



UNIVERSITY OF NAIROBI
SCHOOL OF MATHEMATICS

Modeling Non-performing Loans in Kenya Commercial Banks

By

Emmanuel Munyao Musau

**A project submitted to the School of Mathematics in partial fulfillment for the award
of the degree of Master of Science in Social Statistic.**

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Declaration

I declare that all assessed work submitted for my degree is the results of my work.

In all other cases, material from the work of others is acknowledged and quotations and paraphrases are suitably indicated.

Emmanuel Munyao Musau I56/80688/2012

SignatureDate

This project has been submitted for examination with my approval as supervisor.

Dr. John Nderitu

School of Mathematics

SignatureDate

Dedication

To

My loving wife,

Jackline Katunge,

My son Humphrey and my Daughter Purity

Acknowledgement

I acknowledge the support and guidance by my supervisor Dr. John Nderitu who was readily available to make this project a success.

Finally I acknowledge my parents and my siblings for financial and spiritual support through this course.

ABSTRACT

Banks role in the economy of any country is very significant. Lending is very risky in that repayment of the principal loan plus interest is not always guaranteed. High levels of Non-performing Loans is as a result of failure to manage loans, this would likely affect the performance of Banks and the country's economy at large. In reference to the annual reports by Central Bank of Kenya (2012), it is reported that the banking industry had been registering high Non-Performing Loans (NPLs) in the last three years. According to the report there was a decrease in NPLs between 2009 and 2012. It is shows that in 2009/2010, NPLs were 61.5 billion (7.4%). In 2010/2011; NPLs were 58.3 billion (5.4%). In 2011/2012, the NPLs were 57.5 billion (4.5%). Though there has been some decrease in NPLs, the figures still remain high. The study seeks to fill the existing research gap by conducting a study to model non-performing loans in Kenya commercial banks. It aimed to model non-performing loans in Kenya from the empirical evidences that help answer the research objective. Secondary data from central bank for a 13 year period was used. The data that was collected in the study was quantitative. Regression analysis was used to analyze the data and find out whether there exists a relationship between bank specific factors and macro-economic factors in Kenya. In this research a dynamic econometric model was used to link and assess the joint relationship between Nonperforming loan ratio and its determinants in Kenya Banking sector. The study found out that there was a positive relationship between inflation rate, Rear Interest rate, credit growth, liquidity of the bank and non-performing loan among Commercial Banks in Kenya. The relationship between Gross domestic product, capital adequacy and non-performing loans was found to be negative. The study established a model to forecast the relationship between inflation rate, GDP, Real Interest Rate, size of the banks, capital adequacy and liquidity of the bank and Non-performing Loans among commercial Banks in Kenya.

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LIST OF ABBREVIATIONS

CBK	Central Bank of Kenya
GDP	Gross Domestic Product
IMF	International Monetary Fund
NPLs	Non-Performing Loans
SPSS	Statistical Package for Social Science
NFBI's	Non bank financial institutions
VAR	Vector Auto regression

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Banking industry in the economy of any country is very significant. They play intermediation function in that they collect money from those who have excess and lend it to others who need it for their investment. Lending credit to borrowers is one means by which banks contribute to the growth of a country's economies. Advancing credit facilitates is a key role of the banking industry. Loans are the dominant asset and represent 50-75 percent of the total amount at most banks; they are the major contributor of operating income and represent the banks greater risk exposure (Mac Donald and Koch, 2006). The Basel Committee¹ (2001) puts non-performing loans as loans left unpaid for a period of 90 days, this is what the CBK have also adopted.

Failure to manage loans, which make up the largest share of banks assets, would likely lead to high levels of non -performing loans. As contained in a Central Bank of Kenya annual report (2012), it is reported that the banking industry had been registering high Non-Performing Loans (NPLs) in the last three years. According to the report there was a decrease in NPLs between 2009 and 2012. It is shows that in 2009/2010, NPLs were 61.5 billion (7.4%). In 2010/2011, NPLs were 58.3 billion (5.4%). In 2011/2012, the NPLs were 57.5 billion (4.5%). Though there has been some decrease in NPLs, the figures still remain high.

Regular monitoring of the quality of the credit facilities and with an early warning system capable of alerting regulatory authorities of potential bank stress, is thus essential to ensure a sound financial system and prevent high levels of defaults. In line with Basel II, assets quality is regularly monitored by supervisory authorities like central banks to ensure their well-being. Banks have been forced to seek expertise in debt collection to curb default rates of their loan facilities. Financial institutions with poor loan collection have faced serious liquidity problems, yet more banks have depended on government subsidy to financially cover the losses they face through loan default.

1.1.1 Non Performing Loans in Kenya

Kenya has experienced banking problems since 1980's culminating in major bank failures (Kithinji and Waweru, 2007; Ngugi, 2001), this was due to under-capitalization, high levels of non-performing loans and weaknesses in corporate governance. Non-Bank financial institutions (NBFIs) were the most affected, but the number of failing commercial banks increased as well in the 1990s. Most of the larger local bank failures in Kenya, such as the Continental Bank, Trade Bank and Pan African Bank, involved extensive insider lending, often to politicians.

Karumba and Wafula (2012) in their article on alternatives for Kenyan banking industry identified that credit risk is one of the oldest and most challenging risk faced by banks, which results due to the probability that borrowers may default terms of their debt and hence putting an institutions capital into risky positions. Defaults rates leads to piling of non-performing loans in an institution's balance sheet. Musyoki and Kadubo(2011) in their paper on credit risk management on financial performance of banks concluded that default rate is the most important factor as it influences 54% in total credit risk influence on bank performance.

1.2 Research Problem

In the past, banks have generated most of their income from transactional processes as compared to interest income. But with the demand for funds being on the increase and introduction of different technological ways of transacting like mobile banking, banks have focused more on the interest income, this is the income from credit facilities to borrowers. This being the main revenue generator has made lending the core business of all financial institution. Despite the huge income created from lending, available literature shows that huge shares of banks loans regularly go bad and therefore affect the financial performance of these institutions. The issue of bad loans can fuel banking crisis and result in the collapse of some of these institutions.

The single biggest contributor to the bad loans of many of the failed local banks is poor management of lending, this is where the Banks' staff fail to take note and analyze their customers/borrowers information before they approve and release loans to them and also fail to monitor and follow up on how the borrowers are faring on with their repayments.

In at least half of the bank failures, poor management of the loans and quick approval of loans to unqualified borrowers accounted for a substantial proportion of the bad debts. Most of the larger local bank failures in Kenya, such as the Continental Bank, Trade Bank and Pan African Bank, involved extensive poor unanalyzed lending, often to politicians. Credit evaluation, supervision, approval and monitoring play a big role in determining the nature and repay ability of the loan taken by a borrower. To the research knowledge there is limited empirical knowledge on the relationship between determinants of credit default and financial performance of commercial banks, this study seeks to fill the existing research gap by conducting a study to model non-performing loans in Kenyan Commercial Banks.

1.3 Research Questions

The following research questions were formulated to help achieve the objectives of the study: -

- i. Does there exist a relationship between macro-economic factors and non-performing loans in Kenya?
- ii. Does there exist a relationship between bank specific factors and non-performing loans in Kenya?

1.4 Objective of the Study

1.4.1 General Objective

The general objective of the study was to model non-performing loans in Kenya Commercial Banks with its determinants.

1.4.2 Specific Objectives

The project was guided by the following specific objectives

- i. To determine the relationship between macro-economic factors and non-performing loans in Kenya
- ii. To determine the relationship between bank specific factors and non-performing loans in Kenya

1.5 Justification of the study

Bank failures come with massive effects and costs not only to Banks but also to the economy of a country at large. Since Banks depend on credit or rather moneys lent out to borrowers as their major profits generator, default on the same brings about problems to the

performance of the banks which in turn affect the economy at large. This study sought to come up with ways to help banks improve on their credit management in order to avoid default in turn this helped in curbing of financial distress and loss experienced by depositors. It has been argued that bank failures may result in loss of deposits that represent depositors' life savings and therefore bank failures arguably impose significantly more costs than the insolvency of a normal firm (Mayes, 2004). This study sought to provide remedies to the disruption of the payment system that is normally caused by failure of commercial banks.

1.6 The study outline

This report is divided into five chapters. In the first chapter the background of the selected research area is presented. In chapter two is the literature review of studies related to the topic. Chapter three is the research Methodology is which details how regression analysis was used to link non-performing loan ratio and its determinants. Chapter four presents study findings of the research project, clearly shows that macroeconomic factors and bank specific factors are key in explaining non-performing loan ratio in a financial institution. Lastly chapter five is about data analysis, this outlines results and interpretations of the model and ends with conclusion of the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter summarizes the information from other researchers who have carried out their research on Non-performing loans. The specific areas covered here are theoretical review, empirical review and conceptualization.

2.2 Theoretical Review

2.2.1 Theory of Delegated Monitoring of Borrowers

This is one of the most influential in the literature on the existence of banks. Defined broadly, ‘monitoring’ of a borrower by a bank refers to information collection before and after a loan is granted, including screening of loan applications, examining the borrower’s ongoing creditworthiness and ensuring that the borrower adheres to the terms of the contract. This is most relevant in the case of small and medium enterprises and is linked to banks’ role in the payments system (Drzik, 2005).

2.2.2 Portfolio Theory to Credit Risk Management

Since the 1980s, banks have successfully applied modern portfolio theory (MPT) to market risk. Many banks are now using value at risk models to manage their interest rate and market risk exposures. Unfortunately however, even though credit risk remains the largest risk facing most banks, the practical of MPT to credit risk has lagged (Margrabe, 2007).

Banks recognize how credit concentrations can adversely impact financial performance. As a result, a number of sophisticated institutions are actively pursuing quantitative approaches to credit risk measurement, while data problems remain an obstacle. This industry is also making significant progress toward developing tools that measure credit risk in a portfolio context. They are also using credit derivatives to transfer risk efficiently while preserving customer relationships. The combination of these two developments has precipitated vastly accelerated progress in managing credit risk in a portfolio context over the past several years.

Traditionally, banks took an asset-by-asset approach to credit risk management. While each bank’s method varies, in general this approach involves periodically evaluating the credit quality of loans and other credit exposures, applying a credit risk rating, and aggregating the results of this analysis to identify a portfolio’s expected losses. The

foundation of the asset-by-asset approach is a sound loan review and internal credit risk rating system. A loan review and credit risk rating system enable management to identify changes in individual credits, or portfolio trends in a timely manner. Based on the results of its problem loan identification, loan review, and credit risk rating system management can make necessary modifications to portfolio strategies or increase the supervision of credits in a timely manner.

While the asset-by-asset approach is a critical component to managing credit risk, it does not provide a complete view of portfolio credit risk, where the term risk refers to the possibility that actual losses exceed expected losses. Therefore to gain greater insight into credit risk, banks increasingly look to complement the asset-by-asset approach with a quantitative portfolio review using a credit model. Banks increasingly attempt to address the inability of the asset-by-asset approach to measure unexpected losses sufficiently by pursuing a portfolio approach. One weakness with the asset-by-asset approach is that it has difficulty identifying and measuring concentration. Concentration risk refers to additional portfolio risk resulting from increased exposure to a borrower, or to a group of correlated borrowers.

2.3 Determinants of Nonperforming loans

The macroeconomic determinants of NPLs have generated a substantial amount of interest since the outbreak of the financial crisis in 2008. There is a rich theoretical literature on the subject of the interactions between the financial system and the wider country's economy. The most prominent examples are Bernanke and Gertler (1989) and Bernanke, Gertler and Gilchrist (1998) who developed the concept of the "financial accelerator", arguing 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. The Kiyotaki and Moore (1997) model showed how relatively small shocks might suffice to explain business cycle fluctuations, if credit markets are imperfect.

2.3.1 Macroeconomic Factors

Overall, the literature on the major economies has confirmed that macroeconomic conditions matter for credit risk. Keeton and Morris (1987) had already showed, for over

2400 insured commercial banks in the U.S. during 1979–85, that local economic conditions explained the variation in loan losses recorded by banks. Authors who looked at asset-price evidence also found a linkage between credit risk increases and adverse macroeconomic conditions (Mueller, 2000)

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. Other macroeconomic variables, in particular the exchange rate, unemployment, and asset and house prices can also be important.

The real interest rates; An increase in RIRs is likely to increase the probability of banking sector distress. RIRs would signal an impending liquidity problem in the financial system that would indicate deterioration in commercial bank loan portfolios and is also potentially to result in a slowdown in the rate of economic growth. Banks are faced with increasing financial and credit risks there are high chances of loans terms no met.

The ratio of cash held by banks to total assets; to study bank's liquidity, the ratio of cash held by the bank to total banking sector assets is employed. This ratio mainly reflects the ability of banks to deal with potential runs on their deposits (i.e. the ability to provide liquidity support to banks) and is expected to be positively related to nonperforming loan ratio.

The ratio domestic credit to private sector; an increase in credit extended to the private sector reflects a rise in the risky credit, particularly following financial liberalization. For this reason an increase in the private credit is expected to be negatively related to nonperforming loan ratio (NPL).

The real exchange rate; An increase in the RER is also expected to decrease nonperforming loan ratio. In principle: volatility in RER can cause difficulty for banks either

directly – when banks have sizeable un-hedged foreign liabilities or when a currency or maturity mismatches between bank liabilities and assets, or indirectly – when exchange rate volatility creates deterioration in balance sheet of bank borrowers (Goldstein and Turner, 1996, p. 10). The results of Gonzalez-Hermosillo *et al.* (1996) and Borovikova (2000) show that exchange rates are an important determinant of the time to bank failure.

2.3.2 Bank-Specific Factors

In addition to macro-economic factors, many of these studies included bank-specific variables, since they can cause risky lending. For instance, Salas and Saurina (2002) showed for Spanish banks that, in addition to real GDP growth and credit growth, credit growth, capital ratio and market power also explained variations in NPLs. Bercoff, Giovanni and Grimard (2002) showed that asset growth, operating efficiency and exposure to local loans also helped explain NPLs.

Additional bank specificities are also likely to be correlated with credit risk. For instance, Levine et al. (1995) 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.

Capital adequacy (C): The first variable is the indicator of capital adequacy, defined as the ratio of total capital equity to total assets (capital/asset). This ratio of total capital equity to total assets is expected to be positively related to the non performing loan ratio. The higher this ratio indicates that there is sufficient capital to absorb unexpected shocks hence longer survival time for the bank. Langrin (2001), and Molina (2002) find that this ratio significantly determines the time to bank failure.

Asset quality (A): The quality of assets usually deteriorates because of non-performing loans. To measure the quality of assets the ratio of the total loans to total assets (loan/asset) is utilized. Growth in bank's riskiest assets may concern banks underestimates of non-performing loans. Hence, higher levels may reflect poorer asset quality, and an increase

in this ratio is expected to shorten bank's survival time. Henebry (1997), and Wheelock and Wilson (2000) found that this ratio significantly determine the non-performing loan ratio.

Earning ability (E); the ratio of net income to total assets (net income/assets), which is also known as the "return on assets" is utilized to measure the earning ability, i.e. the profitability, of banks. It is expected that higher profitability ratios will be positively related to non-performing loan ratio. This implies that the higher these ratios are the longer survival time. The results of Langrin (2001), and Molina (2002) reveal that a return to asset is an important determinant of nonperforming loan ratio.

Liquidity (L); Higher liquidity may impact on the non-performing loans of a bank for two reasons. High ratio of liquidity may send a positive signal to the depositors that the bank is liquid; hence, higher is the depositors' confidence. However, a lower value of this ratio may signal that a bank is not in a good situation. On the other hand, higher liquidity may also imply the inefficient utilization of resources (i.e. weak financial investment activities), therefore may be associated with a high probability of failure. Liquidity ratios are expected to be both positively and negatively related to the survival time. To measure the overall liquidity risk the ratio of liquid assets to total assets (liquid/assets) is used. A higher ratio of liquid assets (cash and government securities) to total assets implies a greater capacity to discharge liabilities, and is therefore associated with a higher survival time. Alternatively, higher liquidity may also imply non-marketability of loans, and therefore may also be related to shorter survival time.

Asset size (S); the last variable is meant to serve as a proxy for the size of the bank and is measured as the ratio of bank assets to total banking sector asset value. Size variable is expected to have a positive influence on the survival time for the banks. That is, as the size of the banks increase it is less likely that they will fail and longer the survival time. Larger banks have the advantage of better access to additional financing, dealing with liquidity problems and diversifying risk. This is probably due to the fact that larger banks benefit from a "too large to fail" policy and are believed to be more likely to survive than smaller banks. Wheelock and Wilson (2000), and Langrin (2001) argue that size is a significant determinant of the time to bank failure.

2.4 Empirical Review

Keeton and Morris (1987) introduced the earliest empirical studies on non-performing loans studying the factors leading to loan loss of 2,500 banks in the USA. Using simple regressions, it was found that large numbers of NPLs variations reflected adverse local economic conditions and poor performance of industries such as agriculture and energy. Sinkey and Greenwalt (1997) used the USA commercial banks data and employed simple linear regression model to investigate factors leading to NPLs. The results proved that both internal and external factors are significant in explaining NPLs. The factors included excessive lending and interest rates have significant positive impact.

Kalirai and Scheicher (2002) used Australian banks data over 1990-2001 to investigate macro-economic determinants of non-performing loans using simple regression analysis on real GDP, CPI, industrial production, money growth, stock market indices, interest rates and other macroeconomic variables as explanatory variables. Stock market indices, interest rates, industrial production and business confidence index strongly influenced the quality of loans.

Sales and Saurina (2002) used Spanish banks panel data over the period of 1985-1997 and employed dynamic model to investigate the determinants of NPLs. Fluctuations in NPLs was found to be explained by growth in GDP, bank size, market power, rapid credit expansion and capital ratio. Rajan & Dhal (2003) studied Indian banks using regression analysis and suggested that macroeconomic factors and financial factors both have significant impact on NPLs rate. These macroeconomic factors included the GDP growth, and the financial factors are bank size, credit orientation, and credit terms.

CHAPTER THREE: DATA AND METHODOLOGY

3.1 Introduction

This chapter sets out various stages and phases that were followed in completing the study. It involved the collection, measurement and analysis of data. The following subsections were included; research design, theoretical models, data collection procedures and finally data analysis.

3.2 Research Design

Creswell (2003) defines a research design as the scheme, outline or plan that is used to generate answers to research problems. Dooley (2007) notes that a research design is the structure of the research, it is the “glue” that holds all the elements in a research project together. The study adopted a descriptive cross-sectional research design. Survey designs have also been found to be accurate in descriptive studies and generalizations of results (Ngechu, 2004). Cross-sectional survey designs survey a single group of respondents at a single point in time. It aimed to modeling non-performing loans in Kenya from the empirical evidences that help answer the research objective.

3.3 Theoretical models

3.3.1 The Classical Linear Regression Model

In a regression model the response variable is a linear function of the regressors. Let's Y_t , denote the response variable at time t (NPLs ratio) and $X_{t,1}, X_{t,2}, X_{t,3} \dots \dots, X_{t,k-1}$ the corresponding explanatory variables (Macroeconomic and bank specific factors in this study) at time t . Therefore NPLs ratio is explained by macroeconomic factors and bank specific factors, where $X_{t,1}, X_{t,2}, X_{t,3} \dots \dots, X_{t,k-1}$ are the determinants of the NPLs ratio. Consider the regression model below

$$Y_t = \beta_0 + \beta_1 X_{t,1} + \beta_2 X_{t,2} + \dots + \beta_k X_{t,k-1} + \varepsilon_t \quad (3.1)$$

This model in matrix form can be expressed as

$$Y_t = X\beta + \varepsilon \quad (3.2)$$

Where Y is an $n \times 1$ vector of response variable values, β_0 is a constant term, X is an $n \times k$ matrix of explanatory variables, β is a $k \times 1$ vector of all unknown regression coefficients, and ε is an $n \times 1$ vector of unobserved errors.

We have

$$Y = \begin{pmatrix} Y_1 \\ \vdots \\ Y_n \end{pmatrix}, \quad \varepsilon = \begin{pmatrix} \varepsilon_1 \\ \vdots \\ \varepsilon_n \end{pmatrix}, \quad X = \begin{pmatrix} 1 & X_{12} & \cdots & X_{1k} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & X_{n2} & \cdots & X_{nk} \end{pmatrix}, \quad \beta = \begin{pmatrix} \beta_0 \\ \vdots \\ \beta_n \end{pmatrix} \quad (3.3)$$

The following are the classical assumptions on the model;

Assumption 1-Linearity $\{Y, X\}$ satisfies the linear relationship;

$$Y = \beta'X + \varepsilon \quad (3.4)$$

Assumption 2-Strict exogeneity, the expected value of ε_t equals zero for every t . Thus, it does not depend on X_1, X_2, \dots, X_{k-1} .

$$E(\varepsilon_t/X) = E(\varepsilon_t/X_1, \dots, X_n) = 0 \text{ for } t=1, 2, \dots, k \quad (3.5)$$

Assumption 3-Homoskedasticity, the variance of ε_t equals a constant, σ^2 for every t . Thus, it does not depend on $X_{t,1}, X_{t,2}, \dots, X_{t,k-1}$.

$$\text{Var}(\varepsilon_t/X) = \sigma^2 I \quad (3.6)$$

Where I is the identity matrix with order n . The basic multiple regression model assumes that the relationship between the mean of response variable Y_t and the explanatory variables $X_{t,1}, X_{t,2}, \dots, X_{t,k-1}$ follows the equation.

$$E(Y_t/X_t) = \beta_0 + \beta_1 X_{t,1} + \beta_2 X_{t,2} + \dots + \beta_k X_{t,k-1} \quad (3.7)$$

The vector Y is identically and independently distributed normal with mean $X\beta$ and the covariance matrix $\sigma^2 I$; that is

$$Y/X \sim N(X\beta, \sigma^2 I) \quad (3.8)$$

The likelihood function of (β, σ^2) is of the form

$$L(\beta, \sigma^2|y) = (2\pi\sigma^2)^{-n/2} \exp \left[-\frac{1}{2\sigma^2} (y-x\beta)'(y-x\beta) \right] \quad (3.9)$$

The log likelihood function is

$$\begin{aligned} \ln(\beta, \sigma^2) &\equiv \log(f(\varepsilon_1, \varepsilon_2, \dots, \varepsilon_n|X; \beta, \sigma^2)) \\ &= -\frac{n}{2} \log(2\pi\sigma^2) - \frac{1}{2\sigma^2} (y-x\beta)'(y-x\beta) \end{aligned} \quad (4.0)$$

This likelihood function is maximized relative to the unknown parameter vector β and the unknown scalar σ^2 . We obtain the First Order Condition (FOC) which gives the standard Maximum Likelihood Estimates of β and σ^2 as below;

$$\frac{\partial \text{Ln}(\beta, \sigma^2)}{\partial \beta} = 0 \quad , \quad \hat{\beta} = (X'X)^{-1}X'Y \quad (4.1)$$

$$\frac{\partial \text{Ln}(\beta, \sigma^2)}{\partial \sigma^2} = 0 \quad , \quad \hat{\sigma}^2 = \frac{1}{n} \hat{\varepsilon}' \hat{\varepsilon} \quad (4.2)$$

Where $\hat{\varepsilon} = y - X\hat{\beta}$ is the vector of fitted residuals.

3.3.2 Ordinary Least Squares Estimation of $\hat{\beta}$ and $\hat{\sigma}^2$

In the classical linear regression model, $\hat{\beta}$ is an unbiased estimate of the coefficient vector β but $\hat{\sigma}^2$ is a biased estimate of σ^2 .

An unbiased estimator of σ^2 is given by

$$s^2 = \frac{1}{n-k} \sum_{i=1}^n \hat{\varepsilon}_i^2 = \text{MSE} \quad (4.3)$$

The linear model requires strict set of assumptions. The Gauss-Markov Theorem states that if we assume that

- i. There is no correlation between any explanatory and the residuals
- ii. The relationship between each explanatory variable and the response variable is linear in structure.
- iii. The residuals are independent with mean zero and constant variance.

Then the ordinary least squares estimates are unbiased and have the lowest variance amongst unbiased linear alternatives.

3.4 Data Analysis

Regression analysis was used to model non-performing loans in Kenya Commercial Banks. In this research a dynamic econometric model was employed to Regression analysis was used to model non-performing loans in Kenya. The dynamic econometric model was employed to assess the joint relationship between macroeconomic factors and bank specific factors to Non-performing loans ratio in Kenya.

3.5 Analytical Model

3.5.1 Variables of this study

The study variable in our study is NPL ratio of the outstanding principal balance of loans past due more than 90 days to the outstanding principal balance of all loans.

$$NPL = \frac{\text{Outstanding principal balance of loans past due more than 90 days}}{\text{Outstanding principal balance of all loans}} \quad (4.4)$$

To establish this relationship the study formulated the following regression equation. Model is used in this paper to model non-performing loans in Kenya and Ordinary Least Square (OLS) is employed to ensure the fulfillment of the assumptions thereof. These assumptions include, linearity of the model, its non-stochastic characteristic, having mean value of 0, and distribution with equal variance etc. In the model used, the study did not use the natural log of GDP, inflation and Real Interest Rate as their absolute value was small. Therefore, define the response and explanatory variables the model takes the form

$$NPL = \beta_0 + \beta_1 INFL + \beta_2 GDP + \beta_3 RIR + \beta_4 \ln CRED + \beta_5 \ln CA + \beta_6 \ln LIQ + \varepsilon \quad (4.5)$$

Where NPL represents non-performing loans ratio, INFL represents inflation, GDP represents gross domestic product, RIR represents real interest rate, CRED represents credit growth, CA represents capital adequacy, LIQ represents liquidity and ε is the error term.

The unknown parameters $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ and β_6 are the various coefficients for the respective explanatory variables.

Table 3.1: Definition of variable under study

Variables	Definition	Measurement
NPL	NPL (non performing loan) are loan past due more than 90 days.	NPL ; is measured ratio of outstanding principal balance of loans past due more than 90 days to outstanding principal balance of all loans.
INFL	INFLT (Inflation)is the general increase in price of commodities	Inflation ; will be measured using the inflation values obtained from Central bank and KNBS.
GDP	GDP (Gross Domestic Product) is the market price of all goods and services produced in a country.	GDP ; will be measured using the country GDP values obtained from Central bank and KNBS.
RIR	RIR (Real Interest Rate) is rate at which interest is paid by a debtor for the use of money that they borrow from a lender.	Real Interest Rate ; in this study real interest rate will be measured using its absolute value obtained from CBK
CRED	CRED (Credit Growth) this is the portfolio capacity of both loans and assets of an institution.	Credit Growth ; will be measured using the size of its loan book to total assets
CA	CA (Capital Adequacy) is the statutory minimum reserves of capital which a bank or other financial institution must have available.	Capital Adequacy ; capital adequacy is the ratio of total capital equity to total assets (capital/asset)
LIQ	LIQ (banks liquidity)is The degree to which an asset or security can be bought or sold in the market without affecting the asset's price	Liquidity ; To measure the overall liquidity risk the ratio of liquid assets to total assets (liquid/assets) is used

3.6 Data validation

Secondary data was collected for the period starting from 2000 to 2012 from Central Bank of Kenya and IMF database. The data that was collected in the study was quantitative in nature. According to Ngechu (2004) a study population is a well-defined or specified set of people, group of things, households, firms, services, elements or events which are being investigated. The study sampled a period of 13 years starting from year 2000 to year 2012.

3.6.1 Test for Heteroscedastic and homoscedastic

One of the assumptions in linear regression analysis is that the standard deviations of the error terms are constant and do not depend on the explanatory variables.

Homoscedasticity means that the variance of the error term is equal across all the observations while heteroscedasticity means that the error term is normally distributed with mean 0, but the variance is no longer constant across the observations.

Residuals can be tested for homoscedasticity using the Breusch-Pagan test which regresses square residuals to independent variables. The consequences of heteroscedasticity are that the OLS regression coefficients are no longer BLUE and are inconsistent; therefore the statistics should not be interpreted. In addition, the standard errors are biased when heteroscedasticity is present. This in turn leads to bias in test statistics and confidence intervals. Heteroscedasticity can be detected by plotting residuals against fitted values then do a visual inspection.

White Test for Diagnosing Heteroscedasticity

The hypothesis for testing heteroscedasticity was formulated as below;

Null hypothesis: homoscedasticity implying that the variance of error terms is equal across all the observations.

Alternative hypothesis: heteroscedasticity this is the case if they are jointly different from 0

This test is done by calculating unstandardised residuals and unstandardised predicted values. Then regress squared residuals on the unstandardised predicted values and check significance of F-value. Alternatively Breusch-pagan was also used to test for heteroscedasticity under the same hypothesis.

Depending on the nature of the heteroscedasticity significance tests can be too high or too low. Therefore OLS does not provide the estimates with the smallest variance. The reason OLS is not optimal when heteroscedasticity is present is that it gives equal weight to all observations when in fact, observations with larger disturbance variance contain less information than observation with smaller disturbance variance. In addition, the standard errors are biased when heteroscedasticity is present. In turn leads to bias in test statistics and confidence intervals.

Heteroscedasticity can be dealt with by transforming the variables or respecifying the model. This is because the effects of the variables may not be linear and some important variables may have been left out of the model. Heteroscedasticity can also be resolved by

use of robust standard errors. As mentioned above, heteroscedasticity causes standard errors to be biased, OLS assumes that errors are both independent and identically distributed; robust standard errors relax either or both of those assumptions. Hence, when heteroscedasticity is present, robust standard errors tend to be more trustworthy. Lastly heteroscedasticity can be dealt with by use of weighted least squares. In this case the observations expected to have error terms with large variances are given a smaller weight than observation thought to have error terms with small variances.

3.6.2 Durbin Watson Test

The Durbin-Watson statistic is a simple numerical method for checking serial dependence. The test is used to test residuals from a linear regression or multiple regression are independent. Most regression problems involving time series data exhibit positive autocorrelation, thus the hypotheses considered in Durbin-Watson test are

$$\begin{aligned} H_0: \rho &= 0 \\ H_1: \rho &> 0 \end{aligned}$$

The test statistic is

$$d = \frac{\sum_{i=2}^n (e_i - e_{i-1})^2}{\sum_{i=1}^n e_i^2} \quad (4.6)$$

Where $e_i = y_i - \hat{y}_i$ and y_i and \hat{y}_i are, respectively, the observed and predicted values of the response variable for individual i . d becomes smaller as the serial correlations increase. Upper and lower critical values, d_U and d_L have been tabulated for different values of k (the number of explanatory variables) and n . Reject null hypothesis if $d < d_L$, fail to reject the null hypothesis if $d > d_U$ and the test is inconclusive if $d_L < d < d_U$.

The fundamental assumption in linear regression is that the errors terms have mean zero and constant variance and uncorrelated. The assumption of uncorrelated or independent error for time series data is often not appropriate. Usually the errors in time series data exhibit serial correlation. Such errors are said to be autocorrelated.

3.6.3 Granger Causality Test

Definition: We say that X_t is Granger causal for Y_t with respect to t if the variance of the optimal linear predictor of Y_{t+h} has smaller variance than the optimal linear predictor of Y_{t+h} . In other words X_t is granger causal of Y_t if X_t helps predict Y_t at some stage in the future.

Granger causality test is used to determine if one time series is useful in forecasting another and can only be applied to pairs of variables. Granger defined causality relationship based on two principles, the cause happens prior to its effect and the cause has unique information about the future values of its effect.

The limitation of this test is that granger causality is not necessary true causality. Granger test is designed to handle pairs of variables, and may produce misleading results when the true relationship involves three or more variables.

The variables were tested for any causal relationship between the either bidirectional or unidirectional. The aim for this test was to determine whether any of the variables were significant in explaining changes in the other variables.

The null hypothesis for this test was as below;

- i. Inflation does not Granger Cause NPL
- ii. NPL does not Granger Cause inflation
- iii. GDP does not Granger Cause NPL
- iv. NPL does not Granger Cause GDP
- v. Interest does not Granger Cause NPL
- vi. NPL does not Granger Cause Interest
- vii. Credit growth does not Granger Cause NPL
- viii. NPL does not Granger Cause Credit growth
- ix. Capital Adequacy does not Granger Cause NPL
- x. NPL does not Granger Cause Capital Adequacy
- xi. Liquidity does not Granger Cause NPL
- xii. NPL does not Granger Cause Liquidity

Granger causality tests are useful in testing any causal relationship between the variables under study. This test helps in eliminating any irrelevant variables, adding relevant variables which could have been omitted and testing autocorrelation of the residuals. This test helps to correct three major consequences of regression analysis which include; estimates of regression coefficients being inefficient, forecasts based on regression equations being sub-optimal and finally the usual significance tests on the coefficients being invalid.

3.6.4 Unit Root Test

An augmented Dickey-Fuller test (ADF) is a test for a unit root in a times series sample. The augmented Dickey-Fuller (ADF) statistic, used in the test is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit roots at some level of confidence.

The ADF test is applied on a model of the form;

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t, \quad (4.7)$$

Where α is a constant, β the coefficient on the time trend and p the lag order of the autoregressive process. In order to obtain stationarity of the variables under ADF statistics, first differencing is done.

The null hypothesis of the Augmented Dickey-Fuller t-test is

$$H_0: \theta = 0 \text{ (i.e. the data needs to be differenced to make it stationary)}$$

Versus the alternative hypothesis of;

$$H_1: \theta < 0 \text{ (i.e. the data is stationary and doesn't need to be differenced)}$$

Unit root test is an important task in determining the most appropriate form of the trend in any data. Like in regression analysis the data must be transformed to stationarity form prior to analysis. That is, if the data is trending, then some form of trend removal is required. Two common trend removal procedures are first differencing and time-trend regression. First differencing is appropriate for $I(1)$ time series and time trend regression is appropriate for trend stationary $I(0)$ time series. Unit root tests can be used to determine if trending data should be first differenced or regressed on deterministic functions of time to render data stationary.

Spurious regression is as result of regressing variables which have unit roots. The results of spurious regression are misleading and incorrect. ADF test is necessary to test unit root in time series data. Trending can be removed by first differencing and time-trend regression.

Inconsistent regression is as a result of using biased estimator to estimate regression coefficients. Biased estimation leads to inconsistent results which cannot be relied on. Inconsistent regression can be resolved by test the data to confirm whether all OLS

assumptions are obeyed. That is; there is no correlation between any explanatory and the residuals, the relationship between each explanatory variable and the response variable is linear in structure and finally the residuals are independent with mean zero and constant variance. Then the ordinary least squares estimates are unbiased and have the lowest variance amongst unbiased linear alternatives.

3.6.5 Correlation Test

Correlation analysis is the statistical tool that can be used to determine the level of association of two variables (Levin & Rubin, 1998). This analysis can be seen as the initial step in statistical modeling to determine the relationship between the dependent and independent variables. A correlation matrix was developed to analyze the relationships between the independent variables as this would assist in developing a prediction multiple models.

Inferential statistics is used to draw conclusions and make predictions based on the analysis of numeric data. The study subjected the gathered data under each research variable to inferential statistics through the use of correlation analysis. Correlation analysis is used to determine how strongly the scores of two variables are associated or correlated with each other. Correlation is measured using values between +1.0 and -1.0. Correlations close to 0 indicate little or no relationship between two variables, while correlations close to +1.0 (or -1.0) indicate strong positive (or negative) relationships (Hayes et al. 2005). It denotes positive or negative association between variables in a study. Two variables are positively associated when larger values of one tend to be accompanied by larger values of the other. The variables are negatively associated when larger values of one tend to be accompanied by smaller values of the other (Moore, 2008).

CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter presents the data analysis, presentation and interpretation of the study, the study analyzed the relationship between non-performing loans, Gross domestic product, and real interest rate, Credit growth in terms of loans size, inflation rate, capital adequacy and liquidity of the banks. The study was conducted for a period of 13 years from 2000 to 2012 where data was obtained from Central Bank of Kenya and Kenya National Bureau of Statistics.

Table 4.1 shows the descriptive statistics for each variable in the study. A good indicator of data having a normal distribution is skewness ranging from -0.8 to 0.8 and kurtosis of range -3.0 to 3.0. From the above table clearly shows that data was within the required criteria for both skewness and kurtosis.

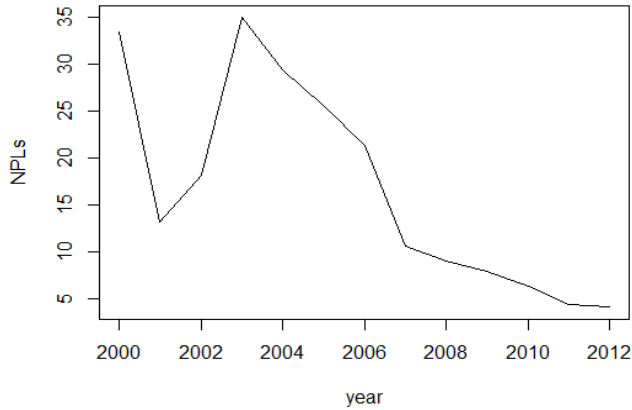
Table 4.1: Descriptive Statistics

Descriptive Statistics										
	N	Minimum	Maximum	Mean		Std. Devia	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Erro	Statistic	Statistic	Std. E	Statistic	Std. E
NPLs	13	4.10	34.90	16.7615	3.07278	11.0790	.488	.616	-1.303	1.191
Inflation	13	3.96	15.00	10.0285	.96593	3.48270	-.423	.616	-.655	1.191
GDP	13	12.70	40.60	23.5154	2.62390	9.46061	.304	.616	-1.289	1.191
interest	13	13.34	22.34	17.1638	.80170	2.89058	.294	.616	-1.289	1.191
credit_growth	13	6.25	9.15	7.7608	.18708	.67453	-.278	.616	2.195	1.191
Capital_adequacy	13	.61	.87	.7509	.01891	.06817	-.157	.616	.349	1.191
Liquidity	13	.35	.75	.5400	.03523	.12702	.325	.616	-.865	1.191
Valid N (listwise)	13									

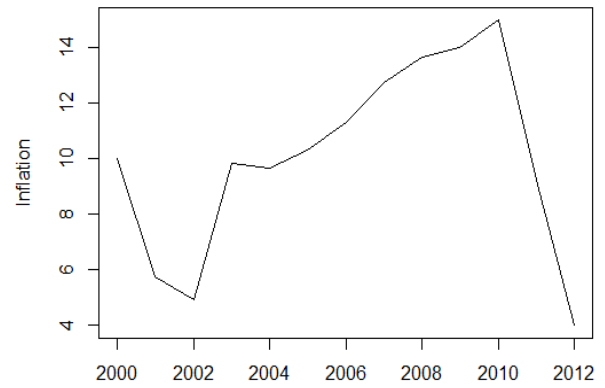
Graphs 4.1 are graphical representations of all the explanatory variables and the response variable against change in time.

Graph 4.1: Plots of the study variables against time in years

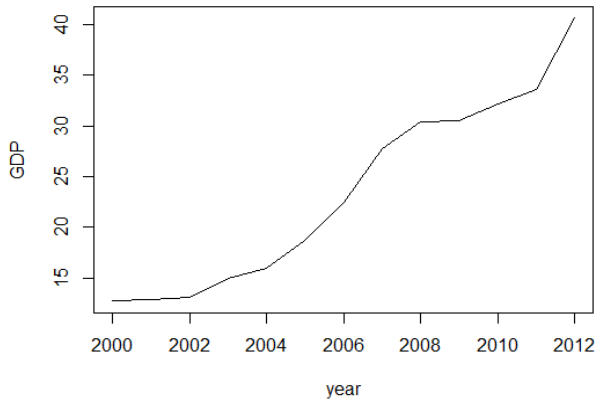
Plot of NPLs against Time in Years.



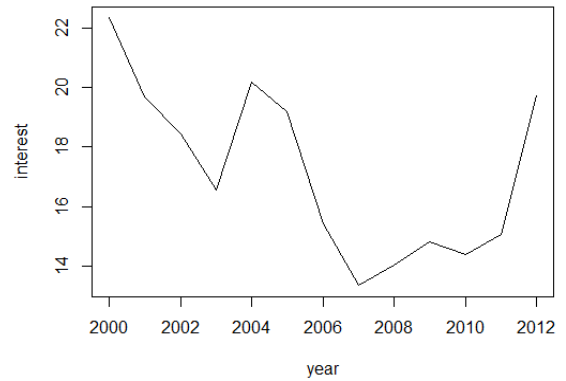
Plot of Inflation against Time in years



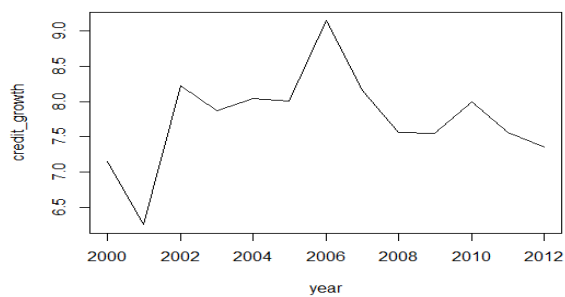
Plot of GDP against Time in years



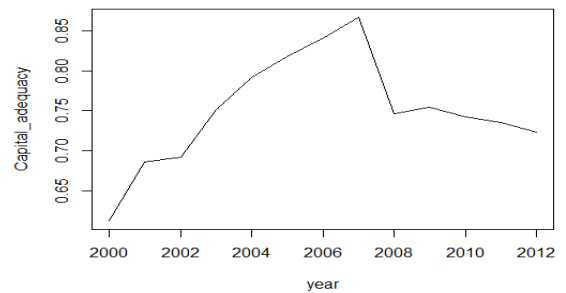
Plot of Interest against Time in years



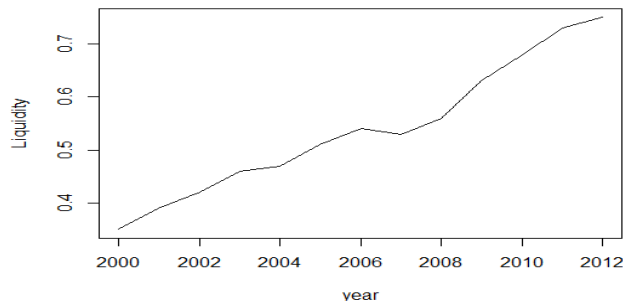
Plot of Credit growth against Time in years



Plot of Capital Adequacy against Time in years



Plot of Liquidity against Time in years



Unit root test of the variables was tested by obtaining ADF statistics at lag difference of 1 at different levels that is with intercept and trend and without either. The results as shown on table 4.2 indicate that all the variables are stationary and don't need to be differenced, hence the null hypothesis is rejected. This implies that regression analysis will provide consistent results of the estimates.

Table 4.2: ADF Statistics

VARIABLE		ADF Statistic	p-value
NPLs	intercept & time trend	-4.243	0.01478
	none	-0.714	0.03813
Inflation	intercept & time trend	-0.2674	0.0985
	none	-0.609	0.4146
GDP	intercept & time trend	-2.5169	0.03755
	none	-1.851	0.09799
interest	intercept & time trend	-1.1159	0.09035
	none	-0.0667	0.05868
credit growth	intercept & time trend	-2.8637	0.02434
	none	-0.3267	0.0712
capital adequacy	intercept & time trend	-1.1907	0.08807
	none	-0.0861	0.6353
Liquidity	intercept & time trend	-1.9529	0.5903
	none	2.1188	0.9887

Heteroscedasticity was tested by white test and Breusch-Pagan test and the results below indicated that there was no statistical significance to reject the null hypothesis hence equal variances of the error term in all the observations. This means the OLS estimates are unbiased.

F cal=0.351 and F tab=4.28.

Durbin Watson statistic was done on the data and the results were as below, which indicated that we fail to reject the Null hypothesis at $\alpha=0.05$ implying that there is no autocorrelation between the error terms.

$$d = 2.3986 > d_L = 0.56. \text{ and } d = 2.3986 > d_u = 2.21.$$

Causal relationship between the independent variable and the explanatory variables was done by granger causality test. The results on table 4.3 indicated there was causality between the NPLs and the explanatory variables. This implies that all this variables have significant effects on NPLs, hence changes in one of them will influence the NPLs. This means that at some significance level changes in Inflation, GDP, Interest, Credit growth, Capital adequacy and Liquidity causes Nonperforming loans to react either by increasing or decreasing depending on the direction of the impact. Therefore all the variables are relevant in this study.

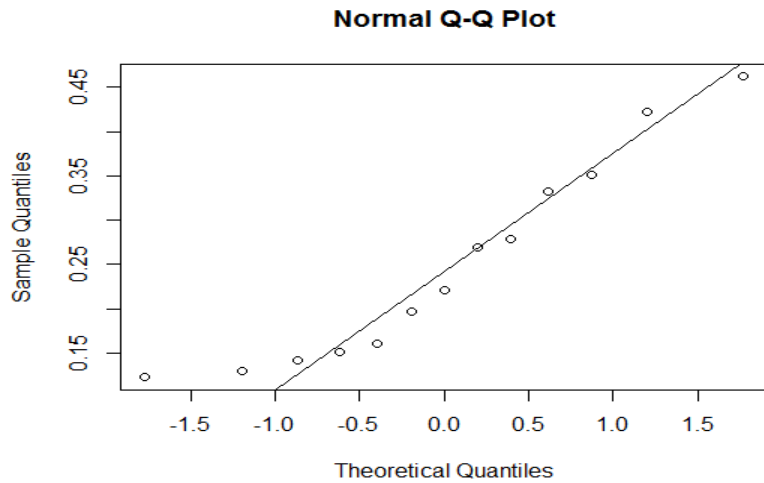
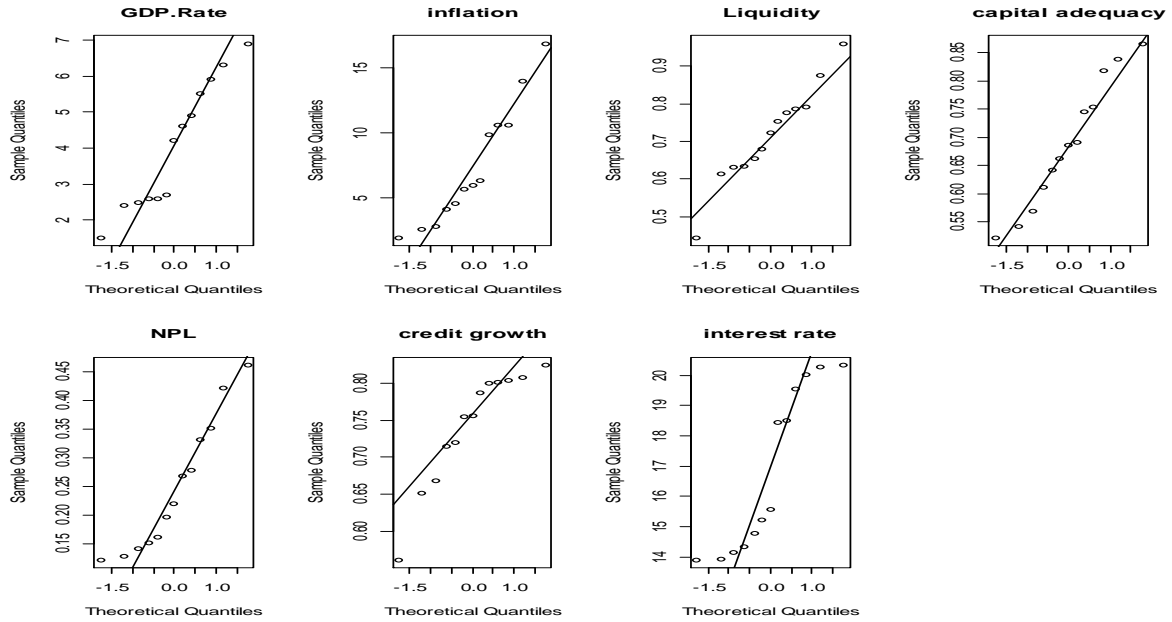
Table 4.3: Granger Causality

Null Hypothesis	F-statistic	prob.
Inflation does not Granger Cause NPL	0.1126	0.7449
NPL does not Granger Cause inflation	8.3898	0.0177
GDP does not Granger Cause NPL	0.296	0.5996
NPL does not Granger Cause GDP	6.6106	0.03013
Interest does not Granger Cause NPL	0.0767	0.788
NPL does not Granger Cause Interest	0.3372	0.5757
Credit growth does not Granger Cause NPL	0.0004	0.9849
NPL does not Granger Cause Credit growth	0.0007	0.9789
Capital Adequacy does not Granger Cause NPL	7.4125	0.02351
NPL does not Granger Cause Capital Adequacy	0.0452	0.8364
Liquidity does not Granger Cause NPL	1.9216	0.1991
NPL does not Granger Cause Liquidity	1.6387	0.2325

4.2.1 Test for Normality

Graphs 4.2 show the qqplots for all the variables under study to test for normality.

Graph 4.2: qqplots for all the variables under study



4.2.2 Test for Correlation

As presented in table 4.4, the study revealed that independent variables had a significant strong correlation with non-performing loans among commercial banks in Kenya (p-values < 0.01). Non-performing loans among commercial banks in Kenya had a strong positive correlation with inflation ($r = 0.955$). This correlation was found to be statistically significant at 0.01 significance level (p-value = 0.000). Gross Domestic Product was found

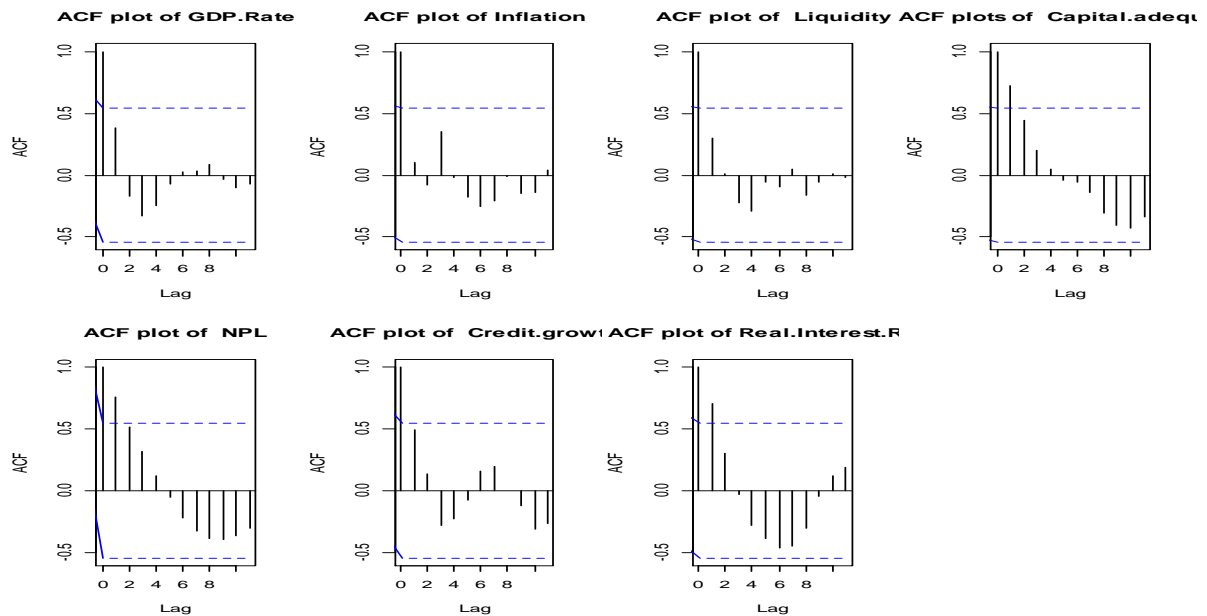
to have a strong negative correlation with non-performing loans among commercial banks in Kenya ($r = 0.911$). This correlation was found to be statistically significant at 0.01 significance level ($p\text{-value} = 0.000$). Real Interest Rate was found to have a strong positive correlation with non-performing loans among commercial banks in Kenya ($r = 0.828$). Credit growth was also found to have a strong positive correlation with non-performing loans among commercial banks in Kenya ($r = 0.788$). Capital Adequacy was also found to have a strong negative correlation with non-performing loans among commercial banks in Kenya ($r = 0.748$). This correlation was found to be statistically significant at 0.01 significance level ($p\text{-value} = 0.000$). Liquidity was also found to have a strong negative correlation with non-performing loans among commercial banks in Kenya ($r = 0.628$). This correlation was found to be statistically significant at 0.01 significance level ($p\text{-value} = 0.000$).

Table 4.4: Correlations Analysis of the Study Variables

	<i>NPL</i>	<i>INFL</i>	<i>GDP</i>	<i>RIR</i>	<i>CRED</i>	<i>CA</i>	<i>LIQ</i>
NPL	1	.955**	-.911**	.828**	.788**	-.748**	.628**
INFL	.955**	1	.871**	.791**	.753**	.715**	.711**
GDP	-.911**	.871**	1	.909**	.864**	.821**	.209**
RIR	.828**	.791**	.909**	1	.951**	.904**	-0.499
CRED	.788**	.753**	.864**	.951**	1	.950**	.451**
CA	-.748**	.715**	.821**	.904**	.950**	1	.604**
LIQ	.628**	.711**	.209**	-0.499	.451**	.604**	1
**. Correlation is significant at the 0.01 level (2-tailed).							

ACF plots were plotted as shown on Graphs 4.3 to test autocorrelation of the variables.

Graph 4.3: ACF plots for all the variables under study



4.3 Regression Analysis

In this study, a multiple regression analysis was conducted to test the influence among predictor variables. The research used statistical package for social sciences (SPSS V 16) and R version 2.15.1 to code, enter and compute the measurements of the multiple regressions. The study conducted multiple regression analysis in order to model non-performing loans in Kenya commercial banks.

Adjusted R squared is coefficient of determination which tells us the variation in the dependent variable due to changes in the independent variable. From the findings in the Table 4.5, the value of adjusted R squared was 0.921, an indication that there was variation of 92.1% on the non-performing loans among commercial banks in Kenya due to changes in inflation, gross domestic product, real interest rate, credit growth, capital adequacy and liquidity at 95% confidence interval. This shows that 92.1% changes in on non-performing loans among commercial banks in Kenya could be accounted for by changes in inflation, gross domestic product, real interest rate, credit growth, capital adequacy and liquidity. R is the correlation coefficient which shows the relationship between the study variables. The findings show that there was a strong positive relationship between the study variables as shown by 0.969

Table 4.5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.969 ^a	.939	.921	.01575

From the ANOVA statistics in the Table 4.6, the processed data, which is the population parameters, had a significance level of 0.015 which shows that the data is ideal for making a conclusion on the population's parameter as the value of significance (p-value) is less than 5%. The F-calculated was greater than the critical value ($4.28 < 7.714$) an indication that inflation, gross domestic product, real interest rate, credit growth, capital adequacy and liquidity were significantly influencing non-performing loans among commercial banks in Kenya. The significance value was less than 0.05 an indication that the model was statistically significant.

Table 4.6: ANOVA Table

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.487	6	0.081	7.714	.015 ^b
	Residual	0.063	6	0.0105		
	Total	0.550	12			

From Table 4.7 the established regression equation was

$$NPL = 0.455 + 0.016 INFL - 0.182 GDP + 0.053 RIR + 0.204CRED - 0.162 CA + 0.142LIQ \quad (4.8)$$

From the above regression equation it was revealed that inflation, gross domestic product, real interest rate, credit growth, capital adequacy and liquidity, to a constant zero, non-performing loans among commercial banks in Kenya would stand at 0.455, a unit increase in inflation in the country would lead to increase in non-performing loans among commercial banks in Kenya by a factor of 0.016, unit increase in gross domestic product would lead to decrease in non-performing loans among commercial banks in Kenya by a factor of 0.182, a unit increase in real interest rate would lead to increase in non-performing loans among commercial banks in Kenya by a factor of 0.053 and further unit increase in liquidity would lead to increase non-performing loans among commercial banks

in Kenya by a factor of 0.204, a unit increase in capital adequacy would lead to decrease in non-performing loans among commercial banks in Kenya by a factor of 0.162, a unit increase in liquidity would lead to increase non-performing loans among commercial banks in Kenya by a factor of 0.142.

At 5% level of significance and 95% level of confidence, gross domestic product had a 0.036 level of significance; liquidity showed a 0.034 level of significance, banks size had a 0.028 level of significance, Real Interest rate showed 0.025, capital adequacy had a 0.011 level of significance while inflation showed 0.011, level of significance hence the most significant factor is inflation. Overall inflation had the greatest effect on non-performing loans among commercial banks in Kenya, followed by capital adequacy, real interest rate, credit growth, then liquidity and gross domestic product had the least effect on non-performing loans among commercial banks in Kenya. All the variables were significant ($p < 0.05$).

Table 4.7: Coefficients Table

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.Error	Beta		
(Constant)	.455	.231		1.973	.106
Inflation	.016	.009	.444	-1.815	.009
GDP	-.182	.050	-1.231	-3.616	.036
Real Interest Rate	.053	.017	1.075	3.159	.025
Credit Growth	.204	.240	.230	.850	.028
Capital Adequacy	-.162	.063	-.223	-2.583	.011
Liquidity	.142	.082	.132	1.739	.034

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

From the analysis and data collected, the following discussions, conclusion and recommendations were made. The responses were based on the objectives of the study. The researcher had intended to determine the relationship between macro-economic factors and non-performing loans in Kenya and to establish the relationship between bank specific factors and non-performing loans in Kenya .

5.2 Summary of Finding

From the finding on the adjusted R squared, the study found that was variation of 92.1% on the non-performing loans among commercial banks in Kenya due to changes in inflation, gross domestic product, real interest rate, credit growth, capital adequacy and liquidity. This is an indication that 92.1% changes in on non-performing loans among commercial banks in Kenya could be accounted for by changes in inflation, gross domestic product, real interest rate, credit growth, capital adequacy and liquidity. The study also revealed that there was strongly positive relationship between non-performing loans among commercial banks in Kenya and inflation, gross domestic product, real interest rate, credit growth, capital adequacy and liquidity

From the ANOVA statistics, the study revealed that inflation, gross domestic product, real interest rate, Credit growth, capital adequacy and liquidity were significantly influencing non-performing loans among commercial banks in Kenya.

From the finding the study found that holding inflation , gross domestic product , real interest rate , credit growth, capital adequacy and liquidity , to a constant zero , non-performing loans among commercial banks in Kenya would stand at 0.455 , a unit increase in inflation in the country would lead to increase in non-performing loans among commercial banks in Kenya by a factor of 0.016, unit increase in gross domestic product would lead to decrease in non-performing loans among commercial banks in Kenya by a factor of 0.182 , a unit increase in real interest rate would lead to increase in non-performing loans among commercial banks in Kenya by a factor of 0.053 and further unit increase in liquidity would lead to increase non-performing loans among commercial banks

in Kenya by a factor of 0.204, a unit increase in capital adequacy would lead to decrease in non-performing loans among commercial banks in Kenya by a factor of 0.162, a unit increase in liquidity would lead to increase non-performing loans among commercial banks in Kenya by a factor of 0.142. The study revealed that inflation had the greatest effect on non-performing loans among commercial banks in Kenya, followed by capital adequacy, real interest rate, credit growth, then liquidity and gross domestic product had the least effect on non-performing loans among commercial banks in Kenya. The study revealed that independent variables had a significant strong correlation with non-performing loans among commercial banks in Kenya. Non-performing loans among commercial banks in Kenya had a strong positive correlation with inflation, Real Interest Rate, credit growth and Liquidity of the bank. The study revealed that there was a strong negative relationship between Gross Domestic Product, capital adequacy and non-performing loans among commercial banks in Kenya.

5.3 Conclusions

From the regression and correlation analysis the study found that there was a positive relationship between inflation rate, Real Interest rate, banks size, liquidity to the bank non-performing loan among Commercial Banks in Kenya. The relationship between Gross domestic product, capital adequacy and non-performing loans was found to be negative. The study also found that 92.1% changes in Non-performing Loans among commercial Banks in could be explained by changes in changes in inflation rate, GDP, Real Interest Rate, size of the banks, capital adequacy and liquidity of the bank. Thus the study concludes that inflation rate, GDP, Real Interest Rate, size of the banks, capital adequacy and liquidity of the bank can be used to forecast for Non-performing Loans among commercial Banks in Kenya. The study established a model to forecast and model the relationship between inflation rate, GDP, Real Interest Rate, credit growth, capital adequacy and liquidity of the bank and Non-performing Loans among commercial Banks in Kenya. The established model is equation 4.8.

5.4 Recommendations

From the finding the study recommend that there is need for the policy makers and bank regulators to enhance economic growth in the country as it was found that increase in

Gross domestic Product will lead to decrease in Non-performing loans among commercial banks in Kenya .

There is need for policy makers to come up with strategies aimed at reducing the inflation rate in the country as it was found that an increase in inflation rate will, lead to increase in non-performing among commercial banks in Kenya .

The study recommends that bank supervisory boards should maintain the Rear Interest Rate and favorable rate as it was found that an increase in Rear Interest rate leads to Increase in Non-performing Loans among Commercial Banks in Kenya.

The study recommends that the bank supervisory boards should ensure the implementation of the Banking industry reforms that will help in enhance capital adequacy among of commercial bank in Kenya to ensure reduction in non-performing loans.

The study further recommends that there is need for bank supervisory boards to ensure that Commercial banks in Kenya operate within the safe level of Liquidity so as to control the level of non-performing loans in the banking industry.

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