

**INTEREST RATES VOLATILITY ON NONPERFORMING LOANS  
PORTFOLIO OF LISTED COMMERCIAL BANKS IN KENYA**

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**DECLARATION**

This research project is my original work and has not been presented for any award of any degree in any other University.

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## **DEDICATION**

This research proposal is dedicated to my family especially my wife Domtila Gati for her consistent support that she accorded me during the entire period of carrying out this study as well as my two children Sean E. Ekweny and Milan N. Ekweny.

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## **ABSTRACT**

Interest rate is the price a borrower pays for the use of money they borrow from a lender/financial institutions or fee paid on borrowed assets. The core function of any financial institution is to facilitate mobilization of savings, diversification and pooling of risks and allocation of resources. Nonperforming loan is a loan whose principal or interest remains unpaid 90 days or more after due date. This is the money lent to an individual that does not earn income and full payment of principal and interest is no longer anticipated. The objective of this study was to establish the relationship between the volatility in interest rates, 91-Day Treasury Bill Rate and nonperforming loans. The study used several theories to explain variations in interest rates. Some of these theories include: loanable funds theory; loan pricing theory and credit market theory. The study adopted a longitudinal case research design. The population of this study was the eleven listed commercial banks in Kenya. The study used secondary data which was collected between 2002 and 2013 from the central bank of Kenya. The study established that 91-Day Treasury Bill Rate and interest rate volatility positively influenced nonperforming loans of commercial banks listed at the NSE at varying degrees at one point in time. The study also established that 91-Day Treasury Bill Rate and interest rate volatility had a negative effect on the nonperforming loans portfolio at some point. The study concludes that on average, the two independent variables influenced the nonperforming loans portfolio to a variation of 91.5%. The study recommended that the Country handles its macroeconomic variables appropriately as the changes in the macroeconomics like exchange rates and inflation bring about devaluation of the currency and affect the performance of the commercial banks. The study also recommends that policies should be put in place to stabilize the performance of commercial banks in Kenya.



# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Study

Interest rate is the price a borrower pays for the use of money they borrow from a lender/financial institutions or fee paid on borrowed assets (Crowley, 2007). In economics, interest is the price paid for inducing those with money to save it rather than spend it, and to invest in long-term assets rather than hold cash (Chodechai, 2004). Interest rates are fundamental to a ‘capitalist society’ and are normally expressed as a percentage rate over the period of one year Interest rate as a price of money reflects market information regarding expected change in the purchasing power of money or future inflation (Ngugi, 2001). Interest rates volatility is anticipated in the real world and these expectations are part of the process that determines interest rates (Gardner and Cooperman, 2005). Interest rate volatility is the sudden rise and fall of interest rate over a given period of time. The estimation of the volatility of interest rates is important as it allows gauging uncertainty surrounding market’s expectations, including the risk of default which causes rise in nonperforming loans of commercial banks. The core function of any financial institutions facilitates mobilization of savings, diversification and pooling of risks and allocation of resources. However, since the receipts for deposits and loans are not synchronized, intermediaries like commercial banks incur certain costs; Key among some of these costs is the nonperforming (Ngugi, 2001).

Nonperforming loan is a loan whose principal or interest remains unpaid 90 days or more after due date (Banks and Financial Institutions Act, 2006). This is the money lent to an individual that does not earn income and full payment of principal and interest is no

longer anticipated. There is evidence that the financial/banking crises in East Asia and Sub-Saharan African countries were preceded by high nonperforming assets. For instance, in Indonesia where over 60 banks collapsed during the financial crisis, nonperforming assets represented about 75% of total asset portfolios (Caprio and Klingebiel, 2002). The banking crisis which affected a large number of Sub-Saharan African countries in the 1990s was also accompanied by a rapid accumulation of nonperforming assets (Caprio and Klingebiel, 2002). NPL is therefore the focal point of any financial Institution as their success or failure largely depends on the levels of NPL in their books. In spite of this apparent association between banking crises and nonperforming assets, the literature on the causes on nonperforming Loans has focused on the macroeconomic determinants and less on the influence of interest rate spread (Fofack, 2005). Many theories have been advanced by several scholars to underpin volatility of interest rates. Some of these theories include: loanable funds theory; loan pricing theory and credit market theory.

The loanable funds theory of interest postulates that both savings and investments are responsible for determination of interest rates in the long run while short term interest rates are based on the financial conditions prevailing in the economy (Wicksell, 19th century). On the other hand, the loan pricing theory states that if banks set interest rates too high, they may induce adverse selection problems because high-risk borrowers are willing to accept these high rates. While the credit market theory advocates that if collateral and other restrictions (covenants) remain constant, the interest rate is the only price mechanism. Although earnings of commercial banks are majorly anchored on the

mentioned theories, there may be other factors that determine the success or failure of these banks.

Performance of listed commercial banks in Kenya is determined by specific factors except for liquidity variable. The monetary policy report indicates that in Kenya the top six banks are squeezing borrowers while using their dominance in the skewed market to pay less for deposits (CBK, 2014). CBK has put concerted efforts to have the commercial banks lower their lending rates, but little seems to have been achieved. According to a World Bank report (1994) in Uganda, the country's banking industry was described as extremely weak, owing to lack of proper regulations with huge non-performing assets and some banks teetering on the verge of collapse. Mukalazi (1999) notes that reeling from years of economic mismanagement and political interference, Uganda's banking industry posted huge losses in the early 1990s. High risk concentration in Kenya and lack of internal policy barriers is thought to have led to a culmination of high nonperforming loans portfolio in the commercial banks (Sinkey and Greenwalt, 1991).

### **1.1.1 Interest Rates Volatility**

Interest is the price paid for inducing those with money to save it rather than spend it (O'Hara, 2005). In other words, it denotes the time value of money, meaning the rate at which an amount of money accrues over time. Chodechai (2004) defines interest as the price paid for inducing those with money to save it rather than spend it, and to invest in long-term assets rather than hold cash. Interest rates reflect the interaction between the supply of savings and the demand for capital; or between the demand for and the supply of money (Elmendorf, 1996). Rates of interest can be expressed as a percentage payable

(a coupon), usually per annum; or as the present discounted value of a sum payable at some future date (the date of maturity).

Commercial banks charge a price for the intermediation services offered under uncertainty, and set the interest rate levels for deposits and loans. The difference between the gross costs of borrowing and the net return on lending defines the intermediary costs i.e information costs, transaction costs (administration and default costs and operational costs (Rhyne, 2002).The base interest rate is arrived at based on the weighted average cost of funds, risk premium, costs such as administrative expenses and a profit margin also known as the spread. Changes of these intermediary costs cause interest rates volatility in the money market. Interest rate volatility therefore is caused by the rise and fall of interest rate over a given period of time. The measure of historical volatilities across a time window demands a large time window while estimation of instantaneous volatility needs a small time window

### **1.1.2 Non-Performing Loans portfolio**

Non-performing loan (NPL) is defined as loans whose principal or interest remains unpaid 90 days or more after due date (BFIA, 2006). Salas and Saurina (2002) argue that rapid credit expansion, bank size, capital ratio and market power explain variation in NPLs. The quantity or percentage of non-performing loans is often associated with bank failures and financial crises in both developing and developed countries (Caprio and Klingebiel, 2002).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. Waweru and Kalani, (2009) argue that when the level of NPL is very high,

the provisions are not adequate protection. The 1990s financial institutions witnessed declining profitability, high non-performing assets and distress borrowing which hugely affected the commercial banks profitability (Ngugi, 2001).

### **1.1.3 Effect of interest rate volatility on nonperforming loan**

Kithinji and Waweru (2007), noted that banking problems is back-dated as early as 1986 culminating in major bank failures (37 banks failed as at 1998) following the crises of 1986 to 1989, 1993/1994 and 1998; they attributed these crises to NPLs which is brought about by the interest rates volatility. However, despite the implications of nonperforming assets for banking crisis, for investment and economic growth, and for anticipating future banking and financial crises, very few studies have been done on the effect of interest rate volatility on the level of NPLs in Sub-Saharan Africa (Caprio and Klingebiel, 2002).

### **1.1.4 The banking industry in Kenya**

According to the Central Bank of Kenya, there are 43 licensed commercial banks in Kenya as at July, 2014. Three of the banks are public financial institutions with majority shareholding being the Government and state corporations. The rest are private financial institutions. Of the private banks, 27 are local commercial banks while 13 are foreign commercial banks. The Companies Act, the Banking Act, the Central Bank of Kenya Act and various prudential guidelines issued by Central Bank of Kenya (CBK), govern the banking industry in Kenya. The Banking sector in Kenya was liberalized in 1995 and exchange controls lifted. The CBK, through its Monetary Policy Committee is responsible for formulating and implementing monetary policy and fostering the

liquidity, solvency and proper functioning of the financial system. Commercial banks in Kenya contribute to economic growth of the country by making funds available for investors to borrow as well as financial deepening in the country. However, the industry has witnessed a number of challenges that have affected it in Kenya.

According to Ngugi (2001), the 1990s financial institutions witnessed declining profitability, nonperforming assets and distress borrowing which hugely affected the commercial banks profitability in Kenya. Daumont et al. (2004) noted that the accumulation of nonperforming assets to be attributable to economic downturn and macroeconomic volatility, terms of trade deterioration, high interest rates, excessive reliance on overly high-priced interbank borrowings, insider lending and moral hazard. The banks have come together under the Kenya Bankers Association (KBA), which serves as a lobby for the banks' interests and addresses issues affecting its members (CBK, 2008).

### **1.1.5 Listed Commercial Banks in Kenya**

Listed commercial banks in Kenya are those banks that have been listed on the Nairobi Securities Exchange (NSE). They are regulated and closely monitored by the Capital Markets Authority to ensure that the interests of shareholders are protected. For this reason, listed commercial banks are under obligation to perform well and ensure that shareholders earn good return on their investments. Performance of these banks is determined by specific factors except for liquidity variable (Ongore and Kusa, 2013). Key among the factors is the interest rates volatility and nonperforming loans portfolio. There is evidence in Kenya that the top six banks are squeezing borrowers while using

their dominance in the skewed market to pay less for deposit and charge high for lending (CBK, 2014). Although CBK has put concerted efforts to have the commercial banks lower their lending rates, little seems to have been achieved (Ondieki and Jagongo, 2013). High risk concentration in Kenya and lack of internal policy barriers is thought to have led to a culmination of high nonperforming loans portfolio in the commercial banks in Kenya (Sinkey and Greenwalt 1991).

## **1.2 Research Problem**

Interest rates volatility has remained a macroeconomic problem that has been difficult to eliminate in many developing countries as a result of high information asymmetry (Doran, 2004). In Kenya, there are indications that the six top banks are squeezing borrowers while using their dominance in the skewed market to pay less for deposits (CBK, 2014). The 10th report of CBK's Monetary Policy Committee shows that the influential financiers enjoy an average interest spread of 15.3 per cent compared to 11 per cent for the small banks (CBK, 2013). This kind of spread is largely attributed to among other factors, interest rates volatility (Chand, 2002 and Asian Development Bank, 2001). The concerns raised on interest rates volatility and nonperforming loans portfolio make this topic an important area of study.

While quite a number of studies have investigated interest rate volatility and NPLs, most of these studies have been done in developed countries with few being done in developing countries. In Kenya, Ondieki and Jagongo (2013) examined the effects of lowering Central Bank Rate on bank's prime rate by conducting an analysis of Kenyan

commercial banks. They established that despite efforts by the CBK on the commercial banks to lower their lending rates, little gain was made since the superior chunk of determination was dependent on high-level non-performance loans, stiff industry competition, internal policy barriers and lending channels. Macharia (2013) examined the effects of global financial crisis on the financial performance of commercial banks offering mortgage finance in Kenya. He found out that capital flow as a result of financial crisis was influencing performance of commercial banks offering mortgage financing. Nakayiza (2013) examined interest rates and loan portfolio performance in commercial banks Uganda by using a case study of Centenary Bank Entebbe Road Branch. The study established that although centenary bank tried to follow procedures and regulations in administering credit, there is still an element of clients' defaulting on loan repayment and increasing the effect of bad debts in the bank. It further established that there is lack of effective analysis on the impact of increasing interest rates on loan repayment trends. Okoye and Onyekachi (2013) examined effect of bank lending rate on the performance of Nigerian deposit money banks between 2000 and 2010. They established that lending rate and monetary policy rate are true parameters of measuring bank performance.

Previous studies have shown that there is a pervasive view amongst some stakeholders that high NPLs are caused by rate spread as a result of the internal characteristics of the banks themselves, such as their tendency to maximize profits in an oligopolistic market, while many others argue that the NPLs is a result of lack of effective analysis on the impact of increasing interest rates on loan repayment trends (Nakayiza, 213). Ngugi (2001) attributed the high non-performing assets to poor business environment and distress borrowing, owing to the lack of alternative sourcing for credit when banks



increased the lending rate, and the weak legal system in enforcement of financial contracts. On the other hand Chand (2002) and Asian Development Bank (2001) state that interest rate volatility is cause of interest rates spread which in turn determines the level of NPLs of commercial banks. These debates can only be resolved through objective, analysis of the interest rates volatility on nonperforming loans portfolio of commercial banks in Kenya. This study therefore sought to fill this gap by establishing the links between interest rate volatility and the level of NPLs portfolio. What is the relationship of interest rate volatility and nonperforming loans portfolio of listed commercial banks in Kenya?

### **1.3 Research Objective**

To establish the relationship between the volatility in interest rates and nonperforming loans.

### **1.4 Value of the Study**

To scholars and academicians, this study would increase body of knowledge to the scholars of interest rate changes and performance of financial institutions. It would also suggest areas for further research so that future scholars can pick up these areas and study further. Commercial Banks and other non-bank financial institutions would also gain from this study as it would help banks determine the likely impact of interest rates changes on their financial performance.

The study would also be important to the government especially the Ministry of Finance for making policy decisions whose overall objectives is to influence the level of interest rates and the level of inflation in Kenya. It also would also help to facilitate better

monetary policy formulation by the CBK. Finally, the general public; this study would inform them of the influence of interest rate changes on loan interest charged by commercial banks and level of nonperforming loans portfolio of commercial banks.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter reviewed the literature on the impact of financial inclusion on financial performance of commercial banks. From this review, broad categories were derived which helped to identify the critical impact of financial inclusion on financial performance of commercial banks. Specifically, the chapter addressed the theoretical review guiding the study, bank performance indicators, empirical literature and conclusion.

#### **2.2 Theoretical Review**

The theoretical review section tries to determine if the existing theories suggest any relationship between interest rates and nonperforming loans. The section's main purpose is to establish a solid foundation for the empirical study, clarifying the underlying problems of the analysis. There are several theories that have been advanced by several scholars to explain variations in interest rates. Some of these theories include: loanable funds theory; loan pricing theory and credit market theory.

##### **2.3.1 Loanable Funds Theory**

The theory, developed by Swedish economist Knut Wicksell in the 19<sup>th</sup> Century, postulates that interest rates are determined by the supply and demand of loanable funds in the capital markets. According to the theory, investments and savings determine the long-term interest rates and the financial and monetary conditions in the economy determine the short-term rates. The rate of interest is calculated on the basis of demand

and supply of loanable funds present in the capital market. The loanable funds theory of interest advocates that both savings and investments are responsible for the determination of the rates of interest in the long run while short-term interest rates are calculated on the basis of the financial conditions prevailing in an economy.

The determination of the interest rates in case of the loanable funds theory of the rate of interest depends on the availability of loan amounts. The availability of such loan amounts is based on factors like the net increase in currency deposits, the amount of savings made, willingness to enhance cash balances and opportunities for the formation of fresh capitals (Bibow, 2000). This theory is relevant to the study because it tries to explain how changes in interest is influenced which in turn is believed to influence the changes in nonperforming loans portfolio.

### **2.3.2 Loan Pricing Theory**

In loan pricing theory, banks cannot always set high interest rates, trying to earn maximum interest income (Stieglitz and Weiss, 1981). If banks set interest rates too high, they may induce adverse selection problems because high-risk borrowers are willing to accept these high rates. Once these borrowers receive the loans, they may develop moral hazard behavior or so called borrower moral hazard since they are likely to take on highly risky projects or investments (Chodechai, 2004). To mitigate this risk therefore banks will be forced to moderate their rates of interest.

### **2.3.3 Credit market theory**

For the credit market theory, a model of the neoclassical credit market postulates that the terms of credits clear the market. If collateral and other restrictions (covenants) remain constant, the interest rate is the only price mechanism. With an increasing demand for credit and a given customer supply, the interest rate rises, and vice versa. It is thus believed that the higher the failure risks of the borrower, the higher the interest premium (Elmendorf, 1996). The size of the domestic credit market is strongly positively correlated with per capita income across countries (Zingales, 1998). However; the causality could be the other way round: richer countries have larger markets for everything including credit.

### **2.4 Empirical Review**

Scholars have reviewed the effects of interest rate changes on performance of financial institutions. Keeton and Morris (1999) undertook a study on why banks' loan losses differ. They examined the losses by 2,470 insured commercial banks in the United States (US) over the 1979-85. Using NPAs net charge-offs as the primary measure of loan losses, Keeton and Morris (1999) shows that local economic conditions along with the poor performance of certain sectors explain the variation in loan losses recorded by the banks. The study also reports that commercial banks with greater risk appetite tend to record higher losses.

Ngugi (2001) analyzed the interest rates spread in Kenya from 1970 to 1999 and found that interest rate spread increased because of yet-to-be gained efficiency and high intermediation costs. Increase in spread in the post-liberalization period was attributed to

the failure to meet the prerequisites for successful financial reforms, the lag in adopting indirect monetary policy tools and reforming the legal system and banks' efforts to maintain threatened profit margins from increasing credit risk as the proportion of non-performing Loans. She attributed the high non-performing loans to poor business environment and distress borrowing, owing to the lack of alternative sourcing for credit when banks increased the lending rate, and the weak legal system in enforcement of financial contracts. According to her findings, fiscal policy actions saw an increase in Treasury bill rates and high inflationary pressure that called for tightening of monetary policy. As a result, banks increased their lending rates but were reluctant to reduce the lending rate when the Treasury bill rate came down because of the declining income from assets. They responded by reducing the deposit rate, thus maintaining a wider margin as they left the lending rate at a higher level. Postulating an error correction model and using monthly data for the study period,

Maudos et al. (2004) analyzed interest margins in the principal European banking countries over the period 1993–2000 by considering banks as utility maximizers bearing operating costs. They found that factors that explain interest margins are the competitive condition of the market, interest rate risk, credit risk, operating expenses, and bank risk aversion among others.

Elsewhere Angbazo (1997) tested the hypothesis that banks with more risky assets and higher interest rate risk select lending and deposit rates so as to earn wider net interest margins. He used United States bank data from 1989–93 and found evidence in support of the hypothesis.

Ondieki and Jagongo (2013) examined the effects of lowering Central Bank Rate on bank's prime rate by conducting an analysis of Kenyan commercial banks. The study's overall objective was to analyze the significant causes that lead to rigidity of commercial banks' lending rates despite cost-incentives from the central bank. The study adopted a descriptive research design for the purpose of accessing the study's general intent. This involved a set of methods that describe the intended variables using statistical logic. The analysis was accomplished by determining how factors other than the CBK inducements influenced cost of credit and its availability to the entrepreneurs. Based on the study findings, it was evident that despite concerted efforts by the CBK for the commercial banks to lower their lending rates, little gain was made since the superior chunk of determination was dependent on high-level non-performance loans, stiff industry competition, internal policy barriers and lending channels. The high non-performance of loans was a culmination of high risk concentration in Kenya, lack of approved credit rating and information sharing agencies, limited risk mitigation strategies, internal policy barriers and instances of the CBK not giving it the consideration it required.

In spite of the fact that competition was high and increasing due to high penetration rate, banks were inadvertently keen not to lower their prime rates as a basis of inducing more clients. This implied that other than competition pressures, intra-industry forces played role to sustain higher prime rates. Convincingly, these forces were centered on a weak regulatory framework that did not have strict penalties on over-charges and single-handed desires of making unjustifiable profits at the expense of borrowers and general economy. With policy guidelines, long chains of decision making, especially by multinationals made policy designs more inflexible and inconsistent with local regulatory

structures. In the same tone, technological shifts were slow most often than not which made structural adjustments and modernizations a far-fetched reality. Finally, with respect to lending channels, there were minimal hindrances from the bureaucrats but with major intent of reducing administration costs and broadening profit margins.

Ngugi and Kabubo (1998) examined financial sector reforms and interest rate liberalization by presenting on the Kenya experience. They expected that for financially repressed economies, financial liberalization was expected to allow for positive real interest rates, and for stimulating the mobilization and efficient allocation of domestic financial resources. At the same time, as the market becomes competitive the costs of intermediation go down, an indication of efficiency in the intermediation of financial assets. But, for successful liberalization, prerequisites must be put in place together with proper sequencing procedures. The study explored the sequencing and actions so far taken in the liberalization process in Kenya. The study also examined the interest rate levels, spreads and determining factors, as an indicator of financial sector response to the reform process. The study found that although much had been accomplished, the financial system was characterized by repression factors including negative real interest rates, inefficiency in financial intermediation and underdeveloped financial markets. This may indicate that the economy is facing secondary financial repression. Interest rates were more responsive to the policy activities during the period than to the fundamentals. Interest rates were a monetary phenomenon with an adjustment speed of 77% to disequilibrium in the monetary sector. The study concluded that there



are several loose knots that need to be tightened for the economy to experience significant positive effects of financial liberalization.

Nakayiza (2013) examined interest rates and loan portfolio performance of commercial banks in Uganda by using a case study of Centenary Bank Entebbe Road Branch. The study was about the contribution interest rates have on loan portfolio performance in commercial banks. The study was based on three objectives that is; to examine how Centenary Bank has ensured that the bank's loan portfolio has been maintained within acceptable limits to enhance performance, to examine how the bank has ensured compliance with regulatory requirements to enhance its performance, and to examine how the bank has worked out problem of loans, including rescheduling and restructuring so as to enhance its performance. The study findings indicate that although Centenary Bank has tried to follow procedures and regulations in administering credit, there is still an element of clients' defaulting on loan repayments and increasing the effect of bad debts in the bank. This created risk in loan portfolio performance and affected profitability. The findings further revealed that there is lack of effective analysis on the impact of increasing interest rates on loan repayment trends.

Okoye and Onyekachi (2014) examined effect of bank lending rate on the performance of Nigerian deposit money banks between 2000 and 2010. It specifically determined the effects of lending rate and monetary policy rate on the performance of Nigerian Deposit Money Banks and analyzed how bank lending rate policy affects the performance of Nigerian deposit money banks. The study utilized secondary data econometrics in a regression, where time-series and quantitative design were combined and estimated. The result confirmed that the lending rate and monetary policy

rate has significant and positive effects on the performance of Nigerian deposit money banks. The implication of these is that lending rate and monetary policy rate are true parameter of measuring bank performance. They recommend that government should adopt policies that will help Nigerian deposit money banks to improve on their performance and there is need to strengthen bank lending rate policy through effective and efficient regulation and supervisory framework.

Enyioko (2012) examined the impact of interest rate policy and performance of deposit money banks in Nigerian. The reviewed the credit crisis and the transatlantic mortgage financial turmoil which have questioned the effectiveness of bank consolidation programme as a remedy for financial stability and monetary policy in correcting the defects in the financial sector for sustainable development. Many banks consolidation had taken place in Europe, America and Asia in the last two decades without any solutions in sight to bank failures and crisis. The study attempted to examine the performances of banks and macro-economic performance in Nigeria based on the interest rate policies of the banks. The study analyzed published audited accounts of twenty (20) out of twenty-five (25) banks that emerged from the consolidation exercise and data from the Central Banks of Nigeria (CBN). They denoted year 2004 as the pre-consolidation and 2005 and 2006 as post-consolidation periods for the analysis. They noticed that the interest rate policies had not improved the overall performances of banks significantly and also had contributed marginally to the growth of the economy for sustainable development.

## **2.5 Summary of the Empirical Study**

Several studies have been conducted on the effects of interest rate changes and performance of commercial banks. Angbanzo (1997) tested the hypothesis that banks with more risky assets and higher interest rate risk select lending and deposit rates so as to earn wider net interest margins. Ngugi and Kabubo (1998) examined financial sector reforms and interest rate liberalization by presenting on the Kenya experience. Keeton and Morris (1999) undertook a study on why banks' loan losses differ. Ngugi (2001) analyzed the interest rates spread in Kenya from 1970 to 1999 and found that interest rate spread increased because of yet-to-be gained efficiency and high intermediation cost. Maudos et al (2004) analyzed interest margins in the principal European banking countries over the period 1993–2000 by considering banks as utility maximizers bearing operating costs. Enyioko (2012) examined the impact of interest rate policy and performance of deposit money banks in Nigerian. Ondieki and Jagongo (2013) examined the effects of lowering Central Bank Rate on bank's prime rate by conducting an analysis of Kenyan commercial banks. Nakayiza (2013) examined interest rates and loan portfolio performance in commercial in banks Uganda by using a case study of Centenary Bank Entebbe Road Branch. Okoye and Onyekachi (2014) examined effect of bank lending rate on the performance of Nigerian deposit money banks between 2000 and 2010.

A review of these studies indicates that the existing studies have been done in other countries and not Kenya. For those done in Kenya, they have reviewed the relationship between interest rate spread, or general credit and performance of commercial banks. This study will therefore seek to fill this research gap by establishing the effects of interest rate volatility on nonperforming loans portfolio of commercial banks in Kenya.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter set out various stages that were followed in completing the study. It explained how research is going to be executed and how data will be collected and analyzed. The section specifically covered; research design, target population, data collection and data analysis. The study used three variables. The three variables were the interest rates, 91-Day Treasury Bill Rates and the nonperforming loans portfolio.

#### **3.2 Research Design**

The study adopted a longitudinal causal research study. Longitudinal study follows the same sample over time and makes repeated observations. With longitudinal surveys, for example, the same group of people is interviewed at regular intervals, enabling researchers to track changes over time and to relate them to variables that might explain why the changes occur.

This method was suitable because longitudinal research designs described patterns of change and help establish the direction and magnitude of causal relationships. Measurements are taken on each variable over two or more distinct time periods. This allowed the researcher to measure change in variables over time. It is a type of observational study and is sometimes referred to as a panel study (Savitt, 1980), which was fit for this study.

### **3.3 Population of the Study**

The Population of the study was the entire eleven listed commercial banks in Kenya. Population in statistics is the specific population about which information is desired. According to Kothari (2004), a population is a well-defined or set of people, services, elements, and events, group of things or households that are being investigated in Kenya. Annual data was used because data at the CBK is analyzed on annual basis in the bank Supervision Report.

### **3.4 Data Collection**

The study used secondary data from the CBK. This is the data released by CBK on interest rates and non-performing loans of all listed commercial Bank. The researcher consolidated the data on nonperforming loans released by CBK into a nonperforming loans portfolio. The data was collected using data collection sheet which was edited, coded and cleaned. Data was mainly obtained covering the period 2002/2003-2012/2013 financial periods. This period has been chosen because of the many changes that occurred in the economy in terms of interest rates that have far reaching implications on the nonperforming loans portfolio of commercial banks

### **3.5 Data Analysis**

The study used the Statistical Package for Social Sciences (SPSS) Version 21.0 to aid in data analysis. The Correlation coefficient was used to determine if there was any relationship between the volatility of interest rates and changes of Nonperforming loans.

Then regression analysis was used to find out the kind relationship that existed between interest rates volatility and nonperforming loans portfolio.

### 3.5.1 Analytical Model

In order to determine whether there was any relationship between changes in interest rates volatility and changes in nonperforming loans portfolio, the researcher first and foremost ascertained the correlation coefficient using the following model:

$$\text{Correlation}(r) = \frac{[N\Sigma XY - (\Sigma X)(\Sigma Y)]}{\sqrt{([N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2])}}$$

Where:

N = Population

X = Interests rates Volatility

Y = Changes of Nonperforming loans portfolio

$\Sigma XY$  = Sum of the product of interest rates volatility and changes of Nonperforming loans portfolio

$\Sigma X$  = Sum interest rates volatility

$\Sigma Y$  = Sum of changes of Nonperforming loans portfolio

$\Sigma X^2$  = Sum of square interest rates volatility

$\Sigma Y^2$  = Sum of square of the changes of nonperforming loans portfolio.

Finally, in order to determine the effects of interest rate changes on nonperforming loans portfolio of listed commercial banks in Kenya, the researcher conducted a multiple regression analysis using the following analytical model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \epsilon$$

Where:        Y = Nonperforming loans portfolio

              X<sub>1</sub> = Volatility in Interest lending rates

              X<sub>2</sub> = 91-Day Treasury Bill Rate

The study was tested at 95% confidence level and 5% significant level. If the significance number found was less than the critical value ( $\alpha$ ) set 2.4, then the conclusion was that the model was significant in explaining the relationship.

## CHAPTER FOUR

### DATA ANALYSIS, RESULTS AND DISCUSSION

#### 4.1 Introduction

This chapter presents the analysis of data as stipulated in the research methodology and the findings of the study as set out in the research objective. The study sought to determine the relationship between non performing loan, 91-Day Treasury Bill Rate and the volatility of the interest rates. The dependent variable is the non performing loan and the independent variables are the 91-Day Treasury Bill Rate and volatility of interest rates.

#### 4.2 Descriptive statistics

**Table 4. 1: Dependent Variable**

	Mean	Std. Deviation
NPL	9.3050	.25956

For the dependent variable, NPL has a mean of 9.3050 and a standard deviation of 0.25956.

**Table 4. 2: Independent Variable**

	Mean	Std. Deviation
VOL	.0098	.00541
TBR	7.9429	1.18203

For the independent variables, VOL has a mean of 0.0098 and a standard deviation of 0.00541, TBR has a mean of 7.9429 and a standard deviation of 1.18203. A reasonable



level of consistency is observed between the mean and standard deviation for all variables.

### 4.3 Regression Analysis

The study conducted a cross-sectional OLS multiple regressions on interest rates volatility on nonperforming loans portfolio of listed commercial banks in Kenya over the period 2002–2013. These findings are discussed below on an annual basis.

#### 4.3.1 Year 2002 Analysis and Interpretations

**Table 4. 3: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.903 <sup>a</sup>	.815	.773	.12358

Table 4.3 above shows the model summary of regression analysis between two independent variables including TBR02 (91-Day Treasury Bill Rate) and VOL02 (Interest Rate Volatility) and a dependent variable namely NPL02 (Non-Performing Loans). The table showed that value of R was 0.903; the value of R square was 0.815 and the value of adjusted R square was 0.773. From the findings, 77.3% of variations in Non-Performing Loans of listed commercial banks in the year 2002 were explained by the two independent variables of the study.

**Table 4. 4: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.604	2	.302	19.762	.001 <sup>b</sup>
Residual	.137	9	.015		
Total	.741	11			

Table 4.4 above depicts analysis of variance of regression analysis between two independent including TBR02 (91-Day Treasury Bill Rate) and VOL02 (Interest Rate Volatility) and a dependent variable namely NPL02 (Non-Performing Loans). On one hand table shows that in regression, the value of sum of squares is 0.604, the value of df is 2, the value of mean square is 0.302, the value of F is 19.762 and the significance value is 0.001<sup>b</sup>. On the other hand in residual, the value of sum of squares is 0.137, the value of df is 9, the value of mean square is 0.015. This makes a total of 0.741 as a sum of squares and 11 as df. Positivity and significance of all values shows that model summary is also significant and therefore gives a logical support to the study model. F calculated is 19.762 while F tabulated is 3.98. Since F calculated is greater than F tabulated, the overall model is therefore significant.

**Table 4. 5: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	13.560	.286		47.491	.000
VOL02	-4.503	6.956	-.094	-.647	.534
TBR02	.200	.032	.911	6.282	.000

According to the coefficient table above, VOL02 (Interest Rate Volatility) was insignificant as its significance value was greater than 0.05 while TBR02 (91-Day Treasury Bill Rate) was significant as its significance value was less than 0.05. However, only TBR02 (91-Day Treasury Bill Rate) was positively correlated while VOL02 (Interest Rate Volatility) was negatively correlated with NPL02 (Non-Performing Loans). From the model, taking all factors (VOL02 and TBR02) constant at zero, NPL02 had an

autonomous of 13.560. The data findings analyzed also showed that taking all other independent variables at zero, a unit increase in VOL02 lead to a decrease in NPL02 by 4.503. A unit increase in TBR02 lead to a 0.200 increase in NPL02. This inferred that 91-Day Treasury Bill Rate contributed more to the Non-Performing Loans while Interest Rate Volatility had a negative effect on Non-Performing Loans in the year 2002. The regression model drawn from table 4.5 above is presented below:

$$Y = 13.560 - 4.503VOL + 0.200TBR + 0.286$$

$$Y = 13.856 - 4.503VOL + 0.200TBR$$

### 4.3.2 Year 2003 Analysis and Interpretations

**Table 4. 6: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.889 <sup>a</sup>	.790	.746	.24094

Table 4.6 above depicts the model summary of regression analysis between two independent variables including TBR03 (91-Day Treasury Bill Rate) and VOL03 (Interest Rate Volatility) and a dependent variable namely NPL03 (Non-Performing Loans). The table showed that value of R was 0.889; the value of R square was 0.790 and the value of adjusted R square was 0.746. From the findings, 74.6% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2003 were explained by the two independent variables of the study.

**Table 4. 7: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.863	2	.431	7.433	.012 <sup>b</sup>
Residual	.522	9	.058		
Total	1.385	11			

Table 4.7 above depicts analysis of variance of regression analysis between two independent including TBR03 (91-Day Treasury Bill Rate) and VOL03 (Interest Rate Volatility) and a dependent variable namely NPL03 (Non-Performing Loans). On one hand table shows that in regression, the value of sum of squares is 0.863, the value of df is 2, the value of mean square is 0.431, the value of F is 7.433 and the significance value is 0.012<sup>b</sup>. On the other hand in residual, the value of sum of squares is 0.522, the value of df is 9, the value of mean square is 0.058. Hence making a total of 1.385 as a sum of squares and 11 as df. The study found out that F calculated is 7.433 while F tabulated is 3.98. Since F calculated is greater than F tabulated, the overall model is therefore significant.

**Table 4. 8: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	13.849	.136		101.896	.000
VOL03	1.157	1.793	.134	.645	.035
TBR03	.097	.025	.799	3.855	.004

According to the coefficient table above, both VOL03 (Interest Rate Volatility) and TBR03 (91-Day Treasury Bill Rate) were significant as its significance value were less than 0.05. Both TBR03 (91-Day Treasury Bill Rate) and VOL03 (Interest Rate Volatility) were positively correlated with NPL03 (Non-Performing Loans). From the model, taking

all factors (VOL03 and TBR03) constant at zero, NPL03 had an autonomous of 13.849. The data findings analyzed also showed that taking all other independent variables at zero, a unit increase in VOL03 lead to an increase in NPL03 by 1.157. A unit increase in TBR03 lead to a 0.097 increase in NPL03. This inferred that both Interest Rate Volatility and 91-Day Treasury Bill Rate contributed more to the Non-Performing Loans in the year 2003. The regression model drawn from table 4.3 above is presented below:

$$Y = 13.849 + 1.157VOL + 0.097TBR + 0.136$$

$$Y = 13.985 + 1.157VOL + 0.097TBR$$

### 4.3.3 Year 2004 Analysis and Interpretations

**Table 4. 9: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.918 <sup>a</sup>	.842	.790	.32730

Table 4.9 shows the model summary of regression analysis between two independent variables including TBR04 (91-Day Treasury Bill Rate) and VOL04 (Interest Rate Volatility) and a dependent variable namely NPL04 (Non-Performing Loans). The table showed that value of R was 0.918; the value of R square was 0.842 and the value of adjusted R square was 0.790. From the findings, 79.0% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2004 were explained by the two independent variables of the study.

**Table 4. 10: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.029	2	.514	4.800	.038 <sup>b</sup>

Residual	.964	9	.107		
Total	1.993	11			

Table 4.10 above depicts ANOVA output between two independent including TBR04 (91-Day Treasury Bill Rate) and VOL04 (Interest Rate Volatility) and a dependent variable namely NPL04 (Non-Performing Loans). On one hand table shows that in regression, the value of sum of squares is 1.029, the value of df is 2, the value of mean square is 0.514, the value of F is 4.800 and the significance value is 0.038<sup>b</sup>. On the other hand in residual, the value of sum of squares is 0.964, the value of df is 9, the value of mean square is 0.107 hence making a total of 1.993 as a sum of squares and 11 as df. The study found out that F calculated is 4.800 while F tabulated is 3.98. Since F calculated is greater than F tabulated, the overall model is therefore significant.

**Table 4. 11: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	13.760	.208		66.195	.000
VOL04	6.791	8.025	.201	.846	.041
TBR04	.143	.053	.646	2.718	.024

According to the coefficient table above, both VOL04 (Interest Rate Volatility) and TBR04 (91-Day Treasury Bill Rate) were significant as its significance value were less than 0.05. Also the study found out that both TBR04 (91-Day Treasury Bill Rate) and VOL04 (Interest Rate Volatility) were positively correlated with NPL04 (Non-Performing Loans). From the model, taking all factors (VOL04 and TBR04) constant at zero, NPL04 had an autonomous of 13.760. The data findings analyzed also showed that taking all other independent variables at zero, a unit increase in VOL04 lead to an increase in NPL04 by 6.791 while a unit increase in TBR04 lead to a 0.143 increase in

NPL04. This inferred that both Interest Rate Volatility and 91-Day Treasury Bill Rate contributed more to the Non-Performing Loans portfolio of the listed commercial banks in the year 2004. The regression model drawn from table 4.11 above is presented below:

$$Y = 13.760 + 6.791VOL + 0.143TBR + 0.208$$

$$Y = 13.968 + 1.157VOL + 0.097TBR$$

#### 4.3.4 Year 2005 Analysis and Interpretations

**Table 4. 12: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.871 <sup>a</sup>	.758	.703	.21493

Table 4.12 depicts the model summary of regression analysis between two independent variables including TBR05 (91-Day Treasury Bill Rate) and VOL05 (Interest Rate Volatility) and a dependent variable namely NPL05 (Non-Performing Loans). The table showed that value of R was 0.871; the value of R square was 0.758 and the value of adjusted R square was 0.703. From the findings, 70.3% of variations in Non-Performing Loans portfolio of listed commercial banks in the year 2005 were explained by the two independent variables of the study. Also positivity and significance of all the values of R indicates that the model is logical for the study

**Table 4. 13: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.476	2	.238	9.916	.011 <sup>b</sup>
Residual	.216	9	.024		
Total	.691	11			

Table 4.13 above depicts ANOVA output between two independent including TBR05 (91-Day Treasury Bill Rate) and VOL05 (Interest Rate Volatility) and a dependent variable namely NPL05 (Non-Performing Loans). On one hand table shows that in regression, the value of sum of squares is 0.476, the value of df is 2, the value of mean square is 0.238, the value of F is 9.916 and the significance value is 0.011<sup>b</sup>. On the other hand in residual, the value of sum of squares is 0.216, the value of df is 9, the value of mean square is 0.024 hence making a total of 0.691 as a sum of squares and 11 as df. The study found out that F calculated is 9.916 while F tabulated is 3.98. Since F calculated is greater than F tabulated, the overall model is therefore significant.

**Table 4. 14: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	7.727	2.000		3.864	.004
VOL05	-.268	5.704	-.012	-.047	.964
TBR05	.573	.238	.634	2.406	.040

Table 4.14 above shows the coefficient values for the independent variables of the study, According table, VOL05 (Interest Rate Volatility) was insignificant as its significance value was greater than 0.05 while TBR05 (91-Day Treasury Bill Rate) was significant as its significance value were less than 0.05. Also the study found out that VOL05 (Interest Rate Volatility) was negatively correlated with NPL05 while TBR05 (91-Day Treasury Bill Rate) was positively correlated with NPL05 (Non-Performing Loans). From the model, taking all factors (VOL05 and TBR05) constant at zero, NPL05 had an autonomous of 7.727. The data findings analyzed also showed that taking all other independent variables at zero, a unit increase in VOL05 lead to a decrease in NPL05 by 0.268 while a unit increase in TBR05 lead to a 0.573 increase in NPL05. This inferred



that 91-Day Treasury Bill Rate contributed more to the Non-Performing Loans portfolio while Interest Rate Volatility had a negative effect on the listed commercial banks in the year 2005. The regression model drawn from table 4.14 above is presented below:

$$Y = 7.727 + 6.791VOL - 0.268TBR + 2.000$$

$$Y = 9.727 + 6.791VOL - 0.268TBR$$

### 4.3.5 Year 2006 Analysis and Interpretations

**Table 4. 15: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.891 <sup>a</sup>	.793	.744	.11504

Table 4.15 depicts the model summary of regression analysis between two independent variables including TBR06 (91-Day Treasury Bill Rate) and VOL06 (Interest Rate Volatility) and a dependent variable namely NPL06 (Non-Performing Loans). The table showed that value of R was 0.891; the value of R square was 0.793 and the value of adjusted R square was 0.744. From the findings, 74.4% of variations in Non-Performing Loans portfolio of listed commercial banks in the year 2006 were explained by the two independent variables of the study. Also positivity and significance of all the values of R indicates that the model is logical for the study.

**Table 4. 16: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.453	2	.226	7.533	.019
Residual	.319	9	.035		
Total	.772	11			

Table 4.16 above depicts ANOVA output between two independent including TBR06 (91-Day Treasury Bill Rate) and VOL06 (Interest Rate Volatility) and a dependent variable namely NPL06 (Non-Performing Loans). On one hand table shows that in regression, the value of sum of squares is 0.453, the value of df is 2, the value of mean square is 0.226, the value of F is 7.533 and the significance value is 0.019. On the other hand in residual, the value of sum of squares is 0.319, the value of df is 9, the value of mean square is 0.035 hence making a total of 0.772 as a sum of squares and 11 as df. The study found out that F calculated is 7.533 while F tabulated is 3.98. Since F calculated is greater than F tabulated, the overall model is therefore significant.

**Table 4. 17: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	11.175	.298		37.463	.000
VOL06	.539	3.248	.046	.166	.002
TBR06	.085	.043	.555	1.992	.078

Table 4.17 above shows the coefficient values for the independent variables of the study. According to the above table, VOL06 (Interest Rate Volatility) and TBR06 (91-Day Treasury Bill Rate) were significant as their significance values were less than 0.05. Also the study found out that both VOL06 (Interest Rate Volatility) and TBR06 (91-Day Treasury Bill Rate) were positively correlated with NPL06 (Non-Performing Loans). From the model, taking all factors (VOL06 and TBR06) constant at zero, NPL06 had an autonomous of 11.175. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL06 lead to an increase in NPL06 by 0.539 while a unit increase in TBR06 lead to a 0.085 increase in NPL06. This

inferred that both Interest Rate Volatility and 91-Day Treasury Bill Rate contributed more to the Non-Performing Loans portfolio of the listed commercial banks in the year 2006. The regression model drawn from table 4.17 above is presented below:

$$Y = 11.175 + 0.539VOL + 0.085TBR + 0.298$$

$$Y = 11.473 + 0.539VOL + 0.085TBR$$

#### 4.3.6 Year 2007 Analysis and Interpretations

**Table 4. 18: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.866 <sup>a</sup>	.749	.694	.26996

Table 4.18 displays the model summary of regression analysis between two independent variables including TBR07 (91-Day Treasury Bill Rate) and VOL07 (Interest Rate Volatility) and a dependent variable namely NPL07 (Non-Performing Loans). The table showed that value of R was 0.866; the value of R square was 0.749 and the value of adjusted R square was 0.694. From the findings, 69.4% of variations in Non-Performing Loans portfolio of listed commercial banks in the year 2007 were explained by the two independent variables of the study. This shows that all the factors of the study were significant.

**Table 4. 19: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.929	2	.465	6.376	.019 <sup>b</sup>
Residual	.656	9	.073		
Total	1.585	11			

The ANOVA output above shows that regression results between two independent including TBR07 (91-Day Treasury Bill Rate) and VOL07 (Interest Rate Volatility) and a dependent variable namely NPL07 (Non-Performing Loans). On one hand table shows that in regression, the value of sum of squares is 0.929, the value of df is 2, the value of mean square is 0.465, the value of F is 6.376 and the significance value is 0.019. On the other hand in residual, the value of sum of squares is 0.656, the value of df is 9, the value of mean square is 0.073 hence making a total of 1.585 as a sum of squares and 11 as df. The study found out that F calculated is 6.376 while F tabulated is 3.98. Since F calculated is greater than F tabulated, the overall model is therefore significant.

**Table 4. 20: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	14.618	1.263		11.570	.000
VOL07	.224	13.666	.004	.016	.987
TBR07	-.578	.201	-.768	-2.873	.018

Table 4.20 above shows the coefficient values for the independent variables of the study. According to the above table, TBR07 (91-Day Treasury Bill Rate) was significant as its significance value was less than 0.05 while VOL07 (Interest Rate Volatility) was insignificant as its significance value was greater than 0.05. The study also found out that VOL07 (Interest Rate Volatility) was positively correlated with NPL07 (Non-Performing Loans) while TBR07 (91-Day Treasury Bill Rate) was negatively correlated with NPL07 (Non-Performing Loans). From the model, taking all factors (VOL07 and TBR07) constant at zero, NPL07 had an autonomous of 14.618. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in

VOL07 lead to an increase in NPL07 by 0.224 while a unit increase in TBR07 lead to a 0.578 decrease in NPL07. This inferred that Interest Rate Volatility contributed more to the Non-Performing Loans portfolio of the listed commercial banks in the year 2007 while 91-Day Treasury Bill Rate had a negative effect. The regression model drawn from table 4.20 above is presented below:

$$Y = 14.618 + 0.224VOL - 0.578TBR + 1.263$$

$$Y = 15.881 + 0.224VOL - 0.578TBR$$

#### 4.3.7 Year 2008 Analysis and Interpretations

**Table 4. 21: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.921 <sup>a</sup>	.848	.799	.49289

Table 4.21 above displays the model summary of regression analysis between two independent variables including TBR08 (91-Day Treasury Bill Rate) and VOL08 (Interest Rate Volatility) and a dependent variable namely NPL08 (Non-Performing Loans). The table showed that value of R was 0.921; the value of R square was 0.848 and the value of adjusted R square was 0.799 and the standard error estimate was .49289. From the findings, 79.9% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2008 were explained by the two independent variables of the study namely Interest rate volatility and 91-Day Treasury Bill Rate. This shows that all the factors of the study were significant.

**Table 4. 22: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.671	2	1.836	7.556	.012 <sup>b</sup>
Residual	2.186	9	.243		
Total	5.858	11			

Table 4.22 shows that ANOVA output of the regression between two independent including TBR08 (91-Day Treasury Bill Rate) and VOL08 (Interest Rate Volatility) and a dependent variable namely NPL08 (Non-Performing Loans). On one hand table shows that in regression, the value of sum of squares is 3.671, the value of df is 2, the value of mean square is 1.836, the value of F is 7.556 and the significance value is 0.012. On the other hand in residual, the value of sum of squares is 2.186, the value of df is 9, the value of mean square is 0.243 hence making a total of 5.858 as a sum of squares and 11 as df. The study found out that F calculated is 7.556 while F tabulated is 3.98. Since F calculated is greater than F tabulated, the overall model is therefore significant.

**Table 4. 23: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	18.153	2.271		7.992	.000
VOL08	3.200	10.172	.066	.315	.760
TBR08	1.145	.298	.804	3.848	.004

Table 4.23 above shows the coefficient values for the independent variables of the study. According to the above table, TBR08 (91-Day Treasury Bill Rate) was significant as its significance value was less than 0.05 while VOL08 (Interest Rate Volatility) was insignificant as its significance value was greater than 0.05. The study also found out that VOL08 (Interest Rate Volatility) was positively correlated with NPL08 (Non-Performing Loans) while TBR08 (91-Day Treasury Bill Rate) was negatively correlated with NPL08

(Non-Performing Loans). From the model, taking all factors (VOL08 and TBR08) constant at zero, NPL08 had an autonomous of 18.153. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL08 lead to an increase in NPL08 by 3.200 while a unit increase in TBR08 lead to a 1.145 increase in NPL08. This inferred that both Interest Rate Volatility and 91-Day Treasury Bill Rate contributed more to the Non-Performing Loans portfolio of the listed commercial banks in the year 2008. The regression model drawn from table 4.23 above is presented below:

$$Y = 18.153 + 3.2VOL + 1.145TBR + 2.271$$

$$Y = 20.424 + 3.2VOL + 1.145TBR$$

#### 4.3.8 Year 2009 Analysis and Interpretations

**Table 4. 24: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.836 <sup>a</sup>	.698	.654	.49982

Table 4.24 above shows the model summary of regression analysis between two independent variables including TBR09 (91-Day Treasury Bill Rate) and VOL09 (Interest Rate Volatility) and a dependent variable namely NPL09 (Non-Performing Loans). The table showed that value of R was 0.836; the value of R square was 0.698 and the value of adjusted R square was 0.654 and the standard error estimate was .49982. From the findings, 65.4% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2009 were explained by the two independent variables of

the study namely Interest rate volatility and 91-Day Treasury Bill Rate. This shows that all the factors of the study were significant.



**Table 4. 25: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.928	2	.964	4.702	.007 <sup>b</sup>
Residual	1.848	9	.205		
Total	3.776	11			

Table 4.25 shows that ANOVA output of the regression between two independent including TBR09 (91-Day Treasury Bill Rate) and VOL09 (Interest Rate Volatility) and a dependent variable namely NPL09 (Non-Performing Loans). On one hand table shows that in regression, the value of sum of squares is 1.928, the value of df is 2, the value of mean square is .964, the value of F is 4.702 and the significance value is 0.007. On the other hand in residual, the value of sum of squares is 1.848, the value of df is 9, the value of mean square is 0.205 hence making a total of 3.776 as a sum of squares and 11 as df. The study found out that F calculated is 4.702 while F tabulated is 3.98. Since F calculated is greater than F tabulated, the overall model is therefore significant.

**Table 4. 26: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	4.435	2.933		1.512	.165
VOL09	55.980	25.990	.555	2.154	.060
TBR09	.528	.394	.345	1.340	.213

Table 4.26 above shows the coefficient values for the independent variables of the study. According to the above table, all the variables (TBR09 and VOL09) were insignificant as its significance value was greater than 0.05. The study also found out that VOL09 and TBR09 were positively correlated with NPL09 (Non-Performing Loans). From the model, taking all factors (VOL09 and TBR09) constant at zero, NPL09 had an

autonomous of 4.435. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL09 lead to an increase in NPL09 by 55.980 while a unit increase in TBR09 lead to a 0.528 increase in NPL09. This inferred that both Interest Rate Volatility and 91-Day Treasury Bill Rate contributed more to the Non-Performing Loans portfolio of the listed commercial banks in the year 2009. The regression model drawn from table 4.26 above is presented below:

$$Y = 4.435 + 55.980VOL + 1.145TBR + 0.528$$

$$Y = 4.963 + 55.980VOL + 1.145TBR$$

### 4.3.9 Year 2010 Analysis and Interpretations

**Table 4. 27: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.826 <sup>a</sup>	.682	.612	.40736

Table 4.27 above shows the model summary of regression analysis between two independent variables including TBR10 (91-Day Treasury Bill Rate) and VOL10 (Interest Rate Volatility) and a dependent variable namely NPL10 (Non-Performing Loans). The table showed that value of R was 0.826; the value of R square was 0.682 and the value of adjusted R square was 0.612 and the standard error estimate was .40736. From the findings, 61.2% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2010 were explained by the two independent variables of the study namely Interest rate volatility and 91-Day Treasury Bill Rate. Also the positivity and the significance of the values of R depicts that the model is logic for that study.

**Table 4. 28: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.209	2	1.604	9.668	.006 <sup>b</sup>
Residual	1.493	9	.166		
Total	4.702	11			

Table 4.28 shows that ANOVA output of the regression between two independent including TBR10 (91-Day Treasury Bill Rate) and VOL10 (Interest Rate Volatility) and a dependent variable namely NPL10 (Non-Performing Loans). On one hand table shows that in regression, the value of sum of squares is 3.209, the value of df is 2, the value of mean square is 1.604, the value of F is 9.668 and the significance value is 0.006. On the other hand in residual, the value of sum of squares is 1.493, the value of df is 9, the value of mean square is 0.166 hence making a total of 4.702 as a sum of squares and 11 as df. The study found out that F calculated is 9.668 while F tabulated is 3.98. Since F calculated is greater than F tabulated, the overall model is therefore significant.

**Table 4. 29: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	6.357	.331		19.220	.000
VOL10	-2.841	28.030	-.019	-.101	.921
TBR10	.285	.065	.829	4.347	.002

Table 4.26 above shows the coefficient values for the independent variables of the study. According to the above table, TBR10 was significant as its significance value was less than 0.05 while VOL10 was insignificant as its significance value was greater than 0.05. The study also found out that TBR10 was positively correlated with NPL10 (Non-Performing Loans) while VOL10 was negatively correlated with NPL10 (Non-

Performing Loans). From the model, taking all factors (VOL10 and TBR10) constant at zero, NPL10 had an autonomous of 6.357. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL10 lead to a decrease in NPL10 by 2.841 while a unit increase in TBR10 lead to a 0.285 increase in NPL10. This inferred that 91-Day Treasury Bill Rate contributed more to the Non-Performing Loans portfolio of the listed commercial banks in the year 2010 while Interest Rate Volatility had a negative effect on the Non-Performing Loans portfolio of the listed commercial banks in the year 2010. The regression model drawn from table 4.29 above is presented below:

$$Y = 6.357 - 2.841VOL + 0.285TBR + 0.331$$

$$Y = 6.688 - 2.841VOL + 0.285TBR$$

#### 4.3.10 Year 2011 Analysis and Interpretations

**Table 4. 30: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.964 <sup>a</sup>	.930	.914	.16669

Table 4.30 above shows the model summary of regression analysis between two independent variables including TBR11 (91-Day Treasury Bill Rate) and VOL11 (Interest Rate Volatility) and a dependent variable namely NPL11 (Non-Performing Loans). The table showed that value of R was 0.964; the value of R square was 0.930 and the value of adjusted R square was 0.914 and the standard error estimate was .16669. From the findings, 91.4% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2011 were explained by the two independent variables of

the study namely Interest rate volatility and 91-Day Treasury Bill Rate. Also the positivity and the significance of the values of R depicts that the model is logic for that study.

**Table 4. 31: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.304	2	1.652	59.460	.000 <sup>b</sup>
Residual	.250	9	.028		
Total	3.554	11			

Table 4.31 shows the ANOVA output of the regression between two independent including TBR11 (91-Day Treasury Bill Rate) and VOL11 (Interest Rate Volatility) and a dependent variable namely NPL11 (Non-Performing Loans). On one hand table shows that in regression, the value of sum of squares is 3.304, the value of df is 2, the value of mean square is 1.652, the value of F is 59.460 and the significance value is 0.000. On the other hand in residual, the value of sum of squares is 0.250, the value of df is 9, the value of mean square is 0.280 hence making a total of 3.554 as a sum of squares and 11 as df. The study found out that F calculated is 59.460 while F tabulated is 3.98. Since F calculated is greater than F tabulated, the overall model is therefore significant.

**Table 4. 32: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	6.176	.098		63.067	.000
VOL11	-.208	1.095	-.023	-.190	.854
TBR11	-.097	.012	-.949	-7.967	.000

Table 4.32 above shows the coefficient values for the independent variables of the study. According to the above table, TBR11 was significant as its significance value was less than 0.05 while VOL11 was insignificant as its significance value was greater than 0.05.

The study also found out that VOL11 and TBR11 were negatively correlated with NPL11 (Non-Performing Loans). From the model, taking all factors (VOL11 and TBR11) constant at zero, NPL11 had an autonomous of 6.176. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL11 lead to a decrease in NPL11 by 0.208 while a unit increase in TBR11 lead to a 0.097 decrease in NPL11. This inferred that both 91-Day Treasury Bill Rate and Interest Rate Volatility had a negative effects on the Non-Performing Loans portfolio of the listed commercial banks in the year 2011. The regression model drawn from table 4.32 above is presented below:

$$Y = 6.176 - 0.208VOL - 0.097TBR + 0.098$$

$$Y = 6.274 - 0.208VOL - 0.097TBR$$

#### 4.3.11 Year 2012 Analysis and Interpretations

**Table 4. 33: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.902 <sup>a</sup>	.813	.782	.12971

Table 4.33 above depicts the model summary of regression analysis between two independent variables including TBR12 (91-Day Treasury Bill Rate) and VOL12 (Interest Rate Volatility) and a dependent variable namely NPL12 (Non-Performing Loans). The table showed that value of R was 0.902; the value of R square was 0.813 and the value of adjusted R square was 0.782 and the standard error estimate was .12971. From the findings, 78.2% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2012 were explained by the two independent variables of

the study namely Interest rate volatility and 91-Day Treasury Bill Rate. Also the positivity and the significance of the values of R depicts that the model is logic for the study.

**Table 4. 34: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.126	2	.063	5.25	.013 <sup>b</sup>
Residual	.111	9	.012		
Total	.238	11			

Table 4.34 shows the ANOVA output of the regression between two independent including TBR12 (91-Day Treasury Bill Rate) and VOL12 (Interest Rate Volatility) and a dependent variable namely NPL12 (Non-Performing Loans). On one hand table shows that in regression, the value of sum of squares is 0.126, the value of df is 2, the value of mean square is .063, the value of F is 5.25 and the significance value is 0.013. On the other hand in residual, the value of sum of squares is 0.111, the value of df is 9, the value of mean square is 0.012 hence making a total of .238 as a sum of squares and 11 as df. The study found out that F calculated is 5.25 while F tabulated is 3.98. Since F calculated is greater than F tabulated, the study therefore established that the overall model is significant.

**Table 4. 35: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	4.408	.121		36.472	.000
VOL12	-1.554	.698	-.685	-2.226	.053
TBR12	.015	.010	.454	1.475	.174

Table 4.35 above shows the coefficient values for the independent variables of the study. According to the above table, all the variables were insignificant as its significance value

was greater than 0.05. The study also found out that VOL12 was negatively correlated with NPL12 (Non-Performing Loans) while TBR12 was positively correlated with NPL12 (Non-Performing Loans). From the model, taking all factors (VOL12 and TBR12) constant at zero, NPL12 had an autonomous of 4.408. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL12 lead to a decrease in NPL12 by 1.554 while a unit increase in TBR12 lead to a 0.015 increase in NPL12. This inferred that 91-Day Treasury Bill Rate contributed more to Non-Performing Loans portfolio of the listed commercial banks in the year 2012 while Interest Rate Volatility had a negative effects on the Non-Performing Loans portfolio of the listed commercial banks in the year 2012. The regression model drawn from table 4.35 above is presented below:

$$Y = 4.408 - 1.554VOL + 0.015TBR + 0.121$$

$$Y = 4.529 - 1.554VOL + 0.015TBR$$

#### 4.3.12 Year 2013 Analysis and Interpretations

**Table 4. 36: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.869 <sup>a</sup>	.755	.717	.06583

Table 4.36 above depicts the model summary of regression analysis between two independent variables including TBR13 (91-Day Treasury Bill Rate) and VOL13 (Interest Rate Volatility) and a dependent variable namely NPL13 (Non-Performing Loans). The table showed that value of R was 0.869; the value of R square was 0.755 and the value of adjusted R square was 0.717 and the standard error estimate was .06583. From the findings, 71.7% of variations in Non-Performing Loans portfolio of listed



commercial banks in the year 2013 were explained by the two independent variables of the study namely Interest rate volatility and 91-Day Treasury Bill Rate. Also the positivity and the significance of the values of R depicts that the model is logic for the study.

**Table 4. 37: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.303	2	.151	6.04	.004
Residual	.237	9	.025		
Total	.540	11			

Table 4.37 shows the ANOVA output of the regression between two independent including TBR13 (91-Day Treasury Bill Rate) and VOL13 (Interest Rate Volatility) and a dependent variable namely NPL13 (Non-Performing Loans). On one hand table shows that in regression, the value of sum of squares is 0.303, the value of df is 2, the value of mean square is .151, the value of F is 6.04 and the significance value is 0.004. On the other hand in residual, the value of sum of squares is 0.237, the value of df is 9, the value of mean square is 0.025 hence making a total of .540 as a sum of squares and 11 as df. The study found out that F calculated is 6.04 while F tabulated is 3.98. Since F calculated is greater than F tabulated, the study therefore established that the overall model is significant.

**Table 4. 38: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	.015	.221		.067	.048
VOL13	.020	.043	.153	.458	.008
TBR13	.002	.013	.051	.154	.031

Table 4.38 above shows the coefficient values for the independent variables of the study. According to the above table, all the variables were significant as its significance value were less than 0.05. The study also found out that both VOL13 and TBR13 were positively correlated with NPL13 (Non-Performing Loans). From the model, taking all factors (VOL13 and TBR13) constant at zero, NPL13 had an autonomous of 0.015. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL13 lead to an increase in NPL13 by 0.02 while a unit increase in TBR13 lead to a 0.002 increase in NPL13. This inferred that both Interest Rate Volatility and 91-Day Treasury Bill Rate contributed more to Non-Performing Loans portfolio of the listed commercial banks in the year 2013. The regression model drawn from table 4.38 above is presented below:

$$Y = 0.015 + 0.02VOL + 0.002TBR + 0.221$$

$$Y = 0.236 + 0.02VOL + 0.002TBR$$

#### 4.4 Summary and Interpretation of Findings

**Table 4. 39: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.966 <sup>a</sup>	.933	.915	.134241

Table 4.36 above depicts the overall model summary of regression analysis between two independent variables including TBR (91-Day Treasury Bill Rate) and VOL (Interest Rate Volatility) and a dependent variable namely NPL (Non-Performing Loans) for the extensive period between 2002 to 2013. The table showed that value of R was 0.966; the value of R square was 0.933 and the value of adjusted R square was 0.915 and the standard error estimate was .134241. From the findings, 91.5% of variations in Non-Performing Loans portfolio of listed commercial banks between the year 2002 to 2013 were explained by the two independent variables of the study namely Interest rate volatility and 91-Day Treasury Bill Rate. Also the positivity and the significance of the values of R depicts that the model is logic for the study.

**Table 4. 40: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.304	2	.152	5.629	.041 <sup>b</sup>
Residual	.250	9	.027		
Total	.554	11			

Table 4.40 shows the overall ANOVA output of the regression between two independent including TBR (91-Day Treasury Bill Rate) and VOL (Interest Rate Volatility) and a dependent variable namely NPL (Non-Performing Loans) for the years 2002 to 2013. On one hand table shows that in regression, the value of sum of squares is 0.304, the value of df is 2, the value of mean square is .152, the value of F is 5.629 and the significance value is 0.041. On the other hand in residual, the value of sum of squares is 0.250, the value of df is 9, the value of mean square is 0.027 hence making a total of .554 as a sum of squares and 11 as df. The study found out that F calculated is 5.629 while F tabulated

is 3.98. Since F calculated is greater than F tabulated, the study therefore established that the overall model was significant for all the years covered.

**Table 4. 41: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	3.816	.279		13.677	.000
VOL	.451	1.234	.081	.365	.004
TBR	.039	.067	.713	.582	.043

Table 4.41 above shows the coefficient values for the independent variables of the study for the extensive period of 2002 to 2013. According to the table, all the variables were significant as its significance value were less than 0.05. The study also found out that both VOL and TBR were positively correlated with NPL (Non-Performing Loans). From the model, taking all factors (VOL and TBR) constant at zero, NPL had an autonomous of 3.816. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL lead to an increase in NPL by 0.451 while a unit increase in TBR lead to a 0.039 increase in NPL. This inferred that both Interest Rate Volatility and 91-Day Treasury Bill Rate contributed more to Non-Performing Loans portfolio of the listed commercial banks between the years 2002 to 2013. The overall regression model drawn from table 4.38 above is presented below:

$$Y = 3.816 + 0.451VOL + 0.039TBR + 0.279$$

$$Y = 4.095 + 0.451VOL + 0.039TBR$$

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Summary of Study Findings**

For the year 2002, the study established that the value of R was 0.903; the value of R square was 0.815 and the value of adjusted R square was 0.773. Hence 77.3% of variations in Non-Performing Loans of listed commercial banks were explained by the two independent variables of the study. The value of F was 19.762 while F tabulated was 3.98. Since F calculated was greater than F tabulated, the study established that the model was therefore significant. The study also established that VOL02 (Interest Rate Volatility) was insignificant as its significance value was greater than 0.05 while TBR02 (91-Day Treasury Bill Rate) was significant as its significance value was less than 0.05. However, only TBR02 (91-Day Treasury Bill Rate) was positively correlated while VOL02 (Interest Rate Volatility) was negatively correlated with NPL02 (Non-Performing Loans). From the model, taking all factors (VOL02 and TBR02) constant at zero, NPL02 had an autonomous of 13.560. The data findings analyzed also showed that taking all other independent variables at zero, a unit increase in VOL02 lead to a decrease in NPL02 by 4.503. A unit increase in TBR02 lead to a 0.200 increase in NPL02.

For the year 2003, the study established that the value of R was 0.889; the value of R square was 0.790 and the value of adjusted R square was 0.746. From the findings, 74.6% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2003 were explained by the two independent variables of the study. The value of F calculated was 7.433 while F tabulated is 3.98. Since F calculated is greater than F

tabulated, the overall model was therefore significant. The study also established that both VOL03 (Interest Rate Volatility) and TBR03 (91-Day Treasury Bill Rate) were significant as their significance values were less than 0.05. Both TBR03 (91-Day Treasury Bill Rate) and VOL03 (Interest Rate Volatility) were positively correlated with NPL03 (Non-Performing Loans). From the model, taking all factors (VOL03 and TBR03) constant at zero, NPL03 had an autonomous of 13.849. The data findings analyzed also showed that taking all other independent variables at zero, a unit increase in VOL03 lead to an increase in NPL03 by 1.157. A unit increase in TBR03 lead to a 0.097 increase in NPL03.

For year 2004, the study established that the value of R was 0.918; the value of R square was 0.842 and the value of adjusted R square was 0.790. From the findings, 79.0% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2004 were explained by the two independent variables of the study. The value of F calculated was 4.800 while F tabulated is 3.98. Since F calculated was greater than F tabulated, the overall model is therefore significant. The study also established that both VOL04 (Interest Rate Volatility) and TBR04 (91-Day Treasury Bill Rate) were significant as their significance value were less than 0.05. The study also found out that both TBR04 (91-Day Treasury Bill Rate) and VOL04 (Interest Rate Volatility) were positively correlated with NPL04 (Non-Performing Loans). From the model, taking all factors (VOL04 and TBR04) constant at zero, NPL04 had an autonomous of 13.760. The data findings analyzed also showed that taking all other independent variables at zero, a unit increase in VOL04 lead to an increase in NPL04 by 6.791 while a unit increase in TBR04 lead to a 0.143 increase in NPL04.

For the year 2005, the study established that the value of R square was 0.758 and the value of adjusted R square was 0.703. From the findings, 70.3% of variations in Non-Performing Loans portfolio of listed commercial banks in the year 2005 were explained by the two independent variables of the study. The value of F calculated was 9.916 while F tabulated was 3.98. Since F calculated was greater than F tabulated, the model was therefore significant. The study further established that VOL05 (Interest Rate Volatility) was insignificant as its significance value was greater than 0.05 while TBR05 (91-Day Treasury Bill Rate) was significant as its significance value were less than 0.05. The study also found out that VOL05 (Interest Rate Volatility) was negatively correlated with NPL05 while TBR05 (91-Day Treasury Bill Rate) was positively correlated with NPL05 (Non-Performing Loans). From the model, taking all factors (VOL05 and TBR05) constant at zero, NPL05 had an autonomous of 7.727. The data findings analyzed also showed that taking all other independent variables at zero, a unit increase in VOL05 lead to a decrease in NPL05 by 0.268 while a unit increase in TBR05 lead to a 0.573 increase in NPL05.

For the year 2006, the study established that the value of R was 0.891; the value of R square was 0.793 and the value of adjusted R square was 0.744. From the findings, 74.4% of variations in Non-Performing Loans portfolio of listed commercial banks in the year 2006 were explained by the two independent variables of the study. The value of F calculated was 7.533 while F tabulated was 3.98. Since F calculated was greater than F tabulated, the overall model was therefore significant. The study also established that VOL06 (Interest Rate Volatility) and TBR06 (91-Day Treasury Bill Rate) were significant as their significance values were less than 0.05. The study also found out that

both VOL06 (Interest Rate Volatility) and TBR06 (91-Day Treasury Bill Rate) were positively correlated with NPL06 (Non-Performing Loans). From the model, taking all factors (VOL06 and TBR06) constant at zero, NPL06 had an autonomous of 11.175. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL06 lead to an increase in NPL06 by 0.539 while a unit increase in TBR06 lead to a 0.085 increase in NPL06.

The findings for the year 2007 established that the value of R was 0.866; the value of R square was 0.749 and the value of adjusted R square was 0.694. From the findings, 69.4% of variations in Non-Performing Loans portfolio of listed commercial banks in the year 2007 were explained by the two independent variables of the study. This shows that all the factors of the study were significant. The study found out that F calculated was 6.376 while F tabulated was 3.98. Since F calculated was greater than F tabulated, the overall model was therefore significant. The study also found out that TBR07 (91-Day Treasury Bill Rate) was significant as its significance value was less than 0.05 while VOL07 (Interest Rate Volatility) was insignificant as its significance value was greater than 0.05. The study also found out that VOL07 (Interest Rate Volatility) was positively correlated with NPL07 (Non-Performing Loans) while TBR07 (91-Day Treasury Bill Rate) was negatively correlated with NPL07 (Non-Performing Loans). From the model, taking all factors (VOL07 and TBR07) constant at zero, NPL07 had an autonomous of 14.618. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL07 lead to an increase in NPL07 by 0.224 while a unit increase in TBR07 lead to a 0.578 decrease in NPL07.



The findings for the year 2008 established that the value of R was 0.921; the value of R square was 0.848 and the value of adjusted R square was 0.799 and the standard error estimate was .49289. From the findings, 79.9% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2008 were explained by the two independent variables of the study namely Interest rate volatility and 91-Day Treasury Bill Rate. This shows that all the factors of the study were significant. The study found out that F calculated was 7.556 while F tabulated was 3.98. Since F calculated was greater than F tabulated, the overall model was therefore significant. The study further established that TBR08 (91-Day Treasury Bill Rate) was significant as its significance value was less than 0.05 while VOL08 (Interest Rate Volatility) was insignificant as its significance value was greater than 0.05. The study also found out that VOL08 (Interest Rate Volatility) was positively correlated with NPL08 (Non-Performing Loans) while TBR08 (91-Day Treasury Bill Rate) was negatively correlated with NPL08 (Non-Performing Loans). From the model, taking all factors (VOL08 and TBR08) constant at zero, NPL08 had an autonomous of 18.153. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL08 lead to an increase in NPL08 by 3.200 while a unit increase in TBR08 lead to a 1.145 increase in NPL08. 2008.

For the year 2009, the study established that the value of adjusted R square was 0.654 and the standard error estimate was .49982. From the findings, 65.4% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2009 were explained by the two independent variables of the study namely Interest rate volatility and 91-Day Treasury Bill Rate. This showed that all the factors of the study were significant. The

study found out that F calculated was 4.702 while F tabulated was 3.98. Since F calculated was greater than F tabulated, the overall model was therefore significant. The study further established that TBR08 (91-Day Treasury Bill Rate) was significant as its significance value was less than 0.05 while VOL08 (Interest Rate Volatility) was insignificant as its significance value was greater than 0.05. The study also found out that VOL08 (Interest Rate Volatility) was positively correlated with NPL08 (Non-Performing Loans) while TBR08 (91-Day Treasury Bill Rate) was negatively correlated with NPL08 (Non-Performing Loans). From the model, taking all factors (VOL08 and TBR08) constant at zero, NPL08 had an autonomous of 18.153. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL08 lead to an increase in NPL08 by 3.200 while a unit increase in TBR08 lead to a 1.145 increase in NPL08.

For year 2010, the study established that the value of R was 0.964; the value of R square was 0.930 and the value of adjusted R square was 0.914 and the standard error estimate was .16669. From the findings, 91.4% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2011 were explained by the two independent variables of the study namely Interest rate volatility and 91-Day Treasury Bill Rate. Also the positivity and the significance of the values of R depicts that the model is logic for that study. The study found out that F calculated was 9.668 while F tabulated was 3.98. Since F calculated was greater than F tabulated, the overall model was therefore significant. The study also established that TBR10 was significant as its significance value was less than 0.05 while VOL10 was insignificant as its significance value was greater than 0.05. The study also found out that TBR10 was positively correlated with NPL10

(Non-Performing Loans) while VOL10 was negatively correlated with NPL10 (Non-Performing Loans). From the model, taking all factors (VOL10 and TBR10) constant at zero, NPL10 had an autonomous of 6.357. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL10 lead to a decrease in NPL10 by 2.841 while a unit increase in TBR10 lead to a 0.285 increase in NPL10.

The findings for the year 2011 found out that the value of R was 0.964; the value of R square was 0.930 and the value of adjusted R square was 0.914 and the standard error estimate was .16669. From the findings, 91.4% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2011 were explained by the two independent variables of the study namely Interest rate volatility and 91-Day Treasury Bill Rate. Also the positivity and the significance of the values of R depicts that the model is logic for that study. The study found out that F calculated was 59.460 while F tabulated was 3.98. Since F calculated was greater than F tabulated, the overall model is therefore significant. The study further established that TBR11 was significant as its significance value was less than 0.05 while VOL11 was insignificant as its significance value was greater than 0.05. The study also found out that VOL11 and TBR11 were negatively correlated with NPL11 (Non-Performing Loans). From the model, taking all factors (VOL11 and TBR11) constant at zero, NPL11 had an autonomous of 6.176. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL11 lead to a decrease in NPL11 by 0.208 while a unit increase in TBR11 lead to a 0.097 decrease in NPL11.

The findings for the year 2012 found out that the value of R was 0.902; the value of R square was 0.813 and the value of adjusted R square was 0.782 and the standard error estimate was .12971. From the findings, 78.2% of changes in Non-Performing Loans portfolio of listed commercial banks in the year 2012 were explained by the two independent variables of the study namely Interest rate volatility and 91-Day Treasury Bill Rate. Also the positivity and the significance of the values of R depicts that the model is logic for the study. The study found out that F calculated is 5.25 while F tabulated is 3.98. Since F calculated is greater than F tabulated, the study therefore established that the overall model is significant. The findings further established that all the variables were insignificant as its significance value was greater than 0.05. The study also found out that VOL12 was negatively correlated with NPL12 (Non-Performing Loans) while TBR12 was positively correlated with NPL12 (Non-Performing Loans). From the model, taking all factors (VOL12 and TBR12) constant at zero, NPL12 had an autonomous of 4.408. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL12 lead to a decrease in NPL12 by 1.554 while a unit increase in TBR12 lead to a 0.015 increase in NPL12.

The findings for the year 2013 found out that the value of R was 0.869; the value of R square was 0.755 and the value of adjusted R square was 0.717 and the standard error estimate was .06583. From the findings, 71.7% of variations in Non-Performing Loans portfolio of listed commercial banks in the year 2013 were explained by the two independent variables of the study namely Interest rate volatility and 91-Day Treasury Bill Rate. Also the positivity and the significance of the values of R depicts that the model is logic for the study. The study found out that F calculated is 6.04 while F

tabulated is 3.98. Since F calculated is greater than F tabulated, the study therefore established that the overall model is significant. The study also established that all the variables were significant as its significance value were less than 0.05. The study also found out that both VOL13 and TBR13 were positively correlated with NPL13 (Non-Performing Loans). From the model, taking all factors (VOL13 and TBR13) constant at zero, NPL13 had an autonomous of 0.015. The data findings analyzed also showed that taking all other independent variables constant at zero, a unit increase in VOL13 lead to an increase in NPL13 by 0.02 while a unit increase in TBR13 lead to a 0.002 increase in NPL13.

## **5.2 conclusions**

This was an analytical study that adopted longitudinal approach, supplemented by cross-sectional comparisons. The study used data for the commercial banks listed at the NSE for the period (2002-2013) which was exposed to sensitivity analysis using OLS regression. The study established that from the overall regression model for the years 2002 to 2013, 91.5% of variations in Non-Performing Loans portfolio of listed commercial banks were explained by the two independent variables of the study namely Interest rate volatility and 91-Day Treasury Bill Rate. The study therefore concludes that the Interest rate volatility and 91-Day Treasury Bill Rate influenced the Non-Performing Loans portfolio of listed commercial banks for the years 2002 to 2013.

From the analysis, it can be noted that Non Performing Loans Portfolio had varying degrees. However, in general, Interest rate volatility and 91-Day Treasury Bill Rate had a high impact on Non-Performing Loans portfolio of listed commercial banks for the years

2002 to 2013. The effects of interest rate volatility and 91-Day Treasury Bill Rate on the Non-Performing Loans portfolio of listed commercial banks in Kenya however remained high whereby in some instances it was 91.5% on average. This shows that interest rate volatility and 91-Day Treasury Bill Rate greatly influence activities of the listed commercial banks. These findings are consistent with the empirical findings in an earlier study by Keeton and Morris (1999) who showed that local economic conditions along with the poor performance of certain sectors explain the variation in loan losses recorded by the banks. The study also reports that commercial banks with greater risk appetite tend to record higher losses.

### **5.3 Recommendations**

This study established that interest rate volatility and 91-Day Treasury Bill Rate play a key role on the Non-Performing Loans portfolio of listed commercial banks in Kenya. The study therefore recommends that the Country handles its macroeconomic variables appropriately as the changes in the macroeconomics like exchange rates and inflation bring about devaluation of the currency and affect the performance of the commercial banks.

This study also established that both interest rate volatility and 91-Day Treasury Bill Rate were positively correlated with Non performing Loans Portfolio of listed commercial banks in Kenya. The study therefore recommends that policies should be put in place to stabilize the performance of commercial banks in Kenya.

#### **5.4 Recommendations for Further Research**

The study investigated the interest rates volatility on nonperforming loans portfolio of listed commercial banks in Kenya. The financial Industry in Kenya however is comprised of various other financial institutions which differ in their way of management and have different setting. This warrants the need for another study to generalize the findings of all the financial institutions in Kenya. This Study therefore recommends another study be done with an aim to investigate the causes of Non-Performing Loans of Financial Institutions in Kenya.

The study also applied only two independent variables in determining the results, a further study can be carried out by including more independent variables to the regression model.

Lastly, twelve year of study was chosen. This study also recommends that a study be carried with the aim of increasing the period under study so as to come up with a comprehensive generalization.

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### **Appendix: Listed commercial banks in Kenya**

1. Barclays Bank Limited
2. I&M Holdings limited
3. CFC Stanbic Holding Ltd
4. Diamond Trust Bank Ltd
5. Housing Finance Co. Ltd
6. Kenya Commercial Bank Ltd
7. National Bank Ltd
8. NIC Bank Ltd
9. Standard Chartered Bank ltd
10. Equity Bank Ltd.
11. Co-operative Bank of Kenya Ltd