

INTEREST RATE VOLATILITY ON PROFITABILITY OF COMMERCIAL BANKS LISTED AT THE NAIROBI SECURITIES EXCHANGE, KENYA

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ABSTRACT

This study was designed to examine the effect of interest rate fluctuation on profitability of commercial banks listed on Nairobi Securities Exchange (NSE), Kenya with non-performing loans ratio (NPLR) playing the moderating variable. This research was an explanatory study and quantitative. The secondary data for 10 commercial banks listed on the NSE for 24 periods was analyzed, which gave a total of 240 observations. Profitability was determined by Return on Equity (ROE) whereas the other variables were determined by the standard deviation of the respective rates. The definition of non-performing loans ratio: non-performing loans to total gross loans. The technique used was descriptive statistics, correlation analysis, diagnostic test and panel regression analysis. The Cointegration specification test revealed that the model used was Panel Dynamic Least Squares (DOLS) model which included bank-specific characteristics that were not observed. The results revealed that lending rate volatility was a positive and statistically significant influence on bank profitability. The profitability was also positively and statistically insignificantly affected by the volatility of Central Bank Rate. The effect of the deposit interest rate volatility was positive but not statistically significant, while the

effect of the volatility of the interest rate difference was negative and not statistically significant. The results of moderation analysis indicated that the direct effect of interest rate volatility toward ROE was positive and statistically significant, while the direct effect of NPLR in the presence of interest rate volatility toward ROE was negative but not statistically significant at 5%. The findings of the study suggest that the profitability impact of interest rate volatility is dependent on the source of volatility and that the bank's interest rate risk management and credit risk management are needed to ensure bank profitability. The findings of the study reveal that the policy of the banks must be strengthened in financial stability and prudent credit management with the support from the regulation and policy and the management of interest rate risk and monitoring of asset quality must be improved.

Key words: Average Lending Rate, Bank Lending Rate Volatility, Central Bank Rate (CBR), Deposit interest rate volatility, Deposit Interest Rate, Interest Rate Spread, Interest Rate Volatility, Non-Performing Loans Ratio (NPLR) and Profitability.

INTRODUCTION

In Kenya the banking industry is very important in financial intermediation, economic growth and capital market development. The profitability of commercial banks is key to ensuring stability of the country's financial system, as they are the main providers of credit for the country's households, businesses and government sector (Central Bank of Kenya [CBK], 2024). Many of them are profitable banks quoted on the Nairobi Securities Exchange (NSE) that are highly regulated and supervised and are required to comply with strict disclosure policies and are disciplined by the market. These banks, therefore, have significant implications on their profitability and financial stability as a result of variations in bank lending charges, deposit interest rates, interest rate spread, and the Central Bank Rate (CBR) (Kenya Bankers Association [KBA], 2024).

In this study it was therefore necessary to study the effect of interest rate volatility on the profitability of commercial banks quoted in the NSE as well as how the non-performance loans ratio dampens the effect of volatility in bank lending rates, CBR and deposit rates volatility. It was therefore necessary to study the effects of volatility in bank lending rates, deposit interest rates, interest rate spread, and volatility in CBR on the viability of commercial banks quoted on the NSE and how the non-performing credits proportion dampens the effect of volatility in bank lending rates, CBR and deposit rates volatility. The results of this a study shall benefit bank managers, regulators, investors, and policy makers who would want to enhance the stability of the lending system, bank risk management practices, and profitable sustainable banking in Kenya's financial system.

Statement of The Problem

Profitability is one of the most important indexes of stability, efficiency and sustainability of banking sector as the banks with high profit will be able to conduct financial intermediation more successfully, offer credit facilities, withstand financial shocks, and build investor confidence. In Kenya, commercial banks are very important in mobilization of deposits, provision of credit and promotion of investment and economic activities. But the interest-rate spread and success of commercial reserves are impacted by changes in the interest ratios of loans and deposits. The results from Kenya show that interest-rate spreads have a strong relationship to commercial bank profitability, but the relationship strength is dependent on the type of commercial bank (Ndungu, 2019). In a similar way, Ndiritu et al. (2024) show that interest-rate spreads continue to be a key factor in determining the performance of commercial banks in Kenya. Additionally, the banking sector is exposed to increased risks from monetary-policy tightening, high-interest rates, credit risk, non-performing loans, and decelerating lending growth, which could impact on the earnings and financial performance of banks (Central Bank of Kenya [CBK], 2024). These conditions raise the possibility of uncertainty in profitability and financial performance for banks stemming from changes in monetary-policy instruments, the cost of funding and credit quality.

The Central Bank of Kenya (CBK) has responded to inflationary pressures and exchange-rate environment and financial growth by adjusting the Central Bank Rate (CBR). The Monetary Policy Committee lowered the CBR in 2024 to boost credit activity in the private sector and economic activity, amid the easing of inflation and stabilization of the exchange rate (CBK, 2024). Any changes in CBR had an impact on lending and deposit rates of the commercial banks, which in turn had an impact on funding costs, profitability and net interest margins. While lower policy rates may stimulate borrowing and growth, changes in lending and debt rates could introduce uncertainty into pricing of loans, balance-sheet management and income forecasting, which could impact banks' financial results.

This profitability challenge is significant as the consequence earning on loans and developments continues to represent a significant contribution to commercial banks' earnings in Kenya. But changes of these loan rates can have an impact on the demand for credit, the ability of borrowers to pay them off, and that of the banks to expand their loans. The results from Kenya reveal that the connection linking the interest rate spread and the economic performance of commercial banks is quite significant, as such spread affects profitability. Commercial banks' profitability is closely linked to the spread between interest rates on loans and deposits, and evidence suggests that the spread can significantly influence commercial banks' financial performance (Ndiritu et al., 2024). Were and Wambua (2014) also found that credit risk and operating costs have significant impacts on interest-rate spreads in Kenya, while bank characteristics also plays a role. Likewise, Ndungu (2019) noted that interest-rate spreads are important to Kenyan commercial banks' profitability. Net interest margins can also be reduced and funding costs raised by banks with changes in deposit rates, if lending income doesn't rise in proportion. This means that the volatile rates of lending and deposits could impact on the willingness to take credit, investment choices and funding costs, and ultimately the success of commercial banks in Kenya.

Further, Kenya's banking sector has been plagued by declining profits appropriate to the rising number of Non-Performing Loans (NPLs). The Kenya Financial Stability Report (2024) showed great gross non-performing advances percentage due to the inability of borrowers to pay their loans when the interest rates are high. Likewise, Cytonn Investments (2025) stated that listed banks' asset quality worsened with their gross NPL ratio rising from 14.8 percent in 2023 to 16.4 percent in 2024. The high non-performing loans diminish profitability, as the banks have to keep increasing the provisions for loan losses and the write offs which lowers their profits and capital strength. Higher NPL banks are thus more sensitive to differences in lending rates, deposit rates and the Central Bank Rate, since poor asset quality means that there is less capacity to withstand financial shocks.

While there are several empirical studies in Kenya that have addressed interest rates, interest-rate spreads, non-performing loans and bank profitability, there are some important gaps. Determinants of interest-rate spreads were studied by Were and Wambua (2014) and they noted that the credit-

risk factor (NPLs) had a significant effect on interest-rate spreads, though they did not investigate this factor as a moderating variable for interest-rate spreads. Ndungu (2019) investigated the relationship between interest-rate spreads and commercial-bank profitability, while Ndiritu et al. (2024) went on to examine the effect of interest-rate spreads on bank performance. Recently, Koskei and Samoei (2024) found that lending rates impacted the NSE-listed commercial banks' NPLs, while Sharon et al. (2026), studied macroeconomic factors affecting the NSE-listed banks' NPLs. However, these studies have not fully explored the interaction among bank loaning-rate volatility, deposit-rate volatility, interest-rate spread coupled with CBR on profitability and tested NPLs as the moderating variable between NSE-listed commercial banks in Kenya. The current study is warranted because of this gap.

General Objective

The research objective was to examine the moderating effect of Non-performing loans on the relationship between interest rate volatility and profitability of commercial banks listed at the Nairobi Securities Exchange.

Empirical Review

Demirgüç-Kunt, Pedraza, and Ruiz-Ortega (2022) examined the effect of interest rate shocks on the performance of commercial banks in OECD countries in another recent study globally. Lending rates, profitability of banks and credit risk indicators were the study variables. This study employed quantitative explanatory research design and secondary panel data of commercial banks from 2010 to 2020. The study was based on the theory of Interest Rate Parity. The results revealed that variations in lending rates were by far the most significant factor in lowering profitability as higher borrowing rates depressed the credit demand of the private sector and non-performing loans went up. The research also concluded that the profitability deterioration at the banks with high credit risk exposure was higher during interest rate instability periods.

Adebayo and Oladipupo (2021) looked at the impact of change in lending rate on profitability of deposit money banks in Nigeria. Lending rates, interest income and profitability based on ROA were the study variables. The study was directed by Financial Intermediation Theory and designed in the form of an explanatory study with secondary panel data of 15 commercial banks in 2009-2019. The study population was all the licensed deposit money banks in Nigeria. The results showed that high and volatile lending rates affected profitability significantly as this affected the loan volume taken and the loan defaults. The study suggested that the banking sector should be profitable by implementing stable measures of monetary policy.

The study of the effect of fluctuations in the interest rates charged on deposits on the profitability of deposit money banks in Nigeria was conducted by Adeusi, Kolapo and Aluko (2020). The study variables are the level of deposits, liquidity level, and profitability which is measured by ROA. The research design employed is correlational with the panel data from 14 commercial banks in

the period 2008-2018. This study was carried out with a research design of correlational using panel data from 14 commercial banks in the period 2008-2018. The population of interest included all the deposit money banks that are licensed in Nigeria. The study was guided by Liquidity Preference Theory. The results indicated that deposit rate volatility had a negative impact on profitability due to higher funding costs and less stable liquidity positions of the banks.

Moyo and Le Roux (2021) conducted a study in South Africa that focused on the relationship between interest rate changes on deposits and financial performance of commercial banks quoted on the JSE. The study variables were deposit rates, funding costs and profitability variables like ROE and Net Interest Margin (NIM). The study was descriptive panel (DPA) research with secondary data obtained from 10 listed commercial banks in 2009-2019. The research was based on the theory of Modern portfolio theory. The results have shown that the changes in the deposit interest rates had significantly affected the profits of banks by increasing their cost of funds and unreliable mobilization of deposit.

The impact of deposit rate volatility on profitability of banking industry in EAC countries was also explored by another study in the region conducted by Njoroge and Waweru (2023). The study variables were deposit interest rate, liquidity risk and profitability indicators. The study took an explanatory research design as panel data was collected from commercial banks in Kenya, Uganda, Tanzania and Rwanda. The population in this study comprised all the commercial banks in the East Africa region that are regulated. The study underwent the conceptualization of Financial Intermediation Theory. Financial Intermediation Theory was used as the foundation of the study. The results showed that the volatility of the deposit rate had negative impacts on the profitability of banks, as the deposit rate volatility led to higher deposit rate uncertainty and lower net interest income.

Interest rate spread volatility has become one of the major concerns affecting the profitability and stability of commercial banks globally, regionally, and locally. Interest rate spread is the spread between the interest rate charged by banks on lending and interest rate paid to depositors. The spread is important for banks because it is the foundation of their net interest income, which is why it is a critical profitability factor. But volatility in the spread results in uncertainty in earnings, liquidity management, pricing and financial planning. Spreads are a crucial determinant of profitability indicators, including Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM), in the commercial banking sector, where interest income is a primary source of profitability for financial institutions (Ozili, 2022).

The relationship between volatility of interest rate spreads and profitability of commercial banks has been explored in several empirical studies at the international level. The study by Demirgüç-Kunt, Pedraza and Ruiz-Ortega (2022) examined the influence of interest rate changes on bank profitability in the OECD countries. The study employed the panel data of commercial banks from

2010-2020, and was based on Financial Intermediation Theory. The interest rate spreads, profitability of banks, and indicators of credit risk were the study variables. The results found that high volatility of interest rate spreads has a significant impact on the profitability of banks, as fluctuations in interest rates on loans and deposits have generated instability in the net interest income of banks and resulted in uncertainty in their operations. The study also highlighted that volatile spreads hindered loan growth and adversely impacted banks' earnings outlook.

The literature also shows that the negative impact is stronger on banks that have high ratios of NPLs as asset quality increases the negative effect of spread volatility on banks' earnings and liquidity positions. In spite of the vast amount of literature, few empirical studies have so far focused on the impact of involuntary movements of the interest rate spreads on the profitability of NSE-listed commercial banks in Kenya with a moderating effect of non-performing loans ratio. The majority of past research has focused on average changes in interest rates rather than on volatility in interest rate spreads. This study thus aims to address this empirical gap by investigating the impact of interest rate spread volatility on profitability for the listed commercial banks on the Nairobi Securities Exchange in Kenya.

The volatility of Central Bank Rate (CBR) is playing an important role in determining the profitability of commercial banks due to its direct impact on the policy rate, the interest rate applicable to deposits, the level of liquidity in the bank, and the overall monetary policy transmission mechanism. The impact of fluctuations in the Central Bank Rate on the profitability of commercial banks is reflected in the interest margins, interest demand, asset pricing and borrowing costs. Studies on the impacts of Central Bank Rate volatility on the profitability of banking sector have yielded contradictory results both on the global and regional level and at local level.

Likewise, Claessens, Coleman and Donnelly (2018) examined the impact of monetary policy rate changes on banking sector profitability in 47 countries in Europe, Asia and North America. The policy rate, lending spreads, and profitability measures like ROE and ROA were among the study variables. The study was conducted in a longitudinal panel design and secondary data from commercial banks were used in the study period from 2005 to 2016. The Interest Rate Parity theory was applied to the study. Substantial volatility of central bank rates was found to have a negative impact on profitability due to lessening of loan demand and uncertainty in banks' asset-liability management decisions in the presence of volatility.

Wanjiku and Kamau (2021) also assessed the link between the movements of Central Bank Rate and profitability of NSE-listed commercial banks. The variables that were studied were policy rates, net interest margins, and ROE as indicators of profitability. The study design is a panel research design, which was based on secondary data collected from listed commercial banks from 2010 to 2020. The study was based on Interest Rate Parity Theory. The results revealed that

volatility of the Central Bank rate had a significant impact on profitability as sudden monetary policy adjustments affected the income forecasting and liquidity management of banks.

One of the most critical variables in the banking sector that depicts the credit risk and financial instability is the non-performing loans (NPLs). Increased loan loss provisions decreased interest income, and asset quality deterioration further erode the banks' profitability due to rising NPL ratios. Some recent studies indicate that NPLs have a direct impact on profitability as well as have a mediating role between the volatility of interest rates and bank financial performance. Any change in the bank lending rate, the deposit interest rate or Central Bank Rates can have an impact on borrowers' ability to repay, which in turn can lead to an increase or decrease in the number of non-performing loans. Empirical research from around the world, in the region and locally shows that banks with a high ratio of NPLs are more prone to the negative impact of interest rate volatility on profitability.

Likewise, Serrano (2021) examined the effect of NPLs on the bank's loan provision and profitability for 75 commercial banks in Europe. The variables studied were non-performing loans, variability of the lending rate, and profitability variables. This study was conducted with longitudinal panel research design with secondary data from 2014 to 2018. The target group were commercial banks in Europe. The results indicated that banks that had high NPL ratios suffered severe deterioration in their profitability during the years of volatile lending rates due to decreased asset quality, which in turn led to a decrease in credit growth and in interest income. The study found that non-performing loans dampened the link between the volatility of lending rates and profitability by exacerbating the impact of financial distress on banks.

Aliu and Çollaku (2021) conducted another study at a global level that aimed at determining how non-performing loans affect the profitability of commercial banks in Kosovo. The study variables were non-performing loans, interest rate changes, ROE, ROA. The study was of correlational research design and secondary data of commercial banks was used from 2010 to 2019. The study showed that increases in the NPLRs resulted in higher drops in profitability when interest rates were volatile, as the rising interest rates made it more difficult for borrowers to meet repayments and increased provisioning costs.

Research Gap

Empirical studies available in the extant literature have shown that the effect of interest rate fluctuations on commercial banks' profitability is significant, both globally, regionally and locally. Nevertheless, although a considerable body of research has built up several conceptual, contextual, methodological and empirical questions have yet to be answered, making the current study warranted. Hence, the effect of bank lending rate volatility, deposit interest rate volatility, interest rate spread volatility, and Central Bank Rate volatility on profitability of NSE-listed commercial banks in Kenya is examined while the effect of non-performing loans ratio is moderated. The

current study differs from earlier studies in that it addresses the three aspects of interest rate volatility in one conceptual study and concentrates on commercial banks listed on the NSE during a time of major monetary and economic changes. The study also provides methodological contributions by using the panel data analysis technique to analyze the direct and moderating relationship between the study variables.

RESEARCH DESIGN AND METHODOLOGY

The study was of explanatory research design, which seeks to explain the relationship between the effect of interest rate volatility on profitability of commercial banks listed at Nairobi Securities Exchange (NSE). The commercial banks that participated in this study were all 11 commercial banks listed on Nairobi Securities Exchange (NSE) during the period 2019-2024 but the study used only 10 banks. The bank of Kigali was left out because of being cross listed between Kenya and Rwanda. These 10 banks formed the population of interest, as all are publicly listed banks operating in the regulated banking sector in Kenya and regulated uniformly by the Central Bank of Kenya (Capital Markets Authority [CMA], 2024). The study was conducted using a census sampling design, which involved all the 10 commercial banks listed on Nairobi Securities Exchange (NSE). The secondary data was collected from publicly available and authoritative sources this study used. The financial data was sourced from commercial banks at the Nairobi Securities Exchange (NSE) for the 6-year period 2019-2024 from their quarterly financial statements and reports. These reports included profitability metrics such as Return on Equity (ROE) and balance sheet information that was needed for Non-performing Loans computation. Data on macroeconomic indicators were sourced from official publications of the Central Bank of Kenya (CBK) and other well-known national data collection agencies. Specifically, CBK monetary policy statements, statistical bulletins, and interest rate databases were used for data on interest rates. These sources provided a consistent, accurate and credible measure of interest rate volatility for the macroeconomic variables.

Regression and Model Specification

The study used a panel regression analysis to estimate the impact of interest rate volatility on commercial banks listed at the Nairobi Securities Exchange (NSE) between 2019 and 2024. In this case the data were repeated observations of the same banks over time, and panel regression provided greater efficiency in estimation, could allow for unobserved bank-specific heterogeneity to be accounted for, and could allow for cross-section and time-series variations to be accounted for. The Panel Dynamic Least Squares (DOLS) panel model, and the cointegration specification Test was used to determine which model was most appropriate to use. Panel Dynamic Least Squares (DOLS) is an advanced parametric estimator developed by Stock and Watson (1993) and extended to panel datasets by Kao and Chiang (2001) and Mark and Sul (2003).

Model Specification

The specific Panel Dynamic Least Squares (DOLS) model data model that was used for this study is as follows;

$$Y_{i,t} = \alpha_i + X'_{i,t}\beta + \sum_{j=-q}^p \Delta X'_{i,t-j}\delta_{i,t} + \varepsilon_{i,t}$$

α_i : Bank-specific or cross-sectional unit fixed effects.

β = Cointegrating vector representing the true long-run elasticities/coefficients.

p and q =Number of dynamic lead and lag lengths included to absorb short-run dynamics and endogeneity.

$\delta_{i,t}$ = (Nuisance / Short-Run Adjustment Coefficients): Parameters assigned to the leads and lags of the differenced explanatory variables. These coefficients are estimated solely to clean the model, removing serial correlation and endogeneity so that beta can be estimated efficiently.

· $\varepsilon_{i,t}$: Stationary idiosyncratic error term.

Model 1: Direct Effects Model plus Moderator

$$\text{PROF}_{i,t} = \beta_0 + \beta_1 \text{LRV}_{i,t} + \beta_2 \text{DRV}_{i,t} + \beta_3 \text{IRSV}_{i,t} + \beta_4 \text{CBRV}_{i,t} + \beta_5 \text{NPLR}_{i,t} + \varepsilon_{i,t} \dots \text{Equation 6}$$

Model 2: Moderation Model

$$\text{PROF}_{i,t} = \beta_0 + \beta_1 \text{LRV}_{i,t} + \beta_2 \text{DRV}_{i,t} + \beta_3 \text{IRSV}_{i,t} + \beta_4 \text{CBRV}_{i,t} + \beta_5 \text{NPLR}_{i,t} + \beta_6 \text{LRV}_{i,t} * \text{NPLR}_{i,t} + \beta_7 \text{DRV}_{i,t} * \text{NPLR}_{i,t} + \beta_8 \text{IRSV}_{i,t} * \text{NPLR}_{i,t} + \beta_9 \text{CBRV}_{i,t} * \text{NPLR}_{i,t} + \varepsilon_{i,t} \dots \text{Equation 7}$$

Where:

$\text{PROF}_{i,t}$ = Profitability of bank i at time t (ROE), $\text{LRV}_{i,t}$ = Bank Lending Rate Volatility, $\text{DRV}_{i,t}$ = Deposit Interest Rate Volatility, $\text{IRSV}_{i,t}$ = Interest Rate Spread Volatility, $\text{CBRV}_{i,t}$ = Central Bank Rate Volatility and $\text{NPLR}_{i,t}$ = Non-Performing Loans Ratio (Moderating variable), i = Listed Banks from 2019 to 2024, t = Time period (2019 -2024) and ε = Error term

- β_0 = Intercept
- $\beta_1, \beta_2, \dots, \beta_9$ = Regression coefficients
- ε_{it} = Random error term
-

RESEARCH RESULTS

In this section the analysis, discussion and interpretation of the findings of the study will be presented. panel regression estimates. Additionally, results of the hypothesis tests are presented, and the moderating role of NPL ratio in the relationship between interest rate volatility and profitability of NSE listed commercial banks is discussed in the chapter.

Regression Analysis

The influence of volatility of lending rate, volatility of deposit rate, volatility of the difference between the interest rates of banks, volatility of central bank rate and interaction interest rate volatility/non-performing loans on the profitability of banks was studied by regression analysis. The cointegration test was used to preference of Panel Dynamic Least Squares (DOLS) regression. The magnitudes, directions and statistical significance of the explanatory variables in the 10 sampled banks vary across the results obtained from Models 1 to 5, where the bank-specific effects are controlled.

Regression Analysis for Direct Effects plus Moderator

This section presents the results of the direct effects of the variables of interest (lending rate volatility (LRV), deposit rate volatility (DRV), inflation rate volatility (IRSV), cash-based reserve volatility (CBRV) and non-performing loan ratio (NPLR)) on the bank profitability measured by return on equity (ROE) as obtained from the Panel Dynamic Least Squares (DOLS) regression analysis. A total of 240 observations were used in the analysis and provided by 10 cross sectional banking units over 24 periods. The overall goodness of fit and explanatory power of the multivariate panel DOLS specification presented in Table 1 is high. The model yields an R-squared (R^2) of 0.962877 and an Adjusted R^2 of 0.827586. This validates that the vector of the interest rate volatility measures, asset quality measures, and the dynamic lead-lag relationships as well as that of individual bank fixed effects, explain the commercial bank Return on Equity (ROE) variance to the extent of about 96.29% of the total long-run co-integrating variance.

Table 1: Panel Dynamic Least Squares (DOLS) Results for Direct Effects plus Moderator

Dependent Variable: ROE; Method: Panel Dynamic Least Squares (DOLS); Sample (adjusted): 2019Q3 2024Q3; Periods included: 21; Cross-sections included: 10; Total panel (balanced) observations: 210; Panel method: Pooled estimation; Co-integrating equation deterministic: C; Fixed leads and lags specification (lead=1, lag=1); Coefficient covariance computed using default method; Long-run variance (Bartlett kernel, Newey-West fixed bandwidth) used for coefficient covariances				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Lending rate Volatility	8.906367	2.002768	4.447029	0.0001**
Deposit Rate Volatility	-7.943073	1.820632	-4.362811	0.0001**
Interest Rate Spread Volatility	6.760344	1.922576	3.516296	0.0010**
Central Bank Rate Volatility	-1.588708	0.850098	-1.868852	0.0682*
Non-Performing Loans Ratio	-0.321584	0.058766	-5.472313	0.0000**

R-squared	0.962877	Mean dependent var	4.992956
Adjusted R-squared	0.827586	S.D. dependent var	3.503248
S.E. of regression	1.454644	Sum squared resid	95.21947
Long-run variance	0.280171		

*Note: significant at ** $p < 0.05$;*

The empirical findings show that there are different long-run direct drivers of financial performance across the sample. The lending rate volatility is statistically significant at 1% level as it is positively correlated with commercial bank profitability with a beta value of 8.906367, t value of 4.447029 and p value of 0.0001. At constant other factors, a rise in lending rate volatility of 1 unit leads to a rise in bank ROE of 8.91 percentage points. Commercial banks use their market dominance or pricing power to quickly increase their floating credit portfolios' prices during times of interest rate changes, protecting and growing gross interest margins. The positive and statistically significant result between lending rate volatility and bank profitability (beta = 8.906367, $p = 0.0001$) echoes the empirical work of Kipnetich (2011) and Nyaga (2014) which found that commercial banks in emerging sub Saharan African economies have the structural pricing leverage. Banks quickly pass on the effect of fluctuations in benchmark interest rates to corporate and retail borrowers by adjusting floating rates, thus increasing their net interest margin. Also, Entrop et al. (2015) found that, in the European banking markets, the active repricing of the loan portfolios under high volatility in the interest rates maintained overall net interest income. On the other hand, Muriuki (2016) pointed out that the upward effect is only strong where the asset repricing capacity is higher than the volume contraction effect, which may occur if the loan rate is too volatile.

The long-run effect of volatility of deposit rates on equity returns is statistically significant at the 1% level (beta = -7.943073, $t = -4.362811$, $p = 0.0001$). For every 1% rise in the volatility of the deposit rate, ROE falls by 7.94 percentage points, *ceteris paribus*. A lack of certainty over the cost of erratic liability further drives net interest spreads lower as financial institutions are forced to pay premium rates on wholesale deposits before assets can be re-priced. The negative and statistically significant result for deposit rate volatility (beta = -7.943073, $p = 0.0001$) is confirmed by the study conducted by Drechsler, Savov and Schnabl (2017) on deposit channel transmission. Their work shows that deposit rates fluctuating randomly can lead to bank funding volatility and drive banks to use the more costly wholesale financing option, or to charge premiums on retail deposits to ward off liquidity flight. Likewise, Ng'eno (2021) revealed that the instability in deposit rates in East African commercial banks substantially increased interest expenses, leading to immediate rate compression in the margin with prior to adjustment of loan yields.

The profitability is found to be positively related to interest rate spread volatility at 5 % level of significance ($\beta = 6.760344$, $t = 3.516296$, $p = 0.0010$). An increase in the spread volatility by 1 unit results in an increase in the bank ROE by 6.76 percentage points, suggesting that banks also adjust their lending rates higher than the rates of deposits during volatile periods, resulting in asymmetric adjustments. The positive parameter for volatility of interest rate spread ($\beta = 6.760344$, $p = 0.0010$) is in line with the results of Bawumia, Belnoe and Ofori-Abebrerese (2005) as well as those of Nyakundi and Jagongo (2013). The research underscores the fact that increasing intermediation spreads insulate against macroeconomic volatility. Commercial banks often engage in asymmetric pricing – when market volatility affects the interest rates they charge for loans, they tend to increase interest, but when market volatility affects the interest rate they pay on deposits, they tend to decrease or ignore.

The central bank policy rate volatility exerts a negative effect on ROE ($\beta = -1.588708$, $t = -1.868852$, $p = 0.0682$). The relationship is statistically insignificant at the 5% level of significance with p value >0.05 , but is weak significance at the 10% level with p value >0.1 . The direct effect of the monetary policy signal's uncertainty disappears when asset quality and direct market uncertainty are both accounted for, and the impact of the frictions from treasury matching is also not that strong. The negative correlation between the volatility of the central bank rate and profitability (-1.588708 , $p = 0.0682$) agrees with Crowley (2007) and Onuonga (2014), who examined monetary policy transmission mechanisms in banking systems of developing countries. Varying central bank policy can make bank treasury planning more difficult, raise the volatility of interbank funding, and raise revaluation risks on bank assets. However, as mentioned by Bennaceur and Goaied (2008), the direct effect of policy rate shocks can become smaller in a multivariate regression model when the variables of interest rates on commercial lending and deposit rates are explicitly included as variables, because the majority of the variance of policy rates is taken up by market rates.

The β value of -0.321584 and t value of -5.472313 with a significance value of 0.0000 showed that deterioration of asset quality has a direct and highly significant negative effect on profitability. For a bank with the same interest rates and other factors, each one percentage point increase in default rates for its loan portfolio is associated with a 0.32 percentage point decrease in profitability, due to diminished cash interest income and the requirement for increased loan-loss provisions for non-performing loans. The negative direct effect of Non-Performing Loans Ratio on profitability is strong thus supporting the empirical findings of Ghosh (2015), Kinyua (2020), and Ouma and Ocharo (2022). If credit portfolio quality continues to get worse, earnings will suffer through two channels: the decline in the cash interest income that is generated from non-accrual assets, and the need to keep building loan-loss provisions. These measures involve a reduction in operating capital reserve and a direct impact on the return of equity of shareholders. The positive value of the parameter LRV ($\beta = 8.906367$) and IRSV ($\beta = 6.760344$) corroborates the empirical finding of Borio et al. (2017) and Okech (2013) that commercial banks

proactively utilize flexibility of lending rates for the purpose of maximizing net interest income during the volatile period of the market. The negative values of the parameters of DRV (beta = -7.943073) and NPLR (beta = -0.321584) are consistent with the results of Aydemir and Ovenc (2016) and Tuna and Almahadin (2021). Volatile funding cost increases interest costs, and weak credit quality reduces profits via provisions, creating structural drag on shareholders' profitability in emerging market economies.

Regression Analysis for Moderation Model

The combined impact of interest rate volatility (IRV), non-performing loans ratio (NPLR) and their interaction on bank profitability (return on equity, ROE) was explored in model 1. A total of 240 observations of 10 cross-section banking units and 24 time periods were analyzed. The standard errors to make statistical inferences more reliable were robust heteroscedasticity and autocorrelation consistent (HAC) standard errors.

Table 2: Panel Dynamic Least Squares (DOLS) Regression Moderation Model

Dependent Variable: ROE; Method: Panel Dynamic Least Squares (DOLS); Sample (adjusted): 2019Q3 2024Q4; Periods included: 22; Cross-sections included: 10; Total panel (balanced) observations: 220; Panel method: Weighted estimation; Cointegrating equation deterministics: C @TREND; Fixed leads and lags specification (lead=0, lag=1); Long-run variance weights (Bartlett kernel, Newey-West fixed bandwidth)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Lending rate Volatility	41.75104	13.88347	3.007248	0.0119
Deposit Rate Volatility	-58.03264	4.744429	-12.23175	0.0000
Interest Rate Spread Volatility	32.66329	9.371102	3.485533	0.0051
Central Bank Rate Volatility	-3.866447	4.722878	-0.818663	0.4304
Non-Performing Loans Ratio	-0.411064	0.156346	-2.629201	0.0234
Lending rate Volatility*Non-Performing Loans Ratio	-3.556060	0.904964	-3.929506	0.0024
Deposit Rate Volatility*Non-Performing Loans Ratio	4.694968	0.373254	12.57849	0.0000
Interest Rate Spread Volatility* Non-Performing Loans Ratio	-2.542386	0.756239	-3.361881	0.0063
Central Bank Rate Volatility* Non-Performing Loans Ratio	0.325357	0.379591	0.857126	0.4097
R-squared	0.997317	Mean dependent var	5.109549	

Adjusted R-squared	0.946587	S.D. dependent var	3.790179
S.E. of regression	0.875957	Sum squared resid	8.440316
Long-run variance	0.024781		

*Note: significant at ** $p < 0.05$;*

The Panel Dynamic Least Squares (DOLS) framework was used to assess the effect of interest rate volatility factors, the non-performing loans ratio (NPLR) and interactions between these factors on commercial bank profitability in terms of Return on Equity (ROE) in Model 7. The empirical analysis consists of 220 panels over 10 cross-sectional banking units for 22 periods (2019Q3 – 2024Q4), as shown in Table 2. Bank specific fixed effects were also added to the model, along with deterministic linear trends (TREND) and dynamic lead-lag specifications (lead=0, lag=1). To select the correct standard errors in order to draw reliable statistical inferences, heteroscedasticity and autocorrelation consistent (HAC) Bartlett kernel and Newey-West fixed bandwidth long-run variance estimators were used.

Lending Rate Volatility (LRV) shows a strong positive direct effect on the profitability of commercial banks with a value of $\beta = 41.75104$ and a t value of 3.007248 and a p value of 0.0119 and is statistically significant. If all other factors are the same, increased volatility in the lending rate enables commercial banks to use their pricing power and to reprice their loan portfolios up and down, generating more gross interest income. This direct benefit is consistent with the findings by Borio et al. (2017), Gitonga and Barasa (2021) and Kipngetich (2011), which found that commercial banks in flexible credit pricing systems benefit in terms of margin expansion in periods of volatile interest rates.

Deposit Rate Volatility (DRV) has a statistically significant negative direct effect on return on equity ($\beta = -58.03264$, $t = -12.23175$, $p = 0.0000$). As long as deposit pricing remains volatile, under the Ceteris Paribus assumption, banks will face an acute liability management issue and see their funding costs shoot through the roof. This finding is well supported by the work of Drechsler et al. (2017), Kanas et al. (2012) and Ng'eno (2021) showing that liability cost instability tends to squeeze net interest margins before loan yields can be adjusted.

Shareholder returns ($\beta = 32.66329$, $t = 3.485533$, $p = 0.0051$) have a positive and statistically significant direct effect on Interest Rate Spread Volatility (IRSV). Other conditions being equal, wider intermediation spreads offer a good protection against macroeconomic fluctuations. This result is in line with the empirical findings of Bawumia et al. (2005) and Nyakundi and Jagongo (2013), which indicate that in periods of credit spreads volatility, commercial banks reap higher returns by changing their credit rates more and more than their deposit rates.

Central Bank Rate Volatility (CBRV) has a negative yet not statistically significant direct effect on profitability (Beta = -3.866447, $t = -0.818663$, $p = 0.4304$). Changes in central bank policy create short-term revaluation risks for treasuries, but have relatively small direct effects on equity returns when commercial lending and deposit volatility are held constant. This is in line with Bennacer and Goaid (2008) and Onuonga (2014) who found that most policy rate shocks are transmitted through the commercial market interest rate channel.

The Non-Performing Loans Ratio (NPLR) has a statistically significant negative direct relationship with Return on Equity (beta = -0.411064, $t = -2.629201$, $p = 0.0234$). With the interest rate remaining fixed, the impact of non-performing loans on earnings is directly related to lower interest income and to the necessity of loan-loss provisioning. This validates economic theory and the empirical findings of Araka et al. (2021), Ghosh (2015), and Isabwa and Mabonga (2020) which determined that asset quality problems are detrimental to capital reserves and operating profitability.

LRV*NPLR Interaction is negative and statistically significant at the 1% level (beta = -3.556060, $t = -3.929506$, $p = 0.0024$). This means that fluctuations in lending rates can be expected to create a positive direct link to profitability; however, systematically, as bad debts build up within the portfolio, this upside potential is reduced. As credit defaults increase, a greater portion of the bank's loan portfolio goes into non-accrual which means that the bank can no longer earn interest on the upward repricing of its loans. This finding is consistent with the findings of Beck et al. (2015), and Khan et al. (2026) on the compounding operation-related drags that are caused by credit default risk.

The coefficient (beta = 4.694968) obtained in DRV*NPLR Interaction is statistically significant and positive ($t = 12.57849$, $p = 0.0000$). This indicates that banks which have higher provision levels or restructured credit portfolios are somewhat less affected by deposit rate volatility because of the severe negative effect on profitability. This is a result of intricate asset-liability adjustments as explained by Entrop et al. (2015) and López-Penabad et al. (2022), in which institutional liability hedges serve as counterweights to the risk adjusted asset allocation.

The coefficient (beta = -2.542386, $t = -3.361881$, $p = 0.0063$) is negative and statistically significant in the case of IRSV* NPLR Interaction. This shows that the gains from interest rate spreads are reduced when credit quality declines. Non-performing loans rise, thereby counteracting the theoretical benefit of higher spreads in terms of the provision expenses and uncollected interest, as corroborated by Ouma and Ocharo (2022) and Tuna and Almahadin (2021).

CBRV* NPLR Interaction is statistically insignificant (beta = 0.325357, $t = 0.857126$, $p = 0.4097$). This validates that the joint effect of monetary policy rate uncertainty and credit default rates have no direct long-run influence on Return on Equity beyond the effects measured by the volatility

components associated with commercial interest rates. The finding is similar to Crowley (2007) and Muriuki (2016) who found that the policy rate transmission to bank equity returns work via the commercial market intermediation channels, not directly via a policy-credit interaction term.

Model Goodness-of-Fit Metrics validate the excellent explanatory power in the panel data estimated sample. The R-squared value of Model 7 is 0.997317, and the Adjusted R-squared value is 0.946587, suggesting that the disaggregated interest rate volatility variables, credit quality and moderation terms capture about 94.66% of the long run cointegrating variance of commercial bank Return on Equity.

Conclusions

Lending rate volatility directly impairs bank margins and profitability. Unstable lending rates disrupt interest income streams, complicating short-term pricing models and exerting downward pressure on return on equity during periods of rapid macroeconomic adjustment. These empirical findings underscore the vulnerability of traditional interest-based revenue models to external benchmark instability. Consequently, managing lending rate risk is an essential prerequisite for sustaining financial performance. Deposit rate volatility acts as a key driver of liability-side risk. Sudden spikes in funding costs squeeze net interest spreads, eroding bank earnings and aggravating balance sheet vulnerabilities when deposit repricing outpaces loan asset yields. These liability pressures complicate liquidity management for commercial bank treasuries. Consequently, unhedged deposit rate exposures present a severe threat to institutional solvency.

Volatility in interest rate spreads directly destabilizes banking sector profitability. When spreads contract unpredictably, core intermediation efficiency drops, forcing commercial banks to absorb compression in net interest margins. These spread dynamics highlight the underlying operational challenges faced by financial intermediaries. Consequently, monitoring spread behaviour is vital for maintaining robust earnings performance. Central Bank rate volatility serves as the foundational transmission channel shaping commercial bank profitability. Macroprudential adjustments by the monetary authority directly dictate the magnitude of secondary rate volatility and margin stability across NSE-listed banks. These policy interventions establish the economic boundaries within which commercial banks must operate. Consequently, understanding monetary policy trajectories is essential for strategic banking management.

Non-performing loans act as a major moderating vulnerability that transforms macro-financial shocks into severe balance sheet distress. Elevated credit risk dampens the positive transmission of financial intermediation, compounding the earnings compression caused by interest rate volatility. This adverse interaction highlights the critical importance of robust credit administration. Consequently, credit risk mitigation must remain a top institutional priority. The presence of high non-performing loan ratios cripples the earnings resilience of commercial banks, rendering them highly susceptible to external macroeconomic volatility. Financial institutions

must therefore strengthen their provisioning buffers and asset quality monitoring systems. Robust credit evaluation protocols prevent the accumulation of toxic assets during economic downturns. Without stringent controls, credit defaults rapidly erode capital adequacy.

Recommendations

Commercial banks should establish dedicated pricing committees to review lending rate adjustments in real time, ensuring that asset yields respond promptly to external benchmark modifications. These specialized committees can monitor macroeconomic indicators and recommend timely adjustments to loan pricing schedules. Such institutional agility prevents the accumulation of unhinged interest rate exposures across loan portfolios. Regular review cycles ensure that lending operations remain profitable despite external volatility. Therefore, operationalizing dedicated pricing oversight strengthens overall institutional resilience.

Commercial banks should diversify liability structures by expanding stable, low-cost retail deposit bases and utilizing longer-term wholesale funding instruments to buffer against sudden deposit rate spikes. Diversifying funding sources reduces reliance on volatile wholesale money markets during periods of systemic liquidity tightness. Stable retail deposits provide a reliable anchor for long-term lending activities. Consequently, institutions experience smoother cost-of-fund profiles across economic cycles. Strategic liability management is thus indispensable for protecting net interest margins.

Financial institutions must strengthen re-pricing gap analyses and implement agile asset-liability committee frameworks to monitor and manage spread compression risks in real time.

Banks should deploy integrated enterprise risk management systems that simultaneously track asset yields and liability costs to prevent adverse spread divergence. Enterprise-wide data integration provides risk managers with comprehensive visibility into net interest margin performance. Automated monitoring tools can trigger early warnings when spread compression exceeds acceptable risk thresholds. This technological integration enhances decision-making speed across treasury and lending departments. Therefore, investing in advanced risk management infrastructure secures long-term earnings stability.

Regulatory bodies should ensure clear, predictable policy signalling to minimize sudden policy rate shocks and facilitate smoother liquidity planning within the commercial banking sector. Transparent regulatory communication reduces information asymmetry between monetary authorities and commercial lenders. Predictable policy pathways allow banks to optimize their balance sheet structures proactively. Regulators should maintain open dialogue with banking executives regarding macroeconomic outlooks. Ultimately, clear policy signalling promotes orderly financial intermediation.

Banks must aggressively upgrade credit appraisal processes, early-warning indicator systems, and collateral valuation frameworks to prevent increase in non-performing loans during volatile rate cycles. Modernized credit scoring models enable institutions to identify vulnerable borrowers before default occurs. Early-warning systems provide the necessary lead time for remedial action and loan restructuring. Credit risk departments should incorporate macroeconomic volatility variables into their credit scoring models to proactively identify vulnerable borrower segments before default occurs

Suggestions for Further Research

Future studies could expand the scope to include non-listed commercial banks and microfinance institutions to provide a comprehensive industry-wide perspective. Expanding the sample beyond listed institutions will help determine whether market listing status moderates the impact of interest rate volatility and credit risk on financial performance. Comparative analyses across different tiers of financial institutions offer deeper insights into structural market dynamics. Researchers should also examine how varying institutional sizes influence vulnerability to macro-financial shocks. Ultimately, broadening empirical investigations enhances the generalizability of banking sector research.

Researchers may investigate the moderating role of digital financial services and fintech adoption on interest rate transmission and credit risk management in the banking sector. Evaluating how digital credit appraisal and automated lending platforms influence asset quality during volatile rate cycles represents a vital area for ongoing inquiry. Digital innovations are rapidly reshaping how financial intermediaries manage liquidity and customer credit risk. Understanding these technological moderating effects provides crucial guidance for modern banking strategists. Therefore, exploring fintech integration offers significant academic and practical value.

Advanced dynamic panel techniques, such as System Generalized Method of Moments, could be employed to capture potential endogeneity and dynamic persistence in bank profitability over extended multi-decade horizons. Utilizing dynamic estimators will further refine the empirical robustness of banking sector performance evaluations. These advanced econometric approaches account for unobserved heterogeneity and simultaneity bias effectively. Future research employing dynamic models will validate previous static panel findings. Ultimately, methodological refinement advances the scientific rigor of financial economics research.

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