# EFFECTS OF SELECTED BANK SPECIFIC FACTORS ON NON PERFORMING LOANS AMONGST COMMERCIAL BANKS IN KENYA

**BY:**

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**A RESEARCH PROJECT PRESENTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION, SCHOOL OF BUSINESS, UNIVERSITY OF NAIROBI**

**2015**

# DECLARATION

I declare that this research project is my original work and has not been presented for a degree in any other University.

Signed .................................................. Date...............................................

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**D61/64409/2013**

This research project has been presented for examination with my approval as university supervisor.

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# ACKNOWLEDGEMENTS

I am grateful to God for the gift of life, good health, strength and ability to complete this project. I wish to acknowledge a few people for their professional input, support and encouragement during this research project.

First and foremost, I wish to express my profound gratitude and deep regard to my supervisor, Ms Winnie Nyamute, for her exemplary guidance, valuable feedback and constant encouragement throughout the duration of the project. His continued interest, remarkable patience, constructive feedback and critiques of the project in progress have been invaluable.

My sincere gratitude goes to my parents: Dad,Jason Awuor (gone but ever present) and Mum Serfina Awuor for bringing me up and providing the best possible and inspiring me in my academic life. To my brothers,sisters and extended family members, for your support, encouragement and belief in me and keeps me going.

To all my friends and colleagues, thank you for helping me in one way or the other, to become who I am.

# DEDICATION

I dedicate this research project to my wife, Bessy whose presence in my life is beyond chance and my son, Jesse who is a daily reminder of what it means to be unstoppable and fully self-expressed.

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# ABBREVIATIONS AND ACRONYMS

**CPI:**        Consumer Price Index

**FX:**        Exchange Rate

**IR:**        Interest Rate

**IMF:**        International Monetary Fund

**INF:**        Inflation

**IRF:**        Impulse Response Functions

**MS:**        Money Supply

**NPLS:**        Non-Performing Loans

**POD:**        Probability of Default

# ABSTRACT

Non-performing loans refer to loans which for a relatively long period of time do not generate income. Controlling non-performing is very important for both the performance of an individual bank and the economy's financial environment. Over the past decade, the credit quality of loan portfolios across most countries in the world remained relatively stable until the financial crises hit the global economy. Studies conflict on the causes of the levels of NPLs as authors point to macro economic factors, bank specific factor and customer characteristics. With these conflicts in mind, the current study sought to determine the effects of firm specific variables on non performing loans in Kenya.

This study designed as across sectional survey collected secondary data from commercial banks for a period of five years (2010 to 2014). The data was on levels of bank NPLs and bank specific characteristics notably, asset quality, operational cost efficiency, earnings ability, liqudity and bank size. The study findings indicate that 15.6 percent of variations in bank NPL levels is explained by variations in the bank specific characteristics. Specifically, there is a negative relationship between bank size, asset quality and levels of bank NPLs. There is also a positive relationship between liquidity, operational cost efficiency, earnings ability and levels of NPLs.

The study recommends that bank managers should ensure that their liqudity is optimal to avoid custody of idle resources. Efforts should be put in place to support small banks so as to reduce their NPLs burdens and prudent lending techniques should be implemented to improve the specific banks' asset quality. The study suggests that future research should consider longer time periods with different credit information sharing regimes. Other types of financial institutions should be considered in the studies that also look at credit officers demographic attributes and overall loan portfolio performance.

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background

Kithinji and Waweru (2007) explain that banking problems that caused major bank failures in Kenya are attributable to non performing loans (NPLs). According to McNulty et al. (2001), controlling NPLs is very important for both the performance of an individual bank and the economy's financial environment. Due to the nature of their business, commercial banks expose themselves to the risks of default from borrowers. Prudent credit risk assessment and creation of adequate provisions for bad and doubtful debts can cushion the banks risk.

Muriithi (2013) explain that over the past decade, the credit quality of loan portfolios across most countries in the world remained relatively stable until the financial crises hit the global economy in 2007-2008. Since then, average bank asset quality deteriorated sharply due to the global economic recession. The fact that loan performance is tightly linked to the economic cycle is well known and not surprising. Yet the deterioration of loan performance was very uneven across countries. For example, the Baltic countries which stand out in cross-country comparisons of GDP performance during the crisis had very large increases in non-performing loans (NPLs) even when controlling for the severity of the recession.

### 1.1.1 Bank Specific Variables

Haron (2004) identify bank internal factors as bank specific factors which can either be financial factors or non financial factors. The financial statement variables relate to the decisions which directly involve items in the balance sheet and income statement, while non - financial statement variables are outside the financial statement. The financial statement indicators include; bank size, capital ratios, liquidity, asset quality,

deposits, operational efficiency, risk management etc. The non - financial variables include; number of branches, employees, ATM, customers, age of the bank, ownership etc. The internal factors are generally believed to be within the control and influence of the management.

Dang (2011) explain that studies apply the CAMEL framework to measure bank specific factors which are within the scope of the banks to manipulate and they differ from bank to bank. These variables include bank capital, size of deposit liabilities, size and composition of credit portfolio, interest rate policy, labor productivity, state of information technology, risk level, management quality, bank size and bank ownership.

### 1.1.2 Non-Performing Loans

There is no global standard to define NPL at the practical level. Variation exists in terms of the classification system, the scope, and contents. A Non-Performing Loan is a loan that is in default or close to being in default. A loan is non-performing when payments of interests and principal are past due by 90 days or more, or at least 90 days of interest payment have been capitalized, refinanced or delayed by agreement, or payments are less than 90 days overdue, but there are other good reasons to doubt that payment will be made in full (IMF, 2009).

Non-performing loans generally refer to loans which for a relatively long period of time do not generate income; that is the principal and/or interest on these loans has been left unpaid for at least 90 days (Caprio and Klingebiel, 1999). NPLs can be treated as undesirable outputs or costs to loaning banks which decreases the bank's performance. Van Gruening and Bratanovic (2009) define NPLs as assets not generating income. This is when principal or interest is due and left unpaid for 90 days or more.

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Loan defaults are inevitable in any lending. What banks do is to minimize the risk of defaults. NPL are loans that have defaulted or in danger of defaulting, when payment are no longer able to be made. Typically, loans that have not received payments for three months are considered to be non-performing though specific contract terms may differ occasionally (Mikiko, 2003).

NPLs can be measured by non-performing loans net of provision of capital. This is calculated by taking the value of non-performing loans (NPLs) less the value of specific loan provisions as the numerator of and capital as the denominator (Warue, 2012). Another method of measuring NPLs is by non-performing loans to total gross loans. This is calculated by using the value of NPLs as the numerator and the total value of the loan portfolio (including NPLs and before the deductions of specific loan loss provisions) as the denominator (IMF, 2004)

### 1.1.3 Bank Specific Variables and Non performing Loans

Berger and DeYoung (1997) draw attention to the links between bank-specific characteristics and focus on efficiency indicators and problem loans. Specifically, Berger and Young formulate possible mechanisms, namely 'bad luck', 'bad management', 'skimping' and 'moral hazard', relating efficiency and capital adequacy. They conclude that, generally, decreases in measured cost efficiency lead to increased future problem loans.

Podpiera and Weill (2008) provide evidence of a negative relationship between decreased cost efficiency and future NPLs. Breuer (2006) explains the influence of a very wide range of institutional variables on NPLs. These include the legal, political, sociological, economic and banking institutions.

### 1.1.4 Commercial Banks in Kenya

In Kenya, commercial banks are licensed and regulated by the Central Bank of Kenya (CBK). Currently, there are forty three licensed commercial banks and one non-banking financial institution. Radha (2010) posit that the banking systems in Sub-Saharan Africa (SSA) in general and Kenya in particular are shallow and fragile. This is reflected in low spending levels, high interest rate spreads, high levels of non-performing loans and several bank failures.

Karumba and Wafula (2012) while advancing alternatives for Kenyan banking industry, singled out credit risk as one of the oldest and most challenging risk faced by commercial banks. Defaults leads to piling of non-performing loans in a financial institution's balance sheet. Musyoki and Kadubo (2011) opine that default rate is an important factor that influences 54 performance of the overall credit risk influence on bank performance in Kenya.

### 1.2 Research Problem

Akerlof (1978) advance the argument that non-performing loans are one of the major causes of the economic stagnation problems. Each non-performing loan in the financial sector is viewed as an obverse mirror image of an ailing unprofitable enterprise. From this point of view, the eradication of non-performing loans is a necessary condition to improve the economic status. If the non-performing loans are kept existing and continuously rolled over, the resources are locked up in unprofitable sectors; thus, hindering the economic growth and impairing the economic efficiency.

According to Kithinji and Waweru (2007) and Ngugi (2001), Kenya has experienced banking problems since 1980''s culminating in major bank failures explained by

various factors notably; under-capitalization, high levels of non-performing loans and weaknesses in corporate governance amongst the banks.

It is accepted that the quantity or percentage of non-performing loans (NPLs) is often associated with bank failures and financial crises in both developing and developed countries (Caprio and Klingebiel, 2002). In spite of this apparent association between banking crises and nonperforming loans, the literature on the causes on non-performing loans has focused on the macroeconomic determinants and less on the influence of interest rate spread (Fofack, 2005).

In the majority of studies that investigate the determinants of NPLs, the aggregate level of NPLs is considered and either macroeconomic or bank-specific determinants (but not both) are used as explanatory variables. Exceptions include Salas and Saurina (2002) who combine macroeconomic and microeconomic variables to explain aggregate NPLs of Spanish Commercial and Savings Banks for the period 1985–1997. They focus on the NPLs determinants for commercial and savings banks and find that bank-specific determinants can serve as early warning indicators for future changes in NPLs. Other similar studies include Clair (1992) and González-Hermosillo et al. (1997).

In Kenya, Studies by Murithi (2013), Mboka (2013), Warue (2012), Ochami (2004) and Kiyai (2003) focus only on the macroeconomic determinants or the bank specific determinants of the levels of non-performing loans. Thus this study sought to answer the research question; what are the effects of bank specific factors on non-performing loans in Kenya?

## 1.3 Research Objective

This study sought to determine the effects of firm specific variables on non-performing loans in Kenya.

## 1.4 Value of the Study

Findings of this study benefits stakeholders in the banking sector in Kenya. The managers of the commercial banks apply the study findings as a guideline for managing the levels of non-performing assets. The study helps them to prepare performance indicators for managers responsible for portfolio management with the indicators as well.

The findings of this study could influence effective formulation of regulatory policies by government and regulatory agencies that guide sound and acceptable bank variables which subsequently influence the levels of non-performing loans in the economy.

In theory, non-performing loans are influenced by interest rates and interest rate spreads. The study informs other theories of interest rates behavior that include liqudity preference theory and market segmentation theory. Researchers and academicians benefit from the study findings as it informs further research on the effects of micro level factors and macro level factors on bank asset quality.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

This chapter focuses on theoretical and empirical literature. The chapter starts with a review of relevant theories explaining determinants of non performing loans upon which this study is anchored. This is followed by an empirical review of the studies on the concepts and determinants of non performing loans.

## 2.2 Theoretical Review

The study will be guided by theories which have previously been developed and that have called for more research on the subject matter over the years. These theories include Asymmetry Theory, Agency Theory and Transaction Cost Theory.

### 2.2.1 Information Asymmetry Theory

This strand of theory proposed by Akerlof (1970) and Stiglitz and Weiss (1981) is based on the notion that the borrower is likely to have more information than the lender about the risks of the project for which they receive funds. This leads to the problems of moral hazard and adverse selection (Matthews and Thompson, 2008). These problems reduce the efficiency of the transfer of funds from surplus to deficit units. The banks overcome these problems in three respects: First by providing commitment to long-term relationships with customers, Secondly through information sharing and thirdly through delegated monitoring of borrowers. Under direct financing, it is necessary for a lender to collect information to try to redress the information asymmetry.

The theory of asymmetric information tells us that it may be difficult to distinguish good from bad borrowers (Auronen, 2003 and Richard, 2011), which may result into adverse selection and moral hazards problems. The theory explains that in the market, the party that possesses more information on a specific item to be transacted is in a position to negotiate optimal term for the transaction than the other party (Auronen, 2003).

The party that knows less about the same specific item to be transacted is therefore in a position of making either right or wrong decision concerning the transaction. Adverse selection and moral hazards have led to significant accumulation of non-performing loans in banks (Bester, 1994).

### 2.2.2 Agency Theory

Agency theory has its roots in economic theory and was developed by Jensen and Meckling in 1976. According to the agency theory, there are two parties in a large corporation (such as a bank), the shareholders who are the principals, and the managers who are the agents. The shareholders are the principal or the main party because the corporation belongs to them. As owners, they receive the profit or bear the loss managers are the agents because they are hired by shareholder to run the day to day task of the corporation.

In principal, the agents are supposed to make decisions in the best interest of the principal. To ensure that agents are effective, it will  require the principal to monitor the agent. Without monitoring, most managers will diverge from the principal's objectives. They will make decisions which enhance their interest at the expense of shareholders. The tendency for agents to act in their own interest instead of the

principal is called the principal-agent problem (Bester, 1994; Bofondi and Gobbi, 2003).

According to the Agency theory, the principal-agency problem can be reduced by better monitoring, such as establishing more appropriate incentives for managers. In the field of corporate risk management, agency issues have been shown to influence managerial attitudes towards risk taking and hedging Smith and Stulz (1985). Theory also explains a possible mismatch of interest between shareholder management and debt holders due to asymmetries in earning distribution, which can result in the firm taking too much risk or not engaging in positive net value project (Smith and Stulz, 1987). Consequently, agency theory implies that defined hedging policies can have important influence on firm value (Fite and Pfleiderer, 1995).

### 2.2.3 Financial Intermediation Theory

This theory proposed by Allen and Santomero (1997) point out that banks are able to effectively monitor borrowers and thus play the role of delegated monitoring. Financial intermediation refers to the process by which financial institutions bring deficit spending units and surplus spending units together.

Financial intermediation theories try to explain why surplus funds are first lent to banks who then lend to deficit unit, instead of lending directly. According to Diamond (1984), banks are able to effectively monitor borrowers and thus play the role of delegated monitoring. If the role of delegated monitoring is performed efficiently, then the intermediation process will run smoothly and there will be less or no market frictions.

Matthews and Thompson (2008) identify that financial intermediaries can be distinguished by four criteria: first their main categories of liabilities (deposits) are specified for a fixed sum which is not related to the performance of a portfolio. Second, the deposits are typically short-term and of a much shorter term than their assets. Third, a high proportion of their liabilities are chequeable (can be withdrawn on demand). And fourth, their liabilities and assets are largely not transferable. The most important contribution of intermediaries is a steady flow of funds from surplus to deficit units.

Financial intermediation theory emphasizes on the role of banks as reducing the frictions of transaction costs and asymmetric information. It projects that a proper intermediation process ldeads to profitable and stable financial institutions. Screening as a role of financial institutions is explained by King and Levine (1993) to be enhancing profitability, growth and stability by weeding out borrowers with low probability of success.

**2.3 Determinants of Non-Performing Loans**

The levels of non-performing loans in commercial banks are considered to be influenced by bank specific and macro-economic factors as discussed below.

**2.3.1  Bank Specific Factors**

Salas and Saurina (2002) establish that capital ratio and market power explain variations in NPLs amongst Spanish banks. Bercoff, Giovanni and Grimard (2002) observe that asset growth, operating efficiency and exposure to local loans also explain NPLs.

Capital adequacy, earning ability and size of a bank are established by Langrin (2001) and Molina (2002) to be significant determinants of levels of bank non performing loans. Henebry (1997), Wheelock and Wilson (2000) also show that asset quality and size of a bank significantly determines the levels of non-performing loans.

According to Musau (2014), higher bank liquidity may influence non-performing loans of a bank for two reasons. Foremost, high liquidity ratio sends a positive signal to the depositors that the bank is liquid and subsequently improves the depositors' confidence. However, a lower liquidity ratio signals that a bank is not in a good situation. Secondly,  a higher liquidity may also imply the inefficient utilization of resources suggesting weak financial investment activities.

Laeven and Levine (2009) link risk taking to banks' operating efficiency. The argument is that risk-averse managers are willing to trade off reduced earnings for reduced risk, especially when their wealth depends on the performance of the bank. In order to improve loan quality, they will increase monitoring and incur higher costs, affecting the measure of operating efficiency. Therefore, a less efficient bank may in fact hold a low risk portfolio. On the other hand, riskier loans also generate higher costs for banks.

### 2.3.2 Macroeconomic Factors

Bernanke and Gertler (1989) and Bernanke, Gertler and Gilchrist (1998) developed the concept of the "financial accelerator" and argued that credit markets are procyclical and that information asymmetries between lenders and borrowers as well as the balance sheet effect work to amplify and propagate credit market shocks to the economy. Kiyotaki and Moore (1997) also showed how relatively small shocks suffice to explain business cycle fluctuations, if credit markets are imperfect.

Kent and D'Arcy (2000) suggested in a study of Australian banks that, although risks tended to be realized during the phase of the business cycle, they actually peaked at the top of the cycle. Rajan and Dhal (2003) looked at Indian banks and uncovered a similar relationship. Bercoff, Giovanni and Grimard (2002) analyzed Argentina''s banking system using an accelerated failure time model and found that the money multiplier, credit growth and reserve adequacy affected NPLs. Interest rates were also found to be significant in several studies. For instance, Fuentes and Maquieira (2003) found, looking at Chilean banks, that interest rates had a greater effect on NPLs than the business cycle.

## 2.4 Empirical Studies

Berger and DeYoung (1997) apply granger causality models to test whether cost efficiency in banks pre-dates loan quality, whether loan quality pre-dates cost efficiency, or both. They also used pooled cross section-time series data on nonperforming loans, operating cost efficiency, equity capital ratios, and other variables for U.S. commercial banks. They established that the inter-temporal relationships between loan quality and cost efficiency run in both directions. The data provided support for the bad luck proposition.

Increases in nonperforming loans tend to be followed by decreases in measured cost efficiency, suggesting that problem loans cause banks to increase spending on monitoring, working out, and/or selling off problem loans. Berger and DeYoung (1997) draw attention to the links between bank-specific characteristics and focus on efficiency indicators and problem loans. Specifically, the study formulate possible

mechanisms, namely 'bad luck', 'bad management', 'skimping' and 'moral hazard', relating efficiency and capital adequacy.

Keeton (1999) used data from 1982-1996 and a vector auto regression model to analyze the impact of credit growth and loan delinquencies in the US. It reported evidence of a strong relationship between credit growth and impaired assets. Keeton (1999) showed that rapid credit growth, which was associated with lower credit standards, contributed to higher loan losses in certain states in the US. In this study loan delinquency was defined as loans which are overdue for more than 90 days or does not accrue interest.

Shehzad *et al.* (2001) present empirical evidence, from a data set comprising 500 banks from 2005 to 2007, that ownership proxied by three levels of shareholding (10%, 20%, and 50%) has a positive impact on the ownership concentration is defined at 10% but a negative impact when the level of ownership concentration is defined at 50%. The study of the finding suggested that sharing of control may have adverse effect on the quality of loans extended up to a level, but in case of a strong controlling owner bank's management becomes more efficient leading to lower Non-Performing Loans.

Kiayai (2003) illustrate that the poor fiscal policy had resulted to high inflation rates and that this could be one of the contributors of NPLs. Inflationary expectation is a factor that is embedded in the interest rate. Interest will remain high if investors believe that the government will introduce inflation in future by adding money in circulation through extended credit form the central bank.

Gorter and Bloem (2001) argues that the true underlying cause of NPLs is entirely of our own making. Poor risk management. This is a situation whereby the bank credit officials do not properly access the suitability of advancing credit to their customers. They do not adhere to the good lending principles.

Practically all affected banks display similar symptoms; insider lending; poor monitoring of loan accounts, under-qualified staff, little or no cash flow appraisal of loan requests, continuous monitoring of customer conditions and proper follow up on how the loan has been utilized as there is a possibility that the loan may not be utilized for the intended purpose leading to project failure.

Salas and Saurina (2002) investigated the determinants of problem loans of Spanish Commercial and Savings Banks using a dynamic model and panel dataset covering the period 1985-1997. The finding of the study was that real growth in GDP, rapid credit expansions, bank size, capital ratio and market power all explain variation in NPLs.

Hu, Li and Chiu (2003) derive a theoretical model to predict that the relation between nonperforming loan ratios and government shareholdings can be downward-sloping, upward sloping, U-shaped, and inversely U-shaped. The study finds that an increase in the government's shareholding facilitates political lobbying. On the other hand, private shareholding induces more nonperforming loans (NPLs) to be manipulated by corrupt private owners.

The results show that the rate of NPLs decreased as the ratio of government shareholding in a bank rose (up to 63.51 percent), while the rate thereafter increased.

Bank size was negatively related to the rate of NPLs. Rates of NPLs are shown to have steadily increased from 1996 to 1999. Banks established after deregulation, on average, had a lower rate of NPLs than those established before deregulation.

Hu *et al*. (2004) with a panel dataset covering the period 1996-1999, used a regression analysis and analyzed the relationship between NPLs and ownership structure of commercial banks in Taiwan. The study showed that banks with higher government ownership recorded lower non performing loans. The finding of the study showed that bank size is negatively related to NPLs while diversification may not be a determinant.

Ochami (2004) investigated the factors that contribute to the level of non-performing loans in Housing Finance Company of Kenya Limited. The study established that credit risk management and the external environment were major contributors to the level of non-performing loans. This study however, did not test how macro – economic variables impact on the level of non-performing loans through a scientific model like multiple regression model.

Goodhart *et al*. (2006) confirm that there is a two way simultaneous relationship between surges in bank lending and asset prices. This relationship is stronger in the case of real estate both housing and commercial property than with equity. The links between bank lending and property are manifold, but differ in strength from country to country.

Rinaldi and Sanchis-Arellano (2006) analyzed household NPLs for a panel of six European countries to understand the extent to which current increase in the debt to income ratio is related to a riskier financial position for the banking sector. The study

provides empirical evidence that disposable income, unemployment and monetary conditions have a strong impact on NPLs.

The study suggests that, in the long-run, an increase in the ratio of indebtedness to income is associated with higher levels of arrears. However, if the rise in the debt ratio is accompanied by a rise in disposable income, the negative effect is more than offset. The finding suggests that increases in real disposable income would allow relatively higher increases in the debt to income ratio combined with a same level of the ratio of arrears. Monetary conditions are also important because rising inflation and lending rates significantly worsen financial conditions.

Breuer (2006) examines the influence of a very wide range of institutional variables on NPLs while considering problem bank loans as the outcome of decisions made by banks in the dual role they serve as bank intermediaries. The study finds that the dual role introduces conflicts of interest that can lead to bank mismanagement and consequently problem bank loans.

Li *et al.* (2007) investigates the effect of incentive contracts on performance. In the context of China's economic transition, the study finds that incentive contracts have a positive effect on managerial efforts to reduce NPLs in the Chinese banking system. The study notes that the incentive contracts have a positive effect on the bank manager's performance in deposit taking and non-performing loan reduction. The study finding is robust when the endogeneity of incentive contracts is controlled for. The results thus present evidence on the positive effects of incentive-based banking reforms in rural China.

Berge and Boye (2007) analyzed the macro economic factors which function as driving forces behind developments in bank's problem loans. The study found that problem loans are highly sensitive to the real interest rates and unemployment for the Nordic banking system over the study period. The study notes that the volume of problem loans is highly sensitive to cyclical developments and will usually increase during economic downturns.

Podpiera and Weill (2008) examine the causality between non-performing loans and cost efficiency in order to examine whether either of these factors is the deep determinant of bank failures. The study provides empirical evidence in favor of a negative relationship between decreased cost efficiency and future NPLs. The study findings support the bad management hypothesis, according to which deteriorations in cost efficiency precede increases in non-performing loans. Banking supervisors should consequently focus on enhanced cost efficiency of banks in order to reduce the likelihood of bank failures in transition countries.

Boudriga, Boulila, Jellouli (2009) empirically analyses the cross-countries determinants of non-performing loans and the potential impact of regulatory factors on credit risk exposure using banking, financial, economic and legal environment data for a panel of 59 countries over the period 2002-2006.

The study finds that higher capital adequacy ratio and prudent provisioning policy seem to reduce the level of problem loans. The study findings do not support the view that market discipline leads to better economic outcomes and to reduce the level of problem loans. In contrast, all regulatory devices either exert a counterproductive

impact on bad loans or do not significantly enhance credit risk exposure for countries with weak institutions, corrupt business environment and little democracy.

Waweru and Kalani (2009) investigated the commercial banking crisis in Kenya, causes and remedies. The study suggest that many financial institutions that collapsed in Kenya since 1986 failed due to non-performing loans. Customer failure to disclose vital information during the loan application process was considered to be the main customer specific factor.

The study further found that lack of an aggressive debt collection policy was perceived as the main bank specific factor, contributing to the loan performing debt problem in Kenya. The researcher only considered only one customer specific factor, that is, disclosure of vital information and did not consider the bank specific and macroeconomic factors like the Treasury Bills, Inflation or exchange rate volatility.

Nkusu (2011) analyzes the link between nonperforming loans (NPL) and macroeconomic performance from a sample of 26 advanced countries. The study finds that a sharp increase in NPL triggers long-lived tailwinds that cripple macroeconomic performance from several fronts. The impulse response functions (IRFs) indicate that, of all the variables included in the model, NPL is the only one that has both a statistically significant response to- and predictive power on- every single variable over a 4-year forecast period.

The signs of the IRFs are broadly as expected and the magnitudes of the responses of NPL and indicators of macroeconomic performance to shocks affecting each other are very meaningful in the advanced economies' context. Regardless of the factors behind

the deterioration in loan quality, the evidence suggests that a sharp increase in aggregate NPL feeds on itself leading to an almost linear incremental response that continues into the fourth year after the initial shock. The confluence of adverse responses in key indicators of macroeconomic performance, GDP growth and unemployment, leads to a downward spiral in which banking system distress and the deterioration in economic activity reinforce each other.

Louzis, *et al*. (2012) examine the determinants of non-performing loans(NPLs) in the Greek banking sector, separately for each loan category (consumer loans, business loans and mortgages). The study is motivated by the hypothesis that both macroeconomic and bank-specific variables have an effect on loan quality and that these effects vary between different loan categories.

The results show that, for all loan categories, NPLs in the Greek banking system can be explained mainly by macroeconomic variables (GDP, unemployment, interest rates and public debt) and management quality. Differences in the quantitative impact of macroeconomic factors among loan categories are evident, with non-performing mortgages being the least responsive to changes in the macroeconomic conditions.

Warue (2012) used a causal comparative research design based on bank structures was adopted and studied the effects of Bank Specific and Macroeconomic factor on non-performing loans in commercial bank in Kenya. The period under this study was 1995 to 2009. The study found evidence that bank specific factors contribute to NPLs performance at higher magnitude compared with macroeconomic factors. The study establishes that per capita income was negative and significantly related to NPL levels across bank size categories. The study considered only macroeconomic factors like

GDP and bank specific factors like bank structures but it did not factor in any other factor like inflation, GDP growth rate or Bank Development Index.

Mboka (2013) investigated the relationship between macro-economic variables on nonperforming loans of commercial banks in Kenya. The study found that a strong correlation existed between inflation and gross domestic product and current account deficit. GDP also correlated strongly with inflation and Money supply. Current account deficits correlated strongly with inflation only while Money supply correlated strongly with GDP. A good, significant and positive correlation was also found between nonperforming loans and GDP growth rate, exchange rate volatility, and banking sector development index. There was good, significant and negative correlation between nonperforming loans and inflation rate and moderate significant and negative correlation between nonperforming loans and treasury bills rates. The determinant variables in the study were all macroeconomic variables.

Muriithi (2013) sought to determine the causes of non-performing loans in commercial banks in Kenya. The study established that the non-performing loans were positively correlated to inflation rate and negatively correlated with real interest rate and growth rate in loans in Kenya. The study applies macro economic indicators as determinants of NPLs but does not incorporate the bank specific factors.

Ndungu (2014) sought to find out the factors that influence non-performing loans of microfinance institutions in Kenya. The study established that institutional characteristics contribute most to the non-performing loans of microfinance institutions in Kenya followed by Macroeconomic variables and finally Customer characteristics. These factors are established to have a statistically significant positive influence on the levels of NPLs.

**2.5 Summary of Literature Review**

Theoretical literature point that borrowers are likely to have more information than lenders about risks of projects they are seeking financing for. This scenario leads to moral hazards, adverse selection and non performing loans. With assymetric information, it is a challenge to distinguish good from bad borrowers. Financial intermediaries are thus expected to reduce frictions of transaction costs and asymetric costs in the credit markets.

The determinants of non-performing loans of financial institutions have been investigated by various authors as indicated in the literature. Empirical literature distinguish the determinants of bank non performing loans as bank specific and macro economic factors. The identified macroeconomic determinants include; disposable income, unemployment, inflation, interest rates, GDP growth rate and Public debt levels.

The cited bank specific factors include; Market power, Capital ratio, Bank size, Ownership, Capital adequacy, earning ability, asset growth, operating efficiency, liquidity, exposure to local loans, size of bank and Industry. Studies in Kenya by Ndungu (2014), Murithi (2013), Mboka (2013), Warue (2012), Ochami (2004) and Kiyai (2003) focus either on selected bank specific factors or both bank specific and macro economic factors.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter provides a research methodology that was used for the study. It includes the research design, the sample population, data collection procedures and the techniques used in the data analysis.

## 3.2 Research Design

Cooper and Schindler (2003) summarize the essentials of research design as an activity and time based plan which is based on the reserach questions, a guided selection of sources and types of information, a framework for specifying the relationship among the study variables and outlines the procedure for every research activity.

The study was carried out through a cross sectional survey. The choice of this reserach approach is based on the advantages and reliability of results associated with it. Kerlinger (1986) justify that a cross sectional survey is of empirical nature because of the nature of data collected. Empirical research methods bridges the gap between the theoretical foundations of models and its practical application.

## 3.3 Population

For the purpose of the study, the target population was all Commercial Banks in Kenya. These Banks are forty three (43) in number as per the Central Bank of Kenya's Banking Supervision Report of 2014 and as attached in appendix one.

According to Cooper and Schindler (2006), population refers to the total collection of the elements about which the researcher wishes to make inferences. Jankowicz (1994)

and Saunders, Lewis and Thornhill explain that inorder to generalize research findings to the population, it is necessary to select samples of sufficient sizes. A large sample is deemed better than a small one. Due to the small size of the population, no sampling was done. This is envisaged to limit the likely error in generalizing the population.

## 3.4 Data Collection

The study used secondary data to achieve its objective. The secondary data sources are the specific bank supervision reports and financial statements filed with the CBK. The data sought for the period 2010 to 2014 are the annual outstanding principal balance of loans past due more than 90 days, annual outstanding principal balance of all loans, annual operating costs, annual operating income, net income, liquid assets, capital equity, total assets, total loans and total banking sector asset value.

## 3.5 Data Analysis

According to Babbie (2010), data analysis is carried on the data collected to transform it to a form that is suitable for use in drawing conclusions that reflect on the ideas, and theories that initiated the inquiry. After collection, the data was edited, classified, coded and tabulated. Quantitative data was analyzed using Statistical Package for Social Science (SPSS) version 17.0.

The quantitative data was analyzed by using descriptive statistics such as range, mean and standard deviation. Pearson correlation analysis was used to examine the relationship between the dependent variable (Non performing loans levels) and the independent variables (Bank specific variables). Further, Linear regression dimension of independent variable and dependent variable was estimated.

$$NPLs = f(Bank\ specific\ factors)..................................................................3.1$$

To achieve the objective of the study, a model was developed using causes as independent variables and individual bank NPLs levels as dependent variable. The levels of NPLs in commercial bank and their causes was analyzed using a regression analysis model presented as:

$$NPLs = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \mathcal{E}.................................................3.2$$

Where:

NPLs: Non performing loans - measured ratio of outstanding principal balance of loans past due more than 90 days to outstanding principal balance of all loans.

$X_1$ : Operating efficiency – Log of Operating Profit

$X_2$ : Earning ability - ratio of net income to total assets (net income/assets)

$X_3$ : Asset Quality – ratio of the total loans to total assets (loan/asset)

$X_4$ : Liquidity - the ratio of liquid assets to total assets (liquid assets/assets)

$X_5$ : Size of the bank – Log of asset value

$\beta_i$ : are coefficients

$\mathcal{E}$ : error term

## 3.6 Test of Significance

Inferential statistics such as non parametric test which include analysis of variance (ANOVA) was used to test the significance of the overall model at 95% level of significance. Coefficient of correlation (r) was used to determine the magnitude of the relationship between the dependent and the independent variables. Coefficient of determination (r2) was also be used to show the percentage for which each independent variable and all independent variables combined would be explaining the change in the dependent variable.

# CHAPTER FOUR

# DATA ANALYSIS, RESULTS AND DISCUSSIONS

## 4.1 Introduction

This chapter presents the information processed from the data collected during the study on the effects of bank specific factors on levels of non performing loans amongst commercial banks in Kenya. It presents the descriptive statistics, correlation analysis and regression analysis from the study findings.

## 4.2 Descriptive Statistics

The study targeted 43 commercial banks with an expectation of attaining annual data on the study variables translating to 215 observations. Because of instances of data inavailability, a panel data of 131 observations was attained as shown in table 4.1 below providing 60.9 percent of the expected data points.

**Table 4.1: Descriptive Statistics**

|  | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| NPLS | 131 | .005 | 5.938 | .214 | .748318 |
| Op Efficiency | 131 | .000 | 9.684 | 6.751 | 2.023581 |
| Earning Ability | 131 | -.034 | .172 | .05658 | .034379 |
| Liquidity | 131 | .003 | .846 | .26870 | .169551 |
| Size | 131 | 8.418 | 12.625 | 10.409 | 1.218137 |
| Asset Quality | 131 | .009 | .954 | .56396 | .150961 |
| Valid N (listwise) | 131 |  |  |  |  |

From table 4.1 above,  it is noted that the mean percentage of non performing loans amongst the commercial banks is 21.4 percent with a standard deviation of 0.748. The mean levels of operational efficiency is 6.751 with a standard deviation of 2.023. The mean levels of bank earnings ability is 5.6 percent with a standard deviation of 0.034.

The mean levels of bank liqudity is 26.87 percent with a standard deviation of 0.169.

The mean levels of bank assets in natural log is 10.409 with a standard deviation of

1.218 and the mean levels of asset quality measures for the bank is at 56.39 percent

with a standard deviation of 0.150.

## 4.3 Correlation Analysis

The study variables are tested for correlation to understand the association and

movements amongst the study variables. The findings are presented in a correlation

matrix in table 4.2 below.

**Table 4.2: Correlations**

|                | NPLS     | Op Efficiency | Earning Ability | Liquidity | Size  | Asset Quality |
|----------------|----------|---------------|-----------------|-----------|-------|---------------|
| NPLS           | 1        |               |                 |           |       |               |
| Op Efficiency  | -.066    | 1             |                 |           |       |               |
| Earning Ability| .085     | .377**        | 1               |           |       |               |
| Liquidity      | .003     | -.229**       | -.143           | 1         |       |               |
| Size           | -.150    | .816**        | .159            | -.234**   | 1     |               |
| Asset Quality  | -.329**  | .164          | .262**          | -.441**   | .152  | 1             |

 **. Correlation is significant at the 0.01 level (2-tailed).

As indicated in table 4.2 above, there is a statistically significant weak negative

association between Asset quality and levels of non performing loans in the banks

(r=-0.329). There are noted weak negative associations between bank size and the

levels of non performing loans (r =-0.150), operational efficiency and levels of non

performing loans (r=-0.066) and earnings ability and liquidity (r =-0.143).

The correlation matrix in table 4.2 above shows weak positive associations between

earnings ability and levels of non performing loans (r=0.085), liquidity and levels of

non performing loans (r=0.003), asset quality and size (r=0.152) and earnings ability and bank size (r=0.159).

The study also establishes statistically significant weak negative associations between bank liquidity and asset quality (r=-0.441), liquidity and bank size (r=-0.234) and liquidity and operational efficiency (r=-0.229) as presented in table 4.2 above.

From table 4.2, it is presented that there is a statistically significant strong positive association between bank size and operational efficiency (r=0.816). There are also statistically significant weak positive associations between asset quality and earnings ability (r=0.262) as well as between earnings ability and operational efficiency (r=0.377).

## 4.4 Regression Analysis

To further test the relationships between the study variables, a regression model was fitted as presented in Table 4.3 below. As indicated, 15.6 percent of variations in bank levels of non performing loans are explained by variations in the bank specific factors considered in the study (Adjusted R square = 0.156).

**Table 4.3: Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|------|----------|-------------------|----------------------------|
| 1 | .434[a] | .188 | .156 | .687630 |

a. Predictors: (Constant), Asset Quality, Size, Earning Ability, Liquidity, Op Efficiency

**Table 4.4: ANOVA<sup>a</sup>**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 13.693 | 5 | 2.739 | 5.792 | .000<sup>b</sup> |
| | Residual | 59.104 | 125 | .473 | | |
| | Total | 72.797 | 130 | | | |

a. Dependent Variable: NPLS

b. Predictors: (Constant), AssetQuality, Size, EarningAbility, Liquidity, OpEfficiency

Table 4.4 above below shows that the regression model is significant with F statistic

of 5.792 and $P< 0.05$ which indicates that the points lie moderately close to the line of

best fit in the scatter diagram. This indicates that the model is relatively suitable in

explaining the variance of levels of non performing loans as explained by the variance

in the bank specific attributes.

**Table 4.5: Coefficients<sup>a</sup>**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 2.655 | .747 | | 3.553 | .001 |
| | Op Efficiency | .024 | .057 | .064 | .414 | .680 |
| | Earning Ability | 3.944 | 2.030 | .181 | 1.943 | .054 |
| | Liquidity | .885 | .404 | .201 | 2.192 | .030 |
| | Size | -.129 | .090 | -.210 | -1.440 | .152 |
| | Asset Quality | -2.200 | .457 | -.444 | -4.809 | .000 |

a. Dependent Variable: NPLS

From table 4.5 above, the fitted regression equation is in the form of:

NPLS = 2.665 + 0.181 (Earnings Ability) + 0.201 (Liquidity) – 0.210 (Size) – 0.444 (Asset Quality) + 0.064 (Operational Efficiency)

From table 4.5, it is inferred that the constant levels of non performing loans before incorporating the bank specific factors is 2.665. The regression model suggests that there is a positive relationship between Earnings ability and the levels of non performing loans in the commercial banks ($\beta$=0.181, t= 1.943, p>0.05). This shows that a unit increase in earnings opportunities leads to an increase in NPLs of commercial banks by up to 0.181.

The study finds a statistically significant positive relationship between Liquidity and levels of non performing loans among the commercial banks ($\beta$=0.201, t=2.192, p<0.05) which indicates that for a unit increase in bank liquidity, there is a proportionate increase in bank non performing loans of up to 0.201. This shows that high liqudity levels lead to imprudent lending and investment decisions that affect overall bank performance.

The weak negative relationship between bank size and levels of non performing loans is not statistically significant ($\beta$=-0.210, t=-1.44, p>0.05). Due to economies of scale in operations, a unit increase in bank size is established to relate to a decline in levels of bank non performing loans to the extent of 0.210. This imply that larger commercial banks have proprotionately lower levels of NPLs when compared with the smaller commercial banks.

The statistically significant negative relationship between bank asset quality and levels of non performing loans ($\beta$=-0.444, t=-4.809, p<0.05) shows that a unit increase in bank asset quality translates to a decline in levels of non performing laons up to 0.444. This finding shows the significance of prudent lending approaches that ensures the bank asset quality is sound.

The study establishes a weak positive relationship between operational efficiency and levels of non performing loans though it is not statistically significant ($\beta=0.064$, t=-0.414, p>0.05). This indicates that a unit increase in operational efficiency translates to a proportionate increase in operational efficiency by up to 0.064. This finding shows that increased operational cost efficiency increases the risk of default for the banks.

# CHAPTER FIVE

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Introduction

This chapter presents a summary of the key elements of the study, discussion of major findings and interpretation of the results. The chapter further presents the conclusions drawn from the research findings as well as recommendations for improvement and suggestions for further research.

## 5.2 Summary of Findings

The statistically significant weak negative association between asset quality and levels of non performing loans is an indication that choice of borrower clientele is of importance to the commercial banks since reductions in quality of bank loan portfolio increases the levels of the non performing loans.

The statistically significant strong positive association between bank size and operational efficiency confirms the economies of scale enjoyed by larger financial institutions. The statistically significant weak positive association between asset quality and earnings ability points to the earnings contributions of clean loan books to the commercial banks. The statistically significant weak positive association between earnings ability and operational efficiency shows that increased operational efficiency improves the banks earnings ability in a competitive environment.

The weak negative association between bank size and levels of non performing loans is explained by inefficiencies associated with size of bank operations. The weak negative asociation between operating efficiency and levels of non performing loans is explained by inefficiencies caused by deteriorating margins that possibly affect due

diligence. The weak negative association between bank liquidity and earnings ability indicates that highly liquid banks limit their returns as they pursue conservative lending or investment strategies.

The statistically significant weak negative associations between bank liquidity and asset quality shows that most liquid commercial banks invest in substandard assets which affcet their overall loan book quality. The weak positive association between earnings ability and bank size is an indication of the size advantage for commercial banks in competing for earnings.

The study establishes that 15.6 percent of variations in bank levels of non performing loans are explained by bank specific factors namely; liqudity, asset quality, size, earnings abilty and operational efficiency. The remainder portion (84.4 percent), is explained by various other factors. This proportion may be accounted for by macro economic variables as explained by Louzis, *et al*. (2012), Warue (2012), Mboka (2013) and Murithi (2013).

The regression model suggests that there is a positive relationship between Earnings ability and the levels of non performing loans in the commercial banks which shows that a unit increase in earnings opportunities leads to an increase in NPLs of commercial banks by up to 0.181.

There is also a statistically significant positive relationship between Liquidity and levels of non performing loans among the commercial banks which imply that a unit increase in bank liquidity has a proportionate increase in bank non performing loans of up to 0.201. This is an indication that high liquidity levels for the commercial

banks leads to imprudent lending and investment decisions that affect overall bank performance through low returns and sub standard assets book.

The study finds a weak negative relationship between bank size and levels of non performing loans which is not statistically significant. A unit increase in bank size is established to relate to a decline in levels of bank non performing loans to the extent of 0.210 which is explained by economies of scale in bank operations confirming that larger commercial banks have proprotionately lower levels of NPLs when compared with the smaller commercial banks.

There is also established a statistically significant negative relationship between bank asset quality and levels of non performing loans showing that a unit increase in bank asset quality translates to a decline in levels of non performing laons up to 0.444. The non statistically significant weak positive relationship between operational efficiency and levels of non performing loans indicates that a unit increase in operational efficiency translates to a proportionate increase in operational efficiency by up to 0.064.

This finding therefore shows that increased operational efficiency incrases the risk of default for the commercial banks. This finding is consistent with Podpiera and Weill (2008) evidence in favor of a negative relationship between decreased cost efficiency and future NPLs for commercial banks which supports the bad management hypothesis where deteriorations in cost efficiency precede increases in non-performing loans.

## 5.3 Conclusions

From the findings, 15.6 percent of variations in NPLs are explained by variations in specific bank characteristics. The other possible factors that could explain variations in NPLs are macro economic variables as highlighted by Louzis, *et al*. (2012), Warue (2012), Mboka (2013) and Murithi (2013). These findings are contrary to Ndungu (2014) who in a different contextual setting established that institutional characteristics contribute most to the non-performing loans of microfinance institutions in Kenya followed by Macroeconomic variables and finally Customer characteristics.

The study findings that bank liquidity and Asset quality are statistically significant and have a positive and negative relationship with levels of nonperforming loans respectively for commercial banks in Kenya confirms Breuer (2006) arguments that NPLs and problem bank loans are the outcome of decisions made by banks in the dual role they serve as bank intermediaries. The study therefore shows that such dual roles introduce conflicts of interest that may lead to bank mismanagement and consequently problem bank loans.

## 5.4 Limitations of the Study

Secondary data was collected from the specific banks' financial reports that are filed with the regulator. The study was therefore limited to the degree of precision of the data obtained from the secondary source. While the data was verifiable, it may however be prone to these shortcomings associated with preparation or collection.

The Study targeted 43 banks with an expectation of attaining annual data on the study variables translating to 215 obseravtions. Because of data inavailability, a panel of

131 obserations was attained providing 60.9 percent of the expected data points. The study was based on a five year study period from the year 2010 to 2014. A longer duration of the study may be ten years  could have captured periods of different provisioning requierements for NPLs and different credit information sharing regulations and regimes.

The study was limited to establishing the relationship between non-performing loans and commercial banks specific characteristics. For this reason, other lending financial institutions could not be incorporated in the study and the findings can not be generalizable.

## 5.5 Recommendations

In view of the research findings, a significant negative relationship is evident between asset quality and levels of commercial banks non performing loans. Bank management should institutionalize sound and prudent lending mechanisms and loan screening approaches to improve the standards of the advances and create a sound financial system with minimal NPLs.

Since increased liquidity could possibly increase levels of bank NPLs, bank managament should put in place liquidity management techniques to avoid mismatches that affects bank cashflows. Efforts  should be put in place to have optimal cashflow holdings that cover the liquidity gaps while at the same time not having idle cash flows that pushes the financial institution to engage in substandard lending contracts.

The study documents a negative relationship between bank size and levels of NPLS. This is an indication of competitive advantage for larger commercial banks due to

economies of scale in their operations. Policy efforts should be directed on supporting the smaller financial institutions to reduce their vulnerability resulting from NPL exposures.

## 5.5.1 Policy Recommendations

The study recommends that Central bank should provide strict lending policies based on the prevailing economic environment as this will ensure uniformity in administration of credit facilities. The ability and qualifications of the credit officer is of importance in assessing the credit worthiness of the borrower. Therefore the banks staff should be given occasional training to equip them with the relevant skills as this will go a long way in reducing the levels of non-performing loans among commercial banks.

The study recommends the bank to come up with loan differentiation strategies by segmenting the customers based on their needs, size and type of business and designing products that meet the unique needs of these customer segments and also creating a pricing strategy for each segment.

## 5.5.2 Suggestions for further Research

This study has examined the effect of specific bank characteristics on levels of NPLs in Kenya. A similar study should be carried out in other forms of financial institutions and in other countries to ascertain if the same findings will be obtained.

The study suggests that further studies can be conducted on human capital and levels of non performing loans. Credit officers demographic attributes are expected to have an influence on the quality of their asset portfolio.

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# APPENDICES

## Appendix One: Licensed Commercial Banks in Kenya

1. African Banking Corporation Ltd

2. Bank Of India

3. Bank of Africa Kenya Ltd

4. Bank Of Baroda (Kenya) Ltd.

5. Barclays bank of Kenya Ltd

6. CFC Stanbic Bank Limited

7. Chase Bank Kenya Ltd

8. Charterhouse Bank Ltd

9. Citibank N A Kenya

10. Co-operative Bank of Kenya Ltd

11. Commercial Bank of Africa

12. Consolidated Bank

13. Credit Bank Ltd

14. Development Bank Of Kenya Ltd

15. Diamond Trust Bank

16. Dubai Bank Kenya Ltd

17. Ecobank Kenya Ltd

18. Equatorial Commercial Bank Limited

19. Equity Bank

20. Family Bank ltd

21. Fidelity Commercial Bank Ltd

22. First community Bank Ltd

23. Giro Commercial Bank Ltd

24. Guardian Bank Ltd

25. Guaratee Trust Bank Ltd

26. Gulf African Bank Ltd

27. Habib Bank A.G Zurich

28. Habib Bank Ltd

29. Imperial Bank Ltd

30. Investments & Mortgages Bank Limited – I&M Bank

31. Jamii Bora Bank Ltd

32. K-Rep Bank

33. KCB Bank

34. Middle East Bank (K) Ltd

35. National Bank

36. NIC Bank

37. Oriental Commercial Bank Ltd.

38. Paramount Universal Bank Ltd

39. Prime Bank

40. Standard Chartered Bank Kenya Ltd

41. Trans-National Bank(K) Ltd

42. UBA Kenya Bank Ltd

43. Victoria commercial Bank Ltd

**Non-Banking Financial Institution**

1. Housing Finance Company Ltd

**Source: Central Bank of Kenya (CBK)**

**Appedix Two: Data Collection Template**

Name of Bank.....................................................................................................

| Year | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|
| Outstanding principal balance of loans past due more than 90 days | | | | | |
| Outstanding principal balance of all loans | | | | | |
| Operating costs | | | | | |
| Operating income | | | | | |
| Net income | | | | | |
| Liquid assets capital equity | | | | | |
| Total assets | | | | | |
| Total loans | | | | | |
| Total banking sector asset value | | | | | |

## Appedix Three: Raw Data

| NPLS | Op Efficiency | Earning Ability | Liquidity | Size | Asset Quality |
|---|---|---|---|---|---|
| 0.133649 | 5.723585102 | 0.02053216 | 0.003352 | 9.163877 | 0.77362246 |
| 0.281051 | 5.683579767 | 0.024199217 | 0.007029 | 9.206232 | 0.267597148 |
| 0.057034 | 6.173786104 | 0.06720404 | 0.030883 | 9.239608 | 0.532970768 |
| 0.057034 | 6.173786104 | 0.06720404 | 0.030883 | 9.239608 | 0.532970768 |
| 0.038851 | 6.244166901 | 0.060126329 | 0.031502 | 9.434044 | 0.576237307 |
| 0.038851 | 6.244166901 | 0.060126329 | 0.031502 | 9.434044 | 0.576237307 |
| 0.126848 | 5.545177444 | 0.117609186 | 0.042387 | 9.139811 | 0.762206245 |
| 0.126848 | 5.545177444 | 0.117609186 | 0.042387 | 9.139811 | 0.762206245 |
| 0.091878 | 6.216606101 | 0.082722409 | 0.026055 | 9.912844 | 0.539132158 |
| 0.091878 | 6.216606101 | 0.082722409 | 0.026055 | 9.912844 | 0.539132158 |
| 0.021061 | 6.32256524 | 0.022180274 | 0.032091 | 9.855924 | 0.522835719 |
| 0.105751 | 6.259581464 | 0.090531498 | 0.029882 | 10.16593 | 0.66333359 |
| 0.105751 | 6.259581464 | 0.090531498 | 0.029882 | 10.16593 | 0.66333359 |
| 0.213361 | 4.709530201 | 0.113950456 | 0.102868 | 8.945072 | 0.755280313 |
| 0.213361 | 4.709530201 | 0.113950456 | 0.102868 | 8.945072 | 0.755280313 |
| 0.151943 | 5.209486153 | 0.032031593 | 0.196358 | 8.424639 | 0.620886354 |
| 0.151943 | 5.209486153 | 0.032031593 | 0.196358 | 8.424639 | 0.620886354 |
| 0.194087 | 5.262690189 | 0.038767396 | 0.198807 | 8.523175 | 0.679125249 |
| 0.194087 | 5.262690189 | 0.038767396 | 0.198807 | 8.523175 | 0.679125249 |
| 0.125982 | 4.736198448 | 0.01511254 | 0.181833 | 8.735525 | 0.634244373 |
| 0.023161 | 3.850147602 | 0.007495741 | 0.213288 | 8.67761 | 0.544293015 |
| 0.018196 | 4.521788577 | 0.042034921 | 0.274628 | 8.442254 | 0.544945031 |
| 0.018196 | 4.521788577 | 0.042034921 | 0.274628 | 8.442254 | 0.544945031 |
| 0.102971 | 5.068904202 | 0.073078538 | 0.385342 | 8.468423 | 0.409911802 |
| 0.102971 | 5.068904202 | 0.073078538 | 0.385342 | 8.468423 | 0.409911802 |
| 1.010919 | 8.448914351 | 0.03838666 | 0.020082 | 11.45648 | 0.953529711 |
| 0.11145 | 5.774551546 | 0.024201795 | 0.25588 | 9.082621 | 0.521986138 |
| 5.9375 | 5.686975356 | 0.073143955 | 0.318101 | 8.893847 | 0.008782764 |
| 5.9375 | 5.686975356 | 0.073143955 | 0.318101 | 8.893847 | 0.008782764 |
| 0.157163 | 5.552959585 | 0.059165951 | 0.222063 | 9.257129 | 0.610840729 |
| 0.157163 | 5.552959585 | 0.059165951 | 0.222063 | 9.257129 | 0.610840729 |
| 0.103777 | 0 | -0.034162591 | 0.224254 | 9.554568 | 0.549790914 |
| 0.084257 | 5.509388337 | 0.056469513 | 0.215759 | 9.636784 | 0.629912521 |
| 0.084257 | 5.509388337 | 0.056469513 | 0.215759 | 9.636784 | 0.629912521 |
| 0.086291 | 5.407171771 | 0.01302682 | 0.282759 | 9.371183 | 0.628522776 |
| 0.231542 | 0 | 0.028560439 | 0.336955 | 9.249465 | 0.497547841 |
| 0.231542 | 0 | 0.028560439 | 0.336955 | 9.249465 | 0.497547841 |
| 0.240403 | 3.526360525 | 0.063796909 | 0.832892 | 8.418477 | 0.46004415 |
| 0.240403 | 3.526360525 | 0.063796909 | 0.832892 | 8.418477 | 0.46004415 |
| 0.085573 | 4.262679877 | 0.030324128 | 0.29566 | 9.467073 | 0.532451458 |
| 0.085573 | 4.262679877 | 0.030324128 | 0.29566 | 9.467073 | 0.532451458 |
| 0.154835 | 4.644390899 | 0.005366326 | 0.290229 | 9.504278 | 0.544905717 |

| | | | | | |
|---|---|---|---|---|---|
| 0.040402 | 6.452048954 | 0.03986711 | 0.409224 | 9.233471 | 0.495798319 |
| 0.040402 | 6.452048954 | 0.03986711 | 0.409224 | 9.233471 | 0.495798319 |
| 0.052275 | 5.170483995 | -0.001999889 | 0.247431 | 9.798183 | 0.582356536 |
| 0.144923 | 3.931825633 | 0.06154987 | 0.846125 | 8.593043 | 0.564145347 |
| 0.144923 | 3.931825633 | 0.06154987 | 0.846125 | 8.593043 | 0.564145347 |
| 0.119297 | 4.394449155 | 0.01092555 | 0.713751 | 8.765146 | 0.506321211 |
| 0.03725 | 7.789868559 | 0.058675332 | 0.092632 | 10.91101 | 0.769953994 |
| 0.03725 | 7.789868559 | 0.058675332 | 0.092632 | 10.91101 | 0.769953994 |
| 0.029558 | 5.332718793 | 0.018403909 | 0.415635 | 9.415727 | 0.45732899 |
| 0.142695 | 6.736966958 | 0.017427788 | 0.165209 | 10.34126 | 0.626948523 |
| 0.06383 | 7.129297549 | 0.143718748 | 0.283056 | 9.872977 | 0.627506573 |
| 0.06383 | 7.129297549 | 0.143718748 | 0.283056 | 9.872977 | 0.627506573 |
| 0.037447 | 5.736572297 | 0.091455913 | 0.392481 | 9.590829 | 0.821394395 |
| 0.037447 | 5.736572297 | 0.091455913 | 0.392481 | 9.590829 | 0.821394395 |
| 0.040084 | 6.021023349 | 0.025767883 | 0.663575 | 9.180087 | 0.246856318 |
| 0.049202 | 7.397561536 | 0.172027481 | 0.251308 | 10.15105 | 0.657701616 |
| 0.049202 | 7.397561536 | 0.172027481 | 0.251308 | 10.15105 | 0.657701616 |
| 0.023171 | 5.85220248 | 0.02851312 | 0.385364 | 9.749753 | 0.830437318 |
| 0.088967 | 4.795790546 | 0.025946343 | 0.249945 | 10.21134 | 0.41969864 |
| 0.088967 | 4.795790546 | 0.025946343 | 0.249945 | 10.21134 | 0.41969864 |
| 0.033628 | 8.119993828 | 0.053057175 | 0.101928 | 11.20614 | 0.792527962 |
| 0.033628 | 8.119993828 | 0.053057175 | 0.101928 | 11.20614 | 0.792527962 |
| 0.04615 | 7.182352112 | 0.018409531 | 0.168068 | 10.80172 | 0.602769575 |
| 0.041729 | 7.555905094 | 0.03879734 | 0.247933 | 10.45132 | 0.65469789 |
| 0.130952 | 0 | -0.033206383 | 0.292846 | 10.36631 | 0.455478266 |
| 1.00818 | 8.085794701 | 0.088143778 | 0.121325 | 11.25743 | 0.928124153 |
| 1.00818 | 8.085794701 | 0.088143778 | 0.121325 | 11.25743 | 0.928124153 |
| 0.04135 | 6.985641818 | 0.046154721 | 0.271017 | 10.4684 | 0.535411812 |
| 0.04135 | 6.985641818 | 0.046154721 | 0.271017 | 10.4684 | 0.535411812 |
| 0.004807 | 6.455198563 | 0.008354099 | 0.196658 | 10.79872 | 0.611912251 |
| 0.218325 | 5.236441963 | 0.03409936 | 0.372676 | 10.19958 | 0.368920125 |
| 0.218325 | 5.236441963 | 0.03409936 | 0.372676 | 10.19958 | 0.368920125 |
| 1.010768 | 7.96276393 | 0.083319114 | 0.181995 | 10.97859 | 0.884175682 |
| 1.010768 | 7.96276393 | 0.083319114 | 0.181995 | 10.97859 | 0.884175682 |
| 0.039887 | 6.646390515 | 0.034736777 | 0.369005 | 10.38727 | 0.469054371 |
| 0.039887 | 6.646390515 | 0.034736777 | 0.369005 | 10.38727 | 0.469054371 |
| 0.015497 | 6.408528791 | 0.022832335 | 0.53262 | 10.1217 | 0.407243639 |
| 0.023047 | 6.882437471 | 0.047276465 | 0.603845 | 10.05844 | 0.314020212 |
| 0.023047 | 6.882437471 | 0.047276465 | 0.603845 | 10.05844 | 0.314020212 |
| 0.0335 | 7.424165281 | 0.062287131 | 0.393668 | 10.51056 | 0.52704286 |
| 0.0335 | 7.424165281 | 0.062287131 | 0.393668 | 10.51056 | 0.52704286 |
| 0.02911 | 7.651595574 | 0.038641391 | 0.141284 | 11.58188 | 0.558536107 |
| 0.02911 | 7.651595574 | 0.038641391 | 0.141284 | 11.58188 | 0.558536107 |
| 0.039807 | 8.001019961 | 0.115077507 | 0.184395 | 11.33 | 0.588187265 |

| | | | | | |
|---|---|---|---|---|---|
| 0.039807 | 8.001019961 | 0.115077507 | 0.184395 | 11.33 | 0.588187265 |
| 0.035884 | 7.057036982 | 0.021972712 | 0.363298 | 10.67967 | 0.49754964 |
| 0.037957 | 7.510977752 | 0.051868118 | 0.517258 | 10.38381 | 0.417202771 |
| 0.037957 | 7.510977752 | 0.051868118 | 0.517258 | 10.38381 | 0.417202771 |
| 1.016207 | 8.007700013 | 0.060333802 | 0.286482 | 11.04375 | 0.575089526 |
| 1.016207 | 8.007700013 | 0.060333802 | 0.286482 | 11.04375 | 0.575089526 |
| 0.047216 | 8.368925175 | 0.028573674 | 0.181848 | 11.53049 | 0.667806469 |
| 0.043482 | 7.900266037 | 0.072750596 | 0.314658 | 11.00255 | 0.358605294 |
| 0.043482 | 7.900266037 | 0.072750596 | 0.314658 | 11.00255 | 0.358605294 |
| 0.026166 | 7.418780883 | 0.029823573 | 0.459578 | 10.73939 | 0.482920803 |
| 0.014166 | 8.476787777 | 0.041757093 | 0.292085 | 11.22051 | 0.3829944 |
| 0.014166 | 8.476787777 | 0.041757093 | 0.292085 | 11.22051 | 0.3829944 |
| 0.041121 | 8.727129915 | 0.070840188 | 0.132543 | 12.03036 | 0.680095606 |
| 0.041121 | 8.727129915 | 0.070840188 | 0.132543 | 12.03036 | 0.680095606 |
| 0.01852 | 8.457867725 | 0.023309691 | 0.177968 | 11.80094 | 0.501589468 |
| 0.016084 | 8.048149102 | 0.04295188 | 0.181273 | 11.85002 | 0.462919471 |
| 0.016084 | 8.048149102 | 0.04295188 | 0.181273 | 11.85002 | 0.462919471 |
| 0.010682 | 9.018089684 | 0.061608459 | 0.154938 | 12.00873 | 0.587890268 |
| 0.010682 | 9.018089684 | 0.061608459 | 0.154938 | 12.00873 | 0.587890268 |
| 0.041387 | 7.80139132 | 0.073996942 | 0.377645 | 11.13699 | 0.421204398 |
| 0.041387 | 7.80139132 | 0.073996942 | 0.377645 | 11.13699 | 0.421204398 |
| 0.075176 | 7.044905117 | 0.01095972 | 0.400581 | 11.11476 | 0.445089718 |
| 0.013528 | 8.459987718 | 0.036746066 | 0.298459 | 11.42431 | 0.611440122 |
| 0.047361 | 8.623173515 | 0.061714204 | 0.223341 | 11.9446 | 0.595932045 |
| 0.047361 | 8.623173515 | 0.061714204 | 0.223341 | 11.9446 | 0.595932045 |
| 0.039289 | 9.16680637 | 0.038685185 | 0.172501 | 12.20439 | 0.603597061 |
| 0.037036 | 8.293549515 | 0.031088238 | 0.345435 | 11.51748 | 0.541600303 |
| 0.059274 | 9.13905917 | 0.087482262 | 0.280536 | 11.80477 | 0.551146464 |
| 0.059274 | 9.13905917 | 0.087482262 | 0.280536 | 11.80477 | 0.551146464 |
| 0.054929 | 9.393744676 | 0.097642031 | 0.224733 | 12.02757 | 0.596521323 |
| 0.054929 | 9.393744676 | 0.097642031 | 0.224733 | 12.02757 | 0.596521323 |
| 0.030212 | 9.401291255 | 0.091701477 | 0.215572 | 12.0834 | 0.608057159 |
| 0.030212 | 9.401291255 | 0.091701477 | 0.215572 | 12.0834 | 0.608057159 |
| 0.032301 | 9.684086988 | 0.050952374 | 0.195136 | 12.28224 | 0.576345162 |
| 0.019248 | 9.351753125 | 0.04128025 | 0.237262 | 12.18328 | 0.579601316 |
| 0.036148 | 9.474241916 | 0.047222612 | 0.25681 | 12.12866 | 0.563732429 |
| 0.066067 | 9.552652665 | 0.082430069 | 0.18485 | 12.55141 | 0.655178517 |
| 0.066067 | 9.552652665 | 0.082430069 | 0.18485 | 12.55141 | 0.655178517 |
| 0.101177 | 9.353401215 | 0.088084295 | 0.248981 | 12.31504 | 0.646268356 |
| 0.101177 | 9.353401215 | 0.088084295 | 0.248981 | 12.31504 | 0.646268356 |
| 0.01983 | 8.944811104 | 0.058671613 | 0.38995 | 11.86976 | 0.425657895 |
| 0.01983 | 8.944811104 | 0.058671613 | 0.38995 | 11.86976 | 0.425657895 |
| 0.074015 | 9.284983915 | 0.09075748 | 0.324255 | 12.05926 | 0.511590065 |
| 0.074015 | 9.284983915 | 0.09075748 | 0.324255 | 12.05926 | 0.511590065 |
| 0.075788 | 9.664976524 | 0.040126664 | 0.26115 | 12.62515 | 0.63996817 |