EFFECTS OF INTEREST RATE ON BANK SECTOR ASSET QUALITY IN KENYA

BY

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December, 2021

DECLARATION

I declare that this work's originality remains undisputed as my own, and has not been submitted to any other institution for the award of degree.

Signature:  Date: 10th December, 2021

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This research report has been submitted for examination with my approval as the University supervisor.

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DEDICATION

This research report is dedicated to my parents, Mr. and Mrs. Kiboi for the continued support and prayers throughout my studies. Secondly, to brothers and sisters for believing in me and supporting me throughout the period. Finally, to all my friends who provided advice, support and encouragement during the process.

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Grateful to my friends and colleagues who dedicated time to review and offer feedback on this thesis. Special thanks to Peris Wachira.

LIST OF ACRONYMS

ARCH	Autoregressive Conditional Heteroscedasticity
ARDL	Autoregressive Distributed Lag Model
BSAQ	Bank sector asset Quality
CBK	Central Bank of Kenya
CBR	Central Bank Rate
ECM	Error Correction Method
ECT	Error Correction Term
FSD	Financial Sector Deepening
GDP	Gross Domestic Product
IMF	International Monetary Fund
KIPPRA	Kenya Institute for Public Policy Research and Analysis
MTP	Medium Term Plan
NPL	Non-Performing Loans
OLS	Ordinary Least Squares
PP	Phillips-Perron
SIC	Schwarz Information Criterion
SMEs	Small – Medium Enterprises
SSA	Sub-Saharan Africa
VAR	Vector Autoregressive

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Abstract

In the Kenya vision 2030, financial services were designated as one of the six key priority sectors within the plan framework. The plan framework was introduced in 2008 to be implemented through a series of medium-term plans. The Medium-Term Plan 1 identifies the promotion of private sector credit and improvement of financial sector performance as the major actions to stimulate economic growth for the attainment of an annual target rate of 10 per cent. Commercial banks occupy the largest proportion accounting for 49.5 per cent of the financial sector. This makes the performance of the bank sector to be a key element in driving investment through mobilization of both domestic and international resources. Loans are not only the major income-generating but also the major asset in the banking industry, accounting for an ordinary 50 per cent of the bank total assets (CBK,2019). The quality of the stock of bank loans is a pointer of bank sector credit risk and asset quality.

This research aimed at establishing how the bank sector asset quality is affected by the rate of interest. Bank sector loan assets served as a proxy to bank sector assets. Specifically, this paper sought to examine the nature of causality and to determine the relationship on interest rate and the bank asset quality. The study also examined the effect in short and long term. To achieve the study objective, the study utilized monthly data over the period January 2015 to February 2020. The study adopted Granger causality and ARDL F bound test to establish the nature of causality and the correlation between the interest rate and bank sector asset quality. The long- and short-run impact of the rate of interest was examined using the ARDL model. The findings suggested bi-directional causality between bank asset quality and interest rate in Kenya. In addition, a relationship was established between bank asset quality and interest rate in the long-run. In the short-run, asset quality was significantly and negatively affected by interest rate. This effect turned positive in the long-run suggesting a deterioration of asset quality an increase in the rate of interest. To achieve the targeted level of bank asset quality of 5%, the study recommends for lower interest rate in the banking sector.

CHAPTER ONE

INTRODUCTION

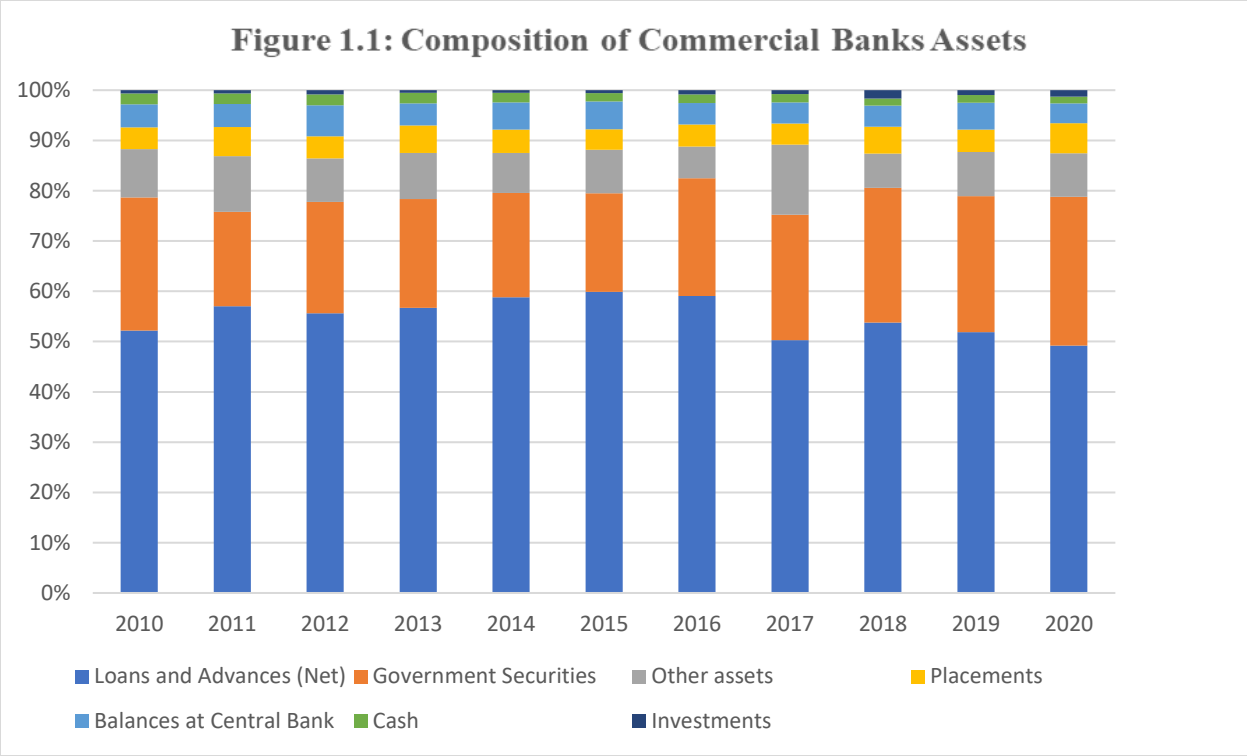
1.1 Background to the Study

The financial sector is important within the economy. It supports a country's aggregate demand, hence, a key economic growth stimulus (Levine, 1997). This is by encouraging technical innovations and economic growth through the provision of financial intermediaries' function which involves channeling savings into productive investment. Kenya identifies Financial Sector as one of the major Vision 2030 growth pillars through its financing of the investment role (The Republic of Kenya, 2010). Moreover, according to Medium Term Plan (MTP) 1, a vibrant and globally competitive financial sector is key to poverty reduction and job creations since it ensures macroeconomic stability and promotes private sector development (The Republic of Kenya, 2008). Thus, the performance of the financial sector is crucial in achieving 10% and 7% as envisioned in the Kenya Vision 2030 and MTP III, respectively.

The banking industry occupies the largest proportion of Kenya's financial sector, accounting for 49.5% of nominal GDP in 2018 (CBK, 2018). Other industries in the sector include; pensions, capital markets, insurance, and Saccos. The public and private sectors obtain financial services from the financial sector. The sector also makes it possible for funds from depositors to reach borrowers. Moreover, the banking industry acts as a platform whereby the Central Bank of Kenya (CBK) implements monetary policy. Therefore, banking industry operations and performance are crucial for a country's financial sector stability.

1.1.1 Composition of Kenya's Banking Sector Assets

Bank loans form an important component of bank assets since they generate interest income which evaluates a bank's financial performance and stability (Abata & Adeolu, 2014). Moreover, figure 1.1 shows that bank loans (net advances) are the major banks' assets and occupies more than 50 per cent of the total commercial bank assets. Other commercial bank assets include; government securities, fixed assets, tangible and intangible assets, account receivable, and cash and deposit balances in banks and financial institutions. Moreover, CBK uses bank loan quality to measure the commercial banks' asset quality and assess the bank's credit risk (CBK,2017). Thus, maintaining a good bank loan quality is significant for achieving better bank performance, maintaining a stable financial sector, and resilient economic growth of a country.



Source of data: Annual Bank supervision Report, CBK (Various Issues)

1.1.2 Sources of Credit in Kenya

Credit enables households, government, and organization to smoothen their consumption and investment patterns. Credit availability and access converge to an increase in aggregate demand, hence, strong economic growth. There are various sources of credit in Kenya; formal and informal (FSD,2019).

Table 1.1 shows that the demand for credit from the informal and formal sectors has been growing since 2006. This is reflected by an increase in credit uptake from all sources of credit. Personal bank loan proportion rose from 1.8 per cent in 2006 to 4.3 per cent in 2019. This was a decline from 4.4 per cent in 2016 which can be attributed to a shift in demand for credit towards mobile banking loans and digital loan apps. The main source of credit in 2018 and 2019, irrespective of interest cap, was from informal specifically from shopkeepers, family/friends, and digital loan app, which can be attributed to low cost or zero cost of borrowing.

Table 1.1: Credit Uptake in Kenya (%)

Formal					
	2006	2009	2013	2016	2019
Personal Bank Loan	1.8	2.6	3.6	4.4	4.3
House/land Bank/Building society loan	0.5	0.2	0.9	0.6	0.3
Overdraft	0.3	0.2	0.5	0.4	0.2
Credit Card	0.8	0.8	1.8	1.2	0.5
Mobile Banking Loan	_	_	_	5.9	9.5
Sacco Loan	4.2	3.1	4	5	5.1
MFI loan	0.8	1.8	1.6	1.8	0.9
Government Loan	0.9	0.3	0.6	1.3	1.3
Hire Purchase	0.6	0.1	0.2	0.1	0.6
Informal					
Employer Loan	0.9	0.5	1	5.1	1.4
Chama Loan	1.7	1.8	6	8.3	8
Informal Moneylender	0.7	0.4	0.4	0.4	0.5
Shopkeeper	22.8	24.3	5.5	9.9	29.7
Buyer Credit	0.9	1.2	1.1	0.3	1
Digital Loan Apps	_	_	_	_	8.3
Family/Friend/Neighbor Loan	12.6	12.2	5.2	6.6	10.1

Source: 2019 FinAccess Household Survey.

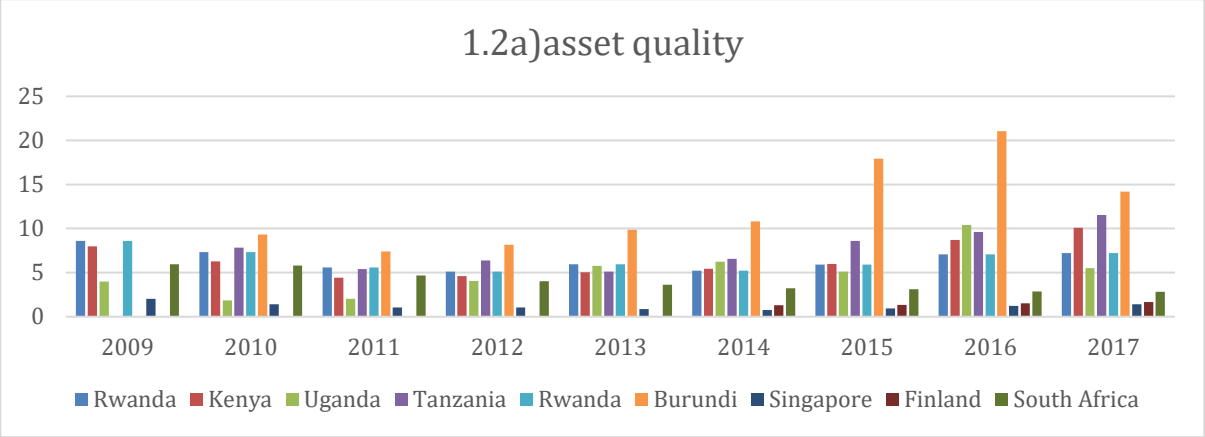
1.1.3 Bank Sector Asset Quality

Bank sector asset quality is one of the measures of banks' credit risks and can be used to evaluate the health of individual banks. Every bank is mandated to retain asset quality not in excess of 5% (CBK, 2010). An NPL is any credit that has not been serviced for at least 90 days (Ariff, 2007). Poor bank asset quality is as a result of high default risks by borrowers and leads to reduced profits as banks are required to make loan provision to protect themselves from bank failure (Wandera, 2013). Literature shows that substandard bank asset quality is also linked with bank failure. For instance, it is due to poor asset quality that 37 banks collapsed in Kenya in the 1980's and 1990's following banking crises (Mwega,2009).

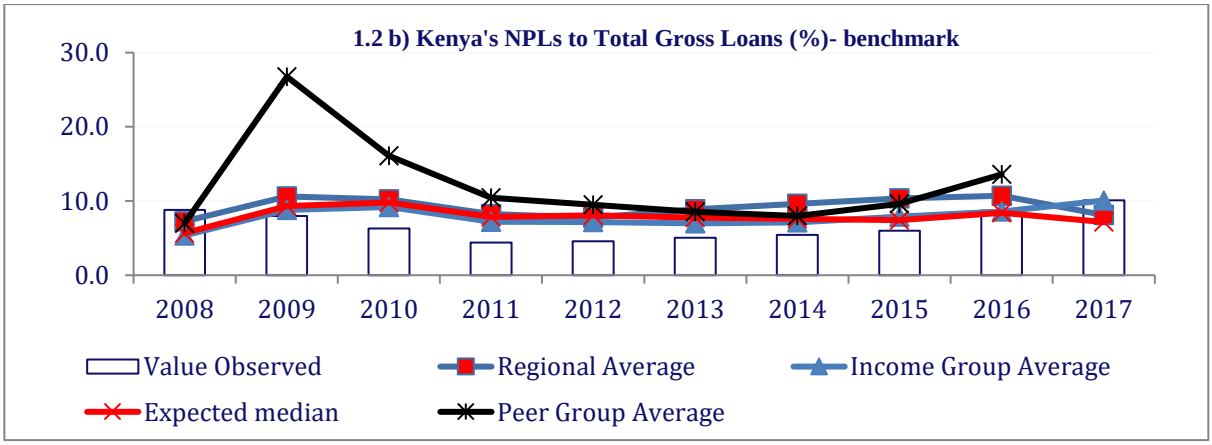
Based on figure 1.2a, poor bank asset quality in the banking industry is also a problem in other parts of the World. Figure 1.2a also shows that Burundi's banking industry continues to have the poorest asset quality since 2010, among the reviewed countries. South Africa and Finland have managed to maintain a quality asset status. Figure 1.2 b indicates that Kenya has maintained a better bank sector asset quality compared to lower-middle income countries within the sub-

Saharan Africa region up until 2016 when the bank sector asset quality deteriorated and surpassed the expected median.

Figure 1.2: Cross-region/country Bank Sector Asset Quality Comparison



Source of Data: World Bank Data Indicator,2018



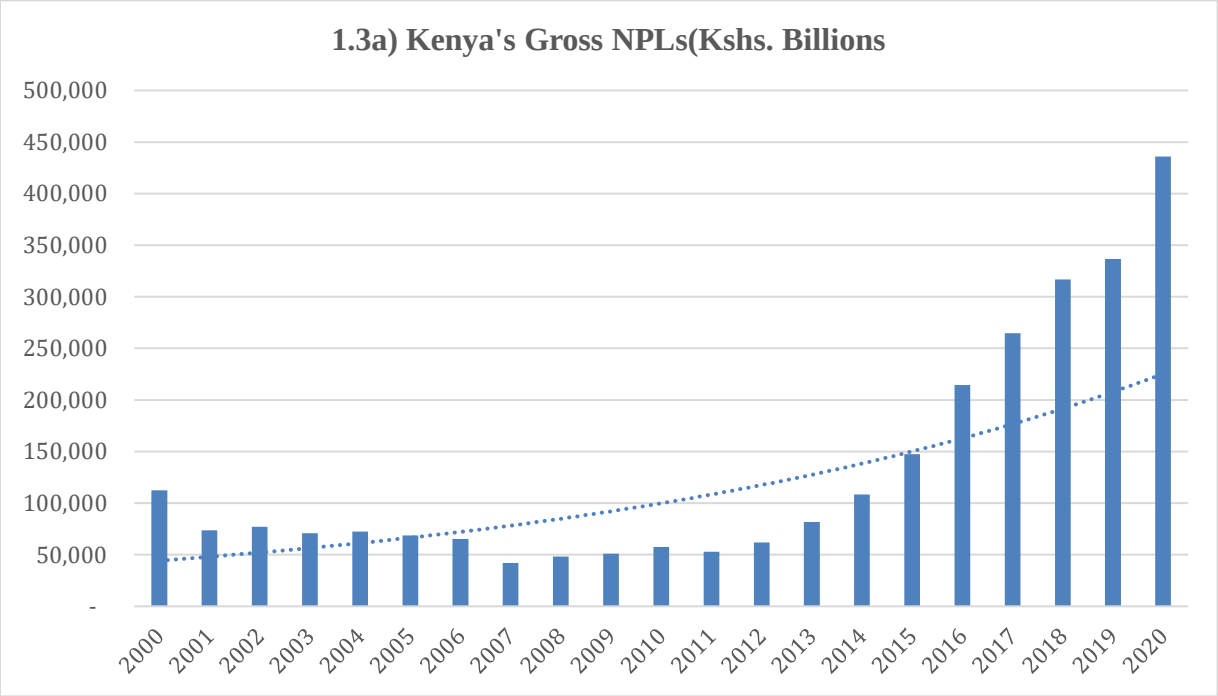
Source: Finstats 2019(IMF)

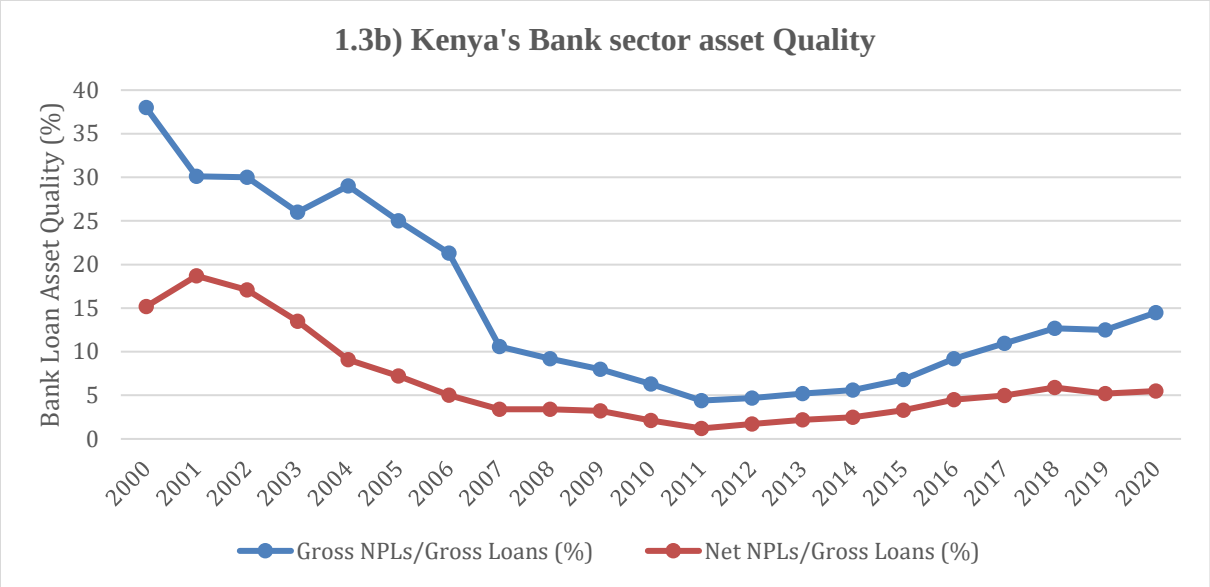
Kenya's banking industry gross NPLs have been increasing since 2007. Figure 1.3 a and b specifies two phases of NPLs and asset quality; phase one which is characterized by declining NPLs and improving asset quality (2001-2007) and phase two (2008-2018) which is characterized by increasing NPLs and deteriorating asset quality. Phase one can be attributed to NPLs resolutions, recoveries, write off of 2 banks, and enhanced credit appraisal standards by the CBK. The upward trajectory in banks NPLs accompanied by deteriorating bank sector asset quality in the second

phase could be ascribed to slow economic growth in the period and high-interest rates following 2013 general elections, poor/ unreliable weather conditions, 2017 general elections shock, reclassification and provision of loans and delayed payments by public entities following the alignment of National Government operations and the County government according to the Constitution of Kenya (2010) in 2013.

Figure 1.3b shows that bank loan asset quality has been deteriorating since 2011 and currently the ratio remains above the CBK target of 5 per cent. For example, bank sector asset quality deteriorated from 1.2% in 2011 to 4.96% in 2017 before deteriorating further to 5.9% in 2018. This is irrespective of government efforts to maintain stability and improve banks' performance. The bank loan asset quality improved in 2019 to 5.2 per cent before further deteriorating to 5.5 per cent in 2020.

Figure 1.3: Trends of Bank Sector Asset Quality in Kenya





Source of Data: Annual Bank Supervisory Report (Various Issues)

Kenya's government has been committed to promoting the performance of the financial sector. For example: in 1990, the financial sector was liberalized to allow interest rates to be determined by the market, reduce interest rates spread, improve interest rate margin, increase competition, and thus, promote its performance. However, the interest rates spread remained as high as 10 per cent contributing to the high cost of borrowing and crowding out private investment among them Small-Medium Enterprises (SMEs). Following these negative impacts on the financial sector, the government enacted and implemented Interest Rate Cap Bill -The Banking (Amendment) Act, 2016 whose main aim was to: make credit affordable to common man, reduce interest spread and improve the performance of the financial sector. Interest rate cap involved imposing an upper margin of 4% for lending rate above the bank (CBK, 2016).

The government further enacted the Credit Reference Bureau Regulations, 2013 to facilitate Credit Information Sharing. The Regulations required all the CBK licensed institutions to discloses advances and outstanding loans through CBK-licensed CRBs. However, the Regulations faced the following challenges; it was not mandatory for the participation of the non-bank institutions in credit information sharing and they only participated in providing negative information, banks were cautious in using the credit information and lack of positive credit information from institutions. Consequently, the Regulations were replaced by the Banking (Credit Reference

Bureau) Regulations, which provided more advanced regulatory structure. The CBK have licensed three (3) credit reference bureaus to operate in the Kenyan banking sector.

Despite all these efforts, high non-performing loans, reduced demand for credit as reflected by declining ratios of advances to deposits from 85.7% in September 2016 to 79% in June 2019, and reduced private sector credits remain to be key challenges in the financial sector (KIPPRA, 2018).

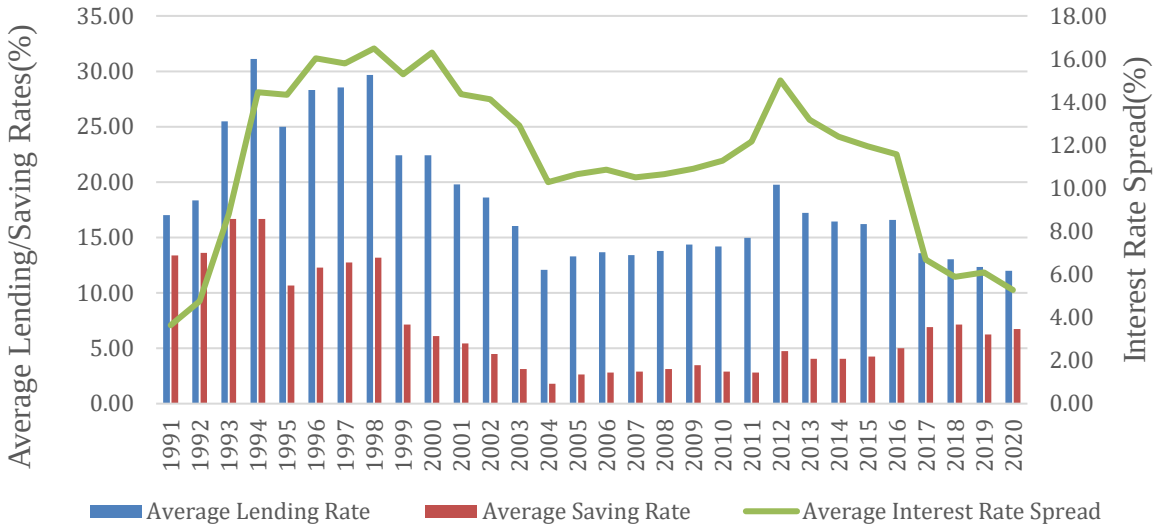
1.1.1 Interest Rates, Interest Rate Spread and their Trends in Kenya

The literature points out that interest rate is the main factor that affects bank sector asset quality (Sangmi and Nazir, 2010). Interest rate is the price paid or charged by commercial banks to its depositors or borrowers. There are two main types of interest rates utilized between bank sector and borrowers: Deposit interest rate which is the price paid to bank depositors and lending rates, which is the price charged by banks on its borrowers. However, there exists other rates of interest at the CBK's disposal, namely; central bank rate (CBR), inter-bank rate, Treasury Bill rates, Repo and Reverse Repo.

The difference between the rate at which banks lend and the rate at which depositors receive a reward on savings is the spread of interest rate (CBK, 2017). In this study, lending rates will be used as a proxy for interest rate. This is because lending rate measures the price of a loan and it is likely to affect bank sector asset quality (Mwangi, A. C., 2004).

Figure 1.4 shows that even after the financial sector liberalization, interest rate spreads were at least 10 per cent. In 1998, interest rate spreads were as high as 16.49 per cent. However, following the 2016 interest cap, both interest rate levels and spreads have decreased significantly. The average commercial bank lending rates reduced from 31.11% in 1994 to 16.58% and 12.0% in 2016 and 2020, respectively. Consequently, interest spread reduced from 14.45% in 1994 to 11.58% and 5.27% in 2016 and 2020, respectively.

Figure 1.4:Interest Rates and Interest rates Spreads in Kenya



Source of Data: CBK

1.2 Problem of the Research

Suitable functioning of the financial sector is important to support a country's aggregate demand and transmission of monetary policy, hence, a key economic growth accelerator (Levine, 1997). In Kenya, the banking industry occupies the largest proportion of the financial sector (CBK, 2018). Statistics indicate that, loans or advances are the major bank's assets constituting at least 50% of the bank's assets in Kenya. Nevertheless, bank sector asset quality is one of the key measures of banking industry performance as it shows the overall condition of the banks (CBK, 2018)

In line with the theoretical background, Kenya's government has been committed to promoting the performance of the financial sector. For example:1990's financial sector liberalization and 2016 interest rate capping which aimed at making credit affordable and accessible to common man, reducing interest rate spreads, promoting private sector credit growth, and improving banking industry asset quality. However, even with a decrease in interest rate spreads, the poor asset quality remains a problem in Kenya's financial sector (CBK, 2019). Kenya's bank sector asset quality remains as high as 12.7 per cent in 2017 which is far much above 5 per cent ceiling required by the CBK.

This study will therefore, add to the literature by analyzing the causality, relationship and dynamic effects of interest rates and bank loan quality in Kenya. Besides, this study will utilize Autoregressive Distributed Lags (ARDL) to determine the effects of interest rates on bank sector asset quality which has not been captured by other studies.

1.3 Main Objective

The main objective of this research was to examine the effect of interest rate on bank sector asset quality in Kenya.

1.3.1 Specific Objectives

i. To ascertain the nature of causality between the interest rate and bank sector asset quality.
ii. To determine the nature of the connection between interest rates and bank sector asset quality in Kenya
iii. To analyze the short and long run effects of the interest on bank sector asset quality in Kenya.
iv. To recommend policy.

1.4 Hypotheses of the Study

The research aimed at testing the following hypotheses:

a) The lending interest rate causes bank loan asset quality.
b) Bank loan asset quality causes lending rate of interest.
c) A dynamic pattern between the lending interest rate and Bank Loan Asset Quality does exist.
d) The lending interest rate of interest negatively effects on bank loan asset quality

1.5 Significance and Justification of the Research

Suitable functioning of financial sector is vital to support a country’s aggregate demand, hence, a key economic growth accelerator. Its performance can be assessed by banks' asset quality since banks occupy the largest proportion of the financial sector. Moreover, loans are the greatest income-generating assets in banking industry and hence, faced by the largest risk. This studyprovides an insight to the government on how interest rate affects asset quality. The findings also provideinsights to the government on what needs to be done on the interest rates to improve

banks asset quality. In addition, the research serves as a foundation for future research on banks' asset quality.

1.6 Shortcomings of the Research

The study abstracted from institutional changes and developments that have affected bank credit in Kenya. Ordinarily, those institutional changes would have had the opportunity to affect the rate of interest which is at the centre of this study, however the interest-setting environment for banks has been arguably repressive.

1.7 Arrangement of the Rest of the Project

The remainder of the project comprises of discussion of the literature in chapter two, followed by the methodology. Chapter captures and discusses the findings while policy implications and recommendations in captured in chapter five.

CHAPTER TWO

REVIEW OF THE LITERATURE

2.1 Introduction

The relevant theoretical literature and previous studies are captured in this section.

2.2 Theoretical Literature

The link between interest rates and asset quality can be explained using transaction cost theory, Market Power Theory/Concentration and imperfect market.

2.2.1 Transaction Cost Theory

Williamson brought this theory in 1979 and Douglass reaffirmed it in 1986. Douglass defined transaction costs as the price of exchanging goods or services. For example, between the borrower and the lender. The author explained that institutions that facilitate low transaction cost stimulate economic growth. According to North 1992, transaction costs composed of measurement, enforcement, ideological attitude and perception, and market size factors. Measurement factor captured the value of goods or services involved in the transaction; enforcement captured the need for a third party to ensure that neither of the parties defaulted on their obligation; while market size affects partiality or impartiality of transactions.

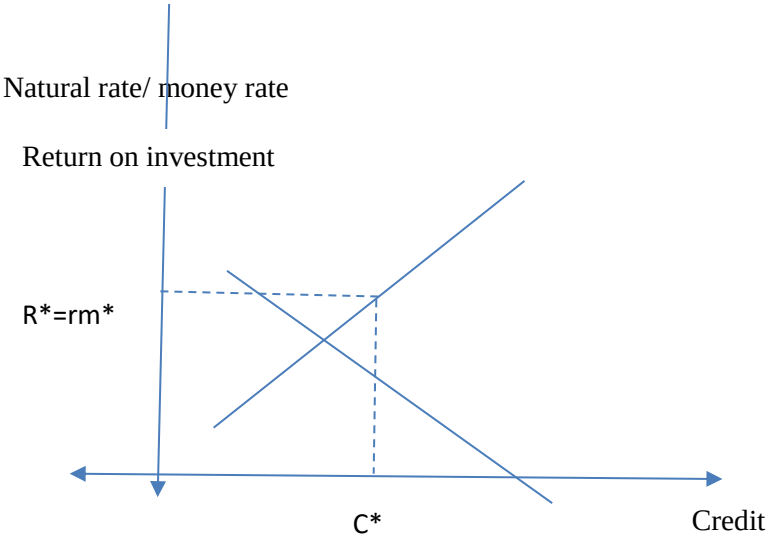
According to the theory transaction cost are classified into three; search and information cost, policy enforcement, and bargaining and enforcement cost. Search and information costs are the cost incurred by an individual to search for goods that are offered at low prices while policy and enforcement cost ensures that each party is bound to the contractual arrangement. It is these costs that are used to determine the prices (interest) of loans. Thus, if a lender (bank) are willing to offer loans at high transaction cost, to capture all the risks, borrowers are likely to default hence poor loan asset quality. This is because the loan prices are too high due to credit risk.

According to Rhyne 2002, explains intermediary costs as costs involved in activities of administration, information, transaction and operational costs. These costs are the gap between gross borrowing cost and net return on lending. This means high transaction costs, makes the loans expensive and increases the chances of default thereby increasing the non-performing assets in the banking industry.

2.2.2 Neo-Classical View on Interest Rate

Wicksell (1898) pioneered this theory which was later amended by Myrdal and J. Viner. The theory stipulates that demand and supply for credit depends on the prevailing interest rates in the market. That is, demand credit fluctuates due to variations of interest rates away from the equilibrium. According to Wicksell (1898), investors make decisions on whether or not to take

credit by comparing the cost of capital with the return on investment. If the capital return exceeds the cost of capital, investors are motivated to borrow for investment. However, if the capital cost is greater than the capital return rate, the investors demand for credit decline leading to a negative disequilibrium. In addition, increase in cost of capital during the repayment period can discourage the investors to service their loans leading to high non-performing loans.



2.2.4 Imperfect Credit Market Theory

The theory was developed by Ken Arrows in 1960. The theory illustrates the inefficiencies in the credit markets due to information asymmetry. Unlike, in perfect market where credit prices are determined by market forces, imperfect credit market results to inefficiencies that influences credit prices. The imperfect credit market theory asserts that the performance of financial markets depends on the symmetrical nature of the information. That is, whether the information between the borrower and the banks (lenders) is perfect or imperfect. If imperfect, the issue of adverse selection and moral hazard are likely. According to this theory, banks lend money at a cost to finance projects which have a positive net present value. However, it is difficult for the banks (Lender) to distinguish between high risky borrowers from low risky borrowers, hence adverse selection problem. This is because the borrower has more information than the banks. Banks lend more to high-risk borrowers than less risky borrowers, since high-risk borrowers tend to have high prosperity to borrow than less risky borrowers.

Moral hazard occurs when the borrower does not use the loan for its intended purpose. For example, using borrowed money for personal use like buying food rather than for business investment like capital. This, therefore, makes it difficult for the borrower to service his/her loan when due for payment and thus an increase in NPLs in banking industry.

Bank considers adverse selection and moral hazard risks while pricing the loan. However, lenders cannot pursue high-interest loans due to adverse selection. On the other hand, high-risk borrowers are ever ready to accept high rates that motivate moral hazard behaviors. Thus, to determine the cost of borrowing (interest rates) lenders take into account risks that will be associated with that loan and the demand of credit depends on the cost of borrowing. This has an implication on the non-performing assets in banking industry, since high rate of interest rates may induce moral hazard and adverse selection among borrowers.

2.3 Empirical Literature

This part captures past researches that have been carried out about bank sector asset quality. Studies reviewed concentrated on the determinants of bank sector asset quality where in addition to interest rates, other factors considered included; economic growth, inflation rate, exchange rate, domestic debt, money supply, and private investments. Some of the literature reviewed are as follows:

2.3.2 Determinants of Bank Loan Asset Quality

The analysis of the effects of interest rates on bank asset quality has received little attention. Most of the studies have concentrated on how the financial performance of the banking industry is affected by asset quality.

Bock and Demyaret (2012) carried out a research examination to find what determines the asset quality in emerging markets. Utilizing ordinary least squares (OLS) technique, the findings suggested a reduction in credit growth is caused by low growth in economic, depreciation in exchange rate, debt decline, and feeble terms of trade which improved the quality of assets. Although this study explained how various macroeconomic variables affect the asset quality of the banking industry, it failed to assess the effects of interest rates on asset quality in Kenya.

Mburu (2017) analyzed the impact of the quality of assets on commercial banks' performance in Kenya. Utilizing a panel of 42 commercial banks over the period 2007-2016, the findings indicated

that asset quality hurt banks' performance, which implies that, increase in asset quality ratio (asset quality deterioration) worsened the performance of commercial banks.

Swamy (2017) conducted a study to find out what determines the profitability and asset quality of bank in emerging economies. Utilizing a panel of countries drawn over the period 1997-2009 and employing instrumental variable estimation technique, the findings suggested that asset quality was highly determined by the performance of the industry, management procedures, and technology. This study focused more on how micro and management factors affect asset quality.

Similarly, Erasmus (2018) analyzed asset quality in South African banks. Utilizing a panel of banks drawn over the period 2000-2017, the findings suggested that interest rates hurt asset quality. This indicates that rise in interest rate (cost of borrowing) leads to a rise in asset quality ratio (asset quality deterioration). Hence, to improve banking industry asset quality, Central Bank should focus on reducing interest rates.

2.4 Overview of the Literature

An analysis of the theories indicates that interest rates are a key factor that affects bank sector asset quality. For example, the imperfect market theory establishes that asset quality is linked to adverse selection and moral hazard. It is these complications that contribute to the high cost of borrowing due to lenders' need to account for them. Secondly, theories reviewed point out that, the interest rate adversely affects loan asset quality. This implies that a rise in interest rates would adversely affect the asset quality of the banking industry. The introduction of interest rate capping Law in Kenya i.e. The Banking (Amendment) Act, 2016 on a liberalized financial sector was supposed to improve asset quality, to stimulate economic growth. However, this is not the case based on Kenya's statistics.

Studies reviewed on the impact interest rates have on asset quality (Bock and Demyaret, 2012; Mburu, 2017; Swamy 2017 and Erasmus, 2018). The findings of these studies are conflicting and inconclusive of the Kenyan case. The findings in these studies have differences which could be attributed to either difference in economic behaviors across countries or due to differences in methodology used. Moreover, cross-country focus of the reviewed studies render the findings inapplicable in Kenya. The present study, therefore, improves upon the literature by contextualizing the effects of interest rates on bank sector asset quality in Kenya.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This section captures the theoretical basis and the analytical model employed as well as the design of the study and a discussion of data source and econometric issues.

3.2 Theoretical Framework

The present study adopted the imperfect market theory as its theoretical basis. According to the imperfect market theory, information asymmetry paves way for moral hazard and adverse selection. This theory explains that bank loan asset quality is associated with adverse selection and moral hazard. It is these issues that contribute to the high cost of borrowing due to lenders' need to account for them thus poor asset quality. This implies that bank loan asset quality is influenced by interest rates which are the cost of borrowing.

$$Bank\ Loan\ Asset\ Quality = f(interest\ rates) \quad \text{.....} \quad 3.1$$

3.3 Analytical Model specification

This research estimates the model given by:

$$BLAQ = f(Int_{rates}, Infl_{rate}, Loan_{size}, Dom_{debt}, money_{supp}, Pri_{inve}) \quad \text{.....} \quad 3.2$$

Where BLAQ is Bank loan asset quality, $Int_{rates,}$ is lending rates, $Infl_{rate}$ is inflation rates, $Loan_{size}$ is gross loan size, Dom_{debt} is domestic debt, $money_{supp}$ is money supply and Pri_inve is private investment. The study tested for correlation between variables, to avoid multi-collinearity problem. The study dropped variables that are highly correlated.

3.3.1 Granger Causality Test

The Engle and Granger (1987) test was employed to ascertain if the series of bank sector asset quality can be used to forecast the values of interest rates and if the values of interest rate can be used to predict the values of bank sector asset quality in Kenya. That is if the past values of interest rates can be used to predict the values of bank loan asset quality in Kenya and vice versa. The following equation was used to conduct granger causality test between the two variables;

$$BLAQ)_t = \ddot{Y}_0 + \sum_{i=1}^{m+d} \ddot{Y}_{1i}(int\_rate)_{t-i} + \sum_{i=0}^{m+d} \ddot{Y}_{2i}(BSAQ)_{t-i} + \epsilon_t$$

$$(int\_rate)_t = \gamma_0 + \sum_{i=0}^{m+d} \gamma_{1i}(BSAQ)_{t-i} + \gamma_{2i}(int\_rate)_{t-i} \quad \text{....3.3}$$

Where m=length of lag at optimum, d= maximum order of integration which was established through stationarity test, and $\ddot{Y} and\ \gamma\ are$ = parameters.

3.3.2 Analytical Model

Based on the direction of causality, order of integration and nature of the relationship between the study variable, the model (3.2) was estimated using OLS, Error Correction Model (ECM), or ARDL. The claims being tested were:

Ho: interest rate has an insignificant effect on bank loan asset quality in Kenya

Ha: interest rate has a significant effect on bank loan asset quality in Kenya

The decision rule was such that H_0 fails to hold for p-values<0.05. 0.05 was the preferred significance level for convenience. If H_0 fails to hold, then there is no sufficient evidence to support the claim that interest rate has an insignificant effect of bank asset quality.

OLS would be applicable if the model is order-zero integrated. The OLS equation would then take the form:

$$BLAQ_t = \beta_0 + \beta_1 \beta int_{rate_t} + \beta_2 inf_t + \beta_3 loan\ size_t + \beta_4 Dome_{debt_t} + \beta_5 Money_{supp_t} + \beta_6 Pri_{invest} + \varepsilon_t \quad (3.4a)$$

Error Correction Method was to be used if all variables were found to be I(1). However, if variables were found to have different order of integration the study would employ ARDL model due to its flexibility as well as in its ability to offer both the long- and short-run effects together. The ARDL model is given by:

$$BLAQ_t = \alpha_0 + \sum_{i=1}^{m} \alpha_{ji}(int\_rate)_{t-i} + \sum_{i=0}^{m} \alpha_{ji}(infl\_rat)_{t-i} + \sum_{i=0}^{m} \alpha_{ji}(money\_supp)_{t-i} + \sum_{i=0}^{m} \alpha_{ji}(loan\_size)_{t-i} + \sum_{i=0}^{m} \alpha_{ji}(Domes\_debt)_{t-i} + \sum_{i=0}^{m} \alpha_{ji}(priv\_invest)_{t-i} + \mu_t \quad (3.4b)$$

Where j = 1 to 7

Model (3.4b) is estimated to give short-run effects of interest rate on bank loan asset. ECT were obtained by estimating equation (3.4b (i))

$$BLAQ_t = \beta_0 + \beta_1 \beta int_{rate_t} + \beta_2 inf_{rate_t} + \beta_3 loan\ size_t + \beta_4 Dome_{debt_t} + \beta_5 Money_{supp_t} + \beta_6 Pri_{invest} + \varepsilon_t \text{-----} \quad 3.4b\ (i)$$

After estimating equation 3.4b (i), the ECT were generated by lagging the error terms once. Convergence speed was then computed using the ECT while coefficients for short-run effects were based on the model given by:

$$\Delta BLAQ_t = \gamma_0 + \sum_{i=1}^{m} \gamma_{1i}\Delta(int\_rate)_{t-i} + \sum_{i=0}^{m} \gamma_{2i}\Delta(inf\_rate)_{t-i} + \sum_{i=0}^{m} \gamma_{3i}\Delta(Money\_supp)_{t-i} + \sum_{i=0}^{m} \gamma_{4i}\Delta(exc\_rate)_{t-i} + \sum_{i=0}^{m} \gamma_{5i}\Delta(Loan\_size)_{t-i} + \sum_{i=0}^{m} \gamma_{6i}\Delta(Dome\_debt)_{t-i} + \sum_{i=0}^{m} \gamma_{7i}\Delta(pri\_invest)_{t-i} + \ddot{Y}ECT_{t-1} + E_t \ldots \quad 3.4b(ii)$$

Where; $\ddot{Y}$ is the speed of adjustment, $''\gamma''$'s approximates the short-run effects,, and ECT gave the residuals.

3.4 Variables, Description, and Expectation

Variable	Measurement	Expected Sign
Bank Loan Asset Quality	Net Non-performing Loans divided by Gross Loans	
Inflation Rate	Monthly inflation rate	Negative
Interest Rate	Monthly bank sector lending interest rate	Negative
Exchange rate	Log of Monthly Value of one US dollars in Kenyan shillings	Negative
Domestic Debt	Monthly domestic debt as a per cent of total debt	Negative
Money Supply	Monthly M3 growth rate	Positive
Private investment	Growth in credit extended to private sector	Positive

Thus, the equation to be estimated can be represented as;

$$NPL/GL_t = \beta_0 + \beta_1 Lending\_intrate_t + \beta_2 GDP_t + \beta_3 inf\_rate_t + \beta_4 loan\ size_t + \beta_5 Dome\_debt_t + \beta_6 Money\_supp_t + \beta_7 Pri\_invest + \varepsilon_t \ldots\ldots\ldots \quad 3.5$$

Where NPL/GL is a proxy of bank loan asset quality representing non-performing loan as a per cent of gross loans, lending rate of interest is a proxy for interest rate.

3.5 Sources and Type of Data

This research secondary data retried from monthly economic indicators by the Central Bank of Kenya over the period January 2015 to December 2020.

3.6 Time Series Properties

The study tested for stationarity (unit root) and co-integration to ensure that the results are not spurious.

3.6.1 Stationary Series Test

A stationary series has zero mean and constant variance. To test for stationary series, the study employed Phillip-Perron (1988) PP-test which is robust on autocorrelation and structural breaks.

The PP- test entails estimating the difference equation given by:

$$\Delta y_t = \alpha + \sum_{i=1}^{m} \beta_i y_{t-i} + e_t \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad 3.5$$

Δy_t = endogenous variable differenced once, i = number of lags, e=random error, and β and α are coefficients.

Non-stationary variables were differentiated and subjected to the test until they become stationary, and declared to be integrated at that order. Hence I(1) is stationary after differencing once.

3.6.2 Relationship in the Long-Run

This was tested using co-integration test with the claim being tested specified by:

H_0: Long-run coefficients are jointly equal to zero (no co-integration)

H_1: Co-integration

Based on the Wald procedure which checks whether the F statistic computed is higher or lower than the upper boundary and lower boundary, the variables were concluded to be either (i) co-integrated (F computed is greater than upper boundary) or (ii) not co-integrated (F computed is less than lower boundary).

3.7 Model Estimation

To achieve the first objective of the nature of causality, equation 3.3 was estimated using the Granger (1987) test. The second goal was achieved by carrying out a co-integration test. To achieve the third objective model (3.4) was estimated using ARDL model.

3.7.1 Post Estimation Tests

The study conducted two types of test to ensure reliable and non-spurious results, which includes: (i) Diagnostic tests which ensures that the estimates are efficient. These tests were carried out as follows: use of a histogram to verify that the series is normally distributed(Jarque Bera, 1987); use of correlation matrix to assure that the variables are not autocorrelated and to avoid multi-correlation(Steiger,1980).; the Durbin-Watson test to ensure no serial correlation(Tillman, 1975); and Breusch–Pagan test to ensure homoskedasticity among variables.(ii) stability and model specification tests utilized the Recursive test and RESET test, respectively, following Ploberger & Krämer (1992).

CHAPTER FOUR: EMPPIRICAL FINDINGS

4.1 Introduction

This section captures the results of the pre-analysis tests as well as the model estimation.

4.2 Granger causality Test Results

Ascertaining the nature of causality involved the utilization of the Granger causality test with the optimal lag given by AIC. The results are captured in Table 4.1.

Table 4.1: GCT Results for interest rates and bank asset quality

Pair-wise Tests			
Sample: July 2015-December 2021			
Lags: 2			
Null Hypothesis:	Observations	F-Statistic	Probability
Bank asset quality is not Granger caused by interest rates	64	4.38839	0.0499
Interest rate is not Granger caused by bank asset quality		7.80231	0.0001

Source: Authors Computation, 2021

The findings suggest that the claim of interest rates not granger causing bank asset quality fails to hold at 5% significance level. Similarly, the claim of bank asset quality not granger causing interest rate fails to hold at 5% significance level. The results imply bi-directional causality between interest rates and banks loan asset quality. The study findings are in line with the theory, since, high interest rates can be too expensive for borrowers resulting to large non- performing loans, hence, poor asset quality. Additionally, poor asset quality as a result of increasing non-performing loans can prompt the banks to raise risk premium to caution themselves against loss which further results high interest rates.

4. 3 Issues Related to the Observed Time Series

To prevent spurious estimates, both stationary series and long run relationship between variables was tested.

4.3.1 Stationary Series Test

The PP-test was employed with the claim under investigation being that the observed time series is not stationary. The decision rule was such that the claim fails to hold at probability value less

than 5%. A non-stationary is transformed using the difference operation after which the PP-test is repeated. This is carried out until a stationary series is achieved. The results are captured in table 4.2.

Table 4.2: Stationary series test

Variable	**Form of test**	**P-Value (level)**	**P-value (1st difference)**	**Conclusion**
Bank asset quality	Intercept	0.2332	0.0000	I (1)
	Trend and intercept	0.4939	0.0000	
	None	0.9989	0.0000	
Lending rate	Intercept	0.7715	0.0000	I (1)
	Trend and intercept	0.5422	0.0000	
	None	0.2562	0.0000	
Inflation rate	Intercept	0.2343	0.0000	I (1)
	Trend and intercept	0.4118	0.0000	
	None	0.4103	0.0000	
Ln Exchange rate	Intercept	0.8711	0.0000	I (1)
	Trend and intercept	0.8796	0.0000	
	None	0.8918	0.0000	
Ln Domestic debt	Intercept	0.7908	0.0021	I (1)
	Trend and intercept	0.1185	0.0118	
	None	1.0000	0.3211	
Private investment	Intercept	0.0000		I (0)
	Trend and intercept	0.0000		
	None	0.0000		

Source: Authors computation, 2021

Table 4.2 shows that bank asset's quality, domestic debt, exchange rate, and rate of interest were stationary after the first difference. The variables were, therefore, order-one integrated. Private investment variable was, however, order-zero integrated.

4.3.2 Long run relationship test

Since the study variables had mixed order of integration, co-integration was ascertained using ARDL. The claim under investigation was absence of relationship among variables in the long-run. The decision rule was such that the claim failed to hold computed F-statistic greater than the critical value. The co-integration results are captured in table 4.3.

Table 4.3: Co-integration test results

ARDL Bounds Test		
Sample: 2015M12 2020M12		
Number of observations: 47		
H0: No co-integration		
Test Statistic	Value	k
F-statistic	5.526656	5
Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
10%	2.26	3.35
5%	2.62	3.79
2.50%	2.96	4.18
1%	3.41	4.68

Table 4.3 shows that the calculated F-statistic value of 5.53 exceeded the upper critical and, hence, the claim of no co-integration failed to hold.

4.4 Effects of interest rate on bank asset quality

This research's third goal was to determine the effect of interest rate on bank loan asset quality. Utilizing the ARDL model, the findings suggested that the estimated R-squared was 98.65 percent and adjusted R-squared was 97.86. The model's probability value was zero suggesting that the explanatory variables were jointly significant.

To ensure the estimates are efficient, consistent and reliable, the study carried out a test on normality, multicollinearity, heteroskedasticity and serial correlation. The results are as presented in section 4.4.1.

4.4.1 Post-Estimation Test

To avoid the issue of multi-collinearity, the study used a pair-wise correlation matrix to find out if variables were highly correlated. The problem of multi-collinearity arises when the degree of correlation between variables is equal or over to 80 percent. The correlation matrix is as shown in Table 4.4. Based on the results, domestic debt was highly correlated with bank loan asset quality at 96.8 percent and interest rate at 86.1 percent. Since both bank loan asset quality and interest rate were variables of interest, domestic debt variable was dropped from the analysis.

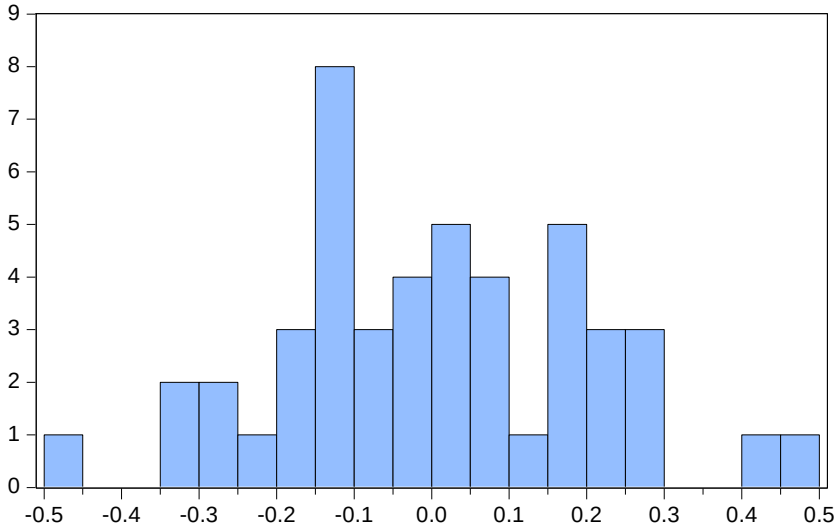
Table 4.4: Correlation Matrix

	Bank asset quality	Interest rate	Inflation rate	Domestic Debt	Exchange Rate	Private credit
Bank asset quality	1.000					
Interest rate	-0.549	1.000				
Inflation rate	-0.453	0.250	1.000			
Domestic Debt	**0.968**	**-0.861**	-0.446	1.000		
Exchange Rate	0.303	-0.358	-0.058	0.442	1.000	
Private credit	0.087	-0.040	-0.159	0.025	-0.118	1.000

Source: Authors computation, 2021

The study used Jarque-bera to test if the residuals were normally distributed. Based on the histogram (Figure 4.1) and the Jarque-Bera probability of 0.8995 exceeded the 5% significance level. This suggested that the residuals were approximately normal.

Figure 4.1: Distribution of the Error Term



Series: Residuals	
Sample 2015M12 2020M12	
Observations 47	
Mean	-2.63e-14
Median	-0.008207
Maximum	0.465232
Minimum	-0.478249
Std. Dev.	0.202676
Skewness	0.136387
Kurtosis	2.816472
Jarque-Bera	0.211673
Probability	0.899572

Source: Authors computation, 2021

Serial correlation test is important in determining if the residuals of different estimations are correlated. The test is critical especially for lagged dependent variable like the case of ARDL. The procedure given by Godfrey and Breusch suggested that the error terms are uncorrelated since the probability value of 18.77% exceeded the 5% significance level.

Autocorrelation Test

F-statistic	1.034565	Prob. F(2,27)	0.3690
Obs*R-squared	3.345443	Prob. Chi-Square(2)	0.1877

Presence of heteroscedasticity implies that the error term is changing with the explanatory variable. This leads to biased and inconsistent estimates. Following the procedure given by Godfrey, Pagan,

and Breusch, the findings suggested that the error term has a constant variance since the probability value of 24.51% exceeded 5% significance level.

Test for constant error term variance

Computed F	1.330163	F-probability value	0.2426
N*R^2	20.59181	Chi-square probability value	0.2451
Scaled explained SS	7.120222	Chi-square probability value	0.9819

4.4.2 ARDL Results

The short run effects of interest rates on bank loan asset quality were obtained by estimating the general ARDL model represented by equation 3.4b. The difference operator was thereafter applied on the residuals. The short run effects are as presented in Table 4.5.

Table 4.5: Short-run Estimation

Variable	Coefficient	Standard error	Probability value
Asset quality	0.792	0.127	0.000
D (Asset quality)	0.257	0.132	0.057
Interest rate	-0.190	0.074	0.013
D(interest rate)	0.091	0.066	0.043
INFLATION	0.014	0.027	0.061
Exchange rate	-7.799	4.257	0.072
D (exchange rate)	10.354	4.550	0.027
Private investment	5.020	0890	0.416
C	3.621	8.934	0.033
ECT-1	-0.563	3.481	0.050

The findings suggest that bank asset quality is significantly improved by interest rate at 5% significance level in the current period. In the subsequent periods, however, bank asset quality is worsened by interest rate, ceteris paribus. Other variables that significantly affected bank loan asset quality in the short run were previous and previous period asset quality and exchange rate. Bank asset quality is also significantly affected by inflation.

Table 4.5 also indicates that the ECT coefficients ranges between 0 and -1. This implies that the short run effects of inflation, exchange rate, and interest rate will converge in the long-run.

Long run effects

The coefficients were obtained by estimating equation 3.4b(ii). Based on the long run coefficient, a positive on bank asset quality exists for interest rate. That is, higher interest rates have adverse effects on bank loan asset quality in Kenya, holding other factors constant.

Variable	Coefficient	Standard error	Probability value
Interest rate	1.452	0.074	0.003
INFLATION	0.924	0.027	0.071
Exchange rate	-7.799	4.257	0.772
Private investment	0.000	0.000	0.416

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the research as well as captures conclusions drawn from the findings and recommends policy.

5.2 Finding Summary

The study objective was three-fold: (i) analyze the nature of causality between bank loan asset quality and interest rates (ii) Analyze whether their relationship was short or long run (iii) determine how bank asset quality is affected in the long- and short-run. Using granger causality

test, the study found bi-directional causality between asset quality and interest rate. This implies that the previous period interest rate can be used to forecast bank loan asset quality in Kenya. Similarly, the present and previous period bank loan asset quality can be used to forecast interest rate. The results were in line with theory, since higher interest rate (cost of lending) can result to higher non-performing loans, thus, poor asset quality. Similarly, if banks incur poor asset quality, they may end up increasing risk premiums to cushion themselves against loss, which may result to high interest rates.

Using ARDL F Bound test, the study established that bank loan asset quality and interest rate were related in the long-run in Kenya. In addition, the findings suggested that bank asset quality is negatively affected by interest rate in the current period. However, the effect became positive after the first period.

5.3 Conclusion

The research has comprehensively covered the effects of bank asset quality and interest rate. In conclusion, bank asset quality is negatively affected by interest rate in the short-run and positively affected in the long-run.

5.4 Policy Recommendations

To achieve the recommended level of asset quality of 5 percent, the study recommends reduction of interest rate in Kenya. This can be achieved by maintaining low Central Bank Rate by the Monetary Policy Committee. This is because CBR act as the basis of lending rates that is used by bank.

5.5 Limitation of Study

The study focused on banking sectors in Kenya, thus, these studies cannot be used to generalize the situation in other financial institutions. Additionally, the study concentrated on the banking sector industry as a whole and not for specific banks.

5.6 Areas for Further Studies

The study identifies an examination on Nairobi Stock Exchange-listed banks as an area for further studies.

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Kenya	8.8	8.0	6.3	4.4	4.6	5.0	5.5	6.0	8.7	10.1
SSA Average	7.3	10.6	10.2	8.2	7.7	8.9	9.6	10.3	10.7	8.1
SSA Median	7.0	8.0	7.8	5.6	6.1	6.2	6.2	6.9	9.6	7.9
LMC Average	5.4	8.8	9.2	7.2	7.1	7.0	7.1	7.9	8.6	10.1
LMC Median	4.5	6.8	5.9	4.5	4.8	5.7	5.1	6.0	7.9	6.2
HIC Median	2.0	3.7	4.0	3.8	3.6	3.2	3.2	3.1	3.2	2.9
Peer Group Average	7.0	26.8	16.1	10.5	9.5	8.6	8.0	9.6	13.6	-
Expected 25th percentile	4.2	6.3	6.0	5.1	4.9	5.0	4.8	5.1	5.4	4.5
Expected median	5.7	9.3	9.8	7.9	8.1	7.8	7.6	7.4	8.4	7.2
Expected 75th percentile	8.3	11.8	11.7	11.3	12.4	11.4	11.5	11.6	11.0	9.8

Number of countries used for the regional and income group benchmarks (not the OECD benchmark)

S01IFS0	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Regional benchmarks	14	13	25	25	26	27	27	28	23	9
Income group benchmarks	20	23	29	31	32	32	32	31	24	16