The Determinants of Non-Performing Loans: Evidence from African Banking Systems

FTX5003W Master's Dissertation

Supervisor: Francois Toerien

Student: Michael Paul

Student Number: PLXMIC007

Abstract

Historically, the evolution of NPLs across different regions has been relatively heterogenous, in part due to unique structural differences that comprise different banking sectors and the varying impact that certain macroeconomic conditions have on different countries' banking systems. This study empirically investigates the leading determinants of credit risk in the African context by employing the ARDL approach to cointegration on eight African countries: Egypt and Morocco (North African countries), Botswana and South Africa (Southern African countries), Kenya and Mauritius (East African countries), and Ghana and Nigeria (West African countries). Due to data availability and reliability concerns quarterly data is used in Egypt (Q1 2009 – Q4 2020), Morocco (Q1 2005 – Q4 2020), Botswana (Q1 2007 – Q4 2020), Kenya (Q1 2009 – Q4 2020), Mauritius (Q1 2009 – Q4 2020), Ghana (Q1 2008 – Q4 2020), and Nigeria (Q1 2010 – Q4 2020). Monthly data is used in South Africa (December 2012 – December 2020). The study aims to examine how certain macroeconomic and banking industry specific factors uniquely impact the accumulation of NPLs across different African regions. In addition, an external variable accounting for the implementation of IFRS 9 is introduced as a dummy variable. The findings indicate that macroeconomic factors are critical determinants of NPLs in the case of North African countries in both the long-run and short-run. As for the Southern African countries, NPL fluctuations are highly sensitive to banking industry-specific factors rather than macroeconomic factors. This indicates that NPLs in the Southern African banking systems are less vulnerable to adverse macro-financial shocks but rather more exposed to problems originating from the banking sector itself. In the case of the East and West African banking systems, NPLs are driven by banking industry-specific factors in the short-run but not in the long-run. Lastly, the findings indicate that the implementation of IFRS 9 has a decreasing effect on NPLs in both the short run and long run in the case of Egypt, South Africa, and Mauritius. As for Kenya, IFRS 9 seems only a critical determinant of NPLs in the long-run but not the short-run. Drawing on these results, this study recommends the promotion of a positive environment for economic growth in the case of North African countries, and the strengthening of banks' balance sheets in the case of the South, East, and West African countries.

Table of Contents

List of Tables.

List of Figures.

Chapter 1: Introduction and background.

The determinants of credit risk are an issue of substantial importance for bank officials and regulators. Evidence from the 2008 to 2009 Global Financial crisis (hereafter referred to as GFC) has shifted researchers' attention towards the notion that excessive credit growth and leverage are strongly associated with, and often precede, banking crises (Bholat et al., 2016; Castro, 2012; Louzis, Vouldis, and Metaxas (2012); Mpofu and Nikolaidou, 2018). Periods of excessive credit growth have previously been characterised by rapid growth in the rate of loans relative to deposits, and the result of such lending booms has been an exponential accumulation of non-performing loans (Bholat et al., 2016). Non-performing loans (hereafter referred to as NPLs) pose a major stumbling block to economic growth and investment as, according to Fofack (2005), high levels of unchecked credit risk can compound into financial crises. This is because when left unresolved, NPLs can lead to severe liquidity and solvency problems for a country's banking system, which, in turn, can further lead to a run on its banks. In this context, Baudino, Orlandi, and Zamil (2018) found NPLs to be a recurring feature in past banking crises. Their study underlines that poor lending and credit standards translate to lower interest income and higher loan loss provisions, which ultimately leads to a deterioration in a bank's profitability. The European Banking Coordination Vienna Initiative (2012) further highlights the importance of understanding the drivers of NPLs, emphasising that as NPLs accumulate within a country's banking system, so do the funding costs for banks, which are then frequently passed down onto firms and households. The implications of this are that as the circulation of credit contracts, so does economic growth and investment.

As proposed by several studies (see Castro, 2013; Klein, 2013; Mustafa and Ali, 2019), NPLs and the overall quality of assets on bank balance sheets has played a key role in models of financial instability. Therefore, bank management and regulators must formulate a deeper understanding of financial stability within the context of credit risk. Bholat and Markose (2018) highlight the importance of early identification and provisioning against NPLs, emphasising how a greater understanding of these risk exposures can assist in lowering the probability of a further financial crisis, and in mitigating the consequences associated with such crises. Further, according to Ali and Daly (2010), to achieve financial stability within the banking sector, bank management and regulators must attain a deeper understanding of the deterministic factors driving such risks. Thus, developing frameworks to access the drivers behind credit risk is an "important aspect of macro-prudential surveillance" and having such frameworks in place,

enables bank management and regulators to identify any key vulnerabilities that may have been building up within these sectors (Beck, Jakubik, and Piloiu, 2015).

In general, NPLs [1] refer to loans that have failed to generate income for a relatively long period; that is, the payment of interest or the repayment of principal is overdue for at least 90 days (Bholat and Markose, 2018; Fofack, 2005; Warue, 2005). In other words, NPLs are loans for which (in terms of any contractual obligations) borrowers have failed to make any repayments, or the recovery of which is highly doubtful. The issue with this definition is that it is too broad, and the criteria to classify loans as "non-performing" varies across jurisdictions and firms (Bholat and Markose, 2018), which, in turn, creates a serious stumbling block, as it enhances the difficulty of conducting any meaningful comparison of different banks' loan quality.

Following the GFC, the need for international accounting standards and enhanced supplementary disclosure increased. Previously, under both the IFRS and the US GAAP accounting standards, banks operated under an "incurred-loss model". This meant that banks looked for evidence that a loan will not be repaid, and only when there was sufficient evidence that a loan was impaired would a provision be raised for non-performance. The main drawback of such a model is that it is reactive and backwards looking. In addition to poor lending, critics have often argued that such models were the root of the GFC as loans were under-provisioned (Bholat et al., 2016). Thus, in the post-crisis period, accounting standard-setters and prudential regulators were called upon to "strengthen accounting recognition of loan-loss provisions" (G20 Research Group, 2009). In 2014, the IASB released a final standard for a new provisioning model, IFRS 9. Under the IASB approach, IFRS 9 requires that banks operate under an "expected-loss model". The expected-loss model, unlike the incurred-loss model, is forward-looking, meaning that as a new loan is written, banks already must start raising provisions for non-performance. Given this paradigm shift from a backward-looking to a forward-looking accounting standard, a structural break should be present within the data. Therefore, this study will also analyse the leading determinants of NPLs whilst utilising a dummy variable to account for the implementation of IFRS 9.

Given the link between past banking crises and the accumulation of NPLs, a growing number of studies have attempted to find statistically significant indicators that affect NPLs. The

[1] For the purposes of this study, NPLs were measured as the ratio of defaulting loans to total gross loans.

empirical literature identifies two sets of factors that drive NPLs across commercial banks: macroeconomic and banking industry-specific factors. However, most of the work pays greater attention to the macroeconomic drivers of NPLs and hence fail to incorporate any banking industry-specific or any novel external factors that may significantly explain NPL surges. Castro (2013), for example, concludes that the macroeconomic environment is the main factor driving credit risk within the banking systems of Greece, Ireland, Portugal, Spain, and Italy.

1.1 Significance and Contribution.

This study therefore contributes to the existing literature by taking an all-encompassing view of the leading determinants of NPLs by empirically investigating the macroeconomic, banking industry-specific, and external factors affecting NPLs. Specifically, the study considers eight African countries that are found in different sub-regions of the continent. The primary purpose of investigating different African regions is driven by the underlying difference in which these financial systems operate. Therefore, this study proposes that certain factors should impact NPLs across each region uniquely. However, given the limited data available for most African countries, the study considers two countries as representatives for each sub-region - these are Egypt and Morocco (North African countries), Botswana and South Africa (Southern African countries), Kenya and Mauritius (East African countries), and Ghana and Nigeria (West African countries).

Although in recent years greater attention has been paid towards understanding the determinants of credit risk, to a large extent this research has focused more on advanced economies, whereas little attention has been given to large emerging markets (Nikolaidou and Vogiazas, 2017). Furthermore, similar situations that occurred during the 1970 African debt crisis are beginning to resurface. Hard currency lending during the 1970s and 1980s resulted in mounting debt levels that became far too large for these African countries to repay. The mounting debt levels at present is a serious issue that needs to be addressed, as “rising debt levels can severely limit any country’s ability to finance critical imports and new development projects” (Greene, 1989). Zambia, for example, became the first African country during the pandemic era to start defaulting on its government bonds (Strohecker and Bavier, 2020). Therefore, empirically investigating the casual relationship between certain prespecified variables and NPLs in a region that has recently been affected by adverse economic and financial conditions will be of great importance, as it can assist in enabling improved policy

recommendations at a government level, with the overall goal of achieving financial stability within the banking system.

This study employs the Auto-Regressive Distributed Lag (ARDL) approach to cointegration to model the determinants of NPLs. Contrary to the other methodology applied in the literature, cointegration analysis has received comparatively less attention. However, a growing number of studies have begun using this methodology owing to its flexibility and favourable features that are lacking in other techniques (Nikolaidou and Vogiazas, 2017). Unlike the other cointegration procedures, the ARDL approach gives realistic and efficient estimates irrespective of whether the underlying variables are integrated of order zero, order one, or a combination of both (Nkoro and Uko, 2016). Once a cointegrating vector has been identified, the ARDL approach reparameterises the cointegrating vector into an ECM that gives the short-run dynamics and long-run information of the underlying variables for the single model. Essentially, the ECM enables the ARDL approach to effectively test for the presence of a long-run relationship between a set of variables (Pesaran, Shin, and Smith, 2001). Therefore, this study contributes to the existing literature by applying this cointegration technique to empirically test the existence of a long-run relationship between specific underlying macro-economic, bank-specific variables and an external factor for a region that has largely been excluded in the literature.

1.2 Document Map.

The remainder of this thesis will proceed as follows: Chapter 2 provides a brief review of the literature, focusing on the theoretical underpinnings and the empirical findings of past studies. Chapter 3 gives an overview of the country's banking sectors, and Chapter 4 follows with a discussion of the data and research methodology used. Chapter 5 then presents the empirical findings of the study, along with an analysis of these findings. Finally, Chapter 6 provides the concluding remarks, policy recommendations, and suggestions for future research.

Chapter 2: Literature Review

This chapter provides a critical account of the theoretical aspects and empirical findings of the determinants of NPLs. The empirical literature on modelling credit risk and the determinants of NPLs is grounded in theoretical models that seek to explain the underlying interaction between the relevant variables.

2.1. Theoretical literature.

Several theoretical studies analyse the relationship between the macroeconomic environment and the quality of loans on commercial banks' balance sheets, relating the different phases of the business cycle with banking stability. The business cycle theory postulates that during economically good times (expansionary phase), NPLs tend to reach low levels as, during these times, unemployment decreases and consumers and businesses have sufficient income and revenue streams, which increases the likelihood of facilitating servicing debt. More discretionary income translates into greater consumer spending, which, in turn, increases cash flows and profits for businesses. However, during prolonged expansionary phases, commercial banks credit standards tend to lower and often result in credit being extended to low-quality borrowers. Thus, when the recessionary phase begins, unemployment increases, and income levels decrease. As such, these low-quality borrowers are no longer able to service their debt and consequently results in the volume NPLs to increase (Louzis, Vouldis, and Metaxas, 2012; Rivai, 2018).

Another important theoretical framework that models macro-financial linkages is the "financial accelerator" theory, discussed by Bernanke and Gertler (1994). The theory investigates the role of financial conditions in amplifying monetary and non-monetary influences and builds on the concept of information asymmetry through the principal-agent approach. Essentially, this states that information asymmetry arises in situations where lenders (principals) are unable to costlessly acquire information on borrowers (agents) (Bernanke and Gertler, 1994). The theory explains how changes to credit market conditions magnify and propagate initial shocks to the economy. At the cyclical peak of an economic upswing, borrowers are "financially extended", meaning that they have borrowed more than what they can facilitate servicing and are therefore vulnerable to economic shocks (Bernanke and Gertler, 1994). When an economic downturn occurs (following any adverse macroeconomic shocks or simply the natural end to a peak), financial conditions deteriorate, and individuals' access to additional credit subsequently

declines. Also, during a downturn, any subsequent adverse shocks can lead to reductions in borrower's net worth, which, in turn, hinders spending and production. Overall, this creates an "accelerator" effect that amplifies the rate of economic contraction.

Lawrence (1995) introduces the life-cycle model, which constitutes a theoretical model that incorporates a default probability into a consumption model. The study finds that individuals with relatively low-income levels have greater default probabilities than individuals with high-income levels. This is driven by the unstable nature of low-income sources and hence implies that these individuals are more vulnerable to future unemployment, which, in turn, will adversely affect their debt repaying capacity. It is further seen that the existence of default risk (a default option on a loan) causes individuals life cycle consumption to differ from the standard life-cycle model. One explanation postulated by Lawrence (1995) is that the ability to default when an individual's discretionary income levels are low provides a "Pareto-improving insurance", which refers to a situation in which one individual is better off without someone else being worse off. Therefore, individuals can borrow freely even when faced with future uncertainties. Lawrence (1995) further emphasises that on the basis of the existence of default risk, an individual's optimal level of consumption and debt are higher than the levels anticipated by the standard life-cycle model. This implies that as the marginal propensities to consume of the low-income individuals increases, the probability of default increases.

Chen, Feng, and Wang (2018) introduce the concept of financial inclusion and how it may affect the NPLs of commercial banks. Their theory is split into three components: the definition of financial inclusion; the measurement of financial inclusion; and the role of financial inclusion in the financial industry. Whilst acknowledging that the study of financial inclusion and its impact on NPLs is still in the exploration phase, they highlight several intriguing findings from other studies. First, adequate levels of financial inclusion can effectively channel greater levels regional financial upgrades, improve capital flow efficiencies, and ultimately help combat the level of NPLs of commercial banks (Raddatz, 2006). Second, developing a technically sound and stable financial industry can ultimately provide individuals with greater access to financial services, which, in turn, would ease their capital problems (Beck et al., 2007). Lastly, throughout the process of constructing an inclusive financial system, an important factor supporting the development of the financial industry is the interaction between individuals and financial institutions, as the primary function of an inclusive financial system is to provide the users of the financial institutions with an adequate level of financial services,

from which they can then meet their capital requirements (Chen, Feng, & Wang, 2018). Overall, the concept of financial inclusion suggests that constructing an inclusive financial system has a statistically significant and negative effect on the development of NPLs. Furthermore, it demonstrates how financial inclusion could help relieve the issue of potential banking crises caused by poor loan quality (Chen, Feng, & Wang, 2018).

2.2. Empirical literature

In general, the empirical literature identifies two sets of drivers that explain NPLs across commercial banking: macroeconomic and bank industry-specific factors. Macroeconomic factors capture the influence of the macroeconomic environment and relate to specific indicators like real GDP, the unemployment rate, the inflation rate, terms of trade, and exchange rate movements. These factors influence the borrower's balance sheets and their ability to facilitate servicing debt (Nkusu, 2011). As for the bank industry-specific factors, the empirical literature asserts that these factors look more into the variability of NPLs and explaining how certain factors affect bank's behaviour and risk management practices (Klein, 2013 and Nkusu, 2011).

2.2.1. Macroeconomic factors.

Most studies on the topic tend to concentrate on the macroeconomic factors affecting credit risk. Thus, the vast majority of studies emphasise the considerably more prominent influence that changes to the macroeconomic environment have on the evolution of NPLs across the banking sector. Some studies attempt to explain NPLs based on a single country analysis (see, for example, the studies of De Bock and Demyanets, 2012; Ghosh, 2015; Louzis, Vouldis, and Metaxas, 2012; Nikolaidou and Vogiazas, 2014) while others focus on multiple countries (see, for example, the studies ; Castro, 2013; Espinoza and Prasad, 2010; Klein, 2013; Nkusu, 2011; Rinaldi and Sanchis-Arrelano, 2006).

Bohachova (2008) for example, confirms the relevance of the theoretical relationship between the business cycle and NPLs. By employing a linear mixed-effects model for a large international panel of banks in OECD and non-OECD countries, the study finds that the business cycle plays a significant role in the development of credit risk in the banking sector. This suggests that during expansionary phases, commercial banks tend to accumulate risk more rapidly, and as a result some of these risks materialise as asset quality deteriorates during

subsequent recessions (Bohachova, 2008). Studies by Ali and Daly (2010), and Nkuzu (2011) further confirm the existence of an adverse link between macroeconomic conditions and NPLs.

Louzis, Vouldis, and Metaxas (2012) study panel data across nine Greek commercial banks from the first quarter of 2003 to the third quarter of 2009, investigating the main macroeconomic and bank industry-specific determinants of NPLs. The study is driven by the hypothesis that both sets of factors have a significant effect on the loan quality of commercial banks. Overall, Louzis, Vouldis, and Metaxas (2012) find that across all loan categories, the levels of NPLs can mainly be explained through macroeconomic variables. Specifically, the study identifies that the economic environment (Real GDP growth and unemployment), the lending rates, and public debt all display significant effects on NPLs. Whilst using the Autoregressive Distributed Lag (ARDL) approach to cointegration over the period December 2001 to November 2010, Nikolaidou and Vogiazas (2011) find that macroeconomic variables have a significant effect on the level of NPLs in the Romanian banking sector. They find that using M2 as a proxy for economic activity has a strong negative effect on loan defaults, whilst the unemployment rate displays a strong positive effect on the level of NPLs. Using both fixed effects and dynamic-GMM estimations, Ghosh (2015) finds that for commercial banks in 50 US states, real GDP, real personal income growth rate, and changes in the state housing price index reduce the level of NPLs. This reinforces the hypothesised relationship between the borrower's income levels and loan default probability stipulated by Lawrence (1995). Furthermore, Ghosh (2015) finds that the inflation rate, the unemployment rate, and US public debt levels have a significantly positive effect on the level of NPLs.

In a study that analyses the determinants of credit risk across a set of countries, Castro (2013) investigates the link between macroeconomic developments and credit risk in the banking sector. Panel data across five European countries – Greece, Ireland, Portugal, Spain, and Italy (GIPSI)- who have all been adversely affected by unfavourable economic and financial conditions, is used. Overall, the results suggest that GDP growth and share price index growth have a significantly negative effect on NPLs but that credit growth, unemployment rate, interest rate, and the real effective exchange rate has a positive effect on NPLs. In addition, Castro (2013) introduces a dummy variable for the 2008/09 financial crisis and finds that credit risk during that period significantly increased. Through studying panel data for 75 countries over the last decade, Beck, Jakubik, and Piloiu (2015) find similar results. Their study shows that real GDP growth and share price index growth have a significantly negative effect on NPLs

and the lending interest rate has a positive effect on NPLs. The relationship between the lending interest rates and the probability of loan defaults is analysed in a study by Rinaldi & Sanchis-Arellano (2006), who further extend the life-cycle credit model stipulated by Lawrence (1995). Lawrence (1995) hypothesises that the probability of loan default is dependent on one's current income and the unemployment rate. Rinaldi and Sanchis-Arellano (2006) postulate that the probability of default is also dependent on the uncertainty of future incomes, inflation, and interest rates. Overall, the results suggest that rising inflation and interest rates can severely dampen borrower's financial conditions and thus exacerbate their ability to facilitate servicing debt.

In the case of African countries, Fofack (2005) investigates the leading determinants of NPLs in 16 Sub-Saharan African countries. By applying a pseudo-panel-based prediction model Fofack (2005) finds that the substantial increase in NPLs for the SSA region is driven primarily by macroeconomic volatility. In particular, Fofack (2005) shows that macroeconomic stability and economic growth inhibit NPLs while adverse macroeconomic shocks amplify NPLs. Akinlo and Emmanuel (2014) investigate the determinants of NPLs in Nigeria by applying an Error Correction Model (ECM). The results suggest a positive relationship between private sector credit, the lending rates, the exchange rate, the stock market index, and NPLs, and a negative relationship between economic growth and NPLs. Kangogo and Asienga's (2014) panel study of commercial banks in Kenya for the period 2000 to 2012 finds a strong association between GDP, inflation, unemployment, interest rates and the level of NPLs. The study provides evidence of a negative relationship between GDP, unemployment and NPLs, and a positive relationship between inflation, interest rates and NPLs.

2.2.2. Bank industry-specific factors.

In addition to the aforementioned macroeconomic factors, a much smaller number of studies investigate the role of bank industry-specific factors in explaining credit risk. Amongst others, the literature identifies the "bad management" and "skimping" hypothesises proposed by Berger and De Young (1997). The "bad management" hypothesis postulates that riskier banks tend to undertake low efficiency, low capital, and excess lending. In particular, these banks with low-cost efficiency engage in poor management practices, such as poor loan underwriting, monitoring and control, which, in turn, increases NPLs (Berger and De Young, 1997; Nikolaidou and Vogiazas, 2017). In the same vein, Louzis, Vouldis and Metaxas (2011) and Podpiera and Weil (2008) find that deteriorations in cost efficiency precede increases in NPLs,

which therefore supports the "bad management" hypothesis. Alternatively, the "skimping" hypothesis argues that high-cost efficiency can signal that banks have not adequately allocated enough resources to monitor lending risks, which increases NPLs. (Berger and De Young, 1997; Klein, 2013).

Keeton and Morris (1987) investigate credit risk through the "moral hazard" hypothesis. The theory postulates that less capitalised banks tend to be riskier on average (credit standards deteriorate and hence engage in riskier lending), which, in turn, leads to higher loan defaults. Overall, the study finds support for a negative relationship between a banks' capital ratios and NPLs. In the same line, Koju, Koju, and Wang (2018) find that banks with relatively high capital ratios have a greater capacity for long-term and short-term financing. In particular, these banks, on average, are better equipped to absorb potential financial shocks, which, in turn, reduces the likelihood of loans defaulting. It is further seen that banks who engage in riskier lending practices, such as excess lending, absorbed higher loan defaults at a later stage (Keeton and Morris, 1987). This finding is also supported by the research of Jimenez and Saurina (2005), who find that during economically good times, banks' over-optimism brings about more generous credit policies with lower credit standards. When suddenly faced with an economic downturn, borrowers are no longer able to facilitate servicing their debt and default on their loan payments, which, in turn, leaves banks flooded with NPLs.

Makri, Tsagkanos and Bellas (2014) apply a dynamic panel regression model, investigating the macroeconomic and bank industry-specific factors affecting NPLs in the Eurozone region for the period 2000 to 2008. The studies results support the "moral hazard" hypothesis discussed by Keeton and Morris (1987), which argues the existence of a negative link between capital adequacy and NPLs. The study further identifies a negative association between profitability and NPLs. In particular, the return on equity (ROE) and return on assets (ROA) ratios. As the risk-taking behaviour of banks is linked to profitability, higher expected profitability should translate into fewer incentives for banks to engage in any high-risk activities, which, in turn, should improve loan quality and reduce NPLs (Makri, Tsagkanos and Bellas, 2014). This negative link between profitability and NPLs is in line with the "bad management" hypothesis discussed by Berger and De Young (1997), which argues that poor management can expose banks to high-risk activities and weak performance.

Warue (2013) incorporates the influence of bank industry-specific factors on NPLs in an African context. Using panel data for the period 1995-2009, Warue (2013) finds evidence that

the return on assets (ROA) ratio is negative and significantly related to large banks, local banks, and government banks in Kenya while being statistically non-significant for small banks and foreign banks. Similarly, Waweru and Kalani (2009) also investigate the determinants of NPLs in Kenya, finding from a sample of 30 managers in the ten largest banks that the main bank industry-specific factors contributing to a rise in NPLs were a lack of an aggressive debt collection policy (Waweru and Kalani, 2009). While using a panel regression model, Amuakwa-Mensah and Boakye-Adjei (2015) found that the previous year's NPL, bank size, net interest margin, and current year's loan growth were all significantly related to NPLs. In particular, a positive effect was found between bank size and NPLs, suggesting that as banks increase in size, they tend to increase their credit base, which, in turn, exposes them to a greater probability of loan defaults. Furthermore, Amuakwa-Mensah and Boakye-Adjei (2015) find that the previous year's NPL have a positive relationship with NPLs, while net interest margin and the current year's loan growth have a negative relationship with NPLs.

The above review indicates that the vast majority of studies consider macroeconomic volatility to be the most significant factor in explaining banking credit risk. Moreover, most studies on the determinants of credit risk focus on single-country analysis, while the minority focus on a panel of countries. Given the limited number of studies that use multi-country comparative analysis techniques and the fact that only a small majority of the work focus on bank industry-specific factors, this provides an opportunity to add to the existing literature by incorporating the aforementioned within a region that has largely been excluded from past research. This study is grounded in theoretical models that deal with the business cycle, such as the "financial accelerator" theory formulated by Bernanke and Gertler (1994) and is additionally influenced by the life-cycle consumption model formulated by Lawrence (1995), and Rinaldi and Sanchis-Arrelano (2006). Thus, this study takes a comprehensive view of credit risk and investigates how certain macroeconomic, bank industry-specific, and external factors affect NPLs.

Before proceeding to the data and methodology section, an overview of the sample countries' banking systems is presented.

Chapter 3: Overview of the African banking industry

This section presents a general overview of the sample countries' banking systems by focusing on the financial depth and penetration of the banking institutions across the African continent, as well as discussing the efficiency and stability of its banking institutions. The evolution of NPLs can be quite heterogenous if a given region is exposed to different macroeconomic conditions and if unique structural features exist amongst the different country's banking sectors. Thus, given the significant structural differences that comprise the banking sectors across Africa, and that the level of financial of development within these banking systems varies widely, there is a cause for closer examination as it may provide deeper insight into the factors triggering the accumulation of NPLs.

Given the lack of available information for many of these African countries, this chapter considers the two largest economies from each region as representatives. Further, for this chapter, the West African region has been separated into two components: English-speaking countries (which include Ghana and Nigeria), and French-speaking countries (which include Cote d'Ivoire and Senegal)[2]. The purpose of the separation is primarily driven by the underlying difference in which the countries financial systems operate. For example, the French West African countries (which includes eight countries) operate under a single central bank (the Central Bank of West African States) and a common financial market (WEAMU). So, once banks and other financial institutions have been granted a licence to operate in one of the French West African countries, they essentially have a license to operate in any of the eight francophone countries without any administrative formalities (Allen, Otchere, and Senbet, 2011). On the other hand, the English West African countries form part of the Economic Community of West African States (ECOWAS), and each operates under their own central bank with their own policies. Given these underlying differences, each country will respond uniquely to the build-up of inadvertent credit risk within the banking system, and therefore NPLs fluctuations may be driven by different factors.

[2] The French-speaking West African countries were only included in this chapter and not the final results due to a lack of available and reliable data. The primary purpose of including this region within this chapter is to highlight the structural differences between the English-speaking and French-speaking African countries financial sectors.

The level of financial development across many African countries remains low in comparison to most other regions of the world. In particular, the banking industry in most parts of Africa have often been characterised as underdeveloped and lacking adequate competition, which, in turn, has resulted in severely low levels of financial intermediation. However, over the past 20 years, the African banking system has experienced remarkable changes. Once controlled by state-owned banks and subject to restrictive regulatory policies - financial liberalisation, improved institutional and regulatory reforms, financial innovations, and increased globalisation, have significantly changed banking systems by deepening and broadening the access to financial services across the African continent (Beck and Cull, 2013; Nikolaidou and Vogiazas, 2017). In discussing the African banking systems, it is important to consider the diversity of the regions, where the characteristics of each country differ in terms of population size, income levels, and access to readily available resources (Mlachila, Park and Yabara, 2013). Irrespective of the striking diversity found across the African continent, Honohan, Beck, Demirgüç-Kunt, and Levine (2007) postulate four very distinct characteristics that captures the challenges of banking in Africa. First, service providers are unable to realise the benefits of economies of scale due to the relatively small size of many African countries. Second, given that the informal sector contributes to a large portion of the economy, many African countries, therefore, lack the required formal documentation which facilitates financial transactions. Third, volatility has plagued Africa for the past 50 years. Given many African countries' dependence on commodity exports, large price swings in commodity prices are a significant risk that leaves many African countries highly exposed to external shocks. Lastly, governance issues and political unrest continue to afflict many African countries, constantly resulting in slow reform implementations, provisions made for financial services, government interventions for addressing market failures and risk management.

3.1 Financial depth of banking institutions.

The significance of deeper banking systems is well acknowledged not only for stable economic growth but also for how it relates to the accumulation of NPLs. Deeper banking systems grant wider access to credit that helps to promote and sustain economic growth through strengthening banks' ability to withstand adverse shocks, which in turn, reduces the volume of NPLs. Therefore, examining the level of financial depth across the different African regions justifies

the need for closer examination as it may assist in identifying weaknesses that feed NPL growth.

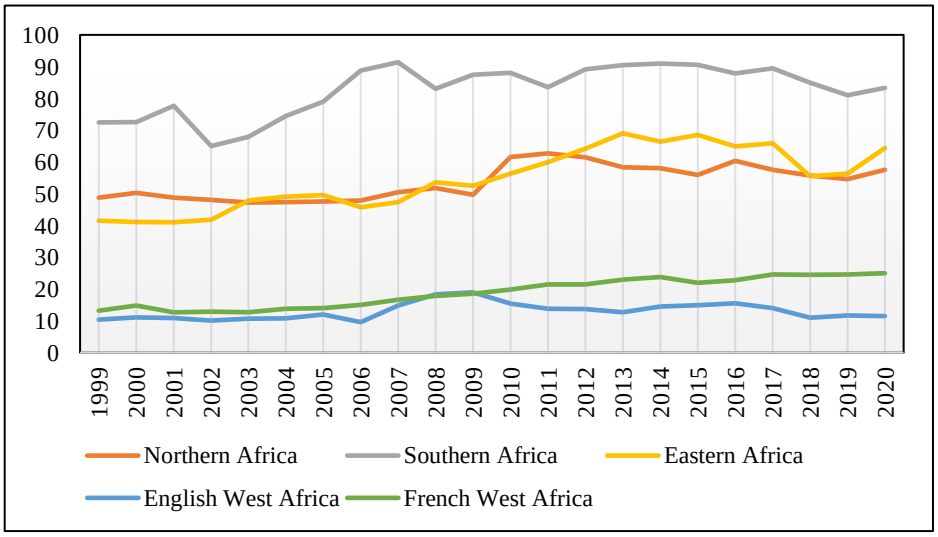
The World Bank defines financial depth as follows, “Financial depth captures the financial sector relative to the economy”. Thus, in terms of this definition, financial depth involves comparing the combined size of a country’s banks, non-bank financial institutions and financial markets to a measure of economic activity (The World Bank, 2021). Academic literature further extends this definition by referring to financial depth as the extent to which individuals and businesses can participate in financial markets for savings and investment-based decisions (Nyantakyi and Sy, 2015). Two commonly used measures of financial depth include the ratio of liquid liabilities to GDP and the ratio of domestic credit to the private sector as a percentage of GDP. The ratio of liquid liabilities to GDP is a measure of relative size and captures the extent to which a country’s banking system can redirect funds from savers to borrowers. On the other hand, the ratio of domestic credit to the private sector as a percentage of GDP measures private-sector claims by deposit money banks as a percentage of domestic economic output and hence captures the degree to which banks can finance economic activity (Ahokpossi, Ismail, Karmakar, Koulet-Vickot, 2013). A higher ratio for both these measures is indicative of deeper financial markets.

Figures 1 and 2 below present a plot of the ratio of domestic credit to the private sector as a percentage of GDP and the ratio of liquid liabilities to GDP for the period 1999 to 2020 for the regions covered by this chapter. From Figure 1, it can be seen that when using domestic credit to the private sector as a measure of financial depth, the sub-regions that comprise the West African region display the shallowest financial depth. This suggests that the range of financial assets for the West African region is limited (Udo Ndebbio, 2004). Further, recent banking sector trends highlight that many West African banks are plagued by a crippling long-term domestic savings deficit that has severely hindered the lending process within the region (European Investment Bank, 2020). As a result, banks within the region have encountered obstacles in providing long-term access to finance for individuals and firms. In combination with poor credit information quality and governance deficiencies, NPLs within the West African region remain high, despite improved asset quality.

On the other hand, the Southern African region has consistently recorded the highest ratio of domestic credit to the private sector, propelled predominantly by South Africa’s high level of financial depth. Figure 2 appears to correspond with Figure 1, displaying signs of low financial

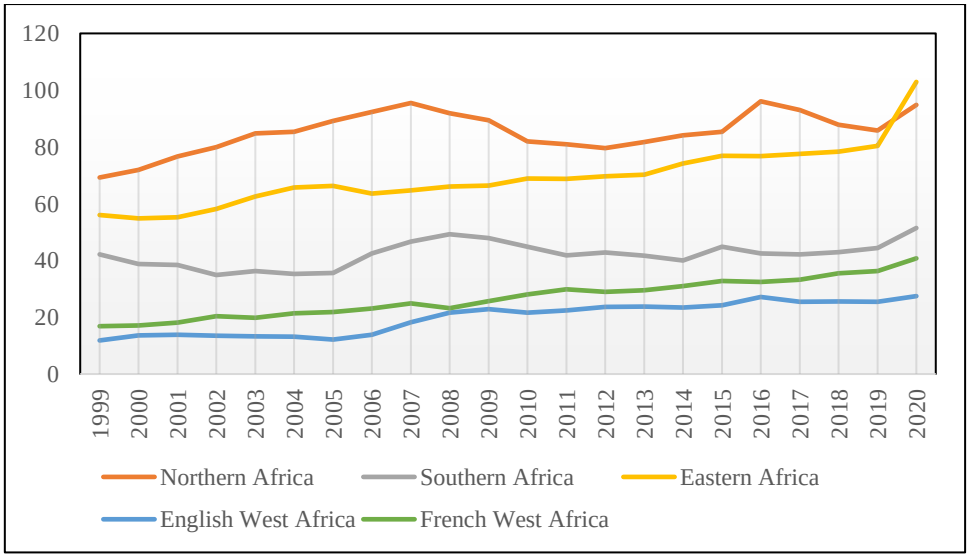
depth across the West African region. Despite the ratio showing improvement for the West African region, when compared with the other African regions the rate of improvement proves dismal. A plausible explanation could be that even though savers are becoming increasingly confident in these formal banking systems, there is still a cloud of doubt over whether these funds will be returned on demand. As a result, the rate at which savings are deposited in the banking systems is substantially below that of the other African regions (Allen et al.,2010).

Overall, in terms of financial depth, despite showing substantial improvement in the last two decades, African countries are still under-developed when compared with developed countries. Benson (2019) highlights a range of possible problems that may have led to such low levels of financial depth, such as ineffective and inadequate service delivery, growing consumer distrust in the banking system, rising non-performing loans, and severe poverty. The result is an environment in which it is nearly impossible for the average individual to deposit savings with a bank.



Source: The Global Financial Development Database and own analysis.

Figure 1: The ratio of domestic credit to the private sector as a % of GDP (1996-2017)



Source: The Global Financial Development Database and own analysis.

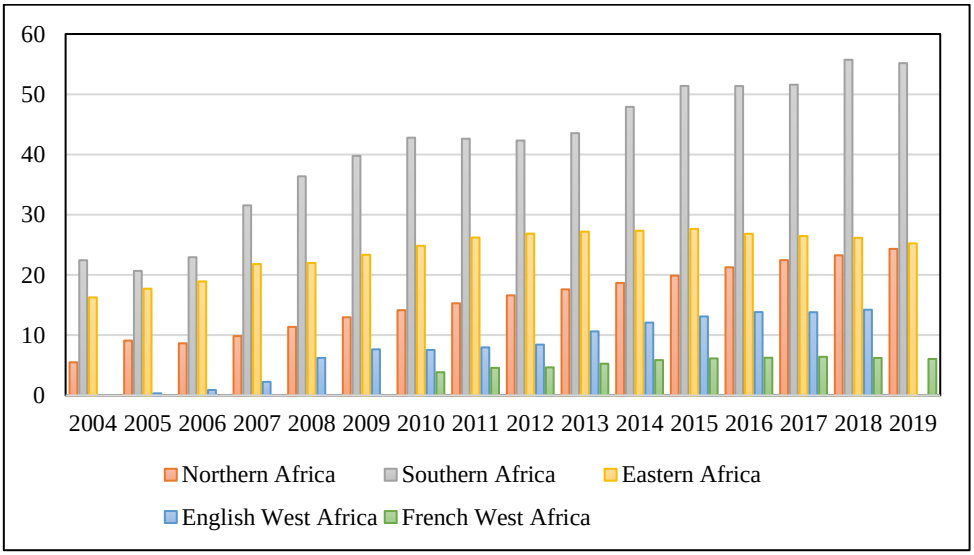
Figure 2: The ratio of liquid liabilities to GDP (1996-2017)

3.2 Financial inclusion.

As NPLs are an important indicator of banking stability, examining the differences in financial inclusion across the different African regions is vital, particularly because improved levels of financial inclusion can help support financial stability within the banking sector by increasing the deposit base of banks and by increasing the number of financial instruments on offer to individuals and firms (Ozili and Adamu, 2021). Broadly, financial inclusion is defined as having equal access to a range of financial services for individuals and businesses. To ensure inclusive growth, financial inclusion within the African region needs to be addressed because by broadening individuals' ability to access basic financial services such as saving accounts, allow households to accumulate greater savings, better channel capital for investments, and help grow the class of entrepreneurs (Triki and Faye, 2013). Thus, the benefits of improved financial inclusion are shared throughout the real economy.

In recent decades, many African countries have been experiencing positive developments in economic growth that have shaped the continent into one of the fastest growing regions in the world (The World Bank, 2021). The accelerated growth that many African countries have been experiencing has mainly been driven by a young and rapidly urbanising population. However, despite this growth, large segments of these African countries' adult populations still lack access to a transaction account with a financial institution (African Development Bank, 2021). Many reasons have been cited for individuals within these African countries not having formal

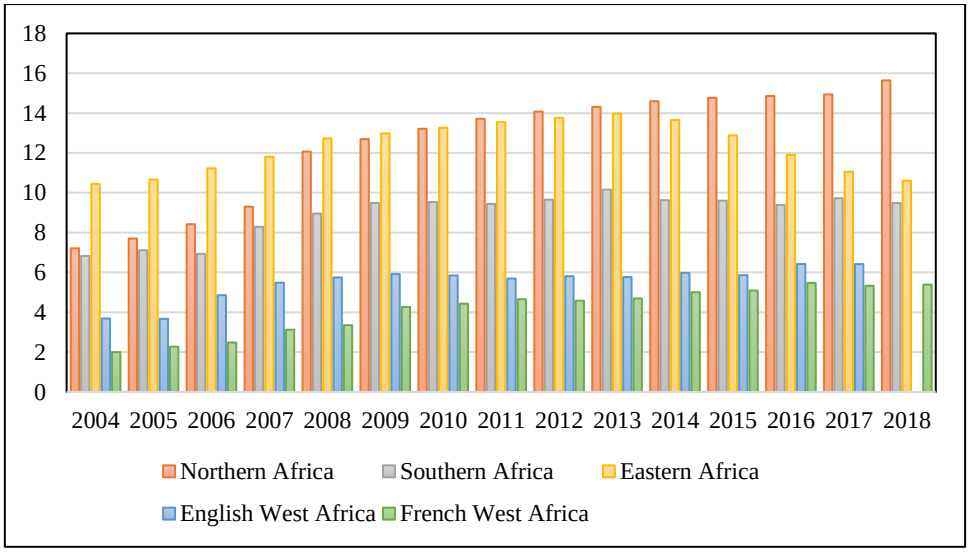
transaction accounts, with the two most common reasons being a lack of adequate capital and insufficient documentation (Demirgüç-Kunt and Klapper, 2012). Several studies have analysed the effect that financial inclusion has on bank performance and stability. Ahamed and Mallick (2019) conclude that financial inclusion has a positive relationship with financial stability. In the same line, Musau, Muathe and Mwangi (2018) conclude that bank availability, accessibility, and usage have a significant effect on NPLs. Thus, given the empirical findings of prior literature, this study utilises two broad indicators of financial inclusion, namely the number of ATMs per 100 000 adults and the number of bank branches per 100 000 people. Figures 3 and 4 below present a plot of both indicators for the regions covered for the period 2004 to 2020. The upward trend in both figures suggests that in recent years a great deal of development has been undertaken by these African countries in prompting financial inclusion. However, the level of financial inclusion remains low in the West African region, indicating that within the low-income countries, individuals do not yet have the necessary access to essential financial services. This is a major concern because it means that the poorer communities do not have the means to save, borrow, invest, or take out insurance.



Source: The Global Financial Development Database and own analysis.

. Figure 3: ATMs per 100,000 adults.

As shown in Figure 3, the Southern African region is relatively well penetrated by the banking system. This is predominantly driven by South Africa, where the number of ATMs per 100 000 adults increased from 29.25 to 65.31 in the space of a 16-year period. The East African sample region, comprised of Kenya and Mauritius, exhibits high levels of financial inclusion



Source: The Global Financial Development Database and own analysis.

Figure 4: Bank branches per 100 000 people.

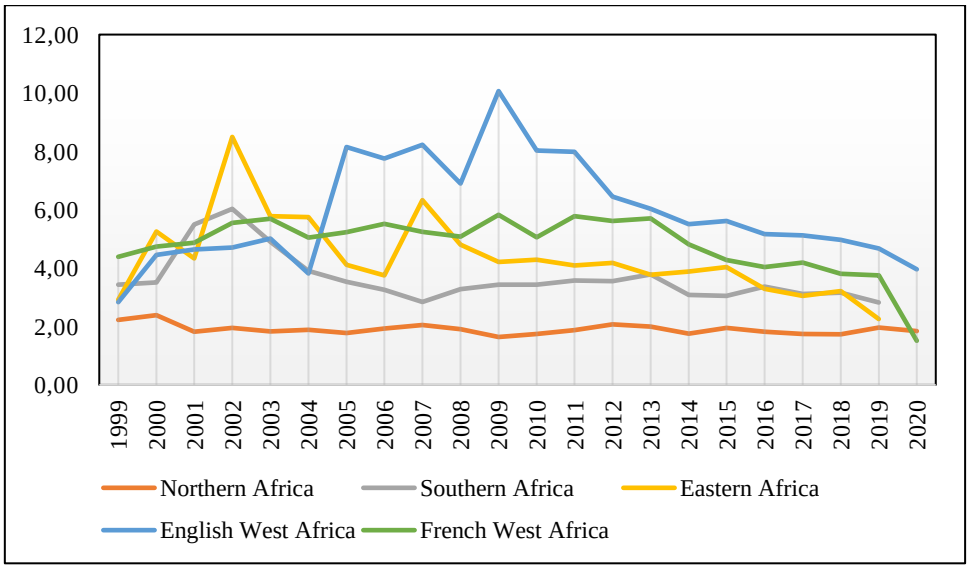
3.3 Banking system efficiency.

The notion of efficiency can be interpreted as the extent to which an organisation can generate its desired output level from the minimum input level (Drucker, 1963). Essentially, the idea of efficiency, as a general performance indicator, is the optimal use of available resources to produce the best products at the lowest possible cost. In terms of the banking sector, efficiency is necessary for banks and non-bank financial institutions to be profitable, as cost controls and effective utilisation of resources allows these institutions to operate in a highly competitive environment (Nyantakyi and Sy, 2015). According to Isrova (2015), efficiency in the banking sector supports the effectiveness of macroeconomic policies, which, in turn, generates sustainable financial development, economic growth and improves the general welfare of society. McKinley and Banaian (2005) summarise efficiency in terms of cost minimisation and profit maximisation. Given this simple breakdown, McKinley and Banaian (2005) use banks' overhead costs as a percentage of total assets and banks' net interest margin as proxies for operational efficiency to compare African banks compare in terms of efficiency.

In terms of its effect on NPLs, cost efficiency negatively impacts NPLs as poor credit management can degrade the quality of assets on banks' balance sheets. This is in line with the "bad management" hypothesis as postulated by Berger and De Young (1997), which states that bad decision-making such as poor credit monitoring of borrowers leads to rise in NPLs. As such, two broad measures of banking efficiency are utilised in this chapter, namely banks'

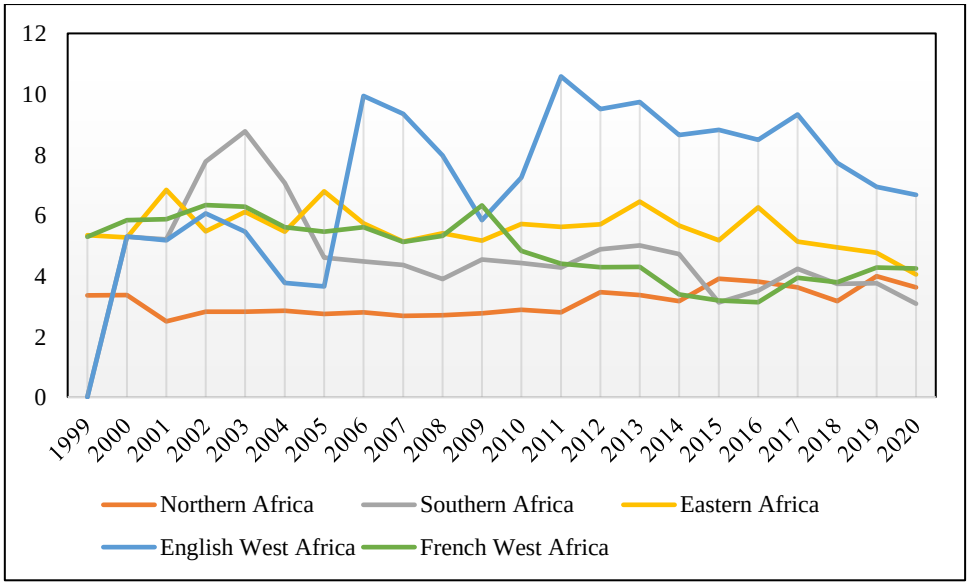
overhead costs as a percentage of total assets and banks' net interest margin. Figures 5 and 6 below present both indicators for the regions covered by this chapter for the period 1999 to 2020. Figure 5 shows that in 2020 operating expenses accounted for approximately 1.85% of total assets in the North African banks, whereas, in the other African regions, little variation was found, with operating expenses accounting for 2.26% of total assets in the East African banks, 2.82% in the South African banks and 1.51% in the French-speaking West African banks.

The English-speaking West African banks, as shown in Figure 5, are relatively less efficient as approximately 3.96% of the banks' total assets were comprised of operating expenses. Figure 6 shows a correlation between the net interest margin and operating expenses, suggesting that the English-speaking West African banks spend, on average, more than their sub-region counterparts to generate additional income. We can further observe this concept with the North African banks, which consistently produced the lowest overhead costs and net interest margin. Furthermore, little variation was found between the East African and South African banks. East African banks generated a net interest margin of approximately 4.05%, and the South African banks generated a net interest margin of 3.38%.



Source: The Global Financial Development Database and own analysis.

Figure 5: Bank overhead costs to total assets (%).



Source: The global financial development database and own analysis.

Figure 6: Bank net interest margin (%)

3.4 Banking system stability.

In general, the concept of financial stability within the banking sector is relatively difficult to define and even more so to measure. Given the difficulty of defining financial stability, several studies have attempted to answer the question as to what financial stability is within the financial system. There are commonalities in these definitions that allow for a consensus to be formed on what financial stability is. Strictly speaking, in this study, stability within the financial system is considered to be the absence of excessive volatility, stress or crisis episodes that result in the financial system failing to function (Gadanecz and Jayaram, 2009; The World Bank, 2021). This study makes use of two measures of stability, namely the banks' non-performing loans to total gross loans and the banks' z-score. According to The Global Financial Development Database, the z-score is calculated by dividing the capitalisation and returns of a country's banking sector by the volatility of those returns. Thus, the z-score is estimated as follows:

$$\frac{ROA + \left(\frac{equity}{assets}\right)}{Std(ROA)}$$

Equation 1

Where:

ROA = Return on Assets

Equity = Equity of Banks

Assets = Assets held by Banks

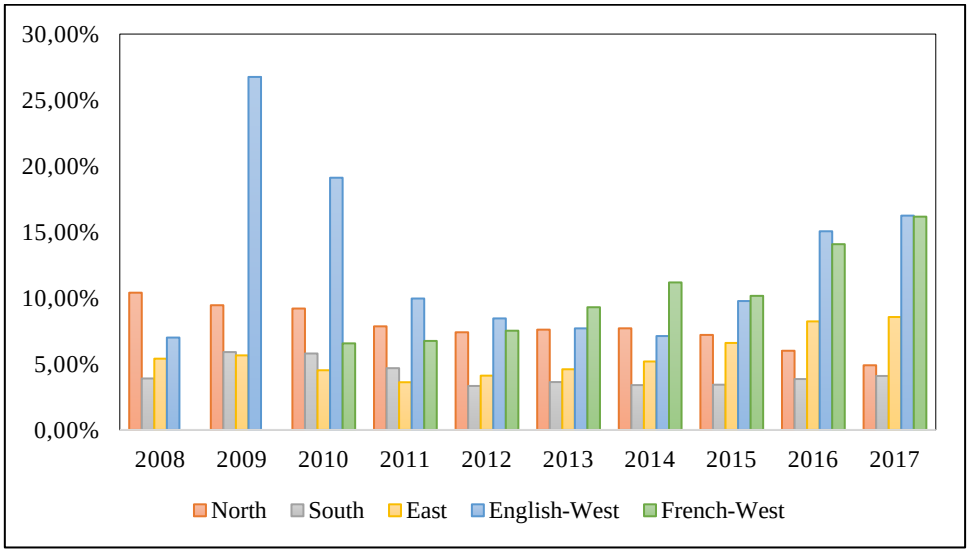
Std(ROA) = standard deviation of ROA

Broadly, the z-score captures the probability of a country's commercial banking system going insolvent, meaning that it measures the probability that the value of a financial institution's total assets (in aggregate) falls below the value of its current debt obligations. Thus, a higher z-score is desirable as it suggests a lower probability of default. Overall, a negative association exists between NPL growth and banking stability. A plausible explanation could be that increasing of NPL volumes impede bank lending activity, widens lending spreads, and subsequently leads to decreases in real GDP growth (Hulijak et al., 2020). Therefore, an understanding of differences in banking system stability across different African countries may provide greater understanding of the weaknesses that feed NPL growth within these regions.

Figure 7 below presents the average of banks' non-performing loans to total gross loans by the various African regions as a percentage for the period 2008 to 2017[3]. Havrylchyk (2010), in studying the South African banking system, found that the quality of loans is sensitive to economic cycles. Given this insight, the 2008 subprime meltdown, which saw a global slowdown in economic activity, had adverse consequences on banks' loan quality. According to Nikolaidou and Vogiazas (2017), Africa in particular was not as severely impacted by the GFC as African banking systems, in general, tend to have sufficient capitalisation, low leverage, excess liquidity and limited dependence on external funding. However, several African banking systems experienced a lag effect from the GFC in which they were indirectly impacted through trade linkages and exchange rate depreciation. The result of which was a decrease in bank lending activity and an increase in financial challenges for borrowers, which, in turn, led to an increase in non-performing loans. Figure 7 illustrates important disparities between the different African regions. Given the fragility of these banking systems, the countries most affected by the African Debt Crisis, experienced a dramatic erosion of their equity and capital (Fofack, 2005). In particular, the English-speaking Western African banking systems were impacted the most, where towards the end of 2009 these loans accounted for over 25% of total loans. Non-performing loans in the Southern Africa banks increased from 3.9%

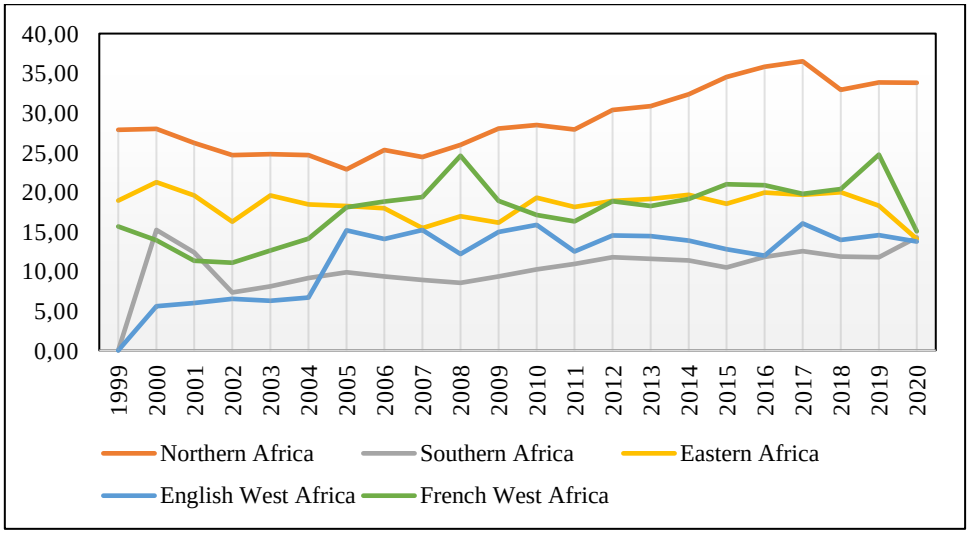
[3] The relatively short time period covered in Figure 7 highlights the limited data available on African countries. For the purpose of conducting a comparative analysis, the time period for each region was aligned in this chapter.

in 2008 to 5.9% in 2009, which continued until the first quarter of 2011, where it began to decrease below the 5% level. Figure 8 presents the banks' z-score (at an aggregate level) for the regions covered in this chapter the period 1999 to 2020. Using the banks' z-score as another measure of stability within the financial system, Figure 8 indicates that, on average, the Northern African banking systems are relatively stable, producing a z-score that remained resilient throughout the GFC.



Source: The global financial development database, and own analysis.

Figure 7: Bank non-performing loans to gross loans (%).



Source: The global financial development database, and own analysis.

Figure 8: African bank system Z-Scores.

With national authorities highlighting macroeconomic stability as a primary objective, along with reforms that encourage private sector development, the outlook for economic performance and real GDP growth is set to remain stable across Africa. As the chapter suggests, in terms of financial inclusion, the Northern African countries are far superior to the vast majority of other African countries. A reasonable explanation could be that banking activities dominate most financial sectors in the North African region, where most banks are well developed and have thus enabled North African banks to reach a greater proportion of unbanked individuals (IQPC Middle East, 2016). Similarly, the Southern African banking systems are also deeper, better penetrated, and more efficient than those of the other sub-regions across Africa. However, the main downside risks that feed NPL growth for the Southern African countries include a combination of weak economic performance and deteriorating government finances that put pressure on banks having to fund budget deficits (European Investment Bank, 2020). As for the Eastern and Western African countries, the main bottleneck to stable banking sector performance involves access to finance, in particular, for small-medium sized enterprises (SMEs). SMEs are broadly seen as being too risky, which, in turn, has led to high-interest rates and collateral requirements. As a result, the range of accessible finance for the private sector has decreased, as most of the banking sectors in these regions lend predominantly to the public sector. However, despite the challenges faced, the economic outlook for Africa remains favourable.

Overall, the chapter highlights that except for the Northern African countries, the banking systems across Africa are vulnerable to adverse shocks. Going forward, the volume of NPLs incurred will depend not only on banking sector performance but also on the extent to which the main downside risks to economic growth are addressed.

Chapter 4: Data and Research Methodology.

As evident from the literature review, both macroeconomic and bank industry-specific variables have been found to be significant explanatory factors explaining the development of NPLs in the banking sector. As such, this study employs the ARDL approach to cointegration to investigate the macroeconomic, bank industry-specific, and external factors affecting NPLs in the African region. The literature on credit risk further identifies that past studies made use of both aggregate and disaggregate data when analysing credit risk behaviour.

A limitation when researching developing countries is the lack of reliable, consistent, and sufficiently long time-series data (Nikolaidou and Vogiazas, 2017). Given these limitations, this study exclusively uses aggregate data in the regression analysis. This follows the study by Boudriga, Taktak, and Jellouli (2009), who find that examining aggregate data for the whole banking sector of the country to be preferable, as opposed to disaggregate (individual) data because it reduces the problem of non-representativeness. Further, in a similar line to the current study, Rinaldi and Sanchis-Arellano (2006) also use aggregate data as the scarcity of information in the Eurozone region does not permit such disaggregate analysis.

Aggregate data for each country was obtained from the databases of the World Bank, the International Monetary Fund (IMF), the Central Banks of each country, and other sources such as CEIC data. The aim was to collect data from the selected countries for the longest time possible. However, given the scarcity of information available for many African countries, many aspects of this study, such as country selection, variables chosen, and the period covered, were determined by the data available. As such, quarterly data is used for Egypt (Q1 2009 – Q4 2020), Morocco (Q1 2005 – Q4 2020), Botswana (Q1 2007 – Q4 2020), Kenya (Q1 2009 – Q4 2020), Mauritius (Q1 2009 – Q4 2020), Ghana (Q1 2008 – Q4 2020), and Nigeria (Q1 2010 – Q4 2020). Monthly data is used for South Africa (December 2012 – December 2020).

Table 1: Description of Regression Variables.

Variable	Description	Expected Effect	Nature
NPL	Non-Performing Loans Ratio to total gross loans (%)	n/a	Macroeconomic
LGDP	Log of Nominal Gross Domestic Product: In constant US$	-	Macroeconomic
UNEM	Unemployment Rate (%)	+	Macroeconomic
GD	Government Debt: as a percentage of GDP (%)	+	Macroeconomic
LDC	Log of Domestic Credit: In constant US$	+	Macroeconomic

LMS	Log of Money Supply, M2 (USD mn)	+	Macroeconomic
LA	Liquid Asset Ratio (%)	-	Bank-specific
CAR	Capital Adequacy Ratio (%)	-	Bank-specific
D	Dummy variable that captures the implementation of IFRS 9	-	External

Note: All data is sourced from the central bank of each country, the IMF, the World Bank and CEIC data.

4.1 Expected Effects.

Following on Castro (2013), two proxies were used to control for the general state of the economic environment, namely Gross Domestic Product (GDP) and the Unemployment Rate (UNEM). As discussed by theoretical models that deal with business cycles, the economic environment is a fundamental component for any study attempting to explain the determining factors of credit risk. The variables to control for the state of the economic environment reflect households' and firms' ability to facilitate servicing their debt obligations (Touny and Shehab, 2015). The expansionary phase of the business cycle is characterised by a relatively low level of NPLs and an increase in economic activity. Generally, this tends to increase the GDP growth rate, which, in turn, increases productivity and disposable income. However, an increase in unemployment can adversely influence individuals' and firms' cash flow streams and increases the debt burden (Castro, 2013). Thus, during phases of favourable economic conditions (high GDP and low unemployment), individuals and firms are in a better position to service their debt obligations. Therefore, the coefficient for GDP is expected to be negative, while the coefficient for unemployment is expected to be positive.

The level of government debt (GDEBT), as a percentage of nominal GDP, is another important variable included in the analysis of credit behaviour. According to Ari, Chen and Ratnovski (2019), higher debt levels are expected to be positively associated with a higher NPL as an increase in debt levels may lead to fiscal consequences that could hinder a government's fiscal ability to cushion fallouts from banking crises. Ali and Daly (2010) and Ptasica (2020) confirm this finding of a positive association between government debt levels and the NPLs. In particular, these studies find that higher levels of public debt usually translate into higher levels of government debt, which, in turn, increases the likelihood of higher loan default rates.

The level of domestic credit is expected to display a positive long-term effect on NPLs, as banks who engage in excess lending absorb higher loan defaults at a later stage (Keeton and Morris, 1987). Domestic credit growth is a significant indicator of the general credit market

conditions because it signals the relative ease at which individuals can gain access to credit. Thus, excess credit growth and lenient credit standards may increase the likelihood of future loan defaults because future economic downturns may constrain borrowers' overall capacity to repay debt, which consequently will increase the volume of NPLs (Jimenez and Saurina, 2005; Keeton and Morris, 1987). However, prior literature also provides mixed views on the direction of the relationship between the two variables. As mentioned previously, domestic credit to the private sector as a percentage of GDP measures the degree to which banks can finance economic activity and thus a higher ratio would indicate deeper financial markets. This would suggest a negative relationship with NPLs, as the private-sector claims by deposit money banks as a percentage of domestic economic output increases, banks would be better equipped to redirect funds from savers to borrowers and hence banks would incur lower NPLs. This negative relationship is supported by Khemraj and Pasha (2009), who suggest that banks that extend moderately high levels of credit are more likely to incur a lower level of NPLs. For this study, the expected relationship is based on the former.

Similarly, the hypothesised effect of money supply (M2) on NPLs is positive in the long-term. There are several channels through which this relationship could be analysed, one of which is the monetary transmission mechanism. The traditional view is that policy changes through which money supply is adjusted flow through changes in interest rates and consumer and business spending. The impact of monetary policy changes on credit market conditions is amplified through information asymmetries (between borrowers and lenders) in financial markets, which cause adverse selection and balance sheet effects, which, in turn, creates a combined effect that accelerates the level of credit risk (Bernanke and Gertler, 1994).

The credit effect of monetary policy operates directly through two channels, bank dependent borrowers and firms' balance sheets. Broadly, when policymakers want to kickstart economic activity and subsequently spending, they replete bank reserves. This overload of reserves subsequently increases the supply of deposits available, which, in turn, drives down lending interest rates and incentivises consumer and business investment spending due to the lower cost of capital (Morgan, 1998). Thus, the short-term effect of an expansionary monetary policy can be a reduction in loan defaults, as the debt servicing capacities of businesses and consumers are enhanced through increased cash flows and borrowing. However, during these phases, bank dependent borrowers become "financial overextended" and are exposed to adverse credit market shocks (Bernanke and Gertler, 1994). Thus, when the expansionary policy subsides or

when economic conditions enter a downturn, the availability of credit declines. This creates an accelerating effect as borrowers require additional credit due to them being "financially overextended". So, as the supply of bank loans decrease, spending declines and firms balance sheets deteriorate, which subsequently reduces their ability to borrow. As a result, consumer and business cash flows weaken, production declines, and the debt servicing capacities at a firm and individual level fall, which, in turn, increases the likelihood of loan defaults as borrowers do not have the means to pay off their debt obligations. Overall, this creates a long-term impact in which the increased money supply translates into higher NPLs.

Banking industry-specific variables are important factors to consider when investigating credit risk, as it often links to the risk-taking behaviour of commercial banks (Makri, Tsagkanos and Bellas, 2014). The liquid asset ratio is expected to have a negative impact on NPLs since liquidity problems (liquid asset ratio decreases) within the banking sector translate into payment problems (borrowers' servicing short-term and long-term debt obligations). Kozaric and Zunic (2015) support this notion by providing empirical evidence of an extreme negative correlation between the liquidity position of banks and NPLs. The study acknowledges that an increase in liquidity problems and unintended levels of liquidity risk often translates into problems with debt collection, which, in turn, is followed by an increase in NPLs.

In terms of bank capitalisation, the capital adequacy ratio is expected to be negatively correlated with NPL growth. As Eyraud et. al (2021) explains, more capitalised banks tend to have lower NPLs, owing to higher capital buffers disincentivising risk-taking activities by banks. Fofack (2005) supports this notion by analysing the impact of capital adequacy on NPLs through the "moral hazard" hypothesis. The "moral hazard" hypothesis suggests that low capitalised banks tend to adopt imprudent lending strategies that are often geared towards high-risk projects. Broadly, these adverse incentives create direct implications for banks' loan portfolios, which, ultimately fuels financial costs and hence impaired loans. Koju, Koju, and Wang (2018) support the negative correlation but through a different channel of influence. Their study establishes that more capitalised banks have a greater capacity for short-term and long-term financing, which, in turn, suggests that they are better positioned to mitigate the impacts of unforeseen macro-financial shocks. Thus, during phases of unfavourable economic conditions, these banks can tap into greater capital reserves and hence reduce the likelihood of an increase in loan defaults.

In terms of external factors, the implementation of IFRS is expected to have a negative effect on NPLs. According to the G20 Research Group (2009), the IFRS 9 accounting standard established a means for accounting standard-setters and regulators to strengthen the accounting recognition of loan-loss provisions following the 2008/2009 GFC. The standard represents a conceptual break from the incurred-loss methodology as it incorporates a broader range of credit information that enables banks and other financial institutions to recognise expected credit losses in loan portfolios as soon as possible (Bholat et.al, 2016). Given that the focus of this study is on NPLs and not loan loss provisions, the hypothesised effect of the dummy variable on NPLs is negative as it is believed that the early identification of expected losses helps to increase bank resilience and aids in mitigating the adverse impact of financial shocks on banks' balance sheets. Ultimately, this will reduce the likelihood of downturns that fuel further debt crises.

4.2 Research question.

This study conducts a comparative analysis of the determinants of NPLs from eight African countries whilst accounting for the implementation of IFRS 9.

4.3 Research Hypothesis.

This section presents the testable hypotheses, based on which the study examines the relationship between the macroeconomic, banking industry-specific, and external factors with NPLs across the African banking industry. Based on the above literature review and expected effects, the following hypotheses are formulated.

4.3.1 Log of Nominal Gross Domestic Product: In constant US $.

Null hypothesis, $H_0: X_1 = 0$. Log of Nominal Gross Domestic Product does not impact NPLs

Alternative hypothesis, $H_1: X_1 \neq 0$. Log of Nominal Gross Domestic Product does impact NPLs

4.3.2 Unemployment rate (%).

Null hypothesis, $H_0: X_2 = 0$. The unemployment rate does not impact NPLs

Alternative hypothesis, $H_1: X_2 \neq 0$. The unemployment rate does impact NPLs

4.3.3 Government debt as a percentage of GDP (%).

Null hypothesis, $H_0: X_4 = 0$. Government debt does not impact NPLs.

Alternative hypothesis, $H_1: X_4 \neq 0$. Government debt does impact NPLs.

4.3.4 Log of Domestic Credit: In constant US$.

Null hypothesis, $H_0: X_1 = 0$. Domestic credit does not impact NPLs.

Alternative hypothesis, $H_1: X_1 \neq 0$. Domestic credit does impact NPLs.

4.3.5 Log of Money Supply, M2 (USD mn).

Null hypothesis, $H_0: X_1 = 0$. Money supply does not impact NPLs.

Alternative hypothesis, $H_1: X_1 \neq 0$. Money supply does impact NPLs.

4.3.6 Liquid Asset Ratio (%).

Null hypothesis, $H_0: X_1 = 0$. The liquid asset ratio does not impact NPLs.

Alternative hypothesis, $H_1: X_1 \neq 0$. The liquid asset ratio does impact NPLs.

4.3.7 Capital Adequacy ratio (%).

Null hypothesis, $H_0: X_1 = 0$. The adequacy ratio does not impact NPLs.

Alternative hypothesis, $H_1: X_1 \neq 0$. The capital adequacy ratio does impact NPLs.

4.3.8 A dummy variable for the implementation of IFRS 9.

Null hypothesis, $H_0: X_1 = 0$. IFRS 9 does not impact NPLs.

Alternative hypothesis, $H_1: X_1 \neq 0$. IFRS 9 does impact NPLs.

4.4 Descriptive Statistics.

Table 2 presents the descriptive statistics for the underlying variables used in this study, in which the maximum, minimum, mean, and standard deviation for each variable are displayed.

Table 2: Estimated Descriptive Statistics.

Egypt
Sample period: 48 observations from 2009Q1 to 2020Q4

Variable(s)	NPL	LGDP	UNEM	GD	LDC	LMS
Maximum	14,34%	11,57	13,40%	94,90%	12,67	12,64
Minimum	3,40%	10,72	7,20%	0,00%	11,70	11,87
Mean	8,12%	11,16	11,03%	65,04%	12,19	12,18
Std, Deviation	3,41%	0,21	2,04%	26,13%	0,26	0,19

Variable(s)	LA	CAR	D
Maximum	46,48%	20,10%	1
Minimum	27,70%	12,50%	0
Mean	38,78%	15,46%	0,25
Std, Deviation	5,29%	1,76%	43,76%

Morocco
Sample period: 64 observations from 2005Q1 to 2020Q4

Variable(s)	NPL	LGDP	UNEM	GD	LDC	LMS
Maximum	19,16%	10,33	12,70%	76,87%	11,92	11,77
Minimum	4,82%	9,59	7,80%	45,44%	10,62	10,59
Mean	7,81%	10,09	9,70%	59,19%	11,45	11,27
Std, Deviation	3,27%	0,20	1,00%	8,18%	0,36	0,28

Variable(s)	D
Maximum	1
Minimum	0
Mean	0,188
Std, Deviation	39,34%

Botswana
Sample period: 43 observations from 2011Q1 to 2020Q4

Variable(s)	NPL	LGDP	UNEM	GD	LDC	LMS
Maximum	5,57%	8,374	18,06%	21,20%	8,772	9,00
Minimum	1,93%	8,007	17,08%	14,59%	6,382	8,66
Mean	3,80%	8,241	17,64%	17,85%	7,631	8,81
Std, Deviation	1,13%	0,092	0,24%	2,07%	0,581	0,09

Variable(s)	LA	CAR	D
Maximum	39,51%	23,10%	1
Minimum	11,52%	17,67%	0
Mean	17,67%	19,53%	0,28
Std, Deviation	7,63%	1,29%	45,39%

South Africa
Sample period: 96 observations from 2013M1 to 2020M12

Variable(s)	NPL	LGDP	UNEM	GD	LDC	LMS
Maximum	5,17%	11,57	32,50%	69,45%	12,67	12,38
Minimum	2,77%	11,12	23,30%	37,58%	12,22	11,93
Mean	3,54%	11,43	26,79%	48,36%	12,48	12,18
Std, Deviation	0,58%	0,10	2,04%	7,82%	0,09	0,09

Variable(s)	LA	CAR	D
Maximum	13,15%	16,89%	1
Minimum	7,93%	13,71%	0
Mean	9,80%	15,55%	0,38
Std, Deviation	1,29%	0,91%	48,67%

Kenya

Sample period: 48 observations from 2009Q1 to 2020Q4

Variable(s)	NPL	LGDP	UNEM	GD	LDC	LMS
Maximum	12,15%	10,21	10,40%	68,65%	10,56	10,30
Minimum	3,50%	9,08	2,64%	39,67%	9,24	9,17
Mean	6,81%	9,65	3,36%	49,96%	10,05	9,87
Std, Deviation	2,65%	0,33	1,46%	8,84%	0,38	0,32

Variable(s)	LA	CAR	D
Maximum	49,82%	23,26%	1
Minimum	33,53%	16,66%	0
Mean	41,72%	19,84%	0,25
Std, Deviation	3,75%	1,69%	43,76%

Mauritius

Sample period: 48 observations from 2009Q1 to 2020Q4

Variable(s)	NPL	LGDP	UNEM	GD	LDC	LMS
Maximum	8,00%	8,23	11,50%	76,27%	9,75	9,73
Minimum	2,40%	7,61	6,30%	44,42%	8,99	9,00
Mean	5,01%	7,97	7,72%	55,54%	9,45	9,39
Std, Deviation	1,89%	0,15	1,03%	6,58%	0,20	0,20

Variable(s)	CAR	D
Maximum	20,40%	1
Minimum	15,30%	0
Mean	17,71%	0,25
Std, Deviation	1,35%	43,76%

Ghana

Sample period: 52 observations from 2008Q1 to 2020Q4

Variable(s)	NPL	LGDP	UNEM	LDC	LMS	LA
Maximum	22,93%	9,88	6,81%	10,06	9,71	64,20%
Minimum	7,60%	8,65	4,10%	8,64	8,37	37,27%
Mean	15,24%	9,39	5,29%	9,37	9,04	51,15%

Std, Deviation	3,90%	0,34	0,87%	0,35	0,34	6,97%

Variable(s)	**CAR**	**D**
Maximum	21,17%	1
Minimum	13,50%	0
Mean	17,66%	0,23
Std, Deviation	1,85%	42,54%

Nigeria
Sample period: 44 observations from 2010Q1 to 2020Q4

Variable(s)	**NPL**	**LGDP**	**UNEM**	**GD**	**LDC**
Maximum	38,35%	11,93	33,28%	18,87%	11,67
Minimum	2,96%	11,35	3,77%	8,57%	10,90
Mean	10,51%	11,61	13,98%	12,91%	11,39
Std, Deviation	8,74%	0,15	8,27%	2,99%	0,23

Variable(s)	**LA**	**CAR**	**D**
Maximum	35,37%	18,10%	1
Minimum	15,03%	1,75%	0
Mean	25,84%	14,40%	0,27
Std, Deviation	5,93%	4,50%	45,05%

The basic descriptive statistics presented in Table 2 highlight some of the main downside risks faced by each region. In particular, the main downside risks for the West African countries derive from global economic uncertainty. The significant impact of the Covid-19 pandemic sent the vast majority of advanced economies into a period of slow economic growth, which, in turn, led to increased trade protectionism (Eyraud et al., 2021). For example, in an attempt to reduce illegal trade with its neighbouring countries, Nigeria closed its terrestrial borders (Kwarkye and Matongbada, 2021). As a result of the escalating trade protectionism, real GDP growth across West Africa slowed, and inflationary pressure across the region increased. In addition, this global uncertainty had been re-priced into capital markets and increased risk premiums for many African economies (European Investment Bank, 2020). Despite these constraints, the West African banking sectors remained resilient, partly due to the implementation of IFRS 9, which led to a significant fall in NPLs. Table 3 further highlights that the Ghanian and Nigerian banking sectors are relatively well-capitalised with capital adequacy ratios well above the regulatory norm of 8.6%.

Similarly, the major bottlenecks to the East African banking sectors have been external shocks. The universal uncertainty that followed the outbreak of Covid-19 negatively impacted the East African region in several ways, some of which include decreased foreign capital flows, reduced

exports and investments, and local currency pressure. Further, escalating budget deficits and public debt levels have left most countries severely exposed to external shocks stemming from adverse movements in exchange rates, interest rates and oil prices (European Investment Bank, 2020). However, in light of these constraints, the banking sectors across the East African region remained relatively stable. Financial inclusion across the region improved, partly due to the evolution of the digital financial services industry that promoted broadening unbanked individuals access to financial services (European Investment Bank, 2017).

For the Southern African countries, the main downside risks stem from lacklustre economic growth, escalating fiscal deficits, and rising debt levels. The rising debt levels have left the vast majority of Southern African countries severely exposed to potential shocks and have subsequently halted access to external financing. Further, deteriorating government finances and weak economic performance have put the banking sectors across the region under immense pressure. As a result, lending to the private sector has slowed, and NPLs across the region have increased (European Investment Bank, 2020). In terms of the banking sector, banks across the region remain relatively well-positioned to mitigate the impact of potential shocks due to high capital and liquid positions. However, with high funding needs, weak international correspondents, and the slow pace at which structural reforms have been implemented have constrained robust banking sector performance.

Lastly, the North African countries have undergone periods of sustained economic performance, partly due to improvements in financial inclusion that have enabled banks across the region to reach a greater proportion of unbanked individuals (IQPC, 2016). Further, accelerated economic growth across the region has been aided by the implementation of structural reforms in Egypt and Morocco. As for the North African banking sectors, greater efforts to converge to international accounting standards are taking place within the central banks of Egypt and Morocco. The introduction of regulatory tools like Basel III and other macroprudential tools have further strengthened the region's defence against rising NPL volumes. Broadly, this is due in part to additional capital buffers, leverage and liquidity ratios enforced by Basel III that aim to constrain banks capacity to provide loans (Eyraud et al., 2021). By and large, these preventive measures ensure that banks maintain adequate capital levels, which, in turn, reduces the off-balance sheet exposures that fed NPL growth.

Overall, the impact of the Covid-19 pandemic has been unprecedented. The global economic uncertainty has triggered economic downturns, financial market shutdowns, and has put the

livelihoods of many vulnerable countries at risk - in particular, those in Africa. GDP across Africa contracted to the lowest levels in the region's history, especially tourism-dependent countries. Further, the indirect effects from a deteriorating external environment, reduced inflows from tight global financial conditions, and the sharp declines in commodity prices all exacerbated the economic challenges that these African countries already face (Eyraud et al., 2021). The global economic shutdown had spillover effects into the financial systems of many countries, where a sharp increase in unemployment resulted in a collapse of income for many borrowers. As a result, these borrowers debt repaying capacity contracted, which, in turn, led to an increase in NPLs. Thus, the main threats to the banking sectors across Africa stem from deteriorating loan portfolios. However, the impact of the pandemic across Africa has varied and therefore justifies an investigation into which factors affect the volume NPLs across Africa.

4.5 Model specification.

This study analyses the effect of several macroeconomic, bank-level and pertinent country-level factors on the level of NPLs, using the ARDL bounds approach to cointegration. Initially developed by Pesaran, Shin and Smith (2001), the approach seeks to mitigate the flaws of previous commonly used cointegration techniques, namely the two-step residual-based approach as proposed by Engle & Granger (1987) and the system-based reduced rank regression approach as proposed by Johansen (1991). Pesaran, Shin and Smith (2001) find that these two principal methods tend to concentrate on cases in which the variables must be of I(1), meaning that if the underlying variables are not integrated of order one, then the cointegration analysis cannot take place. The prerequisite that all the underlying variables must be of I(1) would require a certain level of pre-testing, which, in turn, introduces additional uncertainty into the analysis of levels relationships (Pesaran, Shin and Smith, 2001). Mustafa and Ali (2019) further observe that the cointegration techniques proposed by Engle and Granger (1987) and Johansen (1991) is less feasible when employing a multivariate model, as it assumes that only one cointegrating vector connects all the underlying variables. Thus, given the flaws of these techniques, Pesaran, Shin and Smith (2001) found a more suitable cointegration technique in which the order of integration is not necessary, as the analysis of the levels can take place irrespective of whether the underlying variables are of I(0) or I(1). However, as observed by Nkoro and Uko (2016), the ARDL approach cannot be applied in situations where the underlying variables are of I(2), as this could lead to spurious results, such as model misspecification and unreliable regression estimates. Therefore, to confirm that the variables

are not of order two, a commonly used stationarity test known as the Augmented Dickey-Fuller (ADF) test was employed to ensure that the variables are integrated of purely order zero or purely of order, one or even a combination of both.

Once the integration properties for all the variables for each country were identified, the next step was to conduct a univariate Ordinary Least Squares (OLS) regression, similar to that of Kalirai and Scheiche (2002) and Nikolaidou and Vogiazas (2017). The objective was to model the relationship between the NPL ratio and each variable for the individual countries. This allows for the identification of the explanatory power of each factor on the NPL ratio. To do so, the OLS regression was estimated by regressing the NPL ratio against each variable (see Kalirai and Scheiche, 2002; and Nikolaidou and Vogiazas, 2017). This step is advantageous to the study, as the results from the univariate regression estimates provide insight for identifying factors that significantly affect credit risk, as proxied by the NPL ratio (Nikolaidou and Vogiazas, 2017). The next step was to introduce the statistically significant factors into a multivariate regression model. Following the methodology of the abovementioned studies, stepwise regression was employed and the model that produced the best combination of statistically significant variables with the most explanatory power for each country was then estimated by the ARDL bounds approach to cointegration.

In general, the ARDL bounds approach is a cointegration technique where the researcher can identify and examine the long-run cointegration relationship between the NPL ratio and the variables presented in Table 1 (Pesaran, Shin and Smith, 2001). As already discussed, the ARDL bounds approach to cointegration has numerous advantages over the other two commonly used cointegration techniques, namely those proposed by Engle and Granger (1987) and Johansen (1991). Firstly, unlike these two approaches, the ARDL bounds approach does not impose any restrictive assumptions on the integration properties of the underlying variables, as it can be applied irrespective of whether the variables are of order zero or order one (Kassim, 2016). This is a key advantage, as the other cointegration techniques require all variables to purely order one. Secondly, while the results of the other approaches are sensitive to the sample size, the ARDL bounds approach is more suitable as it provides robust results even for smaller sample sizes and, the approach enables using an appropriate number of lags to capture the data generating process in a general-to-specific framework (Mustafa and Ali, 2019; Nikolaidou and Vogiazas,2017; Odhiambo, 2010). Thirdly, even when some of the regressors in the model are endogenous, the ARDL bounds approach provides unbiased and reliable estimates of the long-

run model (Harris and Sollis, 2003). Lastly, the approach also enables the derivation of an error correction model (ECM) that "integrates short-run dynamics with the long-run equilibrium without losing long-run information" (Nikolaidou and Vogiazas,2017). The ARDL specifications are estimated as follows:

$$\begin{aligned}\Delta NPL = \alpha_0 &+ \Sigma_{i=1}^{n}\alpha_1\Delta LGDP + \Sigma_{i=1}^{n}\alpha_2\Delta UNEM + \Sigma_{i=1}^{n}\alpha_3\Delta GD + \Sigma_{i=1}^{n}\alpha_4\Delta LDC \\ &+ \Sigma_{i=1}^{n}\alpha_5\Delta LMS + \Sigma_{i=1}^{n}\alpha_6\Delta LA + \Sigma_{i=1}^{n}\alpha_7\Delta CAR + \Sigma_{i=1}^{n}\alpha_8\Delta D \\ &+ \Sigma_{i=0}^{n}\alpha_9\Delta LGDP_{t-1} + \Sigma_{i=0}^{n}\alpha_{10}\Delta UNEM_{t-1} + \Sigma_{i=0}^{n}\alpha_{11}\Delta GD_{t-1} \\ &+ \Sigma_{i=0}^{n}\alpha_{12}\Delta LDC_{t-1} + \Sigma_{i=0}^{n}\alpha_{13}\Delta LMS_{t-1} + \Sigma_{i=0}^{n}\alpha_{14}\Delta LA_{t-1} \\ &+ \Sigma_{i=0}^{n}\alpha_{15}\Delta CAR_{t-1} + \Sigma_{i=0}^{n}\alpha_{16}\Delta D_{t-1} + u_{1t}\end{aligned}$$

Equation 2

Where:

α_0 = the constant term

α_1 to α_7 = the short-run regression coefficients

α_8 to α_{14} = the long-run regression coefficients

n = lag lengths

Δ = first difference operator

u_{t1} = residual error term or white noise error term

All the variables were converted into their natural logarithmic form, except for those that represent rates (or percentages), as they can take on negative values and therefore cannot be converted into a logged form.

The ARDL bounds approach involves two steps for testing the existence of cointegration among the underlying variables. The first step involves selecting the optimal lag length and conducting a bounds-testing procedure. The bounds-testing procedure is based on the joint F-statistic (Odhiambo, 2010) that is employed to detect if a long-run relationship amongst the examinable variables exists. The null hypothesis for the model is $H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = 0$ and the alternative hypothesis is $H_1: \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq \alpha_7 \neq 0$. According to Pesaran, Shin and Smith (2001), the asymptotic distribution of the F-statistic is non-standard under the hypothesis that no long-run association exists amongst the underlying variables and, thus, two sets of asymptotic critical values are reported, for which the generated F-statistic will be evaluated. The two sets of critical values assume that all the underlying variables are either purely I(0) or I(1). Thus, under the bounds-testing procedure,

three distinct outcomes can be produced. If the computed F-statistic falls below the lower critical value, then the null hypothesis cannot be rejected and hence we conclude that no cointegration exists within the model. If the computed F-statistic exceeds the upper critical value, then the null hypothesis is rejected, and we conclude that cointegration exists within the model. However, if the computed F-statistic falls between the upper and lower critical values, then the results of the bounds-testing procedure are inconclusive.

Once a long-run relationship between the variables had been established, the next step in the ARDL bounds approach involved estimating the short-run and long-run coefficients (Adebola, Yusoff, and Dahlan, 2011) through the derivation of a dynamic error correction model (ECM). To confirm that cointegration exists amongst the underlying variables, it is required that the ECM coefficient be statistically significant and negative. The ECM is specified as follows:

$$\Delta NPL = \lambda_0 + \Sigma_{i=1}^{n}\lambda_1\Delta LGDP_{t-i} + \Sigma_{i=1}^{n}\lambda_2\Delta UNEM_{t-i} + \Sigma_{i=1}^{n}\lambda_3\Delta GD_{t-i} + \Sigma_{i=1}^{n}\lambda_4\Delta LDC_{t-i} + \Sigma_{i=1}^{n}\lambda_5\Delta LMS_{t-i} + \Sigma_{i=1}^{n}\lambda_6\Delta LA_{t-i} + \Sigma_{i=1}^{n}\lambda_7\Delta CAR_{t-i} + \Sigma_{i=1}^{n}\lambda_8\Delta D_{t-i} + \emptyset ECM_{t-1} + u_{2t}$$

Equation 3

Where:

$\lambda_0 =$ constant term

λ_1 to $\lambda_7 =$ regression coefficients

$\emptyset =$ coefficient on the error term

$ECM_{t-1} =$ the error correction term with one lag

As noted by Kassim (2016), "The short-run dynamics are captured in the specific coefficients of the lagged terms, while the error correction term contains information of the long-run causality". Therefore, short-run causality is confirmed when the coefficient of each lag-independent variable is significant, and if the error correction term is statistically significant and negative, it signifies long-run causation.

Overall, testing for cointegration is an essential step in any time series modelling. Granger (1969) defines causality based on the predictability of a time series. This definition assumes that if causality does exist between a given time series, then the introduction of an additional unspecified variable into the model should not give rise to spurious causality and the opposite should hold true when causality does not exist. (Fawson and Chang, 1994). Based on this predictability criterion, the simple existence of correlation between two prespecified variables

does not justify causation, as seeing two variables move together does not necessarily imply that one variable causes the other to occur (Sakyi, 2011). However, cointegration tests rule out spurious correlation, as they examine how different times series can be paired in such a way that the workings of equilibrium forces do not deviate too far apart (Nkoro and Uko, 2016). Essentially, cointegration tests provide more evidence of casual relationships as it enables researchers to determine whether a specific time series model demonstrates any meaningful long-run relationships. The utilisation of the ARDL approach within this study to test for the existence of cointegration between the underlying variables was primarily driven by its flexibility and its capacity to produce results that are realistic and efficient irrespective of whether the underlying variables are integrated of order zero, order one, or a combination of both.

Chapter 5: Empirical Results and Analysis.

5.1 Stationarity Test.

As mentioned previously, the ARDL bounds approach can only be applied when the underlying variables are of orders I(0) or I(1), which means that the approach is subject to non-stationarity issues. Therefore, to establish the presence of a cointegration relationship between the NPL ratio and the underlying variables, a stationarity test must be conducted to ensure that the variables are not I(2). To determine whether a unit root is present within the variables, this study employed the commonly used Augmented Dickey-Fuller Test (ADF). Tables A1 and A2 (in the appendix) show that apart from NPL and LGDP for Botswana, CAR for Ghana and CAR for Nigeria, all the variables displayed non-stationarity, implying that besides the variables mentioned, all the variables contained a unit root at the level I(0). As such, a first difference was taken for the variables containing a unit root, and the ADF tests were reapplied. Tables A3 and A4 (in the appendix) present the test results after taking the first difference. The results show that all the variables that contained a unit root at I(0) became stationary at I(1) once the first difference was taken, except GD for Botswana. This implies that except for GD for Botswana, all the variables are not I(2) (integrated of order two). Therefore, it is appropriate to continue with the approach for all variables integrated of order zero or one. A summary of the unit root tests is presented in Table 2.

Table 3: Summary of Unit Root Test Results.

	Stationarity of all variables		**Stationarity of all variables of first difference**	
Variables	**Intercept**	**Intercept and Trend**	**Intercept**	**Intercept and Trend**
Egypt				
NPL	-1,323	-2,0309	-6,1389**	-6,364**
LGDP	-2,3676	-2,8535	-7,6011**	-7,5062**
UNEM	-0,29716	-1,2471	-3,822**	-4,8696**
GD	-1,909	-2,3722	-4,5827**	-4,6515**
LDC	-2,3676	-2,8535	-3,4175**	-3,5758**
LMS	-0,95633	-1,9322	-3,9689**	-3,999**
LA	-0,95633	-2,2315	-3,2177**	-3,5591**
CAR	-2,2184	-2,2315	-4,8169**	-5,5056**
Critical Value (5%)	-2,9287	-3,5136	-2,9303	-3,5162

Morocco				
NPL	-5,9281*	-11,7216*		
LGDP	-3,004*	-3,5297*		
UNEM	-2,4383	-2,9273	-6,6756**	-6,868**
GD	-1,909	-2,3722	-5,987**	-6,4056**
LDC	-3,0223*	-2,9701	-3,9782**	-4,5008**
LMS	-2,0965	-3,8078*	-5,298**	-5,3755**
Critical Value (5%)	-2,9101	-3,4849	-2,9109	-3,4862
Botswana				
NPL	-2,4278	-2,2892	-4,8796**	-4,9192**
LGDP	-1,8732	-2,6233	-6,3081**	-6,2949**
UNEM	-1,9449	-2,0416	-5,468**	-5,4371**
GD	-3,1129	-2,9456	-2,0715	-2,1361
LDC	-0,42588	-2,0435	-3,4954**	-3,5394**
LMS	-1,0108	-3,3873*	-7,8428**	-7,7606**
LA	-2,4297	-0,83618	-4,1539**	-4,8085**
CAR	-2,6149	-2,7935	-5,0692**	-5,0296**
Critical Value (5%)	-2,9179	-3,4969	-2,919	-3,4987
South Africa				
NPL	1,047	-0,20421	-4,7753**	-6,1562**
LGDP	-2,6617	-2,6042	-6,635**	-6,6274**
UNEM	-2,3898	-4,797*	-6,6792**	-6,6855**
GD	2,6569	0,76123	-8,3673**	-9,3372**
LDC	-2,0821	-2,6577	-7,068**	-7,0539**
LMS	-1,813	-2,2778	-6,8501**	-6,8889**
LA	0,54887	-2,1446	-5,6257**	-5,7345**
CAR	-0,97974	-2,3014	-6,371**	-6,3378**
Critical Value (5%)	-2,8929	-3,4586	-2,8932	-3,4591
Kenya				
NPL	0,71486	-2,4955	-2,9396**	-5,9933**
LGDP	-1,0194	-6,5754*	-9,4376**	-9,3281**
UNEM	-1,6899	-2,4787	-6,994**	-7,4793**
GD	1,0474	-2,1848	-6,5428**	-7,142**
LDC	-1,7285	-1,8654	-5,4953**	-6,0596**
LMS	-1,7263	-1,6013	-4,746**	-5,0408**
LA	-1,6283	-2,6976	-4,8076**	-4,8338**
CAR	-1,139	-2,0983	-5,1499**	-5,0716**
Critical Value (5%)	-2,9287	-3,5136	-2,9303	-3,5162

Mauritius				
NPL	-1,0665	-1,1199	-4,2913**	-4,3451**
LGDP	-2,6024	-2,9034	-6,2165**	-6,4271**
UNEM	-2,1612	-2,0654	-5,8734**	-6,1179**
GD	0,66199	-1,2623	-4,5108**	-4,7794**
LDC	-2,4042	-2,1003	-3,5433**	-3,9724**
LMS	-0,1208	-2,8516	-4,3422**	-4,3098**
CAR	-1,4608	-4,953*	-6,5535**	-6,4854**
Critical Value (5%)	-2,9287	-3,5136	-2,9303	-3,5162
Ghana				
NPL	-2,7292	-2,4027	-3,6299**	-3,7439**
LGDP	-1,43	-2,5647	-6,5382**	-6,6629**
UNEM	-1,0081	-1,7595	-4,9275**	-5,0105**
LDC	-0,31899	-1,3164	-3,396**	-3,5155**
LMS	-0,95633	-1,9322	-6,3084**	-6,2456**
LA	-1,5254	-2,1454	-5,1688**	-5,1332**
CAR	-3,2371*	-3,5723*		
Critical Value (5%)	-2,9228	-3,5045	-2,9241	-3,5066
Nigeria				
NPL	-1,6862	-1,9688	-4,6902**	-4,3466**
LGDP	-2,1573	-2,2458	-4,9012**	-4,8755**
UNEM	1,3157	-0,49639	-3,2533**	-3,853**
GD	0,1216	-2,2181	-5,335**	-5,5579**
LDC	-2,1842	-2,1916	-4,1438**	-4,3642**
LMS	-2,12	-2,1197	-4,5074**	-4,4522**
LA	-2,5735	-2,4207	-4,2823**	-4,3361**
CAR	-6,8046*	-9,2817*		
Critical Value (5%)	-2,9358	-3,5247	-2,9378	-3,5279

*Represents the 5% significance level. ** Represents the 5% significance level for the differenced series. The results show that only GD for Botswana is integrated of order 2.

5.2 Univariate and Multivariate Regression Estimates.

Having established that all the variables are either I(0) or I(1), the next step was to model the relation between the chosen factors and the NPL ratio (our measure of credit risk). For this purpose, the paper has utilised both a univariate and multivariate OLS linear regression. As indicated previously, this step is advantageous to the study as it provides insight into identifying the factors that affect NPLs for each country, which, in turn, enables the selection of appropriate dependent variables to be used in the ARDL bounds test. The results of the univariate OLS

regression are presented in Table 3. It is observed that all the variables display explanatory power on NPLs, except UNEM and LA for Egypt, UNEM for Botswana, LGDP for South Africa, UNEM for Mauritius, UNEM and LA for Nigeria. The statistically significant variables are then introduced into a multivariate OLS regression. These estimates are presented in Table 4. Through utilising variable exclusion restrictions, the results observed in the multivariate OLS regression indicate that the variables display statistical significance at the 1 per cent, 5 per cent and 10 per cent levels. This systematic methodology enables the derivation of a model that best describes NPLs for each country.

Table 4: Univariate Regression Estimates.

Dependent variable is NPL			
Regressor	**Coefficient**	**Standard Error**	**T-Ratio**
Egypt			
LGDP	-0,0885	0,0199	-4,4434***
UNEM	0,3008	0,2427	1,2392
GD	0,0360	0,0185	1,9457*
LDC	-0,0992	0,0121	-8,2088***
LMS	-0,1247	0,0191	-6,5152***
LA	-0,1453	0,0927	-1,5669
CAR	-0,6085	0,2714	-2,2424**
D	-0,0536	0,0083468	-6,4303***
Morocco			
LGDP	-0,12079	0,014263	-8,4691***
UNEM	1,4984	0,36895	4,0612***
GD	0,08707	0,049447	1,7609*
LDC	-0,066913	0,0079123	-8,4568***
LMS	-0,0766	0,011081	-6,9128***
D	-0,015411	0,0030541	3,8521***
Botswana			
LGDP	-0,036504	0,0090776	-4,0214***
UNEM	0,45488	0,30592	1,4869
LDC	0,0079146	0,0027639	2,8635***
LMS	0,061963	0,0099018	6,2578***
LA	-0,043913	0,012433	-3,532***
CAR	0,20519	0,11713	1,7518*
D	-0,014514	0,0038402	-3,7794***

South Africa			
LGDP	-6,28E-04	0,005918	-0,10604
UNEM	0,099472	0,027535	3,6126***
GD	0,045299	0,0060898	7,4385***
LDC	0,016329	0,0063636	2,566**
LMS	0,025733	0,0063482	4,0535***
LA	0,27732	0,036765	7,5432***
CAR	0,16479	0,063469	2,5963**
D	-0,0072206	9,83E-04	-7,3495***
Kenya			
LGDP	-0,056571	0,008268	-6,8421***
UNEM	1,0392	0,21838	4,7586***
GD	0,26194	0,021444	12,2151***
LDC	0,041113	0,0082758	4,9678***
LMS	0,049061	0,0097683	5,0225***
LA	-0,45172	0,080018	-5,6453***
CAR	-1,1093	0,16243	-6,8296***
D	-0,050614	0,0048897	-10,3512***
Mauritius			
LGDP	-0,06869	0,015712	-4,3719***
UNEM	0,25163	0,26821	0,93818
GD	0,18742	0,032076	5,8429***
LDC	0,070081	0,0091326	7,6738***
LMS	0,071935	0,0093905	7,6604***
CAR	-1,0344	0,13858	-7,4643***
D	-0,013764	0,006031	-2,2822**
Ghana			
LGDP	-0,055145	0,0141	-3,911***
UNEM	2,1601	0,55446	3,8958***
LDC	0,049104	0,01433	3,4266***
LMS	0,068446	0,012954	5,2838***
LA	-0,39374	0,056377	-6,984***
CAR	-1,281	0,23815	-5,3789***
D	0,035603	0,011963	2,9761***
Nigeria			
LGDP	-0,4149	0,064029	-6,4798***
UNEM	0,21424	0,15962	1,3422
GD	-0,42883	0,44655	-0,96032
LDC	-0,25826	0,044198	-5,8432***
LMS	-0,45202	0,07172	-6,3026***

LA	-0,70951	0,19923	-3,5613***
CAR	-1,7375	0,13351	-13,0137***
D	-0,018777	0,029782	-0,63046***

***p<0,01; **p<0,05; *p<0,1 represents significance at the 1%, 5% and 10% levels

Table 5: Multivariate Regression Estimates.

Dependent variable is NPL

Egypt

$$NPL = -0{,}35665 - 0{,}0106LGDP + 0{,}0228GD - 0{,}2884LDC + 0{,}31765LMS - 0{,}2569CAR - 0{,}04515D$$
$$(-0{,}7403)\quad (4{,}0201)***\ (-13{,}912)***\ (8{,}858)***\quad (-1{,}9504)*\ (-9{,}5685)***$$

Morocco

$$NPL = 0{,}708 - 0{,}12731LGDP + 0{,}3453UNEM + 0{,}25404GD - 0{,}11733LDC - 0{,}0673LMS - 0{,}01526D$$
$$(-3{,}6798)***\quad (2{,}4047)**\quad (13{,}2152)***\ (-5{,}3434)***\ (-1{,}9657)*\ (-3{,}3763)***$$

Botswana

$$NPL = -0{,}6078 - 0{,}0025LGDP + 0{,}0026LDC + 0{,}0743LMS - 0{,}0891LA - 0{,}3341CAR - 0{,}0039D$$
$$(-0{,}1273)\quad (0{,}4769)\quad (2{,}0562)**\ (-2{,}9104)**(-1{,}8522)*\ (-0{,}6492)$$

South Africa

$$NPL = 0{,}03158 + 0{,}0048UNEM + 0{,}03378GD - 0{,}11314LDC + 0{,}1164LMS - 0{,}274LA - 0{,}0994CAR + 0{,}0085D$$
$$(2{,}1677)**\quad (2{,}4058)**\ (-5{,}3192)***\ (6{,}6317)***\ (-2{,}1162)**\ (-2{,}2046)**\ (5{,}4466)***$$

Kenya

$$NPL = 0{,}5554 - 0{,}01545LGDP + 0{,}2196UNEM + 0{,}2967GD - 0{,}04432LDC - 0{,}03172LMS - 0{,}196LA - 0{,}52453CAR + 0{,}0146D$$
$$(-0{,}8793)\quad (2{,}0143)*\quad (6{,}6299)***\ (-1{,}4071)\quad (-0{,}7802)\quad (-3{,}4087)***(-3{,}3752)***(2{,}8042)***$$

Mauritius

$$NPL = -0{,}8297 - 0{,}0151LGDP + 0{,}0061GD - 0{,}0451LDC + 0{,}11225LMS - 0{,}7729CAR - 0{,}0318D$$
$$(-0{,}6607)\quad (0{,}1073)\quad (-2{,}3592)**\quad (1{,}9999)*\ (-3{,}0936)***\ (-4{,}2728)***$$

Ghana

$$NPL = 0{,}02467 - 0{,}0442LGDP + 2{,}9446UNEM + 0{,}02884LDC - 0{,}0836LMS - 0{,}49204LA - 0{,}6633CAR - 0{,}0676D$$
$$(-1{,}3789)\quad (4{,}2852)***\quad (0{,}6743)\quad (-2{,}3992)**\ (-2{,}7676)***\ (-2{,}0134)**\ (-4{,}4499)***$$

Nigeria

$$NPL = 2{,}486 - 0{,}1316LGDP - 0{,}0718LDC + 0{,}0163LMS - 0{,}14897LA - 1{,}2682CAR + 0{,}006967D$$
$$(-1{,}8363)*\quad (-2{,}1737)**\ (0{,}18971)\quad (-2{,}1242)**\ (-9{,}4568)***\ (0{,}4394)$$

t-ratios are given in parentheses. ***, **, * represent significance at the 1%, 5% and 10% levels.

5.3 ARDL Bounds Test for Cointegration.

After the test for stationarity was done and the model that best explains NPLs for each country had been identified, the ARDL Bound Test was employed. As advanced by Pesaran, Shin and Smith (2001), the test was used as a tool to identify whether a long-run relationship exists between the NPL ratio and the pre-specified dependent factors. For all countries, the lag selection was based on the Akaike Information Criterion. Table 5 presents the results of the test. Note that for both Morocco and Kenya, the generated F-statistic and W statistic lies above the 5 per cent and the 10 per cent upper critical bounds, which implies that the test for cointegration yields evidence of a long-run relationship between the NPL ratio, and the

underlying variables used. For both Botswana and Mauritius, the generated F statistic and W statistic lie above the 90 per cent upper critical bound but lie between the 95 per cent critical bounds. This implies that there is evidence of cointegration at the 10 per cent level but is inconclusive at the 5 per cent level. For the remaining countries (that is, Egypt, South Africa, Ghana, and Nigeria), as the F statistic and W statistic lie between both the 90 per cent and 95 per cent critical bounds, this implies that the test yields inconclusive evidence of cointegration between the NPL ratio and the underlying variables. Based on the inconclusive results that the test provides, it was proceeded with the ARDL framework to confirm the existence or non-existence of cointegration among the NPL ratio and the underlying variables, based on the statistical significance of the ECM term.

Table 6: ARDL Bounds Test for Cointegration.

	95% Lower Bound	**95% Upper Bound**	**90% Lower Bound**	**90% Upper Bound**
Egypt				
F-Statistic				
3,7120	3,6183	4,9132	3,0421	4,1730
W-Statistic				
17,5599	18,0913	24,5661	15,2104	20,8649
Morocco				
F-Statistic				
6,8160	3,1837	4,5017	2,6934	3,8887
W-Statistic				
35,8960	19,1020	27,0104	16,1602	23,3321
Botswana				
F-Statistic				
4,4189	3,4739	4,6797	2,8934	3,9549
W-Statistic				
17,6756	13,8958	18,7188	11,5735	15,8196
South Africa				
F-Statistic				
3,5478	2,9407	4,1248	2,5476	3,6054
W-Statistic				
24,8343	20,5851	28,8735	17,8330	25,2375

Kenya				
F-Statistic				
5,2094	3,6625	4,9375	3,0595	4,2149
W-Statistic				
26,0471	18,3124	24,6877	15,2977	21,0745
Mauritius				
F-Statistic				
5,0106	4,1022	5,2951	3,4180	4,4852
W-Statistic				
18,0423	16,4087	21,1805	13,6722	17,9407
Ghana				
F-Statistic				
3,6004	3,5744	4,8576	3,0224	4,1619
W-Statistic				
18,0022	17,8720	24,2878	15,1122	20,8095
Nigeria				
F-Statistic				
3,7531	3,2522	4,5075	2,7101	3,8204
W-Statistic				
18,7653	16,2608	22,5377	13,5505	19,1018

5.4 ARDL Estimated Long-Run Coefficients.

Table 6 below presents the long-run estimates of the ARDL model for each of the eight African countries. Based on the results, in the long run, NPLs for the North African countries are primarily driven by macroeconomic variables rather than banking industry-specific variables. This can be attributed to several important indicators for financial soundness, credit quality, the strength of the banks' financial position, and profit levels that outline a stable and well-capitalised banking sector. This is further captured in Chapter 3 of the study. From the long-run model estimates, it is observed that for both Egypt and Morocco that domestic credit to the private sector has a negative relationship with NPLs at a 1% significance level. A 1% increase in the level of domestic credit to the private sector results in a 0,12% (in Egypt) and a 1,52% (in Morocco) decrease in NPLs. Though in contrast with the expected hypothesis, the finding is supported by other studies. Washington (2014) found in a study of commercial banks in Kenya that NPLs displayed a negative correlation with domestic credit to the private sector. The author attributes this relationship to two primary factors. Firstly, borrowed loans were

allocated to the most productive activities, which subsequently earned a greater return and hence increased the likelihood of the loans being repaid. Secondly, greater efforts were undertaken by banks to screen loan applicants, which, in turn, decreased NPLs as tighter lending conditions resulted in loan up takers being vetted out. This finding is supported by the sign and statistical significance of money supply. From the model, the estimates suggest for both Egypt and Morocco that money supply (M2) has a negative and significant relationship with NPLs at a 5% significance level for Egypt and a 1% significance level for Morocco. This supports the finding for domestic credit to the private sector, as it suggests that increasing the level of financial intermediation through easing monetary policies and increasing money supply has a decreasing effect on NPLs (Nikolaidou and Vogiazas, 2017). Thus, a 1% increase in M2 money supply results in a 0,12% (in Egypt) and 0,07% (in Morocco) decrease in NPLs.

Although the domestic credit to the private sector and money supply variables appears as determinants of NPLs in both Egypt and Morocco, other determinants impact NPLs in both countries differently. From the long-run estimates, government debt as a percentage of GDP is statistically significant and positive in the case of Egypt but not Morocco. This would imply that a 1% increase in the level of government debt would result in a 0,03% increase in NPLs. This positive and significant effect of government debt is also observed in other countries such as South Africa and Kenya. Broadly, this finding is well supported amongst relevant literature and is consistent with that of Eyraud et. al (2021). In their findings, they suggest that higher debt levels lead to higher NPLs for two reasons. Firstly, higher debt levels increase the sovereign risk premium, which, in turn, increases banks' funding costs and lending rates. Second, higher debt levels also increase the likelihood of government arrears accumulating, which, in turn, translates into higher NPLs. In the same line, Ali and Daly (2010) establish that higher levels of public debt translate into higher levels of national debt, which, in turn, severely impacts borrowers' debt repaying capacity and results in an increased probability of observing higher default rates.

From the model, the long-run estimates indicate that NPLs in Morocco are significantly impacted by the economic environment, namely economic growth and labour market conditions. It is observed that a negative and statistically significant relationship holds between NPLs and the log of real GDP (measured in constant US$) at the 1% significance level. This suggests that a 1% increase in GDP increases borrowers' ability to service debt, which, consequently, decreases the country's NPLs by 0,12% in the long term. Though not significant,

the direction of this relationship is also observed in Nigeria. This finding is expected and is supported by Castro (2013), Ghosh (2015), and Louzis, Vouldis, and Metaxas (2012). An improved economic environment is associated with greater asset quality, as borrowers' income and their capacity to repay debt increase, and hence NPLs are reduced. As for the effect of unemployment, from the long-run estimates, a positive and significant relationship is observed at the 1% significance level. Thus, a 1% increase in the unemployment rate reduces borrowers' capacity to service debt and subsequently leads to a 3,18% increase in NPLs. This positive correlation is also found in South Africa and Kenya. However, this reported effect seems only a critical factor in determining NPLs in the long term for Ghana. Broadly, the effect of unemployment on NPLs is in line with other studies (Nikolaidou and Vogiazas, 2011; Fofack, 2005; Kangogo and Asienga, 2014), suggesting that a deterioration in labour market conditions decreases asset quality, as rising unemployment results in a loss of income for borrowers' and reduces their ability to service debt obligations. Overall, rising unemployment indicates that a country may be facing a recession, and as a result, NPLs increase (Mustafa and Ali, 2019).

In the case of Southern African countries, in the long-run, NPLs seem to be highly sensitive to banking industry-specific variables rather than macroeconomic variables. Though this indicates that these countries are less vulnerable to NPL surges originating from adverse macro-financial shocks, it does, however, suggest that these countries are more exposed to problems originating from the banking sector itself. An example of such a surge includes the 2009 Nigerian credit bust where a credit financed stock market boom was followed by a bust (Eyraud et. al, 2021). As for the Southern African countries, a plausible explanation for the high exposure to potential banking shocks could be due to deteriorating government finances. As a result, lending to the private sector has decreased as banks within the region have been placed under enormous pressure attempting to fund budget deficits (European Investment Bank, 2020). From the long-run estimates, it is observed that the liquid asset ratio has a negative and statistically significant correlation with NPLs at a 10% significance level (in Botswana) and a 5% significance level (in South Africa). This statistically significant and negative relationship is also observed for Ghana and Nigeria. For this study, the liquid asset ratio is used as a basic indicator of liquidity risk and represents a bank's capacity to respond timely to its obligations (Malandrakis, 2014). In general, an increasing liquid asset ratio indicates decreasing liquidity risk, and a decreasing NPLs ratio indicates decreasing credit risk. Therefore, a plausible interpretation of this effect is that as liquidity risk decreases, so does credit risk. Given that liquidity risk is measured by the liquid asset ratio and credit risk is measured by the NPL ratio.

As for the effect of the capital adequacy ratio, in the long run, the relationship with the NPL ratio is statistically significant and negative for South Africa at a 5% significance level but not for Botswana. This effect is also observed for Mauritius and Nigeria where the relationship is statistically significant and negative at the 1% significance level. This negative effect is expected as more capitalised banks tend to have lower loan default rates due to a greater capacity for long-term financing and solvency and are therefore better equipped to absorb adverse financial shocks (Eyraud et. al, 2021; Koju, Koju, and Wang, 2018). The reverse can be understood through the "moral hazard" hypothesis. As postulated by Keeton and Morris (1987), the "moral hazard" hypothesis suggests that less capitalised banks tend to engage in more risk-taking activities, which, in turn, translates into higher NPLs.

Finally, the dummy variable that accounts for the implementation of IFRS 9 had a statistically significant and negative relationship with NPLs in the long run for Egypt, South Africa, Kenya, and Mauritius. Though not statistically significant, in the long run, a negative relationship was also shown for Ghana. This negative effect highlights a key issue surrounding the post-crisis accounting standards. As stated by Bholat and Markose (2018), when banks raise provisions for doubtful loans, two subsequent entries are made on the balance sheet, the number of assets is reduced, which, in turn, leads to a lower income for that period. The consequence of that is a reduction in shareholders' equity. Therefore, during phases of benign market conditions, early provisioning against doubtful loans can lower banks' profit levels in the short run. However, over the long run, when market conditions prove unfavourable, these forward-looking accounting standards may reduce the need for banks to raise equity when it is more challenging to do so.

Table 7: Estimated Long-Run Coefficients.

Dependent Variable: NPL				
Regressor	**Coefficient**	**Significance**	**Std. Error**	**T-Ratio**
Egypt				
GD	0,0258	***	0,0049	5,2133
LDC	-0,1145	***	0,0222	-5,1482
LMS	-0,1003	**	0,0385	2,6026
CAR	-0,1780	**	0,0688	-2,5871
D	-0,0522	*	0,0256	-2,0410
C	0,0040		1,0460	0,0038
Morocco				

LGDP	-0,1195	***	0,0348	-3,4362
UNEM	3,1773	***	0,8705	3,6499
GD	0,0871		0,0723	-1,2048
LDC	-1,5242	***	0,1846	-8,2577
LMS	-1,1244	***	0,1858	6,0503
D	-0,0058		0,0060	-0,9606
C	-1,1388	***	0,3515	-3,2399
Botswana				
LMS	0,0590		0,1143	-0,5164
LA	-0,7832	*	0,4470	-1,7522
CAR	-2,0670		1,3769	-1,5012
C	0,0440		0,0055	8,0118
South Africa				
UNEM	0,0567		0,1080	0,5250
GD	1,2349	***	0,4275	2,8887
LDC	-0,2080		0,1534	1,3562
LMS	-0,1682		0,1468	-1,1458
LA	-2,3159	**	1,0987	-2,1078
CAR	-2,0002	**	0,8724	-2,2927
D	-0,0154	***	0,0047	-3,3094
C	0,0260	***	0,0025	10,3741
Kenya				
UNEM	0,2032		0,6144	0,3306
GD	6,9811	**	3,3224	2,1012
LA	-2,9237		1,8116	-1,6138
CAR	-5,6357		5,2560	-1,0722
D	-0,0466	**	0,0171	-2,7158
C	0,0160		0,0190	0,8436
Mauritius				
LDC	0,06002		0,10936	0,54881
LMS	0,014178		0,14499	0,097783
CAR	-0,7902	***	0,83562	-2,94565
D	-0,039991	*	0,022084	-1,8109
C	-0,77117		0,51754	-1,4901
Ghana				
UNEM	3,0484	***	9,6962	3,099
LMS	-0,17595		0,21633	-0,81332
LA	-2,3572	**	1,1268	-2,0919
CAR	-1,3659		1,1737	-1,1638
D	-0,021306		0,034193	-0,62313
C	0,3964	*	0,2067	1,9178
Nigeria				

LGDP	-0,0716		0,0745	-0,9620
LDC	0,0340		0,0667	0,5099
LA	-0,4328	**	0,2077	-2,0839
CAR	-1,2393	***	0,4062	-3,0510
C	0,8321		0,8549	0,9733

***, **, * represent significance at the 1%, 5%, and 10% levels

5.5 ARDL Error Correction Model (ECM).

Table 7 presents the error correction term and the short-run causation of the prespecified factors on NPLs. As mentioned previously, the ECM integrates short-run adjustments with the long-run equilibrium without losing long-run information, and as such, measures the extent to which any disequilibrium in one period is corrected in the next (Nkoro and Uko, 2016). As the error correction term is negative for all the countries, this indicates a convergence to equilibrium. More specifically, the coefficient of the error correction term is estimated at -0.12 for Egypt, -0.38 for Morocco, -0.20 for Botswana, -0.06 for South Africa, -0.17 for Kenya, -0.14 for Mauritius, -0.22 for Ghana, and -0.29 for Nigeria. Broadly, these results indicate that 9% of the adjustment takes place in Egypt each quarter, in Morocco by 38% each quarter, in Botswana by 20% each quarter, in South Africa by 6% each month, in Kenya by 17% each quarter, in Mauritius by 14% each quarter, in Ghana 22% each quarter, and in Nigeria by 29% each quarter. Overall, the negative sign and the statistical significance of each of the error correction terms provide sufficient evidence to conclude the existence of cointegration between the prespecified factors and NPLs.

In the case of North Africa, the ECM reveals that in the short-run, NPL surges are primarily driven by macro-financial shocks. The findings are in line with the long-run estimates, where the variables maintain a similar relationship with NPLs and the significance of these relationships. Thus, suggesting that a lag is not present between the absorption of the prespecified variables and NPLs. For both Egypt and Morocco, domestic credit to the private sector is statistically significant at the 1% level. The direction of the effect is in line with the long-run estimates and thus suggests that increasing domestic credit to the private sector results in a decline in NPLs. As for Mauritius, the variable displays a negative and statistically significant impact on NPLs in the short-run but not the long-run. This suggests that for Mauritius, domestic credit to the private is not a long-run determinant of NPLs but rather a short-run determinant. The coefficient of M2 money supply suggests that a negative

relationship exists with NPLs in the short-run, with the relationship maintaining statistical significance at the 1% level for Egypt and 5% level for Morocco. A plausible explanation for this negative relationship between monetary conditions and NPLs could be due to stricter lending regulations implemented by the Central Bank of Egypt (CBE) in early 2016. These new regulations marked a significant macro-prudential advance and according to Moody's, "the overall effect would be credit positive because they will contain the credit risk in banks' rapidly expanding retail portfolios as well as reduce banks' asset quality vulnerability that arises from large single corporate customer concentrations" (Oxford Business Group, 2021). Overall, the findings of this study suggest that domestic credit to the private sector and M2 money supply are critical determinants of NPLs in Egypt and Morocco in both the short-run and long run.

The coefficient for government debt as a percentage of GDP suggests that, in the short run, government debt levels have a positive effect on NPLs at the 10% level in Egypt. This positive effect and the statistical significance align with the long-run estimates presented within this study. Further, this finding is consistent with that of Makri, Tsagkanos, and Bellas (2014) who, find rising debt levels to be positively associated with NPLs, suggesting that fiscal issues within the banking sector can lead to undesirable levels of credit risk. This is supported by Fofack (2005), attributes the exponential rise of NPLs across SSA in the 1990s to continuing fiscal deficits and balance of payment difficulties. As a result, banks and other financial institutions resorted to highly priced short-term financing, which, in turn, compounded the crisis and the accumulation of NPLs across the SSA region. Similarly, to the long-run estimates, government debt has no significant impact on NPLs in Morocco in the short-run. Thus, these findings suggest that in both the long-run and short-run, government debt is not a critical determinant of NPLs in Morocco.

However, a positive and statistically significant effect is observed in other countries such as Kenya and South Africa, indicating that a rise in debt levels adversely impacts borrowers' creditworthiness in the long run and short run. In the case of South Africa, rising debt levels have translated into rising bad debt, which, in turn, has curtailed banks capacity to pump fresh credit into the economy and hence default rates have increased. Overall, the significance of rising debt levels as a determinant of NPLs in each region varies widely. A plausible explanation of this finding is that the results link to the typical dominant profile of borrowers in each country. For example, in the Southern African countries, small and medium-sized

enterprises (SMEs) are facing obstacles in obtaining access to financing due to high interest rates and stringent collateral demands, which, in turn, has fuelled an increase in NPLs (European Investment Bank, 2020).

From the ECM model, the short-run estimates reveal that the economic environment is a critical determinant of NPLs in Morocco. It is observed that, in the short run, the log of real GDP has a negative effect on NPLs at the 5% significance level. This is expected and is aligned with the hypothesised relationship, as credit risk decelerates during periods of economic expansion (Fofack, 2005). As for Nigeria, the results suggest a negative and statistically significant impact on NPLs in the short run but displays no significant effect in the long run. This negative effect is aligned with the findings of Kure, Adigun, and Okedigba (2017), who, in a study of NPLs in Nigerian Banks, found that Real GDP growth reduces the NPL ratio. The study underlines that increased economic activity gives rise to borrowers' income level and their capacity for debt repayment. Policies aimed at expanding employment opportunities and improving productivity could further elevate borrowers' debt repaying capacity and thus reduce NPL growth. Overall, the results suggest that the log of GDP is a short-run determinant of NPLs rather than a long-run determinant. The unemployment rate has a positive and statistically significant impact on NPLs at the 1% level. This supports the finding of Castro (2013), which states that rising unemployment rates adversely impact borrowers' cash flow streams and thus increase the debt burden. Overall, the two variables highlight the effect of the business cycle on banks' loan quality and thus supports the notion that in both the short-run and long-run, favourable economic conditions result in a gain of income source for borrowers, which, subsequently increases the ability for loan repayments.

Similarly to the long-run estimates, the short-run estimates reveal that for the Southern African countries, NPLs surges seem to be highly sensitive to problems arising from the banking sector. The same could be said for the Eastern and Western African countries, where a change in these factors had no long-run impact on NPLs, but a change in these factors is associated with a change in NPLs in the short run. For these countries, the effect of the liquid asset ratio and the capital adequacy ratio is critical in determining NPLs in the short run. Broadly, the negative impact of both variables is in line with prior theoretical and empirical evidence. The negative effect of the liquid asset ratio is according to expectations as the higher this ratio, the greater the amount of liquidity held by banks and thus the lower the NPL ratio (Nikolaidou and Vogiazas, 2017). As such, the negative relationship shown in the results aligns with prior

empirical evidence and the long-run estimates presented in Table 6. In the case of Kenya, the liquid asset ratio displays no significant impact on NPLs in the long run, but a 1% change in the liquid asset ratio does result in a 0,10% decline in NPLs in the short run. As for the effect of the capital adequacy ratio, the short-run estimates maintain the direction and significance of the impact on NPLs for South Africa, Mauritius, and Nigeria. Regarding the negative effect of the capital adequacy ratio on NPLs in Nigeria, this relationship can be attributed to a well-capitalised banking system that has seen both liquidity and solvency ratios increasing and NPLs subsequently decreasing. According to the IMF (2021), since the breakout of Covid-19, banks in Nigeria have been tapping into adequate capital buffers, which, in turn, has seen the system's NPL levels remain stable. For the other countries, the long-run coefficients are not statistically significant. However, the short-run coefficients are statistically significant at the 5% level for Botswana and Kenya and the 1% level for Ghana, thus implying that the capital adequacy ratio is a critical determinant of NPLs for these countries in the short run.

The dummy variable that accounts for the implementation of IFRS 9 has a statistically significant and negative relationship with NPLs in the short run for countries like Egypt, South Africa, and Mauritius. Broadly, the results highlight the importance of early identification of and provisioning against NPLs. The shift to a more forward-looking accounting standard has better enabled banks and other financial institutions to understand where credit risk may be forming on the balance sheet, which, in turn, has better equipped these institutions to mitigate the effects of NPL surges as they arise (Bholat and Markose, 2018). For Kenya, the dummy variable does not have any effect on NPLs in the short run and thus suggests that a lag is present between the absorption of the IFRS 9 dummy variable and NPLs.

Table 8: Summary of Error Correction Model Coefficients.

Dependent Variable: NPL				
Variable	**Egypt**	**Morocco**	**Botswana**	**South Africa**
LGDP		-0,0197**		
UNEM		0,1024***		0,0033
GD	0,0098*	0,0088		0,0207**
LDC	-0,1655***	-0,0662***		0,0122
LMS	-0,1724***	-0,0593**	-0,0117	0,0098
LA			-0,1300**	-0,1356***
CAR	-0,2564*		-0,3468**	-0,1171***
D	-0,0064***	-0,0006		-0,0009***

ECM(-1)	-0,1224***	-0,3789***	-0,1984***	-0,0585***
R-Squared	0,4854	0,5432	0,3398	0,4864
Adjusted R-Squared	0,2098	0,5177	0,1949	0,4222
DW Statistic	1,9525	1,8571	2,0344	1,8169

	Kenya	**Mauritius**	**Ghana**	**Nigeria**
LGDP				-0,0858***
UNEM	0,0477		1,1725**	
GD	0,0572*			
LDC		-0,0636***		0,0097
LMS		-0,0020	0,0084	
LA	-0,1010**		-0,2585**	-0,1563*
CAR	-0,2492**	-0,1125***	-0,6222***	-0,4863**
D	-0,0007	-0,0057*	-0,0045	
ECM(-1)	-0,1701**	-0,1423**	-0,2174**	-0,2867**
R-Squared	0,6031	0,3337	0,6904	0,7617
Adjusted R-Squared	0,4115	0,1813	0,6210	0,6226
DW Statistic	2,0558	2,2294	1,9592	1,9473

***, **, *, represent significance at the 1%, 5%, and 10% levels, respectively

5.6 Diagnostic Tests.

This model aims to predict the long-run and short-run association among the prespecified dependent variables and the NPL ratio. Therefore, it is required that the basic assumptions of the ARDL Bounds approach be tested. This step is vital to the study as it ensures the validity and robustness of the test results. For this purpose, the model was augmented with four diagnostic tests: (A) the Lagrange multiplier test for residual serial correlation; (B) Ramsey's RESET test for functional form; (C) a test for normality that is based on the skewness and kurtosis of residuals; and (D) a test for heteroscedasticity that is based on the regression of squared residuals on squared fitted values. The results of the diagnostic tests are presented in Tables 8 and 9. It is clear from Table 8 that no LM Test statistic displays statistical significance at the 10 per cent level. Therefore, the models for each country are free from any issues relating to serial correlation, functional form, normality, and heteroscedasticity. Similarly, Table 9 presents results that are in line with Table 8, confirming the strong performance of each model.

Table 9: Diagnostic Tests LM version.

Test Statistics		Results (Probability)
Egypt		
A:Serial Correlation	CHSQ(4)	3,7575[0,440]
B:Functional Form	CHSQ(1)	0,2974[0,863]
C:Normality	CHSQ(2)	1,9211[0,371]
D:Heteroscedasticity	CHSQ(1)	1,5409[0,193]
Morocco		
A:Serial Correlation	CHSQ(4)	1,2824[0,684]
B:Functional Form	CHSQ(1)	1,4708[0,225]
C:Normality	CHSQ(2)	3,3040[0,263]
D:Heteroscedasticity	CHSQ(1)	1,7552[0,185]
Botswana		
A:Serial Correlation	CHSQ(4)	2,6284[0,622]
B:Functional Form	CHSQ(1)	0,2451[0,621]
C:Normality	CHSQ(2)	0,9152[0,633]
D:Heteroscedasticity	CHSQ(1)	0,1875[0,665]
South Africa		
A:Serial Correlation	CHSQ(4)	13,9404[0,305]
B:Functional Form	CHSQ(1)	2,5547[0,118]
C:Normality	CHSQ(2)	3,7591[0,157]
D:Heteroscedasticity	CHSQ(1)	0,9128[0,339]
Kenya		
A:Serial Correlation	CHSQ(4)	5,4587[0,243]
B:Functional Form	CHSQ(1)	0,4953[0,482]
C:Normality	CHSQ(2)	2,9247[0,232]
D:Heteroscedasticity	CHSQ(1)	1,2876[0,256]
Mauritius		
A:Serial Correlation	CHSQ(4)	3,8207[0,431]
B:Functional Form	CHSQ(1)	0,3769[0,539]
C:Normality	CHSQ(2)	0,6285[0,730]
D:Heteroscedasticity	CHSQ(1)	1,0093[0,315]
Ghana		
A:Serial Correlation	CHSQ(4)	5,5526[0,235]
B:Functional Form	CHSQ(1)	0,1613[0,688]
C:Normality	CHSQ(2)	1,9142[0,384]
D:Heteroscedasticity	CHSQ(1)	1,0483[0,306]

Nigeria		
A:Serial Correlation	CHSQ(4)	6,0109[0,161]
B:Functional Form	CHSQ(1)	2,6004[0,115]
C:Normality	CHSQ(2)	5,4094[0,152]
D:Heteroscedasticity	CHSQ(1)	,0122[0,912]

A: Lagrange multiplier test of residual serial correlation

B: Ramsey's RESET test using the square of the fitted values

C: Based on a test skewness and kurtosis of residuals

D: Based on the regression of squared residuals on squared fitted values

Table 10: Diagnostic Tests F Version.

Test Statistics		Results (Probability)
Egypt		
A:Serial Correlation	F(4,24)	0,5602[0,694]
B:Functional Form	F(1,27)	0,1826[0,894]
D:Heteroscedasticity	F(1,42)	1,6511[0,187]
Morocco		
A:Serial Correlation	F(4,36)	1.1999[0,372]
B:Functional Form	F(1,39)	0,9971[0,324]
D:Heteroscedasticity	f(1,58)	1,7478[0,191]
Botswana		
A:Serial Correlation	F(4,39)	0,5191[0,722]
B:Functional Form	F(1,39)	0,1883[0,667]
D:Heteroscedasticity	F(1,49)	0,1808[0,673]
South Africa		
A:Serial Correlation	F(12,68)	1,0120[0,448]
B:Functional Form	F(1,79)	1,1357[0,264]
D:Heteroscedasticity	F(1,90)	0,9019[0,345]
Kenya		
A:Serial Correlation	F(4,25)	0,8852[0,487]
B:Functional Form	F(1,28)	0,3188[0,577]
D:Heteroscedasticity	F(1,42)	1,2661[0,267]
Mauritius		
A:Serial Correlation	F(4,31)	0,7369[0,574]
B:Functional Form	F(1,34)	0,2937[0,591]
D:Heteroscedasticity	F(1,42)	0,9861[0,326]

Ghana		
A:Serial Correlation	F(4,24)	0,8038[0,535]
B:Functional Form	F(1,27)	0,0929[0,763]
D:Heteroscedasticity	F(1,45)	1,0266[0,316]
Nigeria		
A:Serial Correlation	F(4,19)	1,4272[0,263]
B:Functional Form	F(1,22)	2,2376[0,149]
D:Heteroscedasticity	F(1,37)	0,0115[0,915]

A: Lagrange multiplier test of residual serial correlation
B: Ramsey's RESET test using the square of the fitted values

D: Based on the regression of squared residuals on squared fitted values
Note: The Test for normality is not applicable for the F Version

In summary, the variety of diagnostic tests performed confirm that the models for each country are free from any issues relating to serial correlation, functional form, normality, and heteroscedasticity. The following chapter presents the concluding remarks of the study, along with a discussion on policy recommendations, limitations, and suggestions for potential future research.

Chapter 6: Conclusion.

This chapter presents a brief overview of the concluding remarks, policy recommendations, limitations, and ideas for potential further research.

6.1 Concluding remarks.

The damaging effect that ensued from the 2008 and 2009 Global Financial Crisis highlighted the dangers of the accumulation of NPLs within a country's banking system and has since revived policy-makers' interest in the analysis of the factors triggering NPLs. Despite the growing number of studies analysing the determinants of NPLs, most of the work pays greater attention to developed countries. Therefore, an opportunity exists within this field to understand the drivers of NPLs in less economically advanced countries, and in particular in African countries, a topic which has received little academic attention in the past. Furthermore, most prior work employed panel studies and therefore fails to incorporate the specificities of each country. Nikolaidou and Vogiazas (2017) provide such an investigation but do not account for any structural break that may exist within the data following the implementation of IFRS 9. Taking an isolated approach, this study focuses on a sample of eight African countries, together representing four main African regions, to empirically investigate the determinants of NPLs, while accounting for the implementation of the IFRS 9 accounting standard.

This study utilises the ADRL bounds approach to cointegration to empirically test the existence of a long-run relationship between specific underlying macro-economic and bank industry-specific variables and the credit risk within the sample African banking systems, using NPLs as a proxy for credit risk. Cointegration tests examine how different times series can be paired in such a way that the workings of equilibrium forces do not deviate too far apart. As such, testing for cointegration is an essential step in any time series modelling, as it determines if a model demonstrates any meaningful long-run relationships (Nkoro and Uko, 2016). Unlike the other cointegration procedures, the ARDL approach gives realistic and efficient estimates irrespective of whether the underlying variables are integrated of order zero, order one, or a combination of both. Once a cointegrating vector has been identified, the ARDL approach reparameterises the cointegrating vector into an ECM that gives the short-run dynamics and long-run information of the underlying variables for the single model. Essentially, the ECM enables the ARDL approach to effectively test for the presence of a long-run relationship between a set of variables (Pesaran, Shin, and Smith, 2001).

The exogenous variables used in this study captures many factors described in theory and the academic literature, namely macroeconomic variables and banking industry-specific variables, as well as a novel external variable that accounts for the implementation of IFRS 9. The empirical findings indicate that volume of NPLs across each region are impacted uniquely. In particular, NPL surges in the Northern African countries are primarily driven by macroeconomic variables rather than banking industry-specific variables. In general, the North African banking systems are much deeper, well penetrated, and more efficient than those of the other sub-regions, signalling that the North African banking systems are more resilient to any systemic banking failures (Nyantakyi and Sy, 2015). This greater resiliency can be attributed to several factors, one of which includes continued improvements in financial inclusion rates that has enabled North African banks to reach a far greater proportion of unbanked individuals (IQPC Middle East, 2016). From the test results, it can be concluded that in both the short-run and long-run, domestic credit to the private sector and the log of money supply (M2) have a statistically significant and negative relationships with NPL growth in Egypt and Morocco. This suggests that credit risk in both banking systems is significantly impacted by monetary conditions: credit risk decreases as the level of domestic credit and money supply (M2) increases. In the case of Egypt, the level of government debt, the capital adequacy ratio, and the dummy variable accounting for the implementation of IFRS 9 are all critical determinants of NPLs in both the short-run and long run. As for Morocco, NPL fluctuations seem to be additionally driven by the economic environment where the log of GDP negatively affects NPLs and the unemployment rate positively affects NPLs. Though the channel of influence appears to be mixed, both are expected and in line with prior theoretical considerations, as it suggests that during phases of economic expansion (high GDP and low unemployment), borrowers' income levels are likely to increase and hence improve their debt repaying capacity.

In both the long-run and short-run, NPLs in the Southern African countries seem to be highly sensitive to banking industry-specific factors rather than macroeconomic factors. This indicates that these countries banking systems are less exposed to macro-financial shocks and more exposed to problems originating in the banking sector itself. In the case of South Africa, the empirical findings indicate that both the liquid asset ratio and the capital adequacy ratio have a statistically significant and negative effect on NPLs. As for Botswana, the liquid asset ratio is a critical determinant of NPLs in both the long-run and short-run. This channel of influence is in line with expectations and suggests that the greater the amount of liquidity held by banks,

the lower the NPLs. Further, a change in the capital adequacy ratio had no long-run impact on NPLs in Botswana, but a change in this factor is associated with a change in NPLs in the short-run. The negative coefficient of the capital adequacy ratio appears to align with the "moral hazard" hypothesis, which implies that low capitalised banks have greater incentives to engage in risky lending activities (lowering credit standards), which, in turn, leads higher NPL levels.

As for the Eastern and Western African countries, the results reveal that, in the short-run, NPLs are highly sensitive to banking industry-specific factors rather than macroeconomic factors, where both the liquid asset ratio and capital adequacy ratios significantly affect NPL growth. In the case of the East African countries, the resiliency to macro-financial shocks is driven by favourable economic outlooks, regulatory developments, and macroeconomic policies that have been supportive of strong economic performance. Thus, the main risks (NPL surges) derive from potential banking sector shocks. In both the long-run and short-run, government debt levels are a critical determinant of NPLs in Kenya. This highlights a common trend within East African banking systems where government debt stocks continue to grow and public deficits remain high, leaving countries such as Kenya increasingly exposed to shocks (European Investment Bank, 2020). Further, the significant effect of domestic credit on NPLs in Mauritius highlights a crowding-out effect in East African banks, where high public debt ratios and financing needs have increased government debt and subsequently crowded out public sector resources. In the case of West Africa, NPL growth is significantly impacted by the liquid asset ratio and the capital adequacy ratio in both the long-run and short-run for Nigeria but only in the short-run for Ghana. Further, the findings reveal that in addition to banking-specific factors, the economic environment also significantly affects NPLs where the log of GDP negatively impacts NPLs in Nigeria and the unemployment rate positively impacts NPLs in Ghana. Overall, amidst a challenging external environment fuelled by the COVID-19 pandemic and the fall in international oil prices, GDP growth remained strong across the West African region and entry into the Basel III capital requirements aided in sustained banking sector performance. However, uninspiring growth in Nigeria and high NPLs on banks' balance sheets has left the region relatively exposed to potential external shocks (European Investment Bank, 2020).

The financial costs of NPLs on banks' balance sheets following the GFC highlighted the need for a universal accounting standard that incorporates a broader array of credit information. IFRS 9 was established to mitigate the flaws of the previous standard. The delayed recognition

of credit losses meant that banks would only raise provisions for non-performance when an actual loss event occurred. Under IFRS 9, provisions must be raised as a new loan is written (Bholat and Markose, 2018). This forward-looking standard aims to resolve the root of bad lending that fuelled the 2008/2009 GFC by ensuring a robust financial system that is resilient to potential shocks. The empirical findings indicate that the implementation of IFRS negatively impacts NPLs in both the long-run and short-run for Egypt, South Africa, and Mauritius. As for Kenya, the effect of IFRS is a critical determinant of NPLs in the long-run but not in the short-run, thus indicating a lag between the absorption of the factor and NPLs. For the other countries, the lack of a significant relationship can be explained through several factors, some of which include how banks implement the standard and the contributions by central banks (South African Reserve Bank, 2017). Overall, IFRS 9 is now required in 125 jurisdictions and the implementation of which has taken great strides in resolving the weaknesses of the previous standard. As evidenced by the negative coefficient and the steps taken to address key issues such as greater disclosure and transparency, the implementation of IFRS has led to lower NPLs and subsequently reduced the consequences associated with NPL surges, such as bank insolvency and systemic risk.

6.2 Policy recommendations.

In the light of the empirical findings for this study, policy recommendations should be directed towards monitoring and preventing the adverse impact NPLs have on the real economy. For the Northern African countries, given the impact of macroeconomic conditions have on NPLs, these countries need to acknowledge the impact alterations in monetary policies and the economic environment have within the economy. In this respect, central banks within the region should promote sustainable economic growth where the benefits of growth are shared throughout the economy. To achieve this goal, central banks should look to integrate potential macroeconomic shocks into financial policy decision-making. Further, central banks could implement monetary policy changes aimed at restoring macroeconomic stability when the level of NPLs prove troublesome. As the empirical results highlight, positive changes to both the level of domestic credit to the private sector and M2 money supply negatively impact NPL growth. Thus, the implementation of expansionary monetary policy changes aimed at injecting greater liquidity into the real economy could contribute to improving individuals and businesses access to additional finance, which, in turn, would decrease the volume of NPLs.

In the case of the Southern, Eastern, and Western African countries, the empirical findings indicate a vulnerability to banking industry-specific problems. Historically, the Sub-Saharan African (SSA) countries have had issues with crises arising from the banking sector where the volume of NPLs increased dramatically. Thus, any policy recommendations should be directed towards ensuring stable banking sector performance. In particular, NPLs in South Africa and Kenya display a high sensitivity to debt levels. Recent banking sector trends can to some extent explain the underlying impact, as public and government finances in both countries continue to deteriorate. As such, budget deficits in both countries have increased, and subsequently, public debt levels have risen (European Investment Bank, 2020). This high exposure to elevated public deficits and government securities leaves both countries vulnerable to potential sovereign crises. Therefore, central banks should seek to reduce this reliance on government debt stocks and ensure that debt levels remain within more comfortable regions. Further, as highlighted by the empirical findings, the capital adequacy ratio has a statistically significant and negative relationship with NPLs. This finding coincides with prior empirical findings and thus, suggests that well-capitalised banks are less exposed to banking sector shocks. Therefore, central banks in these regions should look to encourage the development of solid capital buffers to act as a cushion in times of financial distress.

6.3 Limitations.

A limitation when researching developing countries is the lack of reliable, consistent, and sufficiently long time-series data (Nikolaidou and Vogiazas, 2017). This proved a concern as the original idea for the study was to separate the West African region into two components: English-speaking countries and French-speaking countries. The idea behind the separation was to understand how certain prespecified factors impacted NPLs in region that operates with two different financial systems. However, the unavailability of large data sets for the French-speaking African meant those countries were excluded from the study and that each region is limited to only two countries. Further, the frequency of available data posed another issue, which limited the study to focus predominantly on quarterly data apart from South Africa, where monthly data is utilised. Lastly, due to the unavailability of many variables for the less economically advanced countries, such as certain profitability ratios (ROA and ROE), meant that study is limited to only a few select variables.

6.4 Potential for future research.

This study investigates the determinants of NPLs utilising quarterly data in Egypt (Q1 2009 – Q4 2020), Morocco (Q1 2005 – Q4 2020), Botswana (Q1 2007 – Q4 2020), Kenya (Q1 2009 – Q4 2020), Mauritius (Q1 2009 – Q4 2020), Ghana (Q1 2008 – Q4 2020), Nigeria (Q1 2010 – Q4 2020) and monthly data in South Africa (December 2012 – December 2020). In terms of sample size, the data set is relatively small. Therefore, future research could involve making use of longer and more extensive datasets. Future research could also investigate how the structure of the banking sectors in each country impact NPLs. For example, the vast majority of the Northern African countries utilise an Islamic banking system. Thus, future research could conduct a comparative analysis of how the different banking systems contribute to the development of NPLs. Further, if longer and more extensive datasets were to be available, future research could investigate the factors driving NPLs on an individual bank basis rather than aggregate data for the whole banking sector. Lastly, incorporating a large dataset that excludes crisis periods could be of interest because it may offer greater insight into the accumulation of NPLs under normal market conditions.

References.

Consumer Default and the Life Cycle Model. *Journal of Money, Credit and Banking.* 27(4):939-954. Available: https://doi-org.ezproxy.uct.ac.za/10.2307/2077781.

Adebola, S.S., Yusoff, W.S.W. & Dahalan, J. An ARDL approach to the determinants of nonperforming loans in Islamic banking systems in Malaysia. *Kuwait Chapter of Arabian Journal of Business and Management Review.* 1(2):20-30.

African Development Bank. 2021. African Economic Outlook 2021. *African Economic Outlook.* :5-10. Available: https://www.afdb.org/en/documents/african-economic-outlook-2021.

Ahamed, M.M. & Mallick, S.K. 2019. Is financial inclusion good for bank stability? International evidence. *Journal of Economic Behavior & Organization.* 157:403-427. DOI:https://doi-org.ezproxy.uct.ac.za/10.1016/j.jebo.2017.07.027 Available: https://www-sciencedirect-com.ezproxy.uct.ac.za/science/article/pii/S0167268117302056.

Ahokpossi, C., Ismail, K., Karmakar, S. & Koulet-Vickot, M. 2013. Financial Depth in the WAEMU: Benchmarking
Against Frontier SSA Countries. *International Monetary Fund.* (IMF Working Paper 13/161).

Ali, A. & Daly, K. 2010. Macroeconomic determinants of credit risk: Recent evidence from a cross country study. *International Review of Financial Analysis.* 19(3):165-171. DOI:https://doi-org.ezproxy.uct.ac.za/10.1016/j.irfa.2010.03.001

Al-Khazali, O.M. & Mirzaei, A. 2017. The impact of oil price movements on bank non-performing loans: Global evidence from oil-exporting countries. *Emerging Markets Review.* 31:193-208. DOI:https://doi-org.ezproxy.uct.ac.za/10.1016/j.ememar.2017.05.006

Allen, F., Carletti, E., Cull, R., Qian, J. & Senbet, L. 2010. The African Financial Development Gap. European University Institute. (Working Paper, EUI ECO, 2010/24). 1725-6704. Available: http://hdl.handle.net/1814/14057

Allen, F., Otchere, I. & Senbet, L. 2011. African Financial Systems: A Review. *University of Pennsylvania.* 1(2):79-113. DOI:10.1016/j.rdf.2011.03.003.

Amuakwa-Mensah, F. & Boakye-Adjei, A. 2015. Determinants of non-performing loans in Ghana banking industry. *International Journal of Computational Economics and Econometrics.* 5(1) DOI:10.1504/IJCEE.2015.066207.

Ari, A., Chen, S. & Ratnovski, L. 2019. The Dynamics of Non-Performing Loans During Banking Crises: A New Database. IMF Working Paper. (WP/19/272)
Available: https://www-imf-org.ezproxy.uct.ac.za/en/Publications/WP/Issues/2019/12/06/The-Dynamics-of-Non-Performing-Loans-during-Banking-Crises-A-New-Database-48839.

Baudino, P., Orlandi, J. & Zamil, R. 2018. The identification and measurement of nonperforming assets: a cross country comparison. FSI Insights on Policy Implementation. (No 7). Available: https://www.bis.org/fsi/publ/insights7.pdf.

Beck, R., Jakubik, P. & Piloiu, A. 2015. Key Determinants of Non-performing Loans: New Evidence from a Global Sample. *Open Economies Review.* 3(26) DOI:10.1007/s11079-015-9358-8.

Beck, T. & Cull, R. 2013. Banking in Africa. Policy Research Working Paper; no. 6684. Available: https://openknowledge-worldbank-org.ezproxy.uct.ac.za/handle/10986/16899 License: CC BY 3.0 IGO.

Beck, T., Demirgüç-Kunt, A. & Levine, R. 2007. Finance, inequality and the poor. *Journal of Economic Growth.* 12(1):27-49.

Berger, A.N. & De Young, R. 1997. Problem Loans and Cost Efficiency in Commercial Banks. *Journal of Banking and Finance.* 21 DOI:10.17016/FEDS.1997.08.

Bernanke, B. & Gertler, M. 1994. The Financial Accelerator and the Flight to Quality. National Bureau of Economic Research Working Papers, no 4789. Available: http://www.nber.org/papers/w4789.pdf.

Bholat, D., Lastra, R., Markose, S., Miglionico, A. & Sen, K. 2016. Non-Performing Loans: Regulatory and Accounting Treatments of Assets. Bank of England Working Paper no. 594. DOI:http://dx.doi.org.ezproxy.uct.ac.za/10.2139/ssrn.2776586.

Bholat, D. & Markose, S. 2018. Non-performing loans at the dawn of IFRS 9: regulatory and accounting treatment of asset quality. *Journal of Banking Regulation.* 1(19):1-22. DOI:10.1057/s41261-017-0058-8.

Bohachova, O. 2008. The Impact of Macroeconomic Factors on Risks in the Banking Sector: A Cross-Country Empirical Assessment. *Institut Für Angewandte Wirtschaftsforschung (IAW).* (IAW Discussion Papers 44) Available: https://ideas.repec.org/p/iaw/iawdip/44.html

Boudriga, A., Taktak, N.B. & Jellouli, S. 2009. Banking supervision and nonperforming loans: a cross-country analysis. *Journal of Financial Economic Policy.* 1(4):286-318. DOI:10.1108/17576380911050043.

Castro, V. 2013. Macroeconomic determinants of the credit risk in the banking system: The case of the GIPSI. *Economic Modelling.* 31:672-683. DOI:https://doi-org.ezproxy.uct.ac.za/10.1016/j.econmod.2013.01.027 .

Chen, F., Feng, Y. & Wang, W. 2018. Impacts of Financial Inclusion on Non-Performing Loans of Commercial Banks: Evidence from China. *Sustainability, MDPI, Open Access Journal.* `10(9):1-28.

Demirgüç-Kunt, A. & Klapper, L. 2012. Financial Inclusion in Africa. The World Bank. (Policy Research Working Paper 6088). Available: *https://openknowledge.worldbank.org/handle/10986/9335 License: CC BY 3.0 IGO.*

De Bock, R. & Demyanets, A. 2012. Bank Asset Quality in Emerging Markets: Determinants and Spillovers. IMF Working Paper, no.71.

Drucker, P. 1963. Managing for Business Effectiveness. *Harvard Business Review*. Available: https://hbr.org/1963/05/managing-for-business-effectiveness.

Engle, R. & Granger, C. 1987. Co-integration and Error Correction: Representation, Estimation, and Testing. *Econometrica.* 55(2):251-276.

Espinoza, R. & Prasad, A. 2010. Nonperforming Loans in the GCC Banking System and their Macroeconomic Effects Raphael. IMF Working Paper, no.224.

European Commission. 2014. Vienna Initiative pushes for action plan to deal with NPLs in central and south-eastern Europe. Economic and Financial Affairs. Available: https://ec.europa.eu/economy_finance/articles/governance/2014-09-26-vienna-2_en.htm.

European Investment Bank. 2017. Banking in sub-Saharan Africa: recent trends and digital financial inclusion. European Investment Bank. Available: https://data.europa.eu/doi/10.2867/002264.

European Investment Bank. 2020. Banking in Africa: financing transformation amid uncertainty. Available: https://www.eib.org/en/publications/economic-report-banking-in-africa-financing-transformation-amid-uncertainty.

Eyraud, L., Bunda, I., Jack, J., Jardak, T., Ouedraogo, R., Wang, Z. & Wezel, T. 2021. Resolving Nonperforming Loans in Sub-Saharan Africa in the Aftermath of the COVID-19 Crisis. International Monetary Fund.

Fawson, C. & Chang, T. 1994. Cointegration, Causality, Error-Correction, and Export-Led growth in six countries: Japan, Philippines, South Korea, Taiwan, United Kingdom and United States. Economics Research Institute Study Paper. Paper 39. 94(9) Available: https://digitalcommons.usu.edu/eri/39/.

Fofack, H. 2005. Nonperforming loans in Sub-Saharan Africa: Casual analysis and macroeconomic implications. World Bank Policy Research Paper, 3769. DOI:10.1596/1813-9450-3769.

G20 Research Group. 2009. Global Plan Annex: Declaration on Strengthening the Financial System. Available: http://www.g20.utoronto.ca/2009/2009ifi.html.

Gadanecz, B. & Jayaram, K. 2009. Measures of financial stability – a review. *IFC Bulletins no. 31.* Available: https://www.bis.org/ifc/publ/ifcb31ab.pdf.

Ghosh, A. 2015. Banking-industry specific and regional economic determinants of non-performing loans: Evidence from US states. *Journal of Financial Stability.* 20:93-104. DOI:https://doi-org.ezproxy.uct.ac.za/10.1016/j.jfs.2015.08.004

Granger, C.W.J. 1969. Investigating Causal Relations by Econometric Models and Cross-spectral Methods. *Econometrica.* 37(3):424-438. DOI: https://doi-org.ezproxy.uct.ac.za/10.2307/1912791.

Greene, J. 1989. External Debt Problem of Sub-Saharan Africa. Staff Papers (International Monetary Fund). 36(N0.4):836-874. DOI: https://doi-org.ezproxy.uct.ac.za/10.2307/3867242

Harris, R. & Sollis, R. 2004. Applied time series modelling and forecasting: *International Journal of Forecasting.* 20(1):137-139. DOI:https://doi-org.ezproxy.uct.ac.za/10.1016/j.ijforecast.2003.11.006

Havranek, t. & Irsova, Z. 2015. Bank Efficiency and Interest Rate Pass-Through: Evidence from Czech Loan Products. Working Papers IES from Charles University Prague. (No 2015/24).

Havrylchyk, O. 2010. A macroeconomic credit risk model for stress testing the South African banking sector. South African Reserve Bank Working Paper, 3. Available: https://mpra.ub.uni-muenchen.de/21639/.

Honohan, P. & Beck, T. 2007. Making finance work for Africa. The World Bank. DOI:10.1596/978-0-8213-6909-80.159 Available: https://openknowledge-worldbank-org.ezproxy.uct.ac.za/handle/10986/6626.

Huljak, I., Martin, R., Moccero, D. & Pancaro, C. 2020. Do non-performing loans matter for bank lending and the business cycle in euro area countries? Working Paper Series 2411, European Central Bank. Handle: RePEc:ecb:ecbwps:20202411.

Jiménez, G. & Saurina, J. 2005. Credit cycles, credit risk, and prudential regulation. Working Papers 0531. Available: https://www.bis.org/bcbs/events/rtf05JimenezSaurina.pdf.

Johansen, S. 1991. Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Econometrica.* 59(6):1551-1580.

Kalirai, H. & Scheicher, M. 2002. Macroeconomic Stress Testing: Preliminary Evidence for Austria. *Financial Stability Report.* (3):58-74.

Kangogo, N.J. & Asienga, I. 2014. Determinants of Non-Performing Personal Loans in Kenya's Banking Industry: An Econometric Case Study of Tier One Banks. *Journal of Emerging Issues in Economics, Finance and Banking (JEIEFB).* 3(6).

Kassim, S. 2016. Islamic finance and economic growth: The Malaysian experience. *Global Finance Journal.* 30:66-76. DOI: https://doi-org.ezproxy.uct.ac.za/10.1016/j.gfj.2015.11.007.

Keeton, W. & Morris, C. 1987. Why do banks' loan losses differ? *Economic Review*, Federal Reserve Bank of Kansas City. 72:3-21.

Klein, N. 2013. Non-Performing Loans in CESEE: Determinants and Impact on Macroeconomic Performance. IMF Working Paper, 72.

Koju, L., Koju, R. & Wang, S. 2018. Macroeconomic and Bank-Specific Determinants of Non-Performing Loans: Evidence from Nepalese Banking System. *Journal of Central Banking Theory and Practice.* (3):111-138. DOI:10.2478/jcbtp-2018-0026.

Kwarkye, S. & Matongbada, M. 2021. Nigeria's border closures haven't served their purpose. ISS Africa. Available: https://issafrica.org/iss-today/nigerias-border-closures-havent-served-their-purpose [Dec 12, 2021].

Loayza, N. & Raddatz, C. 2006. The composition of growth matters for poverty alleviation. World Bank Policy Research Working Paper. (No.4077) Available: https://openknowledge-worldbank-org.ezproxy.uct.ac.za/handle/10986/8857.

Louzis, D.P., Vouldis, A.T. & Metaxas, V.L. 2012. Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. *Journal of Banking & Finance.* 36(4):1012-1027. DOI: https://doi-org.ezproxy.uct.ac.za/10.1016/j.jbankfin.2011.10.012

Makri, V., Tsagkanos, A. & Bellas, A. 2014. Determinants of Non-Performing Loans: The Case of Eurozone. *Panoeconomicus.* 61(2):193-206. DOI:10.2298/PAN1402193M.

Malandrakis, I. 2014. Liquidity Risk and Credit Risk: A Relationship Based on the Interaction between Liquid Asset Ratio, Non-Performing Loans Ratio and Systemic Liquidity Risk. *International Journal of Financial Engineering and Risk Management.* 1(4):375-400. DOI:10.1504/IJFERM.2014.065651.

McKinley, V. & Banaian, K. 2005. Central Bank Operational Efficiency: Meaning and Measurement. Central Banking Publications. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2508461.

Mlachila, M., Park, S.G. & Yabara, M. 2013. Chapter 1: Economic Growth in Sub-Saharan Africa. Banking in Sub-Saharan Africa: The Macroeconomic Context. Washington DC: International Monetary Fund. 1-12.

Musau, S., Muathe, S. & Mwangi, L. 2018. Financial Inclusion, GDP and Credit Risk of Commercial Banks in Kenya. *International Journal of Economics and Finance.* 10(3):181. DOI:10.5539/ijef.v10n3p181.

Mustafa, A. 2019. The Determinants of Money Demand in Jordan: ARDL Approach. *Journal of Management Research.* 11(1) DOI:10.5296/jmr.v11i1.13771.

Nikolaidou, E. & Vogiazas, S. 2017. Credit risk determinants in Sub-Saharan banking systems: Evidence from five countries and lessons learnt from Central East and South

East European countries. *Review of Development Finance.* 7(1):52-63. DOI: https://doi-org.ezproxy.uct.ac.za/10.1016/j.rdf.2017.01.003

Nikolaidou, E. & Vogiazas, S.D. 2011. Investigating the Determinants of Nonperforming Loans in the Romanian Banking System: An Empirical Study with Reference to the Greek Crisis. *Economics Research International.* DOI:10.1155/2011/214689.

Nikolaidou, E. & Vogiazas, S.D. 2014. Credit risk determinants for the Bulgarian banking system. *International Advances in Economic Research.* 20(1):87-102. Available: https://doi-org.ezproxy.uct.ac.za/10.1007/s11294-013-9444-x.

Nkoro, E. & Uko, A.K. 2016. Autoregressive Distributed Lag (ARDL) cointegration technique: application and interpretation. *Journal of Statistical and Econometric Methods.* 5(4):63-91. Available: http://www.scienpress.com/Upload/JSEM%2fVol%205_4_3.pdf.

Nkusu, M. 2011. Nonperforming Loans and Macro financial Vulnerabilities in Advanced Economies. IMF Working Paper, 161.

Nyantakyi, E.B. & Sy, M. 2015. The Banking System in Africa: Main Facts and Challenges. *Making Finance Work for Africa.* 5(5) Available: https://www.mfw4a.org/publication/banking-system-africa-main-facts-and-challenges.

Odhiambo, N. 2010. Finance-investment-growth nexus in South Africa: an ARDL-bounds testing procedure. *Economic Change and Restructuring.* 43(3):205-219. Available: https://doi-org.ezproxy.uct.ac.za/10.1007/s10644-010-9085-5.

Ozili, P.K. & Adamu, A. 2021. Does financial inclusion reduce non-performing loans and loan loss provisions? *Journal of Corporate Governance, Insurance, and Risk Management.* Available: https://mpra.ub.uni-muenchen.de/id/eprint/109321.

Pesaran, M.H., Shin, Y. & Smith, R.J. 2001. Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics.* (16):289-326. DOI:10.1002/jae.616.

Podpiera, J. & Weill, L. 2008. Bad luck or bad management? Emerging banking market experience. *Journal of Financial Stability.* 4(2):135-148. DOI: https://doi-org.ezproxy.uct.ac.za/10.1016/j.jfs.2008.01.005

Ptasica, T. 2020. Impact of National Economic Conditions on the Level of Non-Performing Loans in the Commercial Banks of Cyprus. Proceedings of the "New Silk Road: Business Cooperation and Prospective of Economic Development" (NSRBCPED 2019). Atlantis Press. :252-257. DOI:https://doi-org.ezproxy.uct.ac.za/10.2991/aebmr.k.200324.047.

Rinaldi, L. & Sanchis-Arellano, A. 2006. Household debt sustainability: what explains household non-performing loans? An empirical analysis. European Central Bank Working Paper Series, no 570. Available: https://www.ecb.europa.eu//pub/pdf/scpwps/ecbwp570.pdf.

Rivai, A. 2018. Impacts of Business Cycle and Macroeconomics Factors on Non-Performing Bank Loan in Indonesia. *International Journal of Economic Research.* 15(No.2) Available: http: www.seriesjournals.com.

Sakyi, D. 2011. Trade openness, foreign aid and economic growth in post-liberalisation Ghana: An application of ARDL bounds test. *Journal of Economics and International Finance.* 3(3):146-156.

Strohecker, K. & Bavier, J. 2020. As new debt crisis looms, Africa needs more than world is offering. *Reuters.* Available: https://www.reuters.com/article/us-africa-debt-idUSKBN27Z2OW [September 2021].

The World Bank. 2016. Financial depth. Available: https://www-worldbank-org.ezproxy.uct.ac.za/en/publication/gfdr/gfdr-2016/background/financial-depth [August 2021].

The World Bank. 2016. Financial stability. Available: https://www-worldbank-org.ezproxy.uct.ac.za/en/publication/gfdr/gfdr-2016/background/financial-stability [August 2021].

The World Bank. 2021. The World Bank in Africa. Available: https://www-worldbank-org.ezproxy.uct.ac.za/en/region/afr/overview#1. [September 2021].

Touny, M.A. & Shehab, M.A. 2015. Macroeconomic Determinants of Non-Performing Loans: An
Empirical Study of Some Arab Countries. *American Journal of Economics and Business Administration.* :11-22. DOI:10.3844/ajebasp.2015.11.22.

Triki, T. & Faye, I. 2013. Financial Inclusion
in Africa. Avenue du Ghana: African Development Bank (AfDB).

Udo Ndebbio, J. 2004. Financial deepening, economic growth and development: Evidence from selected sub-Saharan African countries. *African Economic Research Consortium.* (Research Paper 142)
Available: https://media.africaportal.org/documents/rp_142.pdf.

Warue, B.N. 2013. The Effects of Bank Specific and Macroeconomic Factors on Nonperforming Loans in Commercial Banks in Kenya: A Comparative Panel Data Analysis. *Advances in Management & Applied Economics.* 3(2):135-164.

Waweru, N.M. & Kalani, V.M. 2009. Commercial Banking Crises in Kenya: Causes and Remedies. *Global Journal of Finance and Banking Issues.* 3(3).

Appendix

Tables A1 and A2 present the Augmented Dickey-Fuller Test (ADF) results. The study employed stationarity tests to establish the order of cointegration for the underlying variables. The importance of conducting such tests stem from the fact that the ARDL bounds approach can only be applied when the underlying variables are of orders I(0) or I(1), and not I(2). For the variables containing a unit root, a first difference was taken, and the ADF was reapplied. These results are presented in Tables A3 and A4.

Table A5: Error Correction Model

Dependent Variable: NPL				
Regressor	**Coefficient**	**Significance**	**Std. Error**	**T-Ratio**
Egypt				
dGD	0,0099	**	0,0048	2,0664
dLDC	-0,1655	***	0,0520	-3,1848
dLMS	0,1724	***	0,0560	3,0779
dLMS1	0,0341	*	0,0191	1,7851
dLMS2	0,0281		0,0195	1,4410
dCAR	-0,2564	*	0,1317	-1,9460
dD	-0,0064		0,0066	-0,9658
ecm(-1)	-0,1224	**	0,1183	-2,0744
Morocco				
dLGDP	-0,0121	***	0,0024	-4,9530
dUNEM	0,0507	**	0,0237	2,1342
dUNEM1	-0,1809	***	0,0550	-3,2911
dUNEM2	-0,0936	**	0,0395	-2,3718
dUNEM3	-0,0283		0,0194	-1,4582
dGD	0,0088		0,0075	1,1717
dLDC	-0,0436	**	0,0185	-2,3627
dLDC1	0,0503	***	0,0179	2,8146
dLDC2	0,0317	**	0,0134	2,3577
dLMS	0,0357	**	0,0177	2,0149
dLMS1	-0,0280	*	0,0162	-1,7306
dLMS2	-0,0303	**	0,0138	-2,1975
dD	-0,0006		0,0006	-1,0461
ecm(-1)	-0,1011	***	0,0154	-6,5618
Botswana				
dLMS	-0,0117		0,0213	-0,5488
dLA	-0,1300	**	0,0575	-2,2610
dLA1	0,0411		0,0648	0,6336
dCAR	0,0342		0,0848	0,4037

dCAR1	-0,3468	**	0,1432	-2,4217
dCAR2	-0,1555		0,0930	-1,6727
ecm(-1)	-0,1984	**	0,0716	-2,7717
South Africa				
dUNEM	0,0033		0,0064	0,5171
dGD	0,0207	**	0,0103	2,0069
dGD1	-0,0325	***	0,0103	-3,1526
dLDC	0,0122		0,0073	1,6579
dLMS	-0,0098		0,0073	-1,3521
dLA	-0,1356	***	0,0393	-3,4528
dCAR	-0,1171	***	0,0349	-3,3557
dD	-0,0009	***	0,0002	-4,6135
ecm(-1)	-0,0585	***	0,0204	-2,8737
Kenya				
dUNEM	0,0477		0,0672	0,7100
dGD	0,0572	*	0,0318	1,8016
dLA	-0,1010	**	0,0422	-2,3907
dLA1	0,0655		0,0563	1,1635
dLA2	0,0522		0,0519	1,0055
dLA3	0,1220	***	0,0437	2,7926
dCAR	-0,2492	*	0,12944	-1,9256
dCAR1	0,1481		0,1968	0,7526
dCAR2	0,2350	**	0,11013	2,1334
dD	-0,0007		0,0035	-0,2111
ecm(-1)	-0,1701	**	0,0650	-2,6194
Mauritius				
dLDC	0,0060	**	0,0255	2,2344
dLDC1	0,0035		0,0207	0,1698
dLDC2	-0,0636	***	0,0208	-3,0514
dLMS	0,0020	**	0,0210	2,0962
dCAR	-0,1125	***	0,1291	-2,8714
dD	-0,0057		0,0038	-1,5090
ecm(-1)	-0,1423	**	0,0702	-2,0282
Ghana				
dUNEM	1,1725	**	0,5151	2,2762
dUNEM1	-2,9218	***	0,6690	-4,3673
dUNEM2	-2,4059	***	0,7911	-3,0412
dUNEM3	-1,9604	**	0,7686	-2,5506
dLMS	0,0084		0,0234	0,3591
dLMS1	-0,0320		0,0230	-1,3936
dLA	-0,2585	**	0,0940	-2,7499
dLA1	-0,1479		0,1095	-1,3504

dCAR	-0,6222	***	0,2015	-3,0878
dCAR1	0,3054		0,1973	1,5485
dCAR2	0,5082	**	0,2029	2,5051
dCAR3	0,4361		0,1905	2,2900
dD	-0,0045		0,0091	-0,4973
ecm(-1)	-0,2174	**	0,0974	-2,2329
Nigeria				
dLGDP	-0,0858	***	0,0212	-4,0425
dLDC	0,0097		0,0183	0,5320
dLA	-0,0926	***	0,0744	-3,0088
dLA1	0,0729		0,0656	1,1128
dLA2	0,2237		0,0687	-1,3486
dLA3	0,1563	*	0,0864	1,8093
dCAR	-0,4863	**	0,1918	-2,5361
dCAR1	0,0388		0,1539	0,2522
dCAR2	0,4269	**	0,1630	2,6197
ecm(-1)	-0,2867	**	0,1167	-2,4563

***, **, *, represent significance at the 1%, 5%, and 10% levels respectively