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**Impact of Monetary Policy Rates on Commercial Bank Lending Rates: Kenya Bankers
Reference Rate**

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**A research project submitted in partial fulfillment of the requirements for the award of a
degree in Bachelor of Business Science - Financial Economics**

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Definition of key terms and abbreviations:

Interest rate spread: The difference between interest charged on loans and the interest rate earned on deposits. It is also defined as the difference between expected return for lenders and costs faced by borrowers.

Money Markets Rates: Rates on short term financial instruments not administratively controlled by Central Bank.

External Finance Premium: The cost of funds raised externally less funds generated internally (Retained earnings)

CBK: Central Bank of Kenya.

CBR: Central Bank Rate. The interest rate charged on short term loan from the Central Bank of Kenya to commercial banks.

T-Bill: Treasury bill. A paper-less, short term borrowing instrument issued by the government of Kenya through the Central Bank to raise money on a short term basis.

KBRR: Kenya Bankers Reference Rate

LIBOR: London Interbank Offered Rate

EURIBOR: European Interbank Offered Rate

MPC: Monetary Policy Committee

ABSTRACT:

The purpose of this study was to find out the impact of monetary policy on commercial bank lending rate with a view of implementation of the Kenya Bankers' Reference Rate (KBRR). The key components of the KBRR; The 91 day T-Bill rate and the Central Bank Rate were the main focus of this study along with the interbank lending rate. This paper used an Autoregressive Distributed Lag (ARDL) Model to estimate the short run and long run impact of the 91 day T-bill Rate, Central Bank Rate and Interbank Lending Rate on the average commercial bank lending rate. Time series data from the Central Bank of Kenya was used for the period July 1991-May 2015. The study finds a significant positive relationship between the forenamed monetary policy rates and the commercial bank lending rate. The conclusion of this study is that the 91 day T-bill rate, interbank lending rate and Central Bank rate all have a positive impact on the commercial bank lending rate. The Central Bank Rate however, a key component of the KBRR, has the greatest and most immediate effect on the lending rate. This study recommends that more weight be allocated to the CBR rate than the 91 day T-bill rate in calculating the KBRR as well as a more regular review of the KBRR than the bi-annual one currently in place.

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CHAPTER ONE

1.0 Introduction:

1.1. Background to the study

A reference rate is a commonly used interest rate that links payments in a financial contract to standard money market interest rates. There is a large number of reference rates each serving a different purpose. (Committee, 2013) Reference rates are used in global financial system as bench marks for a large volume and broad range of financial products and contracts. (Board, July 2014)

Reference rates can be developed under private initiative without the intervention of the Central Bank. There are several reference rates under this classification including, the London Interbank Offering Rate (LIBOR), the HIBOR (Hong Kong) and SHIBOR (Shanghai) used mainly for by lenders and borrowers in the Asian Financial markets. The LIBOR is the average interest rate at which leading banks in London lend to each other in various different currencies and is the most commonly used reference rate globally. It is the primary bench mark for short term interest rates around the world.(Bender, 2014)

There are other cases where the Central Bank participates in the development of Reference rates such as the Equilibrium Interbank Interest Rate (TIIE) in Mexico, Uncollateralized Overnight Call Rate by the Bank of Japan and The Federal Funds Effective Rate in the United States of America. (Committee, 2013) The Federal Funds Rate is set by the Federal Reserve and is the interest rate charged on overnight loans by banks in the US. (Taylor & William, 2009) The Federal Funds Rate target is determined by the Federal Reserve's Monetary Committee which sets an objective to guide the daily conduct of Open Market Operations. This target rate is not an outcome of demand and supply of federal funds.(Hamilton & Jorda, 2002)

The are several benefits that come with the use of reference rates including reduced complexity of financial contracts as well as facilitating standardization of financial contracts because it acts as a primary benchmark rate. The use of a reference rate also lowers transaction costs and promotes market liquidity. (Committee, 2013)

There is increased transparency as a result of the use of an official reference rate which in turn saves monitoring market costs. (Xu & Johnsen, 2014)

Reference Rates are used globally to price credit products, derivatives, corporate contracts, in accounting, tax and capital practices as well as in valuation methods. (Board, July 2014) This study focused on credit products such as loans, short term money markets instruments and bonds, and on reference rates developed under the initiative of The Central Bank.

Kenya has experienced great reforms in the financial system with liberation of the financial institutions and markets; banks, insurance companies, and stock and bond market. The improved stability and efficiency of the banking system has been aided by reduced government interference in the financial sector and reduced inflation. The interest rate spread of commercial banks reduced from an average of 19% in 2002 to about 11% in 2008. (Beck, Cull, Fuchs, Getenga, Gatere, & M.Trandafir, 2010)

Even with all the developments in Kenya's financial system owed to improvement of the fiscal situation, the country has been unable to provide adequate access to banking services to the majority of the population. The banking system is still fragmented, with many small banks serving specific niches, but not contributing to competition in the industry.(Beck, Cull, Fuchs, Getenga, Gatere, & M.Trandafir, 2010) The Monetary Policy Committee of the Central Bank of Kenya argues that low lending rates are better for the economy by increasing demand for loans which in turn increases economic activity thus promoting economic growth. Low lending rates also decrease non-performing loans which in turn reduces the reserve requirement. (Banking Sector Stability, Efficiency and Outreach in Kenya, 2010)

In 2014, The Central Bank of Kenya through the Monetary Policy Committee introduced the Kenya Bankers' Reference Rate with an aim of controlling the high lending rates in the country. The KBRR is to act as a reference point in pricing loan products by commercial banks. High interest rates charged by banks hinder economic growth and push those with debt to default, to increase transparency in loan disclosure and increase competition as well as a result from the increased external borrowing through the sovereign bond. The KBRR has however had little effect on the lending rates: proven by the fact that as of January 2015 the average lending rate was 15.99% yet the KBRR was at 8.54% (CBK, 2015)

1.2. Statement of the Problem:

Governments in the world over use monetary policy rates as a tool to regulate commercial bank lending rate. However there are disagreements on which policy rates in particular have the most effect on commercial bank lending rates. Cottarelli (1994) argues that the use of Central bank Discount Rate as a monetary policy instrument reduces the response of lending rates while recommending the use of Treasury Bills Rate to enhance flexibility of commercial bank lending rates. Taylor & William (2009) make a case for use of Certificates of Deposits in equalizing the borrowing rates across instruments because they are a major source of deposits and thus affect the ability to lend by banks. Fuertes (2010) maintains the importance of the Central Bank Rate in influencing retail rates by banks. Matemilola (2014) argues that the repurchase rate is the most influential factor because of the direct effect it has on banks' ability to borrow money thus affecting lending activities.

There was need to examine which policy rate has the most effect on commercial bank lending rate with a view of implementation of the Kenya Bankers Reference Rate.

1.3. Aim:

The aim of this study was to identify the impact of monetary policy rates on lending rates of Commercial Banks in Kenya in the long and short run.

1.4. Research Objectives:

1. Determine the impact of monetary policy rates (Central Bank Rate, 91 days T-Bill Rate and Interbank lending rate) on the lending rates of commercial banks in Kenya in the long run and short run.
2. Examine the future effectiveness of the Kenya Bankers Reference Rate in regulating the lending rates of Commercial Banks in Kenya by analyzing previous performance of its components in regulating monetary policy.

1.5. Research Questions:

1. What is the impact of monetary policy rates (Central Bank Rate, 91 day T-Bill Rate and Interbank Lending rate) on the lending rates of commercial banks in Kenya in the long run and short run?
2. To what extent will the Kenya Bankers' Reference Rate be effective in regulating the lending rates of commercial banks in Kenya by analyzing previous performance of its components in regulating monetary policy?

1.6. Justification/Significance of Study:

This study will benefit Central Bank of Kenya by identifying the monetary policy rates with the most effect on commercial bank lending rates and thus provide a better foundation for the implementation of the KBRR whose main aim is to lower interest rates in Kenya.

Commercial banks are likely to gain from lower lending rates as a result of increased effectiveness of the KBRR because of increased demand for loans and reduction in non-performing loans.

Lastly, individual & institutional investors will gain from lower interest rates by increasing accessibility of credit thus increased economic activity and reduced default in paying back loans, this in turn promoting economic growth. Favorable interest rates to the forenamed institutions could also aid in the achievement of Vision 2030 goals.

CHAPTER TWO

Literature review:

2.0 Introduction:

There has been extensive literature written on the influence that monetary policy rates have on retail rates of Commercial Banks in various countries all over the world.

Reference rates remain important part of the interest rate channel in monetary policy transmission because of the link they offer with the Central Bank's policy rate. (Committee, 2013)

It is with this view that the Monetary Policy Committee of the Central Bank of Kenya introduced the Kenya Bankers' Reference Rate (KBRR) in June 2014, with an aim of controlling lending rates in the country. The KBRR comprises of the Central Bank Rate, the 91 day Treasury Bill Rate, and a risk component. The Central Bank Rate is the lowest rate of interest that the Central Bank charges on loans to banks as stipulated by the Central Bank of Kenya Act. It is reviewed and announced by the Monetary Policy Committee (MPC) at least every two months. The CBR is the base for all monetary policy operations and its movements and magnitude signal the monetary policy stance. Between May 2013 and May 2015, the committee has kept the rate at 8.50% (CBK, 2015)

The 91 Day Treasury bill is a debt obligation issued by the Central Bank of Kenya, on behalf of the Kenya Government, for 3 months at either a discount or face value, at a competitive auction on a weekly basis. (CBK 2015)

This study will focus on the Central Bank Rate, the 91 Day Treasury bill Rate, and the Interbank Lending rate, to determine the impact of monetary policy in Kenya with respect to lending rates, and find out the causes of the spread between these two interest rates and lending rates of Commercial Banks in Kenya.

Reference rates are however subject to manipulation by market participants, and could have unprecedented behavior in times of stress where effects could be exaggerated for participants

relying on one reference rate. Poorly conceived reference rates could also impair the Central Bank's ability to respond to financial fragilities. (Committee, 2013)

2.1. Impact of Monetary Policy Rates (CBR, 91 day T-bill and Interbank Lending Rate) on Commercial Bank Lending Rates

Cottarelli, Kaurelis (1994) suggest that the stickiness of bank lending rates with respect to money market rates presents an obstacle to the smooth transmission of monetary policy impulses because of the barriers to competition and slow development of financial markets. However, there have been changes in financial markets leading to introduction of various financial instruments such as futures, forwards, swaps and other securities traded in various security exchanges in the world. This has contributed in part to the influence of reference rates in financial markets.

As described by Cottarelli, Kaurelis (1994), stickiness of lending rates refers to the inelasticity of bank rates with respect to shifts in demand of loans and deposits. They further described money market rates as rates on short term financial instruments not administratively controlled by the Central Bank. They found that even with change in money market rates, bank rates change by a smaller amount in the short run and in the long run. This concurs with the study by Makambi, Wawire, Omolo (2013) whose findings were that in the Kenyan Market, lending rates were rigid upwards and adjust faster to a decrease in monetary policy while deposit rates were rigid downwards adjusting faster to an increase in monetary policy.

Cottarelli, Kaurelis (1994) argue there are several factors affecting the demand for loans such as the number of competitors, barriers to entry, and the presence of financial alternatives to bank loans, which in turn affects the interest rate charged on loans. Were, Wambua (2014) concur with these findings concluding further that there are also several determinants of bank rates stickiness including competition within the banking system; this refers to the market share of banks and the number of bank branches. Bank rate stickiness is also determined by the degree of development in the money market i.e. the openness of the economy, the banking system ownership, the development level of financial markets, the type of lending rate: prime or non prime.

2.1.1. Monetary Policy Stance

The Central Bank aims to manage liquidity through manipulation of Commercial Banks' credit.

Bernanke, Gertler (1995) and Stein, Anil (2000) agree that the lending channel is an important aspect of aggregate economic activity. Economic activity in any country is heavily influenced by the monetary stance of the government. It could be expansionary, neutral or contractionary. Though the aggregate loan supply consequences of monetary policy could be very substantial, their attempt to measure the impact is hampered by large estimation biases in big bank regressions.

Monetary policymakers use their leverage over short term interest rates to influence cost of capital and spending on durable goods such as fixed investment and housing. The Federal Funds Rate which is an overnight rate is the most closely controlled rate in the US and has weaker impact on long term rates. (Bernanke, Gertler 1995) However the Federal Funds Rate is the base rate that determines the level of other interest rates in the United States. (Bartolini, Bertola, & Prati, 2007)

The Central Bank through the Monetary Policy Committee effect monetary policy decisions by manipulating the Central Bank Rate and Reserve Requirement which is in turn transmitted to short term interest rates. In Kenya, the most targeted short term Interest Rates are the Central Bank Rate, the Repo Rate and the Interbank Rate. (Central Bank Rate, 2015)

Bernanke, Gertler (1995) suggest that changes in monetary policy, raising or lowering the Open Market Operations Interest Rate change the external finance premium in the same direction, thus affecting the cost of borrowing and consequently real spending and economic activity. Stein, Anil (2000) study the impact of monetary policy on lending rates of banks in the United States of America between 1976 and 1993. They found that unlike previous studies which suggested that in an M-M world banks are indifferent at margin between issuing transaction deposits and large Certificate of Deposits so that shocks to the former do not affect lending decision, the link between reservability and insurability breaks down the M-M theory and confirms that Open Market operations can matter for bank lending.

The effects of monetary expansion may be weaker than those of contraction ordinarily: more powerful in a restrictive environment than an expansionary one. (Fuertes, Hefferman, & Kalotychou, How Do U.K. Banks React to Changing Central Bank Rates, 2010)

Stein, Anil (2000) study the use of Open Market Operations to shift bank's loan supply schedule and conclude that Certificates of Deposits and Treasury bills enhance the flexibility of lending rates and that the use of Central Bank discount rate as a monetary policy reduces the response of lending rates. Also, banks whose customers' loan demand is more sensitive to monetary policy systematically opt to hold less in the way of liquid assets.

Commercial banks react to monetary policy by revising balance sheet i.e. assets and liabilities because it affects their ability to take loans and thus affects money supply. (Makambi, Wawire, & Omolo, 2013) It is also worth noting that an increase in the Treasury bill rate reduces bank deposits thus affecting availability of credit rather than cost. (Cottarelli & Kourelis, 1994)

The South African Reserve Bank adjusts the repo rate upwards to make it more expensive for banks to borrow money and thus lower lending activities. The repo rate is the repurchase rate at which the South Africa Reserve Bank buys back securities it has previously sold in the money market. (B.I.Matemilola, Ariffin, & Muhtar, 2014)

2.1.2. Size of the bank

Stein, Anil (2000) in their paper studying the impact of monetary policy on lending rates of banks in the United States of America between 1976 and 1993, concluded that monetary policy impact is stronger for banks with less liquid balance sheets than is the ratio of securities to assets. This study further concludes that large banks find it easy to raise funds unlike small banks and thus should be less dependent on Monetary Policy Shocks. This partly explains why an empirical study in Kenya by Were and Wambua (2014) found that the size of the bank played a role in determination of lending rates where large banks had a higher interest rate spread than smaller banks.

Stein & Anil (2000) established that small bank lending is more sensitive to monetary policy than large bank lending because large banks find it easy to raise (uninsured) funds and are thus less dependent on monetary policy shocks.

Habbard, Kuttner & Palia (2002) in their study of effects of changes in bank loan supply on the borrowers' cost of funds and investment decisions by borrowers found that low capital banks charged higher loan rates than well capitalized banks. Fuertes et al (2010) concur that well capitalized banks are less likely to fail, have lower funding costs and thus attract more customers.

The market power of banks also played a role in determining the lending rates of commercial banks. Banks with the greatest market power may price retail rates less competitively. (Fuertes, Hefferman, & Kalotychou, How Do U.K. Banks React to Changing Central Bank Rates, 2010)

2.1.3. Other bank specific factors affecting commercial bank lending rate

There are other factors that influence the lending rate chosen by banks other than the monetary policy rates and the size of the bank which are specific to the type of bank. The difference in return earned by lenders and the cost incurred by borrowers goes to show the extent to which there are market imperfections which consequently affects the real spending and activity in an economy. (Bernanke & Gertler, 1995)

Cottarelli (1994) discuss the extent to which the banking system ownership affects the lending rates by banks. He concludes that flexibility of commercial bank lending rates is enhanced by a private ownership of the banking system. This is reiterated by Subramanian (2014) who attributes the stickiness of commercial bank lending rates in India to the fact that 70% of banks in India are owned by the government.

There are risks that are passed on to borrowers by the bank. These include credit risk, inventory risk and liquidity risk. The credit risk is passed on to the borrower as a risk premium. Inventory risk refers to the risk arising from the difference between random intervals of bank deposits and stochastic like requests for loans. Liquidity risk refers to the risk that the bank may be unable to meet the needs of customers who come to withdraw money as a result of shortage of cash. Factors such as operating costs, return on average assets and the net interest income also play a role in determining the interest rate to be charged on loans by banks. (Were & Wambua, 2014)

The interest rate charged on loans by banks is also determined by the degree of capitalization of banks, where well capitalized banks are less likely to fail because they have lower funding costs and thus attract more customers. It is also worth noting that the degree of diversification

influences commercial bank lending rates. This diversification refers to non-interest income to average assets. The more diversified a bank is, the less responsive it is to monetary policy changes. (Fuertes, Hefferman, & Kalotychou, How Do U.K. Banks React to Changing Central Bank Rates, 2010)

2.1.4. Speed of adjustment of interest rates to lending rates

There are several ways that the economy responds to monetary policy shocks. First, unanticipated tightening on monetary policy causes transitory effect on interest rates and sustained declines in the Gross Domestic Product (GDP) and price levels. Secondly, final demand absorbs the initial impact of monetary tightening falling followed by declining demand but with a lag. Fixed business investments also decline but the lags fall behind those of housing and consumer durables. (Bernanke & Gertler, 1995)

It is expected that under perfect market conditions with no uncertainty, transmission should be immediate, one for one and symmetrical. It is important to note that interest rates assume perfect financial market conditions and commercial banks are passive agents who do not influence the level of money supply. (Bernanke, Gertler 1995) However, empirical studies in Kenya, South Africa and the United Kingdom all nullified this assumption.

(Makambi, Wawire & Omolo 2014) challenge the assumption that that monetary policy is transmitted to market interest rates instantaneously, linearly and symmetrically. In Kenya, Monetary policy transmission was ineffective as financial markets were dominated by few commercial banks and security growth stagnated during the 1980s and 1990s. Further as a result of the inefficiency of financial markets, adjustment of bank retail rates was sluggish and incomplete and adjustment to monetary policy by commercial banks retail rates was non-linear.

Fuertes and Hefferman (2010) in their study of the United Kingdom market found that the lending rates of banks were found to be rigid upwards; adjust faster to a decrease in monetary policy than an increase and deposit rates rigid downwards and adjust faster to an increase in monetary policy than a decrease.

In South Africa, there was also a non-uniform speed of monetary policy transmission where bank lending rates adjust during monetary policy expansion but do not adjust during contraction. (B.I.Matemilola, Ariffin, & Muhtar, 2014)

Discount rates play a major role in speeding up adjustment of lending rates to money market shocks. It is important to note that increase of Treasury bill rates reduces bank deposits affecting availability of credit rather than cost. The short term interest rate is driven by the demand for money being equal to the supply of money.

An increase in expected prices leads to an increase in inflation thus pushing down real interest rate. Most countries though have a large buffer government paper which counters the effects of deposit changes. (Cottarelli & Kourelis, 1994)

A single large policy rate change will tend to prompt much swifter deposit rates responses than several gradual changes. The adjustment speed varies proportionally to size of policy rate changes. Deposit rates adjustments tends to be faster when official rate is cut than when it is raised, which is opposite for mortgage rates. (Fuertes, Hefferman, & Kalotychou, How Do U.K. Banks React to Changing Central Bank Rates, 2010)

There are several causes of asymmetry such as menu costs, switching costs and imperfect information. Heterogeneity among financial intermediaries makes transmission mechanism difficult. Non linearity refers to any departure from conventional linear error correction model typically used to characterize dynamics of retail rates. (Fuertes, Hefferman, & Kalotychou, How Do U.K. Banks React to Changing Central Bank Rates, 2010)

2.2. Effectiveness of Reference Rates in regulating lending rates of Commercial Banks.

2.2.1. Development and components of Reference Rates

Reference rates should be composed of a risk free rate and a risk premium. This risk premium incorporates different kinds of risk such as term, liquidity or credit risk premium.(Committee, 2013). Board, (2014) reiterate this by recommending that reference rate should be based around the risk free rate in that country but should also incorporate credit risk thus calling for a premium above the risk free rate.

The Prime Lending Rate (PLR) developed by the Reserve Bank of India which was the main bench mark for loan pricing took into account actual cost of funds, operating expenses, capital charged and the profit margin earned by bank. After the failure of the PLR, it was replaced by the Benchmark Prime Lending Rate by the Indian Banks Association which allowed banks to

price loans both below and above this rate. It comprised of card interest rates adjusting for negative carry, overhead costs and the average return on net work. (Subramanian, 2009)

There are several qualities that all reference rates globally should possess. A good benchmark rate should be reliable across the various economic cycles: during economic boom and stress periods. This rate should be robust in the face of market dislocation and remain resilient in times of stress. (Board, July 2014) The bench mark rates should be safe guarded against market manipulation. It should also get rid of pricing errors across the financial markets and ensure that there is no transfer of risks related to banking industry costs. Board (2014) emphasizes that reference rates should be anchored in observable transactions. It should further be regularly reviewed and readily available or users. (Committee, 2013)

2.2.2. Review of Reference Rates

Reference rates serve as an important part of the interest rate channel in monetary policy transmission.

Most reference rates are usually composed of a risk free rate and a risk premium. However, different reference rates have different valuation structures: Some reference rates such as the LIBOR, EURIBOR, and TIIE are reviewed daily; others such as Swiss National Bank Operational Target are based on 3-month CHF Libor because of its key role in the Swiss economy. The link between reference rates and Central Bank's Policy Rate and the operational target is usually closest in the case of overnight rates such as LIBOR. (Committee, 2013)

This is however not the case for the Kenya Bankers Reference Rates as it is set to be reviewed bi-annually.

The LIBOR is set every working day by a selection of reference banks depending on supply, demand and market conditions. (Bender, 2014) WM/ Reuters fix which is the most commonly used bench mark in the global currency market is produced jointly on every working day by The World Markets Company and Thompson Reuters.

Makambi, Wawire & Omolo (2014) argue that a weak Monetary policy transmission stems from a disconnect between the Central Bank of Kenya and Commercial Banks. In the BIS Economic Consultative Committee paper, the committee suggests that an important part of the interest rate

channel in monetary policy transmission is the link between the reference rate, Central Bank's Monetary Policy rate and operational target. They conclude that the link is usually closest in the case of overnight rates. However this is not the scenario in Kenya: the KBRR is reviewed bi-annually and its components the Central bank reviewed once in two months while the 3-month average 91- day Treasury Bill Rate is used to adjust interest rates on loans and corporate bonds. (CBK 2015)

2.3 Conceptual framework

It is first important to establish a fundamental relationship between monetary policy rates and commercial bank lending rates so as to validate this study. The lending channel plays a role in monetary supply process and overall economic activity.

Researchers such as Fuertes *et al* (2006) and Misati *et al* (2011) have used the Monte-Klein profit maximization model to establish the relationship between monetary policy rates and commercial bank lending rates.

The banks' balance sheet is given by:

$$\text{Reserve (R) + Loans (L) = Deposit (D) + Settlement (S) (2.1)}$$

Thus deposits are given by:

$$D=R+L-S (2.2)$$

A key assumption of this model is that commercial banks issue out loans at interest rate i_L and deposits at the bank earn interest at interest i_D then it gives that the net interest income earned by banks is:

$$\text{Net interest income: } i_L L - i_D (R+L-S)..... (2.3)$$

Clearing of commercial bank loans is done by the Central Bank. If the balance falls below the required reserve at the central bank, then a liquidity penalty i_p is paid. :

$$i_p \theta (S - R)..... (2.4)$$

The above equation is the official policy rate multiplied by the difference between settlement balance and reserves.

Commercial banks also incur costs of managing loans. The managing cost is taken as:

$$\text{Managing cost} = \mu L \dots\dots\dots (2.5)$$

The profit maximization function $\pi(L, R)$ is a result of combining equations (2.3), (2.4) and (2.5):

$$\pi(L, R) = i_L - i_D(R + L - S) - i_P\theta(S - R) - \mu L \dots\dots\dots (2.6)$$

Profit maximizing commercial banks equate their marginal revenue to marginal cost. Therefore, first order conditions with respect to L and R yields:

$$\frac{\partial \pi(L, R)}{\partial L} = i_L - i_D - \mu = 0 \text{ Therefore } i_L - i_D = \mu \dots\dots\dots (2.7)$$

$$\frac{\partial \pi(L, R)}{\partial R} = -i_D + \theta i_P = 0 \text{ Therefore } i_D = \theta i_P \dots\dots\dots (2.8)$$

Equation 3.8 is then substituted into equation 2.7 to give:

$$i_L - \theta i_P = \mu$$

This enables the formation of a linear relationship between monetary policy rates represented by $i_P = MPR$ and commercial bank lending rate represented by i_L :

$$i_L = \theta i_P + \mu \dots\dots\dots (2.9)$$

2.4 Research Gaps

There have been other studies carried out in relation to this field that have provided great insight in preparation of this paper. However, there were gaps in their research that have facilitated the way forward for this study. Unlike Were, Wambua (2014) which focused on interest rate spread in commercial banks, this paper focused on the spread between monetary policy rates and commercial bank lending rates. Also, in contrast to Makambi, Wawire & Omolo (2013) which studied the dynamics of adjustment of commercial banks' retail rates, this study sought to validate the spread between monetary policy and bank lending rates to better implement the Kenya Bankers' Reference Rate. Taylor & William (2009) make a case for use of Certificates of Deposits in equalizing the borrowing rates across instruments because they are a major source of

deposits and thus affect the ability to lend by banks. Fuertes *et al.* (2010) suggests the use of the Central Bank Rate to influence lending rates in the UK while Matemilola *et al* (2014) argue that the repurchase rate is the most effective policy rate in regulating commercial bank lending rates. The differing views on the impact of specific monetary policy rates on commercial bank lending rates paved the way for this study.

CHAPTER THREE

Research Methodology

3.0 Introduction

This chapter introduces the methodology carried out in this study. This study sought to determine the impact of monetary policy on commercial banks' lending rate in Kenya.

3.1. Research Design

The research design appropriate for this study was quantitative and descriptive in nature. This study assumed a quantitative approach to establish the relationship between monetary policy rates and commercial bank lending rates. The research design was descriptive as it presented the state of affairs in the interest channel as they exist and the researcher had no influence over the selected variables and could only report on their movements.

3.2. Population

The population comprised of all commercial banks in Kenya. There are a total of about 46 banks in Kenya (Kenya Bankers Association, 2015)

3.4 Sampling

There was no need for sampling as the average commercial bank lending rate for the industry was used.

3.5 Data Collection

Secondary data which was the source of data for this study was collected from the Central Bank of Kenya's website. The CBK regularly publishes and stores regular data on the short term interest rates such as the Central Bank Rate, 91 Day Treasury bill Rate, the Interbank Rate, and the average lending rate of commercial banks in Kenya.

3.6 Data Analysis

The period that was used in this study was between July 1991 and May 2015, with the aim of establishing the effect that monetary policy has had on commercial bank lending rates over the different economic cycles that Kenya has gone through over that period.

In order to analyze the relationship between monetary policy rates and commercial bank lending rates, the Autoregressive Distributed Lag Model (ARDL) was used to capture both the long run and short run relationship between monetary policy rates enabled by its single reduced form equations. The ARDL model was also appropriate for this study because it allows the use of different optimal lags with limited available data. This is because the changes in monetary policy rates affect the commercial bank lending rate with a lag i.e. the changes are not translated into the lending rate immediately but after a certain period of time. Key components of the KBRR which are the Central Bank Rate and The 91 Day Treasury Bill Rate were used to examine the effect that they have had over the years on commercial bank lending rates and the likely effects they are to have.

The Model:

$$L_t = \beta_0 + \sum_{i=0}^t \beta_1 T_{t-i} + \sum_{i=0}^t \beta_2 I_{t-i} + \sum_{i=0}^t \beta_3 C_{t-i} + \epsilon_t$$

Where:

L_t = Average Commercial bank lending rate

T_t = 91 day Treasury bill Rate

I_t = Inter-Bank Lending rate

C_t = Central Bank Rate

3.6. Definition and Measurement of Variables

Table 1: Description and measurement of variables in this study

Variable	Definition	Measurement
Commercial bank lending rate	This refers to the industry average interest rate charged on loans by commercial banks	This is the dependent variable.
Central Bank Rate	The interest rate charged on Central Bank of Kenya loans to commercial banks.	Dictated by the Monetary Policy Committee of the CBK based on the monetary stance of the government.
Treasury Bill Rate	The interest rate charged on short term borrowing by the CBK from investors or general public	Dictated by the Issuer of the bill i.e. the government
Interbank Rate	The interest rate charged on short term loans that commercial banks issue to each other.	Determined by availability of money in the market, prevailing rates and specifics in the contract.

CHAPTER FOUR

Findings and Interpretation of Results:

4.0 Introduction:

This chapter presents the empirical findings of this study. The sections in this chapter have been divided based on the different empirical tests that were carried out towards achieving the research objectives of this study.

4.1. Impact of monetary policy rates on commercial bank lending rate:

4.1.1 Stationarity and co-integration tests

Each of the variables in the study was tested for stationarity using the Augmented Dickey Fuller approach (ADF) at 5 per cent confidence interval. These results are shown in table 1 with more technical and detailed explanations given in Appendices 1-4.

Variable	ADF Test	t-statistic	Critical Value	Stationarity
Commercial Bank Lending Rate	Intercept	-1.626	-2.88	Not stationary
	Intercept	-7.78	-2.88	Stationary I(1)
Interbank Lending Rate	Intercept	-2.74	-2.88	Not Stationary
	Intercept	-3.83	-2.88	Stationary I(1)
91 Day Treasury Bill Rate	Intercept	-3.06	-2.88	Stationary I(0)
Central Bank Rate	Intercept	-3.01	-2.88	Stationary I(0)

Table 1: Stationarity Tests Results

4.1.2 Co-integration Tests

The long run relationship among the different variables was estimated in accordance with the equation presented in Chapter 3. The study uses a maximum of 4 lags but allows for automatic selection of the best fitting ARDL model. The lags were restricted to 4 because of limited data.

4.1.3 The Long Run and Short Run Dynamics: Aggregate Analysis of interest rate behavior

Table 2 shows the short run and long run dynamics of the interest rates from June 2006 to May 2015. Table 3 shows the short run and long run relationship for interest rates for the same time period but accounting for inflation and exchange rate effects. Table 4 show the short run and long run dynamics of the interest rates since July 1992 until June 2015 using Central Bank Rate as a dummy variable.

Data was analyzed on a monthly basis.

4.1.3.1: Long run and short run relationship between 2006-2015

Table 2: Long run and short run dynamics between 2006 and 2015

ARDL Cointegrating And Long Run Form

Dependent Variable: LENDING

Selected Model: ARDL(3, 3, 3, 4)

Date: 11/02/15 Time: 18:46

Sample: 1 109

Included observations: 104

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LENDING(-1))	-0.258234	0.097860	-2.638801	0.0099
D(LENDING(-2))	-0.132537	0.094719	-1.399267	0.1653
D(I_BANK)	-0.013934	0.016659	-0.836442	0.4052
D(I_BANK(-1))	0.053403	0.016945	3.151530	0.0022
D(I_BANK(-2))	-0.053930	0.018685	-2.886260	0.0049
D(_91_DAY_RATE)	0.026124	0.031641	0.825611	0.4113
D(_91_DAY_RATE(-1))	-0.049654	0.047036	-1.055661	0.2940
D(_91_DAY_RATE(-2))	0.069423	0.031706	2.189554	0.0312
D(C_B_RATE)	0.235808	0.051755	4.556225	0.0000
D(C_B_RATE(-1))	0.122081	0.074041	1.648819	0.1028
D(C_B_RATE(-2))	0.216048	0.074562	2.897568	0.0048
D(C_B_RATE(-3))	-0.079511	0.048150	-1.651328	0.1023
CointEq(-1)	-0.044636	0.022721	-1.964492	0.0527

$$\text{Cointeq} = \text{LENDING} - (-0.0941 * \text{I_BANK} + 0.2250 * \text{_91_DAY_RATE} + 0.9201 * \text{C_B_RATE} + 6.6076)$$

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
I_BANK	-0.094088	0.569278	-0.165275	0.8691
_91_DAY_RATE	0.225014	0.576211	0.390506	0.6971
C_B_RATE	0.920145	0.681022	1.351124	0.1802
C	6.607560	4.043523	1.634110	0.1058

Short Run Analysis:

The Interbank Lending rate has an insignificant impact on the commercial bank lending rate at the first lag: that means a month after the adjustment of the interbank lending rate. It however has a significant and positive relationship with the lending rate in the following month with a 5.34 per cent change in lending rate for a 1 per cent change in the interbank rate. The following month, the third lag, however has contradictory results with a 5.4 per cent decrease in the lending rate for a 1 per cent change in the interbank rate.

The 91 day Treasury bill Rate has an insignificant impact on the lending rate at the first and second month following the change in the T-bill rate. It however has a positive and significant relationship with commercial bank lending rate with a 6.9 per cent change in lending rate for a 1 per cent change in the T-Bill rate at the third lag.

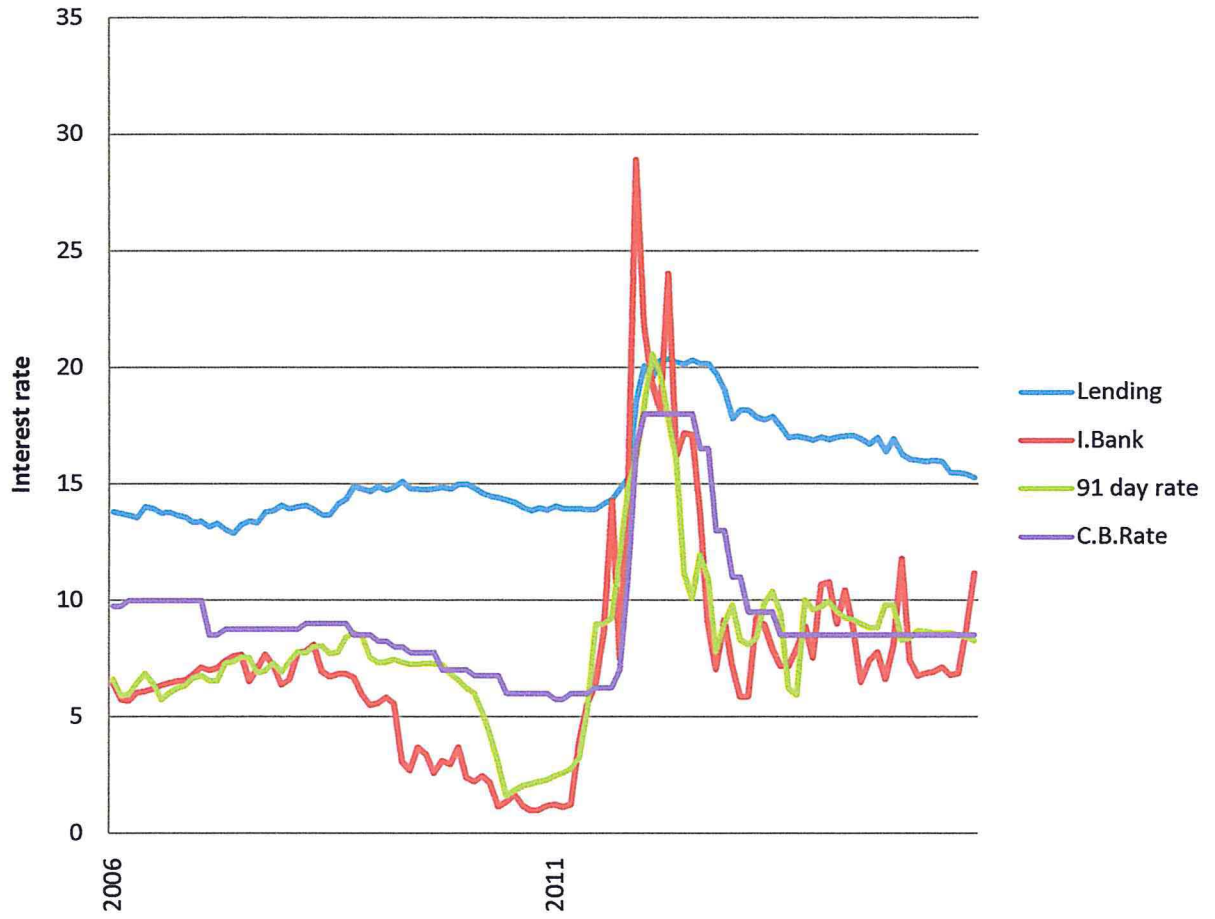
The Central Bank Rate also has an immediate, positive and significant impact on the lending rate with a 23.58 per cent change in the lending rate resulting from a 1 percent change in the CBR.

The error correction term in the above short run commercial bank lending rate model is negative and significant. A significant coefficient of the error correction term indicates long run Granger causality running from the explanatory to the dependent variables. The coefficient of ECM (-1) in the model was -0.0446, which implies that the deviation from the long-term in economic growth is corrected by 4.46 per cent in the coming month. The speed of adjustment is extremely slow at 4.46 per cent from month to month.

Long Run Analysis:

The Interbank lending rate, the Central Bank Rate, and the 91 day Treasury Bill Rate, all have an insignificant impact on commercial bank lending rate in the long run. At the 95 per cent confidence interval, p values for all variables were greater than the critical value thus proving their insignificance.

Interest rate movement between 2006-2015



ARDL Cointegrating And Long Run Form
 Dependent Variable: LENDING
 Selected Model: ARDL(3, 3, 0, 4, 0, 1)
 Date: 11/02/15 Time: 19:01
 Sample: 1 113
 Included observations: 104

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LENDING(-1))	-0.272923	0.098001	-2.784911	0.0066
D(LENDING(-2))	-0.187082	0.096291	-1.942875	0.0553
D(I_BANK)	-0.011622	0.015909	-0.730502	0.4670
D(I_BANK(-1))	0.047857	0.016818	2.845562	0.0055
D(I_BANK(-2))	-0.045177	0.017594	-2.567707	0.0119
D(_91_DAY_RATE)	0.020688	0.020840	0.992712	0.3236
D(C_B_RATE)	0.186931	0.049862	3.748977	0.0003
D(C_B_RATE(-1))	0.057544	0.071887	0.800487	0.4256
D(C_B_RATE(-2))	0.226262	0.072868	3.105076	0.0026
D(C_B_RATE(-3))	-0.069441	0.047724	-1.455078	0.1492
D(INFLATION)	0.017581	0.007463	2.355829	0.0207
D(USD_KES)	-0.037034	0.017593	-2.105038	0.0382
CointEq(-1)	-0.092753	0.037049	-2.503532	0.0142

$$\text{Cointeq} = \text{LENDING} - (-0.1488 * \text{I_BANK} + 0.2230 * \text{_91_DAY_RATE} + 0.5548 * \text{C_B_RATE} + 0.1895 * \text{INFLATION} + 0.1148 * \text{USD_KES} - 0.6596)$$

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
I_BANK	-0.148772	0.261615	-0.568669	0.5710
_91_DAY_RATE	0.223040	0.225575	0.988762	0.3255
C_B_RATE	0.554807	0.291903	1.900655	0.0607
INFLATION	0.189542	0.120241	1.576342	0.1186
USD_KES	0.114766	0.038917	2.948974	0.0041
C	-0.659563	3.773301	-0.174797	0.8616

Short Run Analysis:

Inflation and the exchange rate of the Kenyan Shilling against the dollar were introduced as extra variables for the same time period to see if they had an impact on the commercial bank lending rate.

The interbank rate only has a significant impact at the 3rd lag i.e. 3 months after this policy was adjusted. For a one percent change in this policy rates, the commercial bank lending rate increases by 4.7 per cent.

Central Bank Rate has an immediate and significant impact on the commercial bank lending rate. A one percent change in the CBR results in an 18.6 per cent change in the commercial bank lending rate. At the 3rd lag, the CBR has an even larger effect on the commercial bank lending rate with a 22.6% increase in the lending rate from a 1 per cent change in the CBR.

The 91 day Treasury bill rate has an insignificant impact on the lending rate.

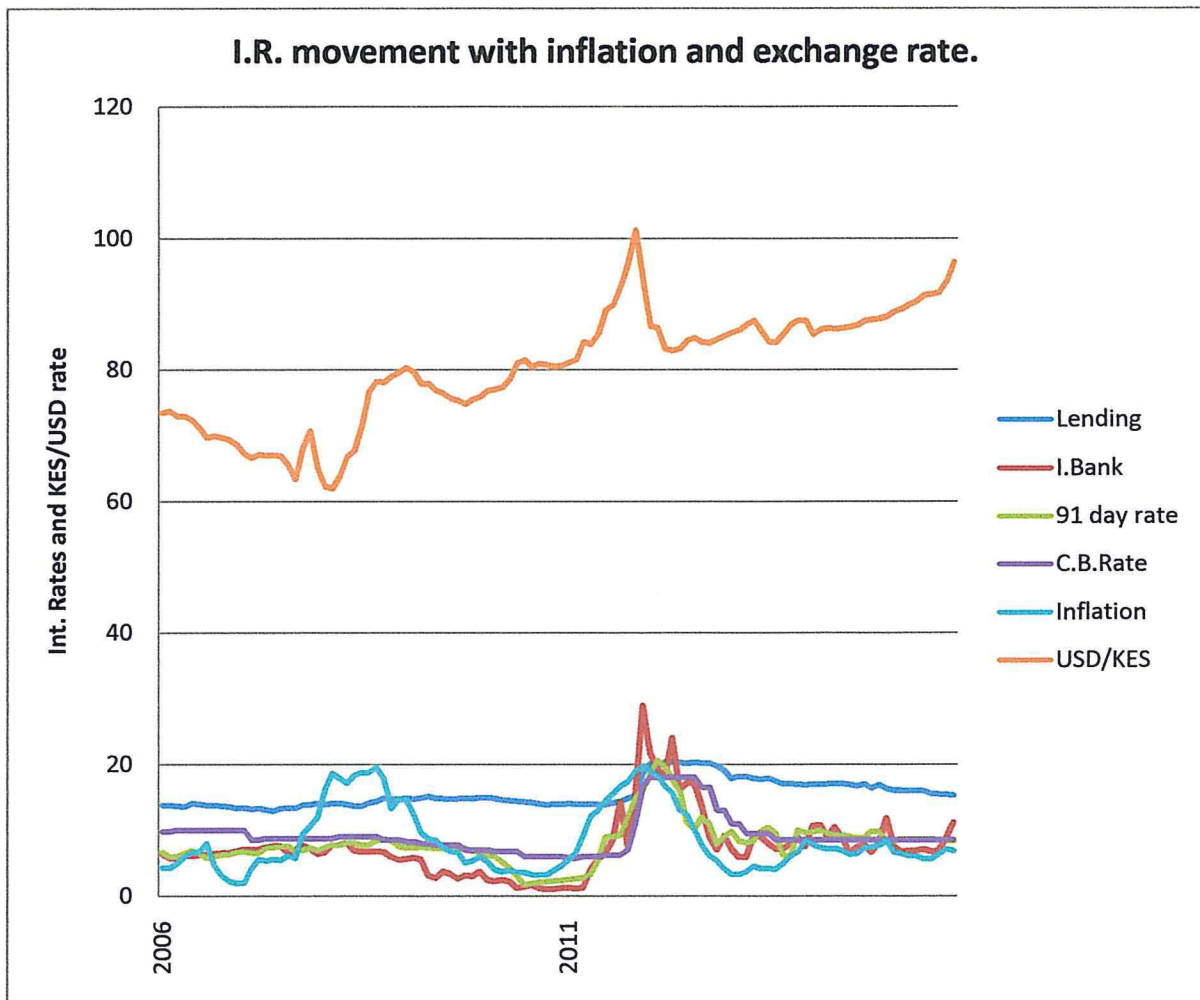
Inflation has positive and significant relationship with the commercial bank lending rate: a one per cent increase in inflation results in a 1.7 per cent change in the lending rate

The Exchange rate however has a negative, significant impact on the commercial bank lending rate. One per cent appreciation of the exchange rate causes a 3.7 per cent decrease on the lending rate.

Just as was the case for the same time period but inputting inflation and exchange rate, the ECM coefficient is negative and significant. The coefficient in the model was -0.0928, which implies that the deviation from the long-term interest rate is corrected by 9.28 per cent in the coming month. This is higher than was the case without accounting for inflation and exchange rate of the Shilling to the US Dollar.

Long Run Analysis:

The Interbank Rate, the 91-day Treasury Bill Rate, the Central Bank Rate and the Inflation rate all have an insignificant relationship with the commercial bank lending rate in the long run. The Exchange rate however has a positive and significant impact on the commercial bank lending rate at 5 per cent confidence interval.



4.2. Future effectiveness of the Kenya Bankers Reference Rate: Previous Analysis of key components of KBRR

4.2.1 Long run and Short Run Relationship between 1991 and 2015 with CBR as a dummy variable.

Table 4: Interest rate dynamics between 1991 and 2015

ARDL Co integrating And Long Run Form

Dependent Variable: LENDING

Selected Model: ARDL(1, 4, 4)

Date: 11/07/15 Time: 13:19

Sample: 2006M06 2015M05

Included observations: 108

Co integrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INTERBANK)	0.052399	0.015904	3.294694	0.0014
D(INTERBANK(-1))	0.086898	0.017722	4.903413	0.0000
D(INTERBANK(-2))	-0.016405	0.017868	-0.918091	0.3609
D(INTERBANK(-3))	0.045197	0.016157	2.797402	0.0062
D(_91_DAY_TBILL)	0.037658	0.036489	1.032036	0.3047
D(_91_DAY_TBILL(-1))	-0.083995	0.058770	-1.429220	0.1562
D(_91_DAY_TBILL(-2))	0.145957	0.055432	2.633068	0.0099
D(_91_DAY_TBILL(-3))	-0.096545	0.035777	-2.698510	0.0082
D(DCBR)	0.071667	0.028014	2.558284	0.0121
CointEq(-1)	-0.080528	0.025058	-3.213726	0.0018

Cointeq = LENDING - (-0.4504*INTERBANK + 0.7648*_91_DAY_TBILL + 0.8900*DCBR + 4.5892)

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTERBANK	-0.450449	0.402027	-1.120444	0.2653
_91_DAY_TBILL	0.764845	0.385437	1.984357	0.0501
DCBR	0.889957	0.452824	1.965347	0.0523
C	4.589249	3.014805	1.522237	0.1313

Short Run Analysis:

The interbank lending rate has positive and significant impact on the commercial bank lending rate. For every 1 percent change in the interbank rate, there is 5.24 per cent change in the lending rate immediately. For the one month lag, there is even a more significant impact with an 8.6 per cent increase in the lending rate for a one percent change in the lending rate. The third lag is insignificant while the following lag allows a 4.5 per cent change in the lending rate from a one per cent change in the interbank lending rate.

For the 91 day T-bill rate, it is insignificant at the first two lags. There is initially a 14.5 per cent increase in the lending rate from a one percent change in the T-bill rate while a 9.6 decrease in the lending rate in the following month.

The introduction of the Central Bank Rate as a dummy variable and being back dated to 1991 in line with the other policy rates has had a significant the impact in influencing the commercial bank lending rate.

In the short run, the ECM co-efficient is negative and significant. The coefficient in the model was -0.080528, which implies that the deviation from the long-term lending rate is corrected by 8.0528 per cent in the coming month. This is lower than was the case between 2006 and 2015 after the introduction of the Central Bank Rate as a policy rate.

Long Run Analysis:

The Interbank Rate has an insignificant relationship with the commercial bank lending rate in the long run. The 91-day Treasury Bill Rate has a positive relationship with the commercial bank lending rate which is significant in the long run.

Introduction of the CBR as a dummy variable has been of significant impact on the commercial bank lending rate in the long run.

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATIONS:

5.0 Introduction:

The purpose of this study was to examine the impact of the monetary policy rates in Kenya on the Commercial Bank Lending Rates with a view of implementing the Kenya Bankers' Reference Rate. (KBRR) This is because the newly formulated KBRR which comprises of policy rates was set up to guide the pricing of credit products by banks.

5.1.1: Impact of monetary policy rates; Central Bank Rate, 91 days T-Bill Rate, and Interbank Lending Rate on the lending rates of commercial banks in Kenya

This study found that the 91 day Treasury bill rate, the Central Bank Rate and the interbank lending rate, all had positive effects on the commercial bank lending rate in the short run. In the long run however, all the policy rates were found to be of insignificant effect to the commercial bank lending rate.

Bernanke and Gertler (1995) found that short term policy rates in the United States had great influence in controlling interest rates: The Federal Reserve used the Federal Funds Rate to regulate commercial bank lending rate though it also did not have much impact in the long run. Similarly, Fuertes *et. al* (2010) found that adjustments to the short term monetary policy rates in the United Kingdom such as the Central Bank Discount Rate had great impact on commercial bank lending rates. In South Africa, B.I. Matemilola, Ariffin & Muhtar (2014) also found that the Reserve Bank used short term policy rates to regulate lending activities by commercial banks with main focus on the South African Reserve Bank's Repo rate.

When inflation and exchange rate were introduced as additional variables between 2006 and 2015, it was evident that inflation had a positive effect on commercial bank lending rate while the exchange rate has a negative effect on the lending rate. The speed of adjustment of commercial bank lending rates to policy rates is also extremely slow at below 10%.

5.1.2.: Future effectiveness of the Kenya Bankers Reference Rate in regulating the lending rates of Commercial Banks in Kenya

The KBRR comprises of two policy rates; The 91 Day T-bill Rate and the Central Bank Rate.

The T-bill rate adjustments took the longest of the three policy rates to reflect changes in the commercial bank lending rate, unlike the Central Bank Rate which was found to have the most immediate effect on the commercial bank lending. Among the three policy rates, adjustments to the CBR also caused the greatest change in commercial bank lending rate.

Contrary to these findings in the Kenyan context, Stein and Anil (2000) found that in the U.S., the treasury bills were the most effective monetary policy instrument in influencing commercial bank lending rate, and thus the Federal Reserve resorted to Open Market Operations to influence commercial bank lending rates. Fuertes *et. al.* (2010) however found that the Central Bank Discount Rate was the most powerful instrument in the U.K. in controlling commercial bank lending rate. This is similar to the Kenyan scenario where the CBR has the fastest and greatest impact on commercial bank lending rate

The CBR should therefore be the main policy tool used by the Central Bank of Kenya to regulate commercial bank lending rate through the Kenya Bankers' Reference Rate.

5.2 Conclusion:

5.2.1: Impact of monetary policy rates; Central Bank Rate, 91 days T-Bill Rate and Interbank lending rate on the lending rates of commercial banks in Kenya

This study finds that in Kenya, monetary policy rates have a positive and short term effect on the commercial bank lending rate but there exists no major long run relationship between these interest rates. The 91 day T-Bill rate, the Central Bank Rate and the interbank lending rate all have significant positive impact on the commercial bank lending rate. Adjustments on the 91 day T-bill rate take the longest time to be reflected in the commercial bank lending rate, followed by the interbank lending rate, while the Central Bank Rate had an immediate effect on the lending rate.

5.2.2: Future effectiveness of the Kenya Bankers Reference Rate in regulating the lending rates of Commercial Banks in Kenya

The Central Bank Rate stood out as the short term policy rate with the greatest effect on the commercial bank lending rate. The changes to the lending rate also took place immediately after the adjustment of the CBR by the Central Bank of Kenya. This is unlike the 91 day T-bill and Interbank rates which took a while before their adjustments reflected in the commercial bank lending rate. This goes to prove that to effectively implement the KBRR and thus lower the commercial bank lending rates; the Central Bank of Kenya needs to pay close attention to the CBR adjustments.

5.3 Recommendations:

It is evident from the analysis that the adjustments to the CBR had the greater and faster impact on the commercial bank lending rate when compared to the 91 day T-bill rate, as key components of the KBRR. Therefore, more weighting should be given to the CBR in calculating the optimum reference rate to be used by the commercial banks in Kenya in pricing their credit products and thus increase the effectiveness of this reference rate.

The KBRR is currently reviewed only twice per annum yet its component policy rates are reviewed more regularly. The CBR is reviewed by the MPC at least once every two months and adjusted in accordance with the prevailing market conditions while the T-bills are sold weekly at

prevailing rates. To make the KBRR more effective, the Central Bank of Kenya should consider reviewing it more regularly than the current biannual system.

5.4 Areas for Further Research:

There is room for further research in bank specific factors such as bank size, ownership type and degree of capitalization that affect the spread between monetary policy rates and commercial bank lending rates. This study focused on the average commercial bank lending rate as provided by the Central Bank of Kenya and not individual bank characteristics. Such research could shed more light on the interest channel in Kenya.

Additionally, more research could be carried out to determine if less frequently used monetary policy tools such as the 182 day T-bill rate and the repurchase “repo” rate have any impact on the commercial bank lending rate.

5.5 Limitations:

The limitation of this study was that it looked at the industry average commercial bank lending rate and did not get into bank specific factors that may be hindering effective transmission of policy rates to bank retail rates.

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APPENDICES:

Appendix 1: Stationarity test for Central Bank Rate

Null Hypothesis: CBR has a unit root
 Exogenous: Constant
 Lag Length: 4 (Automatic based on SIC, MAXLAG=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.008859	0.0373
Test critical values:		
1% level	-3.494378	
5% level	-2.889474	
10% level	-2.581741	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(CBR)
 Method: Least Squares
 Date: 10/28/15 Time: 09:03
 Sample (adjusted): 2006M11 2015M06
 Included observations: 104 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CBR(-1)	-0.076947	0.025573	-3.008859	0.0033
D(CBR(-1))	0.465247	0.096401	4.826149	0.0000
D(CBR(-2))	0.221324	0.101881	2.172374	0.0322
D(CBR(-3))	-0.260595	0.103262	-2.523632	0.0132
D(CBR(-4))	0.283857	0.098908	2.869915	0.0050
C	0.719533	0.246641	2.917329	0.0044
R-squared	0.347268	Mean dependent var		0.000000
Adjusted R-squared	0.313965	S.D. dependent var		0.866025
S.E. of regression	0.717305	Akaike info criterion		2.229329
Sum squared resid	50.42357	Schwarz criterion		2.381890
Log likelihood	-109.9251	F-statistic		10.42763
Durbin-Watson stat	1.973466	Prob(F-statistic)		0.000000

Appendix 2: Stationarity test for Inter Bank Lending Rate

Null Hypothesis: D(IBR) has a unit root
 Exogenous: Constant
 Lag Length: 3 (Automatic based on SIC, MAXLAG=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.834372	0.0036
Test critical values: 1% level	-3.494378	
5% level	-2.889474	
10% level	-2.581741	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(IBR,2)
 Method: Least Squares
 Date: 10/28/15 Time: 09:02
 Sample (adjusted): 2006M11 2015M06
 Included observations: 104 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IBR(-1))	-0.917985	0.239409	-3.834372	0.0002
D(IBR(-1),2)	-0.272262	0.204778	-1.329550	0.1867
D(IBR(-2),2)	-0.466866	0.149268	-3.127710	0.0023
D(IBR(-3),2)	-0.294316	0.097216	-3.027457	0.0031
C	0.067188	0.226038	0.297241	0.7669
R-squared	0.650624	Mean dependent var		0.005288
Adjusted R-squared	0.636508	S.D. dependent var		3.821846
S.E. of regression	2.304203	Akaike info criterion		4.554230
Sum squared resid	525.6258	Schwarz criterion		4.681364
Log likelihood	-231.8199	F-statistic		46.09060
Durbin-Watson stat	2.008027	Prob(F-statistic)		0.000000

Appendix 3: Stationarity test for 91 day Treasury Bill Rate

Null Hypothesis: TBILL has a unit root
 Exogenous: Constant
 Lag Length: 3 (Automatic based on SIC, MAXLAG=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.059874	0.0328
Test critical values:		
1% level	-3.493747	
5% level	-2.889200	
10% level	-2.581596	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(TBILL)
 Method: Least Squares
 Date: 10/28/15 Time: 09:00
 Sample (adjusted): 2006M10 2015M06
 Included observations: 105 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TBILL(-1)	-0.090967	0.029729	-3.059874	0.0028
D(TBILL(-1))	0.534232	0.090357	5.912445	0.0000
D(TBILL(-2))	-0.336731	0.095859	-3.512777	0.0007
D(TBILL(-3))	0.401125	0.091246	4.396070	0.0000
C	0.739040	0.256706	2.878939	0.0049
R-squared	0.327253	Mean dependent var		0.017238
Adjusted R-squared	0.300343	S.D. dependent var		1.162631
S.E. of regression	0.972488	Akaike info criterion		2.828530
Sum squared resid	94.57333	Schwarz criterion		2.954909
Log likelihood	-143.4978	F-statistic		12.16108
Durbin-Watson stat	1.972118	Prob(F-statistic)		0.000000

Appendix 4: Stationarity Test for Commercial Bank Lending Rate

Null Hypothesis: D(Y) has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic based on SIC, MAXLAG=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.780194	0.0000
Test critical values:		
1% level	-3.492523	
5% level	-2.888669	
10% level	-2.581313	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(Y,2)
 Method: Least Squares
 Date: 10/28/15 Time: 08:47
 Sample (adjusted): 2006M08 2015M06
 Included observations: 107 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Y(-1))	-0.732176	0.094108	-7.780194	0.0000
C	0.012769	0.041944	0.304437	0.7614
R-squared	0.365679	Mean dependent var		0.002710
Adjusted R-squared	0.359638	S.D. dependent var		0.541923
S.E. of regression	0.433661	Akaike info criterion		1.185406
Sum squared resid	19.74648	Schwarz criterion		1.235366
Log likelihood	-61.41924	F-statistic		60.53141
Durbin-Watson stat	2.024695	Prob(F-statistic)		0.000000

Explanation for stationarity tests:

Stationarity tests have to be conducted to ensure that the data has a constant mean, variance and that its statistical properties remain constant over time thus giving meaningful results after analysis. If data is not stationary at any point, it would have a non-constant mean and variance which would make the researcher draw wrong conclusions from the data analysis. A series is defined as $I(0)$ if in its natural form it has a constant mean and variance making it stationary at level and this is the desired result. If during the first stage of the ADF test the data is found to be non-stationary, then it can be differenced once to make it stationary. Differencing computes for changes in the series from one consecutive period to another ensuring that the properties in the series are constant over time. Differencing a non-stationary series to make it stationary would mean that the series would then be integrated of order one i.e. $I(1)$. If it is still non stationary, it may need to be differenced once more to make it stationary thus making the series integrated of order two i.e. $I(2)$.

According to the ADF test, the Central Bank Rate and the 91-day Treasury Bill Rate were found to be $I(0)$ which means that they were stationary in their natural state while the Inter-bank Lending Rate and Commercial Bank Lending Rate were found to be $I(1)$. This means that they had to be differenced once to make the series stationary.

The ADF tests for stationarity were conducted at 5% confidence level. For a series to be taken as stationary at level, the t-statistic had to be greater than the critical value. This applied for the Central Bank Rate and the 91 day T-bill rate but was not the case for the Interbank Lending Rate and Commercial Bank Lending Rate which had to be differenced once to make them stationary

An ARDL process could therefore be used to estimate the model because the variables chosen were either $I(0)$ or $I(1)$. From our tests, the dependent variable was found to be $I(1)$ and independent variables were either $I(0)$ or $I(1)$: The CBR and 91 day T-bill rate were $I(0)$ while the Interbank lending rate was found to be $I(1)$ using the AIC criterion with an intercept at 5% significance level.

Appendix 5: Regression for interest rates between 2006-2015

Dependent Variable: Y
 Method: ARDL
 Date: 10/27/15 Time: 09:19
 Sample (adjusted): 2006M10 2015M06
 Included observations: 105 after adjustments
 Maximum dependent lags: 4 (Automatic selection)
 Model selection method: Akaike info criterion (AIC)
 Dynamic regressors (4 lags, automatic): IBR CBR TBILL
 Fixed regressors: C
 Number of models evaluated: 500
 Selected Model: ARDL(3, 3, 4, 3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Y(-1)	0.698100	0.099635	7.006571	0.0000
Y(-2)	0.125678	0.116082	1.082671	0.2819
Y(-3)	0.131350	0.094014	1.397132	0.1659
IBR	-0.014167	0.016527	-0.857236	0.3936
IBR(-1)	0.008489	0.016908	0.502042	0.6169
IBR(-2)	-0.053649	0.016808	-3.191925	0.0020
IBR(-3)	0.054531	0.018339	2.973512	0.0038
CBR	0.233928	0.050609	4.622297	0.0000
CBR(-1)	0.067420	0.075984	0.887292	0.3773
CBR(-2)	-0.122901	0.073522	-1.671609	0.0982
CBR(-3)	-0.218328	0.073275	-2.979583	0.0037
CBR(-4)	0.081049	0.047267	1.714704	0.0899
TBILL	0.027058	0.031121	0.869440	0.3870
TBILL(-1)	0.003533	0.045485	0.077664	0.9383
TBILL(-2)	0.049580	0.046777	1.059915	0.2921
TBILL(-3)	-0.069325	0.031529	-2.198766	0.0305
C	0.295182	0.285763	1.032962	0.3045
R-squared	0.986683	Mean dependent var		15.57210
Adjusted R-squared	0.984261	S.D. dependent var		2.045633
S.E. of regression	0.256632	Akaike info criterion		0.264837
Sum squared resid	5.795668	Schwarz criterion		0.694526
Log likelihood	3.096055	Hannan-Quinn criter.		0.438955
F-statistic	407.4980	Durbin-Watson stat		1.903242
Prob(F-statistic)	0.000000			

*Note: p-values and any subsequent tests do not account for model selection.

Appendix: 6 Regression for interest rates between 2006-2015 including Inflation and exchange Rate

Dependent Variable: LENDING

Method: ARDL

Date: 10/29/15 Time: 11:52

Sample (adjusted): 5 108

Included observations: 104 after adjustments

Maximum dependent lags: 4 (Automatic selection)

Model selection method: Akaike info criterion (AIC)

Dynamic regressors (4 lags, automatic): I_BANK_91_DAY_RATE

C_B_RATE INFLATION USD_KES

Fixed regressors: C

Number of models evaluated: 12500

Selected Model: ARDL(3, 3, 0, 4, 0, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LENDING(-1)	0.634324	0.097434	6.510276	0.0000
LENDING(-2)	0.085841	0.112933	0.760107	0.4492
LENDING(-3)	0.187082	0.096291	1.942875	0.0553
I_BANK	-0.011622	0.015909	-0.730502	0.4670
I_BANK(-1)	0.000502	0.016399	0.030621	0.9756
I_BANK(-2)	-0.047857	0.016818	-2.845562	0.0055
I_BANK(-3)	0.045177	0.017594	2.567707	0.0119
_91_DAY_RATE	0.020688	0.020840	0.992712	0.3236
C_B_RATE	0.186931	0.049862	3.748977	0.0003
C_B_RATE(-1)	0.078895	0.078152	1.009505	0.3155
C_B_RATE(-2)	-0.057544	0.071887	-0.800487	0.4256
C_B_RATE(-3)	-0.226262	0.072868	-3.105076	0.0026
C_B_RATE(-4)	0.069441	0.047724	1.455078	0.1492
INFLATION	0.017581	0.007463	2.355829	0.0207
USD_KES	-0.037034	0.017593	-2.105038	0.0382
USD_KES(-1)	0.047679	0.019125	2.492949	0.0146
C	-0.061177	0.344233	-0.177718	0.8594
R-squared	0.987178	Mean dependent var		15.57298
Adjusted R-squared	0.984819	S.D. dependent var		2.055519
S.E. of regression	0.253260	Akaike info criterion		0.239638
Sum squared resid	5.580224	Schwarz criterion		0.671894
Log likelihood	4.538814	Hannan-Quinn criter.		0.414758
F-statistic	418.6231	Durbin-Watson stat		1.849736
Prob(F-statistic)	0.000000			

*Note: p-values and any subsequent tests do not account for model

Appendix 7: Regression for interest rates between 1992-2015

Dependent Variable: LENDING

Method: ARDL

Date: 11/02/15 Time: 19:57

Sample (adjusted): 5 287

Included observations: 283 after adjustments

Maximum dependent lags: 4 (Automatic selection)

Model selection method: Akaike info criterion (AIC)

Dynamic regressors (4 lags, automatic): INTERBANK_91_DAY_TBILL

Fixed regressors: C

Number of models evaluated: 100

Selected Model: ARDL(4, 1, 3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LENDING(-1)	1.099859	0.059159	18.59157	0.0000
LENDING(-2)	-0.046126	0.087293	-0.528403	0.5977
LENDING(-3)	0.004684	0.087135	0.053752	0.9572
LENDING(-4)	-0.101401	0.055814	-1.816776	0.0704
INTERBANK	0.022489	0.010330	2.176979	0.0303
INTERBANK(-1)	-0.018101	0.011127	-1.626793	0.1049
_91_DAY_TBILL	0.015497	0.019751	0.784612	0.4334
_91_DAY_TBILL(-1)	0.072102	0.036262	1.988371	0.0478
_91_DAY_TBILL(-2)	-0.118843	0.036282	-3.275577	0.0012
_91_DAY_TBILL(-3)	0.055020	0.018107	3.038702	0.0026
C	0.447326	0.140625	3.180981	0.0016
R-squared	0.990989	Mean dependent var		19.41417
Adjusted R-squared	0.990658	S.D. dependent var		5.812630
S.E. of regression	0.561815	Akaike info criterion		1.722804
Sum squared resid	85.85288	Schwarz criterion		1.864500
Log likelihood	-232.7767	Hannan-Quinn criter.		1.779619
F-statistic	2991.420	Durbin-Watson stat		1.999966
Prob(F-statistic)	0.000000			

*Note: p-values and any subsequent tests do not account for model selection.

Appendix 8: CBR as a dummy variable 1991-2015 analysis

Dependent Variable: LENDING

Method: ARDL

Date: 11/06/15 Time: 15:05

Sample (adjusted): 2006M06 2015M05

Included observations: 108 after adjustments

Maximum dependent lags: 4 (Automatic selection)

Model selection method: Akaike info criterion (AIC)

Dynamic regressors (4 lags, automatic): INTERBANK _91_DAY_TBILL

Fixed regressors: DCBR C

Number of models evaluated: 100

Selected Model: ARDL(1, 4, 4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LENDING(-1)	0.919472	0.025058	36.69429	0.0000
INTERBANK	0.052399	0.015904	3.294694	0.0014
INTERBANK(-1)	0.027017	0.018567	1.455131	0.1489
INTERBANK(-2)	-0.086898	0.017722	-4.903413	0.0000
INTERBANK(-3)	0.016405	0.017868	0.918091	0.3609
INTERBANK(-4)	-0.045197	0.016157	-2.797402	0.0062
_91_DAY_TBILL	0.037658	0.036489	1.032036	0.3047
_91_DAY_TBILL(-1)	-0.010650	0.054954	-0.193800	0.8467
_91_DAY_TBILL(-2)	0.083995	0.058770	1.429220	0.1562
_91_DAY_TBILL(-3)	-0.145957	0.055432	-2.633068	0.0099
_91_DAY_TBILL(-4)	0.096545	0.035777	2.698510	0.0082
DCBR	0.071667	0.028014	2.558284	0.0121
C	0.369565	0.334633	1.104389	0.2722
R-squared	0.980585	Mean dependent var		15.50259
Adjusted R-squared	0.978132	S.D. dependent var		2.048793
S.E. of regression	0.302971	Akaike info criterion		0.562125
Sum squared resid	8.720165	Schwarz criterion		0.884974
Log likelihood	-17.35473	Hannan-Quinn criter.		0.693028
F-statistic	399.8369	Durbin-Watson stat		2.028063
Prob(F-statistic)	0.000000			

*Note: p-values and any subsequent tests do not account for model selection.