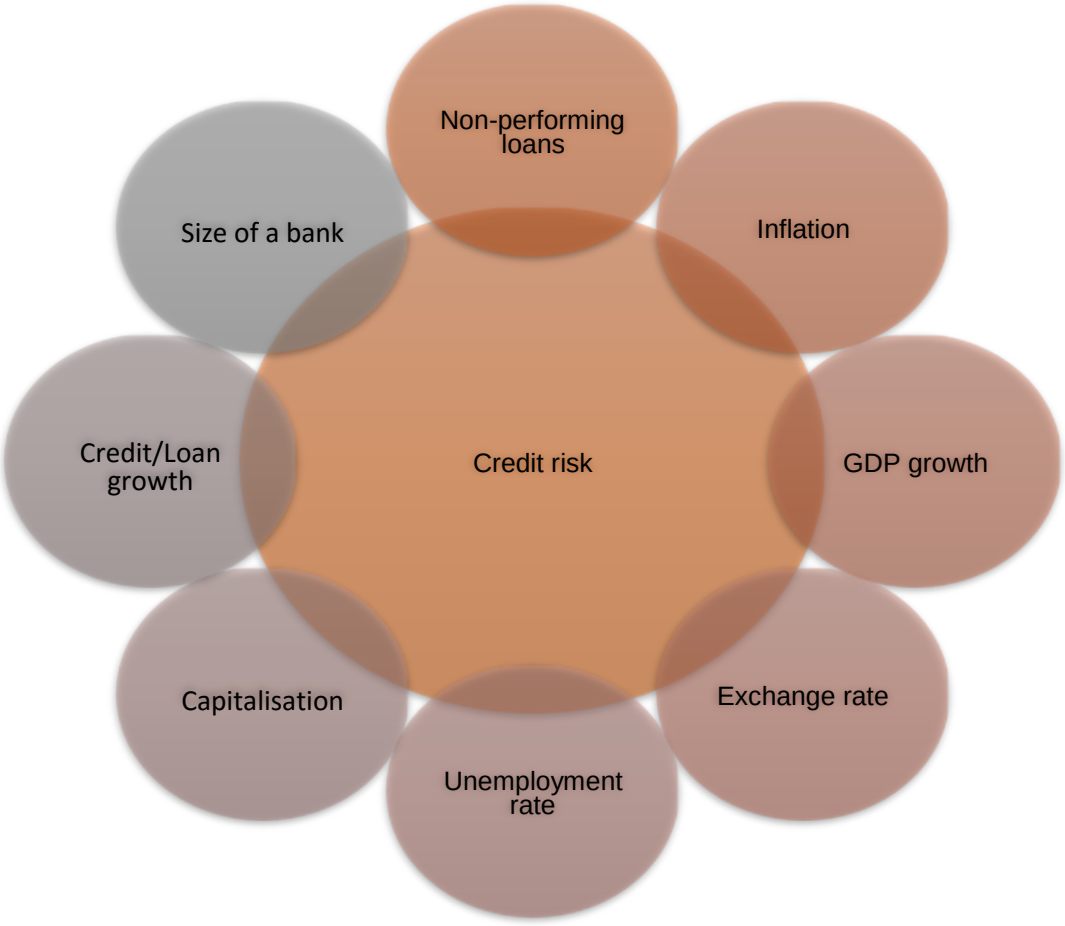

Figure 2.2: Credit risk determinants

***Source**: Author's own compilation*

Each of these determinants is discussed in detail in the following sections.

2.5.1. Non-performing loans

The most common determinant of credit risk is loans. "Non-performing loans" (NPLs) arise when a loan is extended or a loan transaction concluded which turns out to be non-productive during a specific time. The bank then classifies these loans as "non-performing" (Thiagarajan, 2013). "Non-performing loans" can be represented as the ratio of "non-performing loans" to total gross loans extended to different sectors of the economy (Mwaurah, 2013). Therefore, a high level of "non-performing loans" would indicate a decrease in the balance sheet, which would eventually expose a bank to credit risk. Ghosh (2017:304) defines the NPL ratio as the sum of the total loans and leases past due 90 days or more, divided by total gross loans. These loans are no longer generating income; therefore, they may reduce the bank's ability to provide credit to other sectors of the economy (Ghosh, 2017).

When the level of NPLs is very high in the banking system, operating costs also increase as well as the loan provisions for banks. The "non-performing loans" usually affect the capital adequacy and credit terms of the banks (Monokroussos, Thomakos & Alexopoulos, 2016). Louzis, Vouldis and Metaxas (2012:1013) examined factors influencing NPLs in the Greek banking system over the period 2003 to 2009 and noted that real GDP, the unemployment rate and interest rates significantly affect "non-performing loans".

PricewaterhouseCoopers (PwC) (2017:4) highlight that a mix of low economic growth, lower debt and collateral quality can be detrimental to banking sustainability. PwC (2014:4) add that low GDP growth, a high unemployment rate, the bank's lending practices and interest rates are among the key factors that influence the level of NPLs in the banking system. It can be deduced that NPLs in a bank is highly influenced by the economic environment; therefore, "macro-economic" factors will form a substantial part of investigating the sources of credit risk in this study.

2.5.2. Gross domestic product

The gross domestic product (GDP) measures the economic growth of a country (Ongore & Kusa, 2013). The authors further point out that when the GDP rate is growing, it means that the economy of a country is progressing, which leads to higher demand for loans because of the nature of the business cycle. Thus, during economic prosperity, the standard of living for workers improves and correspondingly, the loaning activities of banks increases along with the GDP growth. It confirms a positive relationship between banks' "non-performing loans" and economic (GDP) growth (Makri, *et al.* 2014; Garr, 2013).

Empirical studies by Bucur and Dragomirescu (2014), Haryono, Ariffin and Hamat (2016) and Touny and Shehab (2015) all confirm the negative relationship between the GDP rate and "non-performing loans". Ghosh (2015) also found a negative and significant relationship between GDP and "non-performing loans". Umar and Sun (2018) report similar results, establishing an inverse relationship between GDP and "non-performing loans". Based on the Modigliani's 'life cycle of consumption' model and the business cycle theory (Browning & Crossley, 2001), the economy is one of the most important driving factors that influence loan portfolios. These theories thus suggest that gross domestic product is negatively associated with "non-performing loans".

Lawrence's (1995) life cycle model with default suggests that borrowers with low incomes tend to push up the default rate because of the high possibility of being unemployed and unable to fulfil their loan obligations. According to Ghosh (2015:95), the rate of default depends on the current income and the rate of unemployment. The results imply that economic progress plays an important role in the behaviour of credit risk in the banking sector. Therefore, a negative outcome indicates that the economic progress of a country can lead to a reduction in "non-performing loans".

2.5.3. Inflation

Inflation (INF), according to Haryono *et al.* (2016:14), represents a sustained increase in the overall price of goods and services over a given period, in a particular economy. According

to Skarica (2014), inflation is one of the determinants responsible for "non-performing loans" in emerging economies. Therefore, an overall increase in the price of goods and services cannot be disregarded when examining the macroeconomic determinants of credit risk in the banking sector. According to Bucur and Dragomirescu (2014), inflation can affect the efficiency of the banking sector. Barth *et al*. (2013) found a negative relationship between inflation and bank efficiency, which implies that lower inflation is more expedient for bank efficiency. A sustained increase in the price of goods and services has a negative impact on the economy and hampers the efficiency of banks (Ghosh, 2015) since it limits the growth of consumer spending and investment.

The relationship between credit risk and inflation can be ambiguous (Ghosh, 2015), however, because higher inflation tends to assist borrowers in repaying their debt. Therefore, the relationship between inflation and credit risk in the banking sector can be either positive or negative. When inflation is high, the real value of outstanding loans becomes lower (Ghosh, 2015). However, according to Havrylchyk (2010), central banks tend to increase interest rates when inflation is estimated to rise above the inflation target. At the same time, higher inflation increases the cost of borrowing and reduces disposable income, especially when wages do not increase with inflation (Havrylchyk, 2010). A positive relationship between inflation and credit risk has been found by Haryono *et al.* (2016) and Pretorius and Botha (2016). Umar and Sun (2018) also confirm a significant and positive relationship between inflation and "non-performing loans". Laryea *et al.* (2016) found that inflation has a positive relationship with "non-performing loans". These authors confirm that a higher inflationary environment is associated with higher credit risk in the banking sector.

In contrast, however, other authors report a negative relationship between inflation and credit risk. Studies by Zribi and Boujelbene (2011), Vogiazas and Nikolaidou (2011) identify a negative relationship between inflation and "non-performing loans". Bofondi and Ropele (2011) corroborated these findings in the case of the Slovenian banking system. Other studies observe that inflation is not significant in explaining the variation in "non-performing loans". Valahzaghard *et al*. (2012) confirm no significant relationship between inflation and credit risk in Iran. The relationship between inflation and credit risk is therefore uncertain and can be either positive or negative.

2.5.4. Exchange rate

The exchange rate (EXR) represents the relative price of the local currency against other currencies (Washington, 2014). Isaac (2015) describes the exchange rate as the reaction of bank market value to unexpected exchange rate fluctuations. Borrowing in foreign currency is an important component of the financial markets, especially in developing economies such as South Africa. Credit risk can arise when banks borrow in foreign currency and extend credit in domestic currency. This means that depreciation of the domestic currency could expose the bank to exchange rate risk. According to DemirgucKunt and Detragiachie (1998:86), banks can hedge against the exchange rate risk by extending domestic loans denominated in foreign currency, whereby the risk is transferred onto the borrowers. The author's further state that when the domestic currency depreciates, a bank's "non-performing loans" would also increase because of the increase in borrowers' debt burden. Therefore, an increase in the exchange rate is expected to increase the debt repayment burden of borrowers, which in turn increases the probability of default in the banking sector.

Empirical studies by Bucur and Dragomirescu (2014) and Washington (2014) identify a negative and significant relationship between exchange rate and credit risk. Castro (2013) conducted a study covering Greece, Ireland, Portugal, Spain and Italy from 1997 to 2011. Castro (2013) found that the exchange rate negatively affected the loan portfolio quality in the banking systems of these countries. According to Beck, Jakubik and Piloiu (2013), a depreciation in domestic currency can increase "non-performing loans" in countries with unhedged borrowers extending credit in foreign currencies. However, Akinlo and Emmanuel (2014) indicate that appreciation in the exchange rate can negatively affect the performance of export-oriented sectors, which can weaken banks’ loan portfolios. This implies an appreciation in domestic currency would increase the cost of goods and service produced in that country, which would, in turn; affect borrowers' capability to service debt (Castro, 2013). Moinescu (2012) found a positive relationship between the exchange rate and "non-performing loan" ratios. Farhan, Sattar, Chaudhary and Khalil (2012) confirmed similar results between exchange rates and "non-performing loans". It can, therefore, be concluded that the exchange rate can have a negative effect on banks’ credit risk.

2.5.5. Unemployment rate

The unemployment rate (UNE) refers to the percentage of the workforce that is not working yet is willing and able to work and is actively seeking employment (Statistics South Africa, 2017). Economic progress plays an important role in a country as economic growth can have an impact on the behaviour of credit risk. According to Statistics South Africa (2014), the country experienced a slowdown in economic growth, high inflation and an unemployment rate of 25.5% in the second quarter of 2014. Therefore, due to the high rate of unemployment, the banking industry is faced with challenges in managing default risk. According to the life cycle of consumption model of Modigliani and the business cycle theory, the economy is one of the most important driving factors that influence loan portfolios (Lawrence, 1995). The theory implies that the unemployment rate is positively associated with "non-performing loans".

Castro (2013:674) points out that the high rate of unemployment adversely affects the disposable incomes of households and their debt repayment capacity. He explains that unemployment may also have negative effects on companies' production due to low demand for goods and services. Therefore, a decrease in cash flow streams for both households and firms may lead to an increase in "non-performing loans" in the banking sector. The life cycle model with a default of Lawrence (1995) suggests that borrowers with low incomes tend to escalate the default rate because of the high possibility of being unemployed and unable to fulfil their loan obligations. Ghosh (2015) observes that banks lend at a higher interest rate to borrowers with lower creditworthiness; hence, the default rate is influenced by both current income and the unemployment rate.

Akinlo and Emmanuel (2014) assert that unemployment positively influences "non-performing loans". They suggest that an increase in unemployment in the country negatively affects an individual's income, and thus increases their debt repayment burden. Bofondi and Ropele (2011) observe a positive relationship between "non-performing loans" and unemployment rate. Messai and Jouini (2013) also confirm the positive influence of the

unemployment rate on "non-performing loans" in 85 banks in Italy, Greece and Spain. The unemployment rate can, therefore, be expected to have a positive influence on credit risk in the banking sector.

2.5.6. Capitalisation

Bank capitalisation (CAR) is measured by total equity as a percentage of total assets, which indicates the solvency of a bank. Capital represents the amount of capital which banks are required to hold in order to safeguard the deposits accepted by the bank. Laurine & Le Roux (2013) indicates that banks are required to maintain a minimum amount of capital in order to be able to absorb future losses. According to Ghosh (2015), the effect of bank capitalisation on "non-performing loans" can be ambiguous. Ghosh (2015) explains that managers in banks with a low capital base tend to have a moral hazard incentive to engage in risky lending practices and extend loans to lower creditworthiness borrowers. This moral hazard theory implies an inverse relationship between equity capital and "non-performing loans" (Ghosh, 2015). According to this theory, the lower capital adequacy ratio can result in a higher rate of "non-performing loans".

On the other hand, banks that have higher capital ratio might be willing to relax their credit standards and lend to riskier borrowers. This is in line with the ‘too big to fail’ hypothesis (Rajan, 1994), which implies a positive relationship between the capital adequacy ratio and "non-performing loans". Ghosh (2015) observes a positive and significant relationship between capitalisation and "non-performing loans", reporting that a higher capital ratio increases with "non-performing loans". Laryea *et al.* (2016) indicate that highly capitalised banks are willing to accept more credit risk (NPLs). However, Sala and Sauria (2002) found a negative relationship between industry capital ratio and "non-performing loans". Agoraki *et al*. (2011) indicate that capital ratio has a negative influence on credit risk by reducing "non-performing loans". Based on the results of these studies, the relationship between the bank capitalisation and "non-performing loans" appears to yield mixed results and can, therefore, be expected to be either negative or positive.

2.5.7. Credit/Loan growth

Lending is one of the key sources of external financing in both developing and developed economies (Vithessonthi, 2016). However, it appears that banks are more willing to extend credit to different sectors of the economy during a period of economic growth. In support of this argument, Castro (2013) indicates that bank loans are cyclical, which implies that more risky loans are accepted during a period of economic progress. In this case, banks increase their credit growth (CG) by making loans to riskier borrowers, for example, by relaxing credit standards or charging lower interest rates. According to Vithessonthi (2016:296), the loans that are accumulated during economic growth tend to materialise in periods of economic recession. This implies that the relaxation of credit standards and a slowdown in the economy would increase the probability of defaults by borrowers (Laryea *et al.*, 2016), hence an increase in "non-performing loans".

An empirical study by Vithessonthi (2016) investigated the impact of credit growth on "non-performing loans", considering the effects of the 2007-2009 global financial crisis on the Japanese banking sector. He established a positive relationship between credit growth and "non-performing loans" prior to the financial turmoil. However, a negative relationship was identified after the global financial crisis. The results indicate that the relationship between credit growth and "non-performing loans" varies over time and hence can be either negative or positive. In contrast, Ghosh (2015) and Sheefeni (2015) found that credit growth is positively related to an increase in "non-performing loans". Castro (2013) also found a positive relationship between credit growth and credit risk. Salas and Saurina (2002) established a positive relationship between credit growth and "non-performing loans". Therefore, a positive relationship between banks' "non-performing loans" and credit growth can be expected.

2.5.8. Size of a Bank

The size of banks is imperative because the banking sector provides an important service to different sectors of the economy (Schildbach, 2017). Larger banks tend to have a comparative advantage over smaller banks because of their asset base or risk stability

(Berger & Black, 2011). This suggests that larger banks are better positioned to service the needs of bigger sectors in the economy, hence such banks are considered to have high creditworthiness. Total assets are thus often used to measure the size of the bank, which represents the bank's overall capacity to fulfil its role of a financial intermediary (Marozva, 2017).

Although the size of the bank is important, banks also face the challenge of being ‘too big to fail’. Ghosh (2015:96) indicates that banks in a larger banking industry may increase their leverage too much and extend loans to low-quality borrowers. He found that in such larger size industries, banks often are willing to relax credit standard or extend loans to borrowers with lower creditworthiness. According to Marozva (2017:130), "the size of the bank positively contributes to its liquidity levels, hence larger banks are more stable compared to smaller banks." The size of a bank measured in terms its total assets would positively influence the rate of "non-performing loans". Amuakwa-Mensah and Boakye-Adjei (2015) investigated the determinants of "non-performing loans" in the banking industry in Ghana; their results revealed a positive relationship between industry size and "non-performing loan". Ghosh (2015) found a similar result between the size of the bank and "non-performing loans" in the US banking industry.

In contrast, however, some scholars such as Abid *et al.* (2014) and Laryea *et al.* (2016) confirm a negative relationship between the size of a bank and "non-performing loans". Hu, Yang and Yung-Ho (2004) identified a negative relationship between "non-performing loans" and the size of a bank. The results imply that the relationship between "non-performing loans" and the size of a bank can be ambiguous, which means it can be either negative or positive.

2.6. Conclusion

The chapter has reviewed the literature on the credit rating process and credit risk management. It was established that credit ratings are important in solving the problem of information asymmetry between borrowers and lenders in financial markets. The impact of information asymmetry on bank lending can lead to adverse selection and moral hazard between lenders and borrowers. Therefore, to manage these problems, lenders should use

appropriate measures; however, these problems cannot be eliminated between lenders and borrowers. The literature has indicated the importance of credit risk management in the banking industry. It appears that the main credit risk exposures to a bank emanate from "non-performing loans", credit or loan growth and capitalisation, and those factors outside the direct control of a bank (macroeconomic factors). "Non-performing loans" to total loans and advances represent the credit quality of a bank. A higher value indicates the poorer the credit quality and therefore, the higher the risk of possible bank failure or reduction to further lending. "Non-performing loans" are widely known as a burden that affects both lenders and borrowers because they can contract credit supply as well as slow down economic growth. It was established that banks should be aware of the loan growth because credit quality significantly decreases if the aggregate lending is excessive. It implies that credit growth is positively influencing the "non-performing loans". Capitalisation and bank size are the other factors of credit risk, which are identified as forming an integral and important part of credit risk management. With respect to capitalisation, banks are urged to maintain a higher capital adequacy ratio, which should reduce credit risk. However, the relationship between capitalisation and "non-performing loans" can be either positive or negative.

With respect to "macro-economic" determinants, the economic progress of the country can affect both borrowers and lenders. It implies that when the economy is growing, the gross domestic product will also be increasing, and thus ensures an increase in banks' lending activities. For borrowers, it means an increase in production of goods and service and their disposable income, which lead to a decrease in the debt burden. Therefore, it is expected that an increase in economic growth will result in a decrease in banks "non-performing loans".

It is evident that an overall increase in the price of goods and services has a negative impact on the economy and impedes the efficiency of banks. It was established that higher inflation increases the cost of borrowing and reduces disposable income when wages do not increase with inflation. Hence, higher expected inflation might reduce the growth of consumer spending as well as investment. A negative relationship between inflation and "non-performing loans" is expected. It has also been recognised that currency depreciation can have adverse effects, especially when a large portion of the loan portfolio is denominated in foreign currency. This implies that exchange rate depreciation would increase the repayment

burden for borrowers with loans denominated in foreign currency. It is expected that the exchange rate should have a negative influence on "non-performing loans". A positive relationship between the unemployment rate and "non-performing loans" is expected. It was established that unemployment adversely affects the income level of borrowers. Hence, the higher unemployment rate would negatively affect the payment capacity of borrowers and lead to an increase in the default rate.

This chapter provided the literature review of the study where various "macro-economic" and "bank-specific" factors are identified as the most important factors contributing to "non-performing loans" in the banking industry. The next chapter will deal with the research methodology for empirical research.

CHAPTER 3: Research methodology

3.1. Introduction

The previous chapter focused on the literature review, which examined the effect of credit ratings on the credit risk of South African banks. The purpose of this chapter is to describe the research methodology that was applied in this study. This chapter also deals with the research philosophy, approach, design and population as well as sample choice and sample size. This is followed by data collection and analysis and lastly, a discussion of the model specifications.

3.2. Research philosophy

Saunders *et al*. (2012) describe the research process in the shape of an onion, as shown in Figure 3.1 below.

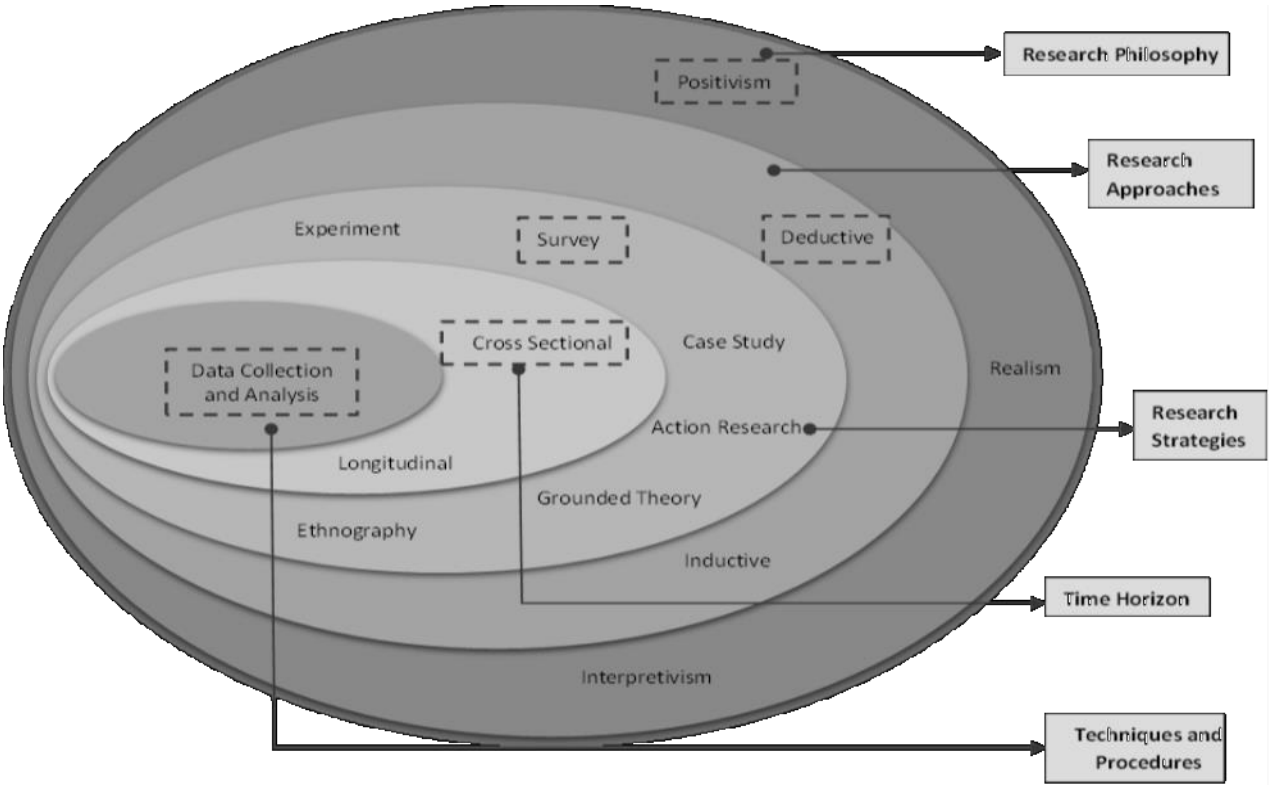

Figure 3.1: The research onion

***Source**: Saunders et al. (2012:128)*

Each layer of the onion needs to be considered before undertaking any research study. The research philosophy is the first important layer. Sudeshna and Datt (2016) define a research philosophy as the basic belief system or worldview that guides the investigation. Saunders and Tosey (2012) refer to a research philosophy as a set of assumptions according to which the researcher views the world. Research is thus based on the philosophical assumptions of the researcher, who decides which approach should be adopted and why.

There are three different types of research philosophy, namely, positivism, realism and interpretivism. According to Gill and Johnson (2010),” positivist scholars argue that the world is concrete and real and that distance is necessary between the researcher and the object. This is to prevent the former's subjective feelings from affecting the research process, which could otherwise lead to bias. Positivists believe that observations and measurements are the core of all scientific research." Similar to positivism, realism is associated with a scientific approach and based on the assumption that reality exists independently from human influence (Saunders & Tosey, 2013). Interpretivists, on the other hand, assume that knowledge of reality is a social construct, created by human actors (Saunders *et al*., 2012). Interpretivists' researchers are concerned with gaining rich insights into the context of the topic under investigation (Saunders & Tosey, 2012). They, therefore, understand a 'reality' from a different perspective to that of the positivist and favour qualitative methods for analysis. Realism is based on the assumption that reality exists independently from the human mind.

This study seeks to examine the potential effect of credit ratings on credit risk employing secondary data in an unbiased manner and without any interference in the outcomes. The positivist philosophy was therefore chosen for this study, as it is well suited to this objective.

3.3. Research approach

The next layer of the research onion that needs to be considered is the research approach. This layer involves choosing a specific research method for a study. Sudeshna and Datt (2016) describe a research approach as a plan and procedure that includes the assumptions, which assist the researcher to make an informed decision about the methods of data

collection, analysis and interpretations. According to Saunders *et al.* (2009), a research approach may be either deductive or inductive.

There are different research methods, for example, qualitative, quantitative or mixed methods. A deductive approach involves the testing of a theoretical proposition by using research strategy designed to perform the test. An inductive approach, on the other hand, involves the development of a theory based on data which has already been collected (Burney, 2008). Qualitative analysis is utilised when new theories are to be generated, which is when an inductive research approach is used. Quantitative research is based more on deductive theory, where the researcher attempts to use data to test a theory rather than developing a new one (Saunders *et al.*, 2012).

For the purposes of this study, a deductive approach was deemed best suited. Therefore, the research can also be classified as quantitative in nature. According to Creswell (2012), quantitative research involves testing objective theories by examining the relationship among variables. Babbie (2013) defines "quantitative research as a method that primarily seeks to express information numerically, in terms of quantities and statistical controls." The next paragraph discusses the research design.

3.4. Research design

Saunders *et al.* (2009:136) define a research design as a general plan of how the research question(s) will be answered. This plan should include a framework of what the researcher will do; such as the objectives resulting from the research hypothesis, sources from which the data will be collected, the manner in which the data will be analysed and how ethical issues will be dealt with in the study.

According to Weathington *et al.* (2012), research designs are methods that are used for collecting data, which will conclusively answer a research question. There are different research designs, for example, explanatory, exploratory or descriptive (Saunders *et al*., 2012). An explanatory design allows the researcher to determine the causal relationships between variables while exploratory research is a valuable means of asking open questions to ascertain what is happening and gain new insights about a topic of interest (Saunders *et al*., 2012). On the other hand, a descriptive study is designed to gain an accurate profile of

events, persons or situations (Saunders *et al*., 2009), therefore, there is no need for any other design. For the purpose of this study, the researcher utilises a descriptive research design to investigate the relationship between credit risk and the independent variables in the South African banking industry. The next section discusses population and sampling used in this study.

3.5. Population and sample size

This section discusses the population and sample size for this study.

3.5.1. Population

According to Bryman (2012:187), "a population is the universe of units from which the sample is to be selected". Burns and Grove (2005:40) define "a population as all the elements, individuals and objects that meet the criteria specified for a study." In 2017, 18 banks were registered in South Africa (see Table 3.1 below). Of these, two new banks, namely Tyme Digital Commonwealth Bank of South Africa and Discovery Bank, were excluded from the population because both banks have not formally begun trading for the period 2006 to 2015.

Table 3.1: SA banking industry as at 31 December 2017

Name of Bank	Total assets as at 31 December by total assets 2017 (R millions)	Ranking of banks
Standard Bank South Africa Ltd	1 254 849	1
FirstRand Bank Ltd	1 120 747	2
Absa Bank Ltd	983 378	3
Nedbank Ltd	892 006	4
Investec Ltd	415 285	5
Capitec Bank Ltd	87 066	6
African Bank Ltd	31 356	7
Grindrod Bank Ltd	16 696	8
Mercantile Bank Ltd	12 892	9

Name of Bank	Total assets as at 31 December 2017 (R millions)	Ranking of banks by total assets
Bidvest Bank Ltd	8 508	10
Sasfin Bank Ltd	7 778	11
Albaraka Bank Ltd	5 930	12
UBank Ltd	5 224	13
HBZ Bank Ltd	4 856	14
South African Bank of Athens Ltd	2 355	15
Tyme Digital (Commonwealth Ba**nk of South Africa) Ltd**	1 403	16
Habib Overseas Bank Ltd	1 186	17
Discovery Bank Ltd	622	18

***Source**: Adapted from Marozva (2017)*

The target population thus comprised 16 commercial banks, which were in operation for the period 2006 to 2015. Because the focus of the study was on locally registered South African banks, both mutual and foreign-controlled banks were excluded.

3.5.2. Sampling technique and sample size

Sampling is described as a subset of organisations or people chosen from a target population. By studying the sample, the researcher should be able to generate the results that are representative of the entire population of interest (Salkind, 2012). Wolverton (2009) affirms that a well-designed sample should produce results that are representative of the entire population. According to Saunders *et al.* (2012), there are two types of sampling probability and non-probability. Examples of probability sampling are systematic, simple random, stratified or cluster sampling. Remler and Van Ryzin (2011:169) describe systematic sampling as a method of drawing every tenth subject or item from the list, beginning at a certain starting point. Simple random sampling is a technique where a subset of individuals is selected from a larger population. In this sampling technique, each individual is chosen

randomly in a manner that each individual has an equal opportunity to be included in the sample (Saunders et al., 2012). In stratified sampling, the population is divided into a number of groups or strata, which must be mutually exclusive (Remler & Van Ryzin, 2011). Similar to stratified sampling as with cluster sampling the researcher need to divide the population into separate groups before sampling (Saunders *et al.,* 2012). Therefore, a simple random sample of clusters is selected from the population.

According to Saunders *et al.* (2012:284), non-probability sampling can be voluntary, convenience or purposive. With the first method, Saunders *et al.* (2012) indicate that participants can be recruited to participate voluntarily. With convenience sampling, the researcher relies on the specific situation of the participants as the selection of the subjects is based on their accessibility to the researcher. With purposive sampling, the researcher uses their own judgement to choose the subjects who are likely to best answer the research questions (Saunders *et al.*, 2012:287).

In ensuring that the sample was representative of the population, the researcher used non-probability, purposive sampling to choose the commercial banks. A sample of 11 banks, namely, Absa Bank Limited, Albaraka Bank Limited, Bidvest Bank Limited, Capitec Bank Limited, FirstRand Bank Limited, Investec Bank Limited, Nedbank Limited, Mercantile Bank Limited, Grindrod Bank Limited, Sasfin Bank Limited and Standard Bank South Africa Limited was chosen for this study. These banks were selected based purely on the availability of the required data on the variables under investigation. The exclusion of five smaller banks from the analysis was due to the lack of data on credit ratings and "non-performing loans" for the period under investigation.

3.6. Data collection

Data can be collected from two types of sources either primary or secondary (Sekaran & Bougie, 2013). According to Gill and Jackson (2002), data collection refers to the process of gathering information from selected respondents to answer the research questions, using different data collection instruments such as interviews or questionnaires. In other words,

data collection methods refer to the actual ways of gathering information for a study (Babbie, 2008).

According to Sekaran and Bougie (2013), primary data is information obtained for the specific purpose of a study by the researcher whereas secondary data is information obtained from sources, which already exist. Secondary data was used in this study, sourced from the banks' annual financial reports. Economic data was also extracted from the Bankscope-Bureau van Dijk database, Moody's website and various annual reports, South African Reserve Bank (SARB) website, World Bank databases on African development indicators and global development finance. Since the study primarily uses annual data, therefore, quarterly and monthly reports were used to compute the annual averages.

3.7. Data analysis

Sreejesh *et al.* (2009) explain that different statistical analysis methods can be used to transform raw data into useful information, which can then be used in decision-making. In this study, the data was cleaned and entered into an Excel spreadsheet. The Econometrics Views (Eviews) software package was then used to analyse the data. The statistical methods that were used included descriptive analysis, correlation analysis and panel regression analysis.

The first level of data analysis involves organising the data, as this helps the researcher to summarise the data. According to Salkind (2012), the data can be reduced to one or two descriptive summaries, such as the mean and standard deviation or correlation. With descriptive analysis, the purpose is to predict the future behaviour of the variable being observed over time. The data were analysed using descriptive statistics to understand the impact of credit ratings on the credit risk of the sampled banks (Salkind, 2012).

After performing the trend analysis of the variables, the researcher established the strength of the relationship using the correlation analysis. As the objective of the study was to determine the nexus between credit ratings and credit risk, all the variables were subjected to correlation analysis. Multiple regression analysis was then used to examine the relationship between one continuous dependent variable, the other key independent

variables and the control variables. The next section discusses the panel data model for this study.

3.8. Panel data model specification

The study used a "non-performing loan" ratio as a proxy for credit risk. The independent variables consisted of individual credit rating codes, gross domestic product, inflation, exchange rates and unemployment whereas the bank-specific included capitalisation, credit growth and control variable was the size of a bank.

This section presents the main estimation using the Generalised Method of Moments (GMM) model. There was only one dependent variable NPLs, which is one of the most important indicators of credit risk. In order to model the non-performing loan ratio of selected banks, the generic GMM model developed by Arellano and Bond (1991) had the following equation:

$$\boldsymbol{y}_{i,\mathrm{t}} = \boldsymbol{\alpha y}_{i,\,t-1} + \boldsymbol{\beta x}_{i,t} + \mu_i + \boldsymbol{\varepsilon}_{i,t} \qquad \textbf{(3.1)}$$

Where:

- The variable $y_{i,t}$ is the "non-performing loan" ratio measures for banks *i* in time *t*;
- $x_{i,t}$ is the vector of the independent variable for bank *i* for time *t,* representing the macroeconomic variables and the bank-specific variables;
- α_0 indicates the slope of the lagged "non-performing loan" variable;
- β is a vector of the unknown parameters;
- μ_i denotes fixed effects in a bank;
- $\varepsilon_{i,\mathrm{t}}$ is a random error term; and the subscript *i* denotes the cross-section and *t* represents the time-series dimension.

For this study, a panel data regression model was used, hence the econometrics model was adopted to measure the importance of each credit rating level on the "non-performing loan" ratio. The statistical evaluation and estimation technique selection of the panel regression between a fixed-effects model (FEM) and a random effect model (REM) was undertaken

based on the Hausman test approach. This test is utilised when selecting a suitable approach between FEM and REM for panel data (Hausman, 1978). Hahn *et al.* (2011) state that the FEM can be used based on the assumption that there is a correlation between the individual-specific effects and independent variables. However, Kouassi *et al.* (2014) argue that the REM is based on the assumption that there is no correlation between the individual specific effect and the independent variables. The researcher derived the following econometric model for this study:

$$\mathrm{NPLR_{it}} = \beta_0 + \beta 1\ \mathrm{ICR_{it}} + \beta 2\ \mathrm{GDP_{it}} + \beta 3\ \mathrm{INF_{it}} + \beta 4\ \mathrm{EXR_{it}} + \beta 5\ \mathrm{UNE_{it}} + \beta 6\ \mathrm{CAR_{it}} +$$

$$\beta 7\ \mathrm{CG_{it}} + \beta 8\ \mathrm{SIZE_{it}} + \beta 9\ \mathrm{Dummy_{it}} + \varepsilon_{it} \qquad \textbf{(3.2)}$$

Where:

$NPLR_{it}$ = "non-performing loan" ratio measured by NPLs ÷ total gross loans

β_0 = represents a constant term

ICR_{it} = Individual credit rating/each-rating scale

GDP_{it} = Gross domestic product

INF_{it} = Inflation

EXR_{it} = Exchange rate

UNE_{it} = Unemployment

CAR_{it} = Capitalisation measured by equity to total assets

CG_{it} = Credit growth measured by loans to assets ratio

$SIZE_{it}$ = Size measured by the natural log of total assets

Dummy = a dummy variable was included to capture the effects of the global financial crisis in 2007-2009; 1 represents the years 2007 to 2009 while 0 equals all other years under investigation.

ε_{it} = Error term.

This study focused on the panel data; the GMM model was therefore reduced to the following specific GMM equations. The model on 3.3 corresponds to the first objective, model 3.4 corresponds to the second objective and model 3.5 corresponds to the third objective.

$$\Delta NPLR_t = (\phi - 1)\,\Delta NPLR_{it-1} + \lambda_1 \sum_{i=1}^{m} \Delta\, ICR_{it-1} + \lambda_2 \sum_{i=1}^{m} \Delta\, GDP_{it-1} + \lambda_3 \sum_{i=1}^{m} \Delta\, INF_{it-1} + \lambda_4 \sum_{i=1}^{m} \Delta\, EXR_{it-1} + \lambda_5 \sum_{i=1}^{m} \Delta\, CAR_{it-1} + \lambda_6 \sum_{i=1}^{m} \Delta\, CG_{it-1} + \lambda_7 \sum_{i=1}^{m} \Delta\, SIZE_{it-1} + \lambda_8 \sum_{i=1}^{m} \Delta\, UNE_{it-1} + \Delta\mu_{it} \quad \textbf{(3.3)}$$

$$\Delta NPLR_t = (\phi - 1)\,\Delta NPLR_{it-1} + \lambda_1 \sum_{i=1}^{m} \Delta\, ICR_{it-1} + \lambda_2 \sum_{i=1}^{m} \Delta\, GDP_{it-1} + \lambda_3 \sum_{i=1}^{m} \Delta\, INF_{it-1} + \lambda_4 \sum_{i=1}^{m} \Delta\, EXR_{it-1} + \lambda_5 \sum_{i=1}^{m} \Delta\, CAR_{it-1} + \lambda_6 \sum_{i=1}^{m} \Delta\, CG_{it-1} + \lambda_7 \sum_{i=1}^{m} \Delta\, SIZE_{it-1} + \lambda_8 \sum_{i=1}^{m} \Delta\, UNE_{it-1} + \lambda_9 \sum_{i=1}^{m} \Delta\, Dummy_{it-1} + \Delta\mu_{it} \quad . \quad \textbf{(3.4)}$$

$$\Delta NPLR_t = (\phi - 1)\,\Delta NPLR_{it-1} + \lambda_1 \sum_{i=1}^{m} \Delta\, GDP_{it-1} + \lambda_2 \sum_{i=1}^{m} \Delta\, INF_{it-1} + \lambda_3 \sum_{i=1}^{m} \Delta\, EXR_{it-1} + \lambda_4 \sum_{i=1}^{m} \Delta\, UNE_{it-1} + \lambda_5 \sum_{i=1}^{m} \Delta\, CAR_{it-1} + \lambda_6 \sum_{i=1}^{m} \Delta\, CG_{it-1} + \lambda_7 \sum_{i=1}^{m} \Delta\, SIZE_{it-1} + \lambda_8 \sum_{i=1}^{m} \Delta\, Dummy_{it-1} + \Delta\mu_{it} \quad . \quad \textbf{(3.5)}$$

Where:

$NPLR_{it}$ is the dependent variable and a proxy for credit risk for bank *i* in time *t.* $NPLR_{it-1}$ represent the lag of "non-performing loan" ratio. ϕ is an auto-regression coefficient, λ is a coefficient which represents the sensitivity of independent variables, μ_{it} is the error term and $Dummy_{it}$ represents the dummy variable for the existence of the global financial crisis in 2007 to 2009. The next section discusses the dependent variable and explanatory variables as well as the control variables of the study.

3.9. Variables of the study

The dependent and independent or control variables and their measurement were adopted from existing literature to construct a useful comparison with previous empirical studies. The explanatory variables included credit rating codes, GDP, inflation, interest rates, exchange rates and unemployment. Apart from the dependent and independent variables, it was important to take banking industry-specific factors into consideration as these variables may have explanatory power on the level of "non-performing loans". The "bank-specific" variables included capitalisation (CAR), credit growth (CG) and the control variable, bank size (SIZE) and dummy. The error (ε) term was added to the regression model. The reason for the inclusion of "bank-specific" factors was that these factors might have had an impact on "non-performing loans". Therefore, it was of interest in this study to determine whether these factors had an influence on the bank's credit risk in South Africa.

3.9.1. Dependent variable

Credit risk is one of the major risks banks face (Mpofu & Nikolaidou, 2018) and as such, it was important to determine the measurement of credit risk in this study. Ideally, when there is negative economic growth, the return on assets (ROA) or return on equity (ROE) of banks will decline. This can lead to rising bad debts, hence the higher incidence of "non-performing loans". Increasing loan default is a critical issue for banks and therefore a "non-performing loan" ratio was deemed the most appropriate measure for credit risk in this study.

The "non-performing loan" ratio was used as a proxy of credit risk; a similar measure is found in a study of Kasana and Naveed (2016). Therefore, credit risk is represented by the following ratio:

$$Non-performing\ loan\ ratio = \frac{non-performing\ loans}{total\ gross\ loans}$$

The "non-performing loans" to total gross loans ratio have been used in previous empirical studies to capture the credit risk of the bank (Kasana & Naveed, 2016; Ebenezer & Omar, 2015; Lu, 2013; Saba, Kouser & Azeem, 2012). This ratio gives information about the credit

risk of banks; the higher the ratio, the more loan defaults and therefore the greater the vulnerability of banks to credit risk.

3.9.2. Macro-economic and bank-specific independent variables

The purpose of the independent variables is to explain the behaviour of dependent variables. In this study, several variables were predicted to have explanatory power in determining the dependent variable. Both "macro-economic and industry-specific variables were investigated to establish the relationship between the credit risk dependent variable and the independent variables.

3.9.2.1. Individual credit rating codes

In line with the objectives of this study, credit ratings were expected to have explanatory power over the level of non-performing loan ratios. To establish the effect of the credit rating scales, the coding method shown in Table 3.2 was used.

Table 3.2: Long-term issuer credit ratings and assigned numerical coding

Credit ratings	Broad rating coding	Individual rating coding
AA+	1	1
AA		2
AA-		3
A+	2	4
A		5
A-		6
BBB+	3	7
BBB		8
BBB-		9
BB+	4	10
BB		11
BB-		12
B+	5	13
B		14
B-		15
CCC+	6	16

***Source**: Adapted from Sajjad and Zakaria (2018)*

The coding method consisted of the real credit ratings of the banks. The coding was divided into broad rating and individual rating categories (Sajjad & Zakaria, 2018). According to Shin and Kim (2015:2), a broad rating is a rating level that includes the plus (+), zero (0) and minus (-) notch rating. The independent variable for each credit rating scale was measured by the ordinal coding scheme mentioned above in Table 3.2. For the purposes of this study, the long-term rating was used because it was important for examining the bank's creditworthiness and how the rating influenced the bank's credit risk.

3.9.2.2. Gross domestic product

In line with previous empirical studies, the growth rate of the growth domestic product was used as a proxy for economic growth. Economic growth is undoubtedly one of the most consistent economic indicators, hence GDP growth was considered as an important "macro-economic" variable of bank credit risk. According to Ghosh (2015:96), GDP captures the economic progress or activity of a country. Ideally, in a period of economic progress, the overall economic activities increase. Similarly, the cash flow for the borrower is also increased, which could lead to an increase in their repayment ability. Ghosh (2015) confirms the negative relationship between banks' credit risk and economic growth. Messai and Jouini (2013) found a negative relationship between the growth rate of GDP and the NPL portfolio of banks. Mpofu and Nikolaidou (2018) also found a negative relationship between GDP growth and the NPL ratio. Progress in the real economy leads to a reduction in the level of "non-performing loans" of banks. In contrast, however, Kasana and Naveed (2016) found a significant and positive relationship between growth in GDP and credit risk. In summary, it is expected that when there is an increase in economic growth, there should be a reduction in the bank's "non-performing loans" portfolio.

3.9.2.3. Inflation

Previous studies by Klein (2013) and Nkusu (2011) indicate that the relationship between NPL ratio and inflation may be ambiguous, as it can be either negative or positive. According to Klein (2013:6), higher inflation can lead to an increase in the loan repayment ability of borrowers by reducing the real value of outstanding debt. Ghosh (2015:96) contends that

theoretically, for a constant nominal interest rate, inflation should reduce the real value of debt and hence make debt servicing easier, which in turn should reduce NPLs. Waeibrorheem and Suriani (2015) found a negative and significant relationship between credit risk and inflation. Other studies by Ahmad and Bashair (2013) and Shingjergji (2013) also found a negative relationship between inflation and the NPL ratio.

However, other scholars such as Sharica (2014) and Ghosh (2015) found a positive relationship between NPL and the inflation rate. In addition, Badar, Javid and Zulfiquar (2013) obtained similar results between "non-performing loans" and inflation. However, Akinlo and Emmanuel (2014) found an insignificant relationship between NPLs and inflation. The literature thus reveals that the relationship between inflation and NPL ratio can be either negative or positive.

3.9.2.4. Exchange rate

Shingjergji (2013) confirmed a positive relationship between foreign exchange rate Euro/ALL and the NPL ratio. Ideally, borrowers are faced with foreign exchange rates of Euro/ALL, which could lead to an increase in the NPL ratio. A cross-country study by Chaibi and Ftiti (2015) found a significant positive relationship between the exchange rate and NPLs in France. Castro (2013), who also found that credit risk was sensitive to an increase in the exchange rate, supports this result. Hence, the higher the exchange rate, the higher the level of NPLs (credit risk).

In contrast to these empirical results, Chaibi and Ftiti (2015) found that a higher exchange rate significantly contributes to lowering NPLs in Germany. Lu (2013) found a significant negative relationship between the exchange rate and a bank's credit risk. Based on these results, it is clear that there are mixed views in the literature. It is therefore expected that the exchange rate will have either a positive or a negative influence on the NPL ratio.

3.9.2.5. Unemployment rate

Unemployment can be used as an indicator of the state of the economy of a country. Compared with the GDP growth rate, the unemployment rate offers more in-depth

information on the economic condition (Castro, 2013). Klein (2013) found the unemployment rate to have a strong effect on the banking system. This explains the fact that an increase in the unemployment rate could mean that borrowers may lose their jobs. This would, in turn, affect their payment capabilities, hence the increase in their debt burden. According to Gosh (2015), there is a positive effect between the unemployment rate and the NPL ratio. Other scholars (Klein, 2013; Messai & Jouini, 2013; Chaibi & Ftiti, 2015) found a positive relationship between the unemployment rate and the NPL ratio. A rise in unemployment would have a significant effect on NPLs. According to the literature, the effect of unemployment on NPLs is positive.

3.9.2.6. Capitalisation

Bank capitalisation is measured by total equity as a percentage of total assets. The proxy for capitalisation in this study was in line with the proxy used by Klein (2013) and Ghosh (2015). According to Ghosh (2015:95), the effect of bank capitalisation on NPLs can be ambiguous. He explains that managers in banks with a low capital base have a moral hazard incentive to engage in risky lending practices along with a poor credit score. This moral hazard hypothesis implies an inverse relationship between equity capital and NPLs (Ghosh, 2015).

According to Makri, Tsagkanos and Bellas (2014), industries that are highly capitalised tend to engage in risky loan activities or portfolios thereby leading to higher levels of NPL. The empirical result of a study by Sala and Sauria (2002) found a negative relationship between the industry capital ratio and the level of NPLs. However, Ghosh (2015) elaborated that managers of banks with a high capital ratio may opt for a liberal policy under the notion of 'too big to fail'. This implies a positive relationship between capital and NPLs. In summary, the relationship between the bank capitalisation and NPLs seems to have mixed results; therefore it would be expected to be either negative or positive.

3.9.2.7. Credit/loan growth

The credit growth rate is measured by a loans-to-assets ratio. This proxy is in line with that used by Klein (2013) and Ghosh (2015). According to Ongore and Kusa (2013), the loan portfolio of banks is the principal business and the dominant source of revenue; hence, loans

are one of the biggest sources of risk to a bank. This ratio can also reflect the liquidity risk since loans are illiquid and riskier. Salas and Saurina (2002) established a positive relationship between credit growth and NPLs. On the other hand, Ghosh (2015) found that credit growth increases NPLs. Sheefeni (2015) found a positive relationship between loan to total ratio and NPLs. Therefore, in this study, a positive relationship between banks' NPLs and credit growth was expected.

3.9.2.8. Size of a bank

According to Ghosh (2015:96), banks operating in a large-size banking industry may increase their leverage too much and extend loans to low-quality borrowers. In this study, log total assets were used as the proxy of the bank size. According to Marozva (2017:130), "the size of a bank positively contributes to its liquidity levels through the implicit guarantee that bigger banks are more stable compared to smaller banks." The size of a bank measured by its total assets may positively influence the NPLs. Amuakwa-Mensah and Boakye-Adjei (2015) investigated the determinants of NPLs in the banking industry of Ghana. Theirs documented a positive relationship between industry size and NPLs. Ghosh (2015) found a similar result between the two variables. In contrast, a study by Abid *et al.* (2014) showed that the size of a bank had a negative relationship with NPL (credit risk). Lu (2013) reported a similar result between NPL and size.

3.10. Ethical considerations

Bhattacherjee (2012) states that ethics in research refers to the distinction between what is right and what is wrong, and adds that what is unethical may not necessarily be illegal. Bhattacherjee (2012) emphasises the importance of ethics in research because people and organisations have often manipulated science in unethical ways to their own advantage by engaging in activities that are contrary to the norms of scientific conduct. In this study, all due processes were followed and ethical clearance was obtained from the University of South Africa. The final dissertation was submitted to the Turnitin antiplagiarism software to assess the degree of similarity between this work and that of other scholars.

3.11. Conclusion

This chapter described the use of the ‘research onion’ of Saunders *et al*. (2012) which was used as the guideline for conducting this study. A deductive approach was adopted since the study was quantitative in nature and secondary data was used to investigate the research problem. The sample was drawn from 16 locally registered banks, based on the availability of bank-specific data on the variables under investigation. The econometric model (GMM) was used to test the effect of credit ratings on credit risk. Credit ratings, "macro-economic" variables and "banking industry-specific" variables were predicted to have explanatory power in determining the dependent variable. In addition, to ensure the robustness and appropriateness of the model, the Hausman test was used to select the appropriate method between the fixed effects model (FEM) and the random-effects model (REM). The estimation models were run through the Eviews software. The next chapter presents the statistical analysis and interpretation of the findings.

CHAPTER 4: Data analysis and interpretation of findings

4.1. Introduction

In the previous chapter, the methodology and data analysis techniques used in this study were discussed. This chapter presents the results of the data analysis and interprets the results. The structured of the chapter is as follows: Section 4.2 presents the descriptive statistics of the variables used in the study. The correlation coefficient analysis is presented in Section 4.3, while Sections 4.4, 4.5 and 4.6 show the regression model specifications and the results from the sample of banks in South Africa. For the purpose of the study a panel data analysis was adopted, therefore, a generalised method of moments (GMM) model used to regress explanatory variables against the credit risk of banks in South Africa is presented. GMM is the main model that was used in the study. Section 4.7 summarises the overall findings and draws conclusions that form the basis of the final recommendations of this study.

The secondary objectives of this study were identified as follows:

- To test the effect of each credit rating level on the level of "non-performing loan" ratio (NPLR) in selected South African banks during the period 2006 to 2015.
- To examine the effect of each credit rating level on "non-performing loans" in selected South African banks during the period 2006 to 2015 taking into consideration the effects of the global financial crisis of 2007-2009.
- To examine the effects of "macro-economic" variables and "bank-specific" factors on credit risk in South African banks during the period 2006 to 2015.

4.2. Descriptive statistics

The summary of the descriptive statistics for all the variables relating to the entire sample of the banks under investigation is presented in this section. "Non-performing loans" as a proxy for credit risk was used. The descriptive statistics for all the explanatory variables are presented in Table 4.1.

Table 4.1: Summary of descriptive statistics

	NPL	ICR	GDP	INF	EXR	CAR	CG	SIZE	UNE
Mean	0.0163	7.1545	0.0264	0.0618	8.6541	0.1529	1.1816	17.5185	0.4166
Median	0.0045	7.0000	0.0265	0.0575	8.2308	0.0859	1.1152	16.6980	0.4111
Maximum	0.1642	11.0000	0.0560	0.1150	12.7507	0.6350	2.0089	20.9621	0.4490
Minimum	-0.0004	1.0000	-0.0150	0.0430	6.7672	0.0373	0.6471	13.3060	0.4004
Std. Dev.	0.0350	1.7198	0.0195	0.0202	1.8203	0.1198	0.2369	2.5322	0.0135
Skewness	2.8494	-0.7409	-0.3725	1.6786	1.0784	1.6135	1.5858	0.0227	1.2282
Kurtosis	9.8101	5.4908	3.0676	5.1080	3.0789	5.4046	5.7783	1.2982	3.6916
Jarque-Bera	361.4137	38.4979	2.5654	72.0273	21.3476	74.2271	81.4822	13.2836	29.8487
Probability	0.0000	0.0000	0.2773	0.0000	0.0000	0.0000	0.0000	0.0013	0.0000
Observations	110	110	110	110	110	110	110	110	110

***Source**: Author's computation via Eviews 10*

The summary of descriptive statistics in Table 4.1 was based on the raw data, before any transformations. The summary of the descriptive statistics also reflects that the total observations for each variable were 110. The descriptive statistics for the dependent variable, as shown in Table 4.1, indicate that a "non-performing loan" in South African banks ranged from a minimum value of - 0.04% up to a maximum of 16.42%, and on average grew by 1.63% during the period 2006 to 2015 with a standard deviation of 3.5%. On average of 1.63%, it shows that the increase in "non-performing loans" in the South African banks were not severe over the period under investigation. The test statistics indicate the reject of the null hypothesis of normal distribution because the probability value is highly statistically significant and the result indicates that the distribution for NPLs is not normal.

The ICR ranged between a minimum value of 1% and a maximum value of 11%, with a standard deviation of 1.7% and averaging 7.1% for the period 2006 to 2015. The reason for this huge gap might be that ICR downgrade has a negative effect on NPLs. The test statistics indicate the reject of the null hypothesis of normal distribution because the probability value is highly statistically significant, therefore the distribution is not normal for ICR.

Table 4.1, revealed that the South African economy had a maximum growth of 5.6%, with GDP at the lowest minimum of -1.5%. On average GDP between 2006 and 2015 was 2.6%.

It is expected that in the period of economic growth the NPLs should decrease, while they would increase during the recession periods (Klein, 2013). The Jarque-Bera statistic for GDP is 2.6% with the probability value of 0.27. The statistic indicates that the null hypothesis cannot be rejected because the probability value for GDP is greater than the significant level of 0.05, therefore it means that the GDP is normally distributed.

The inflation was at a maximum rate of 11.5% and had a minimum value of 4.3%, but on average it was 6% over the same period. This average rate forms part of the upper bound of the inflation target set by the South African Reserve Bank of 3% to 6% (SARB, 2017a). The rand-dollar exchange rate had a minimum value of R6.76/$1 up to a maximum value of R12.75/$1 and an average exchange rate of R8.65/$1 for the period 2006 to 2015. The exchange rate had a standard deviation of R1.82, which is fairly consistent over the period under investigation. Table 4.1 indicates the Jarque-Bera statistic for INF and EXR were at 72% and 21.3% respectively, with the probability value of both variables at 0.00%. The statistics indicate the reject of the null hypothesis of normal distribution because the probability values are highly statistically significant, hence the distribution is not normal for both INF and EXR.

The capital adequacy for the banks on average is at 15%, while some banks are over capitalised. The capital held has a standard deviation of 11.9%, with a maximum capital adequacy ratio held at 63.4% and a minimum value of 3% respectively. It implies that banks were generally well capitalised over the period 2006 to 2015. Capitalisation is imperative because this strengthens the lending book, thereby reducing NPLs (Ghosh, 2015). Credit growth, on average is at 118.1% for the overall dataset. The minimum value indicates that there was a growth of credit at a stage, measuring a minimum of 64.7%, while the maximum growth was at 200%. Credit growth with a standard deviation of 23.6%, it may be an indication that some banks attempted to increase their credit growth in order to achieve higher profits. The credit growth was significant and in line with the increase in the bank size, therefore the higher the bank asset base, the more loans or credit extends by the banks. During the 2006 to 2015 period, the Jarque-Bera statistic for CAR and CG were at 74.2% and 81.5% respectively, with the probability value of both variables at 0.00%. The statistics indicate the

reject of the null hypothesis of normal distribution because the probability values are highly statistically significant, which implies that the distribution is not normal.

According to Stats (2019), South Africa has high levels of unemployment, with the average unemployment rate at 29% during the period of the study. Table 4.1 indicates that during the period 2006 to 2015 period the minimum and maximum unemployment rate were at 40.0% and 44.9%, respectively. Both the unemployment rate and inflation rate cause "non-performing loans" to increase (Ghosh, 2015). From Table 4.1, it is clear that the Jarque-Bera statistic for unemployment is 29.8% with the probability value of 0.00%. The statistics indicate the reject of the null hypothesis of the normal distribution because the probability value is highly statistically significant, therefore the distribution is not normal.

4.3. Correlation coefficients

According to Gitman, Smith, Makina, Malan, Marx, Mestry, Ngwenya and Strydom (2014), the correlation coefficient measure, the strength of association between dependent and independent variables, typically lies between -1 and +1. Cohen (1988) suggests that the assessment of the strength of the relationship for particular variables can be an absolute value that ranges from 0.1 and 0.3, however, this value reveals a weak correlation. Cohen (1988) argues that an absolute value of between 0.3 to 0.5 indicates a moderate correlation while values above 0.5 imply a strong correlation.

Table 4.2 below shows the correlation coefficients between the dependent variables and the explanatory variable, with significance levels of 0.001, 0.05 and 0.01 respectively. This section was presented to analyse if there is a statistically significant association between all the variables investigated. Significant correlations between "non-performing loans" and the "micro" plus "macro-economic" variables were observed.

Table 4.2: Correlation coefficient of variables

Correlation Probability	NPL	ICR	GDP	INF	EXR	CAR	CG	SIZE	UNE
NPL	1.0000								

ICR	-0.0044	1.0000							
	0.9637	-----							
GDP	-0.0299	-0.0925	1.0000						
	0.7564	0.3363	-----						
INF	0.0192	-0.0864	-0.0484	1.0000					
	0.8425	0.3695	0.6159	-----					
EXR	0.0193	0.4467***	-0.5307***	-0.0959	1.0000				
	0.8416	0.0000	0.0000	0.3192	-----				
CAR	0.2490**	-0.1432	0.1125	0.0044	-0.0940	1.0000			
	0.0087	0.1356	0.2419	0.9634	0.3286	-----			
CG	0.3977***	-0.1022	0.2367	-0.1734	-0.2476	0.4225***	1.0000		
	0.0000	0.2880	0.0128**	0.0701**	0.0091***	0.0000	-----		
SIZE	-0.0757	-0.0127	-0.0996	-0.0569	0.1482	-0.6664***	-0.3748***	1.0000	
	0.4321	0.8949	0.3008	0.5548	0.1223	0.0000	0.0001	-----	
UNE	-0.0055	-0.1688***	0.2166**	-0.0495	-0.3576***	0.0945	0.1485	-0.1143	1.0000
	0.9543	0.0780	0.0230	0.6076	0.0001	0.3263	0.1217	0.2346	-----

***Source**: Author's computation via Eviews 10*

NB: t-statistic are significant at p < 0.001***, p < 0.05*, p < 0.01**

Table 4.2 indicates that there was a positive and significant relationship between "non-performing loans" and credit or loans growth. The results are in line with the hypothesis of Keeton (1999), this implies that banks experience a high level of NPL because of relaxing credit standards (Ghosh, 2015). As far as the relationship between "non-performing loans" and capital adequacy ratio was concerned, it was found that a positive and significant relationship exists between the variables. This result shows that banks that are adequately

capitalised can resort to lax credit standards; this relationship is in line with the notion of ‘too big to fail’. A similar relationship was found between bank size, credit growth and "non-performing loans". In contrast, Vithessonthi (2016) tested the relationship between credit growth and NPL in Japan for the period 1993 to 2013 (pre- and post-global financial crisis). Vithessonthi (2016) found a positive and significant relationship, but after the global financial crisis, the relationship was significantly negative.

The following section discusses the regression model specifications and the results from the sample of banks in South Africa.

4.4. Econometric model specifications and results

As discussed in Chapter 3, this section presents the main estimation using the Generalised Method of Moments (GMM) model in order to address the research objectives. There was one dependent variable NPLR which is one of the most important indicators of credit risk. In order to model the "non-performing loan" ratio of selected banks, the study employed the generic GMM model of Arellano and Bond (1991) and Blundell and Bond (1998). The model had the following equation:

$$\boldsymbol{y_{i,t}} = \boldsymbol{\alpha y_{i,-1}} + \boldsymbol{\beta x_{i,t}} + \mu_i + \boldsymbol{\varepsilon_{it}} \qquad \textbf{(4.1)}$$

Where:

- The variable $y_{i,t}$ is the "non-performing loan" ratio measure for banks *i* in time *t*;
- $x_{i,t}$ is the vector of the independent variable for bank *i* for time *t* representing the "macro-economic" variables and "industry-specific" variables; α_0 denotes a constant term.
- μ_i denotes fixed effects in a bank.
- $\varepsilon_{i,t}$ denotes a random error term; and

The subscript *i* denotes the cross-section and *t* represents the time-series dimension.

The statistical evaluation and estimation technique selection of the panel regression between a fixed-effects model and a random-effects model were undertaken based on the Hausman

test. Hausman's (1978) estimation test is utilised when selecting a suitable approach between FEM and REM for panel data.

This study focused on the panel data model and used the dynamic GMM model. A number of models were run for robustness; however, the system GMM model was preferred over the difference GMM model. This was because, with difference GMM, the coefficient is assumed to be biased downward and does not solve the problem of endogeneity. In support of this statement, Arellano and Bond (1991) indicate that the system GMM model is free from endogeneity problems. Marozva (2017) concurs, noting that the GMM model is preferred over other methods because it avoids the endogeneity problem between banks. The empirical estimation of the relationship between credit risk and the explanatory variables of micro and "macro-economic" factors was expressed in equations 3.2, 3.3, 3.4 and 3.5. The detailed results are presented in the appendices. Equation 3.2 was reduced to the following specific GMM model in order to address or correspond with the secondary objectives:

$$\mathrm{NPLR}_{it} = \beta_0 + \beta 1\ \mathrm{ICR}_{it} + \beta 2\ \mathrm{GDP}_{it} + \beta 3\ \mathrm{INF}_{it} + \beta 4\ \mathrm{EXR}_{it} + \beta 5\ \mathrm{UNE}_{it} + \beta 6\ \mathrm{CAR}_{it} +$$

$$\beta 7\ \mathrm{CG}_{it} + \beta 8\ \mathrm{SIZE}_{it} + \beta 9\ \mathrm{Dummy}_{it} + \varepsilon \qquad \textbf{(3.2)}$$

$$\Delta\mathrm{NPLR}_t = (\phi - 1)\Delta\mathrm{NPLR}_{it-1} + \lambda_1 \sum_{i=1}^{m} \Delta\ \mathrm{ICR}_{it-1} + \lambda_2 \sum_{i=1}^{m} \Delta\ \mathrm{GDP}_{it-1} + \lambda_3 \sum_{i=1}^{m} \Delta\ \mathrm{INF}_{it-1} +$$
$$\lambda_4 \sum_{i=1}^{m} \Delta\ \mathrm{EXR}_{it-1} + + \lambda_5 \sum_{i=1}^{m} \Delta\ \mathrm{CAR}_{it-1} + \lambda_6 \sum_{i=1}^{m} \Delta\ \mathrm{CG}_{it-1} + \lambda_7 \sum_{i=1}^{m} \Delta\ \mathrm{SIZE}_{it-1} +$$
$$\lambda_8 \sum_{i=1}^{m} \Delta\ \mathrm{UNE}_{it-1} + \Delta\mu_{it} \qquad \textbf{(3.3)}$$

$$\Delta\mathrm{NPLR}_t = (\phi - 1)\Delta\mathrm{NPLR}_{it-1} + \lambda_1 \sum_{i=1}^{m} \Delta\ \mathrm{ICR}_{it-1} + \lambda_2 \sum_{i=1}^{m} \Delta\ \mathrm{GDP}_{it-1} + \lambda_3 \sum_{i=1}^{m} \Delta\ \mathrm{INF}_{it-1} +$$
$$\lambda_4 \sum_{i=1}^{m} \Delta\ \mathrm{EXR}_{it-1} + \lambda_5 \sum_{i=1}^{m} \Delta\ \mathrm{CAR}_{it-1} + \lambda_6 \sum_{i=1}^{m} \Delta\ \mathrm{CG}_{it-1} + \lambda_7 \sum_{i=1}^{m} \Delta\ \mathrm{SIZE}_{it-1} +$$
$$\lambda_8 \sum_{i=1}^{m} \Delta\ \mathrm{UNE}_{it-1} + \lambda_9 \sum_{i=1}^{m} \Delta\ \mathrm{Dummy}_{it-1} + \Delta\mu_{it} \qquad \textbf{(3.4)}$$

$$\Delta\mathrm{NPLR}_t = (\phi - 1)\Delta\mathrm{NPLR}_{it-1} + \lambda_1 \sum_{i=1}^{m} \Delta\ \mathrm{GDP}_{it-1} + \lambda_2 \sum_{i=1}^{m} \Delta\ \mathrm{INF}_{it-1} + \lambda_3 \sum_{i=1}^{m} \Delta\ \mathrm{EXR}_{it-1} +$$
$$\lambda_4 \sum_{i=1}^{m} \Delta\ \mathrm{UNE}_{it-1} + \lambda_5 \sum_{i=1}^{m} \Delta\ \mathrm{CAR}_{it-1} + \lambda_6 \sum_{i=1}^{m} \Delta\ \mathrm{CG}_{it-1} + \lambda_7 \sum_{i=1}^{m} \Delta\ \mathrm{SIZE}_{it-1} +$$
$$\lambda_8 \sum_{i=1}^{m} \Delta\ \mathrm{Dummy}_{it-1} + \Delta\mu_{it} \qquad \textbf{(3.5)}$$

As discussed, the study focused on the system GMM model over other methods hence the system GMM results were reported. Equation 3.3 was used to address the relationship between credit rating level and the "non-performing loan" ratio (NPLR). The equation included the dependent variable and independent variables; however, it excluded the dummy, which captured the impact of the 2007-2009 global financial crisis.

The model results are presented in Table 4.3 below.

Table 4.3: Summary of results variable

Summary of results on the lagged dependent variable

	Pooled effects	Random effects	Fixed effects	Diff GMM	System GMM
NPL(-1)	**0.9557*** **	**0.9557*** **	**0.3192*** **	**0.7126**	**0.3837*** **
	83.001	83.001	4.8726	1.2257	8.8353
CAR	**0.0134**	**0.0134**	**0.1031*** **	**0.1797**	**0.1098*** **
	1.4379	1.4379	3.1678	1.4907	12.431
CG	**0.0036**	**0.0036**	**0.0003**	**0.0039**	**-0.0019**
	0.9665	0.9665	0.0852	0.3693	-1.5125
EXR	**-0.0004**	**-0.0004**	**-0.0011**	**-0.0039**	**-0.0026*** **
	-1.2498	-1.2498	-1.4408	-0.3162	-7.0972
GDP	**-0.0212**	**-0.0213**	**-0.0711**	**0.9738**	**-0.0518**
	-0.5802	-0.5803	-1.2438	0.5087	-1.1441
ICR	**0.0004**	**0.0004**	**0.0009**	**-0.0158**	**0.0011*** **
	1.5156	1.5156	1.1046	-0.642	3.2713

	Pooled effects	Random effects	Fixed effects	Diff GMM	System GMM
INF	**0.0327**	**0.0328**	**0.0674**	**-0.1487**	**0.0825*** **
	0.8771	0.8771	1.1842	-0.3256	3.4675
SIZE	**0.0006****	**0.0006****	**0.0065**	**0.0203**	**0.0085*** **
	2.2312	2.2312	1.6518	1.0573	5.6359
UNE	**0.1160**	**0.1160**	**0.0824***	**3.0697**	**0.3375****
	1.5831	1.5831	1.9580	0.6399	2.0088
C	-0.0649	-0.0649	-0.1514		
	-1.8898	-1.8898	-1.9617		

***Source**: Author's computation via Eviews 10*

NB: t-statistics are significant at p < 0.001***, p < 0.05*, p < 0.01**

The result shown in Table 4.3 indicates that there was a positive and significant relationship between lagged NPL and the current NPL. The results imply that NPL is consistent, meaning that the higher the previous period NPL, the higher the current period NPL. This result is in line with Ghosh (2015), who found the same results that current NPL is positive and significantly related to its lagged value. Similar results where the relationship is positive and significant were also found by Hajja (2017), Peric and Konjusak (2017) and Kjosevski and Petkovski (2017). From a policy perspective, this could imply that bankers should understand the fact that the current period of "non-performing loans" is dependent on previous period "non-performing loans". Therefore, when formulating credit policies they should take this phenomenon into account.

As indicated in Table 4.3, there is a positive and significant relationship between capital adequacy ratio and "non-performing loans". This result suggests that as the capital adequacy ratio increases, there seem to be higher "non-performing loans". A positive relationship between CAR and NPL is in line with the ‘too big to fail’ theory. This theory implies that banks with higher capital adequacy ratio may resort to a liberal credit policy, which in turn, may lead to higher NPLs (Rajan, 1994).

These findings are in line with those of Ghosh (2015) and Macit (2012), who found the same results that the capital adequacy ratio is positively and significantly related to "non-performing loans". Consequently, regulators should take into account the possibility that credit risk can increase with the capital adequacy ratio. When formulating policies, they should, therefore, be aware of this phenomenon and consider increasing the 10% minimum capital requirement or introduce additional loan loss reserves.

The results in Table 4.3 show a negative and insignificant relationship between credit growth and "non-performing loans". This result implies that as credit growth increases, there seem to be fewer "non-performing loans". This result is contrary to what was expected. The summary in Table 4.3 indicates that there was a positive and significant relationship between credit ratings and "non-performing loans". This result implies that as the banks are rated down the scale, the higher the "non-performing loans". This result is aligned with the life-cycle consumption model of Lawrence (1995), who used the logit model to find the variables that are the best prediction of a loan moving into default. This is based on the fact that credit ratings have significant explanatory power on NPLs. Therefore, when formulating credit policies, bankers should be aware of this phenomenon, as one of the key determinants of credit risk.

The results in Table 4.3 also indicate a positive and significant relationship between inflation and "non-performing loans". Theoretically, this result implies that an increase in inflation is not matched by the same rise in nominal incomes, which in turn, results in real incomes to fall. Rising inflation seems to be affecting the repayment ability of borrowers, hence there is an increase in "non-performing loans". This result is in line with Ghosh (2015), Alhassan *et al.* (2014), Klein (2013) and Fofack (2005), who found a positive association between inflation and "non-performing loans". Since inflation has implications for decision-makers at both "macro-economic" and bank levels, policymakers should pay particular attention to inflation when designing macro-prudential and fiscal policies in South Africa.

The results in Table 4.3 reveal a positive and significant relationship between the size of the bank and "non-performing loans". This result implies that as the size a bank increases, so do "non-performing loans". This relationship between size and NPL is in line with the moral hazard hypothesis. According to this hypothesis, banks that are greater in size could resort to lax credit standards and liberal lending practices, which in turn, would increase NPLs (Rajan, 1994). This result is consistent with Ghosh (2015), who also found that bank size is positively related to "non-performing loans".

Lastly, the results in Table 4.3 indicate that there is a positive relationship between unemployment and "non-performing loans". This result indicates that as unemployment increases, there appears to be a rise in NPLs. These findings are in line with the life-cycle consumption model of Lawrence (1995). This model implies that borrowers with low earnings tend to have a higher default rate because of the increased risk of unemployment and being unable to service their debts. Similar results were found by Mazreku, Morina, Misiri, Spiteri and Grima (2018) and Ghosh (2015). Policymakers and regulators should, therefore, focus more on this phenomenon. These findings could help policymakers to improve the economic conditions of the country as the reduction of NPLs is important in the banking industry.

4.5. Analysis of credit ratings on credit risk

This section examines the effect of credit rating level on "non-performing loans" in selected South African banks during the period 2006 to 2015, taking into consideration the effects of the global financial crisis of 2007-2009. The equation below was derived in order to address this secondary objective.

$$\Delta NPLR_t = (\phi - 1)\Delta NPLR_{it-1} + \lambda_1 \sum_{i=1}^{m} \Delta\, ICR_{it-1} + \lambda_2 \sum_{i=1}^{m} \Delta\, GDP_{it-1} + \lambda_3 \sum_{i=1}^{m} \Delta\, INF_{it-1} + \lambda_4 \sum_{i=1}^{m} \Delta\, EXR_{it-1} + \lambda_5 \sum_{i=1}^{m} \Delta\, CAR_{it-1} + \lambda_6 \sum_{i=1}^{m} \Delta\, CG_{it-1} + \lambda_7 \sum_{i=1}^{m} \Delta\, SIZE_{it-1} + \lambda_8 \sum_{i=1}^{m} \Delta\, UNE_{it-1} + \lambda_9 \sum_{i=1}^{m} \Delta\, Dummy_{it-1} + \Delta\mu_{it} \quad \textbf{(3.4)}$$

Table 4.4: Summary of results on credit ratings and credit risk

	Pooled effects	Random effects	Fixed effects	Diff GMM	System GMM
NPL(-1)	**0.9561*** **	**0.9561*** **	**0.3220*** **	**0.2638*** **	**0.1872**
	74.8791	74.8791	3.6135	4.4039	0.9751
CAR	**0.0136**	**0.0136**	**0.1094*** **	**0.0873*** **	**0.0946*** **
	1.4883	1.4883	3.7643	5.5991	6.6281
CG	**0.0034**	**0.0034**	**0.0015**	**0.0018**	**-0.0006**
	0.7963	0.7963	0.4732	0.5631	-0.2287
EXR	**-0.0005**	**-0.0005**	**-0.0015** **	**-0.0380** **	**-0.0044**
	-1.3787	-1.3787	-1.7952	-2.1959	-1.0648
Dummy	**0.0018**	**0.0018**	**0.0065** **	**0.0562** **	**0.0089**
	0.8504	0.8504	1.7825	1.8496	1.0570
GDP	**-0.0441**	**-0.0441**	**-0.1635** **	**-1.4467**	**-0.1643**
	-0.8885	-0.8895	-1.7858	-1.4980	-0.3564
ICR	**0.0004** **	**0.0004** **	**0.0010**	**-0.0077** **	**0.0014**
	1.8020	1.8020	1.2317	-1.8282	0.5420
SIZE	**0.0006** **	**0.0006** **	**0.0085** **	**0.0127** **	**0.0113*** **
	2.5296	2.5296	2.0878	2.2945	6.4584
UNE	**0.1159**	**0.1159**	**0.0668** **	**-0.8588**	**0.1058**
	1.3159	1.3159	1.7352	-0.6608	0.0985
C	-0.0623	-0.0623	-0.1756		
	-1.5941	-1.5941	-2.3852		

***Source**: Author's computation*

NB: t-statistics are significance at p < 0.001***, p < 0.05*, p < 0.01**

The results in Table 4.4 show that the lagged value of "non-performing loans" was positive but not significant. This result implies that current NPL was not dependent on the previous period NPLs. The results in Table 4.4 also show a positive and significant relationship between capital adequacy ratio and "non-performing loans". This result suggests that an increase in capital adequacy ratio will result in higher "non-performing loans". A positive relationship between CAR and NPLs is in line with ‘too big to fail’ theory. This theory implies

that banks with higher capital adequacy ratio may resort to a liberal credit policy, which in turn, could lead to a higher NPLs (Rajan, 1994).

These findings are consistent with those of Ghosh (2015), Katuka and Dzingirai (2015), and Macit (2012), who also found that the capital adequacy ratio is positively and significantly related to "non-performing loans". However, the result is inconsistent with the findings of Kingu, Macha and Gwahula (2017), Makri *et al.* (2014) and Abid *et al.* (2014), who obtained a negative relationship between CAR and NPLs. Regulators should, therefore, take into account the possibility that credit risk may increase with the capital adequacy ratio. When formulating policies they should take this phenomenon into account and consider increasing the 10% minimum capital requirement as lower CAR can create incentives for moral hazards. Regulators should also consider introducing additional loan loss reserves.

The credit growth rate measures the percentage increase or decrease in a bank's loan portfolio. In Table 4.4, however, it shows a negative but insignificant relationship between credit growth and "non-performing loans". This result implies a negative association between CR and NPLs. In addition, Table 4.4 indicates that the exchange rate was statistically insignificant but adversely related to "non-performing loans". These findings imply that as the exchange rate increases, the "non-performing loans" will increase.

The dummy variable was used in this study to capture the effect of the global financial crisis from 2007 to 2009. However, in Table 4.4, the results show a positive but not significant relationship between the global financial crisis and "non-performing loans". This result implies that the crisis did not have a major effect on the South African banking sector, hence the insignificant impact on NPLs. The results in Table 4.4 also show that GDP appeared to have a negative but insignificant impact on "non-performing loans". This result suggests that when there is economic growth, the "non-performing loans" will slightly decrease. In addition, the results in Table 4.4 show that there was a positive and insignificant relationship between credit ratings and "non-performing loans". These findings suggest that "non-performing loans" increased with credit ratings.

The size of the bank was measured as the natural log of total assets. Table 4.4 shows that there was a positive and significant relationship between the size of the bank and "non-performing loans". This result implies that the bigger the bank, the higher the "non-performing loans". The relationship between size and NPL is aligned with the ‘too big to fail’ hypothesis. According to this hypothesis, banks that are greater in size could resort to lax credit standards and liberal lending practices, which in turn, would increase NPLs (Rajan, 1994). This result is consistent with Ghosh (2015), who also found that bank size is positively related to "non-performing loans".

Lastly, the results in Table 4.4 reveal a positive insignificant relationship between unemployment and "non-performing loans". This result indicates that as unemployment increases, there seems to be a rise in NPLs. These findings are in line with the life-cycle consumption model of Lawrence (1995). This model implies posits that borrowers with low earnings tend to have higher default rates because of the increased risk of unemployment and being unable to service their debts.

4.6. Determinants of non-performing loans

This section examines the effects of "macro-economic" variables and "bank-specific" factors on credit risk in South African banks during the period 2006 to 2015. The equation below was derived in order to answer this objective.

$$\Delta NPLR_t = (\phi - 1)\Delta NPLR_{it-1} + \lambda_1 \sum_{i=1}^{m} \Delta\, GDP_{it-1} + \lambda_2 \sum_{i=1}^{m} \Delta\, INF_{it-1} + \lambda_3 \sum_{i=1}^{m} \Delta\, EXR_{it-1} + \lambda_4 \sum_{i=1}^{m} \Delta\, UNE_{it-1} + \lambda_5 \sum_{i=1}^{m} \Delta\, CAR_{it-1} + \lambda_6 \sum_{i=1}^{m} \Delta\, CG_{it-1} + \lambda_7 \sum_{i=1}^{m} \Delta\, SIZE_{it-1} + \lambda_8 \sum_{i=1}^{m} \Delta\, Dummy_{it-1} + \Delta\mu_{it} \quad \textbf{(3.5)}$$

Table 4.5: Summary of results on the determinants of NPLs

	Pooled effects	Random effects	Fixed effects	Diff GMM	System GMM
NPL(-1)	**0.9567*** **	**0.9567*** **	**0.3692*** **	**0.3098*** **	**0.9239*** **
	80.2062	80.2062	6.6153	2.8154	1.1672
CAR	**0.0111**	**0.0111**	**0.1195*** **	**0.1222*** **	**0.1770*** **
	1.2828	1.2828	3.4110	3.0565	9.0337
CG	**0.0035**	**0.0035**	**0.0012**	**-0.0028*** **	**0.0011**
	0.9123	0.9123	0.3960	-3.1469	0.4537
EXR	**-0.0002**	**-0.0002**	**-0.0011** **	**-0.0004**	**-0.0011**
	-1.1810	-1.1810	-2.1242	-0.0457	-1.3483
Dummy	**-0.0007**	**-0.0007**	**0.0073*** **	**0.0169** **	**-0.1308** **
	-0.0793	-0.0793	5.1724	1.8298	-2.0134
GDP	**-0.0040**	**-0.0040**	**-0.1563*** **	**-0.2670**	**2.8009** **
	-0.0365	-0.0365	-3.4707	-0.5676	1.8498
INF	**0.0406**	**0.0406**	**-0.0171**	**-0.1339**	**1.1768** **
	0.2895	0.2895	-0.2953	-1.139	2.0234
SIZE	**0.0005** **	**0.0005** **	**0.0093**	**0.0107*** **	**0.0059*** **
	2.4053	2.4053	2.0931	2.6823	3.9021
UNE	**0.1175**	**0.1175**	**0.0761**	**-0.0750**	**5.4257** **
	1.3540	1.3540	1.7478	-0.1015	1.9751
C	-0.0630	-0.0630	-0.1910		
	-1.4552	-1.4552	-2.2129		

***Source**: Author's computation*

NB: t-statistics are significance at $p < 0.001$***, $p < 0.05$*, $p < 0.01$**

The results in Table 4.5 show that the lagged value of "non-performing loans" was, as anticipated, positive and significant. This result implies that NPLs are consistent, meaning the current period NPLs are dependent on the previous period NPLs. This result is in line with Ghosh (2015), who also found that current NPL is positive and significantly related to its lagged value. Similar results where the relationship is positive and significant were obtained by Hajja (2017), Peric and Konjusak (2017) and Kjosevski and Petkovski (2017). From a policy perspective, bankers should understand the fact that the current period of "non-performing loans" is dependent on previous period "non-performing loans". Therefore, when formulating credit policies, they should take this phenomenon into consideration.

From the results in Table 4.5, it can be seen that there is a positive and significant relationship between the capital adequacy ratio and "non-performing loans". This result implies that an increase in capital adequacy ratio will result in higher "non-performing loans". A positive relationship between CAR and NPLs is in line with moral hazard under the notion of ‘too big to fail’. This theory implies that banks with a higher capital adequacy ratio may resort to liberal credit policies, which in turn, would lead to higher NPLs (Rajan, 1994).

These findings are in line those of Ghosh (2015), Katuka and Dzingirai (2015) and Macit (2012), who also report that the capital adequacy ratio is positively and significantly related to "non-performing loans". However, these results are inconsistent with the findings of Kingu *et al.* (2017), Makri *et al.* (2014) and Abid *et al.* (2014), who obtained a negative relationship between CAR and NPLs. Regulators should, therefore, take into account the possibility that credit risk may increase with the capital adequacy ratio. When formulating policies, regulators should be aware of this phenomenon and consider increasing the 10% minimum capital requirement or introduce additional loan loss reserves.

The results in Table 4.5 show a positive but insignificant relationship between credit growth and "non-performing loans". This result suggests that credit growth positively influences "non-performing loans". In addition, Table 4.5 shows that the exchange rate was statistically insignificant but negatively related to "non-performing loans". This result suggests that as the exchange rate increases, there will be fewer "non-performing loans".

The dummy was used to capture the global financial crisis of 2007-2009. The results in Table 4.5 show a negative and significant relationship between the global financial crisis and "non-performing loans". The findings also suggest that "non-performing loans" did not increase during the crisis. This could be due to the fact that the banks were well capitalised above the 10% minimum capital requirement. These findings are in line with those of Amuakwa-Mensah *et al*. (2017), who found that NPLs were lower during the period of the global financial crisis. In terms of policy implication, banks should take cognisance of systemic risk when developing overall risk management frameworks in order to minimise "non-performing loans" in the event of a global financial crisis.

The results in Table 4.5 show that there was a positive and significant relationship between GDP and "non-performing loans". This result implies that as the economy grows, there will be a rise in "non-performing loans". The findings are consistent with Katuka and Dzingirai (2015) and Garr (2013), who found that GDP increases with "non-performing loans". However, studies by Koju *et al*. (2018), Amuakwa-Mensah *et al.* (2017), Peric and Konjusak (2017) and Morakinyo and Sibanda (2016), found GDP to be negatively associated with NPLs.

The results in Table 4.5 also indicate that there was a positive and significant relationship between inflation and "non-performing loans". This result implies that an increase in inflation was not matched by the same rise in nominal incomes, which in turn, would result in real incomes to fall. A rise in inflation seemed to affect the repayment ability of borrowers, hence there was an increase in "non-performing loans". This result is in line with those of Ghosh (2015), Alhassan *et al.* (2014), Klein (2013) and Fofack (2005), who also found a positive association between inflation and "non-performing loans". Since inflation has implications for decision-makers at both "macro-economic" and bank levels, policymakers should pay particular attention to inflation when designing macro-prudential and fiscal policies in South Africa.

The results in Table 4.5 reveal a positive and significant relationship between the size of the bank and "non-performing loans". This result implies that as the size a bank increases, so do "non-performing loans". This relationship between size and NPL is in line with moral hazard under the notion of ‘too big to fail’. According to this hypothesis, banks that are greater in size could resort to lax credit standards and liberal lending practices, which in turn, would increase NPLs (Rajan, 1994). This result is consistent with Ghosh (2015), who also found that bank size is positively related to "non-performing loans".

Lastly, the results in Table 4.5 show a positive relationship between unemployment and "non-performing loans". This result suggests that as unemployment increases, there seems to be a rise in NPLs. These findings are in line with the life-cycle consumption model of Lawrence

(1995). This model implies that borrowers with low earnings tend to have a higher default rate because of the increased risk of unemployment and being unable to service their debts. Similar results were found by Mazreku *et al.* (2018) and Ghosh (2015). Policymakers and regulators should, therefore, be aware of this phenomenon as the reduction of NPLs is important in the banking sector.

4.7. Summary of the results

This chapter presented the results which emerged from the various models applied in this study. The results indicate that there was a positive and significant relationship between lagged "non-performing loans" and "non-performing loans". This implies that "non-performing loans" are consistent, meaning the higher the previous period NPLs, the higher the current period NPLs. From a bank's perspective, when formulating credit policies, policymakers should take cognisance of this phenomenon.

The capital adequacy ratio had a positive and significant influence on "non-performing loans". This implies that banks that were highly capitalised were more willing to take on more credit risk. This result is in line with the 'too big to fail' hypothesis, which states that highly capitalised banks may resort to liberal credit policies. The implementation of the capital adequacy ratio above the minimum requirement should, therefore, be an essential part of a bank's overall risk management process. However, banks should be proactive in determining the implications of maintaining a higher capital base on their balance sheets.

The results also indicate that "non-performing loans" were positively and significantly influenced by credit ratings. This suggests that a variation in "non-performing loans" can be explained by credit ratings, therefore, the credit advancement policies of banks should be informed by the level of credit ratings. In addition, it was concluded that bank "non-performing loans" were influenced by inflation, and the relationship was both statistically and economically significant. NPLs were positively and significantly related to unemployment. This finding was consistent with the life cycle default theory which implies that borrowers with

low earnings turn to have a higher default rate because of the increased risk of unemployment and being unable to service their debts.

A positive significant relationship between size and "non-performing loans" of the bank was also found. The observation that NPLs are dependent on the size of the bank is consistent with moral hazard under the notion of ‘too big to fail’ which states that banks that are greater in size could relax credit standards and adopt liberal lending practices which would, in turn, increase NPLs.

The exchange rate had a negative and significant influence on "non-performing loans", suggesting that the higher the exchange rate, the weaker the local currency and the consequent increase in "non-performing loans". Credit growth was found to have a weaker negative and insignificant influence of "non-performing loans", which implies that credit growth had a minimal impact on "non-performing loans". The gross domestic product had a negative but non-significant influence on "non-performing loans". This implies that economic progress slightly reduced "non-performing loans".

A dummy variable was used to capture the effects of the global financial crisis from 2007 to 2009. The crisis had a negative and significant influence on "non-performing loans". This implies that during the period of financial turmoil, banks did not experience a higher level of "non-performing loans". However, credit growth had a positive but insignificant influence on "non-performing loans". This implies that loan growth resulted in a minimal increase in "non-performing loans". The exchange rate had a negative but not significant impact on "non-performing loans". Higher exchange rates would negatively affect the local currency which would, in turn, affect borrowers’ ability to pay off their debts, hence the increase in "non-performing loans". However, this result shows a minimal impact on "non-performing loans".

The results suggest that some of the bank-specific variables were the most important factors influencing the NPLs. This indicates that the capital adequacy ratio and size of a bank are responsible for the increase in "non-performing loans". On the basis of these findings,

regulators and policymakers should focus on both "macro-economic" and bank levels when there is a movement in the credit rating by the rating agencies.

The next chapter presents the final conclusions and recommendations of the study.

CHAPTER 5: Summary and recommendations

5.1. Introduction

The purpose of this chapter is, firstly, to review the objectives of the study. Secondly, the chapter summarises the literature review and the research methodology. Thirdly, it recapitulates the key empirical findings, policy implications and recommendations for potential implementation. Lastly, the chapter indicates the limitations of the study and proposes recommendations for future research.

5.2. Reviewing the research objectives

This section recaps the research objectives and the corresponding questions that were used to guide the study. The purpose of this research was to examine the effects of credit risk in South African banks when there is movement in the credit ratings by rating agencies during the period 2006 to 2015. In addressing this objective, the following secondary objectives were formulated:

- To test the effect of each credit rating level on the level of "non-performing loans" (NPLs) in selected South African banks during the period 2006 to 2015.
- To examine the effect of each credit rating level on "non-performing loans" in selected South African banks during the period 2006 to 2015 taking into consideration the effects of the global financial crisis of 2008/9.
- To examine the effects of "macro-economic" variables and "bank-specific" factors on credit risk for the South African banks during the period 2006 to 2015.

In order to address these objectives, "non-performing loans" were used as a proxy for credit risk in three models. The empirical results of the study highlighted that the "macro-economic" variables of the country and the bank-specific factors influence the level of "non-performing loans".

5.3. Overview of the study

The South African banking industry fulfils an important role in the economy by providing loans to different sectors. However, problems arising from both "macro-economic" and "bank-specific" variables can render the industry vulnerable. Downturns in the economy and credit rating downgrades could render the banking industry fragile, a situation that calls for research on the influence of credit ratings on credit risk in the South African banking industry.

According to the literature, credit ratings are a vital factor in making credit risk decisions. Credit rating agencies express their opinions about a bank's creditworthiness through credit ratings. There are three main rating agencies, namely, Moody's, Standard and Poor's (S&P) and Fitch, which use a combination of bank credit information, the industry within which the bank operates and the economic environment, to assign credit ratings. Credit rating agencies help reduce information asymmetry between banks and external stakeholders by speeding up the disclosure of creditworthiness information to the financial markets. In terms of information asymmetry, managers are assumed to have an advantage over external stakeholders because they have greater in-depth knowledge of the bank-specific events compared to external stakeholders. Investors thus rely on credit ratings to evaluate the risk of a business when deciding on investments.

Credit ratings are essential to a bank because of their influence on credit risk evaluations. The financial stability of the banking industry is important to ensure that it adequately fulfils its role and responsibility of providing loans to different sectors of the economy. Technological innovations and growth in lending activities, however, increased the complexity of managing credit risk in the banking industry. A review of the literature indicated that credit risk was a type of risk in the banking environment, which, if not managed appropriately, could have a severe effect on both the banking industry and the global economy. Credit risk can be understood as the risk associated with bank transactions such as loan creation assets and other financial products. Credit risk can, therefore, be influenced by the identified determinants when there is a movement in the credit ratings by the rating agencies. It is precisely these determinants that were researched in this study.

The study concluded that the determinants, which could influence credit risk in the banking industry, were (i) "macro-economic", such as inflation, gross domestic product, exchange rate and unemployment, and (ii) bank-specific, such as capital adequacy ratio, credit growth and bank size measured in terms of the asset base. These identified determinants are therefore significant factors when evaluating a bank's credit risk. The most widely used measures of credit risk management are "non-performing loans" (NPLs) and loan loss provisions (LLPs) (Noman *et al.,* 2015; Kolapo, Ayeni & Oke, 2012; Boahane, Dasah, & Agyei, 2012; Havrylchyk, 2010). This study used "non-performing loans" against total gross loans extended to different economic sectors (Havrylchyk, 2010). "Non-performing loans" can be defined as loans that did not generate income for a minimum period of 90 days (Laryea *et al.,* 2016). Taking into consideration that banking has experienced a series of important changes following the global financial crisis of 2007-2009, banks have emphasised their interest in credit losses in order to reduce "non-performing loans" and run profitable institutions.

This has necessitated the establishment of risk management structures in order to ensure that credit risk is maintained at a minimum level in the banking industry. Credit risk management can be understood as a framework for managing losses or minimising the potential effects of credit risk. Credit risk policies and procedures should be clearly specified in the overall risk management of the banking industry. Therefore, such policies should determine the bank's credit risk and serve as a framework for managing credit risk exposure.

The research methodology consisted of secondary data and involved the use of an econometric model to test the effect of credit ratings on credit risk. The Eviews 10 software was used to run the Generalised Methods of Moments (GMM). A sample of 11 locally registered banks was selected. Credit ratings, "macro-economic" and "bank-specific" variables were predicted to have explanatory power in determining the bank's credit risk. In addition, to ensure the robustness and appropriateness of the model, the Hausman test was used to select the appropriate method between fixed effects and the random-effects model. However, a system GMM model was used because this model avoids the problem of endogeneity. The next section presents a summary of key results.

5.4. Summary of key results

The empirical results showed that "macro-economic" and "bank-specific" variables influenced the credit risk of South African banks. Thus, the capital adequacy ratio lagged "non-performing loans", credit ratings, the inflation rate, bank size and unemployment caused banks' credit risk to increase. There was a positive relationship between capital adequacy ratio and "non-performing loans", implying that highly capitalised banks engaged in riskier lending. There was a positive and significant relationship between lagged "non-performing loans" and "non-performing loans", suggesting that "non-performing loans" were consistent with previous period "non-performing loans". The results also showed that credit ratings had the greatest influence on bank "non-performing loans". It has been shown that credit ratings positively and significantly influence variations in "non-performing loans", therefore, credit risk management policies in the banking industry should be informed by the level of credit ratings.

The results of the study showed that inflation had a positive influence on "non-performing loans". This influence was both statistically and economically significant, indicating the greater influence of inflation on the South African bank's credit risk. The exchange rate was also statistically significant and negatively influenced "non-performing loans". The results showed that an increase in the exchange rate could lead to a decline in "non-performing loans" of South African banks. Unemployment had a positive and significant influence on "non-performing loans". This trend between unemployment and "non-performing loans" was in line with the life-cycle theory, which implies that borrowers with low earnings tend to have a higher default rate because of the increased risk of unemployment and being unable to service their debts. The findings suggested that low economic growth, rising unemployment and high inflation can all lead to an increase in "non-performing loans" in the banking industry. Therefore, banks need to modify their credit extension policies based on "macro-economic" variables.

The results showed a positive and significant relationship between a bank's size in terms of asset base and "non-performing loans". This result was consistent with 'too big to fail' hypothesis which states that banks that are greater in size could resort to more relaxed credit standards and more liberal lending practices which would, in turn, increase "non-performing loans". The results also indicated that credit growth and the gross domestic product did not have a significant influence on "non-performing loans". This is because both credit growth and gross domestic product were insignificant and negatively related to the "non-performing loan". Banks are therefore encouraged to continuously monitor these determinants and adapt their lending policies as required.

As stated in Section 5.2, one of the objectives was to shed light on the impact of the global financial crisis of 2007-2009. The crisis was captured by a dummy variable, which showed a positive but insignificant association with the "non-performing loans". The results, therefore, indicated that the South African banks' "non-performing loans" were not severely affected during the crisis of 2007-2009. Another objective was to determine the effects of "macro-economic" and "bank-specific" variables on "non-performing loans". The results indicated that both these variables were the most important determinants of credit risk in the South African banking sector.

The results of this study found that variations in "non-performing loans" were explained by the capital adequacy ratio, bank size, inflation, exchange rate and unemployment when there was a movement in credit ratings by rating agencies. However, credit growth and gross domestic product were found to have a slight influence on a bank's credit risk. The global financial crisis of 2007-2009, on the other hand, had an insignificant impact on "non-performing loans" in South African banks. These results support the fact that the South African banking sector is regulated and well capitalised; hence, the influence on the banking industry was minimal. These findings show that both "macro-economic" and "bank-specific factors influence "non-performing loans" in South African banks. Policy implications and recommendations of this study are discussed in the ensuing section

.

5.5. Policy implications and recommendations

Credit risk management is particularly important in the case of the banking industry since most of the bank's profits are obtained by extending credit to different sectors in the economy. Based on the key findings of this study, the following recommendations are proposed to decision-makers and regulators at both "macro-economic" and "bank-specific" level:

- The capital adequacy ratio was shown to have a positive and significant influence on bank credit risk. Banks that intend to increase their credit extensions should, therefore, maintain a capital adequacy ratio above the minimum requirement. It is imperative that awareness of capital and its management in the banking industry be heightened, given the important role of the banking sector in the economy.
- The influence of lagged "non-performing loans" indicated that current "non-performing loans" have a level of persistence. "Non-performing loans" are a permanent feature of banks' balance sheets, therefore, it is imperative that banks develop mechanisms such as provisions for bad debts and continuously monitor "non-performing loans". It is therefore recommended that banks constantly review their banking practices and monitor these provisions by at least putting a minimum threshold in place.
- Increased bank size was shown to lead to higher "non-performing loans". These results are in line with the moral hazard under the 'too big to fail' theory. This theory states that bigger banks can resort to relaxed credit standards or extend credit to unworthy borrowers which may, in turn, increase "non-performing loans". Banks that extend more credit to different sectors of the economy should develop new approaches to assess creditworthiness. Banks can also consider implementing more effective credit risk management policies that align the level of credit risk to their increased lending.
- The variations in "non-performing loans" were shown to be influenced by credit ratings, the exchange rate, inflation and unemployment. Therefore, the credit policies of banks should be informed by the progress of the economy. It is important for policymakers and regulators to accord more focus on the performance of the economy in order to better manage "non-performing loan" growth and avoid a future banking crisis. A dummy variable was used to capture the period of the global financial crisis of 2007-2009. The

results indicated that the crisis had a minimal impact on "non-performing loans". However, policymakers should remain observant of any future economic turmoil. Banks should consider the exchange rate, inflation, unemployment, and the capital adequacy ratio and bank size as key determinants of credit risk when there is a movement in the credit ratings by rating agencies. Banks should consider developing more robust credit risk management systems and completely review their creditworthiness evaluation models and other credit control approaches.

5.6. Limitations of the study

The study was limited to locally registered commercial banks in South Africa for the period 2006 to 2015. The main limitation of the study was the unavailability of credit ratings and bank-specific data for some of the smaller banks. Although these banks were smaller in terms of their total assets base, their inclusion could have added valuable insights on credit risk and bank size. It would also have been interesting to discover how the global financial crisis of 2007-2009 affected those banks.

5.7. Recommendation for future research

Future research could be extended to include foreign-owned banks operating in South Africa. It would also be useful to investigate a similar topic, however, splitting the period under investigation into pre-crisis and post-crisis. As the growth of the South African economy is slowing down and facing a series of credit rating downgrades, it would be interesting to extend this study by including more bank-specific variables over a longer period.

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Appendix A: ETHICAL CLEARANCE

UNISA university of south africa

UNISA DEPARTMENT OF FINANCE, RISK MANAGEMENT AND BANKING ETHICS REVIEW COMMITTEE

Date: 04 JUNE 2019

Dear Mr KS Choenyana

ERC Ref #2019/CEMS/FRMB/005
Name : Mr KS Choenyana
Student #: 43388671
Staff #: 90226534

Decision: Ethics Approval from 01 July 2019 to 30 June 2024

Researcher(s): Name Mr KS Choenyana

E-mail address choenks@unisa.ac.za, telephone 012 429 6333

Supervisor (s): Name Prof J Young
E-mail address youngj@unisa.ac.za, telephone 012 429 3010

Working title of research:

An investigation into the influence of credit ratings on credit risk: South African banking industry

Qualification: Mcom

Thank you for the application for research ethics clearance by the Unisa DFRB Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 01 July 2019 to 30 June 2024

*The Negligible **risk application** was **reviewed** by the DFRB Ethics Review Committee on 04 June 2019 in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment*

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The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the DFRB Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
7. No fieldwork activities may continue after the expiry date (2024). Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number 2019/CEMS/FRMB/005 *should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Yours sincerely,

Signature

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