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LIST OF ABBREVIATIONS

AR(1)	Autoregressive estimation
BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlements
DL	Doubtful loans
EME	Emerging market economy
EMEs	Emerging market economies
FE	Fixed effects
GDP	Gross domestic product
GFC	Global financial crisis
GLA	Gross loans and advances
LL	Loss loans
LM	LaGrange multiplier
n.d.	No date
NCA	National Credit Act No. 34 of 2005
NPL	Non-performing loan
NPLs	Non-performing loans
RE	Random effects
ROA	Return on assets
ROE	Return on equity
SARB	South African Reserve Bank
SSL	Substandard loans
StatsSA	Statistics South Africa
Unisa	University of South Africa
WGC	World Gold Council

CHAPTER 1: INTRODUCTION: THE QUALITY ASSET DILEMMA

1.1 INTRODUCTION

"*Bank – A financial establishment that uses money deposited by customers for investment, pays it out when required, makes loans at interest, and exchanges currency*" – Concise Oxford Dictionary (2011).

Di Clemente (1983) researched the true definition of a bank from a legal perspective and concluded that a bank is an institution that accepts demand deposits and engages in commercial lending activities. Demand deposits are defined as any deposit that is available to the public that may be used to make payments to third parties, while loans are defined as all loans made to individuals or businesses, whether secured or unsecured (Di Clemente, 1983; Hassan & Jreisat, 2016).

The traditional definition of a bank explains that the business of a bank is to act as an intermediary by accepting deposits and advancing loans (Goyal & Joshi, 2011). According to the traditional definition, DeYoung and Rice (2004) stated that banks primarily derive earnings from the interest income on the advanced funds. This interest income that is generated from loans is the most significant source of income, and therefore, the largest asset of a bank (Ifeacho & Ngalawa, 2014).

Assets are generally accepted as items of value that can be used to derive income or service outstanding debts. According to Stulz (2015), a bank's primary goal is to maximise shareholder wealth. Profits are only earned when the interest received by the bank outperforms the cost of interest and the operating expenditure of the bank (Tayi & Leonard, 1988). Furthermore, Ifeacho and Ngalawa (2014) regard the returns generated by the assets of a bank, typically in the form of loans, as an indicator of positive bank performance.

This chapter introduces the dilemma of poor bank asset quality and the impact it has on the banking sector and the broader financial markets, and consequently the economy. The proposed determinants of poor asset quality, the facts regarding the determinants and the ongoing academic debates on the topic, have emphasised the need for this research.

This chapter provides a structured approach by introducing the problem and providing the background to banks and banking activities (Section 1.2). The background discussion explains that poor asset quality has far-reaching consequences, especially in African countries, and in times of structural changes or crisis. An exploratory literature review follows in Section 1.3, while Section 1.4 presents the research problem, and Section 1.5 lists the contribution that stems from this study. The study outline in Section 1.6 and a chapter summary in Section 1.7 concludes this chapter.

1.2 BACKGROUND

The performance of a bank is determined by the business activities the bank engages in, advancing funds to deficit economic units (DeYoung & Rice, 2004; Di Clemente, 1983; Goyal & Joshi, 2011). A bank could engage in riskier lending activities, thereby increasing the exposure to riskier assets and achieving higher possible returns, *ceteris paribus* (Tayi & Leonard, 1988). The performance of a bank is therefore dependent on the interest income earned on its loans, and the quality of these loans is determined by the repayments from borrowers (Ifeacho & Ngalawa, 2014).

Extensive research has been conducted on bank asset quality. This study predominantly stems from the European, Asian or North American perspective (Beck, Demirgüç-Kunt & Merrouche, 2013; Beck, Jakubik & Piloiu, 2015; Bouvatier & Lepetit 2008; Ćurak, Pepur & Poposki, 2013; Eken, Selimler, Kale & Ulusoy, 2012; Salas & Saurina, 2002). Only a few studies (Alhassan, Kyereboah-Coleman & Andoh, 2014; Fofack, 2005; Nikolaidou & Vogiazas, 2017) have an African focus. Irrespective of the number of research contributions made to the field of bank asset quality, the different studies rarely use a similar approach or similar independent variables when studying bank asset quality.

Research on bank asset quality often makes use of the non-performing loan (NPL) ratio as an indicator and dependent variable of asset quality in a bank (Beck *et al*., 2015; Ćurak *et al*., 2013; Filip, 2015). However, Moody's (2011), in its role as ratings agency, also presents five other asset quality ratios. These ratios make use of line items, such as loan loss provisions, gross loans, problem loans, provisional income, loan loss reserves and other accounting data, to describe the asset quality of a bank. Regardless of the asset quality measure, researchers have attempted to explain the

changes in the dependent variables by measuring the effect that changes in the macroeconomic and microeconomic variables, and structural breaks have on the asset quality variable.

Macroeconomic and microeconomic variables successfully explain changes in the bank asset quality. One of the most often used macroeconomic variables is the gross domestic product (GDP) (Alhassan *et al*., 2014; Louzis, Vouldis & Metaxas, 2012; Pain, 2003) which is known to improve bank asset quality. Other explanatory variables that measure changes in bank asset quality are loan growth, lagged non-performing loans (NPLs), interest rates, exchange rates, inflation rates, bank size, and unemployment rate (Alhassan *et al*., 2014; Louzis *et al*., 2012; Pain, 2003). However, there are other unique variables that may provide new information on factors that influence bank asset quality.

Structural breaks, such as global economic events, country-specific events and bank-specific events, have also been used as explanatory variables (De Haas & Van Lelyveld, 2014; Fofack, 2005; Pain, 2003). For example, Chipeta and Mbululu (2012) used a unique variable representing changes in regulation to determine the impact on credit extension, however, the focus of their study was not on bank asset quality research in Africa. Other variables such as a local crisis period and a global crisis period have also been included in previous studies (De Haas & Van Lelyveld, 2014; Saurina & Jimenez, 2006).

Though some commonly used variables, such as the GDP, unemployment rate and lending rates, generally return consistent results when explaining bank asset quality, researchers still grapple with other aspects of the determinants of bank asset quality (Ćurak *et al.,* 2013; De Haas & Van Lelyveld, 2014; Messai & Jouini, 2013). Laeven and Majnoni (2003) stated that regulation improves the stability of banking systems in the emerging market economy (EME). The Bank for International Settlements (BIS) (2014) also reported that authorities in EME should increase compliance with macroprudential measures to prohibit deterioration in bank asset quality. However, regulation is only one of the factors influencing bank asset quality and which has the potential to reduce the probability of a crisis in the banking sector.

Alhassan *et al.* (2014) stressed the importance of high-quality bank assets, especially in African countries, as some African countries experienced banking crises during the

1980s as a result of poor bank asset quality. Ćurak *et al.* (2013) concluded that a combination of a lower economic growth[1] rate, rising inflation and rising interest costs are associated with an increase in NPLs. The BIS (2014) warned that countries less affected by the global financial crisis[2] (GFC) should prepare for a period with increased non-performing bank assets. In general, countries did not have similar exposure to the GFC and the deterioration of asset quality was different amongst countries (Beck *et al*., 2015).

1.3 EXPLORATORY LITERATURE REVIEW

The exploratory literature review provides an overview of bank asset quality, determinants of bank asset quality, conclusive empirical findings on bank asset quality, empirical findings still debated on bank asset quality, and a review of factors creating a conducive environment for bank asset quality research.

1.3.1 A brief overview of bank asset quality

A bank generally incurs unwanted risk when, acting as an intermediary, it advances funds from a surplus economic unit to a deficit economic unit (Eken *et al*., 2012). A bank always bears risk when funds are advanced to a deficit unit which should not have obtained funds due to it not being able to service the debts (Saurina & Jimenez, 2006). Alternatively, no funds might be advanced to a deficit unit which would have been able to service debts, resulting in a lending error (Saurina & Jimenez, 2006).

To protect the banking system against credit risk, the BIS (2014) implemented minimum capital requirements by promulgating these minimum capital requirements in the Basel Accords. These minimum capital requirements reduce credit risk in the banking sector (BIS, 2014; Kavwanyiri, Mutua & Abraham, 2017). According to Ćurak *et al.* (2013), of all the risks that banks are exposed to, credit risk has the potential for the most substantial impact on a bank, as the primary assets of a bank are the loans.

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[1] Economists regard the GDP as an indicator of economic growth, although acknowledging that the GDP has shortcomings (Van den Bergh, 2009).

[2] Refers to the 2007 – 2009 subprime crises. The crisis started in July 2007 and in September 2008, Lehman Brothers collapsed, followed by a global recession (Eichengreen, Mody, Nedeljkovic & Sarno, 2012). For reference purposes, this study only refers to the global financial crisis (GFC).

Messai and Jouini (2013) concluded that poor bank asset quality threatens the banking system of a developed economy. An increase in NPLs could cause the collapse of a bank, and consequently require intervention from a central bank to preserve stability in the banking sector. Beck *et al.* (2015) supported the findings and stated that the bank asset quality deteriorated due to the GFC, although there are differences in the loan performance in the various world economies. Discounting the severe impact that poor asset quality has on the financial services sector could lead to significant losses in an economy.

Banks are aware of the importance of maintaining quality bank assets, and as a result, some banks do not correctly account for losses, as it directly impacts on the profit of the institution and the shareholder value (Laurin & Majnoni, 2003). To promote information accuracy, the BIS (2014) suggested that institutions should account for all losses, especially after experiencing any financial difficulties, as this enables institutions to strengthen their intermediation capacity.

In support of improving intermediary activities, Filip (2015) concluded that intermediaries should regularly assess the quality of bank assets by using the financial results and various economic indicators. Beck *et al*. (2015) further stated that regular stress tests should be conducted analysing the effect that different factors have on the bank asset quality. Laurin and Majnoni (2003) averred that constant asset quality reviews provide detailed asset quality information to the bank managers.

The information provided on asset quality is also beneficial to regulators. Messai and Jouini (2013) found that banks with a portfolio of deteriorating assets are one of the leading causes of bank failures and financial crises. The GFC is an indication of the widespread chaos that results from poorly regulated loan portfolios experiencing a sudden shock in the macroeconomic environment (Saksonova, 2013). As a result of poor asset quality, bank regulators had to intervene during the crisis period to protect the stability of the financial services sector by providing market liquidity, and stimulating activity using quantitative easing[3] (Fratzscher, Lo Duca & Straub, 2018).

[3] Quantitative easing is the process of reducing interest rates and increasing the supply of money in order to stimulate economic activity to meet the inflation target (Benford, Berry, Nikolov, Young & Robson, 2009).

The prevailing macroeconomic conditions in a country have an impact on the asset quality of a bank (Messai & Jouini, 2013). Beck *et al.* (2015) confirmed that support exists for a relationship between asset quality and economic activity. Bouvatier and Lepetit (2008) explained that banks allow excessive credit advances during growth periods due to the positive outlook on the economy. In contrast, during a contraction, a bank reduces credit advances because of the pessimistic outlook on the economy. *Vis-à-vis*, during the economic growth periods, banks take on additional risk to generate profits.

1.3.2 Determinants of bank asset quality

Bank asset quality is determined by a range of different factors, which may include macroeconomic and microeconomic factors, as well as structural changes in an economy. To mention but a few, Salas and Saurina (2002) studied the effect of loan growth, regulation, GDP, indebtedness of families, manager incentives, market power, asset ratios, collateralisation, bank size and bank competition on NPLs in Spain. Messai and Jouini (2013) focused on fewer variables, only studying the effects macroeconomic factors on NPLs in Italy, Spain and Greece, while Pain (2003) conducted a study in the United Kingdom on NPLs incorporated macroeconomic variables, microeconomic indicators and structural breaks as determinants of bank asset quality.

According to Beck *et al*. (2015) who studied 75 countries across different regions, the majority of research findings are based on the influence of macroeconomic variables on bank asset quality. Messai and Jouini (2013) found that the macroeconomic variables studied most often are GDP, interest rate, inflation rate, loan growth, exchange rate, unemployment and money supply. Beck *et al*. (2015) concluded that GDP has a definitive impact on bank asset quality, although other determinants should not to be discounted.

Various other scholars (Bouvatier & Lepetit[4], 2008; Saurina & Jimenez[5], 2006; Salas & Saurina, 2002) found that the frequently used macroeconomic determinants of bank

[4] Bouvatier & Lepetit (2008) studied 186 European banks for the period 1992 – 2004.

[5] Saurina & Jimenez (2006) studied Spanish banks for the period 1984 – 2002.

asset quality are GDP, credit growth, bank size, interest rate, exchange rate and unemployment rate. In contrast, the microeconomic variables tend to be more unique measures (Klein, 2013). Some of these microeconomic variables are the interest rate spread (Salas & Saurina, 2002), capital ratio (Salas & Saurina, 2002), solvency ratio (Bouvatier & Lepetit, 2008), bank efficiency (Bouvatier & Lepetit, 2008), share index (Beck *et al.,* 2015), return on assets (ROA) (Messai & Jouini, 2013), and return on equity (ROE) (Eken *et al*., 2012).

Bank-specific variables that explain the bank asset quality consist primarily of financial ratios. Louzis *et al.* (2012) found evidence that supports a relationship between the bank performance ratios and bank asset quality. There is nothing strange about this relationship because the bank asset quality indicator is the financial ratio incorporating NPLs and gross loans (Bouvatier & Lepetit, 2008; Pain, 2003; Saurina & Jimenez, 2006). This financial ratio is also critical as an explanatory variable in asset quality research, because the lagged value of the NPL ratio is a good indicator of risk that explains the persistence of NPLs (Bouvatier & Lepetit, 2008; Pain, 2003; Saurina & Jimenez, 2006).

Studies by various other scholars (Louzis *et al*., 2012; Salas & Saurina, 2002; Saurina & Jimenez, 2006) included fewer variables and added categorical variables for monetary policy changes or other structural changes, indicating the vast number of determinants that influence bank asset quality. The BIS (2014) stated that regulation within the banking industry brought about positive changes. Eken *et al*. (2012) also identified the microeconomic variables of bank size, geographic location and share index in the bank asset quality analysis. Some of the variables that influence bank asset quality are discussed in the following three subsections and address the empirical and conclusive empirical findings, and debate the empirical findings.

1.3.3 Empirical research findings on bank asset quality

The empirical results provide information on results about market capitalisation, the GFC, financial reporting and the impact of interest rates on NPLs. Salas and Saurina (2002) identified the market capital of a bank as a significant determinant of NPL. According to Bouvatier and Lepetit (2008), the market share can increase by adapting the credit policy of a bank, although this would only benefit the bank in the short term and would increase the NPLs after a period.

The empirical results further indicate that the asset quality of banks in economies with varying share market capitalisation rates react differently to share market changes (Beck *et al.*, 2015). According to Beck *et al.* (2015), the falling share prices have a negative impact on bank asset quality. Further interfering with share prices, the GFC had a significant effect on the share prices in the economy (Davis, 2011). Beck *et al.* (2015) concludes that a decrease in share prices leads to an increase in NPLs.

De Haas and Van Lelyveld (2014) studied the effect of the GFC and credit growth in a country and found that the type of ownership of a bank, whether locally-owned or foreign-owned, influenced the credit growth of a bank. De Haas and Van Lelyveld (2014) concluded that countries that have a majority of foreign-owned banks have decreased levels of GDP and a contraction in credit growth.

The credit growth of a bank is captured in the financial results of the bank. These financial results inform stakeholders of the bank's financial position. Pain (2003) identified a limitation in the financial reporting, as financial reports make provisions for NPLs, but these provisions are made by relying on historical data. Pain (2003) was of the opinion that provisions should be set by assessing the future changes in the level of NPLs. Salas and Saurina (2002) found that the bank-specific indicators act as early warning indicators of NPLs. However, Pain (2003) concluded that a limitation of financial results is that they are determined by capturing historical financial information.

Financial results, which form part of company analysis, are used in the fundamental analysis to evaluate assets (Robu & Istrate, 2015). Some essential uses of financial results are to report on capital and for various different types of bank analysis. Bouvatier and Lepetit (2008) found that the solvency ratio (capital to total assets) suggests capital strength but that the level of capital strength has a negative impact on NPLs. NPLs increase as a result of banks that enter into riskier activities, due to a higher level of capital being required. Bouvatier and Lepetit (2008) also made use of financial information to determine the cost-efficiency of a bank and concluded that there is an indirect relationship between efficiency and NPLs.

Banks have various lending activities which range from corporate lending to revolving credit to individuals. Louzis *et al.* (2012) averred that each type of loan has a different level of impact on NPLs. Each type of loan is also priced at a different interest spread

that also directly impacts NPLs (Salas & Saurina, 2002). Pain (2003) stated that provisions for NPLs are made in the financial statements. The importance of adequate financial reporting is paramount as all findings are dependent on the accuracy of the financial reporting.

1.3.4 Stylised facts on bank asset quality

Research has revealed that similar findings are supported when evaluating bank asset quality across different countries around the world, irrespective of whether the research took place for a single country or multiple countries. The empirical results of Louzis *et al.* (2012) who studied the Greek banking sector, as well as that of Bouvatier and Lepetit (2008), suggested that macroeconomic variables such as GDP growth, unemployment and interest rates consistently deliver similar results.

GDP growth is expected to have an adverse effect on bank asset quality. Ćurak *et al.* (2013) explained that in flourishing economic conditions, borrowers have access to funds to repay debts, as the income of the deficit economic units increase. Messai and Jouini (2013) averred that the income increases typically reduce bad debts as borrowers can repay borrowed funds. However, the negative relationship indicates that a contraction in GDP increases the bad debts, leading to reduced bank asset quality. During an expansion cycle, borrowers repay loan commitments as scheduled, reducing the probability of deteriorating bank asset quality (Alhassan *et al*., 2014). According to Filip (2015), it is also possible that the opposite may occur, because when GDP growth contracts, bank asset quality deteriorates. According to Beck *et al*. (2015), GDP growth has been the leading indicator of bank asset quality performance during the last decade.

The business cycle has a strong relationship with bank asset quality (Bouvatier & Lepetit, 2008). Saksonova (2013) found that the deterioration of GDP growth in Latvia reduced the asset quality of banks in this European country. Similarly, the BIS (2014) found that weak economic growth in the Chinese economy was the cause of the increased non-performing assets in the country.

The interest rate adversely influences the ability of a borrower to repay debt (Ćurak *et al*., 2013). Bouvatier and Lepetit (2008) stated that the prevailing lending rate offered to a borrower includes the risk premium that a bank charges debtors to accommodate

the risk profile of a borrower. Therefore, increases in interest rates cause the debtor, irrespective of the interest rate offered, increased pressure to repay borrowed funds and conversely, reduces the bank asset quality (Ćurak *et al*., 2013).

Beck *et al*. (2015) were of the opinion that the interest rate is one of the macroeconomic determinants that delivers generic results when used to measure bank asset quality. According to Ćurak *et al.* (2013), a positive relationship exists between bank asset quality and interest rates, and this empirical finding is consistent with the findings of Espinoza and Prasad (2010), Fofack (2005), and Louzis *et al.* (2012). However, Beck *et al.* (2015) found that the effect of interest rate changes is absorbed in countries that follow an inflation-targeting framework, as decreases in the interest rate only reflect marginally in the ratio of NPLs.

Unemployment has a significant correlation with NPLs (Filip, 2015). According to Louzis *et al.* (2012), the significant impact is explained by the inability of unemployed borrowers to service debts. Furthermore, Louzis *et al.* (2012) found that consumer debt is more sensitive to unemployment than business borrowings. Messai and Jouini (2013) concluded that banks also increase loan loss provisions during business cycles that show increases in the unemployment rate.

The bank asset quality also has certain levels of sensitivity to industry variables. Salas and Saurina (2002) determined that NPLs have a negative relationship with the size of a bank. The size of the bank determines the diversification opportunities available to the bank (Bouvatier & Lepetit, 2008). A higher level of banking asset diversification could potentially mitigate the exposure to default risk on the NPLs (Bouvatier & Lepetit, 2008). Although it seems that the relationship between the macroeconomic and microeconomic variables and NPL is conclusive, some aspects are still debated by policymakers, academia and practitioners.

1.3.5 Ongoing academic debates

Although the generalisability of results is important, some determinants have unique relationships with NPLs, as the environment in which research takes place has a level of uniqueness. The GDP has been known to have a definite negative relationship with bank asset quality (Alhassan *et al*., 2014; Filip, 2015; Salas & Saurina, 2002). However, Laeven and Majnoni (2003) stated that the GDP variable reacts differently

across various countries. Beck *et al.* (2015) agreed that although the relationship between bank asset quality and GDP is well established, other factors may cause a variation in the deterioration of the bank asset quality amongst different countries. The GDP growth in a country also has relationships with other macroeconomic factors, such as inflation and interest rates (Bittencourt, Van Eyden & Seleteng, 2015).

Inflation is yet another variable that has an assumed definitive impact, although not all researchers support this finding (Shu, 2002). Empirical results indicate that the inflation rate has a positive relationship with the bank asset quality (Filip, 2015; Fofack, 2005). Contrary to these findings, Shu (2002) expected a negative relationship between inflation and bank asset quality, because inflation is associated with GDP growth and it essentially reduces the real debt amount that needs to be repaid by borrowers. Ćurak *et al.* (2013) explained that low levels of inflation spur economic growth which improves the ability of borrowers to repay debts. Alhassan *et al*. (2014) argued that inflation reduces consumption, as inflation erodes the purchasing power of consumers leading to difficulty in servicing debts.

Exchange rates also have an undetermined relationship with bank asset quality. Ćurak *et al*. (2013) found that bank asset quality in the emerging market economy (EME) is at risk when loans are denominated in a foreign currency. Beck *et al.* (2015) concluded that the exchange rate in countries without currency mismatches have a positive impact on bank asset quality, as the depreciating currency causes an increase in exports, thereby strengthening the balance sheets of corporate entities. However, the lack of data in the research by Beck *et al.* (2015) prevented the researchers from investigating precisely how currency impacts bank asset quality.

Bank asset quality is also subject to the regulatory environment within which the bank operates. This environment potentially benefits banks in the EME because of the less-regulated market (Laeven & Majnoni, 2003). However, De Haas and Van Lelyveld (2014) who conducted research on the 48 multinational banks located in different countries across the world found that regulation, especially for banks with cross-border operations, might reduce the credit standards in foreign countries where there is less regulation, and which consequently might reduce the bank asset quality in the domestic country.

The GFC highlighted that banks face risks from both the local and the global perspective. De Haas and Van Lelyveld (2014) emphasised that foreign-owned banks remain stable lenders during periods of domestic crisis, but when the foreign-owned banks experience crisis in their domiciled countries, these banks tighten their credit standards in the other countries of operation. According to Eken *et al*. (2012), the impact of the GFC on bank asset quality was due to the risk appetite of banks, and if the banks altered their risk appetites during the GFC, the balance sheet sensitivity to the GFC could have been reduced, even across borders.

The risk appetite of a bank is dependent on the profitability of the bank, for example, low profits often cause bank managers to engage in riskier lending practices to generate profits (Ghosh, 2015). Bank profitability is often measured using the ROA and ROE as proxies for the profitability of a bank (Berger & DeYoung, 1997; Ghosh, 2015; Messai & Jouini, 2013). In support of this, Erdinç and Abazi (2014) stated that these two determinants have a similar impact on NPLs. However, the assumption that the ROA and ROE have a similar impact on NPL was rejected by Moussu and Petit-Romec (2014). Ifeacho and Ngalawa (2014) further explained that the ROA and ROE might not even be the best profitability measures and recommended the use of interest income on loans.

This study makes an original contribution to bank asset quality knowledge because of the ongoing academic debates, and as a result of the unique relationship that bank asset quality has with the different determinants amongst different countries. This study explains how the different macroeconomic and microeconomic determinants interact with bank asset quality from a South African perspective.

1.3.6 Research environments conducive to bank asset quality research

Bank asset quality deteriorates disproportionately between different countries (Beck *et al*., 2015). De Haas and Van Lelyveld (2014) were of the opinion that the GFC is an example of the distortion that exists in the variations in bank asset quality between developed economies and EMEs. Generally, findings suggest that the NPL ratios deteriorate due to crisis periods, but research indicates that the NPL ratios of EMEs were almost 40% lower than that of the NPL ratios of developed economies in 2009 during the GFC (Beck *et al.,* 2015).

Countries with rich mineral commodity reserves benefited from the commodity boom cycle from 2007 to 2010 because of above-normal commodity prices (Mariscal & Powell, 2014). South Africa, as a key producer in the commodity mineral market and one of the largest gold producers in the world, benefited from the commodity boom periods (Baxter, 2009; Dick & Naidoo, 2016). According to the BIS (2014), banks in countries experiencing a boom period tend to have weaker balance sheets than they actually realise. This is predominantly a risk for EMEs when developed economies reduce quantitative easing (BIS, 2014). The BIS (2014) advised that regulatory entities must actively manage risks in EME banks and should aim to improve prudential measures.

Banks from developed economies and multinational African banks have expanded significantly, and have started sourcing business across borders (De Haas & Van Lelyveld, 2014). According to De Haas and Van Lelyveld (2014), banks that operate in different countries are, not only foreign-owned, but also have a different balance sheet composition. The BIS (2014) stated that multinational banks determine how to match funding and assets according to the geographic location of a bank and that this location also impacts the bank model used in a specific country.

The monetary policy in a country is determined by the central bank (Bruno & Shin, 2015). According to Beck *et al.* (2015), if the central bank of a specific country adopts an inflation-targeting approach, interest rate decreases may only marginally offset the increase in NPLs. However, it was acknowledged that interest rates have a significant impact on bank asset quality (Beck *et al*., 2015). According to Louzis *et al.* (2012), bank regulators can more accurately assess the riskiness of banks in economies with a smaller number of banks than in countries with more banks. Effective risk management of banks is essential because poor monetary policy impacts financial stability and has a negative effect on the real economy as well as the financial sector (Beck *et al*., 2015).

Bank regulators aim to reduce systemic risk in the banking sector by setting capital adequacy requirements and minimum credit standards (De Haas & Van Lelyveld, 2014). According to Eken *et al.* (2012), tighter credit standards reduce the banks' ability to lend funds from surplus economic units to deficit economic units. However, Filip (2015) stated that banks may apply credit standards that are stricter than the minimum credit standard in determining whether a borrower qualifies for a loan.

Beck *et al.* (2015) were of the opinion that countries that have a deteriorating level of share prices might expect a decrease in bank asset quality if the share market capitalisation is high compared to the level of GDP. According to the World Bank (n.d.), the percentage of South African shares (stocks) that were traded in comparison to the total value of GDP deteriorated, declining from 142% in 2007 to 78% in 2012.

Because South Africa has a number of the attributes that would deliver insights into the macroeconomic and microeconomic factors that influence bank asset quality, the country offers a suitable context for the research. A study done by Khanyile in 2014, concluded that South Africa is an EME that is rich in mineral commodities, especially gold, it has multinational banks, supervised by a central bank, regulated using different bank and credit acts, and it hosts the largest stock exchange in Africa.

1.4 RESEARCH PROBLEM

This study is guided by a research problem and five distinct research questions that require further investigation in order to develop the knowledge about bank asset quality in South Africa. According to Alhassan *et al*. (2014) there is a shortage of bank asset quality research across Africa. Filip (2015) further states that banks should conduct regular asset quality assessments.

1.4.1 Problem statement

Investigate the macroeconomic and microeconomic determinants of bank asset quality in South Africa, accounting for structural changes in the economy.

1.4.2 Research questions

The problem statement was supported by five research questions. The five research questions of this study are:

- Is the NCA effective in reducing NPLs in South Africa?
- Did the GFC have an impact on bank asset quality in South Africa?
- Does a value of gold exports in South Africa have an impact on bank asset quality?
- Does interest income on loans have superior explanatory power regarding NPLs, in comparison to the ROE?

- Does interest income on loans have superior explanatory power regarding NPLs, in comparison to the ROA?

In answering these five research questions, this study will contribute to the knowledge of bank asset quality in South Africa.

1.5 RESEARCH CONTRIBUTION

The findings from this research will enable researchers, policymakers and practitioners to replicate the research to determine the bank asset quality in other EMEs. The findings contribute to the body of knowledge by determining the influence on bank asset quality when the following factors are considered:

- GFC resilience;
- Regulatory changes;
- Profitability measures;
- Impact of gold sales as an asset of the last resort;
- Country-specific bank-per-bank perspective; and
- Macroeconomic and microeconomic determining variables.

This study includes macroeconomic and microeconomic variables that could be used by regulators to ensure and determine the stability of asset quality in the banking sector (Alhassan *et al*., 2014; Beck *et al*., 2015). Beck *et al.* (2015) posited that a review of the macroeconomic variables in a study on bank asset quality may provide information on country-specific vulnerabilities. Although the macroeconomic determinants impact the asset quality of banks, Makri, Tsagkanos and Bellas (2014) stressed the importance of conducting research that includes the macroeconomic and microeconomic data on an aggregate level between the banks in an economic zone.

Alhassan *et al.* (2014) advised that African countries should emphasise the control of bank asset quality as this reduces the probability of a banking crisis occurring. The South African economy presented some resilience to the GFC (Baxter, 2009). An understanding of the delay in the spill-over of the major effects of the GFC can contribute to knowledge on preserving bank asset quality during times of crisis. The BIS (2014) concluded that banks that hold subsidiaries in foreign countries have

proved to be somewhat resilient, but at the same time, warned that bank offices in EMEs might be weaker than they seem, especially in cases where a country experienced GDP growth. Louzis *et al*. (2012) highlighted the importance of further investigation into the effects of the GFC, as this might better explain the interrelationship between NPLs and its determinants. De Haas and Van Lelyveld (2014) also advocated for research on the GFC and the bank asset quality of multinational banks, as this can contribute to the current knowledge on the financial support parent banks would allow their foreign subsidiaries.

Before the GFC, South Africa implemented the NCA. Laeven and Majnoni (2003) reported that regulation could be a potential barrier against instability in the EME banking environment. Chipeta and Mbululu (2012) recommended that future research should focus on explaining the relationship between the NCA and bank performance. Bank performance depends on asset quality, as quality assets are the primary source of income. The BIS (2014) was of the opinion that regulatory changes can improve bank profitability. This could be explained by investigating the impact of regulation on the availability of funds (Saurina & Jimenez, 2006). De Haas and Van Lelyveld (2014) also stressed the importance of appropriate regulation, as it might have adverse effects on banks, depending on the severity of the imposed regulations.

As one of the top ten gold exporters, South Africa shared in the lucrative gains due to the commodity boom cycle (Baxter, 2009; Helbling, 2012; Williams, 2015). Eken *et al.* (2012) stated that the booming commodity prices was one of the contributing factors that improved liquidity in the European banking sector in the first decade of the new millennium. However, the exact effect of the commodity boom on bank asset quality has yet to be determined.

The originality of this study is supported because this study makes use of publically available bank data that encompasses the effect of macroeconomic and microeconomic determinants, financial crisis periods, regulatory influences and commodity sales.

1.6 STUDY OUTLINE

The study consists of seven chapters. The first chapter is an introductory chapter, providing the necessary background of bank asset quality before providing the

problem statement and associated research questions. The contribution of this study is provided before a study outline is presented.

- **Chapter 2: Literature review**

Although Chapter 1 provided background on the determinants of bank asset quality, it did not explain how banks do business. Chapter 2 explains the banking environment and the functions of banks in the economy. This chapter explains that NPLs impact bank asset quality and provides information on how banks operate internationally and in the South African environment.

- **Chapter 3: Theoretical foundation and hypothesis development**

This chapter presents the theoretical foundations for this study. These foundations depict the current knowledge, the shortcomings in the body of knowledge, the contribution made by this study to the body of knowledge and the objectives of this study.

- **Chapter 4: Research design and empirical methodology**

Chapter 4 presents the research design for this study. This design explains how the data was collected from the different data sources. The statistical methods that were utilised for analysis and the panel data regression models are described. The chapter concludes with the proposed regression models for the estimations and the ethical considerations undertaken in this study.

- **Chapter 5: Variable description**

This chapter provides information on the dependent variable, as well as the explanatory variables that are employed as the determinants of the NPLs. The data sources are also provided in this chapter. In addition to the information on the determinants, the expected influence (sign) that explanatory variables have on the dependent variable are discussed.

- **Chapter 6: Empirical results**

The empirical results chapter presents the descriptive statistics and the econometric regression analysis results. The regression results are presented in four parts, firstly the influence of the macroeconomic determinants, followed by the microeconomic determinant results. After these discussions, the determinants that relate to the

hypotheses are interpreted. Lastly, the different income performance measures are discussed.

- **Chapter 7: Conclusion**

The conclusion chapter is a summary of this study. The conclusion reinforces the findings of the hypothesis statements. A discussion of the contribution made by this research is followed by concluding remarks on the hypothesis statements. Recommendations are made that stem from this study and the limitations of this study are explained. The future research that has to be conducted precedes the final summary of this study. Fundamentally, this chapter emphasises the contribution to the academic body of knowledge.

1.7 SUMMARY

Important aspects that are highlighted in this chapter and that guide this study are that poor bank asset quality remains one of the leading causes of financial crises. Although the importance of maintaining bank asset quality is established and an abundance of research is available on multi-country studies, the majority of these studies only focus on developed economies, and there is a lack of research from a single country perspective. The principles that guide this study are as persistent as NPLs, and suggest that bank asset quality has to be researched from an EME perspective, using macroeconomic and microeconomic determinants, studying the impact that structural breaks and changes have on bank asset quality. Also, the influence that commodity exports and different bank profitability measures have on NPLs should not be discounted, as it also has an influence on NPLs, and consensus has not yet been reached on the impact that commodity sales and different bank profitability measures have on NPLs.

The study outline presents the course of action that this study undertook to investigate the research problem and its contribution to the bank asset quality body of knowledge in South Africa. In countries where the capital markets are less developed, the banking industry dominates the financial market, because fewer alternative funding institutions are available (Mullineux, 2006). For this reason, a thorough understanding of banks, and the role of bank asset quality in the broader financial environment is essential.

CHAPTER 2: LITERATURE REVIEW: BANKS AND QUALITY OF ASSETS

2.1 INTRODUCTION

The banking system, though easily defined, is a complex system. Knowledge about the impact that bank asset quality has on each aspect of the bank's business environment is essential. Beck *et al.* (2015) averred that economic activity is not singularly to blame for the deterioration in bank asset quality. Earlier research (Berger & DeYoung, 1997; Salas & Saurina, 2002) attempted to explain the inference of bank asset quality and bank models, financial ratios, macroeconomic influences and legislation. No prior research has reached consensus on the bank environments that lead to the higher probabilities of poor bank asset quality. However, it is important to synthesise the literature on bank asset quality and bank business environments to contribute to the information on banks and quality assets.

The aim of this chapter is to describe the functions of a bank and the types of banks that are available. The functions of a bank, the regulatory environment, financial reporting and the role of credit agencies are discussed, as these concepts shape the banking environment. The context of bank asset quality underpins each discussion of the various banking concepts.

This chapter has five subsections and a chapter summary. Section 2.2 defines bank asset quality, Section 2.3 reviews the various types of bank structures and Section 2.4 explains the financial model and financial reporting of the bank. Section 2.5 discusses the international and domestic regulatory principles, while Section 2.6 provides information on the bank credit ratings. This chapter concludes with the chapter summary, Section 2.7.

2.2 AN INVESTIGATION INTO BANK ASSET QUALITY

Bank asset quality is expressed as a ratio of different financial statement line items. The primary measures of bank asset quality are NPLs, loan loss provisions, gross loans, pre-provision income, loan loss provisions, and total assets (Biswas, 2014; Moody's, 2011). Biswas (2014) posited that the asset quality measures how NPLs

impact the interest income of different types of loans. Irrespective of the importance of bank asset quality as a ratio of a bank's financial strength, the variables that determine bank asset quality must be demarked (Mishra & Aspal, 2012).

Individual investors, corporate institutions and regulators use asset quality ratios when making investment decisions or evaluating the condition of an institution. Moody's (2011) provides five possible ratios to determine asset quality. According to Moody's (2011) asset quality (AQ) ratios are calculated as per Equations 2.1 to 2.5.

$$Loan\ loss\ provisions\ /_{Gross\ loans} = AQ \quad (2.1)$$

Source: Moody's (2011)

$$Loan\ loss\ provisions\ /_{Pre\text{-}provision\ income} = AQ \quad (2.2)$$

Source: Moody's (2011)

$$Allowance\ for\ loan\ losses\ /_{Gross\ loans} = AQ \quad (2.3)$$

Source: Moody's (2011)

$$Problem\ loans\ \&\ leases\ /_{Gross\ loans} = AQ \quad (2.4)$$

Source: Moody's (2011)

$$Problem\ loans\ \&\ leases\ /_{(Shareholders'Equity\ +\ Loan\ loss\ reserves)} = AQ \quad (2.5)$$

Source: Moody's (2011)

Equation 2.1 delivers an AQ ratio presenting loan loss provisions as a percentage of gross loans. Equation 2.2 calculates an AQ ratio presenting loan loss provisions as a percentage of pre-provision income. Equation 2.3 delivers an AQ ratio of problem

loans and leases as a percentage of gross loans. Equation 2.4 delivers an AQ ratio of problem loans and leases as a percentage of gross loans. Lastly, Equation 2.5 delivers an AQ ratio presenting problem loans and leases as a percentage of shareholders' equity and loan loss reserves.

Moody's (2011) presents various formulae to calculate asset quality ratios. However, past research (Alhassan *et al*., 2014; Beck *et al*., 2015; Ghosh, 2015; Klein, 2013; Mishra & Aspal, 2012) only used the AQ ratio as in Equation 2.4. Alhassan *et al.* (2014) who researched bank-specific determinants in Africa, also regard NPLs divided by total loans as the most accurate method to calculate the asset quality ratio.

The ratios presented by Moody's (2011) are all measures of asset quality. These asset quality measures all refer to various financial statement line items. All ratios either use loan losses, NPLs, or synonymously, problem loans to describe an institution's asset quality. This study makes use of the formula in Equation 2.4 to calculate the NPL ratio. A brief overview of the use of loan loss provisions (LLPs) is presented, as researchers who do not have access to NPL data often replace NPL with LLPs to determine the asset quality of a bank (*cf.* Love & Ariss, 2014).

2.2.1 Loan loss provisions

Loan loss provisions are shown as an expense for the financial institution on the income statement, while the loan loss reserves are a balance sheet item (Cohen, Cornett, Marcus & Tehranian, 2014). Ahmed, Takeda and Thomas (1999) described LLPs as an item that is used to adjust loan loss reserves according to the performance of the loan portfolios. Various scholars (Ahmed *et al*., 1999; Bertay, Demirgüç-Kunt & Huizinga, 2015) have agreed that LLPs offer a meaningful source of information on the quality of a bank's loan portfolio.

Although LLPs indicate bank loan quality, they are often used for other purposes. Laeven and Majnoni (2003) found that LLPs are successfully used to smooth bank profits or to reduce volatility in capital management. This finding is similar to that of Ahmed *et al*. (1999) who stated that one of the most important features of LLPs is capital management. Moreover, LLPs are inaccurate as an asset quality measure because LLPs provide a distorted view of the bank asset quality.

As LLPs provide a construed view of the asset quality, bank managers often use LLPs to misrepresent asset quality information. Ahmed *et al*. (1999) reported that earnings management and the dissemination of private information are not determinants of LLPs. However, Cohen *et al*. (2014) warned that if banks are not upfront in their information dissemination, loan losses should be cautiously interpreted due to bank managers having discretion when estimating LLPs. Furthermore, Cohen *et al*. (2014) stated that the strategic presentation of LLPs is used to manipulate the appearance of a bank's financial position. However, Gunther and Moore (2003) found that in cases of severe misrepresentation of the loan quality or LLPs, the regulator mandates revisions to the LLPs.

Although LLPs have been the cornerstone of some asset quality ratios (Moody's, 2011) and research has been conducted on bank asset quality by using LLPs (Laeven & Majnoni, 2003), LLPs are not considered as the measure of NPLs in this study. Due to the potentially discretionary nature of LLPs, NPLs are the preferred financial statement line item used in the calculation of the asset quality ratio.

2.2.2 Non-performing loans

According to Biswas (2014), as well as Mishra and Aspal (2012), NPLs are an indicator of the bank asset quality. As early as 1987, Meeker and Gray concluded that NPLs are the most suitable measure of bank asset quality. And more recently, Ongore and Kusa (2013) also stated that NPLs offer the best measure of bank asset quality. Zafar, Maqbool and Khalid (2013) defined an NPL as any loan that does not generate any income for a bank.

Various researchers (Meeker & Gray, 1987; Mishra & Aspal, 2012; Ongore & Kusa, 2013; Zafar *et al*., 2013) stated that NPLs offer the best measure of bank asset quality. However, Bholat, Lastra, Markose, Miglionico and Sen (2016) claimed that there is no internationally accepted standard, from an accounting perspective, to describe an NPL. Bholat *et al*. (2016) made specific reference to the International Financial Reporting Standards (IFRS) and the US Generally Accepted Accounting Principles (GAAP) stating that both these accounting standard bodies dealt with credit risk, and not NPLs. Bholat *et al*. (2016) stated that Basel defines a loan as outstanding when the repayment of the loan is 90 days overdue. Wu and Bowe (2012) reported that the IFRS subdivided loans into five groups, namely, 'Standard', 'Special mention', 'Sub-

standard', 'Doubtful' or 'Loss' loans. However, Zafar *et al*. (2013) stated that NPLs should be described as sub-standard loans (SSL), doubtful loans (DL) or loss loans (LL). The definition of an NPL, based on the category of the loan, SSL, DL or LL, is essential for the measurement of an NPL (Zafar *et al*., 2013). Bholat *et al*. (2016) stated that NPL is a term unique to the banking industry.

Not only does the definition of an NPL differ from an accounting perspective, but countries also apply their own unique definition which often leads to mixed interpretations of NPL determinants across countries (Crystal, Dages & Goldberg, 2001). Isa, Choong, Fie, Mohamed and Agil (2013) reported that Malaysia describes a NPL as any loan that has been outstanding for a period. Australia is more definitive in their definition, stating that any loan is an NPL once the principal and interest on the loan amount has been outstanding for more than 90 days (Cummings & Durrani, 2016). The South African definition of NPLs, as set by the SARB, is that loans are classified as NPLs according to the write-off policy of a bank (SARB, 2014). Similar to the IFRS, the SARB also classifies the risk exposure of the loans as 'Standard', 'Special mention', 'Sub-standard', 'Doubtful' or 'Loss' (Bholat *et al*., 2016).

Various studies (Clair, 1992; Meeker & Gray, 1987; Mohi-ud-Din & Nazir, 2010; Ongore & Kusa, 2013) have confirmed that the NPL is the most suitable measure of asset quality, and expresses this quality measure as a ratio of NPLs divided by gross loans. If the asset quality ratio is small, the ratio indicates that the bank has a sound loan portfolio, *ceteris paribus* (Mohi-ud-Din & Nazir, 2010). According to Makri, Tsagkanos and Bellas (2014), research that makes use of aggregate-level AQ ratios is scant in European Monetary Union (EMU) countries. Thus analysing the determinants of NPLs, using aggregate NPL data, and using the proposed definition of AQ presented in Equation 2.4 enhances the current knowledge about asset quality from a perspective that uses publically available data.

Klein (2013) was of the opinion that the repercussions of an increased AQ ratio can hamper lending operations and may reduce economic activity in any country. According to Vatansever and Hepsen (2013), the NPL is directly related to the number of banks and economic failures in a country. According to Makri *et al*. (2014), Eurozone countries are an example of this, as increases in NPLs result in higher levels of credit risk. However, Zafar *et al*. (2013) disagreed with Klein (2013) and concluded that the NPLs' impact on bank asset quality differed from country to country, although they did

not discount the importance of the NPL ratio as an essential component of credit risk management. Even so, the AQ ratio is an indicator of more than only credit risk.

According to Klein (2013), the NPL ratio informs on macroeconomic conditions as well as microeconomic factors. Empirical evidence from past research (Karim, Chan & Hassan, 2010; Klein, 2013) concluded that an increase or high level of NPLs negatively impacts GDP, unemployment and inflation from a macroeconomic perspective. From a microeconomic outlook, high NPLs cause a reduction in interest income, return on investment, capital adequacy, economic value addition, and due to the increased risk, the cost of capital consequently increases (Zafar *et al.*, 2013).

The importance of the NPL ratio is well established. According to Zafar *et al*. (2013), the management of bank asset quality has become paramount in recent years, as poor quality loans have eroded the value of banks. Vatansever and Hepsen (2013) found that the management of NPLs are essential for SSA countries, because increasing NPLs generally precede financial difficulties in these SSA countries. Love and Ariss (2014) recommended regular monitoring of NPLs to reduce the probability of financial distress in a bank or the economy. Zafar *et al.* (2013) concluded that NPLs had different effects in developed markets when compared to developing economies, as the developed economies have control of their financial resources. Various researchers (Vatansever & Hepsen, 2013; Zafar *et al.*, 2013) have stressed the importance of increased knowledge about NPLs in SSA countries and the impact that NPLs have in EMEs.

2.2.3 Impact of bank asset quality

As the impact of a bank failure can be felt throughout an entire economy, it is essential to manage NPLs in an effort to reduce the harsh impact of a bank failure (Moutsianas & Kosmidou, 2016). According to Joo (2014), poor asset quality is an indicator of poor risk management and poor bank solvency levels. The poor management of asset quality ultimately results in a cost at the expense of the bank shareholders (Joo, 2014). However, Trujillo-Ponce (2013) argued that, depending on the quality of the assets, investors are remunerated in accordance with the amount of risk exposure in the form of higher profits. Iannotta, Nocera and Sironi (2007) concluded that the increased risk consequently bears higher interest, thus improving the investors' returns due to bank

profitability increasing. Regulation is required to ensure that asset quality is not disregarded at the expense of investors.

Regulatory authorities ensure that banks do not enter into risky investments that may paralyse an economy. Regulators use capital adequacy requirements to reduce the risk in the banking sector. Klomp and De Haan (2014) argued that poor asset quality and regulations often result in increases in regulation and more stringent capital adequacy requirements. In the Malaysian markets, regulators tightened their monetary policy as banks became aware of a decrease in their asset quality (Detragiache & Gupta, 2006). Past research by Mester (1996) showed that a level of loan monitoring results in increased costs to the bank.

Profit is driven by generating an income and reducing costs. Ongore and Kusa (2013) maintained that the profitability of a bank is dependent on the asset quality of the bank. Trujillo-Ponce (2013) concurred by explaining that poor asset quality directly impacts profitability, as reduced asset quality leads to larger credit or loan loss provisions. Nur Ozkan-Gunay and Ozkan (2007) found that successful banks generally have better asset quality ratios and lower profit levels.

The accurate accounting of transactions has become imperative to ensure profitability, especially since shareholders ultimately benefit from institutions that show strong financial results. Laurin and Majnoni (2003) found that some financial institutions did, however, not appropriately account for losses. Joo (2014) researched the phenomenon where banks resort to actions that superficially alter their asset quality. These misrepresentations of asset quality have an impact on interest rates and default risk indicators (Piskorski, Seru & Witkin, 2015). Poor bank asset quality is considered a reason to drive the institutions to misrepresent information to artificially, achieve better performance.

The importance of maintaining quality bank assets is undeniable. Ongore and Kusa (2013) summarised the importance by confirming that countries are dependent on a thriving banking sector because banks allocate the resources in a country and perform a critical function as creators of economic growth. However, banks can only perform this important function if they remain profitable (Ongore & Kusa, 2013). Profitability can only be achieved by actively managing bank loans, as loans remain the primary asset of a bank (Lee, Miller & Yeager, 2015). Even though all banks have an

intermediation function, not all banks have the same function in the economy, adding more complexity to the banking environment.

2.3 BANK TYPES

The progression of time led to the development of different bank types that perform different functions in the economy. Della-Paolera and Taylor (2002) studied the development of the banking industry in the emerging Argentinian economy, explaining how a central bank was only formed as a result of failed private banks. This study also distinguishes between central banks as banks that determine monetary policy, and private banks that primarily function as intermediaries to the public and generate an income from the interest income on loans.

2.3.1 Monetary policy-setting banks

Central banks determine the supply of money and credit in an economy. This function enables central banks across the world to stimulate economic growth, diminish unemployment and manage inflation (Rose & Hudgins, 2010; Van Zyl, Botha & Skerritt, 2006). The central bank determines the monetary policy and attempts to grow an economy through various policy interventions (Brandl, 2016). In South Africa, the South African Reserve Bank (SARB) is the only central bank, and the SARB utilises an inflation-targeting approach to support economic growth (Van Zyl *et al*., 2006).

According to Hale and Philippov (2015), inflation-targeting is the most effective method a central bank can employ to manage inflation and to achieve price stability in an economy. The inflation-targeting approach involves a process where a central bank attempts to maintain the inflation rate between predetermined target rates by manipulating the prevailing interest rate at which non-monetary policy-setting banks borrow from the central bank (Gallardo & Arriaga, 2015). The interest rate manipulation directly impacts on asset quality in economies that follow an inflation-targeting approach (Beck *et al*., 2015). That said, when central banks follow an inflation-targeting approach, the non-monetary policy-setting banks are less inclined to engage in risky lending activities, thereby reducing their susceptibility to becoming financially distressed (Fazio, Tabak & Cajueiro, 2015).

2.3.2 Non-monetary policy-setting banks

In addition to setting monetary policy, central banks are also responsible for determining the overnight lending rate for interbank lending and capital reserves which are of utmost importance to non-monetary policy-setting banks (Simpasa, Nandwa & Nabassaga, 2015). Although the various types of non-monetary policy-setting banks had unique functions in the past, as time progressed, the large multinational banks started to offer the majority of these 'unique' functions (Rose & Hudgins, 2010). These different types of banks still exist, as not all entities make use of large multinational banks.

The different types of banks are categorised according to their primary functions, for example, a few of the major types include savings banks, retail banks, commercial banks and investment banks. According to Brandl (2016), saving banks were initially named mutual saving banks and these banks encouraged savings in different communities. These banks are best-known for their use to purchase domestic properties, however, the retail and commercial banks have largely absolved the services rendered by savings banks in the USA, especially since the USA deregulated the savings bank market (Rose & Hudgins, 2010).

Retail banks provide banking services to individuals and small businesses, while in the USA, these banks are often known as community banks as they focus on local businesses (Brandl, 2016; Van Zyl *et al*., 2006).

Commercial banks offer a range of services to individuals and businesses, and these services include cheque accounts, deposit accounts and loans. Van Zyl *et al.* (2006) found that the functions of a commercial bank have often been confused with that of an investment bank.

The primary function of an investment bank is to underwrite new security issues and provide financial advice to corporate and municipal entities (Rose & Hudgins, 2010; Van Zyl *et al*., 2006). Brandl (2016) posited that the investment banking function does not fall within the ambit of the actual banking functions. However, new multinational banks provide investment banking as part of their core business offerings.

Figure 2.1 illustrates the variety of business lines multinational banks offer (non-monetary policy-setting banks).

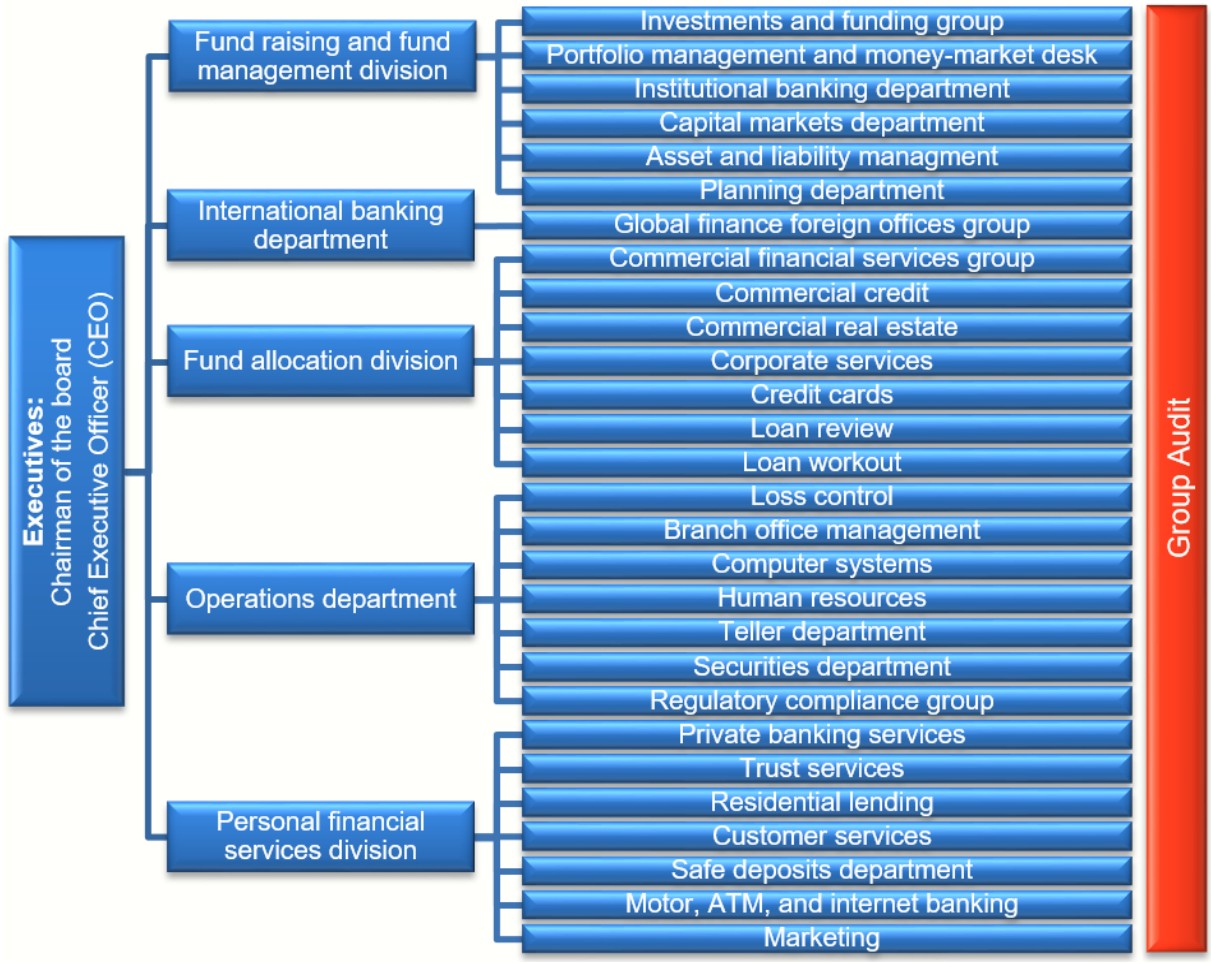

Figure 2.1: Organisation chart for a bank serving domestic and international markets

Source: Adapted from Rose and Hudgins (2010)

As a result of the size of a bank, additional functions for each business line are included, increasing the disparity among specific bank types. However, fundamentally the banking environment has remained unchanged because all banks have an intermediation function and a maturity transformation function. Furthermore, the various business lines in a bank have different roles in ensuring that the maturity transformation and intermediation processes occur. The business lines are divided into five subsections, namely, personal financial services, operations, fund allocation, international banking and fundraising and allocation (Rose & Hudgins, 2010). All of the business lines have their role in the management of bank asset quality. It is important to acknowledge that the subdivisions of the business lines also play an important role, especially considering regulatory services, commercial loans, global finance, capital markets and asset and liability management.

Banks play a significant role in EMEs because there is less funding available in the capital markets in comparison with that in developed economies, resulting in a dominant banking sector in EMEs (Mullineux, 2006). Therefore, it is not surprising that De Bock and Demyanets (2012) found that there is a relationship between banks and commodity exporters, especially considering the terms of trade. Also, Senawi and Isa (2014) found a relationship between gold and the exchange rate, and they stated that gold has a substitution function in an economy as an alternative to improve economic conditions. From these statements, it is evident that the business lines that deal with foreign exchange, capital markets, commercial loans and global finance have a relationship with gold production and sales, although it is most probably only in the financing of mining firms and assisting in their global business transactions.

Commercial banking and banking activities relating to corporate activities are significant, but the individual customer banking should not be discounted. In South Africa, retail customer loans and advances take up the majority of the gross loans and advances, accounting for 63% of all loans, in comparison with the 37% of advances received by corporate entities (PricewaterhouseCoopers [PwC], 2017). PwC (2017) elaborated on the loans and advances, stating that asset quality is improving in South African banks, as a result of their approach to the provisioning in their financial statements that account for past experiences from the credit cycle.

2.4 BANK FINANCIAL REPORTING

It is essential to understand the financial results of a bank because the ratios calculated from the line items obtained in the financial statements have a significant impact on the bank performance, and subsequently bank asset quality. Bholat *et al*. (2016) were of the opinion that three core accounting items are common factors in banking crises, namely, the assets, liabilities and equity. The BIS and the International Accounting Standards Board (IASB) acknowledged the importance of proper financial reporting in the banking environment and found a convergence of the regulations and accounting standards relevant to banks (Schoenmaker, 2015). Although this convergence takes place between accounting and regulatory standards, banks often attempt to mislead regulators and auditors by presenting several views on a single accounting line item (Schoenmaker, 2015).

This study used comparable data that is reported in a consistent form in financial statements to report on bank asset quality and to accurately identify potentially risky assets.

2.4.1 A generic bank balance sheet

Brandl (2016) stated that regardless of the bank, all banks follow similar accounting rules. Brandl (2016) provides a bank-specific accounting formula (Equation 2.6) and uses a simplified balance sheet to explain the accounting formula (Figure 2.2).

$$Assets = Liabilities + Bank\ capital \quad (2.6)$$

Source: Brandl (2016)

The accounting formula illustrated in Equation 2.6 shows the accounting formula that explains the composition of bank assets. This accounting formula is slightly different from the standard accounting formula of 'equity being equal to liabilities that are subtracted from assets'. Equation 2.6 provides a foundation for the accounting formula, and a simplified bank balance sheet is illustrated in Figure 2.2.

Assets	**Liabilities and Capital**
Cash/Reserves	Demand deposits
Business loans	Savings accounts
Consumer loans	Loans from other banks
Mortgages	Other borrowings
Bonds	
Other assets	**Bank capital**

Figure 2.2: Simplified bank balance sheet

Source: Brandl (2016)

Figure 2.2 is a representation of the balance sheet of a bank according to the generic bank accounting formula shown in Equation 2.6. Figure 2.2 shows that the assets of

a bank are described as cash and reserves, while different types of loans and other current and non-current assets are on the debit side of the balance sheet. The credit side of the balance sheet shows the liabilities that consist of deposits from clients and institutions as well as the equity, bank capital. This is different from a standard organisation where loans are on the credit side of the balance sheet. While this may seem strange, it is important to remember that loan generation is the primary business of the bank and should be seen as nothing other than a product that is provided to a client, and in its turn, it provides an interest income to the bank. The deposits on the credit side are used to generate the loans provided to the customers of the bank. Bholat *et al*. (2016) recommended that when reviewing a bank, regulators should follow a generic approach to improve the comparative values of asset quality between different banks.

2.4.2 Bank financial disclosures

Bank disclosure forms part of the recommendations of Basel III – Pillar 3 (see Section 2.5). Proper and complete disclosure allows investors and depositors the option to differentiate between different banks, based on the level of risk that a bank is willing to take. This is due mainly to the depositor and investor requiring this information to determine the extent to which an institution can absorb losses (Wu & Bowe, 2012). Banks are often reluctant to disclose certain information, especially risk information, because this information is of a proprietary nature, and competing banks would have a ‘free ride’ if they were allowed to review the lending practices of market leaders, thus reducing the incentive for innovation (Mullineux, 2006).

It is beneficial for banks to disclose their financial results accurately. Demirgüç-Kunt, Detragiache and Tressel (2008) favoured proper disclosure because it improves bank stability and increased the levels of income, especially in an EME. Furthermore, countries that support the regular and proper disclosure of bank information, generally have higher quality banking institutions (Demirgüç-Kunt *et al*., 2008). West (2011) found that South African banks are protected from global risk as a result of the adoption of specific disclosure principles, and this disclosure is made according to different accounting standards. The International Accounting Standards Board (IASB), as part of International Financial and Reporting Standards (IFRS), recommends the changes to and adoptions of accounting standards. The IFRS principles are of such a

high quality that they have been used by Wu and Bowe (2012) as a proxy to determine the quality of financial disclosure.

2.4.3 Accounting standards

Demirgüç-Kunt *et al*. (2008) stated that bank supervisors should provide instruction in their respective countries regarding the accounting standards that should be used to report financial results, as internationally accepted standards allow for easier comparison of the different banks across borders. However, Brandl (2016) stated that banks typically have similar accounting rules and regulations.

In addition to the IASB, another private institution, namely, the Financial Accounting Services Board (FASB), released accounting standards known as the Generally Accepted Accounting Principles (GAAP). As a result, there are different accounting methods in use in the banking sector. However, the FASB and IASB are in engagements to create a generalised accounting standard for bank institutions (Manganaris, Beccalli & Dimitropoulos, 2017).

The lack of harmonised accounting standards impacts the risk profile of a bank, especially due to the IFRS and GAAP using different recognition standards in their respective classifications of NPLs (Bholat *et al*., 2016). Bholat *et al*. (2016) posited that the differences are because the accounting standards are not industry-specific, therefore allowing banks to interpret the standards from a banking perspective. However, Manganaris *et al*. (2017) stated that the primary differences are attributed to the fact that the FASB and IASB have different approaches to asset securitisation, fair market valuations and provisioning. According to Cummings and Durrani (2016), bank provisions are especially susceptible to different interpretations, as there are variations among countries in the interpretations of risk, performance, tax and regulatory environments.

Manganaris *et al*. (2017) suggested that bank supervisors should focus their attention on the improvement of accounting standards, as this would ensure more transparent financial disclosures from the banking industry. However, according to Demirgüç-Kunt *et al*. (2008), the bank management still provide external auditors with information which is accurate and complete enough to enable them to formulate an accurate

opinion on the results of a bank. The financial results are also submitted to the bank supervisors (Demirgüç-Kunt *et al*., 2008).

Banks face disclosure challenges as a result of the accounting standards, especially related to income recognition, credit risk, loss provisioning and fair market valuation. There are calls for a simplified accounting approach for banks, because jurisdictions are not comparable when dealing with financial disclosure (Schoenmaker, 2015). For example, due to measurement inconsistencies, the measurement of income could negatively impact the capital and assets held by a bank (Joo, 2014). Furthermore, although new loss provisioning standards (IFRS 9) have been implemented from January 2018, at the time of this study, the banks were still calculating their loan loss provision on the historical data of NPLs (Bholat *et al*., 2016; Cummings & Durrani, 2016). The IAS 39 deals with the measurement of financial instruments and includes the appropriate measurement method for instruments that cause credit risk in institutions (Bholat *et al*., 2016; Schoenmaker, 2015; West, 2011).

The impact that asset quality has on the balance sheet of a bank should not be ignored, as the impact of poor asset quality trickles through the entire economy (Manganaris *et al.*, 2016). For example, Joo (2014) found that irregular accounting practices by Indian banks are the leading cause of bank losses as a result of the misrepresentations of NPLs. The importance of correctly applied accounting standards cannot be discounted, especially in an EME.

According to West (2011), South Africa was an early adopter of the newly introduced fair value accounting (IAS 39) standards in 2005. In addition to the adoption of the new standards, South African banks also restated their 2004 financial statements, enhancing the comparability of the figures. West (2011) also found that due to the early adoption of the IFRS recommended accounting standards, the GFC did not severely impact South African banks. Furthermore, the SARB (2014) also allows banks to be more aggressive in their accounting practices, allowing banks to classify an asset as an NPL sooner than the IAS 39 prescription.

Relevant and appropriate accounting standards benefit the banking sector in EMEs. Duenwald, Gueorguiev and Schaechter (2007) found that the incorporation of proper accounting standards enhances the ability of a bank to extend credit to customers. Joo (2014) reported that specific recommendations regarding the recognition of

income, provisioning, regulatory capital and the classification of assets all improve the sustainability of banks. The use of internationally accepted accounting standards, and the motivation from regulatory bodies to unify these standards, indicate that the benefits of these standards cannot be disregarded.

2.5 BANK REGULATION AND SUPERVISION

Increased regulation and supervision of the banking environment is inevitable, mainly as a result of the banks' potential for moral hazard[6] and adverse selection[7] practices (Schoenmaker, 2015). Therefore, regulations were introduced to reduce this type of bank behaviour. Schoenmaker (2015) identified the following three drivers for banking regulations:

- The first motivation for regulation is to ensure that both banks and their clients have similar information (to prevent information asymmetry).
- The second motivation is to ensure that banks refrain from colluding, as this may disadvantage their clients (market powers).
- Thirdly, to reduce the probability of bank failures that may negatively impact the financial markets (externalities).

Dermine (2015) explained that maturity transformation, or the process of transforming deposits into loans, is also a motivation for regulatory intervention.

Goodhart, Hartmann, Llewellyn, Rojas-Suarez and Weisbrod (1998) stated that financial regulation has to promote fairness, efficiency and transparency in the securities markets, protect investors and promote a stable financial system. Central banks attempt to create a financial environment that promotes proper regulation in the financial markets (Schoenmaker, 2015). Although banks have to abide by the restrictions and guidelines relevant within a country, the Basel Committee on Banking Supervision (BCBS) also sets guidelines, and these guidelines are known as the Basel Accords. The BCBS's core function is creating regulatory guidelines from an

[6] Moral hazard in a bank arises when a bank receives deposits from customers (surplus economic units) only to engage in risky lending practices using these deposits (Schoenmaker, 2015).

[7] Adverse selection refers to banks that engage in risky lending practices to attract customers (Schoenmaker, 2015).

international perspective for banks in developed and emerging economies (Goodhart, 2011). Gale (2015) stated that although these regulations may be rigid, central banks use their discretion in the enforcement of these guidelines.

The first Basel Accord was introduced in 1988 with the aim of enabling banks to proactively manage risk, therefore, this accord focused on capital adequacy and the supervision of banks (Demirgüç-Kunt, Detragiache & Merrouche, 2013; Gale, 2015). According to Dermine (2015), central banks are of the opinion that the Basel Accords reduce the probability of a bank run taking place. Due to the ever-changing banking environment, the BCBS has had to improve the Basel Accords since their introduction, and these improvements have mainly relied on data obtained from banks (Cummings & Durrani, 2016).

The failures of Basel I and Basel II led to the introduction of Basel III that addresses not only credit risk, but also liquidity, and the incidences of too-big-to-fail (TBTF) institutions, as a result of the aftermath of the GFC (Dermine, 2015; Schoenmaker, 2015). Basel I focused on credit risk and excluded other factors, such as the type of borrowers and the repayment capacity of borrowers, in the calculation of bank capital (Demirgüç-Kunt *et al*., 2013). Manisha and Hans (2015) further explained that Basel II was introduced as a result of the failure of Basel I to address financial derivatives and securitisation. Basel II failed due to the dependence (and confidence) that was placed on credit rating agencies (CRAs) and opaque bank models (Demirgüç-Kunt *et al*., 2013). As a result, Basel II experienced challenges because of the bias towards inputs, securitisation, pro-cyclicality and uniform portfolios.

The GFC primarily triggered the reforms to the Basel II accord, and Basel III improved on the principles set in Basel II (Cummings & Durrani, 2016). Basel III is based on the three pillars introduced in Basel II, namely, capital and liquidity requirements, enhanced supervision, and enhanced risk disclosure. In addition, Basel III improves on Basel II by increasing and redefining capital requirements, increasing liquidity and enhancing supervisory and risk disclosures (Demirgüç-Kunt *et al*., 2013; Manisha & Hans, 2015). Manisha and Hans (2015) summarised the improvements in each of the three pillars as listed on the next page:

- **Pillar 1: Minimum capital requirements**

Under Basel III the bank capital is improved by raising the quantity of capital, as well as the quality of assets, that are held as bank capital. The capital is only divided into Tier 1 and Tier 2 capital, where Tier 1 capital is shock absorbing capital, while Tier 2 is the reserve capital of the required bank capital reserves.

- **Pillar 2: Supervision and evaluation process**

This process addresses the ability of a bank to maintain the required minimum regulatory capital, both from an institutional and supervisory perspective. This pillar requires regular evaluation of the internal processes by the bank, as well as interventions from the central bank should the need arise.

- **Pillar 3: Market discipline**

This pillar promotes the publication of the banks' incurred risks and market disclosures in financial statements. Publication of this information seeks to improve the bank's stability and to reduce the risks it might undertake.

The BCBS encourages central banks from EMEs to comply with the Basel Accords, by providing training and support to emerging economies (Goodhart, 2011). South Africa adopted regulations similar to the regulations in the European economies as early as 1987 (Botha & Makina, 2011). The Melamet Commission concluded that the European regulations promote efficiency in the financial markets (Botha & Makina, 2011). Adelegan (2009) stated that South Africa lacks the capacity and skills to regulate financial markets effectively. However, the International Monetary Fund (IMF) (2008) stated that the South African financial regulations are of such a calibre that they are comparable to the standards of developed economies. However, the IMF (2008) concluded that South Africa's prudential regulatory environment could improve further. An essential element of prudential supervision is capital adequacy regulations; these regulations also protect customers from unsound financial institutions (Schoenmaker, 2015). To improve the financial services regulations, South Africa introduced a Twin Peaks regulatory model which focuses on market conduct and prudential regulation (Goodspeed, 2013a).

Figure 2.3: Twin Peaks financial regulatory framework

Source: Goodspeed (2013a)

Figure 2.3 illustrates the Twin Peaks model employed in the South African financial regulatory environment. Goodspeed (2013b) explained that the market conduct regulator monitors the conduct of market participants, ensuring that participants comply with standards of conduct, such as consumer protection, while the prudential regulator is responsible for the oversight of macro-prudential and micro-prudential regulatory enforcement. This model ensures that all financial services are regulated efficiently from a market conduct and prudential supervision perspective (Goodspeed, 2013b).

The prudential regulator, namely the SARB, is responsible for the implementation of the recommendations of the BCBS. The ripple effect of the GFC was felt in EMEs, as liquidity reduced in the global markets (Aloa & Raimi, 2011). However, Erasmus and Makina (2014) concluded that due to the conservative regulatory environment in South Africa, exposure to foreign market risk was reduced, and consequently the banks in South Africa were not as severely impacted by the GFC. Although the financial services sector was slightly isolated from the direct impact of the GFC, the SARB still maintains and enforces international standards, implementing the Basel III changes in the banking sector. The importance of this lies in the fact that bank capital adequacy provisions enable banks to absorb unanticipated losses (Cummings & Durrani, 2016).

Although the BCBS prescribes the minimum capital requirements for banks, Schoenmaker (2015) found that banks prefer having capital reserve amounts available

that are much higher than the minimum requirement. The amount of regulatory capital has a significant impact on the NPL ratio of a bank. Calem and Rob (1999) disclosed that when a bank holds capital amounts lower than the minimum regulatory capital requirement, banks are inclined to enter into riskier loans. Gale (2015) explained that the bank incurs riskier business to fund their higher levels of required regulatory capital. López (2016) concluded that the Basel accord implementation periods emphasise the review of risk variables, such as leverage and NPLs. An illustration of the relationship between the capital adequacy ratio and the aggregated average NPL ratio of South African banks is presented in Figure 2.4.

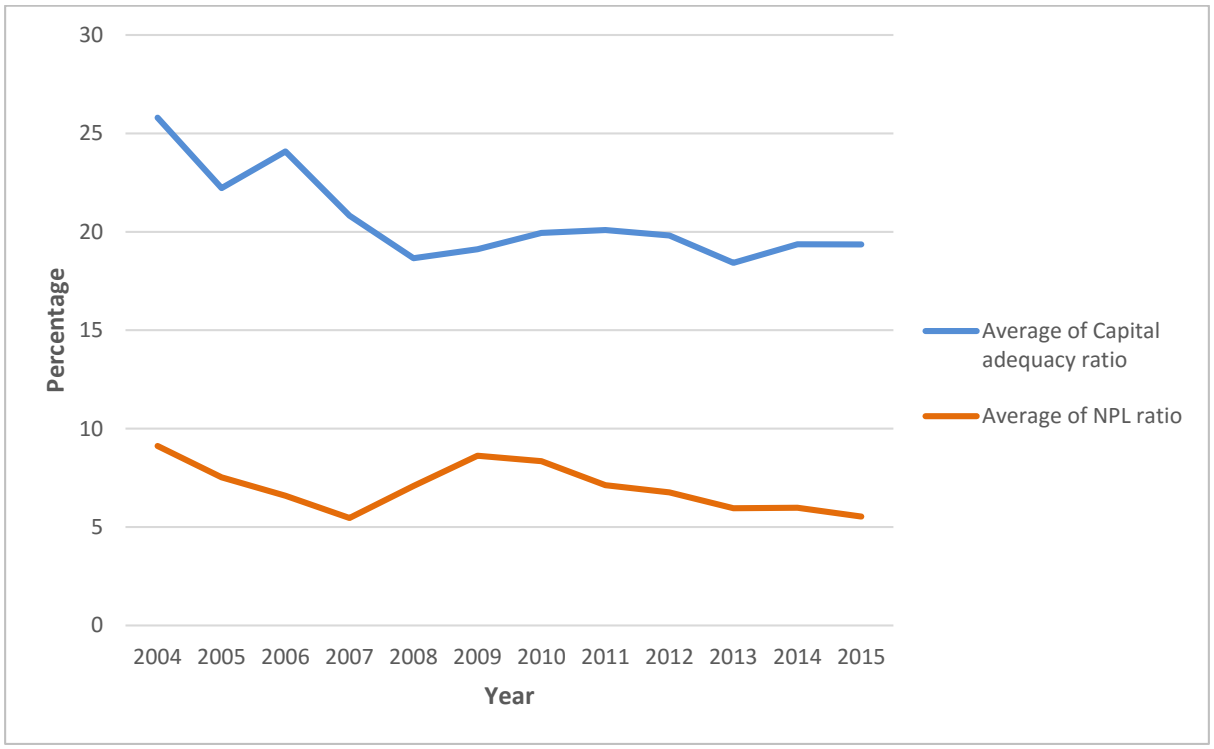

Figure 2.4: The South African average capital adequacy ratio and NPL ratio

Source: Own compilation (2017)

Figure 2.4 is an illustration of the South African average capital adequacy ratio and the NPL ratio over the period 2004 – 2015 of the 13 South African banks included in this study (see Table 4.1). From this illustration an apparent positive relationship between the average capital adequacy ratio and the average NPL ratio variables is seen. The empirical relationship is explored and explained as part of the empirical analysis (see Section 5.4.2).

Chilukuri, Rao and Madhav (2016) argued that bank managers have the responsibility to implement new regulations and to make provision for sufficient regulatory capital, which ultimately impacts the bank asset quality. Cummings and Durrani (2016) also acknowledged the importance of proper disclosure from management, as certain prescriptive rules lead to inaccurate conclusions regarding regulatory capital.

In addition to the regulatory oversight and bank supervision, banks also ascertain credit rating from CRAs. These CRAs scrutinise the financial reports and the banks' compliance levels with regulations.

2.6 BANK CREDIT RATINGS

The opinions that CRAs deliver provide a view on the creditworthiness, or the probability of default, related to the debt of an institution (Frost, 2007). The CRAs provide ratings on both government and private debt. Government ratings are sovereign ratings representing government default risk, while private debt credit ratings are a measure of a company's default risk (Elkhoury, 2009). The sovereign ceiling of debt ratings implies that no institution in the country may have a rating higher than that of the government (Elkhoury, 2009). Ratings do not directly impact the intermediation function of the bank, but it impacts the minimum capital requirement necessary in fulfilment of the banks' intermediation function.

Although the intermediation function is less affected by credit ratings, Schoenmaker (2015) stated that the credit rating assesses the soundness of a bank. This is because the Basel Accords require rated debt to enable a bank to report on its capital adequacy position (Elkhoury, 2009). Credit ratings have the important function of information dissemination (Frost, 2007). Investors, organisations, governments and regulators also use credit ratings in their capital market activities and investment decisions (Frost, 2007). Frost (2007) also stated that investment rules are based on the rating issued on debt, and these rules have a significant impact on a bank if the debt is branded as non-floatable in the financial markets. Non-floatable debt impacts the capital adequacy ratio of the bank.

Credit ratings are often considered as triggers, because the rating initiates a specific action in a financial market (Kraft, 2015). The importance of credit ratings cannot be discounted, as the ratings provide a signal on the bank's asset quality (Gavalas &

Syriopoulos, 2014). In lower-income countries, this signal is disseminated slowly, as the rating agencies do not update ratings as regularly as in high-income countries (Demirgüç-Kunt *et al*., 2008; Gavalas & Syriopoulos, 2014). Baghai, Servaes and Tamayo (2014) stated that poor credit ratings often lead to conservatism in financial markets, which increases cash holdings and decreases investment expenditures, thereby reducing economic growth. Kraft (2015) expanded this interpretation, stating that there is an inverse relationship between interest rates and credit ratings, proving that poor credit ratings impact the various determinants of bank asset quality.

Regardless of the importance of credit ratings, CRAs have not been without critique. Various researchers (Baghai *et al*., 2014; Cornford, 2009; Frost, 2007; Kraft, 2015) stated that a business relationship that gives rise to a conflict of interest exists between CRAs and debt issuers, as the debt issuers pay the CRAs for their opinion on the debt. These findings stem from the fact that corporate failures and the GFC took place even though investment grade debt ratings were issued on corporate debt and mortgage-backed securities (Elkhoury, 2009; Frost, 2007). The CRAs often react too slowly, lagging behind the market and are not accountable for the impact that their rating has in a financial market and on the economy, casting further doubt on the role of CRAs (Cornford, 2009; Elkhoury, 2009).

Demirgüç-Kunt *et al*. (2013) questioned whether CRAs could rely on the information provided to them by banks, and whether there was consistency between the ratings of different banks due to banks not always being transparent in providing their financial information. As regulators use credit ratings to perform their function of bank supervision, Mullineux (2006) pondered whether the regulators should instead bear the cost of debt ratings. Baghai *et al.* (2014) concluded that irrespective of the conflict of interest, or the financial market conservatism, capital markets reflect accurate information regarding company debt, because capital markets do not fully internalise the credit ratings.

2.7 SUMMARY

Bank asset quality and the measure thereof cannot be fully understood if the business of a bank and the bank environment is not understood. This chapter explained that not all banks are in the business of maturity transformation, stating that there are central

banks that act as lenders of last resort and that are responsible for setting the monetary policy within a country. Only non-monetary policy-setting banks are responsible for maturity transformation and financial intermediation. This literature study established that there is a relationship between the functions of the bank, as far as corporate and investment banking, and the interaction with mining firms is concerned, especially considering gold mining and how gold has an impact on the global banking, commercial banking and foreign exchange departments in a bank. However, the primary source of banking income is still generated from retail banking in the South African environment, and not from commercial and investment banking.

Due to the nature of a bank, the financial reporting methods and the differences in reporting of NPLs and the accounting standards were explained. As a result of the impact that NPLs can have on a financial market, regulation is required to limit the probability of a bank defaulting or a financial crisis occurring. This chapter also reported on the regulatory interventions from an international and domestic perspective. Although financial reporting standards and regulations attempt to create a stable banking environment with comparable financial standards, financial reporting methods do not have a harmonised definition of NPL. This is disappointing because investors and regulators depend on the information in financial statements.

The financial results and financial projections from debt are also of importance for CRAs. This chapter concluded by evaluating how CRAs play their role in providing ratings regarding the debt issued by a bank. This debt, with its associated credit rating, is ultimately considered in the capital requirement that each bank has to maintain according to the regulatory and supervisory minimum requirements. This investigation of the intricate workings of the banking sector precedes the theoretical foundation for this study.

CHAPTER 3: THEORETICAL FOUNDATION AND HYPOTHESIS DEVELOPMENT: DETERMINANTS OF BANK ASSET QUALITY

3.1 INTRODUCTION

The preceding chapter explained the functioning of banks and how banking activities impact bank asset quality. However, the theories underpinning the relationships between NPLs and the various determinants were not addressed in the preceding chapter.

This chapter aims to provide the theoretical foundation for this study. The theoretical foundation enables the connection between the bank functions and the theories on how NPLs impact the range of banking activities. These linkages allow the development of hypotheses which are analysed in a later chapter.

This chapter consists of two sections, namely, the theoretical foundation and the hypothesis development. These sections, Sections 3.2 and 3.3, are divided into subsections. Section 3.2.1 presents the theoretical association, Section 3.2.2 the theoretical shortcomings, and Section 3.2.3 the research contribution, while Section 3.2.4 presents the research objectives. Section 3.3 provides the hypothesis development, and the subsequent subsections (Section 3.3.1 – 3.3.5) present the five research hypotheses, before the chapter is concluded with a chapter summary.

3.2 THEORETICAL FOUNDATION

The 19th and 20th centuries were plagued by banking and stock market crashes (Bordo & Haubrich, 2010). These crashes were preceded by changes in monetary policies or various shocks as a result of war, real estate crashes or boom cycles (Bordo & Haubrich, 2010). According to Messai and Jouini (2013) before a bank failure occurs, the banks display excessive levels of NPLs, causing economic deterioration. The construction of a theoretical foundation will allow the researcher to investigate the existing theory to identify the existing gaps in the theory. This will magnify the need for the current study and will also contribute to the research questions (Gentner, 1993).

Scholte, Van Teeffelen and Verburg (2015) also made use of a theoretical framework to present which determinants or characteristics impact the object of their study.

The theoretical foundation of this study is used to:

- Emphasise the contribution made by this study;
- Discuss the findings and shortcomings in past research;
- Present a comparative table of the determinants impacting NPLs; and
- Present the research objectives that guide the hypothesis development.

As an introduction to some theories that have an important impact on this study, Table 3.1 provides an overview of past findings. Table 3.1 also serves as a summary of the past findings discussed in sections 3.2.1 to 3.2.4.

Table 3.1: Summary of NPL determinants discussed in sections 3.2.1 – 3.2.4

Author(s) (Year of publication)	Number of countries	Econometric models used	Independent variables																																								
			Bank foreign portfolio flows	Bank branch network growth	Number of bank branches	Capital adequacy ratio	Credit growth	Credit quality	Debt/Equity ratio	Inefficiency	Equity index	Exchange rate	Foreign direct investment	GDP growth	GDP debt	GDP debt per capita	GDP deficit	Gold price	Home ownership	House price index	Housing starts	Inflation	Income growth	Interest charged	Interest rate	Loan collateral	Loans to assets	Loans to deposits	Loan loss reserves	Money supply	Net capital flows	Net interest margin	NPL_{t-1}	Portfolio flows (foreign)	ROA	ROE	Regulation dummy	Size of bank	Total loans	International trade	Unemployment rate	Volatility index (VIX)
Beck *et al*. (2015)	75	FE, GMM									*** (-)	*** (+)		*** (-)											*** (+)								*** (+)									
Buncic and Melecky (2013)	54	GMM												*** (-)								** (+)			*** (+)								*** (+)									
De Bock and Demyanets (2012)	25	OLS, FE, GMM	*** (-)				* (+)					±	(-)	*** (-)											±					*** (-)	** (-)		*** (+)	*** (-)					** (-)		
Espinoza and Prasad (2010)	6	OLS, FE, GMM					** (+)				*** (-)			*** (-)											** (±)																	*** (+)
Ghosh (2015)	1	FE, GMM				*** (±)	*** (±)	*** (+)		*** (+)				*** (-)	*** (+)		(+)		** (-)	*** (±)	*** (±)	*** (-)	*** (±)		(±)					*** (+)					*** (-)			* (±)			*** (+)	
Klein (2013)	16	FE, GMM									** (-)	** (+)		*** (-)								*** (+)					* (+)					* (+)		** (-)						*** (+)	** (+)
Louzis *et al*. (2012)	1	GMM												*** (-)											*** (+)								*** (+)		*** (-)			** (+)			*** (+)	
Makri *et al*. (2014)	14	GMM				(-)								* (-)	(+)		(-)					(+)						(-)					*** (+)		** (-)						*** (+)	
Messai and Jouini (2013)	3	OLS					(+)							* (-)											** (+)				*** (+)					** (-)							*** (+)	
Nkusu (2011)	26	OLS, PCSE, GMM									*** (-)			*** (-)						*** (-)					*** (+)								*** (±)								*** (+)	
Saba, Kouser and Azeem (2012)	1	OLS												*** (-)											** (-)														*** (+)			
Senawi and Isa (2014)	1	OLS										* (-)						** (-)				(-)		(-)						*** (+)											
Salas and Saurina (2002)	1	GMM		*** (+)	** (+)	(+)	*** (+)		*** (+)	*** (+)				*** (-)		*** (-)								(+)		** (+)						** (-)	*** (+)				* (+)	(-)				
Škarica (2013)	7	FE					(+)				(+)	(+)		*** (-)								* (+)																			*** (+)	
Totals			**1**	**1**	**1**	**3**	**6**	**1**	**1**	**2**	**5**	**5**	**1**	**13**	**2**	**1**	**2**	**1**	**1**	**2**	**1**	**6**	**1**	**2**	**9**	**1**	**1**	**1**	**1**	**3**	**1**	**1**	**8**	**1**	**3**	**3**	**1**	**3**	**1**	**1**	**7**	**2**

(+), (-), (±) provides the sign obtained from regression results reported by authors; (±) is used when different regression models deliver inconsistent sign results.
Shaded blocks indicate that authors did not incorporate the variable in their respective models.
* 10% level of significance. ** 5% level of significance. *** 1% level of significance.

Source: Own compilation (2018)

3.2.1 Theoretical associations

In recent years, NPLs became a popular area for research with various authors, such as Bofondi and Ropele (2011), Dash and Kabra (2010), Erdinç and Abazi (2014), Ghosh (2015), and Saba *et al*. (2012), contributing to the body of knowledge on bank asset quality. The results show conclusively that there are different determinants of NPLs for banks in the developed economies and in the EMEs.

The importance of the determinants has also been debated, leading to disagreements regarding the importance of the macroeconomic determinants in comparison to the microeconomic determinants of bank asset quality. Klein (2013) was of the opinion that the microeconomic variables are significant, although they did not add to the overall explanatory power as determinants of NPLs. Klein (2013) expanded by saying that NPLs are impacted by macroeconomic and microeconomic conditions, irrespective of the bank type (retail, commercial or savings). However, Makri *et al*. (2014) reported that the microeconomic and macroeconomic determinants both contribute significantly to the NPLs of a bank.

The macroeconomic determinants that predominantly impact NPLs are: GDP growth, inflation rate, and the prevailing interest rate. Table 3.1 presents an abundance of evidence that GDP growth has a negative impact on NPLs, because when the GDP increases more funds are available to borrowers to service their debt (Beck *et al*., 2015; Buncic & Melecky, 2013; De Bock & Demyanets, 2012; Espinoza & Prasad, 2010; Ghosh, 2015; Klein, 2013; Louzis *et al*., 2012; Makri *et al*., 2014; Messai & Jouini, 2013; Nkusu, 2011; Saba *et al*., 2012; Salas & Saurina, 2002; Škarica, 2013). Erdinç and Abazi (2014) explained that the inverse relationship between GDP and NPLs is proof of the business cycle dependence of NPLs, as well as the sensitivity of NPLs to macroeconomic shocks.

Inflation and interest rates in countries are amongst the determinants that were evaluated by different researchers as key contributors to NPLs (Beck *et al*., 2015; Buncic & Melecky, 2013; De Bock & Demyanets, 2012; Espinoza & Prasad, 2010; Ghosh, 2015; Klein, 2013; Louzis *et al*., 2012; Makri *et al*., 2014; Messai & Jouini, 2013; Nkusu, 2011; Saba *et al*., 2012; Salas & Saurina, 2002; Senawi & Isa, 2014; Škarica, 2013). However, researchers found contradicting evidence when determining the impact and level of significance that the inflation and interest rate determinants

have on NPLs. The theory suggests that as interest rates increase, growth slows and the ability to repay borrowed funds subdues (Espinoza & Prasad, 2010; Ghosh, 2015). Central banks that use an inflation-targeting approach increase interest rates when inflation rises, resulting in higher levels of NPLs during times of rising inflation (Espinoza & Prasad, 2010). However, inflation causes the real amount that was borrowed to decrease, and in theory, borrowers should find it easier to service their debts during these periods (Ghosh, 2015). The influence that interest rates and inflation have on NPLs and each other seem to rest on contradicting theories.

Banks and borrowers alike are vulnerable to external shocks, such as the GFC, which often impact the macroeconomic conditions that the borrowers, lenders, and banks operate in (Erdinç & Abazi, 2014). Although the NPLs performed consistently during the early years of the millennium, the GFC in 2007 caused a sharp increase in the NPLs (Beck *et al*., 2015; Klein, 2013). Škarica (2013) reported that despite the interventions by central banks and regulators, high levels of NPLs remained for years after the GFC, and the effect may linger on even longer in EMEs.

In the past, regulators intervened when it came to credit extension. Espinoza and Prasad (2010) argued that these interventions reduce the negative impact of macroeconomic and microeconomic risks. The interventions are either in the form of regulatory reforms or changes in the capital requirements of banks (Espinoza & Prasad, 2010). The introduction of stronger prudential measures provides more stability in the banking sector, potentially reducing the NPLs when banks have to abide by stricter capital adequacy requirements (Erdinç & Abazi, 2014; Makri *et al*., 2014). However, according to Saba *et al*. (2012), NPLs increase when there are inadequate credit controls. Often after the introduction of stricter credit controls, NPLs also increase as it becomes more difficult for borrowers to qualify for funds, while the borrowers who obtained credit before the introduction of the new credit controls are still debtors to the bank (Salas & Saurina, 2002). Thus prudential and market conduct regulation impacts the NPLs in different ways.

Rapid credit extensions are the most critical cause of poor bank asset quality (Salas & Saurina, 2002). The prevailing economic conditions influence credit extensions, which in turn, impact the NPLs (Bofondi & Ropele, 2011). During the GFC, credit growth reduced to zero, and in some cases, contracted to such an extent that it became negative (Buncic & Melecky, 2013). Salas and Saurina (2002) reported that

the credit extension rate indicates the willingness of banks to extend credit to borrowers that are 'risky' borrowers. The risk appetite of a bank changes depending on the economic cycle, for example, they might engage in riskier lending practices during economic expansion periods, while they become risk adverse during economic contraction periods.

Saba *et al*. (2012) reported that high NPLs are a result of risky bank behaviour. Bank management is ultimately responsible for the risk appetite of a bank, and the management of a bank impacts the NPLs (Erdinç & Abazi, 2014). The ROA measures the management behaviour of a bank, as the ROA provides information on the willingness of a bank to engage in risky lending activities (Messai & Jouini, 2013). Higher ROA ratios provide management with fewer incentives to engage in risky transactions (Messai & Jouini, 2013). This implies that good management is paramount to reducing NPLs (Erdinç & Abazi, 2014).

Whether banks engage in personal banking, commercial transactions or international banking, the exposure to credit risk remains. Although credit risk is the main contributor to high NPLs (Salas & Saurina, 2002), banks may also provide funds in foreign currencies which expose the banks to currency risk that also impacts the NPLs (Buncic & Melecky, 2013). According to Senawi and Isa (2014), gold could be a substitute for foreign currency, implying that gold could impact the NPLs in a fashion similar to that of the foreign exchange rates. De Bock and Demyanets (2012) found that the asset quality of a bank has a close relationship with commodities, of which gold is one.

3.2.2 Theoretical shortcomings

According to the BIS, the standard loan classifications are defined as: passed, special mention, substandard, doubtful and loss loans. Laurin and Majnoni (2003) maintained that whatever the classification of the loan, the classification of NPLs differs from country to country. According to Filip (2015), 'standard' is the highest quality level of a loan and anything other than 'standard' is a potential loss. The 'standard' classification is the only consistent evaluation of NPLs across different countries.

Although it is widely acknowledged that there are different NPL definitions in different countries, the majority of scholars (Beck *et al*., 2015; Buncic & Melecky, 2013; De

Bock & Demyanets, 2012; Espinoza & Prasad, 2010; Klein, 2013; Makri *et al*., 2014; Messai & Jouini, 2013; Nkusu, 2011; Škarica, 2013) based their research on NPLs on more than one country, while only a few (Ghosh, 2015; Louzis *et al*., 2012; Saba *et al*., 2012; Salas & Saurina, 2002; Senawi & Isa, 2014) based their research on a single country. Of the studies based on a single country, two studies focused on the USA, and these studies were disaggregated by the states in the USA. Nkusu (2011) stated that the differences between the regulatory, supervision and accounting practices also constrain the inferential abilities of cross-country research on NPLs.

The macroeconomic conditions within countries are the drivers for policy and management decisions within banks (Nkusu, 2011). Louzis *et al*. (2012) agreed that there is an abundance of literature on the macroeconomic variables, again stating that GDP growth, unemployment rates and interest rates have a significant impact on NPLs, this is, however, applicable to a multi-country perspective. Salas and Saurina (2002) were pioneers in combining macroeconomic and microeconomic variables into a single study, while assessing savings and commercial banks. Although the research included macroeconomic and microeconomic variables, the research by Salas and Saurina (2002) was conducted on various different bank types and not on banks that offer comprehensive banking services, similar to South African banks. As a result, the impact of macroeconomic variables measures for two different types of banks, while the current study evaluates the macroeconomic variables for comprehensive banks. Messai and Jouini (2013) stated that future studies should evaluate the macroeconomic and microeconomic determinants of bank asset quality from a single-country perspective, as is done in the current study.

The importance of the microeconomic determinants of NPLs should not be discounted, as some research (Makri *et al*. 2014; Saba *et al*., 2012) suggested that the microeconomic determinants have a similar explanatory power to that of the macroeconomic determinants. However, Klein (2013) disagreed stating that although the microeconomic determinants are consistent, their explanatory power was negligible. Past research (Klein, 2013; Makri *et al*., 2014; Saba *et al*., 2012) provides inadequate consistent information on the microeconomic NPL determinants, therefore allowing the current study to fill a void in the literature related to these determinants, and thereby making an original contribution to the South African body of knowledge on bank asset quality.

To further enhance the knowledge on the determinants of NPLs, this study provides more information on bank asset quality from an EME perspective by focusing on the:

- GFC resilience;
- Regulatory changes;
- Profitability measures;
- Impact of gold sales as an asset of last resort;
- Country-specific bank-per-bank perspective; and
- Macroeconomic and microeconomic determining variables.

Louzis *et al*. (2012) suggested that the microeconomic determinants of NPLs may have been influenced by the GFC and recommended that future research should evaluate the impact of the GFC on microeconomic determinants. NPLs remain one of the most common causes of a deteriorating economic environment and bank failures (Messai & Jouini, 2013). Due to the developed economies experiencing the largest shock during the GFC, Nkusu (2011) researched the impact that the GFC had on NPLs in these advanced economies.

The credit risk appetite of a bank is a primary driver of NPLs for banks who engage in riskier lending practices (Saba *et al*., 2012). Ghosh (2015) recommended that regulators intervene in the banking environment to ensure that irresponsible lending does not take place. Chipeta and Mbululu (2012) found that in South Africa, the NCA reduced the credit being extended to individual lenders for credit cards, bank overdrafts and conventional loans, while the total credit extended grew. Erdinç and Abazi (2014) recommended that a study of the determinants of NPLs should allow regulators to enact appropriate regulatory measures to manage NPLs and reduce risk in the banking sector. Chipeta and Mbululu (2012) recommended that future research should focus on how the GFC and NCA impacted credit extended by South African banks. This study is an excellent platform to study asset quality stemming from their recommendations to determine the impact of the GFC and the NCA on NPLs.

Jang and Kataoaka (2013) concluded that commodity exports have an impact on NPLs in New Zealand. This is because those banks have significant credit exposure in the commodity markets (Jang & Kataoaka, 2013). According to Baxter (2009), South Africa has the largest exposure in the mineral export market, especially in the gold

commodity market. Senawi and Isa (2014) found that in the Malaysian banking sector, the value of gold impacts the NPLs in the country. A shortcoming of the study by Senawi and Isa (2014) is regarding the spot price of gold as a determinant of NPLs and not the value of gold exports or gold sales. In this study, gold sales are the determinant of NPLs, because the spot price of gold only determines the price at which gold trades, while the gold sales allow this study to capture the income generated by gold sales.

The shortcomings in in the regulatory environment and the potential impact of gold sales on NPLs lay the foundation for studying the impact of the risk behaviour by banks. From a regulatory perspective, the NCA only reduced the individual client credit, while the total credit extended by banks increased, irrespective of the introduction of the NCA regulations. Chipeta and Mbululu (2012) found that the increase in credit was primarily because more credit was extended to the private sector (this would include mining firms). Messai and Jouini (2013) measured the incentive of risky lending activities by introducing the ROA as a measure of the banks' incentive to generate income from risky lending practices. Support for engaging in risky activities also comes from shareholders, and not only from bank managers, motivating that research should also determine which determinant would have a more significant impact, shareholders or management. Irrespective of the driver behind reckless credit extension, Saba *et al*. (2012) concluded that risky lending behaviour causes larger NPLs.

This section identified the potential caveats of past research, highlighting the potential for new research. Although the contribution is evident, a summary of the contributing factors is presented in the following section.

3.2.3 Summary of research contribution

This research aims to contribute to the body of knowledge by investigating five gaps that exist in the research regarding the determinants of NPLs in the South African banking sector. The five gaps in the body of knowledge pertain to research on the determinants of NPLs from a single country perspective, where a consistent definition of NPLs is used throughout the study. This is in contrast to existing research where a variety of countries were considered in the study, which invariably results in

differences in the definitions of NPLs and differences in the regulatory environment (Beck *et al*. 2015; Nkusu, 2011).

This research also contributes to the existing body of knowledge on the impact that structural breaks, macroeconomic conditions and microeconomic conditions have on the determinants of NPLs for comprehensive banks, thus providing consideration for the international competitiveness of the South African banks (Klein, 2013; Messai & Jouini, 2013). A gap remains in the knowledge about the impact of the GFC on the NPLs of comprehensive banks in EMEs, since most studies on these determinants were conducted in developed economies (Klein, 2013; Nkusu, 2011).

There have been numerous regulatory changes in the South African financial markets since the 1980s. The first changes took place in 1987 when the De Kock Commission stated that the banking sector was over-regulated; this was soon followed by the introduction of a new banking act in 1990 and another government sponsored commission, the Melamet Commission in 1993 (Botha & Makina, 2011). The most recent changes were the introduction of the Twin Peaks financial supervision model and the introduction of the NCA (Botha & Makina, 2011; Chipeta & Mbululu, 2012), this study is undoubtedly unique and contributes to the knowledge on the determinants of NPLs during times of regulatory changes.

The literature indicates that this study is, to the best of the author's knowledge, the first to include gold sales as a determinant of NPLs. Past studies (Jang & Kataoaka, 2013; Nikolaidou & Vogiazas, 2017; Senawi & Isa, 2014) did not use gold sales but rather used the spot price of gold or the production output of gold. The study by Jang and Kataoaka (2013) use agricultural commodity spot prices as these are the predominant exports in New Zealand.

Saba *et al*. (2012) warned that risky lending activities results in poor asset quality and found that bank managers drive the risky activities. This study contributes to the existing knowledge by reviewing the impact of the risky lending activities from a shareholder perspective, as well as a managerial perspective, by introducing the measures ROE and ROA, respectively.

The five primary contributions of this study are based on the theoretical shortcomings as presented in Section 3.2.2. These five contributions also lay the foundation for the research objectives of this study.

3.2.4 Research objectives

Similarly to the five contributions presented in Section 3.2.3, this study also has five research objectives. These research objectives introduce the five hypothesis. The research objectives aim to fulfil the shortcomings of past studies and satisfy the recommendations for future research by authors of past research.

The five research objectives set by this study are to:

- Assess the impact of the GFC on bank asset quality in an EME (*cf*. Klein, 2013).
- Determine whether the NCA is effective in reducing NPLs (*cf*. Chipeta & Mbululu, 2012; Salas & Saurina, 2002).
- Conduct a single-country study on the macroeconomic and microeconomic determinants of NPLs in an EME (*cf.* Saba *et al*., 2012).
- Establish whether a primary commodity export of an EME has an impact on NPLs (*cf.* Jang & Kataoaka, 2013; Senawi & Isa, 2014).
- Determine whether interest income on loans has superior explanatory power regarding NPLs, in comparison to the ROA and ROE (*cf*. Makri *et al*., 2014; Messai & Jouini, 2013; Saba *et al*., 2012).

Considering the five objectives of this study, the following hypotheses were developed to achieve the outcomes of the research objectives.

3.3 HYPOTHESIS DEVELOPMENT

An important part of conducting empirical research is to approach a research question through hypothesis testing (Banarjee, Chitnis, Jadhav, Bhawalkar & Chaudhury, 2009). As such, Banarjee *et al*. (2009) stated that hypotheses have three important characteristics, namely, they are simple, specific and developed when planning a research project.

Five hypotheses (as discussed below) were developed for this study, according to the above-mentioned characteristics of hypotheses.

3.3.1 Hypothesis 1

Hypothesis 1: South African bank asset quality showed resilience against the global financial crisis

The GFC had a substantial impact on financial systems globally (Eichengreen *et al.,* 2012), and the effects of the GFC were spread across all financial markets, however, the levels of strain differed amongst countries and banking models. For instance, Islamic banking systems experienced lower levels of stress in comparison with conventional banking models; this is as a result of their higher levels of capital asset reserves (Beck *et al*., 2013). The GFC also had a subdued impact on certain countries. Asia and Australia showed a level of resilience against the detrimental effects of the GFC (Adiningsih, 2011; Jeasakul, Lim & Lundback, 2014). However, in Asia, the Asian financial crisis led to reforms in the market and led to more support for sound macroeconomic policies. According to Jeasakul *et al.* (2014), the Asian financial crisis incited regulatory reforms that strengthened the banking system before the high of the GFC. Australia similarly engaged in financial reforms before the GFC. The reforms encouraged domestic investment, thereby reducing the effect of the GFC (Adiningsih, 2011). Irrespective of the reforms in Australia and Asia, the effects of the crisis were only reduced, not avoided.

Gualandri and Noera (2014) stated that bank crisis indicators are not reliable indicators of financial crises, as a retrospective analysis may indicate that these common asset quality indicators do not always signal an imminent banking crisis. Bholat *et al*. (2016) disagreed, stating that bank crises frequently occur, and that there are reliable common asset quality indicators that signal when a crisis might be imminent. Chipeta and Mbululu (2012, cited in De Wet, Botha & Booyens, 2015) concurred and concluded that the GFC impacted a variety of bank asset quality indicators. Moreover, Bholat *et al.* (2016) stated that NPLs are crucial in determining whether a crisis is imminent, and that central banks have to refer to asset quality indicators to ensure that there are sufficient financial policies to weather crisis periods.

Botha and Makina (2011) reported that the South African regulatory environment has been ever-changing since the 1980s. Although the South African financial market is a world-class market in terms of infrastructure and legislation, some weaknesses in the

market were exposed during the GFC (Botha & Makina, 2011). According to Baxter (2009), South Africa did not completely escape the spill-over effects of the GFC, although the markets initially showed resilience. However, Erasmus and Makina (2014) argued that, based on bank efficiency, South African banks were resilient against the GFC. The estimations presented later in this study show the impact of the GFC on NPLs.

3.3.2 Hypothesis 2

Hypothesis 2: South African gold sales improve bank asset quality

Banks continuously face a diverse set of risks. The balance sheet of a bank is sensitive to various factors such as changes in interest rates, equity prices, exchange rate fluctuations and commodity prices (Ali, 2012). The reason why banks are sensitive to changes in the commodity prices is because banks hold assets that were generated from corporate and investment banking activities.

Approximately 37% of all loans and advances that South African banks make are to corporate clients (PwC, 2017), and these include South African commodity producers and miners. In New Zealand, for example, banks have exposure to commodity risk due to advances made to the agricultural sector (Jang & Kataoaka, 2013). Jang and Kataoaka (2013) acknowledged that shocks to the agricultural commodities market therefore can impair the bank asset quality in New Zealand due to the loans to organisations active in the agricultural sector. The South African economy is also susceptible to commodity risk, especially in the mineral export markets (Baxter, 2009).

South Africa is a large producer of mineral commodities, and is considered to be the 7th largest producer of gold in the world (Baxter, 2009; Dick & Naidoo, 2016). Helbling (2012) stated that commodity prices soared past the previous high levels of 2008 in 2010, shaking off the shock of the financial crisis. However, Baxter (2009) warned that South Africa did not experience the financial effect of the commodity boom. This is a strange occurrence because the commodity, gold, of which South Africa is one of the top ten producers (Williams, 2015), became an asset of last resort after the collapse of Lehman Brothers in the USA during the GFC (Dempster, 2010). Dempster (2010) concluded that gold was in high demand during the GFC as it was used for payments and to meet margin calls. Baxter (2009) averred that South Africa experienced lower

levels of demand during the commodity boom. In addition, funding became troublesome in the mining industry due to the GFC which affected bank and investor lending.

Since 1925, the SARB has been active in the gold market which has changed considerably over the years. Currently, the gold market is not actively regulated by the SARB (SARB, 2017b). Statistics from 2012 indicate that South Africa has approximately 146 000 individuals working in the mining sector (Nadarajah, Afuecheta & Chan, 2015). The World Gold Council (WGC) (2010) concluded that gold as an investment is also unrelated to adverse market conditions, suggesting that it is independent of other assets.

Senawi and Isa (2014) introduced gold as an indicator of NPLs, assuming that gold prices reduce the asset quality of a bank, but their research subsequently revealed a negative relationship between gold price and asset quality. Gold sales as an indicator of bank asset quality are therefore justified by the employment opportunities that the South African gold mining industry creates. Also, in this study, it is further motivated by the fact that the banks in this study are comprehensive banks offering both retail and corporate lending services.

3.3.3 Hypothesis 3

Hypothesis 3: The South African National Credit Act No. 34 of 2005 (NCA) improves bank asset quality

The main objective of financial regulation is to create a stable financial system where all stakeholders are protected against adverse economic events (Goodhart *et al*., 1998). Ball, Hail and Vasvari (2011) further stated that financial regulation stimulates financial market expansion by ensuring that the financial system allows for transparency, full disclosure, investor protection and effective supervision (Ball *et al*., 2011). Although regulation typically attempts to smooth adverse events in financial markets, the implementation of the National Credit Act No. 34 of 2005 (RSA, 2006) in South Africa had a negative effect on the consumer over-indebtedness (De Wet *et al*., 2015). The effect of the NCA on the asset quality of a bank is yet to be determined. Chipeta and Mbululu (2012) recommended that the impact of the NCA on the

performance of financial institutions and their commonly associated financial indicators should be investigated.

This hypothesis evaluates the impact that the NCA has on bank asset quality. The NCA was integrated into the South African financial system on 1 June 2007. One of the primary objectives of the NCA is to reduce the number of reckless credit extensions (RSA, 2006). 'Reckless credit' is the act of granting credit to a consumer under a credit agreement while the lender is aware that the borrower might not be able to repay the loan as a result of poor income generation (RSA, 2006). Gilbert (2013) explained that the NCA enforces a framework of fair credit assessment and credit marketing for consumers. Chipeta and Mbululu (2012) further explained that the NCA requires banks and credit providers to assess the ability of a borrower to repay debt before extending credit to a borrower. The NCA was enacted as a consumer protection mechanism, reducing reckless credit extension, and as a result, also impacts NPLs.

De Wet *et al.* (2015) conducted research on the South African credit-active consumers and the effect of the NCA on the levels of the indebtedness of these consumers. They founds that the indebtedness of consumers was at such levels that negative shocks to the market may leave the consumers unable to repay their debt obligations (De Wet *et al*., 2015). De Wet *et al*. (2015) concluded that the NCA might not have succeeded in protecting consumers, as the levels of over-indebtedness has a positive relationship with the NCA. With this in mind, it is important to establish whether the NCA has a significant impact on bank asset quality.

3.3.4 Hypothesis 4

Hypothesis 4: Interest income on loans is a superior indicator of non-performing loans in comparison with return on assets

Makri *et al*. (2014) used ROA as a determinant of asset quality. This is because the ROA is calculated as the total earnings of a bank, divided by the total assets of a bank (Lin, Horng & Chou, 2016). This hypothesis assumes that the interest income on loans presents more accurate results when determining the factors that influence NPLs, because this variable took the interest income on loans into account, rather than all the assets of a bank. This is important, as the primary income of a bank is generated by the interest income on loans (Ifeacho & Ngalawa, 2014; Zafar *et al*., 2013).

If the interest income on loans and ROA are substitutes for one another, the relationship between ROA and NPLs, as well as the relationship between interest income on loans and NPLs, would be similar. This similarity would be regarding the expected sign of the determinant, the coefficient and the significance of the variables. If these variables are not substitutes, one of these variables has to provide superior regression results in the form of a better estimation fit.

Although ROA and interest income on loans have an apparent relationship, Erdinç and Abazi (2014) found in their study on NPLs, that the ROA and ROE have a similar relationship, and increases in either one can lead to lower levels of NPLs. Moussu and Petit-Romec (2014), however, disagreed and concluded- that ROA and ROE did not yield similar results in bank measurements.

3.3.5 Hypothesis 5

Hypothesis 5: Interest income on loans is a superior indicator of non-performing loans in comparison with return on equity

The previous hypothesis introduced the possibility that ROE and ROA share similarities as determinants of NPLs (Erdinç & Abazi, 2014). However, Moussu and Petit-Romec disagreed, stating that ROA and ROE do not yield similar results. This hypothesis aims to determine whether interest income on loans is superior as a determinant of NPLs, in comparison with the ROE.

It is expected that if ROE and ROA have a similar impact on the NPLs, then the ROA and ROE would have similar signs, regression coefficients and level of significance. This hypothesis aims to determine the superiority of the interest income on loans.

With specific reference to hypothesis 4 and hypothesis 5, whether the hypotheses are accepted or rejected, they should have the same outcome, as this would indicate that there might be a substitution relationship between ROA and ROE.

3.4 SUMMARY

This chapter explained how a single-country perspective that expanded on the known theories may contribute to new knowledge. It explained that this study is a recontextualisation of a conventional theoretical approach, albeit from a single-

country African perspective. Although the importance of macroeconomic determinants has been well-established, this study includes both the microeconomic and macroeconomic determinants of NPLs to explain the impact of these variables in an EME. South Africa is also a commodity-rich country and banks finance activities in the commodity sector, and for this reason, gold sales are regarded as a determinant of bank asset quality. Gold sales have been identified as the determinant, because gold exports are one of the most significant commodity exports from South Africa. This study also compares the profitability measures of bank asset quality by hypothesising which one of the profitability measures, ROA, ROE or interest income on loans presents the best fit for the estimations when analysing the determinants of bank asset quality.

The following chapter explains these regression models and their associated tests. In addition to presenting information on the regression models, the chapter also includes information on the research design, data analysis and ethical considerations.

CHAPTER 4: RESEARCH DESIGN AND EMPIRICAL METHODOLOGY

4.1 INTRODUCTION

The preceding chapter presented the hypotheses that were tested by this study. The five hypotheses evaluate the impact of the various determinants of bank asset quality in the South African banking sector. This chapter provides more information on how the hypotheses stated in the preceding chapter were tested.

This chapter discusses the research design that was applied to achieve the research objectives. Importantly, this chapter presents the seven regression models that were evaluated to test the five hypothesis. These regressions resulted in interesting information that is discussed in Chapter 6.

This chapter is structured to present information on the research methodology and empirical design followed in the study. To achieve this, this chapter presents information on the research design (Section 4.2), the research data (Section 4.3) and the statistical analysis of this data (Section 4.4). These sections precede the overview of panel data models (Section 4.5), the review of the panel data model specifications (Section 4.6) and an explanation of the panel data diagnostic tests (Section 4.7). Finally, the chapter concludes with a presentation of the panel data regression models (Section 4.8), followed by the ethical considerations relevant to the study (Section 4.9) and the chapter summary (Section 4.10).

4.2 RESEARCH DESIGN

This research study is grounded within the paradigm of positivism, relying on a deductive approach to explain how conclusions are reached, based on underlying theoretical principles. According to Bashir, Syed and Qureshi (2017), quantitative research has a positivistic nature and allows for hypotheses testing. Bryman (2004) stated that the hypotheses are based on underlying theories that positivists test using numerical methods. Gorard (2013) maintained that the main objective of any research design within the paradigm of positivism is to serve as a guarantee that the steps

followed to arrive at the conclusions considered the appropriate methodological approach. The deductive approach followed in this research is illustrated in Figure 4.1.

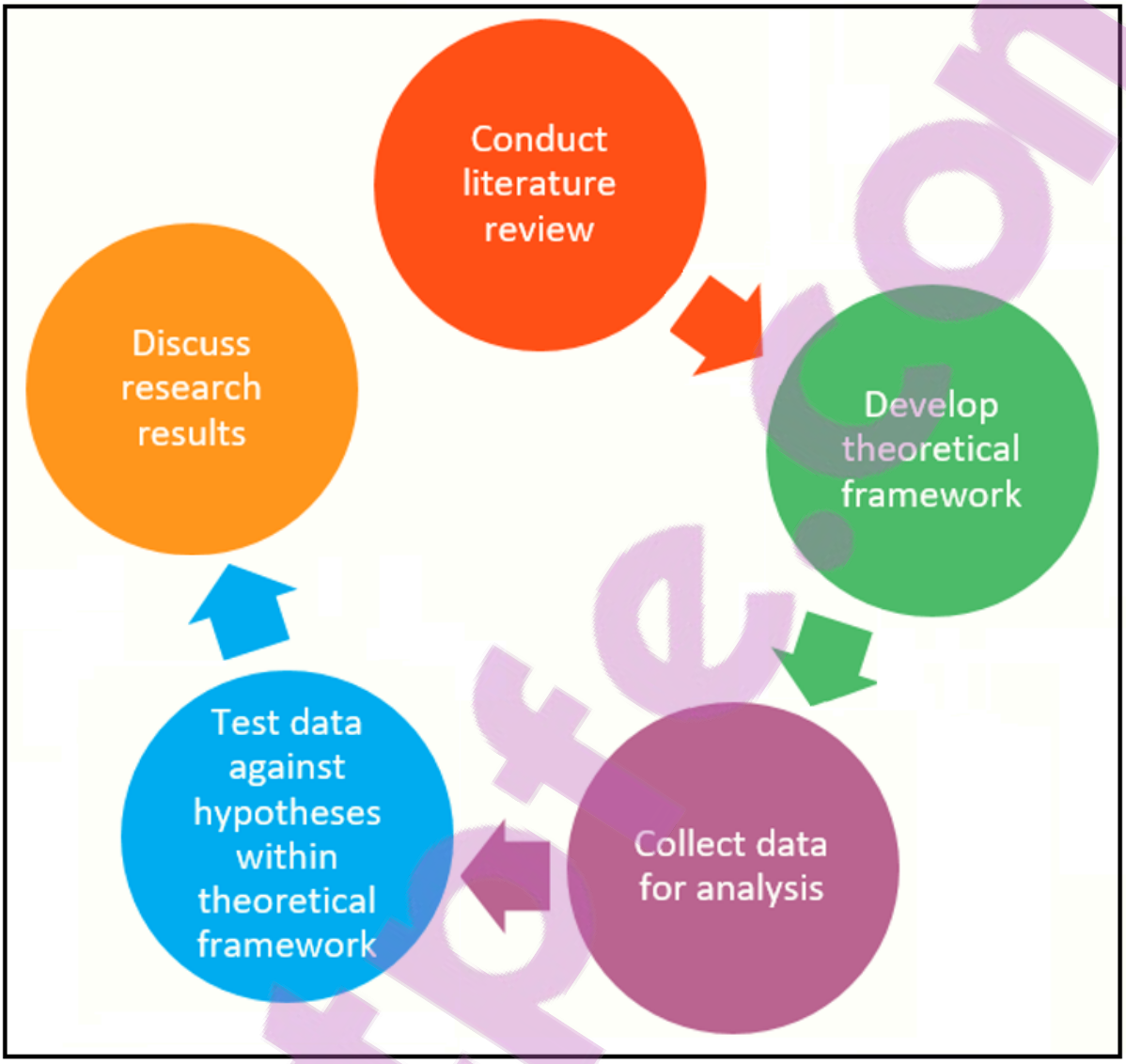

Figure 4.1: Deductive logic framework

Source: Adapted from Van Wyk (2012)

The deductive logic framework follows a specific design. Firstly, a literature review is conducted. For the purposes of this study, the literature review explored the subject of NPL and its determinants. The literature study was further expanded by reviewing the banking environment, the functions of a bank and the different external organisations that impact the business of a bank. The importance of this lies therein that an understanding of the bank environment is essential to an understanding of why bank asset quality changes when specific events take place. The literature review formed the foundation of the theoretical framework upon which the hypotheses were

developed. Thereafter, publically available data was collected from different sources for a period longer than 10 years, and 156 observations were collected for this period. This data was subsequently analysed and tested against the hypotheses within the theoretical framework. Lastly, these results were discussed, presenting the original contribution of this study.

4.3 DATA

In this study, the hypotheses were tested using secondary data that was collected from financial statements and a proprietary database that spanned the 12-year period from 2004 to 2015.

4.3.1 Data period

The data that was obtained ranged from 2004 to 2015. This period allowed the researcher to study firstly, the effects of the GFC, secondly, the commodity boom, and thirdly, the impact of credit legislation on the asset quality of South African banks.

It is widely accepted that the impact of the GFC (from 2007 to 2009) started on the day that Lehman Brothers collapsed in 2007. This was followed by the global economic downturn (Eichengreen *et al*., 2012). With regards to the commodity boom, Mariscal and Powell (2014) stated that the ensuing commodity boom enhanced the financial position of countries that had large mineral reserves during the boom cycle from 2007 to 2010. Regarding the NCA, it is important to note that although the NCA was promulgated in 2005, the legislation was only implemented during the second half of 2007 (Chipeta & Mbululu, 2012), therefore the period under investigation for the NCA variable is thus from 2008 to 2015.

The data was collected from different sources (see Section 4.3.2) and is categorised as secondary data. The researcher utilised the secondary data in an empirical approach to analyse the determinants of NPLs in the South African banking sector.

4.3.2 Sources of data

The unavailability of data is often the single largest constraint when information related to banks needs to be analysed (Bending *et al*., 2015; Meeker & Gray, 1987). According to Ćurak *et al*. (2013), the variables used in estimation models are often determined

by the availability of public data. Louzis *et al*. (2012) stated that a generic approach to bank asset quality analysis is not possible, as the availability of public data often limits the variables being used. Although banks do have detailed information on their bank asset quality, this information is only provided to the bank regulator, as making this information public may cause the banks to lose their competitive advantage (Mullineux, 2006).

This study collected both the macroeconomic and the microeconomic data that was available publically which was used to draw findings from the empirical results. The macroeconomic information was collected from sources that record South African macroeconomic data, namely the SARB and Statistics South Africa (StatsSA). Microeconomic information was collected from BankScope[8] and the annual reports of the individual banks.

Due to ease of access, this research attempted to retrieve all the data from the proprietary database, BankScope. However, due to the database being incomplete, the researcher had to revert to the primary sources for some of the financial results of individual banks. Apart from Bankscope, all the other data sources allow public access to the required data. Although Bankscope is not a free resource, it does not contain any information that is not publically available from the relevant annual reports.

The BankScope database was queried to deliver the financial results of banks that complied with the specific search criterion, namely, to find banks that are listed as banks trading in South Africa, and that are licensed by the SARB. The query used on BankScope was to list South African banks that filed annual reports from 2003 to 2016 and that had consolidated statements containing the required bank-specific information.

[8] This proprietary database is a repository of financial statements available to Unisa students.

Table 4.1: Banks operating in South Africa included in the study

Absa Bank	Investec
African Bank	Ithala Development Finance Corporation (IDFC)
Albaraka Bank	Mercantile Bank
Bidvest Bank	Nedbank
Capitec Bank	Sasfin Bank
Firstrand Bank	Standard Bank
Habib Bank	

Source: Own compilation (2018)

Table 4.1 lists the names of the 13 banks that are the primary sources of information related to asset quality and the associated bank-specific determinants of bank asset quality. These 13 banks reported sufficient financial information, and were consequently included in the panel.

According to Cameron (2005), data may be subject to measurement errors, information loss, and observations may even have been omitted from the dataset. In this study, some information was unavailable, but the missing observations were addressed to ensure that the dataset was a balanced panel. These factors are briefly discussed in the section below

4.3.3 Missing data

Data was only regarded as missing if it could not be obtained from BankScope or the annual report of the relevant bank. The macroeconomic data was well recorded for the research period, but the microeconomic data was not reported as satisfactorily. The inadequate reporting caused empty data points, threatening the possibility of obtaining a balanced data panel.

The majority of the empty data points were filled by obtaining the appropriate annual reports for the banks that had empty data points. After consulting the annual reports, some observations still remained empty. Unlike the finding of Bending *et al*. (2015), no data was missing as a result of national secrecy laws. The observations were generally missing due to the secretariat of a bank not supplying their annual financial statements. In the specific case of the IDFC (2007), the IDFC was exempted from reporting their capital adequacy ratio from 2004 to 2008, although the regulation

required the capital adequacy ratio report for all the other banks. To address these missing observations, the statistical software package, *The R Project for Statistical Computing*, (in the R Studio integrated development environment) was used to fill the missing observations in the dataset.

Cameron (2005) warned that missing observations hamper research due to fewer observations reducing the accuracy of regression and statistical analysis. Cameron (2005) concluded that a midpoint is generally calculated where there are missing observations. However, for the purposes of this study, the researcher decided to use spline regression to determine the appropriate value for missing observations.

Spline regression is a superior method of dealing with missing variables. Ahamada and Flachaire (2010) explained that spline regression splits the sample of observations into some segments and estimates a linear relationship by taking into account the potential non-linear form of the regression. The polynomials in each estimated segment allow for a continuous estimation function (Ahamada & Flachaire, 2010). By introducing spline regression, the potential for error in the estimates obtained from the panel data regression and the results of the statistical analysis was reduced.

It was possible to use spline regression because the missing observations were measured as ratio scale data. The data measurement scale on its own could have had an impact on the data analysis.

4.3.4 Data measurement scales

Studies in the fields of finance and economics generally require data measurement scales with robust relational measurements (Naghshpour, 2012). However, it is important to acknowledge that data measurement can also be of a qualitative nature in finance and economics (Naghshpour, 2012). According to Powner (2015), statistics whether inferential or descriptive, are dependent on using the relevant data measurement scales. Measurement scales are divided into four categories namely, nominal, ordinal, interval and ratio scale measurements (Cooper & Schindler, 2008; Gershkoff, 2008; Gill & Johnson, 2010; Remenyi, Williams, Money & Swartz, 1998).

In this study, nominal scale data is used to distinguish between different periods of time, identifying the GFC, NCA and commodity boom periods. The remainder of the

data primarily consists of ratio scale data. The ratio scale data allowed for robust analysis and econometric testing (Cooper & Schindler, 2008).

4.3.5 Data analysis

The data collected from the four primary sources (BankScope, SARB, StatsSA and annual reports) were compiled into a single Microsoft Excel 2013 spreadsheet. The data on Microsoft Excel 2013 was then saved as a comma separated values (.csv) file to enable the researcher to import the data into the R Studio program.

R Studio is statistical analysis software that has been developed as freeware and is often used for statistical analysis by incorporating different R add-on packages (R Core Team, 2013). The primary purpose for using R Studio was to remove missing observations by creating observations with spline regression. The complete dataset, without missing observations, was exported as a .csv file and imported into Stata 15. Stata 15 (StataCorp, 2017) was used to conduct all panel data regression analyses.

Using Strata 15, data is statistically processed and the researcher is able to obtain estimations using panel data regression, thereby changing data into information ready for interpretation. According to Crowther and Lancaster (2009), information can be defined as accurate, meaningful, relevant and timely data if it is in a logical format that makes it possible to explain it. This information was generated in Stata 15 and Microsoft Excel 2013. The descriptive statistics and panel data regressions were estimated using Stata 15, while Microsoft Excel 2013 was used to create graphic representations of the data.

In the software packages (Microsoft Excel 2013; R Studio; Stata 15), variables were named as listed in Table 4.2. Consistent naming allowed the researcher to easily distinguish the variables in all the software packages, and enabled accurate interpretation and reduced confusion.

Table 4.2: Variable names for Microsoft Excel 2013, R Studio and Stata 15

Data obtained	Variable name in Microsoft Excel, R Studio and Stata
Bank name	bank
Bank code	bankcode
Non-performing loan ratio	npl
Total regulatory capital ratio	capad
Interest income on loans divided by average gross loans	earnings
Return on assets (ROA)	roa
Return on equity (ROE)	roe
Total customer deposits (in R'000000)	deposits
Growth of gross loans	growth
Loans to customer deposits	liquidity
Gross domestic product (GDP)	gdp
Average interest (repurchase) rate	repo
Average yearly rand/dollar exchange rate	rdol
Consumer price inflation (CPI)	cpi
Gold sales (in R'000000)	gsales
Unemployment rate	unemp
Global financial crisis (GFC) period	gfc
Introduction of National Credit Act (NCA)	nca
Commodity boom cycle	cboom

Source: Own composition (2017)

The variable names as listed in Table 4.2 enabled the researcher to quickly match the variables and the relevant output from the statistical and regression analyses.

4.4 STATISTICAL ANALYSIS

Statistical analysis is a broad concept which is divided into three parts in this study, namely, descriptive statistics, inferential statistics and regression analysis. However,

as inferential statistics forms part of the regression analysis, these two parts are discussed in combination.

4.4.1 Descriptive statistics

Descriptive statistics is a tool used by economic and financial researchers to make informed decisions (Naghshpour, 2012). Descriptive statistics comprises a summary of the data collected according to a specific level of measurement (Heiman, 2011). Descriptive statistics is presented both graphically or numerically. A graphic representation of descriptive statistics is in the form of bar charts, box plots, histograms, pie charts and other graphic representations (Rodriguez, 2007). Although the statistical information generated by descriptive statistics is simple, it provides excellent insight into a research problem (Naghsphour, 2012). The numerical representation describes the collected data according to measures of central tendency or measures of dispersion (Heiman, 2011; Moore, 2001).

- **Location statistics**

  Location statistics are measures of central tendency. These central tendency measures are the mean, median and mode of a dataset (Boslaugh, 2013). The average value returned from the data collected is the mean; this is also the most commonly used location statistic (Naghsphour, 2012). The average is the sum of observations divided by the number of elements (Naghsphour, 2012). The mode is the value in the observations per single variable that appears most frequently in a dataset. The median is the observation that is precisely in the middle of a set of observations when the observations are ranked from the minimum value to the maximum value (Boslaugh, 2013).

- **Dependency statistics**

  Dependency statistics provides additional information on relationships between variables in a bivariate form. According to Cameron (2005), the correlation measure is a dependency statistic that explains the relationship between two variables, but it cannot determine influential variables. Naghshpour (2012) explained that the correlation coefficient is a non-unitised measure calculated by determining the measures of association and dispersion.

- **Dispersion statistics**

  The measures of dispersion describe the variability in a dataset (Fielding & Gilbert, 2006). The level of variability refers to the extent to which the distributions differ from one another (Heiman, 2011). According to Fielding and Gilbert (2006), the range, variance, standard deviation and coefficient of variation are associated with the measures of dispersion. The range is the difference between the minimum and maximum values returned in a dataset. The variance and standard deviation measures refer to the distance of the observations away from the mean. The standard deviation is seen as the average error in measurement (Naghshpour, 2012). Due to the fact that datasets are not similar in measurement, a coefficient of variation acts as a standardisation of the variation which allows the researcher to compare the standard deviations of different datasets (Boslaugh, 2013; Heiman, 2011).

The descriptive statistics on this panel data provides overall, between and within results on the standard deviation, and minimum and maximum values, as well as a correlation matrix.

- The overall values provide a mean, a standard deviation, and minimum and maximum values combined for banks over the time period of the study;
- The between results indicate the mean, standard deviation, and minimum and maximum values for the period (T) of the study; and
- The within results express the mean, standard deviation, and minimum and maximum values within the group of banks (N).
- The correlation matrix does not distinguish between the different categories for overall, between and within, it just provides the overall results.

In addition to the descriptive statistics, the research provides regressions to study the relationship between the NPLs and the various explanatory variables.

4.4.2 Inferential statistics

Inferential statistics allows a researcher to make reliable deductions, based on the probability that an explanatory variable may cause a change in a dependent variable

(Asadoorian & Kantarelis, 2005). The regression analysis used to report findings in this study is merely a tool used in inferential statistics.

Woodwell (2014) explained that inferential statistics allows hypothesis testing that is associated with causal research. Inferential statistics allows researchers to reach conclusions by reviewing the results and the probabilities that confirm the likelihood of a pattern (Naghshpour, 2012; Woodwell, 2014). A null hypothesis is rejected when the p-value is small enough (10%, 5% or 1%). The probability at which a null hypothesis is rejected is also the probability that the hypothesis may be rejected while it should have been accepted, this is known as a type 1 or type 2 error (Naghshpour, 2012). More specifically, a type 1 error occurs when there is a false positive, and a type 2 error occurs when there is a false negative, while a type 3 error occurs when an incorrect sign is accepted as correct (Naghshpour, 2012). Should a type 1, 2 or 3 error occur, the hypothesis that is tested might have been incorrectly interpreted.

Inferential statistics is imperative in any regression analysis. Powner (2015) stated that regression analysis on its own does not hold any significance if it is not confirmed by reviewing the results from inferential statistics. Naghshpour (2012) also stated that inference allows researchers to make recommendations and reach conclusions about a certain variable. It must be acknowledged that there is always an unexplained error due to factors that could not be analysed (Naghshpour, 2012). This is also true in any regression model.

The inferential statistical techniques and panel data models used in this study are discussed in the following sections.

4.5 OVERVIEW OF PANEL DATA MODELS

The popularity of panel data regressions stems from the ability of the regressions to measure both cross-sectional and time-series effects (Gujarati & Porter, 2009). The tabular form (panels) may be long or short, and balanced or unbalanced, depending on which panel techniques are being utilised (Baum, 2006). A balanced panel has no missing observations, and there are observations for each of the individual units under investigation (Baum, 2006; Brooks, 2008; Longhi & Nandi, 2014). Gujarati and Porter (2009) described a long panel as a dataset that has a larger number of time periods

(T) than individual units (N), while a short panel has a larger number of individual units (N) than time periods (T), or where N = T.

The current research makes use of a balanced panel where there are 12 years of data for 13 individual banks, thus a short and balanced panel. From past literature (Dash & Kabra, 2010; Louzis *et al.,* 2012; Pain, 2003; Saurina & Jimenez, 2006) it has been determined that the dependent variable (NPL) has a level of persistence, and this implies that the previous levels of NPLs have an impact on the current levels of NPLs. Hence, the lagged values of NPLs which are also included as an explanatory variable in the model. The panel regression is expressed in general terms as:

$$ASQ_{i,t} = f\begin{pmatrix} \text{lagged values of } ASQ_{i,t}\text{, macroeconomic} \\ \text{variables, microeconomic variables and} \\ \text{structural breaks presented as dummy variables} \end{pmatrix} \quad (4.1)$$

Where $ASQ_{i,t}$ represents NPL in time t for bank i.

Section 4.6 below presents a discussion of the different techniques, including the pooled model regression, fixed effect (FE) regression, random effect (RE) regression and the autoregressive [AR(1)] adaption of the FE and RE models. These adaptions are required to confirm that estimations are unbiased, as a result of the inclusion of a positively correlated lagged NPL that may cause a violation of exogeneity (*cf.* Makri *et al*., 2014). According to Klomp and De Haan (2014), in their investigation of the different panel data, regression techniques produces reliable results.

4.6 PANEL DATA MODEL SPECIFICATIONS

Although the multiple benefits of conducting panel data regressions has been established, it is still important to understand the dynamics of the regression models. Each one of the different models are presented below, and in addition to the mathematical representation of the models, the abilities and limitations of the models are also discussed. Because this research only incorporated econometric regression models, the mathematical representation is specified, but not discussed in detail. The models discussed are the pooled panel data model, the FE (fixed effects), the RE (random effects), the AR(1) (autoregressive estimation) FE model and the AR(1) RE model.

4.6.1 Pooled panel data regression model

The pooled panel data regression model provides an estimation that assumes the slopes of different individual units are similar. In addition, the model also assumes that the error term is uncorrelated with the regressors, and that each estimator is consistent (Gujarati, 2014). According to Brooks (2008), the pooled panel data regression model is the simplest method of estimation because it stacks all the data and estimates are derived for the cross-sectional and time-series observations from a single data column.

According to Gujarati and Porter (2009), the pooled data regression model is expressed as:

$$Y_{i,t} = \alpha_i + \beta X_{i,t} + u_{i,t} \text{ with } u_{i,t} = u_i + e_{i,t} \quad (4.2)$$

Where:

$Y_{i,t}$ is the dependent variable which is the asset quality of bank i's asset at time t;

α_i is constant for bank i;

β is vector of coefficient of explanatory variables;

$X_{i,t}$ is a vector of explanatory/independent variables in the estimation model;

$u_{i,t}$ is the disturbance error term which is decomposed into time-invariant error (firm-specific effects), u_i, and the idiosyncratic error term, $e_{i,t}$ (time-variant error).

As a result of the shortcomings of the pooled panel data regression model, a range of different models were developed to determine estimators accurately. The most common problem with the pooled model is that it ignores the uniqueness or heterogeneity of individual units in the data (Gujarati & Porter, 2009). Also, Baum (2006) found that the model becomes too restrictive and that heteroscedasticity and serial correlation are common occurrences when using the pooled model.

The FE and RE models aim to resolve these shortcomings of the pooled model.

4.6.2 Fixed effect panel data model

In this study, the FE within-group model was used to determine the estimates. The FE within-group panel data regression model calculates a mean for both the dependent

and independent variables and subtracts the mean from the variables to create a mean-corrected value for the observations (Gujarati & Porter, 2009). The FE model is usually associated with a regression that yields the best results when analysing the impact of different variables over a period, thus exploring the relationship between the predicting and outcome variables for the different banks (Torres-Reyna, 2007).

The main benefit of using this particular regression is that each bank is analysed according to its characteristics, and therefore the predictions of other banks will not have any influence (Torres-Reyna, 2007).

According to Brooks (2008), the FE panel data regression model is expressed as:

$$y_{it} = \alpha + \beta x_{it} + u_i + \epsilon_{it} \quad (4.3)$$

Where:

$y_{i,t}$ is the dependent variable which is the asset quality of bank i's asset at time t;

x_{it} are variables that vary over individual unit and time;

β are coefficients of explanatory variables;

α is the intercept term;

u_i is the individual effect; and

$\epsilon_{i,t}$ is the disturbance error term.

The FE within-group model is based on certain assumptions, which if violated cannot yield consistent results. According to Baum (2006), the significance of the explanations of the model is dependent on the correlation of the variance between the independent and dependent variables. The assumption is the characteristics that are time-invariant are unique to the individual banks and do not correlate with each other (Torres-Reyna, 2007). If these error terms are correlated, the inferences from the model do not yield strong results, and the RE model may be preferable.

4.6.3 Random effect panel data model

The benefit of the RE panel data regression model is that it remains consistent, even when the true model is the pooled panel data regression model, with the exception of the true model being the FE model (Gujarati, 2014). The RE model produces estimates

for the different intercept terms for every individual bank that are constant over a period (Brooks, 2008).

According to Baum (2006), the RE panel data regression model is expressed as:

$$y_{it} = x_{it}\beta_k + z_i\delta + (u_i + \epsilon_{it}) \quad (4.4)$$

Where:

$y_{i,t}$ is the dependent variable which is the asset quality of bank i's asset at time t;

x_{it} are variables that vary over individual unit and time;

β are coefficients of explanatory variables;

z_i are time-invariant variables that vary for individual banks;

δ is the coefficient of variables for time-invariant variables;

u_i is the individual effect; and

$(u_i + \epsilon_{it})$ is the composite error term.

For the RE model to yield consistent results, a critical assumption of this model is that u_i is uncorrelated with the regressors x_{it} and z_i (Baum, 2006).

If the correlation between time periods does not decrease over a period of time, the AR(1) models have to be estimated (Gujarati, 2014).

4.6.4 Linear AR(1) model specification

This study makes use of a lagged dependent variable, NPL_{t-1} (see Equation 4.1). As a result, the pooled OLS, FE and RE models show signs of autoregressive properties (*cf.* Baum, 2006, Wooldridge, 2010). According to StataCorp (2017), a linear AR(1) panel regression model produces optimal regression results in such instances. Baltagi and Wu (1999) also found that with market data that are unequally spaced (for example, weekdays and different annual financial statement release dates data) the regression models also had certain autoregressive properties or elements of serial correlation.

According to StataCorp (2017), for the FE and RE panel data regression models, the AR(1) model adaption is expressed as:

$y_{it} = \alpha + x_{it}\beta + \nu_i + \epsilon_{it}$, where $\epsilon_{it} = \rho\epsilon_{i,t-1} + \eta_{it}$, with $i = 1, \dots, N; t = 1, \dots, T_i$, $|\rho| < 1$

(4.5)

Where:

y_{it} is the dependent variable which is the asset quality of bank i's asset at time t;

α is the intercept term;

x_{it} are variables that vary over individual unit and time;

β are coefficients of explanatory variables;

ν_i is dependent on the FE or RE estimation;

η_{it} is independent and identically distributed with mean 0 and variance σ_η^2.

ϵ_{it} is the error term.

The estimation model is transformed for the both the FE and RE models. The transformation allows for FE and RE estimations using the linear AR(1) model. When the ν_i is assumed as a fixed parameter, the AR(1) model would yield results for a FE model, while a ν_i with assumed realisations of the independent, and identically distributed process with the mean and variance (0; σ_ν^2) in the AR(1) model, would estimate a RE model adjusted for autoregression (StataCorp, 2017). When the FE model is estimated, correlation between the ν_i and the covariates x_{it} may exist, while with the RE model the ν_i is assumed to be independent of the covariates x_{it} (StataCorp, 2017).

Estimation diagnostic tests are used to determine which one of the regression models deliver the most appropriate results. Stata 15 (StataCorp, 2017) automatically supplies certain estimation diagnostics for each of the regressions.

4.7 PANEL DATA SPECIFICATION AND DIAGNOSTIC TESTS

The various regression models produce unique specification and diagnostic tests. These specification and diagnostic tests allow researchers to determine whether the regressions are appropriate to serve as information regarding the determinants of the

dependent variable, namely, the NPL ratio, for the purpose of this study. This section provides a discussion of the estimation and diagnostic tests that were used in the current study.

4.7.1 F-test

The F-test determines the credibility of the FE model. Longhi and Nandi (2015) explained that if the outcome of the F-test is rejected, the FE model should be preferred above the pooled OLS model. This is because the rejection of the null hypothesis, namely, that all intercept terms are zero, indicates that the pooled model does not yield consistent results (Baum, 2006).

4.7.2 Wald test: Joint significance

The Wald test or Chi-square is used to determine the dependability of the RE model. Chipeta (2012) stated that the null hypothesis of the Wald test for joint significance is that all coefficients of the regressors are equal to zero. When the null hypothesis is rejected, the RE model produces accurate estimates for the proposed regressions (Chipeta, 2012).

4.7.3 Breusch-Pagan LM-test

The Breusch-Pagan LaGrange Multiplier (LM) test statistic which was developed in 1980 has the following three advantages: 1) it requires the lowest number of squared residuals, 2) it is easy to calculate, and 3) it is exact (Breusch & Pagan, 1980). Baltagi (2008) explained that the Breusch-Pagan LM test has a null hypothesis to determine whether the variance of the means is equal to zero ($H_0; \sigma_\mu^2 = 0$). When this null hypothesis is rejected, the RE model is preferred to the OLS model.

4.7.4 Hausman specification test

The Breusch-Pagan LM test and the F-test often yield results that indicate that either the FE or RE model is preferred above the OLS model. The Hausman test determines which model between the FE and RE model are most suitable. This is determined by comparing the estimates from the estimators against the efficient estimators and determining whether correlation is present (Hausman, 1978). Therefore, the null hypothesis assumes that the conditions set by the RE estimator are consistent (Baum,

2006). Although the Hausman test proposes the more robust model, it is possible that the FE model may still be preferred when the research has an intercept term that is correlated with explanatory variables, or when the study aims to describe time-invariant variables (Longhi & Nandi, 2015).

4.7.5 Endogeneity

The relationship between the dependent and independent variables causes empirical deficiencies when these variables are correlated. Formally, an endogenous relationship exists where the dependent variable causes the independent variable, or the independent variable causes the dependent variable, or even in some cases, the independent and dependent variables are caused by some other variable (Longhi & Nandi, 2014). Honaker and King (2010) maintained that the reduction or removal of missing data observations can reduce the endogeneity bias. For this reason, it is important to use spline regression to guarantee that there are no missing variables in the dataset.

4.7.6 Multicollinearity

Multicollinearity describes the relationship between variables, but it only determines the relationship between independent variables. When the independent variables are highly correlated with each other, these variables are said to be multicollinear (Blalock, 1963; Granger & Newbold, 1974). Testing for multicollinearity is done by either using variance inflation factors (VIF) or a correlation matrix (Chipeta, 2012). In the current study, a correlation matrix was used to determine whether variables show levels of multicollinearity.

4.7.7 Autocorrelation

Ak, Altintaş and Akpolat (2013) stated that serial correlation is tested by interpreting the Durbin-Watson (DW) statistic. However, when a regression contains a lagged dependent variable as an independent variable, the DW statistic is invalid, and an alternative, such as the Breusch-Pagan LM or the Baltagi-Wu locally best invariant (LBI) test, should be used (Calzolari & Magazzini, 2012; Drukker, 2003). Therefore, a adjusted DW is required, or alternatively, the Baltagi-Wu LBI, which is a generalisation of the DW statistic, can provide the level of autocorrelation. The interpretation of the

adjusted DW statistic is that when the statistic is close to 2, no autocorrelation is present, and that lower than 2 and above 2, respectively, indicates a positive and negative serial correlation (Calzolari & Magazzini, 2012; Cameron, 2005). It is generally accepted that no autocorrelation is present in an estimation when the adjusted DW statistic lies between 1.5 and 2.5 (De Souza & Junqueira, 2005).

4.8 PROPOSED PANEL DATA REGRESSIONS

To test the hypotheses presented in Chapter 4, seven individual regression models were constructed and are presented as Equations 4.6 – 4.12. Equation 4.6 is a regression that incorporates all the variables that potentially impact the NPL ratio. The remaining regressions include only microeconomic variables and the GFC and NCA variables, respectively, for the three different potential measures of bank profitability.

All variables regression model

$$npl_{i,t} = \alpha + \beta_1 npl_{i,t-1} + \beta_2 capad_{i,t} + \beta_3 deposits_{i,t} + \beta_4 growth_{i,t} + \beta_5 liquidity_{i,t} + \beta_6 roe_{i,t} + \beta_7 gdp_{i,t} + \beta_8 repo_{i,t} + \beta_9 rdol_{i,t} + \beta_{10} cpi_{i,t} + \beta_{11} gsales_{i,t} + \beta_{12} unemp_{i,t} + \beta_{13} gfc_{i,t} + \beta_{14} nca_{i,t} + \beta_{15} cboom_{i,t} + \varepsilon_{i,t} \quad (4.6)$$

Earnings[9] – GFC regression model

$$npl_{i,t} = \alpha + \beta_1 npl_{i,t-1} + \beta_2 capad_{i,t} + \beta_3 deposits_{i,t} + \beta_4 growth_{i,t} + \beta_5 liquidity_{i,t} + \beta_6 gsales_{i,t} + \beta_7 earnings_{i,t} + \beta_8 gfc_{i,t} + \varepsilon_{i,t} \quad (4.7)$$

Earnings – NCA regression model

$$npl_{i,t} = \alpha + \beta_1 npl_{i,t-1} + \beta_2 capad_{i,t} + \beta_3 deposits_{i,t} + \beta_4 growth_{i,t} + \beta_5 liquidity_{i,t} + \beta_6 gsales_{i,t} + \beta_7 earnings_{i,t} + \beta_8 nca_{i,t} + \varepsilon_{i,t} \quad (4.8)$$

[9] 'Earnings' refers to the variable name for interest income on loans divided by average gross loans (see Table 4.2).

ROA – GFC regression model

$$npl_{i,t} = \alpha + \beta_1 npl_{i,t-1} + \beta_2 capad_{i,t} + \beta_3 deposits_{i,t} + \beta_4 growth_{i,t} + \beta_5 liquidity_{i,t} + \beta_6 gsales_{i,t} + \beta_7 roa_{i,t} + \beta_8 gfc_{i,t} + \varepsilon_{i,t} \quad (4.9)$$

ROA – NCA regression model

$$npl_{i,t} = \alpha + \beta_1 npl_{i,t-1} + \beta_2 capad_{i,t} + \beta_3 deposits_{i,t} + \beta_4 growth_{i,t} + \beta_5 liquidity_{i,t} + \beta_6 gsales_{i,t} + \beta_7 roa_{i,t} + \beta_8 nca_{i,t} + \varepsilon_{i,t} \quad (4.10)$$

ROE – GFC regression model

$$npl_{i,t} = \alpha + \beta_1 npl_{i,t-1} + \beta_2 capad_{i,t} + \beta_3 deposits_{i,t} + \beta_4 growth_{i,t} + \beta_5 liquidity_{i,t} + \beta_6 gsales_{i,t} + \beta_7 roe_{i,t} + \beta_8 gfc_{i,t} + \varepsilon_{i,t} \quad (4.11)$$

ROE – NCA regression model

$$npl_{i,t} = \alpha + \beta_1 npl_{i,t-1} + \beta_2 capad_{i,t} + \beta_3 deposits_{i,t} + \beta_4 growth_{i,t} + \beta_5 liquidity_{i,t} + \beta_6 gsales_{i,t} + \beta_7 roe_{i,t} + \beta_8 nca_{i,t} + \varepsilon_{i,t} \quad (4.12)$$

For all regressions, $i = 1 \ldots N$ and $t = 1 \ldots T$ where N is the number of banks while T is the number of observations per bank. Each of the regressions serves a unique role in testing the five hypotheses. These results inform on macroeconomic and microeconomic influences, as well as structural breaks within the economy that may impact NPLs.

The results are interpreted within the realm of ethical data collection, analysis and reporting.

4.9 ETHICAL CONSIDERATIONS

Research is subject to specific ethical guidelines. Ethics has various dimensions, and researchers often transgress some of the ethical principles, whether inadvertently or not. Ethical principles are often transgressed from a data collection perspective or an

authorship perspective. From an authorship perspective, authors should fully accredit the work of other authors referenced in their research, as the possibility of plagiarism exists (Coats, 2009; Eriksson & Kovalainen, 2008; Israel & Hay, 2006). Ethical transgressions from a data collection perspective generally refers to the issues of confidentiality, consent, privacy, deception and potential harm (Diener & Crandall, 1978; Israel & Hay, 2006; Pimple, 2002; Walliman, 2006). However, as this study made use of secondary data, transgression from a data collection perspective is improbable. Although only secondary data was used, this study still acknowledges that data was dealt with ethically. The data was collected accurately and it was not manipulated to the extent that the reader could be misinformed or the study could yield inaccurate results.

Ethical clearance was obtained from the College of Economic and Management Sciences (CEMS). This study is bound by the ethical guidelines proposed by the University of South Africa's (Unisa) policy on research ethics (Unisa, 2016). The clearance was issued based on the researcher's undertaking to uphold ethics in data collection and authorship (Unisa, 2016). The ethical clearance certificate is attached (Appendix A).

The researcher did not intentionally infringe on any copyright or plagiarise the work of other researchers. Secondary data or the work of others was not misinterpreted or manipulated in any form to unduly benefit this study. All information was presented accurately according to the referenced literature.

4.10 SUMMARY

This chapter provided information on the research design and empirical methodology followed in the study. Although this chapter provided comprehensive details, there are four aspects of this chapter that must be highlighted. First and foremost, the research design: the research design is a typical empirical design, presenting information on how the phenomenon is explored, investigated and explained. Secondly, the data section explains where data was obtained from, for which period it was obtained and how missing data was dealt with. Thirdly, the panel data model specifications are of importance as it informs readers which regression models were used for the model estimations. Lastly, the seven regression models that would be estimated were

presented. These models lay the foundation for the following chapter, the bank asset quality variable descriptions.

CHAPTER 5: BANK ASSET QUALITY VARIABLE DESCRIPTIONS

5.1 INTRODUCTION

This methodology presents a structured approach to achieving the research objectives. The previous chapter on the research design explained how the research was conducted utilising the available resources. These resources were identified as the data and the method of analysis that were required in this study.

This chapter provides information on the variables that were analysed. In addition to providing a theoretical overview of each of the variables that were considered to be determinants of NPLs, this chapter also predicts whether the determinant would positively or negatively impact NPLs.

The chapter commences with an explanation of the types of data that were obtained from the various sources that provided information on the determinants of bank asset quality, as discussed in Section 5.2. Sections 5.3 and 5.4 deal with the variables that were divided into two groups, namely, the dependent variable and the independent variables, respectively. The chapter concludes with a summary of the expected signs for each variable in Section 5.5 and a summary of the chapter in Section 5.6.

5.2 DATA REPRESENTING DETERMINANTS OF BANK ASSET QUALITY

A thorough explanation has previously been provided on how data was obtained, how missing data points were filled and how the data analysis was conducted (see Section 4.3). Ongore and Kusa (2013) found that there is no consistency in identifying the financial ratios used to study NPLs. Table 5.1 provides information on the description of the data obtained from the data sources.

Table 5.1: Variables obtained from secondary sources

NPL ratio	Gross domestic product
Capital adequacy ratio	Unemployment rate
Loans profitability	Inflation
Return on assets	Interest rate
Return on equity	Yearly rand-dollar exchange rate
Credit growth	Gold sales
Deposits	Liquidity

Sources: African Bank Investment Limited (2004, 2005, 2006, 2007, 2015), Albaraka Bank (2007, 2009, 2011, 2013, 2015), Absa Group (2005), Bidvest Group Limited (2006), Capitec Bank (2004, 2005), HBZ Bank Limited (2007, 2009), IDFC (2006, 2007, 2009, 2012, 2015), Mercantile Bank (2005, 2007), Sasfin Bank (2006, 2012); StatsSA (2017).

There are three variables in the econometric model that were not obtained from any database but were derived from literature. Love and Ariss (2014) stated that loan quality is often described by variables other than macroeconomic and microeconomic variables. In this study, categorical variables explain changes or shocks to the economic environment. The categorical variables are:

- The Global Financial Crisis (GFC);
- The National Credit Act (NCA); and
- The commodity boom cycle.

Each one of the listed variables obtained from the data collection process have been discussed in previous sections of the thesis and will be further elaborated on in the following sections. The description of the variables formed the motivation for the use of the specific variable, and information was provided on the expected impact that the variable would have on the dependent variable, NPLs.

5.3 DEPENDENT VARIABLE

Linear regression studies determined the causation between two or more variables, where the dependent variable is explained by different independent variables (Asteriou & Hall, 2015). The independent variables may explain variations of the dependent

variable, and in this study the aim is to explain which variables impacted the NPLs of banks.

5.3.1 Non-performing loan ratio

Some empirical studies adopted the classifications used by Adebola *et al.* (2011), Alhassan *et al*. (2014) and Ezeoha (2011), namely, the ratio of substandard (SSL), doubtful loans (DL) and loss loans (LL) to gross loans and advances (GLA), which constituted NPLs as proxies for the asset quality of banks. The SSL represents loan assets for which the principal and interest remaining have been outstanding for 90 days, but less than 180 days. The DL are loan assets for which the principal and interest have been outstanding for 180 days, but less than 360 days. The LL are loans for which the principal and interest have been outstanding for more than 360 days. A higher NPL ratio indicates lower bank asset quality.

Thus the asset quality (ASQ) for bank i at time t is by:

$$ASQ_{i,t} = \frac{(SSL_{i,t} + DL_{i,t} + LL_{i,t})}{GLA_{i,t}} \quad (5.1)$$

Source: Alhassan *et al*. (2014)

The NPL ratio is an important indicator of bank strength, asset quality, credit risk, financial stability and potential financial crisis (Bholat *et al*., 2016; Cummings & Durrani, 2016; Ghosh, 2015; Joo, 2014; Mohi-ud-Din & Nazir, 2010). As the importance of this indicator has been widely acknowledged, it is important to understand which determinants impact the dependent variable, the NPL ratio.

The NPL ratio is often a measure of the credit risk of a bank (Cummings & Durrani, 2016). According to Joo (2014), this measure has to be evaluated regularly, as credit risk may lead to financial crisis. The NPL ratio contains significant credit risk information, and CRAs often use the NPL ratio as a proxy in the assessment of the bank credit risk, while central banks use the ratio in determining policy decisions (Bholat *et al*., 2016).

Central banks use NPL ratios in setting monetary policy; this is evident since Ghosh (2015) reported that loan quality has an impact on the financial stability and market confidence. Although bank asset quality may have a macroeconomic impact, the microeconomic impact should not be discounted. According to Mohi-ud-Din and Nazir

(2010), the NPL ratio is an indicator of bank health and performance. A high NPL ratio slowly depletes capital and reduces the income of a bank (Joo, 2014). Zhang, Cai, Dickinson and Kutan (2016) recommended that the NPL ratio of a bank should not exceed 5% at any time, and they further recommended that banks had to attempt reporting an NPL ratio of less than 4% to reduce adverse economic conditions.

Although NPLs have caveats, it is still widely used by researchers (Alhassan *et al*., 2014; Buncic & Melecky, 2013; Salas & Saurina, 2002) to evaluate bank asset quality. Because the asset quality of a bank is sensitive to a number of influencing factors, the determinants that are included in the regression models are explained, and a conclusion is drawn on the impact that these determinants have on the NPL ratio of South African banks.

5.4 INDEPENDENT VARIABLES

Asteriou and Hall (2015) explained that independent variables are used to predict the value of the dependent variable. If the independent variables do not explain the dependent variable, the error term will contain the effect that the unmeasured variables have on the dependent variable (Asteriou & Hall, 2015).

Macroeconomic, microeconomic and categorical variables were identified to determine whether they have a significant impact on the bank asset quality. Sections 5.4.1 to 5.4.8 discuss the microeconomic or bank-specific variables, with Sections 5.4.9 to 5.4.14 addressing the macroeconomic variables, and Sections 5.4.15 to 5.4.17 explaining the use of the categorical (dummy) variables.

5.4.1 Lagged non-performing loan (NPL_{t-1}) ratio

Past studies (Buncic & Melecky, 2013; Jakubík & Reininger, 2013; Nkusu, 2011; Salas & Saurina, 2002) included the use of a lagged NPL variable as an independent variable. According to Espinoza and Prasad (2010), a shock to the NPLs will not immediately impact the bank asset quality, but the asset quality is more likely to deteriorate over time and for an extended period. Salas and Saurina (2002) motivated the use of lagged NPLs by reporting that the loss loans are not written off immediately, and that these loss loans remain on the balance sheet for some years. Recent studies

also found a degree of persistence in the NPL ratio of a bank, especially during times of crisis (Buncic & Melecky, 2013; Jakubík & Reininger, 2013).

The NPL ratio lagged for one period was included as an explanatory variable in this study. Past research (Buncic & Melecky, 2013; Espinoza & Prasad, 2010; Jakubík & Reininger, 2013) found that the lagged NPL variable has a negative and significant impact on bank asset quality. In this study, it was also assumed that the lagged NPL variable has a negative impact on NPLs.

5.4.2 Capital adequacy ratio

Shrieves and Dahl (1992) reported that the capital adequacy ratio changed along with the banking environment, and banks continuously have to respond to these changes to ensure optimal exposure according to their risk appetite. Bholat *et al*. (2016) concluded that the BCBS attempted to harmonise the definition and the prescribed minimum requirements from a capital adequacy perspective. López (2016) stated that the Basel requirements impact the risk perception of a bank.

The impact that the capital adequacy requirements have on the banking sector is still being debated. Admati, DeMarzo, Hellwig and Pfleiderer (2013) stated that capital requirements cannot force changes in the banks' deposits or lending activities. Gale (2015) argued that capital requirements increase the cost of funds which consequently leads to increased interest rates. However, capital requirements do have a confirmed benefit, as increased capital requirements lead to a strengthened NPL ratio (López, 2016). Scholars are in agreement that poor asset quality negatively impacts the credit quality. Hence banks have to maintain their regulatory capital requirement (Joo, 2014).

Makri *et al*. (2014) had difficulty in determining whether capital requirements have a positive or negative impact on asset quality. Makri *et al*. (2014) explained that low capital adequacy ratios increase the NPL ratio, while a high capital adequacy ratio indicates that a bank is involved in riskier activities which also increases the NPL ratio. Zhang *et al*. (2016) were of the opinion that the capital requirement set by the BCBS can lead to a moral hazard dilemma for bank managers, and concluded that capital requirements might not have the desired effect in reducing risk-taking behaviour. It seems that the impact of the capital requirement on NPLs cannot be conclusively

determined as having a positive or negative impact on NPLs. This study assumes that the relationship between capital adequacy and NPLs are inconclusive.

5.4.3 Return on assets (ROA)

Return on assets (ROA) is often used as a proxy for the profitability of a bank when studying the impact of profitability on NPLs (Messai & Jouini, 2013; Wu & Bowe, 2012). The ROA is calculated by dividing the annual earnings by the average annual total assets, and it indicates how well assets are used to generate income (Lin, Horng & Chou, 2016; Wu & Bowe, 2012). In studies where diversification of assets was considered, the ROA was included as a measure, because it comprises of all assets, non-interest income, and interest income on loans, and provides information on asset diversification (Hamdi, Hakimi & Zaghdoudi, 2017).

Although Messai and Jouini (2013) reported a significant and negative relationship between ROA and NPLs, Jakubík and Reininger (2013) reported that ROA proves to be insignificant in its relationship with NPLs. Ghosh (2015) concluded that highly profitable banks do not have an incentive to engage in affording risky loans and that therefore, the ROA has a negative relationship with NPLs. This argument seems to be non-monotonic and may require further deliberation.

The question remains, is the ROA the most suitable measure of loan profitability? The ROA is reported to be insignificant in its relationship with NPLs, but it has a negative relationship with NPLs (Jakubík & Reininger, 2013; Messai & Jouini, 2013). However, Ghosh (2015) found the relationship between ROA and NPLs to be significant. This study assumes a negative relationship, similar to the findings from previous research.

5.4.4 Return on equity (ROE)

Both Louzis *et al*. (2012) and Makri *et al*. (2014) included ROE as a proxy for bank management behaviour. ROE is reported to determine whether management decides on only awarding loans to customers with a lower level of risk. It is expected that ROE has a negative relationship with asset quality. The ROE is also an indication of growth, and is often used by investors to determine whether a company is suitable for investment. The ROE is calculated as the net income of a company that is returned to shareholders (Chiang & Yu, 2018).

The assumption is that investors prefer a company that shows consistent growth. The correlation between credit growth and ROE is evaluated to report on whether the relationship between ROE and credit growth indicates that management behaviour is driving ROE growth, or rather to determine whether ROE growth is due to stronger earnings from all banking activities. This study expected that a high ROE will reduce the risk-taking behaviour of bank managers, and ROE would subsequently have a negative relationship with NPLs.

5.4.5 Credit growth

The importance of the growth of gross loans is well established as a determinant of bank asset quality, because loans are the primary asset and income generator of a bank (Ongore & Kusa, 2013). However, Joo (2014) warned that a sudden increase in the growth of loans can compromise the asset quality of the bank at a later stage. Ghosh (2015) explained this phenomenon by stating that banks may reduce the interest rates they charge on loans and relax their credit standards to attract borrowers. Shocks to the financial system can also interfere with the relationship between asset quality and credit growth. During the GFC, liquidity reductions consequently caused slower credit growth and increased NPLs (Škarica, 2014).

Credit growth is sensitive to changes in the economic environment. This is deduced from the relationship between credit growth and asset quality. De Bock and Demyanets (2012), as well as Nkusu (2011), found a negative relationship between bank asset quality and credit growth, while Jakubík and Reininger (2013) and Joo (2014) reported a positive relationship, but only after lagging the credit growth variable. Espinoza and Prasad (2010), as well as Klein (2013), also lagged the credit growth variable, but concluded that the significance and impact were negligible.

As a result of the inconclusive relationship between credit growth and asset quality, the explanatory variable was included in the econometric model. This variable is assumed to have a positive relationship when no lags are introduced. However, this study is in agreement with the explanation by Ghosh (2015) that the increases in credit growth will lead to poor asset quality.

5.4.6 Liquidity

The ratio between loans to customer deposits is considered an effective measure of bank liquidity (Ongore & Kusa, 2013). This ratio is interpreted as a healthy ratio when it is lower, while a higher liquidity ratio indicates that banks have too much liquidity tied up in extended credit (Bunda & Desquilbet, 2008). Bank liquidity is associated with a growth rate in deposits that can be used to service deposit withdrawals (Wu & Bowe, 2012). Makri *et al*. (2014) explained that an increase in deposits enables banks to grant additional loans to borrowers, or it may alternatively be used to determine what ratio of deposits are converted into income-generating loans. Although an increased loan-to-deposit ratio creates a risk-taking loan cycle, Louzis *et al*. (2012) found that it is only the case when the banking environment is poorly regulated.

The significance of the potential relationship between liquidity and asset quality seems to be relevant, but unfortunately, it does not have a significant impact on NPLs (Louzis *et al*., 2012; Makri *et al*., 2014; Trujillo-Ponce, 2013). Although the relationship is insignificant, an expectation was formed to investigate whether there is a positive relationship between asset quality and liquidity. This study assumed that there is a positive relationship between liquidity and asset quality, because additional deposits enable banks to generate additional loans that could subsequently cause increases in NPLs.

5.4.7 Deposits

Deposits are used for maturity transformation. Thus, deposit growth leads to growth in the loans of a bank, *ceteris paribus* (Cucinelli, 2015; Geletta, 2012). Warue (2013) further explained that only a certain percentage of the deposit funds is used to grant loans. However, Festić, Kavkler and Repina (2011) warned that the additional deposits do not entitle a bank to make reckless credit extensions, stating that increased deposits lead to increases in NPLs. Borrowers who do not perform according to the loan agreement will result in a loss of interest income for the bank, and this will result in increased NPLs (Filip, 2015).

Makri *et al*. (2014) studied the impact of deposits on NPLs and concluded that the deposits do have a negative impact on NPLs, albeit insignificant. In this study, the deposits were expected to have a negative impact on NPLs, thus an expected

negative sign for the coefficient. Ezeoha (2011) provided an appealing view that the proper management of financial intermediation (changing deposits into loans) has the ability to alleviate the negative impact that the increased lending can have on NPLs. However, the management of deposits was not measured, and thus this study assumes that an increase in deposits can cause an increase in loans that would potentially increase NPLs. Also, that the deterioration in asset quality can result in depositors that withdraw their funds from a bank (Gruben, Koo & Moore, 1999).

5.4.8 Interest income on loans (earnings)

Throughout this study, it has been reported that the primary asset and largest portion of the income generated by a bank is derived from interest on loans (Ongore & Kusa, 2013). Ifeacho and Ngalawa (2014) stated that this measurement of bank profitability is superior amongst the profitability measures. The interest income on loans is the income that is generated by participating in the conventional commercial and retail banking activities (Tsumake, 2016).

The interest income on loans is an indicator of NPLs and it has a negative impact on NPLs, because higher interest income is a result of additional interest charges which ultimately cause NPLs (Filip, 2015; Islam & Nishiyama, 2016). Abedifar, Molyneux and Tarazi (2018) explained that this is not always the case, as banks charge different interest rates depending on their business model and size, since it is possible for some banks to use their non-interest income to subsidise their interest income. However, although interest income is considered a driver for engaging in risky lending activities, past studies (Ghosh, 2015; Messai & Jouini, 2013) found that the more profitable the bank, the less likely it is that the bank would engage in risky lending practices.

This study assumed that the earnings would show a positive relationship between the interest income on loans and the NPLs. This is because the South African banks are profit-making entities (Khumalo, 2017), assuming the motivation that profitable banks do not engage in risky lending activities is accurate.

5.4.9 Gross domestic product (GDP)

Before the GFC, Salas and Saurina (2002) stated that GDP growth and asset quality have a negative relationship. Researchers (Klein, 2013; Nkusu, 2011) continued to study this relationship after the GFC and reached a similar conclusion that there is a

negative relationship between GDP growth and asset quality. Irrespective of the economic conditions, the relationship between NPLs and the GDP remain countercyclical. This countercyclical relationship exists because during economic expansion periods households easily service their debts (Salas & Saurina, 2002). While economic downturns result in increased indebtedness reducing the ability of households to service debts, and asset quality, in turn, deteriorates (Cummings & Durrani, 2016).

Although the motivation for a countercyclical relationship between GDP growth and asset quality has been widely accepted, Laeven and Majnoni (2003) argued that GDP growth might react differently across borders. Nkusu (2011) reported that NPLs in EMEs were subdued during the GFC and that asset quality reinforced business cycles. In this study, GDP growth was expected to take on a negative sign, as suggested by past studies (Ghosh, 2015; Klein, 2013; Škarica, 2014). It is sensible to assume that borrowers service their debt with ease during economic expansion periods, while indebtedness reduces this ability during an economic turndown, especially during a period of economic turmoil such as the GFC.

5.4.10 Unemployment rate

Macroeconomic variables have close relationships with each other. Messai and Jouini (2013) concluded that the GDP growth and the unemployment rate are closely related to the ability of deficit financial units to service their debt. Nkusu (2011) concurred, explaining that slow growth and a higher rate of unemployment are associated with weak asset quality. Louzis *et al*. (2012) stated that the unemployment rate is, in fact, a leading indicator of NPLs.

Unemployment increases the debt burden for both households and enterprises. Households cannot service debt as no income is being received from an employer, while enterprises cannot service their debt because of a reduction in demand (Louzis *et al*., 2012; Messai & Jouini, 2013). Ghosh (2015) interpreted unemployment, GDP growth and personal income as a collective and explained that unemployment decreases personal income, which reduces spending, impacting on GDP growth, thereby causing a downturn in bank asset quality.

The majority of researchers (Ghosh, 2015; Louzis *et al*., 2012; Messai & Jouini, 2013; Nkusu, 2011; Škarica, 2014) explained that unemployment has a negative influence on NPLs. This study accepted the motivation for this relationship and expected that the sign in the econometric model would be positive.

5.4.11 Inflation

The Phillips curve that was developed in 1958, illustrates the inverse relationship between unemployment and the inflation rate (Phillips, 1958). Although the relationship between inflation and unemployment has been established, Ghosh (2015) averred that there is an ambiguous relationship between the inflation rate and asset quality. This is further illustrated by Škarica (2014) who assumed that inflation has a negative relationship with asset quality, while Nkusu (2011) reported a positive relationship between the NPLs and inflation variables.

The ambiguity is a result of inflation that is subject to the monetary policy tools used to combat inflation. Both Ghosh (2015) and Škarica (2014) explained that inflation theoretically enables a borrower to service debt due to the impact of inflation reducing the real value of the debt. The reality is, however, that increased interest rates reduce the negative impact that inflation has on the economy, and in turn, the increase in interest rates reduces the real income of a borrower, while the income remains unchanged as wages are often sticky (Ghosh, 2015).

Although academic debates are set to continue regarding this topic, this study assumed that the sign for inflation is positive. Similar to the banks that Škarica (2014) researched, the SARB also has an objective to maintain price stability, and therefore this study assumed that inflation causes the SARB to increase interest rates thereby incidentally causing an increase in NPLs.

5.4.12 Interest rate

In South Africa, the SARB makes use of an inflation-targeting policy to maintain price stability in the country (*cf.* Škarica, 2014). The SARB therefore enters into open market operations to adjust the repurchase rate to maintain the target inflation rate (Van Zyl *et al*., 2006). When the interest rate increases, borrowers have to pay more to service their debt, while lower interest rates make debt inexpensive (Ghosh, 2015). The relationship between NPLs and interest rates is positive, because as interest rates

increase, the NPLs also increase (Messai & Jouini, 2013). Louzis *et al*. (2012) reported that interest rates are also dependent on the risk profile of clients, as banks charge higher interest rates for clients that are presumed to be high-risk clients. Mullineux (2006) commended this approach as depositor funds are used to generate loans, and depositors prefer a safe haven for their funds.

Past research (Espinoza & Prasad, 2010; Ghosh, 2015; Louzis *et al*., 2012; Messai & Jouini, 2013; Nkusu, 2011) all reported that interest rates have a positive relationship with NPLs. In this study, a positive relationship was also assumed because the SARB enters into open market operations to adjust the repo rate, thereby maintaining price stability.

5.4.13 Yearly rand-dollar exchange rate

The exchange rate is also impacted by changes in the macroeconomic environment, as deteriorating GDP growth is also associated with a deteriorating exchange rate (De Bock & Demyanets, 2012). The impact that the foreign exchange rate has on NPLs should not be discounted, as borrowers often enter into transactions denominated in a foreign currency (Škarica, 2014). This foreign currency denominated debt negatively impacts the NPLs when the local currency deteriorates, as borrowers have to pay more to service debts, thereby lowering the funds available (Jakubík & Reininger, 2013; Škarica, 2014).

Although a negative relationship with NPLs seems to be justified, Buncic and Melecky (2013) explained that the deterioration in the exchange rate has two potential outcomes, as explained by the Myburgh Commission (2002) and Fofack (2005). The Myburgh Commission (2002) supported these outcomes, stating that the deterioration in the foreign exchange rate has a positive income effect for lenders who issued foreign-denominated debt, but it has a deteriorating effect on the balance sheet when the balance sheet is smaller in dollar-denominated terms and the capital requirement has increased. Fofack (2005) stated the mixed effect is a result of weakened exporting competitiveness and the adverse effect of servicing foreign-denominated debt. Jakubík and Reininger (2013) concluded that the exchange rate and NPLs have a negative relationship. However, Škarica (2014) and Nkusu (2011) found no significant relationship between the exchange rate and the NPLs at all.

Jakubík and Reininger (2013), however, acknowledged that the results are misleading, as only partially available data on a disaggregated level was compared to study this impact. Future research is suggested to make use of aggregated NPL ratios as this will allow for more reliable results. In this research, the nominal effective exchange rate between the South African rand (ZAR) and USA dollar (USD) was used to measure the impact on the aggregated bank NPLs. Because inflation was included as a variable, the exchange rate did not have to be adjusted to nominal terms (*cf*. Nkusu, 2011). The USD/ZAR exchange rate was used, because commodities (metals, precious metals and agricultural) are denominated in dollar terms. The relationship between the exchange rate and NPLs was assumed to be undetermined.

Figure 5.1: ZAR/USD exchange rate

Source: Bloomberg (2017)

Figure 5.1 illustrates the dollar-rand exchange rate from 2004 to 2015. This graph depicts a deteriorating rand against the dollar during for this period. The impact that this change in the exchange rate has on NPLs is presented in section 6.3.1.2.

5.4.14 Yearly gold sales

Banks that have significant exposure to the commodities produced in the country may experience an increase in NPLs as a result of shocks to the commodity price (Fofack, 2005). Kittikulsingh (1999) was of the opinion that any movements in commodity prices greater than 10% per month point towards an economic disaster. However, banks in countries that have well-maintained macro-prudential regulations have a less adverse reaction to commodity price shocks (Kinda, Mlachila & Ouedraogo, 2016).

Senawi and Isa (2014) assumed that increasing gold prices cause increased NPLs. However, Senawi and Isa (2014) found a negative relationship between NPLs and the gold price. Senawi and Isa (2014) interpreted this to mean that there is no meaningful relationship between NPLs and the gold price, because the gold price, according to them, is at most only a substitute for the exchange rate. Although Senawi and Isa (2014) found that the gold price only acts as a substitute for the exchange rate, their study only included Malaysian Islamic banks for the period 2007 to 2009. Malaysia produced approximately 4.73 tonnes of gold in 2015 (The Star Online, 2017), while during the same time, South Africa was expected to produce approximately 140 tonnes of gold, and has subsequently been identified as the 7th largest gold producer (Dick & Naidoo, 2016).

In this study, the relationship between gold sales and NPLs was assumed to be negative, indicating that a rise in gold price reduces NPLs, as institutional borrowers are able to service their debts due to the increased income from gold sales. According to StatsSA (2017), the mining sector in South Africa contributed 8% to the annual GDP in 2016, an indication that mining institutions contribute to the economy and are active participants in the economic environment. An additional motivation for including gold sales as a determinant of asset quality was because increased commodity prices cause an increase in the operational costs of banks that can potentially result in banks entering into questionable lending agreements (Damankah, Anku-Tsede & Amankwaa, 2014).

5.4.15 Global financial crisis (GFC)

Poor bank asset quality negatively impacts the entire economy, and not only the banks (Ghosh, 2015). Zhang *et al*. (2016) maintained that, irrespective of regulatory

requirements, banks do take risks that impair their financial position. The GFC is an excellent example of how, even though the relevant financial regulations were in place, additional requirements had to be set to reduce the banks' risk-taking activities even further.

During the GFC, financial market liquidity deteriorated reducing the available funds in the financial system (Škarica, 2014). An increase in NPLs is generally associated with the onset of adverse economic conditions, especially in developed economies, while a reduced impact is felt in EMEs (Nkusu, 2011). Gualandri and Noera (2014) were of the opinion that NPLs are not good indicators of a crisis, because NPLs do not infer that a crisis is imminent. Past studies (Joo, 2014; Karim *et al*., 2010) found this to be true, but only after the fact that banks in the countries that were studied, namely, Malaysia, Singapore and India, reclassified their definition of an NPL, resulting in limited losses during the GFC.

This research expected that the GFC had a positive relationship with NPLs, as South Africa is considered to be an EME. South Africa has the advantage that the Department of Trade and Industry had just introduced the NCA to limit reckless lending by financial institutions. Therefore, the NCA might have reduced the potential impact of the GFC.

5.4.16 National Credit Act (NCA)

Ghosh (2015) concluded that NPLs are a recurring item on any bank's balance sheet, and that regulatory reforms are necessary to avoid the adverse impact of increased levels of NPLs on the economy. Ghosh (2015) found that bank managers have the incentive to make use of lax credit standards to inflate earnings, even though it might be at the expense of future increases in NPLs. However, the NCA attempts to reduce the availability of funds to borrowers who would potentially not have the means to service their debts, as financial institutions have been accused of reckless lending practices (RSA, 2006).

According to Chilukuri *et al*. (2016), regulatory reforms enhance the asset quality of banks when the bank managers implement the reforms. Enhanced credit standards and regulations reduce the supply of loans to borrowers who do not show sufficient ability to repay the borrowed funds (*cf*. Ghosh, 2015). Klomp and De Haan (2014)

agreed that regulation reduces risks, but stated it is only true for developed economies, as EMEs often face high levels of corruption, lawlessness and reduced obligations of contract enforcement.

In the South African context, this dummy variable explains the impact of the NCA on NPLs. Similar to research conducted by Klomp and De Haan (2014), as well as Salas and Saurina (2002), a positive impact on NPLs was expected. The assumed sign is negative, as improved regulation reduces risky bank lending activities, albeit by only a fraction, if the assumption by Klomp and De Haan (2014) is correct regarding the regulatory enforcement in EMEs.

5.4.17 Commodity boom cycle

In separate sections of this study (see Sections 3.2.2 and 5.5.12) it is stated that South Africa has been considered as one of the top 10 gold producers for some years (Baxter, 2009; Dick & Naidoo, 2016; Williams, 2015). Commodities, especially gold, did not respond negatively to the GFC, and unexpectedly in 2010, it outperformed its previous highest recorded prices which was attained in 2008 during the GFC (Helbling, 2012). Baxter (2009) posited that South Africa might not enjoy the full effects of the commodity boom period. Moreover, Kittikulsingh (1999) warned that unexpected boom cycles are often followed by adverse economic effects that could reduce bank asset quality.

This study assumed a negative relationship between NPLs and the price of gold (see Section 5.5.12). As the research includes the commodity boom period, it was assumed that the increased price of gold during the boom period would improve the bank asset quality. As previously stated, Baxter (2009) held that South Africa would not enjoy the full benefits of the commodity boom. Thus, the boom cycle was expected to have just a small coefficient in the explanation of NPLs during the boom period. According to Dempster (2010), gold was the asset of last resort during the GFC. Subsequently this could provide a larger coefficient for the explanatory categorical variable.

5.5 SUMMARY OF EXPECTED VARIABLE SIGNS

Table 5.2 provides a summary of all the variables discussed in this chapter with their expected sign. This sign indicates whether the relationship will be positive, negative or undetermined related to the NPL ratio of a bank.

Table 5.2: Expected sign of independent variables

Independent variable	Expected sign
NPL_{t-1} ratio	**–**
Capital adequacy ratio	**+ or –**
Loans profitability	**–**
Deposits	**+**
Interest income on loans (earnings)	**+**
Return on assets	**–**
Return on equity	**–**
Credit growth	**+**
Liquidity	**+**
Gross domestic product	**–**
Unemployment rate	**+**
Inflation	**+**
Interest rate	**+**
Yearly rand-dollar exchange rate	**+ or –**
Gold sales	**–**
Global financial crisis (GFC)	**+**
Changes in credit standards	**–**
Commodity boom cycle	**–**

Source: Own composition (2017)

5.6 SUMMARY

The variable description explains that the dependent variable, the NPL ratio, is expressed as an aggregate of SSL, DL and LL divided by the gross loans and advances. Considering the disaggregate forms of problem loans that are included in

the NPL ratio, it is clear why the NPL has a lingering impact as a determinant of bank asset quality. With the exception of the capital adequacy ratio and the exchange rate variables, all the variables are associated with a definitive direction that it will have on NPL. The signs are inconclusive for the capital adequacy ratio, because a high capital adequacy ratio is associated with risk-taking activities, while a lower capital adequacy ratio is associated with a poorly capitalised bank which deteriorates bank asset quality. The exchange rate is also problematic, because the exchange rate causes debtors to easily service foreign debt when the exchange rate strengthens, while a strong exchange rate also indicates that one would pay more for products and services denominated in a foreign currency. However, the estimations in the following chapter provide complete information on the effects of these independent variables on bank asset quality.

CHAPTER 6: EMPIRICAL RESULTS

6.1 INTRODUCTION

The preceding chapters provided the foundations for the results about the determinants of NPLs of South African banks. The foundations were laid by introducing the relevant literature related to banking, providing a methodology on econometric models, and an explanation of all the variables that have been identified as possible determinants of NPLs.

This chapter discusses the results of the empirical tests associated with the study on the determinants of NPLs. These results inform the research objectives of this study. The results were obtained by following the methodological approach as described in Chapter 4.

This chapter includes the three key contributions to this study. Firstly, the data is presented descriptively, providing a visual representation, along with the central tendency and dispersion statistics, and the correlation matrix of the variables in Section 6.2. This is followed in Section 6.3 by the results from the seven regression models. A further discussion follows of the results of the five specific hypotheses. Finally, the chapter is concluded in Section 6.4 with a summary.

6.2 DESCRIPTIVE PANEL DATA EXPLORATION

Panel data exploration was conducted in the form of a visual and numerical presentation of the collected bank data. The visual presentation provided an overview of the collected data in the form of a histogram. The numerical presentations provided the results in table format.

6.2.1 Visual presentation of data

This study was conducted on a panel of 13 banks and spanned a period of 12 years. Visual representations of panel data are generally illogical due to the difficulty experienced in producing an easily understandable visual presentation of the data. However, it is important that the NPL ratios for the banks are visually presented. This visual presentation allows for an overview for the banks with the highest NPL ratios.

The visual presentation is in the form of a histogram shown in Figure 6.1. The x-axis is used to present each one of the thirteen banks for the twelve-year period, while the y-axis presents the NPL ratio from a scale of 0% up to 40%. This scale has intervals of 5% and ends at 40% because the highest recorded NPL ratio is at 36.6% for the twelve-year period under investigation.

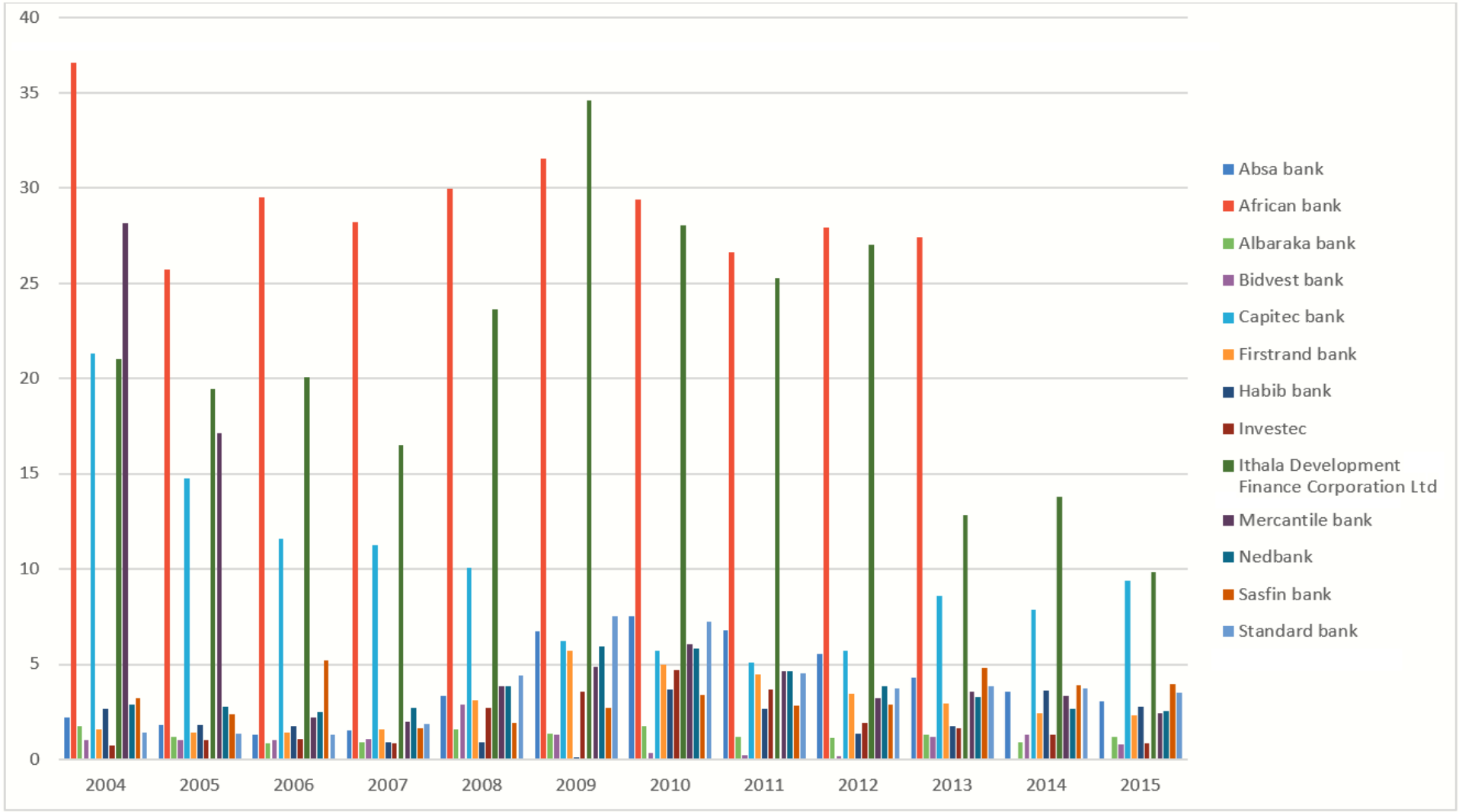

Figure 6.1: NPL ratios for South African banks

Source: Compiled from data in Microsoft Excel 2013 (2017)

Figure 6.1 shows how the NPL ratio was inordinately high for some banks over the period of this study. African Bank, Capitec Bank, the IDFC and Mercantile Bank had the highest NPL ratios for the entire period under investigation. Although the NPL ratios for these banks were the highest for this period, all four of these banks drastically reduced their NPL ratios over this period. During 2004, the NPL ratios for these four banks ranged from 9.98% (IDFC) up to 36.6% (African Bank). In 2015, the NPL ratios for these four banks were all below 10%. The IFDC managed their NPL ratio and reported a NPL ratio of 9.84%, while Mercantile Bank reported an NPL ratio of 2.41%, a drastic reduction from the 28.14% in 2004. Although African Bank reduced their NPLs and increased their market share from R660 million in 2003, up to R1.6 billion in 2008, they were placed under curatorship in 2014 (Giamporcaro, 2018; Sanderson, Maré & De Jongh, 2017). Giamporcaro (2018) explained that African Banks's failure was due to corporate governance failure, underlining the importance of understanding the governance structure, even when the financial results suggest a thriving entity.

In 2015, the final year reported in this study, the histogram shows that none of the banks reported an NPL ratio of above 10%. The progress made by Capitec Bank and Mercantile Bank in reducing their NPL ratios are noteworthy. Capitec Bank reduced their NPL ratio each year, even during and after the GFC, and only showed an increase in their NPL ratio from 2013 up to 2015. Mercantile Bank reduced their NPL ratio by 23% from 2004 to 2006. However, Mercantile Bank did not escape the impact of the GFC, as their NPL ratio increased to above 4.5% for the period 2009 to 2011, with their highest reported NPL ratio of 6.04% in 2010.

Figure 6.1 illustrates the increased NPL ratios for the banks in the aftermath of the GFC. For 2009 and 2010, the majority of the banks (Absa Bank, African Bank, Firstrand Bank, Investec, IFDC, Mercantile Bank, Sasfin Bank, Standard Bank) showed increased NPL ratios. NPLs are persistent, and as explained by Espinoza and Prasad (2010), the impact of NPL is often only seen after a period. This is evident from the histogram in Figure 6.1.

This visual representation allows for an interesting perspective on the NPL ratios of the banks in the study. However, the primary focus of this research is the empirical analysis of the determinants of South African bank asset quality. The next section provides the measures of central tendency and dispersion for the identified potential determinants of NPLs in South African banks.

6.2.2 Descriptive statistics

The descriptive statistics that are presented in numerical form are divided into two parts. The first part of the descriptive statistics reviews the statistics of central tendency and dispersion, while the second part provides information on the correlation of the identified independent and dependent variables.

The measures of central tendency and dispersion that were considered were the mean, standard deviation, and minimum and maximum for the data panel consisting of 156 observations, where the observations comprised of 13 banks for a period of 12 years. The results are presented in Table 6.1 on the next page.

The independent variables will also be discussed in greater detail in their respective groups of microeconomic variables, macroeconomic variables and structural variables in the sections to follow.

The **microeconomic variables** are:

- capital adequacy ($capad_{i,t}$),
- deposits ($deposits_{i,t}$),
- interest income on loans ($earnings_{i,t}$),
- credit growth ($growth_{i,t}$),
- liquidity ($liquidity_{i,t}$),
- ROA ($roa_{i,t}$), and
- ROE ($roe_{i,t}$)

The **macroeconomic variables** are:

- GDP ($gdp_{i,t}$),
- interest rate ($repo_{i,t}$),
- the rand-dollar exchange rate ($rdol_{i,t}$),
- inflation ($cpi_{i,t}$),
- gold sales ($gsales_{i,t}$), and
- the unemployment rate ($unemp_{i,t}$).

Lastly, the **structural variables** are:

- the GFC ($gfc_{i,t}$),
- the NCA ($nca_{i,t}$), and
- the commodity boom cycle ($cboom_{i,t}$).

Table 6.1: Descriptive statistics for the determinants of NPLs

Variable		Mean	Std. Dev.	Min	Max	Observations
$npl_{i,t}$	Overall	6.715	8.53	0.05	36.6	N = 156
	Between		7.872	1.258	26.681	n = 13
	Within		3.896	-11.946	28.079	T = 12
$capad_{i,t}$	Overall	21.95	16.692	5.774	124.756	N = 156
	Between		11.512	10.696	48.053	n = 13
	Within		12.47	-4.675	107.53	T = 12
$deposits_{i,t}$	Overall	146838.4	211249.6	-9321.76	756047	N = 156
	Between		205498.9	723.325	535458.5	n = 13
	Within		73440.83	-140383	410757.4	T = 12
$earnings_{i,t}$	Overall	16.912	27.592	0.64	246.72	N = 156
	Between		18.305	8.304	75.099	n = 13
	Within		21.213	-30.587	188.533	T = 12
$growth_{i,t}$	Overall	19.697	24.415	-9.98	139.78	N = 156
	Between		15.178	2.344	61.424	n = 13
	Within		19.547	-35.027	98.053	T = 12
$liquidity_{i,t}$	Overall	168.88	238.39	25.68	1367.024	N = 156
	Between		224.84	32.548	905.953	n = 13
	Within		99.322	-486.458	629.951	T = 12
$roa_{i,t}$	Overall	2.7	3.328	-9.548	14.406	N = 156
	Between		2.226	0.799	7.032	n = 13
	Within		2.544	-12.027	11.927	T = 12
$roe_{i,t}$	Overall	15.732	12.157	-47.173	48.63	N = 156
	Between		6.076	5.606	23.761	n = 13
	Within		10.653	-44.275	51.528	T = 12
$gdp_{i,t}$	Overall	2.996	1.982	-1.538	5.585	N = 156
	Between		0.0	2.996	2.996	n = 13
	Within		1.982	-1.538	5.585	T = 12

$repo_{i,t}$	Overall	7.143	1.907	5	11.621	N = 156
	Between		0.0	7.143	7.143	n = 13
	Within		1.907	5	11.621	T = 12
$rdol_{i,t}$	Overall	8.283	1.861	6.37	12.764	N = 156
	Between		0.0	8.283	8.283	n = 13
	Within		1.861	6.369	12.764	T = 12
$cpi_{i,t}$	Overall	5.542	2.35	1.4	11.5	N = 156
	Between		0.0	5.542	5.542	n = 13
	Within		2.35	1.4	11.5	T = 12
$gsales_{i,t}$	Overall	1036.35	376.939	435.6	1657.5	N = 156
	Between		0.0	1036.35	1036.35	n = 13
	Within		376.939	435.6	1657.5	T = 12
$unemp_{i,t}$	Overall	24.1	1.017	21.9	26.4	N = 156
	Between		0.0	24.1	24.1	n = 13
	Within		1.017	21.9	26.4	T = 12

Source: Compiled from Stata output (2017)

Table 6.1 presents the descriptive statistics for the independent and dependent variables identified in this study. Although explained thoroughly in the methodology section (Section 4.4.1), it is worth mentioning that the panel data descriptive statistics contains three results for each variable pertaining to the dataset of the panel. The three results presented are for the overall, between and within results of the variable analysed. The overall result considered all the information for time (T) and entities (n), while the within result indicates the measurements across the entities (n), and the between result presents the measurements across the time (T).

The independent variable, $NPL_{i,t}$, has a mean of 6.7% across the 156 observations. For all the observations, the maximum $NPL_{i,t}$ is 36.6% and the minimum $NPL_{i,t}$ is less than 1%. The $NPL_{i,t}$ differs across entities when compared over time (between) and entities (within). The $NPL_{i,t}$ shows a standard deviation across entities of 3.9%, while over time it has a standard deviation of 7.9%. However, there is a wide range between the data in the minimum and maximum, ranging from 1.3% up to 26.7%, and there is an even a wider range within the data with the minimum and maximum values, -11.9% and 28.1%.

6.2.2.1 *Microeconomic variables*

The microeconomic variables show that there is variance between the variables across entities and across time. The capital adequacy ($capad_{i,t}$) for the banks is on average at 22%, while some banks are over capitalised overall, with a maximum capital percentage held at 124.8% and a minimum of 5.8%. When compared over time, the capital held has a standard deviation of 11.5%, with a minimum and maximum of 10.7% and 48.1%, respectively. This indicates that banks were generally well capitalised over the period under investigation. Capitalisation is important because this strengthened the lending book, thereby reducing NPLs (López, 2016). The capital adequacy varies significantly within entities, with a minimum of -4,7% and a maximum of 107.5%, which is possibly the result of changes in the Basel requirement which required of banks to increase their capital adequacy to reduce risks in the banking sector (López, 2016).

The deposits ($deposits_{i,t}$) are reported in millions (R'000 000). The average deposits are R147 billion, with a standard deviation of R211 billion. The minimum and maximum deposits received by banks ranged over time from R723 million to R535 billion. This speaks to the size of the banks in this panel of data, indicating that the banks included in the study ranged from small to large banks, based on deposits. Some banks shrank, while others showed growth, with a minimum and maximum deposit value of –R140 billion and R411 billion within the bank entities. Banks require deposits for maturity transformation, and the size of deposits directly impacts their ability to grant credit to customers, driving growth and potential interest income (Ifeacho & Ngalawa, 2014; Zafar *et al*., 2013).

Credit growth ($growth_{i,t}$), on average, did not exceed 20%, averaging at 19.7% for the overall dataset. The minimum value for the overall data set indicates that there was a contraction of credit at a stage, measuring a minimum of -10%, while the maximum growth was at 139.8%. Between banks, the range is 133.1%, with a standard deviation of 19.5%. The range over the period of the study is at 59.1%. This range may be an indication that some banks attempted to increase their credit book to achieve higher profits, although it could also be as a result of increased deposits that allowed the bank to lend a larger portion of the deposited funds to deficit economic units.

The liquidity ($liquidity_{i,t}$) in this study is measured as a ratio of loans to customer deposits. This ratio indicates the liquidity level of a bank, and the higher the ratio, the less liquid the bank (Bunda & Desquilbet, 2008). The overall average was 1:168.9, and the extreme values from African Bank are included in this result. The minimum liquidity ratios overall and between the years are 1:25.7 and 1:32.5 respectively, indicating that the remainder of the included banks have lower liquidity ratios.

The financial performance of the bank assets is measured as interest income on loans (earnings), ROA and ROE. The earnings ($earnings_{i,t}$) on average generated a return of 16.9%. The maximum earnings were 246.7% overall, 75.1% for the period under investigation, and 188.5% within entities. The minimums reported indicate that there were years that the relevant banks suffered losses and that almost zero income was generated. Well capitalised banks can remain as running entities, even in circumstances where losses are reported, and this is also the primary reason for being well capitalised and supported by a central bank. The central bank also acts as a lender of last resort, ensuring that a bank run will not occur and that banks will not cause a systemic failure of the financial system (Van Zyl *et al.*, 2006).

The mean ROA ($roa_{i,t}$) ratio is 2.7, and the ROA shows a standard deviation of 3.2, with a minimum of -9.5 and a maximum of 14.4 for the overall panel dataset. In the period under investigation, the standard deviation is only 2.2, and the ROA ranged from a minimum of 0.8, up to a maximum of 7. However, amongst the entities, the ROA ranged from -12 up to 11.9. The ROA provides information on the total asset return profit-generating ability of the various banks. According to Ghosh (2015), low profitability is an indication of low or negative ROA, implying that the banks might be engaging in risky lending practices to achieve higher earnings.

The ROE ($roe_{i,t}$) is identified as a measure of risky lending activities, and it is expected that the higher the ROE, the less likely it is that banks would engage in risky lending practices. The ROE has an overall average of 15.7%, but the overall ROE has a range from -47.1% up to 48.6%. Amongst the banking entities, the ROE is at a minimum 44.3% and at maximum 51.5%, while the results for the period are 5.6% up to 23.8%.

This study has a particular interest in the interest income on loans ($earnings_{i,t}$), and the ROA ($roa_{i,t}$) and ROE ($roe_{i,t}$) variables, because of the hypothesised outcomes for the interaction between these determinants with the dependent variable, $NPL_{i,t}$. When

comparing the outcome of the descriptive statistics, it was found that there are differences amongst the descriptive results related to the profitability measures of the interest income on loans, ROA and ROE.

6.2.2.2 *Macroeconomic variables*

The macroeconomic descriptive statistics revealed interesting, yet presumably obvious results. The descriptive statistics provided results for the overall, between and within panel dataset. However, the results for the between statistics show that there are no differences in the minimum, maximum and standard deviations for the macroeconomic variables. This should have been presumed, seeing that the macroeconomic information has the same impact on each one of the banks. This also impacts the regression analysis, as the information is not unique to each bank over the period of investigation.

From 2003 to 2015, the GDP ($gdp_{i,t}$) showed a maximum growth of 5.6% within a year, and during the recession periods the economy contracted by 1.5%. The average yearly GDP for the period of the study was 3%. Because of the well-reported relationship between GDP and NPL, it was assumed that NPLs should decrease in periods of economic growth, while they would increase in periods of GDP contraction (Klein, 2013; Nkusu, 2011).

The average interest rate ($repo_{i,t}$) ranged between a minimum of 5% and a maximum of 11.6[10]%, with a standard deviation of 1.9% and an overall average of 7.1% for the period under investigation. The interest rate has a positive effect on NPLs (Messai & Jouini, 2013; Nkusu, 2011). However, the interest rate does not have a unique impact on each bank, as banks use the repo rate as a reference rate to present borrowers with a proposed 'personalised' interest rate (Nelson, Pinter & Theodoridis, 2018). The personalised interest rate is essentially the risk pricing of a borrower, yet low-interest rates cause rapid credit growth (Nelson *et al*., 2018).

The repo rate has a far-reaching impact on the macroeconomic environment, and impacts inflation, unemployment and factors that affect the money in a country (Mankiw & Reis, 2018). The inflation rate ($cpi_{i,t}$) was at a maximum rate of 11.5% and

[10] Although the SARB changes the interest rate by either 25 or 50 basis points at a time, the interest rates are calculated as the average interest per year.

had a lower bound of 1.4%, but on average it was 5.5% per year. This average rate forms part of the upper bound of the inflation target set by the SARB of 3% to 6% (SARB, 2018a).

South Africa has high levels of unemployment (Black, Craig & Dunne, 2017), with the average unemployment rate ($unemp_{i,t}$) at 24.1% during the period of the study. During the 2004 to 2015 period the minimum and maximum unemployment rate were at 21.9% and 26.4%, respectively. Both the unemployment rate and the inflation rate cause NPLs to increase (Ghosh, 2015).

The rand-dollar exchange rate, ranged from a minimum of R6.37/$1 up to R12.76/$1 and had an average exchange rate of R8.28/$1 for the period under investigation. The exchange rate was fairly consistent over the period 2004 to 2015, showing only a standard deviation of R1.86. This is important because gold sales ($gsales_{i,t}$) are derived from selling gold at the internationally quoted dollar price. The maximum gold sales for a year was R1.66 billion, and the minimum gold sales was R436 million, but on average the gold sales were R1 billion per year. The importance of the gold sales is highlighted because commodity shocks generally have a negative impact on the economy and banking sector (Fofack, 2005; Kinda *et al*., 2016).

6.2.2.3 *Structural change variables*

The GFC ($gfc_{i,t}$), NCA ($nca_{i,t}$) and commodity boom cycle ($cboom_{i,t}$) are excluded in the descriptive analysis because they did not provide any logical descriptive statistical results. The structural change periods under consideration for the GFC are the years from 2007 to 2009, for the implemented NCA, the years from 2008 to 2015, and for the commodity boom cycle, the years from 2007 to 2010.

The statistics on the central tendency and dispersion of the variables under consideration indicate that the average yearly impact of the variables is consistent over the period under investigation. The microeconomic variables indicated that the banks are unique, and this was identified when the variables interacted for both the between and within analysis. However, the macroeconomic variables showed that irrespective of the entity (bank), the determinant remained consistent. Therefore, the macroeconomic variables had a similar impact on the different banks. This is because this study only considered a single country, while other studies (Beck *et al*., 2015; Buncic & Melecky, 2013; De Bock & Demyanets, 2012; Espinoza & Prasad, 2010;

Klein, 2013; Makri *et al*., 2014; Messai & Jouini, 2013; Nkusu, 2011; Škarica, 2013) focused on a multiple country analysis in their panel datasets.

The correlation coefficients discussed below are the final descriptive statistics to be reviewed in this study.

6.2.3 Correlation coefficients

The correlation coefficients presented in this section provide the statistical dependencies between the various panel data measurements. It is important to distinguish between serial correlation and correlation coefficients. The latter only determines whether the measurement data correlate with each other, while serial correlation indicates that there are dependencies within the data (Andre, 2008).

Table 6.2 contains the results of the measurement data correlation coefficients.

Table 6.2: Correlation coefficients for the determinants of NPLs

	npl_t	$npl_{i,t-1}$	$capad_{i,t}$	$deposits_{i,t}$	$earnings_{i,t}$	$growth_{i,t}$	$liquidity_{i,t}$	$roa_{i,t}$	$roe_{i,t}$	$gdp_{i,t}$	$repo_{i,t}$	$rdol_{i,t}$	$cpi_{i,t}$	$gsales_{i,t}$	$unemp_{i,t}$	$gfc_{i,t}$	$nca_{i,t}$	$cboom_{i,t}$
npl_t	1.0																	
$npl_{i,t-1}$	0.932	1.0																
$capad_{i,t}$	0.087	0.152	1.0															
$deposits_{i,t}$	-0.242	-0.258	-0.311	1.0														
$earnings_{i,t}$	0.276	0.326	0.417	-0.311	1.0													
$growth_{i,t}$	0.034	0.069	0.614	-0.263	0.519	1.0												
$liquidity_{i,t}$	0.692	0.678	0.217	-0.188	0.181	0.081	1.0											
$roa_{i,t}$	0.24	0.229	0.459	-0.34	0.461	0.508	0.367	1.0										
$roe_{i,t}$	-0.155	-0.195	0.087	0.109	0.142	0.231	0.077	0.632	1.0									
$gdp_{i,t}$	-0.0278	0.035	0.189	-0.102	0.173	0.326	0.076	0.183	0.25	1.0								
$repo_{i,t}$	0.034	-0.044	0.018	-0.108	0.104	0.22	0.011	0.24	0.325	0.225	1.0							
$rdol_{i,t}$	-0.103	-0.093	-0.164	0.164	-0.156	-0.262	-0.124	-0.218	-0.28	-0.594	-0.34	1.0						
$cpi_{i,t}$	0.018	-0.082	-0.135	-0.013	-0.052	0.0329	-0.048	0.092	0.136	-0.18	0.751	0.047	1.0					
$gsales_{i,t}$	0.028	0.014	-0.187	0.115	-0.229	-0.249	-0.032	-0.2	-0.27	-0.485	-0.568	0.234	-0.075	1.0				
$unemp_{i,t}$	-0.018	0.036	-0.036	0.078	-0.075	-0.189	-0.01	-0.175	-0.249	-0.403	-0.799	0.315	-0.687	0.466	1.0			
$gfc_{i,t}$	0.041	-0.054	-0.082	-0.071	-0.071	0.118	-0.01	0.177	0.23	-0.158	0.853	-0.178	0.783	-0.286	-0.495	1.0		
$nca_{i,t}$	0.023	-0.028	-0.233	-0.136	0.136	-0.337	-0.083	-0.232	-0.303	-0.781	-0.321	0.568	0.252	0.768	0.204	-0.083	1.0	
$cboom_{i,t}$	0.081	-0.014	-0.092	-0.068	-0.068	0.058	0.005	0.123	0.157	-0.129	0.725	-0.28	0.578	-0.092	-0.432	0.81	0.039	1.0
	Perfect or high correlation.																	
	Moderate correlation.																	
	Zero or low correlation.																	

Source: Compiled from Stata output (2017)

Statistics Solutions (2018) explained that there are five levels of correlation between measurements, namely, zero, low, moderate, high and perfect correlation. For each level of correlation, a corresponding value or range is presented. Zero correlation is for a correlation coefficient of 0, low correlation is for correlation coefficients between 0 and ±0.3, medium correlation is when the correlation coefficient is between ±0.3 and ±0.7, high correlation is when the correlation coefficient is between ±0.7 and ±1, while perfect correlation is when the correlation coefficient is exactly ±1 (Statistics Solutions, 2018).

The most important correlation coefficients to study are those of the dependent variable, $NPL_{i,t}$. Andre (2008) explained that the correlation $Corr(y_{it}, y_{i1})$ signifies statistical dependencies, while the correlation, $Corr(y_{it}, y_{it-1})$ signifies serial correlation, depending on the coefficient. When analysing the NPL ($NPL_{i,t}$) correlation coefficients with the independent variables, only two variables show signs of a high and moderate correlation, respectively. The NPL ($NPL_{i,t}$) and lagged NPL ($NPL_{i,t-1}$) have a correlation coefficient of 0.932, while the NPL ($NPL_{i,t}$) and liquidity ($liquidity_{i,t}$) have a correlation coefficient of 0.692.

The motivation to include a lagged NPL variable has been well substantiated because problem loans tend to show persistence in the subsequent years (Dash & Kabra, 2010; Louzis *et al.,* 2012). However, because the lagged dependent variable causes serial correlation, it has been recommended that autoregressive models should be used to adjust for the serial correlation between the dependent and lagged dependent variables (Erdinç & Abazi, 2014). The lagged NPL has a highly correlated relationship with the dependent variable NPL, and is the variable that posed the most risk to the econometric analysis. However, the autoregressive model adjusts for the negative impact of the high correlation between these variables.

Louzis *et al*. (2012) in their study found that banks often become involved in riskier lending activities when they consider themselves as banks that are ‘too-big-to-fail’ (TBTF). Vodova (2011) found that banks increase liquidity when there is an increase in NPLs, and this explains the moderate correlation coefficient between NPL and liquidity. Vodova (2011) explained that because banks act prudently, a cautionary action is to offset the higher risk associated with increased NPLs by increasing liquidity.

Table 6.2 provides the correlation coefficients for all the variables in this study. Although the correlation coefficients between the dependent and independent variables are the primary concern, it is interesting to take notice of the relationship between certain other variables. The interest rate ($repo_{i,t}$) is the variable that has the most highly correlated relationships. This is not unexpected, because the SARB has an inflation-targeting approach and the highly correlated relationships (inflation rate and unemployment rate) have macroeconomic measurements that the interest rate is known to impact (SARB, 2018b; Van Zyl *et al*., 2006). The interest rate ($repo_{i,t}$) is also highly correlated with the GFC ($gfc_{i,t}$) and the commodity boom period ($cboom_{i,t}$). With the exception of the commodity boom period, the interest rate ($repo_{i,t}$) is the monetary policy tool that influences the inflation rate and unemployment rate, and can stimulate economic activity in periods of financial crisis (Cukierman, 2013; Hodson & Mabbett, 2009; Roger, 2010).

The three determinants that were identified to measure the financial performance of the banks based on their asset quality, namely, interest income on loans ($earnings_{i,t}$), ROA ($roa_{i,t}$) and ROE ($roe_{i,t}$), also provide interesting results. The earnings on loans have a moderate positive correlation with the ROA, with a correlation coefficient of 0.46, while the ROA and ROE have a moderate positive correlation of 0.63. Interestingly, the interest income on loans only holds a low correlation with the ROE, with a coefficient of 0.14. The correlation coefficients between these variables indicate that they are not perfectly correlated, priming thoughts on what impact the profitability measures have on NPLs.

The descriptive statistics provide insight regarding the determinants that may have had an impact on NPLs. The econometric model estimation results in Section 6.3 provide more conclusive information on the extent of the influence that the different variables have on the NPLs from a single-country perspective for individual banks.

6.3 REGRESSION RESULTS

These regression results are derived from running the regression models, as specified in the methodology section (Section 4.8). Seven different models were regressed to achieve the research objectives (see Equations 4.6 – 4.12). The models were regressed, and each considered a pooled regression, fixed effects regression, random

effects regression and the autoregressive adapted regressions for the FE and RE regression models. However, autoregressive adapted panel data regression models have to be incorporated when lagged dependent variables are included in the regression models, because lagged dependent variables cause serial correlation in the regression analysis (Ak *et al*., 2013).

The most suitable regression models are identified by analysing the F-statistic, Wald Chi-test, Breusch-Pagan LM test and the Hausman test. Each one of the diagnostic tests has a role, the Hausman test distinguishes between the superior panel data regression model, while the F-statistic and Wald Chi-test determine the viability of an FE or RE model, rather than the pooled OLS regression models (Al-Refai, Aqel & Afaneh, 2013). Erdinç and Abazi (2014) concluded that the various panel data models yield similar results concerning the sign and significance of determinants, but the precision of the results shows slight variations between the models.

The regressions are presented in the following order: Firstly, the macroeconomic and microeconomic determinants within a single regression are presented. This regression includes all the microeconomic and macroeconomic variables, as well as the structural change variables, namely, the GFC, NCA and the commodity boom period. The second section of the regression results consists of a presentation of the six regressions, and includes the microeconomic variables together with the structural change variables, GFC and NCA. Each measurement of the bank profitability measures, namely, ROA, ROE and interest income on loans, is reported respectively.

6.3.1 Macroeconomic and microeconomic determinant model

The descriptive statistics signals that the analysis of all the determinants of NPLs might not yield the desired results, because all the banks in this study are subject to the same macroeconomic conditions and shocks (see Section 6.1.1). Interestingly, when Bacchetta and Ballabriga (2000) studies the effect of monetary policy on a bank's balance sheet, they found that although there are vast differences between countries, the impact of macroeconomic performance on the bank's balance sheets is negligible in certain instances. However, Bacchetta and Ballabriga (2000) maintained that an understanding of macroeconomic conditions plays a role in the bank's lending environment. Table 6.3 presents a summary of the regression model that includes the macroeconomic and microeconomic determinants of NPLs.

Table 6.3: Macroeconomic and microeconomic variable regression model

Model	$npl_{ti,t} = npl_{i,t-1} + capad_{i,t} + deposits_{i,t} + earnings_{i,t} + growth_{i,t} + liquidity_{i,t} + roa_{i,t} + roe_{i,t} + gdp_{i,t} + repo_{i,t} + rdol_{i,t} + cpi_{i,t} + gsales_{i,t} + unemp_{i,t} + gfc_{i,t} + nca_{i,t} + cboom_{i,t}$									
	Pooled model		**Fixed effects model (Within)**		**Random effects model (FGLS)**		**Fixed effects model (AR1)**		**Random effects model (AR1)**	
	Coef.	P >|t|	Coef.	P >|t|	Coef.	P >|z|	Coef.	P >|t|	Coef.	P >|z|
npl_{t-1}	0.789	0.043***	0.474	0.0***	0.789	0.0***	0.329	0.002***	0.614	0.0***
$capad_{i,t}$	-0.042	0.059**	-0.174	0.422	-0.042	0.056**	-0.011	0.747	-0.033	0.151
$deposits_{i,t}$	0.0	0.884	0.0	0.574	0.0	0.884	0.0	0.706	0.0	0.974
$earnings_{i,t}$	-0.004	0.785	0.006	0.714	-0.004	0.785	0.016	0.724	0.0	0.956
$growth_{i,t}$	0.002	0.86	0.012	0.38	0.003	0.859	0.006	0.679	0.008	0.571
$liquidity_{i,t}$	0.004	0.008***	0.009	0.002***	0.004	0.007***	0.012	0.0***	0.008	0.0***
$roa_{i,t}$	0.152	0.318	0.021	0.94	0.152	0.317	0.175	0.575	0.144	0.506
$roe_{i,t}$	-0.029	0.447	-0.019	0.762	-0.029	0.445	-0.053	0.436	-0.062	0.225
$gdp_{i,t}$	-0.628	0.177	-0.516	0.205	-0.628	0.174	-0.279	0.792	-0.567	0.122
$repo_{i,t}$	0.268	0.687	0.193	0.745	0.268	0.686	0.314	0.767	0.338	0.562
$rdol_{i,t}$	-0.297	0.207	-0.472	0.045	-0.297	0.205	-0.678	0.555	-0.359	0.119
$cpi_{i,t}$	0.39	0.438	0.291	0.508	0.39	0.437	0.234	0.577	0.303	0.499
$gsales_{i,t}$	0.0	0.938	-0.001	0.756	0.0	0.932	-0.003	0.817	0.0	0.971
$unemp_{i,t}$	-0.071	0.942	0.149	0.864	-0.072	0.942	0.866	0.838	0.043	0.958
$gfc_{i,t}$	-2.565	0.36	-2.048	0.404	-2.565	0.358	-1.857	0.365	-2.323	0.271
$nca_{i,t}$	-1.205	0.688	2.633	0.354	-1.205	0.687	2.364	0.796	-0.448	0.855
$cboom_{i,t}$	0.929	0.498	1.012	0.403	0.929	0.497	0.65	0.8	0.835	0.467
_cons	4.08	0.874	1.107	0.961	4.08	0.874	-14.06	0.826	2.231	0.911
R-squared (Overall)	0.881		0.857		0.895		0.822		0.8842	
R-squared (Within)			0.529		0.479		0.384		0.5129	
R-squared (Between)			0.926		0.984		0.884		0.9579	
F statistic (Prob > F)			4.23 (0.0)***				3.67 (0.0)***			
Wald Chi^2 ($Prob > Chi^2$)					1064.2 (0.0)***				354.6 (0.0)***	
Breusch and Pagan LM test ($Prob > Chibar^2$)					0.0 (1.0)					
Hausman test – Chi^2 ($Prob > Chi^2$)			56.9 (0.0)***				37.3 (0.001)***			
* 10% level of significance. ** 5% level of significance. *** 1% level of significance. # fails to satisfy model assumptions.										

Source: Compiled from Stata output (2017)

The regression results presented in Table 6.3 provide information on the pooled OLS model, the FE regression model, the RE regression model, and the AR(1) adapted FE and RE regression models. The diagnostic statistics for this regression model (see Equation 4.6) indicates that the FE model regression is the preferred regression model for this estimation. The F-test statistic rejects the null hypothesis that all intercept terms are equal to zero, rejecting the use of the pooled OLS regression model. The Breusch and Pagan LM test similarly reject the null hypothesis that the variance of the means is equal to zero, rejecting the use of the pooled OLS regression model. Due to both the FE and RE being preferred above the pooled OLS model, the Hausman test was conducted and it found that the FE model is preferred to the RE model.

A lagged NPL variable was included in the regression model. Ak *et al*. (2013) indicated that when a lagged dependent variable is included in a regression model, the AR(1) adapted FE and RE models have to be used in the regression analysis. When the AR(1) adapted FE, and RE regression models were analysed, the FE regression (AR(1) adapted model) remained the preferred regression model.

The microeconomic and hypotheses specific determinants are discussed after the tabular presentation of the regression models, as specified in Equation 4.7 – 4.12. The macroeconomic determinants of NPLs will be discussed in the following section. According to Abid, Ouertani and Zouari-Ghorbel (2014) the GDP growth, inflation rate and interest rate are some of the most important macroeconomic determinants of NPLs.

6.3.1.1 *GDP growth ($gdp_{i,t}$)*

The results presented in Table 6.3 show that the GDP has a negative impact on NPLs. Unfortunately, none of the GDP growth coefficients from the different estimations is statistically significant. The coefficient sign is similar to the expected sign for GDP, and both the theory and the results coincide, which confirms that GDP has a negative impact on NPLs. Previous studies (Bittencourt *et al*., 2015; Laeven & Majnoni, 2003) considered whether GDP might react differently when considered from a single-country perspective. This is because other factors, such as inflation, often influence the GDP, especially since there is a variation in the macroeconomic factors between countries (Beck *et al*., 2013; Bittencourt *et al*., 2015; Laeven & Majnoni, 2003).

The results of this study, conducted from a single country perspective, show that there is a negative relationship between the GDP and NPLs. This provides evidence that, irrespective of the number of countries in the study, the relationship of the GDP growth remains negative. This is a similar result to that of Abid *et al*. (2014). This estimation cannot explain whether Bittencourt *et al*. (2015) were correct in stating that a number of other macroeconomic factors can influence GDP growth. Bittencourt *et al*. (2015) stated that GDP growth was an inaccurate determinant of NPLs, because GDP growth was sensitive to changes in the interest rate, unemployment rate and the inflation rate. However, the correlation matrix (Table 6.2) indicates that there is a moderate negative correlation between GDP and two macroeconomic variables, namely, the exchange rate and the unemployment rate.

6.3.1.2 *Rand-dollar exchange rate ($rdol_{i,t}$)*

The impact of the exchange rate on NPLs has been studied by various researchers (Beck *et al*., 2015; De Bock & Demyanets, 2012; Senawi & Isa, 2014) who found contradicting evidence and different levels of significance. Senawi and Isa (2014) found that the exchange rate has a significant impact on NPLs. However, Beck *et al*. (2015) reported a positive impact, while Senawi and Isa (2014) reported a negative impact. This study found that the exchange rate does not have a significant impact on NPLs, although it did show a negative relationship. This provides clarity on what can be expected in South Africa, although it is uncertain whether the exchange rate would have a positive or negative impact as a determinant of NPLs. The uncertainty about the outcome of the sign could be because the number of loans that are obtained in foreign-denominated currency impacts the NPLs in either a positive or negative manner.

As a result of the positive influence that the rand-dollar exchange rate has on NPLs, this study rejected the results presented by Škarica (2014), Jakubík and Reininger (2013) and De Bock and Demyanets (2012). According to De Bock and Demyanets (2012), the negative influence that the foreign exchange rate has on NPLs is the result of the GDP deterioration in a country. Since the mid-2000s the GDP growth rate has deteriorated from above 5% to a mere 0.5% in 2016 (Burger, 2017), and this low growth environment contributed to the deterioration of the exchange rate. The negative influence could also be a result of the amount of foreign-denominated debt that banks hold on their balance sheets. The deterioration of the foreign exchange rate reduced

the ability of borrowers to service their foreign-denominated debt, leading to higher levels of NPLs (Jakubík & Reininger, 2013; Škarica, 2014).

6.3.1.3 *Unemployment ($unemp_{i,t}$)*

Unemployment has a moderate to strong relationship with macroeconomic indicators, such as the inflation rate, exchange rate, interest rate and GDP (see Table 6.2). It is not surprising that the unemployment rate was identified as a determinant of NPLs. Unemployment results in borrowers being unable to repay their debt, thereby increasing NPLs, and causing bank asset quality to deteriorate (Louzis *et al*., 2012; Messai & Jouini, 2013).

The OLS, FE, RE and AR(1) estimations produced mixed estimation results. The coefficients for the pooled OLS, RE and the AR(1) RE estimations yielded negative coefficients for unemployment, while the FE and autoregressive FE estimations delivered a coefficient for unemployment that is positive but insignificant (see Table 6.2). In this study, the positive influence of the unemployment rate is ascribed to the low GDP growth, because a low GDP growth also causes lower levels of employment (Burger, 2017). Alternatively, it is also possible that individuals who do not have an income cannot borrow funds or obtain long-term loans (Cucinelli, 2015). However, the negative impact may have been the result of the quick response from regulators to change the interest rate when low growth and high unemployment was prevalent. Quadt and Nguyen (2016) argued that interest rate changes are an effective intervention to reduce a rise in unemployment.

6.3.1.4 *Interest rate ($repo_{i,t}$)*

The interest rate was expected to have a positive relationship with the NPL ratio (see Section 5.4.12). Past studies (Ghosh, 2015; Messai & Jouini, 2013) explained that this result indicates the inability of borrowers to repay their loans when interest rates increases, or points to their ability to repay loans when interest rates decrease. The results from this study concurred with the results of prior research. Although the coefficient did not yield any level of significance, the expected positive direction of the relationship remained.

The results of this study (see Table 6.3) and the past studies (Espinoza & Prasad, 2010; Louzis *et al*., 2012; Nkusu, 2011) suggest that the relationship between the interest rate and NPL ratio is positive. However, in South Africa, there are apparent

differences in the monetary transmission period during periods of GDP growth and GDP contraction periods (Matemilola, Bany-Ariffin & Muhtar, 2015). As a result, although the interest rate has a positive influence on the NPL ratio, the influence is delayed during periods of slow GDP growth, while the changes in interest rates show a more efficient transmission during GDP expansion periods. The SARB has a mandate to enter into open-market transactions to adjust the repurchase rate in the South African economy, therefore, maintaining price stability and combatting the negative effects of inflation (SARB, 2018c; Van Zyl *et al*., 2006).

6.3.1.5 *Inflation rate ($cpi_{i,t}$)*

The inflation rate has an ambiguous relationship with the NPL ratio. Alhassan *et al*. (2014) advocated that the inflation rate has a positive influence on the NPL ratio, because inflation reduces the ability to repay funds by causing prices to rise. However, some researchers (Ćurak *et al*., 2013; Shu, 2002) were of the opinion that the impact would be negative because a low inflation rate would positively impact GDP growth, enabling borrowers to repay their borrowed funds. However, this study found that the inflation rate has a positive influence on the NPL ratio.

The results reported in Table 6.3 show that inflation has a positive influence on the NPL ratio, though it is insignificant, irrespective of the estimation model. In South Africa, it would be correct to assume a positive sign, because the expectation is that due to interest rates having a positive influence on the NPL ratio, the inflation rate would yield a similar direction (sign) as the interest rates. This is because the interest rate is the monetary policy instrument used to manage inflation (SARB, 2018c). In addition to the conclusion by Alhassan *et al*. (2014) that inflation erodes the purchasing power effectively reducing the performance of repayments, monetary policy that targets inflation and upholds price stability may also be the cause for the positive influence between inflation and the NPL ratio.

6.3.1.6 *Commodity boom period ($cboom_{i,t}$)*

The commodity boom cycle was included as part of this study to determine the impact that the boom cycle had on NPLs. It was assumed that the commodity boom cycle would cause a decrease in the NPL ratio. However, the coefficient for the commodity boom categorical variable was positive and it did not yield a result that was significant at 10% or lower. Although boom periods are generally associated with above-average

economic growth, the result from the estimation provided information to the contrary. The commodity boom cycle had a positive relationship with NPLs. It is most probably an indication that South Africa did not benefit from the commodity boom period to the extent that it could have, as Baxter (2009) stated. A decade before the commodity boom period ended, Kittikulsingh (1999) warned that unexpected boom cycles have the opposite effect than expected, causing adverse effects on the economy. However, the price of gold reached unexpected highs during 2010 (Helbling, 2012), indicating that although the commodity boom might not have had a significant impact on NPLs, the influence that gold sales had may still be valid in further econometric tests.

Erdinç and Abazi (2014) stated that the macroeconomic determinants of bank asset quality are important and that the interactions between these determinants and the NPLs are well-established and well-documented for both advanced and EMEs. The descriptive statistics indicate that from a single-country perspective, the macroeconomic determinants would have the same impact on the various banks, because they all operate within the same macroeconomic environment (see Section 6.2). As a result of the well-known information on macroeconomic determinants, it is recommended that the microeconomic determinants require in-depth investigation as they too could yield interesting results, and provide additional information on bank asset quality (Louzis *et al.*, 2012).

6.3.2 Microeconomic determinant models

To achieve the five research objectives, the microeconomic determinant regression models have been adapted into three forms from an income perspective (earnings on loans, ROA and ROE), and studying the impact of the two structural changes (GFC and NCA), respectively (see Equations 4.7 – 4.12). These regression models are summarised for each of the proposed models in Tables 6.4 to 6.9. Due to the regression models being presented in Tables 6.4 to 6.9 containing six generic determinants and only five unique determinants, the results pertaining to the determinants will be discussed after the presentation of all six regression models. Only a discussion of the diagnostic tests is provided after each presentation of the regression results.

Table 6.4 provides the regression results for the Earnings – GFC regression model.

Table 6.4: Earnings – GFC regression model

Model	$npl_{ti,t} = npl_{i,t-1} + capad_{i,t} + deposits_{i,t} + growth_{i,t} + liquidity_{i,t} + gsales_{i,t} + earnings_{i,t} + gfc_{i,t}$									
	Pooled model		**Fixed effects model (Within)**		**Random effects model (FGLS)**		**Fixed effects model (AR1)**		**Random effects model (AR1)**	
	Coef.	P >|t|	Coef.	P >|t|	Coef.	P >|z|	Coef.	P >|t|	Coef.	P >|z|
$npl_{i,t-1}$	0.797	0.0***	0.51	0.0***	0.8	0.0***	0.505	0.0***	0.729	0.0***
$capad_{i,t}$	-0.029	0.052*	-0.005	0.8	-0.028	0.181	-0.006	0.839	-0.025	0.232
$deposits_{i,t}$	0.0	0.457	0.0	0.876	0.0	0.65	0.0	0.975	0.0	0.601
$growth_{i,t}$	-0.003	0.788	0.002	0.899	-0.003	0.81	-0.006	0.638	0.002	0.851
$liquidity_{i,t}$	0.004	0.111	0.008	0.000***	0.004	0.001***	0.012	0.0***	0.006	0.0***
$gsales_{i,t}$	0.001	0.327	0.001	0.058*	0.001	0.217	0.002	0.099*	0.001	0.22
$earnings_{i,t}$	0.002	0.853	0.009	0.525	0.002	0.868	0.022	0.443	0.003	0.863
$gfc_{i,t}$	1.736	0.011**	1.601	0.002***	1.728	0.002***	1.657	0.006***	1.604	0.005***
Constant	-0.455	0.73	-0.428	0.71	-0.466	0.668	-1.235	0.401	-0.348	0.762
R-squared (Overall)	0.888		0.863		0.888		0.867		0.887	
R-squared (Within)			0.477		0.442		0.425		0.453	
R-squared (Between)			0.938		0.982		0.936		0.975	
F statistic (Prob > F)	79.55 (0.0)***		13.9 (0.0)***				10.1 (0.0)***			
Wald Chi^2 (Prob > Chi^2)					929.0 (0.0)***				619.7 (0.0)***	
Adjusted Durbin-Watson							1.6		1.6	
Baltagi-Wu LBI							1.8		1.8	
Breusch and Pagan LM test (Prob > $Chibar^2$)					1.9 (0.085)*					
Hausman test – Chi^2 (Prob > Chi^2)			57.5 (0.0)***				21.6 (0.003)***			

* 10% level of significance.
** 5% level of significance.
*** 1% level of significance.
# fails to satisfy model assumptions.

Source: Compiled from Stata output (2017)

The results strongly reject the pooled OLS estimation in favour of the FE estimation. The pooled OLS estimation is also rejected in favour of the RE estimation. Although the FE and the RE are indicated as the superior estimations against the pooled OLS estimation, the Hausman test indicated that the FE would be the preferred estimation. This is an indication that there is a degree of bank-level heterogeneity in the NPLs. Due to the potential first-order serial correlation, the AR(1) FE and RE models have

been estimated. The adjusted Durbin-Watson (DW) test statistic is 1.6, an indication that there is no autocorrelation present in this estimation. The next model that is presented in Table 6.5 is the ROA – GFC regression model.

Table 6.5: ROA – GFC regression model

Model	$npl_{ti,t} = npl_{i,t-1} + capad_{i,t} + deposits_{i,t} + growth_{i,t} + liquidity_{i,t} + gsales_{i,t} + roa_{i,t} + gfc_{i,t}$									
	Pooled model		**Fixed effects model (Within)**		**Random effects model (FGLS)**		**Fixed effects model (AR1)**		**Random effects model (AR1)**	
	Coef.	P >|t|	Coef.	P >|t|	Coef.	P >|z|	Coef.	P >|t|	Coef.	P >|z|
$npl_{i,t-1}$	0.8	0.0***	0.524	0.0***	0.8	0.0***	0.511	0.0***	0.732	0.0***
$capad_{i,t}$	-0.03	0.145	-0.006	0.772	-0.03	0.143	0.001	0.966	-0.025	0.236
$deposits_{i,t}$	0.0	0.761	0.0	0.925	0.0	0.760	0.0	0.916	0.0	0.612
$growth_{i,t}$	-0005	0.706	0.004	0.744	-0.005	0.706	-0.007	0.585	-0.002	0.881
$liquidity_{i,t}$	0.004	0.008***	0.009	0.001***	0.004	0.007***	0.011	0.0***	0.006	0.001***
$gsales_{i,t}$	0.001	0.235	0.001	0.091*	0.001	0.233	0.001	0.135	0.001	0.233
$roa_{i,t}$	0.06	0.537	-0.04	0.731	0.06	0.536	0.018	0.893	0.006	0.954
$gfc_{i,t}$	1.673	0.004***	1.631	0.002***	1.673	0.004***	1.643	0.009***	1.58	0.006***
Constant	-0.488	0.65	-0.261	0.817	-0.488	0.65	-0.868	0.541	-0.302	0.793
R-squared (Overall)	0.889		0.862		0.889		0.867		0.887	
R-squared (Within)			0.476		0.438		0.415		0.452	
R-squared (Between)			0.936		0.985		0.867		0.975	
F statistic (Prob > F)	133.77 (0.0)***		13.86 (0.0)***				9.66 (0.0)***			
Wald Chi^2 (Prob > Chi^2)					1070.2 (0.0)***				619.5 (0.0)***	
Adjusted Durbin-Watson							1.6		1.6	
Baltagi-Wu LBI							1.8		1.8	
Breusch and Pagan LM test (Prob > $Chibar^2$)					0.0 (1.0)					
Hausman test – Chi^2 (Prob > Chi^2)			40.4 (0.0)***				36.7 (0.0)***			
* 10% level of significance. ** 5% level of significance. *** 1% level of significance. # fails to satisfy model assumptions.										

Source: Compiled from Stata output (2017)

Similar to the previous model, the pooled OLS is rejected for both the FE and RE estimations. The F-statistic and the Breusch-Pagan LM are highly statistically significant, thus rejecting the null hypotheses that all intercept terms or the variance of

the means were equal to zero. The Hausman test indicated that the FE would be the more suitable model between the FE and RE models. Due to the lagged dependent variable, the FE and RE models were adapted for serial correlation, and the AR(1) FE, and RE models had an adjusted DW statistic of 1.6, well within the prescribed range to acknowledge that there is no autocorrelation in the autoregressive estimations. Table 6.6 presents the results of the ROE – GFC regression model.

Table 6.6: ROE – GFC regression model

Model	$npl_{ti,t} = npl_{i,t-1} + capad_{i,t} + deposits_{i,t} + growth_{i,t} + liquidity_{i,t} + gsales_{i,t} + roe_{i,t} + nca_{i,t}$									
	Pooled model		**Fixed effects model (Within)**		**Random effects model (FGLS)**		**Fixed effects model (AR1)**		**Random effects model (AR1)**	
	Coef.	P >|t|	Coef.	P >|t|	Coef.	P >|z|	Coef.	P >|t|	Coef.	P >|z|
$npl_{i,t-1}$	0.799	0.0***	0.521	0.0***	0.781	0.0***	0.507	0.0***	0.717	0.0***
$capad_{i,t}$	-0.028	0.169	-0.008	0.704	-0.273	0.183	0.001	0.985	-0.025	0.231
$deposits_{i,t}$	0.0	0.68	0.0	0.873	0.0	0.67	0.0	0.942	0.0	0.647
$growth_{i,t}$	-0.002	0.851	0.004	0.741	-0.002	0.866	-0.006	0.639	0.0	0.976
$liquidity_{i,t}$	0.004	0.005***	0.009	0.0***	0.005	0.002***	0.012	0.0***	0.006	0.0***
$gsales_{i,t}$	0.001	0.252	0.001	0.115	0.001	0.239	0.001	0.158	0.001	0.285
$roe_{i,t}$	0.0	0.994	-0.019	0.496	-0.003	0.912	-0.01	0.733	-0.014	0.578
$gfc_{i,t}$	1.732	0.003***	1.66	0.002***	1.732	0.002***	1.702	0.006***	1.627	0.005***
Constant	-0.429	0.715	0.038	0.975	-0.389	0.742	-0.725	0.62	-0.005	0.997
R-squared (Overall)	0.888		0.861		0.888		0.863		0.886	
R-squared (Within)			0.478		0.442		0.414		0.453	
R-squared (Between)			0.934		0.981		0.931		0.973	
F statistic (Prob > F)	133.34 (0.0)***		13.9 (0.0)***				9.6 (0.0)***			
Wald Chi^2 (Prob > Chi^2)					928.8 (0.0)***				591.4 (0.0)***	
Adjusted Durbin-Watson							1.6		1.6	
Baltagi-Wu LBI							1.8		1.8	
Breusch and Pagan LM test (Prob > $Chibar^2$)					1.9 (0.084)*					
Hausman test – Chi^2 (Prob > Chi^2)			54.8 (0.0)***				41.6 (0.0)***			

* 10% level of significance.
** 5% level of significance.
*** 1% level of significance.
# fails to satisfy model assumptions.

Source: Compiled from Stata output (2017)

The final estimation that determined the impact of the GFC on NPLs is presented in Table 6.6. In this estimation, ROE is the measure for returns on the primary business of a bank, acting as a financial intermediary to generate income by granting loans. Under the assumption of first-order serial correlation, the AR(1) estimations were conducted for the FE and RE models. The FE estimation was the preferred model. The Hausman test was used to confirm that the FE was more appropriate, although the Breusch-Pagan LM also indicated that the RE model would be preferred when compared against the pooled OLS model, similarly so for the FE when reviewing the F-test statistic.

Table 6.7 introduces the structural change, the NCA, to the estimation results. The NCA was also incorporated into the earnings on loans, ROA and ROE bank success measurements.

Table 6.7: Earnings – NCA regression model

Model	$npl_{ti,t} = npl_{i,t-1} + capad_{i,t} + deposits_{i,t} + growth_{i,t} + liquidity_{i,t} + gsales_{i,t} + earnings_{i,t} + nca_{i,t}$									
	Pooled model		**Fixed effects model (Within)**		**Random effects model (FGLS)**		**Fixed effects model (AR1)**		**Random effects model (AR1)**	
	Coef.	P >|t|	Coef.	P >|t|	Coef.	P >|z|	Coef.	P >|t|	Coef.	P >|z|
$npl_{i,t-1}$	0.791	0.0***	0.511	0.0***	0.775	0.0***	0.487	0.0***	0.697	0.0***
$capad_{i,t}$	-0.043	0.037**	-0.013	0.527	-0.042	0.041**	-0.016	0.597	-0.036	0.09*
$deposits_{i,t}$	0.0	0.497	0.0	0.197	0.0	0.471	0.0	0.139	0.0	0.389
$growth_{i,t}$	0.009	0.5	0.017	0.2	0.009	0.487	0.01	0.453	0.009	0.484
$liquidity_{i,t}$	0.004	0.002***	0.009	0.0***	0.005	0.001***	0.013	0.0***	0.007	0.0***
$gsales_{i,t}$	-0.001	0.185	-0.001	0.331	-0.001	0.182	-0.001	0.398	-0.001	0.268
$earnings_{i,t}$	-0.001	0.958	0.008	0.573	-0.001	0.962	0.037	0.249	0.001	0.956
$nca_{i,t}$	1.809	0.039**	0.839	0.006***	1.835	0.033**	2.439	0.005***	1.855	0.027**
Constant	1.402	0.17	1.058	0.232	1.386	0.174	0.879	0.479	1.226	0.273
R-squared (Overall)	0.878		0.835		0.884		0.817		0.881	
R-squared (Within)			0.469		0.42		0.4		0.44	
R-squared (Between)			0.903		0.98		0.877		0.968	
F statistic (Prob > F)			13.48 (0.0)***				9.1 (0.0)***			
Wald Chi^2 (Prob > Chi^2)					904.0 (0.0)***				512.3 (0.0)***	
Adjusted Durbin-Watson							1.5		1.5	
Baltagi-Wu LBI							1.7		1.7	
Breusch and Pagan LM test (Prob > $Chibar^2$)					2.2 (0.068)**					
Hausman test – Chi^2 (Prob > Chi^2)			67.7 (0.0)***				24.1 (0.001)***			

* 10% level of significance.
** 5% level of significance.
*** 1% level of significance.
# fails to satisfy model assumptions.

Source: Compiled from Stata output (2017)

Table 6.7 presents the results of the Earnings – NCA regression model. The estimations return results indicated that both the FE and RE estimation models were preferred when compared to the pooled OLS estimation. The F-test statistic and Breusch-Pagan LM test statistic were all significant. Under the assumption of first-order serial correlation, that was caused as a result of the lagged dependent variable, the AR(1) estimation for the FE and RE models were incorporated in the estimations.

The adjusted DW test statistic was 1.5. An adjusted DW test statistic in the range from 1.5 to 2.5 indicates that there is no autocorrelation present in the AR(1) estimations (De Souza & Junqueira, 2005).

The estimation results in Table 6.8 present information on the ROA – NCA regression model.

Table 6.8: ROA – NCA regression model

Model	$npl_{ti,t} = npl_{i,t-1} + capad_{i,t} + deposits_{i,t} + growth_{i,t} + liquidity_{i,t} + gsales_{i,t} + roa_{i,t} + nca_{i,t}$									
	Pooled model		**Fixed effects model (Within)**		**Random effects model (FGLS)**		**Fixed effects model (AR1)**		**Random effects model (AR1)**	
	Coef.	P >|t|	Coef.	P >|t|	Coef.	P >|z|	Coef.	P >|t|	Coef.	P >|z|
$npl_{i,t-1}$	0.793	0.0***	0.521	0.0***	0.793	0.0***	0.506	0.0***	0.706	0.0***
$capad_{i,t}$	-0.046	0.026**	-0.011	0.603	-0.046	0.025**	-0.004	0.89	-0.037	0.078*
$deposits_{i,t}$	0.0	0.633	0.0	0.186	0.0	0.632	0.0	0.102	0.0	0.435
$growth_{i,t}$	0.004	0.75	0.016	0.222	0.004	0.749	0.005	0.708	0.008	0.557
$liquidity_{i,t}$	0.004	0.006***	0.009	0.002***	0.004	0.005***	0.011	0.0***	0.006	0.0***
$gsales_{i,t}$	-0.001	0.205	-0.001	0.327	-0.001	0.203	-0.001	0.361	-0.001	0.27
$roa_{i,t}$	0.102	0.295	0.054	0.658	0.102	0.293	0.117	0.377	0.039	0.717
$nca_{i,t}$	1.791	0.04**	2.332	0.006***	1.791	0.038**	2.383	0.006***	1.845	0.029**
Constant	1.22	0.233	1.323	0.209	1.22	0.231	1.304	0.267	1.164	0.299
R-squared (Overall)	0.885		0.835		0.885		0.812		0.882	
R-squared (Within)			0.469		0.419		0.398		0.439	
R-squared (Between)			0.903		0.984		0.87		0.971	
F statistic (Prob > F)	129.38 (0.0)***		13.5 (0.0)***				9.0 (0.0)***			
Wald Chi^2 (Prob > Chi^2)					1035.0 (0.0)***				537.0 (0.0)***	
Adjusted Durbin-Watson							1.5		1.5	
Baltagi-Wu LBI							1.8		1.8	
Breusch and Pagan LM test (Prob > $Chibar^2$)					0.0 (1.0)					
Hausman test – Chi^2 (Prob > Chi^2)			30.5 (0.0)***				-2.0 #			

* 10% level of significance.
** 5% level of significance.
*** 1% level of significance.
# fails to satisfy model assumptions.

Source: Compiled from Stata output (2017)

The pooled OLS was rejected. The F-test statistic and the Breusch-Pagan LM indicated that the FE and RE estimations were preferred compared to the pooled OLS estimation. The Hausman test rejected the null hypothesis, indicating that the FE estimation was preferred to the RE estimation. As a result of the first-order serial correlation caused by the lagged dependent variable, the AR(1) estimations were modelled. The adjusted DW-test statistic was 1.5, an indicator that no autocorrelation was present. This AR(1) estimations for the FE and RE did not satisfy the model assumptions for the Hausman test, rejecting the possibility of the Hausman test determining the adequate estimation between the AR(1) FE and AR(1) RE estimations. The final estimation models presented in Table 6.9 were conducted to determine the determinants of NPLs when the ROE and NCA were included as measurement instrument and structural change.

Table 6.9: ROE – NCA regression model

Model	$npl_{ti,t} = npl_{i,t-1} + capad_{i,t} + deposits_{i,t} + growth_{i,t} + liquidity_{i,t} + gsales_{i,t} + roe_{i,t} + nca_{i,t}$									
	Pooled model		**Fixed effects model (Within)**		**Random effects model (FGLS)**		**Fixed effects model (AR1)**		**Random effects model (AR1)**	
	Coef.	P >|t|	Coef.	P >|t|	Coef.	P >|z|	Coef.	P >|t|	Coef.	P >|z|
$npl_{i,t-1}$	0.799	0.0***	0.523	0.0***	0.783	0.0***	0.503	0.0***	0.697	0.0***
$capad_{i,t}$	-0.042	0.04**	-0.012	0.58	-0.041	0.044**	-0.003	0.913	-0.035	0.09*
$deposits_{i,t}$	0.0	0.437	0.0	0.202	0.0	0.423	0.0	0.123	0.0	0.393
$growth_{i,t}$	0.007	0.582	0.017	0.174	0.008	0.556	0.007	0.592	0.009	0.463
$liquidity_{i,t}$	0.004	0.004***	0.009	0.001***	0.005	0.002***	0.012	0.0***	0.007	0.0***
$gsales_{i,t}$	-0.001	0.201	-0.001	0.301	-0.001	0.196	-0.001	0.326	-0.001	0.265
$roe_{i,t}$	0.017	0.493	0.005	0.866	0.15	0.537	0.012	0.698	0.0	0.993
$nca_{i,t}$	1.879	0.033**	2.339	0.006***	1.899	0.028**	2.367	0.007***	1.85	0.029**
Constant	1.035	0.364	1.301	0.269	1.05	0.359	1.278	0.311	1.238	0.323
R-squared (Overall)	0.885		0.837		0.885		0.817		0.881	
R-squared (Within)			0.468		0.423		0.391		0.44	
R-squared (Between)			0.907		0.981		0.878		0.968	
F statistic (Prob > F)	128.69 (0.0)***		13.4 (0.0)***				8.7 (0.0)***			
Wald Chi^2 (Prob > Chi^2)					908.8 (0.0)***				509.5 (0.0)***	
Adjusted Durbin-Watson							1.5		1.5	
Baltagi-Wu LBI							1.7		1.7	
Breusch and Pagan LM test (Prob > $Chibar^2$)					1.8 (0.088)*					
Hausman test – Chi^2 (Prob > Chi^2)			62.0 (0.0)***				50.0 (0.0)***			

* 10% level of significance.
** 5% level of significance.
*** 1% level of significance.
# fails to satisfy model assumptions.

Source: Compiled from Stata output (2017)

Table 6.9 presents the ROE – NCA regression model. The pooled OLS model was strongly rejected with significant evidence from the F-test statistic and the Breusch-Pagan LM test. The results were respectively 13.4 (0.0***) and 1.8 (0.1*), an indication that both the FE and RE estimations were preferred estimations. The Hausman test was used to determine which estimation would be preferred between the FE and RE estimations, and the result indicated that the FE estimation was preferred. Due to the

assumption of first-order serial correlation, the autoregressive models were included for the FE and RE estimations. The adjusted DW statistics and the Baltagi-Wu LBI were 1.5 and 1.7, respectively, satisfying the notion of no autocorrelation.

From the estimations presented in Tables 6.4 to 6.9, the FE estimations were consistently identified as the most appropriate estimation of each one of the regression models. With the exception of the ROA – NCA model, the autoregressive model for the FE was accepted as satisfying the requirement for no serial correlation.

The determinants of NPLs that are not included as determinants relating to any of the hypotheses are discussed in the following sections.

6.3.2.1 *Non-performing loan ratio ($npl_{i,t-1}$)*

This study focused exclusively on the determinants of bank asset quality. The importance of bank asset quality should not be discounted. The asset quality is a key indicator for three groups, namely investors, depositors and regulatory authorities. Investors determine whether their risk-reward premium is adequate, based on the risk exposure provided by the NPL ratio (Trujillo-Ponce, 2013; Iannotta *et al*., 2007). Klomp and De Haan (2014) argued that the capital adequacy and regulatory interventions are predominantly as a result of banks that do not manage their NPLs properly. As a result of the effects of bank failures, depositors also take into account the riskiness of a bank, and although they do not study the asset quality, depositors prefer a safe haven for their surplus funds selecting banks that have a reputation for properly managing solvency and their asset quality (Joo, 2014).

The results from this study indicate a unilateral significance for all the models and estimations for the $npl_{i,t-1}$ (lagged NPL) coefficient. The NPLs show persistence as the one-year lagged NPL has a significant coefficient. This is not unexpected, as past studies (Buncic & Melecky, 2013; Jakubík & Reininger, 2013; Nkusu, 2011; Salas & Saurina, 2002) yielded a similar result. The influence of the one-year lagged NPL on NPL was found to be negative. This result was expected, because the NPL has a level of persistence, and this is understandable seeing that NPLs consist of loans that could be classified as substandard, doubtful or loss loans.

6.3.2.2 *Capital adequacy ratio ($capad_{i,t}$)*

The capital adequacy ratio provided significant results for the pooled OLS, RE and AR(1) RE models. With the exception of the autoregressive FE ROA – GFC and ROE – GFC estimations, all signs were negative for the capital adequacy coefficient. The coefficients for the autoregressive FE ROA – GFC and ROE – GFC estimations were almost 0 and did not provide results at any level of statistical significance. Interestingly, the Earnings – NCA, ROA – NCA and ROE – NCA models provided significant results at between 5% and 10%.

The estimation results provided significant evidence that the capital adequacy ratio would have a negative impact on the NPLs. South African banks have a reputation for being well capitalised and less susceptible to external shocks (Nikolaidou & Vogiazas, 2017). However, the literature on the influence of having a well-capitalised bank provided uncertainty on whether the capitalisation would benefit the banks, as Boudriga, Taktak and Jellouli (2010) found that a highly capitalised bank has higher levels of NPLs. Makri *et al*. (2014) observed the exact opposite, stating that low capital adequacy ratios increase NPLs. From the South African context, it could be derived that the high levels of capitalisation increased NPLs. This is inconsistent with the findings of López (2016) who observed that well-capitalised banks have better asset quality, perhaps indicating that the well-capitalised banks knew that they can absorb shocks to their asset portfolio because of being well capitalised.

6.3.2.3 *Total customer deposits ($deposits_{i,t}$)*

The impact that deposits have on the level of NPLs is of importance, due to deposits being the primary source of funds to generate loans, thereby providing an interest income on the loans (Al-Refai *et al*., 2013; Warue, 2013). Furthermore, a deterioration in asset quality leads to depositors withdrawing their funds from the bank, decreasing the ability of the bank to generate income from loans, as decreased deposits reduce the funds available for financial intermediation (Geletta, 2012; Gruben *et al*., 1999).

This study expected that deposits would have a negative influence on NPLs, similar to the findings in past studies (Cucinelli, 2015; Makri *et al*., 2014; Geletta, 2012). Unfortunately, deposits did not yield any proper results, as none of the coefficients were at a level of significance of 10% or lower. This is surprising because of the important role deposits have in a bank. This study can only speculate as to why such

results were not as expected. This is possibly the result of deposits that have to be divided and reallocated to capital and other liquid assets, as prescribed by the Basel requirements, before being funnelled into the intermediation function of a bank. This also provides more clarity on why researchers (Cucinelli, 2015; Geletta, 2012) often rather explored the ratio of loans to deposits, rather than only focusing on total customer deposits (Makri *et al*., 2014).

6.3.2.4 *Liquidity (liquidity$_{i,t}$)*

For the purposes of this study, liquidity was defined as the loans to deposits ratio (see Section 5.4.6). Although the influence of both the liquidity and total customer deposits might result in a query as to whether the same determinant was not evaluated twice, the difference between total customer deposits and liquidity has been determined as the difference between the amount of the deposits that were received and how efficiently they have transformed into an income-generating asset. Filip (2015) explained that the worst possible outcome for deposits that have been converted into loans, is a non-performance from the borrower, resulting in NPLs for the bank. Unlike total customer deposits, it was assumed that the liquidity would have a positive sign because the higher the ratio is for liquidity, the fewer funds a bank would have for additional liquid capital, as more funds would have been locked into credit agreements (Bunda & Desquilbet, 2008). Wu and Bowe (2012) averred that a high liquidity ratio increases the extension of riskier loans, while Al-Refai *et al*. (2013) stated that this would only be a concern if there is a poorly regulated banking environment.

The results from this study show that liquidity, unlike deposits, has a significant impact for almost all NPL models, indicating that liquidity has a definite negative effect on NPLs, as the sign for liquidity is positive and significant for all model estimations, except for the pooled OLS model for the Earnings – GFC model. For all other estimations, the level of significance is at 1%. The results are similar to those by Nikolaidou and Vogiazas (2017) who stated that this positive impact is mostly because banks incurred riskier behaviour when the liquidity ratio is at a low level, and this also results in a lessened ability to cover unexpected losses that result in higher NPLs.

6.3.2.5 *Credit growth (growth$_{i,t}$)*

Banks attempt to derive larger incomes from their loans to customers by increasing the volumes and size of loans. Al-Refai *et al*. (2013) explained that this is especially

true during periods of economic expansion when banks relax their credit policies as a result of the surge in funds that are available in the economy. Ak *et al*. (2013), however, observed that prudent banks would not fall into this trap and would only extend additional credit when the capital base and deposits grew. Ghosh (2015) explained that banks often reduce the interest charged on the loans offered to customers to increase the number of borrowers. The bank's competitive edge predominantly originates from their credit offerings, and a poor credit policy and over-extension of credit can result in an increase in NPLs (Erdinç & Abazi, 2014; Joo, 2014).

Even though the coefficient was small, this study found that credit growth had an insignificant positive and negative impact on NPLs. The negative sign was generated by the models that were estimated for the GFC. The remainder of the models had a positive sign, namely, the NCA models and the macroeconomic and microeconomic determinants' model. With such a small and insignificant impact, the interpretation of the results may be considered as speculative. However, it is deemed necessary as the negative sign may have indicated the prudent management of South African banks that do not engage in risky activities to grow their assets to derive additional income. This is unfortunately only true for the GFC models. The remainder of the models yielded a positive sign. The positive sign implies that NPLs increased as additional credit was extended to customers. However, with the near 0 coefficients, the interpretations only provided insight into what might have influenced NPLs, as the credit growth did not have a significant impact on NPLs.

This section above discussed the microeconomic determinants that are not directly associated with any of the hypothesis statements. The next section discusses determinants that are associated with the hypothesis statements and provides information on the objectives that are identified in this study.

6.3.3 Discussion of determinants relating to the hypotheses

This discussion reports on the estimation results as presented in Tables 6.4 to 6.9. The focus of this discussion is limited to the variables that are considered to inform on the hypotheses and are able to provide information to achieve the research objectives of this study. The variables that are discussed are the gold sales, GFC, NCA, interest income on loans, ROA and ROE.

6.3.3.1 *Gold sales ($gsales_{i,t}$)*

Gold sales in South Africa form part of the primary commodity export market. Banks finance mining activities in South Africa. A study by Fofack (2005) reported that banks that have significant exposure in the financing of commodities produced in a country, experience increased NPLs when shocks occur in the commodities market. Kinda *et al*. (2016) reported that, although the banks in such a position might have had increased NPLs, it would be to a lesser extent in countries that have an adequate regulatory environment. Nikolaidou and Vogiazas (2017) stated that South Africa has significant exposure to gold price volatility as a gold exporter.

Although Senawi and Isa (2014) expected a positive relationship between gold and NPLs, their results indicate a negative relationship. The Earnings – GFC model returned a significant positive coefficient at a 10% level of significance for the autoregressive FE estimation model. The FE estimation for both the Earnings – GFC and the ROA – GFC estimations returned coefficients significant at a 10% level of significance. Although the models that incorporated the NCA as a structural change determinant did not yield significant results, the coefficients for these estimations were negative. The negative impact of gold sales on NPLs is easily explained, as an environment where gold has a higher price would result in additional income, allowing borrowers to service debts more easily (Nikolaidou & Vogiazas, 2017). In contrast to Nikolaidou and Vogiazas (2017), Damankah *et al*. (2014) explained that an increase in income from gold sales can cause banks to enter into riskier lending activities to finance commodity agreements.

The studies that include gold as a determinant of NPLs (Nikolaidou & Vogiazas, 2017; Havrylchyk, 2010; Senawi & Isa, 2014) only made use of macroeconomic determinants, and did not include any microeconomic determinants. These studies also reported conflicting results, for example, Senawi and Isa (2014) found a positive coefficient, but they used the market price of gold as the asset quality determinant. Nikolaidou and Vogiazas (2017) reported a negative coefficient, but their study only considered the gold production in South Africa as the asset quality determinant. Havrylchyk (2010) reported a negative coefficient and used the spot market price of gold. Interestingly, Havrylchyk (2010) also stated that South Africa is in a prime position to benefit from the commodity boom post the 2000s, but unfortunately the South African gold exports have declined from 40% in1994 to less than 10% in 2008.

This is a strange phenomenon, because gold was the asset of last resort during the GFC.

6.3.3.2 *GFC descriptor*

The GFC had more of a negative impact on developed economies than on EMEs (Nkusu, 2011). The South African banking environment was not directly impacted by the GFC, because the banks were adequately capitalised, liquid and modestly leveraged. However, unfortunately the impact of the GFC trickled into the economy through the exchange rate depreciation and international trade linkages (Nikolaidou & Vogiazas, 2017). Table 6.10 is a summary of the results produced from the different regression models.

Table 6.10: Summary of all GFC coefficients

	Pooled model		**Fixed effects model (Within)**		**Random effects model (FGLS)**		**Fixed effects model (AR1)**		**Random effects model (AR1)**	
	Coef.	P >|t|	Coef.	P >|t|	Coef.	P >|z|	Coef.	P >|t|	Coef.	P >|z|
Table 6.3 $gfc_{i,t}$	-2.565	0.36	-2.048	0.404	-2.565	0.358	-1.857	0.365	-2.323	0.271
Table 6.4 $gfc_{i,t}$	1.736	0.011**	1.601	0.002***	1.728	0.002***	1.657	0.006***	1.604	0.005***
Table 6.5 $gfc_{i,t}$	1.673	0.004***	1.631	0.002***	1.673	0.004***	1.643	0.009***	1.58	0.006***
Table 6.6 $gfc_{i,t}$	1.732	0.003***	1.66	0.002***	1.732	0.002***	1.702	0.006***	1.627	0.005***

Source: Compiled from Stata output (2018)

Interestingly, the results from this study (GFC coefficients reproduced in Table 6.10) indicate a negative coefficient (no level of significance) and a positive coefficient (<5% level of significance) for estimations that included macroeconomic and microeconomic determinants and for microeconomic determinants only, respectively. These results show that the GFC had a negative relationship with NPLs, indicating that NPLs did not increase as a result of the GFC. However, the macroeconomic determinants were included in this estimation and it was not focused on bank-specific influences.

The bank-specific results provided a positive coefficient for all estimations, and the preferred estimation model for the Earnings – GFC, ROA – GFC and ROE – GFC was the autoregressive FE model which had a coefficient at a 1% level of significance. This result indicates that when only microeconomic determinants were considered, the banks showed an increase in NPL. This is in agreement with Nkusu (2011) and Škarica

(2014) who stated that there is a negative influence on the EME, and that the reduced liquidity has a lingering impact on NPLs. Erdinç and Abazi (2014) warned that the lingering impact of the GFC on NPLs may reduce the growth in the economy and the banking sector as a result of credit stagnation. Although South African banks showed a weakened state as a result of the GFC, the NCA that was implemented before the GFC might have reduced the impact of the GFC.

6.3.3.3 *NCA descriptor*

The NCA that was enacted in South Africa has the purpose of changing the risky lending practices of financial institutions, and aims to limit the ability of financial providers to give loans to individuals who might not be able to repay their debt (RSA, 2006). Klomp and De Haan (2014) stated that regulations can contribute to the reduction of NPLs in developed economies, but because of the prevalence of high levels of corruption, lawlessness and poorly enforced contractual obligations in EMEs, regulations cannot have the same effect. Chilukuri *et al*. (2016) also stated that the bank asset quality would only improve if the bank managers effectively implemented the reformed policies. According to Nikolaidou and Vogiazas (2017), recent changes in macroeconomic policies in many SSA countries have improved the economic prospects of the countries.

Once again, similar to the GFC models, the model that included the macroeconomic and microeconomic determinants produced no coefficients that were of any significance, while the microeconomic and NCA models produced results that were significant at the 5% level of significance. The preferred estimation for these models was the autoregressive FE estimation. The results for this AR(1) FE estimation presented a positive coefficient for econometric models but only showed a level of significance at 1% for the Earnings – NCA, ROA – NCA, and ROE – NCA models. This is strange, as the expectation was that the NCA would reduce NPLs. A negative coefficient, as per the expectation, was only obtained for the pooled OLS, RE and AR(1) RE estimations of the macroeconomic and microeconomic determinant model but the coefficients did not show any level of significance.

The estimation results may indicate that it is necessary to consider the notion that EMEs do not benefit from regulatory changes due to the poor enforcement of the regulations, as stated by Klomp and De Haan (2014). The current study, however,

rejected this notion, because, based on the literature, South Africa is said to have a well-developed financial system that can compete with developed economies (Botha & Makina, 2011; Erasmus & Makina, 2014; IMF, 2008). However, the persistence of NPLs has been established, and the NCA put an end to further reckless credit extensions. Therefore, the persistence of previously granted NPLs may have resulted in the positive coefficient. In addition, Salas and Saurina (2002) expected a positive coefficient in their research, as they anticipated that the persistence of NPLs would cause the regulation to increase the NPLs. Erdinç and Abazi (2014) stated that NPLs are lower in a strong judicial and legal environment. However, a study by Galloway, Lee and Roden (1997) found that the effectiveness of regulations were sometimes incorrectly attributed to the decline in NPLs, while it was in fact the macroeconomic changes such as interest rates, bank profitability and changes in bank risk appetite which were more likely to be the reason for declining NPLs.

6.3.3.4 *ROA descriptor ($ROA_{i,t}$)*

The return on asset measurement is an appropriate measure of bank profitability related loans because the largest source of income of a bank is generated from interest earned on loans (Ongore & Kusa, 2013). The ROA is also an indicator of the ability of management to efficiently manage the assets in order to yield the maximum income from these assets (Nikolaidou & Vogiazas, 2017). The majority of studies (Berger & DeYoung, 1997; Ghosh, 2015; Messai & Jouini, 2013) stated that the ROA would have a negative impact on NPLs. Although this study aligned its expectation with those studies, it did not yield similar results.

The estimation results of the ROA determinant of NPLs is presented in Tables 6.3, 6.5 and 6.8. None of the results provided coefficients that presented a level of significance, and all the coefficients from the preferred model, the autoregressive FE model, had a positive coefficient. Although, without a high level of significance, the estimation for the ROA – GFC model returned a negative coefficient. This is interesting, because Gualandri and Noera (2014) found that the ROA ratio and the ROE ratio did not provide accurate results during times of crisis. By contrast, the positive coefficient for the preferred model could be as a result of highly profitable banks that did not engage in sufficient lending activities, resulting in the deterioration of NPLs (Makri, 2016). Khumalo (2017) reported that, despite the challenging South African financial market environment, the top banks remain profitable. The motivation from Makri (2016) for a

positive coefficient ROA determinant, in contrast to the negative coefficient ROA determinant, was accepted as a more accurate representation of the economic circumstances that South African banks operated in.

6.3.3.5 *ROE descriptor ($ROE_{i,t}$)*

The ROE estimations delivered deeper insight into the impact that operational efficiency and managerial behaviour have on NPLs. Makri *et al*. (2014) and Louzis *et al*. (2012) used the ROE as a proxy for managerial behaviour. Makri *et al*. (2014) reported that the negative relationship between NPLs and ROE was the result of reduced profitability, stating that because profitability deteriorated, certain management behaviour would be inclined to enter into riskier lending activities, consequently increasing NPLs. This is known as the 'Bad management' hypothesis in their study. Klein (2013) reported that a higher ROE ratio would lower NPLs, suggesting that a bank is better managed because no moral hazard exists when banks are profitable.

This study did not yield results that are significant at a 10% level or lower for any of the estimations that include ROE as a determinant of NPLs. However, it is interesting to find that the estimation results from the preferred autoregressive FE estimations yielded the expected negative coefficients for the model presented in Equation 4.6, the all variables regression, and for Equation 4.11, the ROE – GFC regression. However, for the ROE – NCA regression, illustrated in Equation 4.12, the ROE had a positive coefficient. The negative coefficient indicates that the NPLs would decrease as the ROE ratio increased, enforcing the results from Louzis *et al*. (2014), Makri *et al*. (2014), and Klein (2013) that better management reduces NPLs, because the higher profitability that is earned by a bank does not encourage risky behaviour, as the bank is already generating profits.

The positive coefficient for ROE as a determinant of NPLs remains a stumbling block, as researchers (Louzis *et al*., 2014; Makri *et al*., 2014; Klein, 2013) have provided adequate motivation for the significant negative coefficient that was obtained in their studies on NPLs. Anderson and Fraser (2000) concluded that managerial aspects influence the risk appetite of a bank, however, they included the impact of regulation in their research on the risk-taking behaviour of banks. Anderson and Fraser (2000) found that the introduction of new legislation that was designed to reduce risky bank

behaviour did not return the anticipated result, and in certain cases where there were substantial managerial equity holdings, the management showed even riskier behaviour when new legislation was introduced. Earlier, Galloway *et al*. (1997) concluded that risk reduction did not have the required outcome when new legislation was introduced. Bearing in mind that the regression, Equation 4.12, is an ROE – NCA estimation, the positive coefficient is understood in the South African context as a result of the introduction of the NCA.

6.3.3.6 *Earnings descriptor (earnings$_{i,t}$)*

The study by Ofori-Abebrese, Pickson and Opare (2016) provided an example of how revenue streams are measured when they stated that ROE and ROA measure the income on bank assets. However, Ifeacho and Ngalawa (2014) averred that interest income on loans is a better measure of bank income, because ROA and ROE include all profits and also measures the income from the diverse investments that banks make. Diversification in bank income results in a potential agency problem, as the focus on non-interest income diversification causes deteriorating loan quality (Abedifar, Molyneux & Tarazi, 2018). Tsumake (2016) explained that interest income on loans includes the traditional income generated by banks, thus only interest income on loans and investments. The earnings on loans have an expected positive relationship because banks extend credit, based on the risk profiles of the borrowers (Islam & Nishiyama, 2016).

This study assumed that the interest income on loans has a positive relationship with NPLs. This study found the same as Islam and Nishiyama (2016) that the interest income on loans determinant does not produce significant results. However, the autoregressive FE model, which was the preferred regression estimation for all three the models that used the interest income on loans as a determinant of NPLs, returned a positive coefficient. The sign was similar to the anticipated sign of the interest income on loans determinant. With the theory in mind, the positive relationship might be a result of the higher interest charged for riskier lending activities, an example of the ‘risk-return’-principle where a premium is expected, based on the alternative investment opportunities (Merton, 1973). However, Abedifar *et al*. (2018) found that banks with more than $1billion in assets tend to cross-subsidise their banking income with diverse income sources, offering lower interest rates and reduced NPLs because

of the lowered interest rates. The results from this study do not support the relationship described by Abedifar *et al*. (2018).

6.3.4 Asset quality income measurement alternatives

Three different profitability determinants were included in the modelling of the determinants of NPLs. These profitability determinants are the ROA, ROE and interest income on loans. The results pertaining to the impact that these determinants have on NPLs show substantial differences, with some estimations presenting positive coefficients, and other coefficients having a negative impact, indicating that the profitability determinants do not have a similar impact on NPLs (see Section 6.3.3.4, 6.3.3.5 and 6.3.3.6).

The ROA and ROE have been found by various studies (Ghosh, 2015; Klein, 2013; Louzis *et al*., 2012; Messai & Jouini, 2013) to provide significant information as a determinant of NPLs. Gualandri and Noera (2014) recommended that a different profitability measurement should be included, as the ROE ratio and the ROA ratio are not the best determinants of NPLs, especially during times of financial crisis. Table 6.11 and 6.12 summarise the R^2 for the preferred autoregressive FE estimations that model the relationship between the Earnings – GFC, ROA – GFC, ROE – GFC and the Earnings – NCA, ROA – NCA, ROE – NCA, respectively.

Table 6.11: GFC determinant – autoregressive fixed effect estimations

	R^2 (Overall)	R^2 (Within)	R^2 (Between)
Earnings	0.867	0.425	0.936
ROA	0.867	0.415	0.867
ROE	0.863	0.414	0.931

Source: Compiled from Stata output (2017)

Table 6.11 presents information on the R^2 for the Earnings – GFC, ROA – GFC and ROE – GFC autoregressive FE estimations. The results contain the information of the overall, within and between R^2 determination statistics. Although the overall, between and within estimation R^2 coefficients are reported, the within result is the most important in the comparison to determine which determinant would yield a higher level of explanation of NPLs. This is because the between result describes how well the determinant explains NPLs across the panel of banks, while the within describes how

well the determinants (earnings, ROA and ROE) from the panel of banks explains NPLs. The overall result is only a weighted average of the between and within results. The R^2 coefficient indicates that for the industry-specific regression models of the impact that the GFC has on NPLs, the interest income (earnings) on loans determinant yielded the highest level of explanation, with a coefficient of 0.425.

Table 6.12: NCA determinant – autoregressive fixed effect estimations

	R^2 (Overall)	R^2 (Within)	R^2 (Between)
Earnings	0.817	0.4	0.877
ROA	0.812	0.398	0.87
ROE	0.817	0.391	0.878

Source: Compiled from Stata output (2017)

Table 6.12 presents similar information to that presented in Table 6.11, with the exception that it applies to the regression models that attempted to identify the determinants of NPLs for the Earnings – NCA, ROA – NCA and ROE – NCA coefficients. The results show that the interest income on loans is the superior determinant when assessing the explanatory power with an R^2 coefficient of 0.4. However, similar to the previous result, the interest income (earnings) on loans did not yield excessively better results, as the ROA and ROE returned R^2 coefficients of 0.398 and 0.391 respectively.

These results provide an interesting perspective on an alternative for financial performance measurements of banks when establishing the determinants of NPLs. These results indicate that the measurement of interest income (earnings) on loans did provide better information as to the level of explanation of NPLs, and could indicate that the additional assets and profits reported by banks in their diversification approach could reduce the explanatory power when modelling the determinants of NPLs. However, the R^2 coefficients are only slightly lower for the ROA and ROE, indicating that South African banks received the largest portion of their income from the interest income (earnings) on loans.

6.4 SUMMARY

This chapter presented interesting results from the descriptive statistics and regression analyses. The descriptive statistics show how the NPL ratio of South African banks are managed. Capitec Bank shows unique results with their consistent reduction in NPLs, even during the GFC, however, Capitec Bank still has an NPL ratio above 5% which may be regarded as high risk. The descriptive statistics also show that the macroeconomic determinants have the same impact on all banks within South Africa, however, this is not unexpected as this is a single-country study. Lastly, the correlation matrix, the final descriptive result, shows that the NPL ratio only has a high correlation with the lagged NPL ratio, and a moderate correlation with the liquidity, while the remaining determinants all have a low correlation.

The regression results show that NPLs have a significant relationship with a number of determinants. Both the GFC and the NCA have a positive relationship with NPLs, indicating that South Africa has exposure to times of financial crisis and that regulatory changes do not immediately yield the assumed effect. The lagged NPL ratio, capital adequacy ratio and liquidity also have a significant relationship with NPLs. The inclusion of interest income on loans resulted in estimations that deliver a better fit, motivating that the ROA and ROE do not have the explanatory power that interest income on loans have. The interesting results from this chapter present an introduction to the conclusion chapter, as the results enabled interpretations and conclusions on the research objectives and hypothesis statements. This conclusion is presented in Chapter 7.

CHAPTER 7: SUMMARY, CONCLUSIONS AND DIRECTION FOR FUTURE RESEARCH

7.1 INTRODUCTION

The empirical results enabled the realisation of the research objectives of this study. The objective of this chapter is to provide a summary of this study. In addition to the summation of this study, this chapter also provides information on the achievement of the research objectives and its contribution to the body of knowledge, as well as the limitations of this study. In summary, this chapter aims to present readers the opportunity to develop their knowledge and enable advancements in the field of bank asset quality.

The conclusion reiterates the purpose of the research in Section 7.2. Section 7.3 summarises this study, explaining the theoretical, methodological and empirical findings. The contribution follows the summary of the results in Section 7.4, the recommendations stemming from the contribution of this study in Section 7.5, followed by the limitations of this study, which is presented in Section 7.6. Future research is suggested in Section 7.7, before the conclusion chapter is summarised in Section 7.8.

7.2 RESEARCH PURPOSE

Bank asset quality has a significant role in an economy, with bank asset quality being a key indicator of financial distress or potential economic crisis (Messai & Jouini, 2013). For this reason, it is important to understand which determinants have an adverse impact on the asset quality of banks.

Past studies on the determinants of bank asset quality include a range of microeconomic and macroeconomic determinants for a set of countries, with only a few of these studies focusing on a single country (see Section 3.1). From these studies, the importance of studying the impact of the macroeconomic and microeconomic determinants has become clear, however, structural changes and breaks also have an impact on the bank asset quality. In the South African context, these structural changes are the GFC, NCA and the commodity boom period. Each

one of these structural changes has a different impact on asset quality, especially from a single EME country context.

The GFC did not impact EMEs to the same extent that it impacted developed economies that suffered severe losses as a result of the GFC (Nkusu, 2011). Nikolaidou and Vogiazas (2017) stated that the EME's exposure to the GFC was the result of the transmission of the crisis from the developed economies. Erasmus and Makina (2014) stated that the South African banks did not experience a severe impact from the GFC because of the conservative regulatory environment.

The South African regulatory environment is ever-evolving (see Section 2.5). Part of the changes in the regulation included the introduction of the NCA. The NCA has limited the reckless credit extensions that banks were guilty of before the introduction of this Act. The impact of this structural change has not previously been determined, and it was recommended by Chipeta and Mbululu (2012) that the impact of the NCA on bank credit had to be evaluated.

The third structural break, the commodity boom cycle led to the inclusion of another determinant of asset quality, namely gold sales. This is because South Africa is one of the top gold producers in the world. Although the commodity boom is a structural change, the country still has an abundance of gold reserves. Banks have credit exposure to gold in the form of loans that have been granted to mining firms, establishing the need to determine the impact that gold sales have on bank asset quality, because the income from gold sales enables the organisations that borrowed funds from banks to repay these funds. As South Africa is an EME, private companies have to obtain funds from banks because the development of capital markets is not on par with that of developed economies (Mullineux, 2006).

It is interesting to note that previous asset quality studies have not yet tested which profitability measure is superior when assessing asset quality determinants. Past studies (see Section 3.1) used ROE and ROA as profitability measures, and as measures of management ability. Erdinç and Abazi (2014) concluded that ROA and ROE yield similar results as asset quality determinants, which is in contrast with the findings by Moussu and Petit-Romec (2014) who do not share this view. It is strange that these determinants are included, because the primary income of a bank is generated from the interest income on loans (Ifeacho & Ngalawa, 2014). Gualandri

and Noera (2014) recommended that a different measurement of profitability should be used, which led to the inclusion of interest income on loans as a measure of asset quality.

The purpose of this study is to contribute to the knowledge of the determinants of bank asset quality in South Africa, an African EME. The purpose posed five distinct topics in conducting this study, firstly, to research the macroeconomic and microeconomic determinants of asset quality from a single African EME country, South Africa. Secondly, to determine the resilience against the GFC from a South African perspective. Thirdly, to establish the impact of the NCA on asset quality. Fourthly, stemming from the commodity boom cycle, to assess the impact of gold sales on bank asset quality, and lastly, to determine if interest income on loans is the superior profitability measure.

7.3 SUMMARY OF RESULTS

The summary of results explains how the purpose of this study was satisfied. The summary of results is informed from a literature contribution, a methodological contribution and an empirical contribution perspective.

7.3.1 Theoretical insights

The theoretical insights provide information on current theories, and proposes slight adaptions to improve the existing knowledge on bank asset quality studies. The theoretical insights motivate gold sales as a determinant of NPLs, explain the impact of GDP growth on NPLs, and promote the South African regulatory environment.

Senawi and Isa (2014) introduced the spot price of gold as a determinant of NPLs in Malaysia. However, the interaction that the spot price has with NPLs is similar to the relationship that the exchange rate has with NPLs (Senawi & Isa, 2014). Gold sales have been identified as a more relevant measure to determine how the gold price interacts with NPLs. This theory is partially supported by Nikolaidou and Vogiazas (2017) who used the measure of gold output as the determinant of NPLs. However, the gold sales from a country provide more information as a determinant of NPLs because it accounts for the price at the output level instead of only measuring a daily change in the spot price of gold, or total the level of production output.

The GDP growth is an established determinant of asset quality (see Sections 1.3.4, 2.2.2, 3.2.1). The countercyclical relationship between the business cycle and NPLs exists because the availability of funds determines the ability of the debtor to comply with their contractual repayment obligations. However, irrespective of this well-established countercyclical relationship, Laeven and Majnoni (2003) found that the impact of this relationship might be different amongst different countries (see Section 5.4.9), motivating the need to employ this measure of bank asset quality for a multi-country study.

The GDP of a country is one of the key determinants in classifying a country as a developed, emerging or frontier market. Each of these types of markets is associated with specific attributes. South Africa is an emerging market. As a result, the financial regulations in South Africa are associated with those of other EMEs. Klomp and De Haan (2014) stated that EMEs often have high levels of corruption, lawlessness and low levels of contract enforcement. The South African financial sector is not associated with these types of lawlessness, to the extent that the IMF (2008) stated that South Africa has financial regulations that are on the standard of developed markets. Nikolaidou and Vogiazas (2017) reported that macroeconomic changes in SSA countries have improved the economic opportunities in these countries. The South African financial regulatory environment undergoes consistent development to keep its status as a high-calibre regulatory environment with the prudential regulator keeping abreast with leading international regulatory practices (see Section 2.5).

Considering this theoretical contribution, theories underpinning assumptions about the determinants of NPLs in EMEs have been expanded. The expansion of theory motivates consideration for unique country circumstances when asset quality determinants are studied.

7.3.2 Methodological approach

This study employed an established methodology to study the determinants of South African bank asset quality. The independent variables that this methodology employed were the lagged values of asset quality, macroeconomic variables, microeconomic variables, and structural breaks that were presented as dummy variables, while the dependent variable was asset quality (see Section 4.5). A unique methodological approach was followed to collect the data used in this bank asset quality study.

Unlike in past studies (Alhassan *et al*., 2014; Beck *et al*., 2015; Damankah *et al*., 2014; Fofack, 2005; Osei-Assibey & Asenso, 2015; Warue, 2013), the data was obtained in an aggregate format, from publically available sources and spline regression techniques were run to create a balanced dataset for the panel data regression models (see Sections 4.3.3, 4.5). Most statistical analysis software packages can process the computational changes that unbalanced panels require, however, few studies complete their panel datasets to utilise a balanced panel (Park, 2011). Unfortunately, this is to the detriment of the analysis, as balanced panels deliver more accurate results, because no observations are missing from a dataset (Park, 2011).

This methodological approach can enable possible research opportunities on bank asset quality in South Africa and other countries where public data is difficult to obtain. Data availability is a common concern when asset quality studies are conducted. Additionally, it also enables researchers to estimate regressions more accurately when incorporating a balanced panel approach.

7.3.3 Hypothesis findings

The hypothesis findings are a summary of the empirical results that assist in achieving the research objectives of this study. In the execution of the methodological approach, using different panel model specifications and regression models (see Sections 4.6, 4.8) this study fulfilled the research objectives and presented robust regression results.

7.3.3.1 *Hypothesis 1*

Hypothesis 1: South African bank asset quality showed resilience against the global financial crisis

The results from three models show a significant impact between the NPLs and GFC (see Section 6.3.3.2). This impact is, however, positive and rejects the hypothesis that South African bank asset quality was resilient against the GFC. This contradicts the findings by Erasmus and Makina (2014) that South African banks showed resilience in the wake of the GFC. For this reason, this hypothesis confirms that the GFC impacted South African bank asset quality, although South Africa and other EMEs generally had less exposure to the deterioration of asset quality during the financial

crisis. This acknowledges the notion that international trade linkages cause the transfer of a global financial crisis.

7.3.3.2 *Hypothesis 2*

Hypothesis 2: South African gold sales improve bank asset quality

The determinant gold sales provided information on the theoretical knowledge about the determinants of bank asset quality, but surprisingly the hypothesis was rejected. Although this determinant only has a small positive relationship with asset quality, it is significant (see Section 6.3.3.1). This relationship indicates that during the GFC, the gold sales reduced the quality of South African bank assets. In retrospect, this relationship is evident, as gold is the asset of last resort during times of financial crisis, but unfortunately, this relationship did not support this hypothesis.

7.3.3.3 *Hypothesis 3*

Hypothesis 3: The South African National Credit Act No. 34 of 2005 (NCA) improves bank asset quality

The NCA forms part of the regulatory changes in South Africa and motivates the theoretical insight that South Africa has a financial regulatory environment similar to that of developed economies. However, this hypothesis that the NCA improves bank asset quality was rejected. Significant results show that the NCA reduced the asset quality of banks in South Africa (see Section 6.3.3.3). The expectation of this study that the NCA would improve the asset quality of South African banks was derived from the purpose of the NCA. However, similar to Salas and Saurina (2002) this study should have assumed the relationship between the new regulations and NPLs would be negative because of the persistence of NPLs and the reduction in new credit extensions (see Section 6.3.3.3). This resulted in banks having stricter credit extension policies, although the bank was stuck with assets that were awarded due to previous lenient credit policies.

7.3.3.4 *Hypothesis 4*

Hypothesis 4: Earnings on loans is a superior indicator of non-performing loans in comparison with return on assets

ROA is a well-established measure of bank profitability. However, the ROA includes all income-generating assets in the measure of profitability (see Section 2.4.1). The ROA and interest income (earnings) on loans do not present any significance as determinants of South African bank asset quality, but the overall fit of the estimation is better when interest income replaces the ROA in bank asset quality estimations. This supports the recommendation of Gualandri and Noera (2014) who stated that a different measure of profitability should be used in asset quality studies. The inclusion of interest income on loans is the most appropriate measure of profitability of bank assets, as the primary asset of a bank is the loan portfolio.

7.3.3.5 *Hypothesis 5*

Hypothesis 5: Earnings on loans is a superior indicator of non-performing loans in comparison with return on equity

The statement by Erdinç and Abazi (2014) that ROE and ROA yield similar results in asset quality studies motivated the inclusion of ROE as an alternative measure of bank profitability. The ROE determines the value for shareholders, as the net income distributable to shareholders is measured by this ratio (see Section 5.4.4). This measure of profitability still supports the statement by Gualandri and Noera (2014) that alternative profitability measures could yield better results as asset quality determinants. Although the ROE was an insignificant determinant of asset quality in this study, the overall fit of the estimation improves when earnings on loans are compared to the ROE. This fit indicates that the earnings on loans have superior explanatory powers when they replace either ROA or ROE.

The determinants GFC, NCA, ROA, ROE and gold sales provide interesting new perspectives on the relationship that asset quality has with structural changes, profitability measures and commodity exports. These theoretical, methodological and empirical findings provide the foundation of the contribution to bank asset quality knowledge.

7.4 CONTRIBUTION

The summary of results provides new insights on bank asset quality in an EME from a theoretical, methodological and empirical perspective. This study makes a six-fold contribution. The empirical analysis allows for an analysis of the macroeconomic and microeconomic determinants of bank asset quality in South Africa. From a domestic perspective, the impact of the GFC and NCA were studied. Moreover, to further contribute to the knowledge on bank asset quality on an international level, the results pertaining to the commodity exports, gold sales, and profitability measures were presented. This study used public information obtained from annual reports, BankScope, StatsSA and the SARB to contribute to the methodological approach used in bank asset quality studies. The new evidence presented in this single-country EME study recontextualises findings that are consistent with those of multi-country studies.

Firstly, the macroeconomic and microeconomic determinants show that GDP growth, lagged NPL ratio, liquidity and capital adequacy ratio impacted the South African bank asset quality. The lagged NPL ratio, the liquidity and the capital adequacy ratio caused bank asset quality to deteriorate. The influence of the lagged NPL ratio indicates that NPLs also have a level of persistence, irrespective of the SARB directive that allowed banks to write off loans at an increased rate (SARB, 2014). Liquidity, which is measured as the loans to deposits ratio, shows that as the South African banks' loans to deposit ratio increased, so did NPLs. This indicates that the maturity transformation of deposits does not necessarily lead to the extension of credit to borrowers who repay loans as per their contractual agreement. According to Filip (2015), this is the worst outcome for a bank when granting loans. The capital adequacy ratio also has a negative influence on NPLs, showing that the well-capitalised banks entered into riskier loans. Although interest rates did not produce significant results, it did lead to an interesting finding on the South African monetary transmission period. During periods of GDP growth, bank asset quality reflected the impact of the interest rates quicker in comparison with periods of GDP contraction (Matemilola, Bany-Ariffin & Muhtar, 2015). This finding enables South African banks to adjust their credit extension practices that are dependent on the economic cycle.

Secondly, contrary to the expectation, the South African bank asset quality was not resilient against the GFC. The GFC had a significant impact, and this resulted in

increases in the NPL ratio during the GFC. This is in contrast to the finding of Erasmus and Makina (2014) who stated that South African banks weathered the impact of the GFC. Other studies (Adiningsih, 2011; Jeasakul *et al*., 2014) supported findings that conservative banking practices reduced the impact of the GFC, however, unfortunately as a result of global trade linkages, the impact of the GFC trickled through to all economies (Nikolaidou & Vogiazas, 2017). Regulations may reduce the impact of global economic shocks, but it cannot completely protect the economy as a result of globalisation.

Thirdly, regulations do not always immediately translate into the envisioned outcome. The South African NCA may have been successful at reducing reckless credit extension, but it did not improve the bank asset quality. It was assumed that the improved credit regulations would only allow credit extension to borrowers who would service their debt, but the significant positive relationship indicates that the NCA increased NPLs. Anderson and Fraser (2000) stated that stricter regulations often result in decreased bank asset quality, which is strange as South Africa has a financial regulatory environment which competes with developed markets (IMF, 2008). In addition, properly regulated markets generally have lower levels of NPLs (Erdinç & Abazi, 2014).

Fourthly, the primary commodity export of a country contributes to both theory and empirical results. From a theoretical perspective, the primary commodity that is exported from a country should be a determinant of bank asset quality. However, unlike past studies (Jang & Kataoaka, 2013; Senawi & Isa, 2014) the commodity determinant should not be measured as the spot price of the commodity but rather as the sales value at the time of export. Nikolaidou and Vogiazas (2017) used the output levels of gold, but did not account for the spot price of gold in their study of South African bank asset quality. This study did not find prior studies that included the export value of gold sales as a determinant of bank asset quality. In addition to the proposition that the sales value of a commodity, in this study gold, be used as a determinant of bank asset quality, this study found that gold sales have a significant impact on bank asset quality. The significant positive impact that gold sales have on NPLs is easily explained by the potential exposure that banks have to the commodities market in the form of loans to commercial borrowers. Gold sales also produced insignificant negative results when the GFC was excluded from the estimation, indicating that asset

quality may improve as a result of gold sales during non-crisis periods. As a determinant of bank asset quality, the export value of a commodity in a country does have an impact on NPLs.

Fifthly, bank asset quality profitability measures have been presented as the ROA and ROE (see 5.4.3, 5.4.4). However, these profitability measures do not account for only the income earned from the loans granted by a bank. This study introduced the interest income on loans as an alternative measure of profitability, as recommended by Ifeacho and Ngalawa (2014). All estimations that use the interest income on loans as a profitability measure have an improved fit (R^2). Although the fit increased marginally, it proves that interest income on loans is a better measure of profitability. However, in countries where loans generate the primary income of a bank, the ROA and ROE would yield results that are almost similar to that of interest income on loans. If the income does not primarily consist of interest income on loans, the ROA and ROE would not be the most accurate profitability measures of the quality of interest income on loans.

Lastly, this study made use of a balanced panel for the bank asset quality estimations. Louzis *et al*. (2012) stated that no standardised approach to bank asset quality studies is available. This study found that although statistical packages can compute the computational changes required to utilise an unbalanced panel, spline regression techniques can just as easily be incorporated to create a balanced panel. Even when proprietary databases are used, these databases do not always have complete information. Applying spline regression completes the unbalanced panel, and subsequently produces more accurate results (Park, 2011). This can be done for both single-country and multi-country studies, and this study showed that asset quality studies can yield significant results, even when only publically available aggregate data is used.

7.5 RECOMMENDATIONS

Information on the determinants of South African bank asset quality is of importance to academics, policymakers and practitioners. The research problem is addressed by the six recommendations that seek to enhance the knowledge of South African bank

asset quality determinants, and recommend changes to enhance the understanding of NPLs in the global environment.

- Interest income on loans is a superior determinant of profitability when measuring the bank asset quality. Future estimations should include this determinant, replacing the ROA or ROE as profitability measures.
- Gold sales, or a primary export commodity, have a significant impact on the asset quality of a bank. However, the appropriate measure of this commodity is recommended, as the inclusion of a spot price of an export commodity does not yield significant results. The measurement should preferably be in the form of the output value of this commodity.
- The introduction of new regulations and legislation aiming to improve credit extension regulation should be tested pre-emptively on the bank asset quality. Although the purpose of new legislation or regulations is to improve bank asset quality, bank asset quality should be tested to ensure that there are no unintended consequences as a result of the introduction of a new regulation or legislative act.
- In the global economy, even though EMEs have less exposure to financial crisis in comparison with developed economies, policymakers should still prepare for economic consequences. The trade linkages in the global economy cause economic crises from developed economies to disseminate into EMEs. It is important that countries establish regulations that limited their exposure to financial crisis as a result of trade linkages.
- Bank asset quality determinants in multi-country and single-country studies should adjust for the relative impact that macroeconomic variables have, compared to microeconomic studies when considering the impact that the different variables have. Researchers should be aware of the unique impact that the GDP has when adopting a multi-country approach.
- Data is readily available from an abundance of sources. However, the data may not always be complete. Applying a simple spline regression to the incomplete dataset creates a balanced panel dataset that could improve the estimation results when utilising a panel data regression model.

These recommendations are derived from the contributions of this study on the determinants of South African bank asset quality. On the backdrop of the contributions and recommendations, are the limitations.

7.6 LIMITATIONS

These limitations do not prevent the study from contributing to the body of knowledge on South African bank asset quality, but they limit the extent to which the study could contribute. The four limiting aspects are: the long-overdue implementation date of the Twin Peaks model in South Africa, the secrecy around disaggregated NPL data, the reforms of IAS 39, and the inconsistent financial year-ends of banks.

Although the Twin Peaks regulatory reform was announced in 2011, the regulatory model was only launched in April 2018, therefore, it was not possible to include it as an additional structural determinant in the study. This reform strengthens the South African financial regulatory environment, as prudential regulations for the entire financial services sector fall under the watchful eye of the SARB. The three aspects, included in the study, that relate to microeconomic data, did not cause inadequate results, but the collection of the data would have been simpler. Amongst the various South African banks, the banks either followed a calendar year or a tax year, resulting in some publications of the annual financial results only becoming available in the middle of a calendar year. As a result, the study had to suffice with 2015 being the last year that complete financial results were obtainable. Furthermore, the change in the accounting standard on the recognition and measurement of financial instruments (IAS 39) reduced the period under investigation by another year, thereby only including financial results that followed this change and restated financial results. Lastly, it would have been interesting to determine the relationship that each determinant had with NPLs in the different business lines within banks, but the disaggregated NPL results were declared secret by the Bank Act (RSA, 2013).

Fortunately, the loss of two years' data due to changes in IAS 39 and the differences in financial year ends did not hinder the outcomes of this study. However, more data would have allowed even more accurate estimations, but this study still successfully contributes to the existing knowledge of South African bank asset quality.

Unfortunately, an assessment of the relationship between the Twin Peaks regulatory reform and NPLs was not possible as part of this study.

7.7 FUTURE RESEARCH

The empirical study of the determinants of South African bank asset quality has introduced a new set of questions. This is to be expected because as studies progress, new information comes to light or the researchers learn something more of the unknown. The results from this study have added thoughts regarding the impact of the regulatory reforms in South Africa, the impact of gold sales when there is no financial crisis as part of the period under investigation, and the impact that the determinants from this study have on disaggregated NPL data.

These future research suggestions would enlighten researchers on the relationship that the Twin Peaks regulatory reform in South Africa will have on the asset quality in the country, and whether it would also deliver results as interesting as that of the introduction of the NCA. Secondly, gold sales had a significant negative impact on bank asset quality, but this is relevant to models that included the financial crisis period in its investigation. Due to gold being an asset of last resort and well-known for its store of value, it would be interesting to see whether the results remain consistent if there is no crisis period as part of the dataset. Although this study maintains that the approach to evaluate bank asset quality using aggregate NPLs is significant, it would be interesting to see to what extent the determinants of South African bank asset quality impacts on the disaggregated levels of NPLs.

Studies on bank asset quality remain essential to practitioners, academics and policymakers. This is because of the sensitivity that asset quality has to the range of macroeconomic and microeconomic determinants, as well as structural changes in the global economy.

7.8 SUMMARY

The purpose of considering macroeconomic and microeconomic determinants during times of structural reforms from a single-country perspective successfully led to this study making a contribution to the existing body of knowledge. This study makes an

original contribution to the literature, methodological and empirical knowledge of South African bank asset quality.

The importance of using the output measure of the primary commodity export instead of the spot price of such a commodity is the key contribution to literature. In addition, a conclusion on the level of sophistication of the South African financial regulatory environment is long overdue. Furthermore, the inclusion of interest income on loans as the profitability measure of NPLs is a noteworthy change in comparison with the measurements, ROA and ROE. The connectedness of the global economies has also been proven, as the impact of the GFC trickled through to EMEs, impacting the asset quality of these EMEs. The use of a balanced panel regression model also contributes to the knowledge on balancing panels using spline regression techniques to ensure a complete dataset.

The limitations of this study do not reduce the ability of the study to make an original contribution, but it did lead to new questions. These questions form the foundation for post-doctoral or industry research.

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APPENDIX A: ETHICAL CLEARANCE CERTIFICATE

UNISA university of south africa

FINANCE, RISK MANAGEMENT & BANKING RESEARCH ETHICS REVIEW COMMITTEE

02 February 2016

Ref #: 2016/CEMS/DFRB/001
Name of applicant: Mr Coert Erasmus
Student #: 48433217
Supervisor: Prof D Makina
Staff #: 1123696

Dear Mr CF Erasmus,

Decision: Ethics Approval

Name: Mr CF Erasmus, erasmcf@unisa.ac.za, 082 325 9246

Supervisor: Prof D Makina, makind@unisa.ac.za, 012 429 4832

Proposal: An empirical analysis of asset quality of listed banks in South Africa
Qualification: PHD

Thank you for the application for research ethics clearance by the Department of Finance, Risk management and Banking Research Ethics Review Committee for the above mentioned research. Final approval is granted for the duration of the project.

For full approval: The application was reviewed in compliance with the Unisa Policy on Research Ethics by the DFRB RERC 02 February 2016.

The proposed research may now commence with the proviso 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, as well as changes in the methodology, should be communicated in writing to the department of Finance, Risk Management and Banking Ethics Review Committee. An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.
3) The researcher will ensure that the research project adheres to any applicable

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national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study.

Note:

The reference number 2016/CEMS/DFRB/001 should be clearly indicated on all forms of communication [e.g. Webmail, E-mail messages, letters] with the intended research participants, as well as with the [add unit/sub unit name] RERC.

Kind regards,

Prof Ashley Mutezo
Chairperson: DFRB Research Ethics Review Committee
0124294595/muteza@unisa.ac.za

Prof Thomas Mogale
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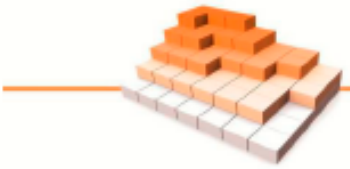
APPENDIX B: DECLARATION OF PROFESSIONAL EDIT



Retha Burger
B.A.(H.E.D.)
tel : 012 807 3864
cell : 083 653 5255
fax : 012 807 3864
e-mail : retha@skillnet.co.za
Independent Skills Development Facilitator

Dear Mr Erasmus

This letter is to record that I have completed a language edit of your thesis entitled "Determinants of asset quality in South African banks".

The edit that I carried out included the following:

-Spelling	-Grammar
-Vocabulary	-Punctuation
-Pronoun matches	-Word usage
-Sentence structure	-Correct acronyms (matching your supplied list)
-Formatting	-Captions and labels for figures and tables

-Spot checking of ten in-text references

The edit that I carried out excluded the following:

-Content
-Correctness or truth of information (unless obvious)
-Correctness/spelling of specific technical terms and words (unless obvious)
-Correctness/spelling of unfamiliar names and proper nouns (unless obvious)
-Correctness of specific formulae or symbols, or illustrations.

Yours sincerely

Retha Burger

12 June 2018