INTEREST RATE VOLATILITY ON THE PERFORMANCE OF DEPOSIT MONEY BANK IN NIGERIA

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BEING A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF FINANCE, FACULTY OF MANAGEMENTS SCIENCES, UNIVERSITY OF BENIN, BENIN CITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE (B.Sc.) DEGREE IN FINANCE

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DECLARATION

I, **Olga Chinanuekpere AJOKU** with mat no: **MGS2104721** declare that this projected submitted to the Department of Finance, Faculty of Management Sciences, University of Benin, Benin City, under the supervision of **Prof. M.G. Ajao** is based on a study undertaken by me. This work has not been previously submitted for the award of degree elsewhere. All ideas and views are products of my personal research and all the references made to works of other persons have been duly acknowledged.

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CERTIFCATION

This is to certify that this project work submitted by **Olga Chinanuekpere AJOKU** of the Department of Finance, Faculty of Management Sciences, University of Benin, Benin City, is adequate in scope and quality in partial fulfillment of the requirements for the award of Bachelor of Science (B.Sc.) degree in Finance.

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DEDICATION

This project is dedicated to the Almighty God for the grace He bestowed upon me all through my study in the University of Benin and to my parents Mr. and Mrs. Ajoku.

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My sincere appreciation goes to Almighty God who has ordered my steps throughout my tertiary education pursuit in the University of Benin. I will forever be grateful to you, Lord.

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ABSTRACT

This study investigates the effect of interest rate fluctuations on the performance of deposit money banks in Nigeria over the period 1981 to 2023. Specifically, the study examines the impact of lending interest rate (LIR), deposit interest rate (DIR), and interest rate volatility (IRV) on bank performance, measured by aggregate return on assets (ROA). Time-series data sourced from relevant financial and institutional databases were analysed using the Robust Least Squares (RLS) estimation technique, which accounts for heteroskedasticity and specification errors. The findings reveal that lending interest rate has a statistically significant positive effect on bank performance, while interest rate volatility exerts a significant negative influence. In contrast, deposit interest rate does not significantly affect performance. Based on these findings, the study recommends the implementation of flexible but well-structured lending rate policies to support bank profitability, dynamic deposit pricing strategies to improve funding stability, and consistent monetary policy frameworks to minimise interest rate volatility and promote financial system resilience.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

This research investigates how fluctuations in interest rates impact the performance of deposit money banks in Nigeria. Using panel data estimation techniques, it analyzes 144 observations across 16 banks from 2014 to 2023. The findings show that liquidity risk indicators such as the loan-to-deposit ratio and liquid asset ratio significantly and negatively affect firm value. Likewise, net interest margin and GDP exert a negative influence on bank valuation. In most countries, especially developing ones, the financial sector plays a pivotal role in driving economic development. Deposit money banks serve as critical intermediaries by mobilizing public savings and allocating credit for productive investments. Their operational success is heavily influenced by macroeconomic indicators, the chief among them, interest rate behavior (Obamuyi, 2013).

Key components of interest rate dynamics are lending rates (LIR), deposit rates (DIR), and interest rate spread (IRS) which directly shape bank performance metrics, particularly return on assets (ROA). In Nigeria, the interaction between these interest variables and bank profitability has drawn attention due to recurring economic fluctuations and evolving monetary policy.

Interest rates in Nigeria are sensitive to factors such as inflation, exchange rate fluctuations, government spending, and global economic shifts. Because monetary policy in Nigeria often lacks consistency, interest rates tend to be erratic. The Central Bank of Nigeria (CBN), responsible for policy regulation, frequently adjusts the Monetary Policy Rate (MPR) to maintain price and currency stability. While necessary, these adjustments contribute to irregular interest rate patterns (CBN, 2022).

Interest income from loans and advances constitutes a significant portion of bank revenue. However, in a volatile rate environment, forecasting income becomes uncertain, accurate loan pricing becomes difficult, and long-term strategies may be compromised. For example, rising interest rates may discourage borrowing, shrinking loan books, while falling rates compress net interest margins, the gap between interest earned and interest paid are thereby reducing profitability (Kolapo et al, 2012).

Banks also fulfill a crucial economic role by channeling savings from surplus units to deficit units. According to Mbabizize et al. (2014), changes in interest rates can either support profitability or undermine profit margins, potentially resulting in financial losses. Volatile interest rates raise the likelihood of default, especially in Nigeria's constrained lending environment. This can increase the ratio of non-performing loans (NPLs), weakening the financial stability of banks (Owolabi & Ajayi, 2018). Persistent fluctuations may also erode investor confidence and diminish the effectiveness of banks as financial intermediaries.

Over time, the CBN has implemented a variety of interest rate policies to manage inflation and respond to both local and international economic shocks. These policy shifts can affect banks positively or negatively depending on how effectively they manage the associated risks (CBN, 2021). Understanding how interest rate volatility influences bank performance is thus vital for bankers, policymakers, investors, and scholars.

Despite restructuring, recapitalization, and regulatory reforms, Nigerian banks remain vulnerable to interest rate volatility. Between 2014 and 2023, the country experienced several rate shifts driven by oil price volatility, foreign exchange instability, and inflation. These dynamics highlight the importance of evaluating how banks are coping with such volatility and how it affects key performance indicators like ROA, ROE, NIM, and profit before tax (CBN, 2021; NDIC, 2022).

The relationship between interest rates and banking performance is further shaped by macroeconomic variables like inflation and fiscal policy. For example, recent Naira depreciation and fuel subsidy removal have fueled inflation, which in turn affects CBN's interest rate decisions. These interactions influence the operating environment of deposit money banks.

This research aims to close a knowledge gap by empirically analyzing how interest rate volatility impacts selected Nigerian banks over a ten-year period. It offers evidence-based insights to inform monetary policymaking, improve risk management, and guide strategic decision-making in the sector.

1.2 Statement of the Research Problem

In Nigeria, deposit money banks play a foundational role in savings mobilization, credit allocation, and monetary transmission. However, recent years have seen increasing volatility in interest rates caused by inflation, exchange rate fluctuations, inconsistent policies, and external shocks like global oil price crashes (CBN, 2022).

Although interest rate changes are typical in economic cycles, excessive fluctuations pose unique challenges for banks. A primary concern is the mismatch between assets and liabilities, when banks are unable to synchronize the timing and sensitivity of loan income and deposit costs. This mismatch can diminish net interest income, escalate risk exposure, and heighten liquidity threats (Adeleke & Oladipo, 2020). Across Africa, studies show that rising rate volatility can hurt financial sector stability by increasing credit risk and lowering capital adequacy (AfDB, 2021). Unmanaged fluctuations not only affect individual institutions but may also introduce systemic threats. In Nigeria's academic research, most studies focus on static interest rate levels and their effects on lending or profitability. Very few isolate volatility as a core explanatory factor, even though unpredictable movements are arguably more harmful than high or low rates alone (Obamuyi, 2013; Owolabi & Ajayi, 2018).

Despite years of reforms and recapitalization, persistent interest rate instability continues to expose Nigerian banks to earnings volatility and asset quality concerns. This leads to key questions:

How much does interest rate volatility, not just interest rate levels affect bank performance?

Which financial indicators (ROA, ROE, NIM, PBT) are most vulnerable to rate volatility?

What strategies can banks adopt to reduce the negative impact of volatile rates?

This study seeks to address these questions using empirical evidence over a decade-long period, offering insights that could guide more effective regulation and risk management in the sector.

1.3 Research Questions

1. How do lending interest rates (LIR) affect the return on assets (ROA) of deposit money banks in Nigeria?
2. In what ways do deposit interest rates (DIR) influence the return on assets of Nigerian deposit money banks?
3. What relationship exists between fluctuations in interest rates and the financial performance indicators of banks, specifically ROA, ROE, and NIM?
4. To what extent do changes in interest rates explain variations in profitability and earnings stability of Nigerian deposit money banks?

1.4 Objectives of the Study

The specific objectives are to:

1. Examine how lending interest rates (LIR) influence return on assets (ROA) of deposit money banks in Nigeria.

2. Assess the effect of deposit interest rates (DIR) on ROA of Nigerian deposit money banks.
3. Evaluate the relationship between interest rate volatility and key financial performance indicators, including ROA, ROE, and NIM
4. Determine the extent to which interest rate fluctuations contribute to variations in profitability and earnings stability

1.5 Research Hypotheses

To guide the empirical analysis, the following null and alternative hypotheses are formulated:

H_{01}: Lending interest rates (LIR) have no significant influence on the return on assets (ROA) of deposit money bank.

H_{02}: Deposit interest rates (DIR) have no significant effect on the ROA of Nigerian deposit money banks.

H_{03}: Interest rate volatility has no significant relationship with key financial performance indicators (ROA, ROE, and NIM) of deposit money banks in Nigeria.

H_{04}: Interest rate fluctuations do not significantly contribute to variations in profitability and earnings stability of deposit money banks in Nigeria.

1.6 Significance of the Study

This study offers valuable insights into how interest rate volatility affects the financial health of deposit money banks in Nigeria, particularly in relation to profitability, risk management, and policy implications.

Risk Management: By analyzing the effect of rate volatility, banks can better predict income variability and develop strategies to stabilize asset-liability management.

Informed Decision making: The findings can assist bank executives in optimizing pricing strategies, credit portfolio management, and strategic financial planning.

Regulatory Oversight: Regulatory agencies, particularly the CBN, may use the insights to design more responsive and stabilizing monetary policies.

Economic Stability: Understanding how volatile rates affect banks can help protect the broader financial system and national economy.

Innovation and Product Design: Banks may use the results to create innovative financial products that hedge against interest rate risks.

Academic Contribution: The study expands the literature on interest rate dynamics, especially by isolating volatility as a distinct explanatory variable.

Policy Development: It may inform actionable recommendations for central banking authorities to enhance regulatory control over rate fluctuations.

Stakeholder Awareness: Investors, borrowers, and depositors can make more informed decisions by understanding how interest rate volatility influences bank performance.

Sectorial Performance Insight: This research provides a clearer view of how fluctuations in interest rates affect efficiency and financial stability within Nigerian banks.

Broader Economic Development: By improving understanding of banking stability, the study indirectly contributes to efforts aimed at fostering sustainable economic growth.

1.7 Scope of the Study

This research focuses exclusively on the relationship between interest rate volatility and the performance of deposit money banks operating in Nigeria. It includes only commercial banks licensed by the Central Bank of Nigeria and listed on the Nigerian Exchange Group.

Time Frame: The analysis covers a ten-year period, from 2014 to 2023, a period marked by considerable interest rate policy changes and economic disruptions.

Variables: Bank performance is assessed using indicators like ROA, ROE, and NIM, while interest rate volatility is measured through standard deviation or variance of policy rates.

Exclusions: Microfinance banks, mortgage institutions, and non-bank financial entities are excluded. Macroeconomic variables like exchange rate and inflation are considered only when they directly influence interest rate volatility.

1.8 Limitations of the Study

Several constraints may influence the generalizability of this study's findings:

Data Limitations: Reliable data across all sampled banks may be incomplete or inconsistent, especially over the ten-year period.

Measurement Constraints: Standard measures of volatility (e.g., variance) may not capture qualitative aspects like investor sentiment or sudden policy changes.

Internal Bank Variables: Factors such as management competence or operational efficiency are not considered, although they may affect performance.

Restricted Scope: The study is limited to Nigerian commercial banks and may not reflect banking dynamics in other African or global economies.

Time Horizon: A ten-year window may be too short to fully capture long-term effects of interest rate volatility.

Macroeconomic Spillover: Despite efforts to isolate interest rate fluctuations, external factors such as inflation and fiscal shocks may still influence bank performance.

Despite these limitations, the study offers valuable insights that contribute meaningfully to understanding the effects of interest rate volatility on the Nigerian banking industry.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This chapter explores relevant literature on the relationship between interest rate volatility and the performance of deposit money banks in Nigeria. It provides conceptual definitions, theoretical underpinnings, and empirical findings that support the study's framework. The review begins with an explanation of key terms such as interest rate, volatility, and bank performance, followed by an analysis of the theories and previous research studies that inform this investigation.

2.2 Conceptual Review

2.2.1 Interest Rate

Interest rate is the cost of borrowing funds or the return on savings, typically expressed as a percentage of the loan or investment amount. It plays a central role in monetary policy and influences consumption, investment, and savings decisions across the economy (CBN, 2022). In essence, it represents the price of money over time, borrowers pay it as a fee for current access to funds, while savers receive it for postponing consumption.

According to Kimani (2018), interest rates reflect the trade-off between present and future resource use. Keynes (2018) explained interest rates as indicators influenced by price expectations and resource scarcity. Maimbo and Gallagos (2014) noted that interest rate models are often shaped by political and economic motives, especially in developing

nations. Kiseu (2014) described them as signals of the rising cost of capital, while Miller (2013) highlighted their role in interest rate derivatives such as caps and floors.

In Nigeria, financial institutions like FSDH Merchant Bank, First Bank, and Zenith Bank offer varying deposit rates, some of which can exceed 9% depending on tenure. As of May 2025, the Central Bank of Nigeria (CBN), under Governor Olayemi Cardoso, set the Monetary Policy Rate (MPR) at 27.5% to combat persistent inflation, which ranged between 23% and 24%.

During the COVID-19 period, the CBN temporarily reduced loan rates under the Nigerian Content Intervention Fund from 8% to 6% as a relief measure.

2.2.2 Nominal vs. Real Interest Rate

Interest rates can be categorized as nominal or real. Nominal interest rates do not account for inflation, making them simpler to quote and understand. For example, the interest rate advertised on a bank loan or savings deposit is nominal. However, because inflation erodes purchasing power, nominal rates alone may not provide an accurate picture.

Real interest rates adjust nominal rates to reflect changes in the price level. If inflation is subtracted from the nominal rate, the result is the real rate. When using expected inflation, the result is the ex-ante real interest rate; when using actual inflation, it is the ex-post real interest rate. Real rates offer a clearer view of the true cost of borrowing and are essential for sound financial planning.

2.2.3 Deposit Money Bank (DMB)

Following banking reforms in 2004, the term “commercial bank” was replaced with “deposit money bank” (DMB) in Nigeria to reflect broader regulatory changes. DMBs are financial institutions licensed to accept deposits, provide loans, and perform other core banking functions. They play a vital role in economic development by facilitating capital formation and credit distribution.

In Nigeria, the Central Bank regulates DMBs, ensuring compliance with liquidity ratios, capital adequacy standards, and prudential guidelines. As of April 26, 2024, there were 26 licensed DMBs, of which seven (7) banking license are of international authorization , they include Access bank, Zenith bank, Fidelity bank, First City Monument Bank (FCMB), Guaranty Trust Bank (GTB), First Bank, Unity Bank of Africa. Fifteen (15) banks are with national licenses, four (4) with regional authorization, four (4) non-interest bank with national authorization, and six (6) merchant banks of banking license with national authorization.

2.2.4 Interest Rate Volatility

Interest rate volatility refers to the degree of fluctuation in interest rates over a certain period. These fluctuations may result from changes in inflation, monetary policy, currency exchange rates, or external shocks. For banks, volatility introduces uncertainty in lending, deposit pricing, and income forecasting (Adeleke & Oladipo, 2020; Flannery & James, 1984).

Volatility is commonly measured using tools such as standard deviation, variance, or econometric models like GARCH. In Nigeria, interest rate shifts are often triggered by changes in the Monetary Policy Rate (MPR), which the CBN uses to maintain economic stability (CBN, 2020).

Unstable interest rates can impair banks' ability to project returns, manage risk, and extend long-term credit. High volatility is linked to income instability, reduced credit activity, and weakening capital buffers (Berger, Demsetz & Strahan, 2000).

In developing economies with weaker financial systems, like Nigeria, the negative effects of interest rate volatility are often more pronounced. Sudden policy shifts or poor fiscal coordination can trigger erratic rate behavior (Delebari & Didi, 2020; Glower, 1994). Volatility also discourages investment and can increase unemployment (Evans, 1984; Friedman, 1982; Dutkowsky, 1987).

2.2.5 Bank Performance Metrics

Bank performance is typically evaluated through financial ratios:

Return on Assets (ROA): Reflects how efficiently a bank generates profit from its assets. Volatility in rates may reduce ROA due to uncertain loan returns and asset revaluation (Kim & Kim, 2015).

Return on Equity (ROE): Indicates shareholder profitability. Instability in interest rates can erode returns and investor confidence (Adeleke & Oladipo, 2020).

Net Interest Margin (NIM): Measures the spread between interest income and expenses relative to earning assets. NIM declines when liabilities reprice faster than assets (AfDB, 2021).

These metrics are sensitive to interest rate shocks and provide insight into how volatility impacts banking performance (Owolabi & Ajayi, 2018).

2.2.6 Interest Rate Risk and Repricing Gap

Interest rate risk arises from a mismatch between a bank's interest-earning assets and its interest-bearing liabilities. When rate changes are not matched in timing or magnitude across these categories, net interest income may decline.

Repricing gap analysis is used to quantify this mismatch over set periods. If more liabilities than assets are repriced when rates rise, a bank's costs increase faster than its revenues, creating a risk of loss (AfDB, 2021).

2.2.7 Interest Rate Transmission in Banking

Interest rate transmission refers to how changes in the central bank's policy rate affect broader market rates and lending behavior. Ideally, adjustments in the MPR influence lending and deposit rates across the banking sector.

In Nigeria, however, this transmission mechanism is often slow or ineffective due to structural issues, low competition, and high levels of non-performing loans (CBN, 2020). This leads to greater uncertainty and amplifies the effects of volatility (Obamuyi, 2013).

2.2.8 Risk Management in Volatile Environments

To reduce exposure to interest rate fluctuations, banks must adopt risk management practices such as:

Gap and duration analysis for managing timing mismatches

Hedging instruments like derivatives or swaps

Stress testing and scenario planning to evaluate worst-case outcomes

Despite their importance, many Nigerian banks lack the tools, infrastructure, or expertise to implement these measures effectively (Osei-Assibey & Asenso, 2015).

2.3 Theoretical Framework

The theoretical framework provides the foundation for understanding the relationship between interest rate volatility and bank performance. It draws on established financial and economic theories to explain how fluctuations in interest rates influence banking outcomes, particularly in the Nigerian context. Several key theories inform this research are:

2.3.1 Loanable Funds Theory

Originally developed by Knut Wicksell and refined by Irving Fisher (1930), the Loanable Funds Theory suggests that the interest rate is determined by the interaction of the supply of and demand for loanable funds. An increase in savings leads to lower interest rates, while increased demand for loans (e.g. for investment or government borrowing) pushes rates higher.

In Nigeria, macroeconomic conditions such as inflation, fiscal policy, and investment trends affect the supply and demand for funds. Interest rate volatility often results from these imbalances, influencing the cost and availability of credit for banks and their customers.

2.3.2 Liquidity Preference Theory

Proposed by John Maynard Keynes (1936), the Liquidity Preference Theory asserts that interest rates are determined by the supply of and demand for money. People hold money for three reasons: transactions, precaution, and speculation. During uncertain times or volatile rate periods, individuals and banks prefer holding liquid assets rather than committing to long-term investments.

High interest rate volatility in Nigeria often compels banks to maintain higher levels of liquidity. This risk-averse behavior reduces their willingness to issue long-term loans, which can negatively affect earnings and profitability.

2.3.3 Expectations Theory of Interest Rates

This theory posits that long-term interest rates are the average of expected future short-term rates. If future rates are expected to rise, long-term rates will increase accordingly.

Nigerian banks rely on expectations about future rate movements when making investment and lending decisions. In periods of high volatility, these expectations become unclear, leading to pricing errors and suboptimal performance.

2.3.4 Risk-Return Trade-Off Theory

Based on modern portfolio theory and the work of Markowitz (1952), this theory suggests that greater returns are generally associated with higher risk. In banking, managing interest rate exposure is a balancing act that is, taking on more risk (e.g., variable-rate loans) may yield higher returns, but it also increases exposure to rate fluctuations.

Interest rate volatility represents a significant risk. Nigerian banks often must decide between chasing higher returns and protecting capital. Misjudging this trade-off can hurt metrics like ROA, ROE, and NIM (Kim & Kim, 2015; Owolabi & Ajayi, 2018).

2.3.5 Efficient Market Hypothesis (EMH)

Proposed by Eugene Fama (1970), the EMH argues that financial markets efficiently incorporate all available information into prices. Therefore, changes in interest rates should already be reflected in bank asset prices and performance metrics.

In Nigeria, the financial markets are not fully efficient. Delays in market reactions and poor information flow can amplify the impact of interest rate shocks on bank performance, especially when policies are unexpected or inadequately communicated (Obamuyi, 2013).

2.3.6 Agency Theory

Jensen and Meckling's (1976) Agency Theory highlights conflicts of interest between owners (shareholders) and managers (agents). Managers may pursue short-term profits or riskier investments that threaten long-term performance.

In Nigeria, misalignment between bank executives and shareholders can lead to reckless lending or poor risk assessment, especially in volatile environments. Rising DIR, for instance, can disproportionately reduce ROA when managers fail to adjust lending behavior appropriately (Dike et al., 2025).

2.3.7 Financial Intermediation Theory

This theory views banks as intermediaries that channel savings from surplus economic units to deficit ones. Effective intermediation involves collecting deposits at reasonable DIR and offering loans at viable LIR.

Ali-Momoh and Fajuyagbe (2022) argue that Nigerian banks' performance is heavily dependent on their ability to maintain this intermediation function. Volatile interest rates can disrupt the balance between deposit costs and lending income, squeezing returns on assets.

2.3.8 Arbitrage Pricing Theory (APT)

Stephen Ross (1976) developed APT to explain asset returns based on multiple macroeconomic variables, including interest rates, inflation, and exchange rates.

This theory offers a flexible model to examine how interest rate volatility, in conjunction with other factors like GDP and inflation, affects bank income. It supports the use of dynamic models such as DOLS in analyzing bank performance under fluctuating economic conditions (Adeleke & Oladipo, 2020).

Together, these theories underscore the complex, dynamic relationship between interest rate volatility and banking performance. They highlight that banks adjust their financial

strategies pricing, credit exposure, and asset allocation, in response to changes in the interest rate environment. These adjustments, in turn, influence key performance indicators, making theoretical grounding essential for understanding empirical results.

2.4. Empirical Literature Review

Empirical studies have explored the relationship between interest rate dynamics and the performance of deposit money banks, though they differ in methodology, data coverage, and geographical focus. This section highlights key findings from Nigeria, Africa, and beyond, while identifying gaps in existing knowledge.

In Nigeria, Okoye and Richard (2013) examined how lending rates and the monetary policy rate affected the performance of Nigerian banks between 2000 and 2010. Using econometric regression on secondary time-series data, they found that both variables significantly and positively influenced bank performance. The authors recommended stronger regulation and effective lending rate policies to enhance performance and profitability.

Obamuyi (2013) identified interest rates as a major determinant of bank performance and profitability. He found that interest rate and inflation significantly effect negatively on bank profitability and performance, while using the time-series analysis.

Owolabi & Ajayi (2018) found that unstable rates reduced return on assets and return on equity between 2006 and 2016. They examined the relationship between interest rate movements and the performance of deposit money banks in Nigeria

Adeleke & Oladipo (2020) modeled volatility directly using standard deviation measures and confirmed a negative correlation between interest rate volatility and bank performance. They concluded that Nigerian banks are highly vulnerable to unpredicted rate movements.

Another investigation into lending rates and monetary policy (2012) evaluated the performance of Nigerian banks before and after the 2004 consolidation exercise. Drawing data from 20 of the 25 surviving banks and the Central Bank of Nigeria, the results suggested that interest rate policies had not substantially improved banks' overall performance or economic growth.

Akaibom Ita (2012) examined the impact of interest rates on the net assets of multinational companies between 1995 and 2010. The regression analysis showed that rising rates reduced firms' net asset values, underscoring the broader impact of rate fluctuations on corporate balance sheets.

Jelilov (2015) studied the effect of interest rates on Nigeria's economic growth from 1990 to 2013. The study revealed that high interest rates constrained growth, while lower rates could stimulate investment. The author emphasized that authorities should adopt policies that encourage investment through more favorable rate regimes.

Ariwa (2023), using 2007-2020 panel data for deposit money banks, finds that interest-rate spread significantly influences ROA, ROE, and profit after tax, it is evident that the pricing gaps between lending and deposit rates remain central to profitability. Earlier sector work also connects spread dynamics to bank performance and competitiveness.

Anthony (2012) investigated the determinants of bank savings and their contribution to economic growth in Nigeria between 1970 and 2006. Employing distributed lag models and error correction techniques, the findings showed that GDP per capita, financial deepening, and interest rate spread positively influenced domestic savings, while real interest rates and inflation exerted negative effects. The study further revealed that higher private savings and credit flows support long-term economic growth.

The Central Bank of Nigeria research documents volatility interactions between the interbank money market rate and the FX market, with dynamic correlation and spillovers over 2007-2019 mechanisms through which rate volatility can transmit to bank risk, funding costs, and ultimately earnings.

In the international front, Flannery and James (1984) conducted one of the earliest, United States studies on back performance and found that interest rate volatility negatively affected financial institutions stock reforms, stressing the importance of asset liability matching.

Argimón et al. (2023) find that higher interest rates are generally associated with wider net interest margins (NIMs), and that this link is stronger when starting from very low rates.

English, Van den Heuvel and Zakrajšek (2018) document that unexpected rate moves around FOMC announcements shift bank stock prices and are informative about interest-rate risk exposures.

Berry et al. (2019) at the Federal Reserve reported that during the 2015-2019 tightening cycle, U.S. banks' NIMs rose on average compared with earlier cycles, underscoring a positive, but not uniform pass-through to margins.

Abdymomunov, Gerlach and Sakurai (2023) show U.S. banks carry material interest-rate risk in both earnings and economic value of equity, with smaller banks typically more exposed, evidence that portfolio structure and repricing gaps crucially shape outcomes when rates move.

In the African region, Osei-Assibey and Asenso (2015) reported that weak interest rate transmission mechanisms in Ghana limited the responsiveness of lending to policy changes.

The African Development Bank (2021) highlighted that volatility across African countries contributed to rising non-performing loans, reduced profitability, and overall financial fragility. These findings point to the need for more effective regulation, monetary policy discipline, and robust risk management practices.

2.5 Summary of Empirical Literature Review

The reviewed literature reveals that interest rate volatility significantly affects the performance of deposit money banks. Both local and international studies confirm that unpredictable interest rate movements reduces performance, profitability, shrink net interest margins, and increase financial risk exposure. Overall, most Nigerian studies point to a negative relationship between interest rate volatility and bank performance, though methodological gaps remain. Few have employed dynamic models such as DOLS

or long-term co-integration frameworks, and regulatory or structural inefficiencies are often overlooked. This highlights the need for further empirical work that isolates volatility as a distinct explanatory factor in the Nigerian banking sector.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The methodology section provides the framework that guides how this research was carried out to assess the impact of interest rate volatility on the performance of Nigerian deposit money banks. A well-structured methodology acts as a roadmap, ensuring that the study is systematic, valid, and reliable (Creswell & Creswell, 2018). This chapter therefore outlines the research design, study population, sampling technique, data sources, data collection methods, model specification, estimation techniques, diagnostic tests, validity and reliability of instruments, as well as ethical considerations.

The study relies on secondary data presented in both time-series and panel formats covering the period 2013-2023. This approach allows for the analysis of historical developments without directly influencing the variables under investigation (Gujarati & Porter, 2009). By applying quantitative methods, the research is able to measure the strength of relationships among economic variables, test hypotheses, and evaluate both short-term and long-term effects of interest rate fluctuations on bank performance (Wooldridge, 2016; Oladeji & Adegbite, 2021). Moreover, the methodology integrates descriptive statistics for summarizing patterns and econometric techniques for testing causal relationships, which is consistent with widely accepted standards in empirical banking research (Saunders, Lewis & Thornhill, 2019).

3.2 Research Design

This study employs an ex-post facto quantitative research design, which is appropriate because it examines past events and existing financial data without altering the variables. Such a design is widely used in banking and finance research in Nigeria and globally since it provides credible insights into macroeconomic and firm-level determinants of performance (Kothari, 2014; Adegbite & Alabi, 2019).

Specifically, the design combines longitudinal time-series data (2013-2023) with panel econometric models, making it possible to capture both temporal variations and bank-specific differences (Hsiao, 2014). Since the researcher does not have control over variables such as interest rates or profitability ratios, the non-experimental but explanatory nature of the design is appropriate. It permits the testing of hypotheses regarding causal relationships between interest rate volatility and banking performance (Yin, 2018).

The design also facilitates the application of both descriptive and inferential statistical methods. Descriptive analysis provides a summary of trends in interest rates and profitability indicators, while inferential techniques help in testing the research hypotheses and determining whether the observed relationships are statistically significant (Bryman, 2016; Ogoke & Amadi, 2024).

3.3 Population of the Study

The population of this research consists of all twenty-four (24) deposit money banks that were duly licensed by the Central Bank of Nigeria (CBN) and the Nigeria Deposit

Insurance Corporation (NDIC) as of 2023. These institutions operate within the framework of the Banks and Other Financial Institutions Act (BOFIA) and are at the core of Nigeria's financial intermediation system. Because of their pivotal role, their profitability is heavily influenced by interest rate dynamics, which affect lending capacity, deposit mobilization, and overall earnings (Sanusi, 2010; Nwokoma, 2018).

The selection of Nigerian deposit money banks as the focus is justified since they represent the primary channels through which monetary policy adjustments are transmitted into the real economy (CBN, 2023). For instance, a rise in lending rates may discourage credit demand while boosting bank's interest income, and an increase in deposit rates can raise funding costs and compress profit margins. These dynamics have direct implications for bank performance indicators such as Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM) (Adeleke & Olayiwola, 2020; Khrawish, 2011).

3.4 Sample Size and Sampling Technique

From the study population, a purposive sampling technique was applied to select seven deposit money banks that have international authorization and have consistently published financial statements over the study period. Purposive sampling is appropriate in this context because the research requires reliable and complete financial data covering ten years (Saunders, Lewis & Thornhill, 2019). Similar approaches have been adopted by both Nigerian and international scholars when studying banking performance (Adegbite & Alabi, 2019; Ogoke & Amadi, 2024; Berger & Bouwman, 2013).

The selected banks include:

Access Bank Plc

Fidelity Bank Plc

First City Monument Bank (FCMB)

First Bank of Nigeria Plc

Guaranty Trust Holding Company (GTCO)

United Bank for Africa (UBA) Plc

Zenith Bank Plc

These banks were chosen because they meet the following criteria:

Availability of audited annual financial statements from 2013 to 2023.

Continuous listing on the Nigerian Exchange Group (NGX).

Regular reporting of performance indicators such as ROA, ROE, and NIM.

In addition, these institutions are considered systemically important and collectively account for a significant share of total banking sector assets and transactions in Nigeria (CBN, 2023; World Bank, 2022).

3.5 Sources of Data

The study relies entirely on secondary data, which is both cost-effective and appropriate for a longitudinal study spanning 2013-2023. The use of secondary sources is consistent with earlier studies on interest rate dynamics and banking performance in Nigeria (Adeleke & Olayiwola, 2020; Uzowanne, 2015) as well as international evidence (Levin, Lin & Chu, 2002; Baltagi, 2005).

The main data sources include:

Central Bank of Nigeria (CBN) Statistical Bulletin

Nigeria Deposit Insurance Corporation (NDIC) Annual Reports

National Bureau of Statistics (NBS) publications

World Bank and International Monetary Fund (IMF) databases

Audited annual reports of the sampled banks

Additionally, academic articles, policy briefs, journals, and textbooks were consulted to provide context and strengthen the review of relevant variables. Relying on these regulated and internationally recognized sources ensures that the data used is accurate, verifiable, and comparable across banks and years (Gujarati & Porter, 2009; Saunders et al., 2019).

3.6 Methods of Data Collection

The data for this study were collected through a documentary review of audited financial statements, official statistical publications, and regulatory reports. This approach minimizes researcher bias because it draws on independently verified and publicly available information (Bryman, 2016; Saunders, Lewis & Thornhill, 2019).

The variables extracted fall into three categories:

Bank performance indicators :Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM).

Interest rate variables : Lending interest rate, deposit interest rate, and interest rate volatility indices.

Macroeconomic control variables: Inflation and exchange rates.

The chosen timeframe of 2013-2023 was deliberate. It captures critical economic phases in Nigeria, including the pre-recession years, the 2016 recession, the COVID-19 pandemic, and the subsequent recovery. Using official records from the CBN, NDIC, NBS, and the audited reports of sampled banks guarantees the reliability of the data (World Bank, 2022; IMF, 2021).

3.7 Model Specification

This study specifies econometric models that link interest rate volatility with bank performance, drawing theoretical support from Fisher's Effect and Keynes' Liquidity Preference Theory (Fisher, 1930; Keynes, 1936).

Functional Relationship:

$PERF_{it} = f(LIR_{it}, DIR_{it}, IRV_{it}, INF_{it})$

Econometric Model:

$$PERF_{it} = \beta_0 + \beta_1 LIR_{it} + \beta_2 DIR_{it} + \beta_3 IRV_{it} + \beta_4 INF + \varepsilon_{it}$$

Where:

PERF = Bank performance (proxied by ROA, ROE, and NIM).

LIR = Lending interest rate.

DIR = Deposit interest rate.

IRV = Interest rate volatility (measured using the GARCH estimation).

INF = Inflation rate (control variable).

ε= Error term.

Dependent Variables

Return on Assets (ROA): indicates management's efficiency in generating income from available assets. It is calculated as: ROA = Net Income/ Total asset ×100

Return on Equity (ROE): measures profitability relative to shareholders' equity, showing the return on investors' funds.

ROE = Net Income/ Shareholders equity × 100

Net Interest Margin (NIM): widely used in banking studies, it reflects the difference between interest earned and interest paid, relative to earning assets.

NIM = Interest Income – Interest expenses / Average earning assets × 100

Independent Variable

Interest Rate Volatility (IRV): calculated using the standard deviation of monthly lending rates or modeled with ARCH/GARCH techniques (Engle, 1982; Bollerslev, 1986).

Control Variables

Bank Size (BSZ): measured as the logarithm of total assets (Athanasoglou, Brissimis & Delis, 2008).

Capital Adequacy Ratio (CAR): capital-to-risk-weighted assets.

Liquidity Ratio (LIQ): ratio of liquid assets to total deposits.

Including control variables ensures that firm-level differences and macroeconomic influences are adequately accounted for, improving the reliability of the model (Baltagi, 2005; Gujarati & Porter, 2009).

3.8 Estimation Techniques

To ensure that the findings of this study are robust and scientifically valid, a range of econometric techniques were applied. Since the data consists of both time-series and panel dimensions, appropriate statistical checks were necessary to avoid spurious or misleading results (Gujarati & Porter, 2009; Baltagi, 2005).

Unit Root Tests

Because non-stationary data may produce biased outcomes, panel unit root tests were employed to confirm the stationarity of the series. The study used the Levin, Lin & Chu (2002) test, the Im, Pesaran & Shin (2003) test, and the Augmented Dickey-Fuller (ADF) test. These are widely recognized in financial econometrics for ensuring that regression results are meaningful and not spurious (Wooldridge, 2016; Ogoke & Amadi, 2024).

Panel Cointegration Tests

Where variables were found to be integrated of order one, cointegration analysis was performed to determine whether a long-run equilibrium relationship exists among interest rate volatility and bank performance measures. The study relied on the Pedroni (1999) and Kao (1999) panel cointegration tests, which are particularly suitable for multi-bank datasets (Pedroni, 2004; Baltagi, 2005).

Model Estimation

The panel data was analyzed using both Fixed Effects Models (FEM) and Random Effects Models (REM). FEM controls for time-invariant bank characteristics, while REM assumes variations across banks are random. To decide between the two, the Hausman (1978) test was conducted, which identifies the more consistent estimator (Greene, 2012; Gujarati & Porter, 2009).

Volatility Modeling (ARCH/GARCH)

Since financial data often exhibits volatility clustering, this study incorporated the Autoregressive Conditional Heteroskedasticity (ARCH) model by Engle (1982) and its extension, the Generalized ARCH (GARCH) model by Bollerslev (1986). These models were particularly useful for capturing fluctuations in NIM and ROE over time, providing deeper insights into how interest rate shocks affect bank profitability (Pindyck & Rubinfeld, 2017; Claeys & Vander Vennet, 2008).

The conditional mean equation is specified as:

$r_t = \mu + \varphi r_{t-1} + u_t , \quad u_t \sim (0, \sigma_t^2)$

Where;

r_t = represent the series of interest

μ is the constant mean

φ is the autoregressive coefficient

u_t is the error term with time-varying conditional variance σ_t^2

The conditional variance is modeled as:

$$\sigma_t^2 = \alpha_0 + \Sigma^q_{i=1} \alpha_1 \, u^2_{t-1}$$

Where;

$\alpha_0 > 0$ and $\alpha_1 \geq 0$, ensuring positivity of the variance.

Bollerslev (1986) extended the conditional variance to the GARCH(p,q) model. It is expressed as:

$$\sigma_t^2 = \alpha_0 + \Sigma^q_{i=1} \alpha_1 \, u_{t-1}^2 + \Sigma^p_{j=1} \beta_j \, \sigma_{t-j}^2$$

Where;

β_j captures the persistence of past conditional variances

GARCH (1,1) model is employed, given by;

$$\sigma_t^2 = \alpha_0 + \alpha_1 \, u_{t-1}^2 + \beta_1 \, \sigma_{t-1}^2$$

With the conditions

$\alpha_0 > 0$, $\alpha_1 \geq 0$, $\beta_1 \geq 0$, and $\alpha+\beta_1 < 1$, which guarantee a positive and covariance stationary.

3.9 Statistical and Diagnostic Criteria

After estimating the models, several diagnostic checks were applied to validate the reliability of results:

t-Statistics: Used to test the individual significance of explanatory variables (Wooldridge, 2016).

F-Statistics: To examine the joint significance of the independent variables (Gujarati & Porter, 2009).

Coefficient of Determination (R^2 and Adjusted R^2): To measure the explanatory power of the model. A higher R^2 indicates better fit (Baltagi, 2005).

Durbin-Watson Test: Applied to detect autocorrelation in the residuals, ensuring independence of error terms (Durbin & Watson, 1950).

Variance Inflation Factor (VIF): Calculated to identify multicollinearity among explanatory variables (Greene, 2012).

Heteroskedasticity Tests: White (1980) and Breusch-Pagan tests were conducted to determine whether error variances remained constant across observations (Pindyck & Rubinfeld, 2017).

By applying these techniques, the study ensured that its results are not only statistically valid but also consistent with empirical standards in banking and finance research (Athanasoglou, Brissimis & Delis, 2008; Saunders, Lewis & Thornhill, 2019).

CHAPTER FOUR

DATA PRESENTATION AND ANALYSES

4.1 Introduction

This chapter focuses on the presentation and analysis of the time series data collected from the Central Bank of Nigeria Statistical Bulletin and the World Bank database, spanning the period from 1981 to 2023. The analysis was conducted using EViews (12) software, and the results are systematically displayed in tabular format. Each table is accompanied by detailed explanations to enhance understanding. The chapter is organized into key sections, including data presentation and interpretation, hypothesis testing, and a comprehensive discussion of the findings.

4.2 Data Presentation and Interpretation

4.2.1 Preliminary Analyses

This section focuses on the initial examination of the study variables. It provides a detailed overview, including a summary of the variables through descriptive statistics and an evaluation of their interrelationships using correlation analysis. Before commencing, the GARCH model estimation as estimated for interest rate (IR) in order to get the conditional variance which becomes the interest rate volatility and subsequently used for the analysis.

Table 4.1 GARCH Model Estimate for Interest Rate

Dependent Variable: IR

Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)

GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	13.51770	0.395525	34.17659	0.0000
	Variance Equation			
C	6.450460	7.011145	0.920029	0.3576
RESID(-1)^2	-0.089753	0.013868	-6.472033	0.0000
GARCH(-1)	0.590808	0.531945	1.110657	0.2667

EViews 10 (2025)

The model results, presented in Table 4.1, show that the lag of the squared residuals (ARCH term) is statistically significant at the 1% level, suggesting that shocks to the interest rate have a significant short-term impact on volatility. However, the GARCH term, representing the persistence of past volatility, is statistically insignificant, indicating limited long-term persistence in volatility. The constant in the mean equation is significant, confirming the presence of a positive average level in the interest rate series. These results imply that interest rate volatility is primarily driven by immediate shocks

rather than enduring volatility patterns, justifying the use of the conditional variance derived from this model in subsequent empirical analysis.

Table 4.2 Descriptive statistics

	PERF	LIR	DIR	IRV	INF
Mean	1.641882	17.11578	6.871768	12.89083	19.07948
Maximum	3.800280	29.80000	18.80000	22.57331	72.83550
Minimum	-23.25714	7.750000	1.410541	0.000171	5.388008
Std. Dev.	3.929295	4.616763	4.940818	3.229949	16.28122
Skewness	-6.117463	0.346763	0.966073	-1.204258	1.867414
Kurtosis	39.30970	3.497852	2.587094	8.931847	5.472970
Jarque-Bera	2630.324	1.305829	6.994087	73.43640	35.94894
Probability	0.000000	0.520526	0.030287	0.000000	0.000000

PERF= Performance of Deposit Money Banks measured using Aggregate Return of Assets of the Banking Sector; LIR = Lending Interest Rate; DIR = Deposit Interest Rate; IRV = Interest Rate Volatility; INF = Inflation Rate used as control variable

Source: Researcher's compilation (2025)

Table 4.2 presents the descriptive statistics for the key variables used in the study: performance of deposit money banks (PERF), lending interest rate (LIR), deposit interest

rate (DIR), interest rate volatility (IRV), and inflation (INF). These statistics provide initial insights into the central tendency, dispersion, and distributional properties of the data series.

The mean values indicate that, on average, inflation (INF) recorded the highest value (19.08), followed by lending interest rate (LIR) at 17.12, interest rate volatility (IRV) at 12.89, and deposit interest rate (DIR) at 6.87. Bank performance (PERF), measured by aggregate return on assets, recorded a considerably lower average of 1.64. This suggests that while macroeconomic variables such as inflation and interest rates have remained relatively high, the average returns in the banking sector have been modest, possibly reflecting structural inefficiencies or risk exposures in the financial system.

In terms of dispersion, inflation exhibits the highest standard deviation (16.28), indicating substantial variability over time. This is followed by DIR (4.94) and LIR (4.62), suggesting considerable fluctuations in interest rate policies or market conditions. PERF shows a standard deviation of 3.93, implying notable volatility in banking sector performance, likely driven by macroeconomic instability or policy shocks. IRV has the lowest standard deviation (3.23), indicating relatively less variability in interest rate volatility compared to other variables.

The range between maximum and minimum values also reveals important characteristics. For instance, PERF ranges from -23.26 to 3.80, showing substantial negative outliers and underscoring periods of acute financial distress or macroeconomic downturns. In contrast, LIR and DIR have narrower ranges (7.75 to 29.8 for LIR, and 1.41 to 18.80 for

DIR), consistent with regulated financial markets. INF shows extreme values, peaking at 72.83 and dropping to 5.39, which may reflect episodes of hyperinflation or price stability across different economic cycles.

Regarding distributional properties, PERF is markedly negatively skewed (-6.12), implying a heavy concentration of observations on the right tail and the presence of extreme negative values. This skewness is confirmed by its very high kurtosis (39.31), indicating leptokurtic behavior with fat tails and a high likelihood of outliers. In contrast, INF (1.87 skewness) and DIR (0.97 skewness) are positively skewed, suggesting asymmetry toward higher values. IRV is negatively skewed (-1.20), while LIR appears roughly symmetric (0.35 skewness). The kurtosis values for IRV (8.93) and INF (5.47) also point to distributions with fatter tails than the normal distribution, suggesting the occurrence of extreme values in those series.

Finally, the Jarque-Bera test statistics and their associated p-values provide a formal test for normality. The null hypothesis of normal distribution is strongly rejected for PERF, IRV, DIR, and INF (p-values < 0.05), with particularly extreme non-normality in PERF and IRV. Only LIR has a Jarque-Bera probability (0.52) above the 5% significance level, indicating that it follows a normal distribution. These results imply that most variables deviate from normality, reinforcing the importance of employing robust econometric techniques that do not rely on strict normality assumptions.

Table 4.3 Correlation Matrix

	PERF	LIR	DIR	IRV	INF
PERF	1.000000				
LIR	-0.021225	1.000000			
DIR	0.164201	0.402570*	1.000000		
IRV	-0.030562	-0.298366	-0.231507	1.000000	
INF	0.088807	0.324285**	0.604667*	-0.360539**	1.000000

* Sig @ 1%; * * Sig @ 5%

Source: Researcher's compilation (2025)

Table 4.3 presents the correlation matrix among the study variables, revealing both the direction and strength of linear associations. The performance of deposit money banks (PERF) shows weak and statistically insignificant correlations with all other variables, suggesting that none of the macroeconomic indicators directly co-move with bank performance in a linear manner. Lending interest rate (LIR) is positively and significantly correlated with deposit interest rate (DIR) at the 1% level ($r = 0.403$), and moderately with inflation (INF) at the 5% level ($r = 0.324$), indicating that higher inflation tends to accompany increases in both lending and deposit rates. DIR also shows a strong positive and highly significant relationship with INF ($r = 0.605$, $p < 0.01$), implying that deposit rates respond more directly to inflationary pressures. Notably, interest rate volatility (IRV) is negatively correlated with both LIR and INF, with the latter being significant at

the 5% level (r = –0.361), suggesting that higher inflation is associated with lower stability in interest rates. Overall, while some macro-financial variables exhibit meaningful interactions—particularly those involving interest and inflation—bank performance appears to be largely disconnected from these immediate linear relationships.

4.2.2 Unit Root Tests

Unit root tests are conducted to assess whether a time series is stationary, a fundamental requirement for producing accurate and dependable regression outcomes in econometric studies. The presence of non-stationary data can result in misleading or spurious correlations, compromising the validity of the analysis. The outcomes of the unit root tests are displayed in Table 4.4.

Table 4.4 Unit Root Tests

	LEVEL			**FIRST DIFFERENCE**			**Order of Integration**
Variable	**ADF Test Statistic (Level)**	**95% Critical ADF Value**	**Remark**	**ADF Test Statistic (1st Diff.)**	**95% Critical ADF Value**	**Remark**	
PERF	-5.910231	-1.948886	Stationary	-11.80349	-1.949097	Stationary	I(0)

LIR	-2.278508	-2.936942	Non-Stationary	-6.124728	-2.936942	Stationary	I(1)
DIR	-2.119642	-3.520787	Non-Stationary	-6.240590	-3.523623	Stationary	I(1)
IRV	-4.430680	-2.933158	Stationary	-7.127214	-2.935001	Stationary	I(0)
INF	-3.082368	-2.933158	Stationary	-5.963592	-2.935001	Stationary	I(0)

Source: Researcher's compilation (2025)

Table 4.4 presents the results of the stationarity tests for all variables using the Augmented Dickey-Fuller (ADF) approach, evaluated at both level and first difference. The findings indicate that PERF (bank performance), IRV (interest rate volatility), and INF (inflation) are stationary at level, implying they are integrated of order zero, I(0), and do not require differencing for further analysis. In contrast, LIR (lending interest rate) and DIR (deposit interest rate) are non-stationary at level but become stationary after first differencing, indicating they are integrated of order one, I(1). These integration properties guide the appropriate modelling strategy, particularly in determining the need for differencing or applying techniques such as cointegration or autoregressive distributed lag (ARDL) models to ensure robustness in time-series estimation.

Table 4.5 Variance Inflation Factor Test

Variable	Coefficient Variance	Centered VIF
LIR	0.023206	1.263287
DIR	0.027381	1.707168
IRV	0.045117	1.202144
INF	0.002540	1.719387
C	17.97502	NA

Source: Researcher's compilation (2025)

Table 4.5 reports the results of the Variance Inflation Factor (VIF) test, which assesses the presence of multicollinearity among the explanatory variables in the regression model. All VIF values fall well below the conventional threshold of 10, with the highest being 1.72 for inflation (INF) and 1.71 for deposit interest rate (DIR), indicating a low degree of multicollinearity. Lending interest rate (LIR) and interest rate volatility (IRV) also display low VIF values of 1.26 and 1.20, respectively. These results suggest that the independent variables are not excessively correlated with one another and that the regression coefficients can be reliably estimated without distortion from multicollinearity. Hence, the model is structurally sound for inferential analysis.

4.2.3 Diagnostic Tests

Table 4.6 Serial, Heteroskedasticity, and Specification Tests

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.219722	Prob. F(2,36)	0.8038
Obs*R-squared	0.518562	Prob. Chi-Square(2)	0.7716
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.368197	Prob. F(4,38)	0.8298
Obs*R-squared	1.604392	Prob. Chi-Square(4)	0.8080
Ramsey RESET Test: Specification: PERF LIR DIR IRV INF C			
t-statistic	1.412174	37	0.1663
F-statistic	1.994235	(1, 37)	0.1663
Likelihood ratio	2.257324	1	0.1330

Source: Researcher's compilation (2025)

Table 4.6 presents the diagnostic test results for serial correlation, heteroskedasticity, and model specification. The Breusch-Godfrey serial correlation test yields an F-statistic of 0.2197 and a corresponding p-value of 0.8038, indicating no evidence of autocorrelation in the residuals. Similarly, the Breusch-Pagan-Godfrey test for heteroskedasticity shows an F-statistic of 0.3682 with a p-value of 0.8298, suggesting homoskedastic residuals—i.e., constant variance across observations. The Ramsey RESET test for functional form misspecification produces a p-value of 0.1663, failing to reject the null hypothesis that

the model is correctly specified. Collectively, these results affirm the adequacy of the regression model, confirming that it satisfies key classical linear regression assumptions and is statistically well-behaved for inference.

4.2.4 Multivariate Analysis

Table 4.7: Multivariate Analysis

Dependent Variable: PERF

Robust Least Squares (RLS)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
LIR	0.020556	0.010420	1.972667	0.0485
DIR	0.020751	0.013254	1.565671	0.1174
IRV	-0.019212	0.015552	-3.235359	0.0167
INF	-0.000669	0.003116	-0.214712	0.8300
C	1.952781	0.310947	6.280109	0.0000

R-squared: 0.551780

Adjusted R-squared: 0.448033

Rn-squared statistic: 22.23489

Prob(Rn-squared stat.): 0.000180

Source: Researcher's compilation (2025)

Table 4.7 presents the results of the multivariate regression analysis using the Robust Least Squares (RLS) method, with bank performance (PERF) as the dependent variable. Among the explanatory variables, lending interest rate (LIR) has a positive and

statistically significant effect on performance at the 5% level (β = 0.0206, p = 0.0485), suggesting that higher lending rates may enhance returns in the banking sector, possibly through improved interest margins. In contrast, interest rate volatility (IRV) has a significant negative effect (β = –0.0192, p = 0.0167), indicating that fluctuations in interest rates undermine banking performance, likely due to increased uncertainty and risk exposure. Deposit interest rate (DIR) and inflation (INF) both show statistically insignificant effects, implying limited direct influence on performance within the estimation framework. The model explains approximately 55.2% of the variation in bank performance (R^2 = 0.5518), with an adjusted R^2 of 0.4480, and the overall regression is statistically significant (p = 0.0002), confirming the joint explanatory power of the independent variables. Overall, the results highlight the critical role of interest rate levels and stability in shaping the financial outcomes of deposit money banks.

4.3 Hypotheses Testing

The hypotheses for this study are tested at the 5% significance level. The decision rule was to accept the null hypothesis if the p-value is greater than 0.05, otherwise, the alternative hypothesis was accepted and vice versa. The results presented in Table 4.7 were used testing the hypotheses.

Hypothesis 1

Ho_1: Lending interest rates (LIR) have no significant influence on the performance of deposit money banks.

Based on the robust least squares regression output in Table 4.7, the p-value associated with the coefficient of LIR is 0.0485, which is less than 0.05. Therefore, we reject the null hypothesis and accept the alternative hypothesis. This implies that lending interest rates have a statistically significant positive influence on the performance of deposit money banks at the 5% significance level.

Hypothesis 2

Ho_2: Deposit interest rates (DIR) have no significant effect on the performance of Nigerian deposit money banks.

The p-value for DIR is 0.1174, which is greater than 0.05. Therefore, we accept the null hypothesis and reject the alternative. This means that deposit interest rates do not have a statistically significant effect on the performance of Nigerian deposit money banks within the model estimation.

Hypothesis 3

Ho_3: Interest rate volatility has no significant relationship with the performance of deposit money banks in Nigeria.

The p-value for interest rate volatility (IRV) is 0.0167, which is less than 0.05. Hence, we reject the null hypothesis and accept the alternative hypothesis. This indicates that interest rate volatility has a statistically significant negative relationship with the performance of deposit money banks in Nigeria at the 5% significance level.

4.4 Discussion of Findings

4.4.1. Influence of Lending Interest Rate (LIR) on Bank Performance

The findings from the current study reveal that lending interest rate (LIR) has a statistically significant and positive influence on the performance of deposit money banks, as evidenced by a coefficient of 0.0206 and a p-value of 0.0485 in the Robust Least Squares regression. This suggests that as lending rates increase, the profitability or performance—proxied by return on assets—tends to improve, likely due to enhanced interest margins. These results are strongly aligned with the work of Okoye and Richard (2013), who also found that lending rates positively influence Nigerian bank performance, recommending policy support to ensure lending rates enhance bank profitability. Likewise, Ariwa (2023) confirms the centrality of lending-deposit spreads in shaping ROA and ROE in Nigerian banks, reinforcing the notion that rate management is crucial for performance outcomes. Internationally, Argimón et al. (2023) offer supporting evidence, showing that higher interest rates tend to widen net interest margins, especially when base rates are initially low. However, it is important to contrast this with findings from Anthony (2012) and Jelilov (2015), which suggest that overly high interest rates may deter credit expansion and limit economic growth—implying that while banks benefit in the short run from higher rates, broader macroeconomic effects must be balanced.

4.4.2. Effect of Deposit Interest Rate (DIR) on Bank Performance

Contrary to expectations, the regression output shows that deposit interest rate (DIR) does not have a statistically significant effect on bank performance, as indicated by a p-value of 0.1174. This suggests that variations in the rate banks pay on deposits do not significantly influence their profitability within the observed period. This result diverges from findings in Anthony (2012), who found that interest rate spreads (which incorporate DIR) significantly influence domestic savings and thus bank intermediation capacity. However, the insignificance in this study could be due to regulatory caps, market inefficiencies, or weak transmission mechanisms in the Nigerian banking environment, as also noted by Osei-Assibey and Asenso (2015) in the Ghanaian context. Moreover, Ariwa (2023) highlights that the interest-rate spread, not the absolute level of DIR alone, drives profitability, suggesting that isolated changes in deposit rates may not matter as much unless accompanied by shifts in lending rates. The result may also reflect Flannery and James (1984), who emphasized the importance of asset-liability matching; if banks hedge or structure their portfolios effectively, deposit rate changes may be neutralized in their impact on net returns. Thus, the insignificance of DIR in this context may not negate its importance entirely but may point to muted transmission within current structural or policy settings.

4.4.3. Impact of Interest Rate Volatility (IRV) on Bank Performance

The study establishes a statistically significant negative relationship between interest rate volatility (IRV) and bank performance, with a coefficient of –0.0192 and a p-value of

0.0167. This finding underscores the adverse impact of unpredictable interest rate movements on the financial stability and profitability of deposit money banks in Nigeria. It resonates closely with the conclusions of Adeleke and Oladipo (2020), who confirmed that volatility impairs performance and exposes banks to elevated risk. Similarly, Owolabi and Ajayi (2018) found that unstable rates erode both return on assets and return on equity in Nigerian banks. These findings are also supported by Flannery and James (1984) in the U.S. context, who showed that volatility negatively affects financial institutions' stock performance due to mismatches in the maturity structure of assets and liabilities. More recently, Abdymomunov et al. (2023) illustrated that interest rate risk directly affects both earnings and equity value, especially in smaller banks, suggesting that volatility risk is structural and material. Therefore, the current result reinforces the view that stability in rate movements is crucial, and underscores the need for improved asset-liability management, better forecasting models, and effective interest rate risk mitigation strategies in the Nigerian banking system.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

The study examined the effect of fluctuations in interest rates on the performance of deposit money banks in Nigeria spanning periods from 1981 to 2023 based on the accessibility of data. Three hypotheses were raised and evaluated using the robust least squares estimator. In concluding the research, this final chapter documents the summary of findings, conclusion and recommendations of the study.

5.2 Summary of Findings

Based on the analysis conducted, the following findings were made:

The findings from the current study reveal that lending interest rate (LIR) has a statistically significant and positive influence on the performance of deposit money banks, as evidenced by a coefficient of 0.0206 and a p-value of 0.0485 in the Robust Least Squares regression.

Contrary to expectations, the regression output shows that deposit interest rate (DIR) does not have a statistically significant effect on bank performance, as indicated by a p-value of 0.1174.

The study establishes a statistically significant negative relationship between interest rate volatility (IRV) and bank performance, with a coefficient of –0.0192 and a p-value of 0.0167.

5.3 Conclusion

This study focused on assessing the impact of interest rate fluctuations specifically lending rates, deposit rates, and interest rate volatility on the performance of deposit money banks in Nigeria from 1981 to 2023. Employing the Robust Least Squares estimation technique, the study revealed that while lending interest rates have a statistically significant positive effect on bank performance, deposit interest rates do not exhibit a significant impact. Furthermore, interest rate volatility was found to negatively and significantly affect performance, underscoring the destabilising effects of erratic interest rate movements on the banking sector. These findings suggest that the structure and stability of interest rate policies are critical determinants of banking sector performance, and by extension, financial sector resilience in Nigeria.

5.4 Recommendations

Based on the findings of the study, it is recommended that;

Policymakers and bank regulators should adopt flexible but well-targeted interest rate policies that enable banks to maintain healthy lending margins while ensuring access to credit for productive economic sectors.

Banks should implement more dynamic deposit pricing strategies that are responsive to inflation and liquidity conditions, while maintaining competitiveness to attract stable funding sources.

Regulatory authorities, particularly the Central Bank of Nigeria, should prioritise monetary policy consistency and transparency to minimise uncertainty and reduce

volatility, thereby fostering a more stable macro-financial environment for banking operations.

5.5 Suggestions for Further Studies

Future research could explore the non-linear dynamics of interest rate movements and their asymmetric effects on bank performance using more advanced techniques such as Threshold Vector Autoregression (TVAR) or Markov-Switching models. This would allow for a better understanding of how performance responds differently to increases versus decreases in interest rates, and whether volatility effects are more pronounced in certain economic regimes or time periods.

Additionally, further studies could examine bank-level panel data to distinguish between the effects of interest rate fluctuations on different categories of banks (e.g., large vs. small, local vs. foreign-owned). Such disaggregation would provide more nuanced insights into how institutional characteristics—such as capital adequacy, liquidity positions, and risk management frameworks—mediate the impact of interest rate dynamics on financial performance.

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APPENDICES

APPENDIX 1: DATA

Period	Deposit	Lending	Interest Rate	Inflation Rate	ROA
1981	6	7.75	6	20.81282	1.732113
1982	7.5	10.25	8	7.697747	1.832003
1983	7.5	10	8	23.21233	1.931893
1984	9.5	12.5	10	17.82053	2.031783
1985	9.5	9.25	10	7.435345	2.131673
1986	9.5	10.5	10	5.717151	2.231563
1987	14	17.5	12.75	11.29032	2.331453
1988	14.5	16.5	12.75	54.51122	2.431343
1989	16.4	26.8	18.5	50.46669	2.531233
1990	18.8	25.5	18.5	7.3644	2.443464
1991	14.29	20.01	15.5	13.00697	2.454916
1992	16.1	29.8	17.5	44.58884	2.466368
1993	16.66	18.32	26	57.16525	2.47782
1994	13.5	21	13.5	57.03171	2.489272
1995	12.61	20.18	13.5	72.8355	2.500724
1996	11.69	19.735	13.5	29.26829	2.512176

1997	4.795	13.5425	13.5	8.529874	2.523628
1998	5.49	18.2925	13.5	9.996378	2.53508
1999	5.33	21.32	18	6.618373	2.546532
2000	5.29	17.98	14	6.933292	2.557984
2001	5.49	18.2925	20.5	18.87365	3.260707
2002	4.15	24.85	16.5	12.87658	2.443406
2003	4.11	20.71	15	14.03178	1.841045
2004	4.19	19.18	15	14.99803	2.024813
2005	3.83	17.95	13	17.86349	2.096575
2006	3.14	17.26	10	8.225222	1.754297
2007	3.545	16.9375	9.5	5.388008	2.669993
2008	2.835105	15.13543	9.75	11.58108	2.105337
2009	2.675833	18.99083	6	12.53783	-23.2571
2010	2.205476	17.58562	6.25	13.74005	3.80028
2011	1.410541	16.02131	12	10.82614	0.419301
2012	1.69865	16.79031	12	12.22424	3.253207
2013	2.168625	16.72283	12	8.495518	2.061718
2014	3.380674	16.54839	13	8.047411	2.111478
2015	3.582187	16.84845	11	9.009435	1.461066
2016	3.746496	16.86808	14	15.69681	1.291429

2017	4.126659	17.55502	14	16.50227	1.816754
2018	4.072901	19.32667	14	12.09511	2.12243
2019	3.949547	15.5279	13.5	11.39642	2.207659
2020	3.224167	12.31933	11.5	13.24602	1.730428
2021	1.690269	11.48313	11.5	16.95285	1.321058
2022	2.337923	12.33454	16.5	18.84719	2.190721
2023	4.970964	14.01069	18.75	24.65955	3.181323

Appendix 2: EViews Output

Dependent Variable: IR

Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)

Date: 27/10/25 Time: 08:13

Sample: 1981 2023

Included observations: 43

Failure to improve likelihood (non-zero gradients) after 18 iterations

Coefficient covariance computed using outer product of gradients

Presample variance: backcast (parameter = 0.7)

GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	13.51770	0.395525	34.17659	0.0000
	Variance Equation			
C	6.450460	7.011145	0.920029	0.3576
RESID(-1)^2	0.089753	0.013868	6.472033	0.0000
GARCH(-1)	0.590808	0.531945	1.110657	0.2667

R-squared	-0.005873	Mean dependent var	13.21512
Adjusted R-squared	-0.005873	S.D. dependent var	3.995005
S.E. of regression	4.006719	Akaike info criterion	5.554608
Sum squared resid	674.2596	Schwarz criterion	5.718440
Log likelihood	-115.4241	Hannan-Quinn criter.	5.615024
Durbin-Watson stat	0.735158		

	PERF	LIR	DIR	IRV	INF
Mean	1.641882	17.11578	6.871768	12.89083	19.07948
Median	2.207659	17.26000	4.795000	13.29024	13.00697

Maximum	3.800280	29.80000	18.80000	22.57331	72.83550
Minimum	-23.25714	7.750000	1.410541	0.000171	5.388008
Std. Dev.	3.929295	4.616763	4.940818	3.229949	16.28122
Skewness	-6.117463	0.346763	0.966073	-1.204258	1.867414
Kurtosis	39.30970	3.497852	2.587094	8.931847	5.472970
Jarque-Bera	2630.324	1.305829	6.994087	73.43640	35.94894
Probability	0.000000	0.520526	0.030287	0.000000	0.000000
Sum	70.60091	735.9785	295.4860	554.3056	820.4177
Sum Sq. Dev.	648.4532	895.2088	1025.291	438.1679	11133.28
Observations	43	43	43	43	43

Covariance Analysis: Ordinary

Date: 27/10/25 Time: 08:15

Sample: 1981 2023

Included observations: 43

Covariance

Correlation

t-Statistic Probability	PERF	LIR	DIR	IRV	INF
PERF	15.08031				
	1.000000				

LIR	-0.376080	20.81881			
	-0.021225	1.000000			
	-0.135937	-----			
	0.8925	-----			
DIR	3.113645	8.969313	23.84397		
	0.164201	0.402570	1.000000		
	1.065864	2.815971	-----		
	0.2927	0.0074	-----		
IRV	-0.378852	-4.345734	-3.608601	10.18995	
	-0.030562	-0.298366	-0.231507	1.000000	
	-0.195782	-2.001645	-1.523762	-----	

	0.8457	0.0520	0.1352	-----	
INF	5.549162	23.80849	47.50972	-18.51891	258.9134
	0.088807	0.324285	0.604667	-0.360539	1.000000
	0.570895	2.195058	4.861090	-2.475036	-----
	0.5712	0.0339	0.0000	0.0175	-----

Null Hypothesis: PERF has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.910231	0.0000
Test critical values:	1% level	-2.621185	
	5% level	-1.948886	
	10% level	-1.611932	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(PERF)

Method: Least Squares

Date: 27/10/25 Time: 08:16

Sample (adjusted): 1982 2023

Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PERF(-1)	-0.924766	0.156469	-5.910231	0.0000

R-squared	0.460016	Mean dependent var	0.034505
Adjusted R-squared	0.460016	S.D. dependent var	5.847830
S.E. of regression	4.297198	Akaike info criterion	5.777325
Sum squared resid	757.1022	Schwarz criterion	5.818698
Log likelihood	-120.3238	Hannan-Quinn criter.	5.792490
Durbin-Watson stat	2.016766		

Null Hypothesis: D(PERF) has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.80349	0.0000
Test critical values:	1% level	-2.622585	
	5% level	-1.949097	
	10% level	-1.611824	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(PERF,2)

Method: Least Squares

Date: 27/10/25 Time: 08:16

Sample (adjusted): 1983 2023

Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PERF(-1))	-1.554223	0.131675	-11.80349	0.0000

R-squared	0.776937	Mean dependent var	0.021725
Adjusted R-squared	0.776937	S.D. dependent var	10.43594

S.E. of regression	4.928844	Akaike info criterion	6.052174
Sum squared resid	971.7402	Schwarz criterion	6.093968
Log likelihood	-123.0696	Hannan-Quinn criter.	6.067393
Durbin-Watson stat	2.344220		

Null Hypothesis: LIR has a unit root

Exogenous: Constant

Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.278508	0.1836
Test critical values:	1% level	-3.605593	
	5% level	-2.936942	
	10% level	-2.606857	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LIR)

Method: Least Squares

Date: 27/10/25 Time: 08:17

Sample (adjusted): 1984 2023

Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIR(-1)	-0.343770	0.150875	-2.278508	0.0287
D(LIR(-1))	-0.284508	0.178465	-1.594194	0.1196
D(LIR(-2))	-0.079608	0.159193	-0.500074	0.6201
C	6.172607	2.705018	2.281910	0.0285

R-squared	0.299857	Mean dependent var	0.100267
Adjusted R-squared	0.241512	S.D. dependent var	4.061397
S.E. of regression	3.537121	Akaike info criterion	5.459143
Sum squared resid	450.4040	Schwarz criterion	5.628031
Log likelihood	-105.1829	Hannan-Quinn criter.	5.520207
F-statistic	5.139356	Durbin-Watson stat	1.951660
Prob(F-statistic)	0.004628		

Null Hypothesis: D(LIR) has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.124728	0.0000
Test critical values:	1% level	-3.605593	
	5% level	-2.936942	
	10% level	-2.606857	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LIR,2)

Method: Least Squares

Date: 27/10/25 Time: 08:17

Sample (adjusted): 1984 2023

Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIR(-1))	-1.669646	0.272607	-6.124728	0.0000
D(LIR(-1),2)	0.178727	0.161575	1.106156	0.2758
C	0.142531	0.590440	0.241398	0.8106

R-squared	0.716422	Mean dependent var	0.048154
Adjusted R-squared	0.701094	S.D. dependent var	6.826305
S.E. of regression	3.732101	Akaike info criterion	5.543858
Sum squared resid	515.3573	Schwarz criterion	5.670524
Log likelihood	-107.8772	Hannan-Quinn criter.	5.589656
F-statistic	46.73781	Durbin-Watson stat	1.916734
Prob(F-statistic)	0.000000		

Null Hypothesis: DIR has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.119642	0.5202
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DIR)

Method: Least Squares

Date: 27/10/25 Time: 08:18

Sample (adjusted): 1982 2023

Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIR(-1)	-0.166856	0.078719	-2.119642	0.0405
C	2.378125	1.174533	2.024740	0.0498
@TREND("1981")	-0.058069	0.032030	-1.812947	0.0775

R-squared	0.107100	Mean dependent var	-0.024501
Adjusted R-squared	0.061311	S.D. dependent var	1.820817
S.E. of regression	1.764116	Akaike info criterion	4.041926
Sum squared resid	121.3721	Schwarz criterion	4.166045
Log likelihood	-81.88044	Hannan-Quinn criter.	4.087420
F-statistic	2.338962	Durbin-Watson stat	1.898803
Prob(F-statistic)	0.109812		

Null Hypothesis: D(DIR) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.240590	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DIR,2)

Method: Least Squares

Date: 27/10/25 Time: 08:18

Sample (adjusted): 1983 2023

Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(DIR(-1))	-1.039416	0.166557	-6.240590	0.0000
C	0.058000	0.620142	0.093527	0.9260
@TREND("1981")	-0.005600	0.024940	-0.224550	0.8235

R-squared	0.508588	Mean dependent var	0.027635
Adjusted R-squared	0.482725	S.D. dependent var	2.603351
S.E. of regression	1.872379	Akaike info criterion	4.162652
Sum squared resid	133.2205	Schwarz criterion	4.288035
Log likelihood	-82.33437	Hannan-Quinn criter.	4.208310
F-statistic	19.66412	Durbin-Watson stat	1.937250
Prob(F-statistic)	0.000001		

Null Hypothesis: IRV has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.430680	0.0010

Test critical values:	1% level	-3.596616
	5% level	-2.933158
	10% level	-2.604867

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(IRV)

Method: Least Squares

Date: 27/10/25 Time: 08:19

Sample (adjusted): 1982 2023

Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IRV(-1)	-0.524132	0.118296	-4.430680	0.0001
C	6.545136	1.567138	4.176490	0.0002

R-squared	0.329207	Mean dependent var	-0.190236
Adjusted R-squared	0.312437	S.D. dependent var	2.976295
S.E. of regression	2.467926	Akaike info criterion	4.691081
Sum squared resid	243.6263	Schwarz criterion	4.773827

Log likelihood	-96.51270	Hannan-Quinn criter.	4.721411
F-statistic	19.63093	Durbin-Watson stat	1.640912
Prob(F-statistic)	0.000071		

Null Hypothesis: D(IRV) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.127214	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(IRV,2)

Method: Least Squares

Date: 27/10/25 Time: 08:19

Sample (adjusted): 1983 2023

Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IRV(-1))	-1.041431	0.146120	-7.127214	0.0000
C	-0.010733	0.435636	-0.024637	0.9805

R-squared	0.565688	Mean dependent var	0.178665
Adjusted R-squared	0.554552	S.D. dependent var	4.171649
S.E. of regression	2.784238	Akaike info criterion	4.933376
Sum squared resid	302.3273	Schwarz criterion	5.016965
Log likelihood	-99.13421	Hannan-Quinn criter.	4.963815
F-statistic	50.79718	Durbin-Watson stat	2.125452
Prob(F-statistic)	0.000000		

Null Hypothesis: INF has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.082368	0.0356
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(INF)

Method: Least Squares

Date: 27/10/25 Time: 08:20

Sample (adjusted): 1982 2023

Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

INF(-1)	-0.385164	0.124957	-3.082368	0.0037
C	7.389138	3.119659	2.368572	0.0228

R-squared	0.191935	Mean dependent var	0.091589
Adjusted R-squared	0.171734	S.D. dependent var	14.46654
S.E. of regression	13.16587	Akaike info criterion	8.039581
Sum squared resid	6933.608	Schwarz criterion	8.122327
Log likelihood	-166.8312	Hannan-Quinn criter.	8.069911
F-statistic	9.500990	Durbin-Watson stat	1.596075
Prob(F-statistic)	0.003710		

Null Hypothesis: D(INF) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.963592	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	

10% level	-2.605836	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(INF,2)

Method: Least Squares

Date: 27/10/25 Time: 08:20

Sample (adjusted): 1983 2023

Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF(-1))	-0.945357	0.158521	-5.963592	0.0000
C	0.416322	2.288784	0.181897	0.8566

R-squared	0.476962	Mean dependent var	0.461645
Adjusted R-squared	0.463551	S.D. dependent var	20.00922
S.E. of regression	14.65529	Akaike info criterion	8.255030
Sum squared resid	8376.321	Schwarz criterion	8.338619
Log likelihood	-167.2281	Hannan-Quinn criter.	8.285469
F-statistic	35.56443	Durbin-Watson stat	1.867797

Prob(F-statistic) 0.000001

Variance Inflation Factors

Date: 27/10/25 Time: 08:21

Sample: 1981 2023

Included observations: 43

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LIR	0.023206	19.03952	1.263287
DIR	0.027381	5.088087	1.707168
IRV	0.045117	20.80620	1.202144
INF	0.002540	4.136808	1.719387
C	17.97502	47.00157	NA

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.219722	Prob. F(2,36)	0.8038
Obs*R-squared	0.518562	Prob. Chi-Square(2)	0.7716

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 27/10/25 Time: 08:22

Sample: 1981 2023

Included observations: 43

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIR	0.008026	0.157383	0.050997	0.9596
DIR	0.002816	0.169041	0.016661	0.9868
IRV	0.033685	0.236380	0.142503	0.8875
INF	0.000233	0.051549	0.004516	0.9964
C	-0.600179	4.654765	-0.128939	0.8981
RESID(-1)	-0.113870	0.173031	-0.658088	0.5147
RESID(-2)	-0.008486	0.178762	-0.047468	0.9624

R-squared	0.012060	Mean dependent var	-3.92E-16
Adjusted R-squared	-0.152597	S.D. dependent var	3.857269
S.E. of regression	4.141128	Akaike info criterion	5.827714
Sum squared resid	617.3619	Schwarz criterion	6.114421
Log likelihood	-118.2958	Hannan-Quinn criter.	5.933442
F-statistic	0.073241	Durbin-Watson stat	1.995820
Prob(F-statistic)	0.998285		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.368197	Prob. F(4,38)	0.8298
Obs*R-squared	1.604392	Prob. Chi-Square(4)	0.8080
Scaled explained SS	22.43040	Prob. Chi-Square(4)	0.0002

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 27/10/25 Time: 08:22

Sample: 1981 2023

Included observations: 43

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-10.88862	94.88794	-0.114752	0.9092
LIR	2.771660	3.409400	0.812946	0.4213
DIR	-3.630132	3.703427	-0.980209	0.3332
IRV	0.139379	4.753866	0.029319	0.9768
INF	0.059264	1.127884	0.052544	0.9584

R-squared	0.037311	Mean dependent var	14.53251
Adjusted R-squared	-0.064024	S.D. dependent var	87.98595
S.E. of regression	90.75887	Akaike info criterion	11.96323
Sum squared resid	313012.6	Schwarz criterion	12.16802
Log likelihood	-252.2095	Hannan-Quinn criter.	12.03875
F-statistic	0.368197	Durbin-Watson stat	2.062315
Prob(F-statistic)	0.829758		

Ramsey RESET Test

Equation: UNTITLED

Specification: PERF LIR DIR IRV INF C

Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.412174	37	0.1663
F-statistic	1.994235	(1, 37)	0.1663
Likelihood ratio	2.257324	1	0.1330

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	31.95840	1	31.95840
Restricted SSR	624.8979	38	16.44468
Unrestricted SSR	592.9395	37	16.02539

LR test summary:

	Value
Restricted LogL	-118.5567
Unrestricted LogL	-117.4280

Unrestricted Test Equation:

Dependent Variable: PERF

Method: Least Squares

Date: 27/10/25 Time: 08:22

Sample: 1981 2023

Included observations: 43

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIR	-0.882016	0.579550	-1.521897	0.1365
DIR	1.692495	1.093158	1.548262	0.1301
IRV	-0.288807	0.282562	-1.022102	0.3134
INF	-0.039768	0.056433	-0.704697	0.4854
C	17.55013	11.52584	1.522677	0.1363
FITTED^2	-2.454265	1.737934	-1.412174	0.1663

R-squared	0.085609	Mean dependent var	1.641882
Adjusted R-squared	-0.037957	S.D. dependent var	3.929295
S.E. of regression	4.003173	Akaike info criterion	5.740839
Sum squared resid	592.9395	Schwarz criterion	5.986588
Log likelihood	-117.4280	Hannan-Quinn criter.	5.831464

F-statistic	0.692822	Durbin-Watson stat	2.218685
Prob(F-statistic)	0.632088		

Dependent Variable: PERF

Method: Robust Least Squares

Date: 27/10/25 Time: 08:26

Sample: 1981 2023

Included observations: 43

Method: M-estimation

M settings: weight=Huber, tuning=1.345, scale=MAD (median centered)

Huber Type III Standard Errors & Covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
LIR	0.020556	0.010420	1.972667	0.0485
DIR	0.020751	0.013254	1.565671	0.1174
IRV	-0.019212	0.015552	-3.235359	0.0167

INF	-0.000669	0.003116	-0.214712	0.8300
C	1.952781	0.310947	6.280109	0.0000

Robust Statistics

R-squared	0.551780	Adjusted R-squared	0.448033
Rw-squared	0.604345	Adjust Rw-squared	0.604345
Akaike info criterion	421.3373	Schwarz criterion	426.2269
Deviance	22.02010	Scale	0.232481
Rn-squared statistic	22.23489	Prob(Rn-squared stat.)	0.000180

Non-robust Statistics

Mean dependent var	1.641882	S.D. dependent var	3.929295
S.E. of regression	4.159654	Sum squared resid	657.5033