



Econometric Analysis on the Impact of Financial Risks on Financial Performance in the Case of Algerian Private Banks (2010–2024)

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Keywords

financial risk, financial performance, credit risk, liquidity risk, solvency risk, interest rate risk, private banks, panel data, Algeria.

Abstract

The banking sector is one of the main financial institutions that plays an important role in ensuring financial stability, supporting investment activity and accelerating economic growth. In recent years, changes observed in global financial markets, financial liberalization, regulatory reforms and economic uncertainties have increased the level of exposure of banks to various financial risks. In this regard, studying the impact of financial risks on the financial results of banks is of particular relevance. The aim of the study is to assess the impact of financial risks on the financial performance of five private banks operating in Algeria during the period 2010–2024. Financial performance was measured based on Return on Assets (ROA) and Return on Equity (ROE), while financial risks were assessed in terms of credit risk, liquidity risk, solvency risk and interest rate risk. The study used panel data methodology and applied Fixed Effects Model for modeling. Empirical results showed that credit risk and solvency risk do not have a statistically significant impact on the financial performance of banks. In addition, it was found that interest rate risk has a significant impact on both ROA and ROE indicators. The results indicate that the profitability of private banks is sensitive to changes in interest rates. At the same time, it was found that liquidity risk has a significant impact only on ROA, which confirms that effective liquidity management increases the efficiency of asset utilization. According to the results of the study, it is recommended to introduce modern hedging instruments in banks to manage interest rate risks, as well as improve liquidity management. These measures can contribute to increasing the profitability of banks, strengthening financial stability and ensuring long-term stable development.

JEL classification: G21, G32, C33.

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INTRODUCTION

The banking sector is considered one of the main pillars of the modern economy and plays an important role in ensuring economic growth, investment activity and financial stability through the function of financial intermediation. Commercial banks make a significant contribution to the process of economic development through the attraction of deposits, granting loans and efficient allocation of financial resources. Therefore, the financial condition and performance of banks are considered one of the important indicators of the stability of not only the banking system, but also the country's economy as a whole.

Globalization, liberalization of financial markets, technological innovations and changes in regulatory mechanisms have significantly changed the operating environment of the banking sector in recent decades. These processes, in addition to creating new opportunities for banks, have also increased the likelihood of them encountering various financial risks. Increased competition, market instability and interest rate volatility have required banks to pay more attention to effective risk management.

Financial risks are an integral part of banking activities and their improper management can lead to a decrease in profitability, liquidity problems, weakening of capital adequacy and even disruption of financial stability. The most common financial risks in the banking sector are credit risk, liquidity risk, solvency risk and interest rate risk. Timely identification, measurement and management of these risks are of particular importance in terms of maintaining the competitiveness of banks and ensuring their sustainable development.

On the other hand, financial performance is one of the main indicators characterizing the effectiveness of banks' activities and the quality of management. Return on Assets (ROA) and Return on Equity (ROE) are widely used indicators in assessing the profitability of banks. Studying the impact of financial risks on these indicators allows us to determine the role of risk factors in the formation of banks' performance results.

The Algerian banking sector has undergone significant changes in recent years, in the direction of modernizing the financial system, regulatory reforms, and strengthening integration into international financial markets. In such a context, investigating the impact of financial risks on banks' financial performance is of great importance from both a scientific and practical perspective. However, the number of empirical studies conducted in this direction on private banks operating in Algeria is limited.

The main objective of this study is to evaluate the impact of credit risk, liquidity risk, solvency risk, and interest rate risk on the financial performance of Algerian private banks over the period 2010–2024 using econometric methods. The results obtained as a result of applying the panel data methodology are expected to provide useful recommendations for decision makers, bank managers, investors, and regulatory authorities in the field of financial risk management. The study also contributes to enriching the existing scientific literature on the impact of bank risks on financial performance in developing countries.

LITERATURE REVIEW

The relationship between financial risk and financial performance has long been a central topic in banking and finance research. Since banks operate by transforming deposits into loans and other financial assets, they are continuously exposed to various forms of risk that may affect their profitability and long-term sustainability. Understanding how these risks influence financial performance is particularly important for both bank managers and regulators seeking to maintain stability within the financial system.

Among the different categories of banking risk, credit risk has received the greatest attention in the literature. Because lending activities constitute the primary source of revenue for most commercial banks, any deterioration in loan quality may have direct consequences for profitability. Akhanolu et al. (2020), in their study of Nigerian banks, found that effective credit risk management contributes positively to financial performance and supports overall banking stability. Similar conclusions were reached by Wanjohi et al. (2017), who reported that sound risk management practices improve profitability in Kenyan commercial banks. Nevertheless, the empirical evidence remains inconclusive, as the strength and direction of the relationship often depend on the institutional environment, regulatory framework, and economic conditions under which banks operate.

Liquidity risk has also been widely recognized as a critical factor affecting bank performance. The Basel Committee on Banking Supervision (2000) emphasized that maintaining adequate liquidity is essential for preserving confidence in the banking system and ensuring the smooth functioning of financial institutions. Empirical evidence generally supports this view. For example, Abdelhamid and Kadem (2020) found that effective liquidity management enhances both financial stability and solvency in Iraqi commercial banks. Likewise, Toutou (2011) demonstrated that liquidity conditions significantly influence the performance of European banks, highlighting the need to balance profitability objectives with prudent liquidity management practices.

Another important dimension of banking risk is solvency risk, which reflects a bank's ability to absorb losses and meet its long-term obligations. Capital adequacy is commonly regarded as the main safeguard against financial distress. Lepetit and Strobel (2015) argued that insolvency risk measures provide valuable insights into the stability of banking institutions and their vulnerability to unexpected shocks. Similarly, Suka (2010) found that stronger capital positions are generally associated with better financial performance because

they increase resilience and strengthen stakeholder confidence. However, some studies suggest that excessive capitalization may also limit profitability by reducing the opportunities for leverage, indicating that the relationship is not always straightforward.

Interest rate risk has become increasingly relevant in recent years due to fluctuations in global financial markets and changes in monetary policy. Variations in interest rates affect both the cost of funds and the return generated by interest-bearing assets, thereby influencing banks' earnings. Nguyen (2024) reported that interest rate risk exerts significant and asymmetric effects on bank profitability, while Khan and Ahmed (2024) concluded that the successful management of financial risks contributes substantially to banking stability in emerging economies. These findings suggest that banks must continuously monitor interest rate movements and adapt their asset-liability management strategies accordingly.

Research focusing specifically on Algeria remains relatively limited. Existing studies have primarily examined liquidity conditions, financial reforms, and broader macroeconomic challenges facing the banking sector. For instance, Chelghoum, Boukhari, and Djafferi (2024) analyzed the determinants of excess liquidity within the Algerian banking system and emphasized the importance of efficient liquidity management. However, empirical studies simultaneously examining multiple dimensions of financial risk and their impact on the profitability of private Algerian banks are still scarce.

Overall, previous studies confirm that financial risks play an important role in shaping banking performance. Nevertheless, the findings reported in the literature are not always consistent. While some researchers identify significant effects of credit, liquidity, solvency, or interest rate risks on profitability, others report weak or insignificant relationships. These differences may stem from variations in banking structures, regulatory environments, economic conditions, and methodological approaches. Such inconsistencies highlight the need for additional evidence, particularly from developing and emerging economies.

Against this background, the present study seeks to contribute to the existing body of knowledge by examining how credit risk, liquidity risk, solvency risk, and interest rate risk influence the financial performance of private banks operating in Algeria over the period 2010–2024. By employing panel data techniques and focusing on an underexplored banking environment, the study aims to provide empirical evidence that may support more effective risk management practices and contribute to the strengthening of financial stability within the Algerian banking sector.

1. RESEARCH PROBLEM

Given the growing importance of risk management in contemporary banking systems and the limited empirical evidence available for emerging banking markets, particularly Algeria, this study seeks to investigate the relationship between financial risk exposure and bank profitability. Specifically, the study addresses the following research question:

To what extent do credit risk, liquidity risk, solvency risk, and interest rate risk influence the financial performance of private banks operating in Algeria during the period 2010–2024?

1.1. Research Hypotheses

To empirically examine the relationship between financial risk and bank performance, the following hypotheses are formulated:

Effects on Return on Equity (ROE)

H1. Credit risk has a statistically significant effect on the Return on Equity (ROE) of private banks operating in Algeria during the period 2010–2024.

H2. Liquidity risk has a statistically significant effect on the Return on Equity (ROE) of private banks operating in Algeria during the period 2010–2024.

H3. Solvency risk has a statistically significant effect on the Return on Equity (ROE) of private banks operating in Algeria during the period 2010–2024.

H4. Interest rate risk has a statistically significant effect on the Return on Equity (ROE) of private banks operating in Algeria during the period 2010–2024.

Effects on Return on Assets (ROA)

H5. Credit risk has a statistically significant effect on the Return on Assets (ROA) of private banks operating in Algeria during the period 2010–2024.

H6. Liquidity risk has a statistically significant effect on the Return on Assets (ROA) of private banks operating in Algeria during the period 2010–2024.

H7. Solvency risk has a statistically significant effect on the Return on Assets (ROA) of private banks operating in Algeria during the period 2010–2024.

H8. Interest rate risk has a statistically significant effect on the Return on Assets (ROA) of private banks operating in Algeria during the period 2010–2024.

1.2. Study Objectives

The primary objective of this study is to assess the extent to which financial risk influences the profitability and financial performance of private banks operating in Algeria. More specifically, the study aims to:

- Examine the theoretical foundations and conceptual dimensions of financial risk and financial performance within the banking sector.
- Identify the major categories of financial risk affecting banking institutions, including credit risk, liquidity risk, solvency risk, and interest rate risk.
- Analyze the relationship between financial risk indicators and bank profitability measures using panel data econometric techniques.
- Evaluate the impact of financial risk on financial performance as measured by Return on Assets (ROA) and Return on Equity (ROE) for a sample of private Algerian banks over the period 2010–2024.
- Provide empirical evidence that may assist bank managers, regulators, and policymakers in strengthening risk management practices and improving banking sector performance and financial stability.
- Contribute to the growing body of literature on banking risk and performance in emerging and developing economies, with particular reference to the Algerian banking industry.

2. THEORETICAL FRAMEWORK

2.1. Financial Performance in the Banking Sector

Financial performance represents one of the most important indicators of a bank's financial health, operational efficiency, and long-term sustainability. In the banking industry, financial performance reflects the ability of institutions to generate profits, efficiently allocate resources, maintain financial stability, and create value for shareholders while fulfilling their intermediation role within the economy. Given the increasingly competitive and dynamic nature of modern financial markets, the assessment of bank performance has become a critical issue for managers, regulators, investors, and policymakers.

From a theoretical perspective, financial performance is commonly viewed as the extent to which a banking institution achieves its strategic and financial objectives through the effective utilization of available resources. It reflects management's ability to transform assets, liabilities, and capital into sustainable earnings while maintaining acceptable levels of risk exposure. Consequently, financial performance serves as a comprehensive measure of managerial effectiveness and institutional success.

The literature identifies profitability as the primary dimension of banking performance. Profitability not only determines the ability of banks to survive and expand but also enhances their resilience against financial shocks and adverse market conditions. Banks with strong profitability are generally better positioned to strengthen capital adequacy, improve liquidity positions, attract investors, and maintain customer confidence. Conversely, weak financial performance may undermine competitiveness and increase vulnerability to financial distress.

Among the various indicators used to evaluate banking performance, Return on Assets (ROA) and Return on Equity (ROE) are the most widely employed in both academic research and professional practice. ROA measures the efficiency with which a bank utilizes its total assets to generate earnings and is considered a key indicator of operational performance. ROE, on the other hand, evaluates the profitability generated from shareholders' investments and reflects the effectiveness of management in creating value for owners. Together, these indicators provide a comprehensive assessment of a bank's profitability, efficiency, and overall financial strength.

Because banking activities are inherently exposed to multiple forms of risk, financial performance cannot be analyzed independently from risk management practices. The ability of banks to identify, measure, monitor, and control risks significantly influences their profitability and long-term sustainability. Therefore, understanding the relationship between financial risk and financial performance remains a central issue in contemporary banking research.

2.2. Financial Risks and Their Implications for Banking Performance

Financial risk constitutes an inherent component of banking operations and arises from uncertainties associated with financial transactions, market conditions, and the broader economic environment. In its broadest sense, financial risk refers to the possibility that unexpected events or unfavorable market developments may negatively affect a bank's earnings, capital position, liquidity, or overall financial stability. Effective risk management has therefore become a strategic necessity for banking institutions operating in increasingly complex and interconnected financial systems.

The modern banking literature generally classifies financial risks into several categories, among which credit risk, liquidity risk, solvency risk, and interest rate risk are considered the most influential determinants of banking performance. These risks are closely interconnected and collectively shape the risk-return profile of financial institutions.

Credit risk is traditionally regarded as the most significant risk faced by commercial banks due to the central role of lending activities in banking operations. It refers to the possibility that borrowers or counterparties will fail to meet their contractual obligations in full or on time. High levels of credit risk may lead to an increase in non-performing loans, a deterioration in asset quality, reduced profitability, and a decline in capital adequacy. Consequently, effective credit risk management is essential for maintaining financial stability and sustaining long-term profitability.

Liquidity risk arises when a bank is unable to meet its financial obligations as they become due without incurring substantial losses. This risk may emerge from unexpected deposit withdrawals, disruptions in funding markets, or mismatches between asset and liability maturities. Adequate liquidity management is crucial for ensuring the smooth functioning of banking operations and preserving market confidence. Failure to maintain sufficient liquidity may result in severe operational difficulties and, in extreme cases, threaten the survival of the institution.

Another critical dimension of financial risk is solvency risk, which reflects the possibility that a bank's capital base becomes insufficient to absorb losses and meet long-term obligations. Solvency represents the capacity of a financial institution to maintain positive net worth, where total assets exceed total liabilities. A deterioration in solvency weakens a bank's financial resilience and increases the likelihood of financial distress or insolvency. Because capital serves as the ultimate buffer against unexpected losses, maintaining adequate solvency remains a fundamental objective of banking regulation and risk management.

Interest rate risk refers to the potential adverse impact of fluctuations in market interest rates on a bank's earnings and economic value. This risk emerges primarily from mismatches between the interest-rate sensitivity of assets and liabilities. Changes in interest rates may affect net interest margins, funding costs, loan profitability, and the market value of financial instruments. Banks with significant exposure to interest rate movements may experience considerable volatility in earnings and financial performance, particularly during periods of monetary policy adjustments and market uncertainty.

Theoretical and empirical studies consistently suggest that excessive exposure to financial risks can adversely affect banking profitability and stability. While risk-taking is an essential component of banking activities and may contribute to higher returns, ineffective risk management often results in declining profitability, capital erosion, and increased vulnerability to financial crises. Consequently, achieving an optimal balance between risk exposure and profitability remains one of the most important challenges facing contemporary banking institutions.

Within this context, the present study focuses on four key dimensions of financial risk—credit risk, liquidity risk, solvency risk, and interest rate risk—and examines their influence on the financial performance of private banks operating in Algeria. Understanding these relationships is essential for developing more effective risk management strategies and enhancing the sustainability and competitiveness of the banking sector.

3. THE EMPIRICAL STUDY

3.1. Study Sample and Variables

3.1.1. Study Sample: The study sample comprises five private commercial banks operating in Algeria: Fransabank El Djazair, BNP Paribas El Djazair, Gulf Bank Algeria, Société Générale Algérie, and Bank ABC Algeria.

3.1.2. Variable Specification

- Dependent Variable:

The dependent variable in this study is the financial performance of banks, which is measured using two financial indicators. The first reflects the profitability of shareholders' funds and is represented by the return on equity (ROE), while the second combines both efficiency and effectiveness and is represented by the return on assets (ROA).

- Independent Variables:

The independent variables: Four independent variables were selected in order to examine their impact on financial performance indicators. These variables are represented by credit risk (LTA), Liquidity Risk (LTD), Insolvency Risk (ERA), and Interest Rate Risk (IRR).

The following table presents the study variables and the methods used to measure them:

Table 01: Study Variables and Their Measurement Methods

Study Variables		Symbol	Measurement Method
Dependent Variable	Return on Equity	ROE	Net Income / Total Equity
	Return on Assets	ROA	Net Income / Total Assets
Independent Variables	Credit Risk	LTA	Total Loans / Total Assets
	Liquidity Risk	LTD	Total Loans / Total Deposits
	Insolvency Risk	ERA	Equity / Risk-Weighted Assets
	Interest Rate Risk	IRR	Interest Rate-Sensitive Assets / Total assets

Source: Prepared by the researcher.

3.2. Research Methodology:

To detect the impact of financial risks on financial performance within the selected sample of banks during the period (2010–2024), this study relies on an econometric approach using pooled cross-sectional time-series data, commonly known as panel data. This methodology is the most appropriate for the nature of the study's data, utilizing the three baseline panel data models: the Pooled OLS model, the Fixed Effects (FE) model, and the Random Effects (RE) model. The econometric analysis was conducted using the statistical software Eviews.

3.2.1. Panel Data Econometric Framework

Panel data are defined as a dataset that allows economists to record repeated observations over time for economic units such as countries, households, banks, and others. These units are referred to as individuals, observed across a specific period of time (Trognon, 2003, pp. 727-728).

Panel data can also be defined as data that combine the characteristics of both cross-sectional data and time series data. Cross-sectional data describe the behavior of multiple individuals or units at a single point in time, while time series data describe the behavior of a single unit over a period of time. Accordingly, panel data integrate both cross-sectional and temporal dimensions, which highlights their importance as they provide richer information by capturing time dynamics as well as multiple units, thereby increasing the number of observations (Dielman, 1989, p. 2).

It is worth noting that if the time period is the same for all cross-sectional units, the panel dataset is referred to as a balanced panel data. In contrast, when the time periods differ across cross-sectional units, the dataset is referred to as an unbalanced panel data (Gujarati, 2004, p. 460).

- **Pooled Regression Model: PRM:** The pooled regression model is considered the simplest panel data model, as it assumes that all estimated coefficients, including the intercept term, remain constant across all time periods and cross-sectional units (Mecran & others, 2013, p. 7).
- **Fixed Effects Model (FEM):** The fixed effects model assumes that individual-specific characteristics remain constant over time and may differ across cross-sectional units. This model allows the intercept term to vary among individuals in order to capture unobservable effects specific to each unit, while the slope coefficients remain constant over time (Baltagi, 2005, pp. 11-16).
- **Random Effects Model: REM** In the random effects model, the error term ε_{it} is assumed to be normally distributed with a zero mean and a variance of σ^2 . For the parameters of the random effects model to be consistent and unbiased, it is typically assumed that the error variance is constant (homoskedastic) across all cross-sectional units, and that there is no serial correlation over time within each cross-sectional unit (Wooldridge, 2010, p. 286).

3.2.2. Model Selection Tests

After estimating the three models, several statistical tests are performed in order to compare them and determine the most appropriate model for the study data, namely:

- **Redundant Fixed Effects Test :** This test is used to choose between the pooled regression model and the fixed effects model, and to determine whether the banks under study follow the same behavior in terms of the intercept term or whether each bank in the sample has its own specific behavior. This test is based on the following hypotheses:

H_0 : The pooled regression model is the appropriate model.

H_1 : The Fixed Effects Model is the appropriate model.

- Hausman Test: The Hausman test is used when there is a significant difference between fixed effects and random effects estimators. It measures the extent to which the individual-specific effect is correlated with the explanatory variables. The null hypothesis assumes that there is no such correlation; under this assumption, both fixed effects and random effects estimators are consistent, but the random effects estimator is more efficient (Hausman, 1978, p. 1251). This test is based on the following hypotheses:

H_0 : The random effects model is the appropriate model.

H_1 : The Fixed Effects Model is the appropriate model.

3.3. Results Presentation and Hypothesis Testing

3.3.1. Descriptive Statistics

Table 02: Descriptive Statistics for the Study Variables

	Mean	Maximum	Minimum	Std.Dev	Jrq-Bera	Probability
ROE	19.03480	47.79000	0.020000	11.88256	7.512705	0.023369
ROA	1.986053	4.440000	0.004000	0.740622	12.48052	0.001949
LTA	64.92973	80.30000	44.35000	9.561214	3.373499	0.045120
LTD	92.95480	190.0000	55.12000	22.63227	53.50001	0.000000
ERA	27.55853	87.00000	11.76000	17.29976	105.4084	0.00000
IRR	69.66307	83.06000	44.94000	8.611304	10.00926	0.006707

Source: Prepared by the researcher based on Eviews 13 software outputs.

Based on Table 02 above, we note the following:

-Return on Equity (ROE): The mean value reached 19.03%, with a standard deviation of 11.88%. The rates ranged from a maximum of 47.79% for BNP Paribas El Djazair to a minimum of 0.02% for Fransabank El Djazair.

- Return on Assets (ROA): The mean value reached 1.99%, with a standard deviation of 0.74%. The rates ranged from a maximum of 4.44% to a minimum of 0.004%, both recorded by Fransabank El Djazair.

- Credit Risk (Total Loans to Total Assets: LTA): The mean value reached 64.93%, with a standard deviation of 9.56%. The ratios ranged from a maximum of 80.30% for ABC Bank Algeria to a minimum of 44.35% for BNP Paribas El Djazair.

- Liquidity Risk (Total Loans to Total Deposits: LTD): The mean value reached 92.95%, with a standard deviation of 22.63%. The ratios ranged from a maximum of 190.00% for Fransabank El Djazair to a minimum of 55.12% for BNP Paribas El Djazair.

- Solvency Risk (Equity to Risk-Weighted Assets: ERA): The mean value reached 27.56%, with a standard deviation of 17.30%. The ratios ranged from a maximum of 87.00% for Fransabank El Djazair to a minimum of 11.76% for BNP Paribas El Djazair.

Interest Rate Risk (Interest Rate-Sensitive Assets to Total Assets: IRR): The mean value reached 69.66%, with a standard deviation of 8.61%. The ratios ranged from a maximum of 83.06% for ABC Bank Algeria to a minimum of 44.94% for Fransabank El Djazair.

Looking at the p-values of the Jarque-Bera test included in the descriptive statistics, we find that all of them are statistically significant. This indicates that the descriptive tests provide a true representation of the study variables and confirms the absence of any outliers.

3.3.2. Estimation Results and Model Selection

A. Estimation Results for the First Model

Table 03: Regression Estimation Results Using Return on Equity (ROE)

Variables	Estimation Method		
	Pooled OLS	Fixed Effects	Random Effects
C	78.31324	29.50965	78.31324
Prob (C)	0.0000	0.0409	0.0000
LTA	0.026293	0.295819	0.026293
Prob (LTA)	0.9122	0.1441	0.8899

LTD	0.236787	0.174538	0.236787
Prob (LTD)	0.0557	0.0874	0.0170
ERA	- 0.822973	- 0.286788	- 0.822973
Prob (ERA)	0.0000	0.0721	0.0000
IRR	- 0.865827	- 0.545527	- 0.865827
Prob (IRR)	0.0001	0.0048	0.0000
R-squared	0.463483	0.679463	0.463483
F-statistic	15.11777	17.48808	15.11777
Prob (F-statistic)	0.000000	0.000000	0.000000
Durbin- Waston stat	0.852948	1.262846	0.852948

Source: Prepared by the researcher based on Eviews 13 software outputs.

As shown in the table above, all three models exhibit overall statistical significance, with the p-values for the Fisher statistic (F-statistic) being less than 0.05 ($p < 0.05$).

As shown below, the Redundant Fixed Effects test results indicate that the p-values for both statistics are statistically significant ($p < 0.05$). Consequently, the null hypothesis is rejected, confirming that the Fixed Effects model is more appropriate for the study's panel data compared to the Pooled OLS model.

Table 04: Redundant Fixed Effects Test Results for the First Model

Test Type	Test Statistic	Probability
Cross-Section F	11.117846	0.0000
Cross-Section Chi-Square	38.632634	0.0000

Source: Prepared by the researcher based on Eviews 13 software outputs.

As shown in Table 05 below, the Hausman test results indicate that the p-value is statistically significant ($p < 0.05$). Consequently, the null hypothesis is rejected, confirming that the Fixed Effects model is the most appropriate model for the study data.

Table 05: Hausman Test Results for the First Model

Test Type	Test Statistic	Probability
Cross-Section Random	44.471385	0.0000

Source: Prepared by the researcher based on Eviews 13 software outputs.

Therefore, the estimated equation for the first model can be expressed as follows:

$$ROE = 29.50965 + 0.295819 LTA + 0.174538 LTD - 0.286788 ERA - 0.545527 IRR + \varepsilon_{it}$$

B. Analysis of the First Model's Estimation Results

Having established that the Fixed Effects model is the most appropriate model for measuring the impact of financial risks on banks' financial performance (represented by Return on Equity - ROE), the estimated results indicate the following:

- The total loans-to-total assets ratio, as a measure of credit risk, has a positive but statistically insignificant impact on banks' financial performance (represented by ROE), where the coefficient is 0.295819 and the p-value is 0.1441 ($p > 0.05$).
- The total loans-to-total deposits ratio, as a measure of liquidity risk, has a positive but statistically insignificant impact on banks' financial performance (represented by ROE), where the coefficient is 0.174538 and the p-value is 0.0874 ($p > 0.05$).
- The total equity-to-risk assets ratio, as a measure of solvency risk, has a negative but statistically insignificant impact on banks' financial performance (represented by ROE), where the coefficient is -0.286788 and the p-value is 0.0721 ($p > 0.05$).
- The interest rate-sensitive assets-to-total assets ratio, as a measure of interest rate risk, has a statistically significant negative impact on banks' financial performance (represented by ROE), where the coefficient is -0.545527 and the p-value is 0.0048 ($p < 0.05$).

- The explanatory power of the estimated model is good, as indicated by the coefficient of determination $R^2 = 0.679463$. This implies that 67.95% of the changes in the dependent variable (banks' financial performance represented by ROE) are driven by the independent variables in the first model, while the remaining 32.05% is due to other factors outside the scope of the model.

C. Estimation Results of the Second Model

Table 06: Regression Estimation Results Using Return on Assets (ROA)

Variables	Estimation Method		
	Pooled OLS	FixedEffects	Random Effects
C	3.418747	2.883402	3.418747
Prob (C)	0.0019	0.0221	0.0009
LTA	- 0.006966	0.007286	- 0.006966
Prob (LTA)	0.6963	0.6767	0.6732
LTD	0.019280	0.016193	0.019280
Prob (LTD)	0.0376	0.0485	0.0250
ERA	- 0.011749	0.004007	- 0.011749
Prob (ERA)	0.3474	0.7698	0.3102
IRR	- 0.035152	- 0.042865	-0.035152
Prob (IRR)	0.0222	0.0123	0.0137
R-squared	0.228069	0.376728	0.228069
F-statistic	5.170433	4.986599	5.170433
Prob (F-statistic)	0.001044	0.000074	0.001044
Durbin- Waston stat	0.999075	1.202178	0.999075

Source: Prepared by the researcher based on Eviews 13 software outputs.

As shown in the table above, all three models exhibit overall statistical significance, with the p-values for the Fisher statistic (F-statistic) being less than 0.05 ($p < 0.05$).

As shown below, the Redundant Fixed Effects test results indicate that the p-values for both statistics are statistically significant ($p < 0.05$). Consequently, the null hypothesis is rejected, confirming that the Fixed Effects model is more appropriate for the study's panel data compared to the Pooled OLS model.

Table 07: Redundant Fixed Effects Test Results for the Second Model

Test Type	Test Statistic	Probability
Cross-Section F	3.935471	0.0063
Cross-Section Chi-Square	16.043383	0.0030

Source: Prepared by the researcher based on Eviews 13 software outputs.

As shown in Table 08 below, the Hausman test results indicate that the p-value is statistically significant ($p < 0.05$). Consequently, the null hypothesis is rejected, confirming that the Fixed Effects model is the most appropriate model for the study data.

Table 08: Hausman Test Results for the Second Model

Test Type	Test Statistic	Probability
Cross-Section Random	15.741883	0.0034

Source: Prepared by the researcher based on EViews 13 software outputs.

Therefore, the estimated equation for the first model can be expressed as follows:

$$ROA = 2.883402 + 0.007286 LTA + 0.016193 LTD + 0.004007 ERA - 0.042865 IRR + \varepsilon_{it}$$

D. Analysis of the First Model's Estimation Results

Having established that the Fixed Effects model is the most appropriate model for measuring the impact of financial risks on banks' financial performance (represented by Return on Assets - ROA), the estimated results indicate the following:

- The total loans-to-total assets ratio, as a measure of credit risk, has a positive but statistically insignificant impact on banks' financial performance (represented by ROA), where the coefficient is 0.007286 and the p-value is 0.6767 ($p > 0.05$).
- The total loans-to-total deposits ratio, as a measure of liquidity risk, has a statistically significant positive impact on banks' financial performance (represented by ROA), where the coefficient is 0.016193 and the p-value is 0.0485 ($p < 0.05$).
- The total equity-to-risk assets ratio, as a measure of solvency risk, has a positive but statistically insignificant impact on banks' financial performance (represented by ROA), where the coefficient is 0.004007 and the p-value is 0.7698 ($p > 0.05$).
- The interest rate-sensitive assets-to-total assets ratio, as a measure of interest rate risk, has a statistically significant negative impact on banks' financial performance (represented by ROA), where the coefficient is -0.042865 and the p-value is 0.0123 ($p < 0.05$).
- The explanatory power of the estimated model is weak, as indicated by the coefficient of determination $R^2 = 0.376728$. This implies that 37.67% of the changes in the dependent variable (banks' financial performance represented by ROA) are driven by the independent variables in the second model, while the remaining 62.33% is due to other factors outside the scope of the model.

3.3.3. Hypothesis Testing

Following the presentation and discussion of the empirical results, the findings for the first model (ROE) indicate the following:

- The credit risk ratio, measured by total loans to total assets, has no statistically significant impact on the Return on Equity (ROE) of the studied banks during the period (2010–2024). Consequently, the first hypothesis (H1) is Rejected.
- The liquidity risk ratio, measured by total loans to total deposits, has no statistically significant impact on the Return on Equity (ROE) of the studied banks during the period (2010–2024). Consequently, the second hypothesis (H2) is Rejected.
- The solvency risk ratio, measured by total equity to risk-weighted assets, has no statistically significant impact on the Return on Equity (ROE) of the studied banks during the period (2010–2024). Consequently, the third hypothesis (H3) is Rejected.
- The interest rate risk ratio, measured by interest-rate-sensitive assets to total assets, has a statistically significant impact on the Return on Equity (ROE) of the studied banks during the period (2010–2024). Consequently, the fourth hypothesis (H4) is Accepted.
- Following the presentation and discussion of the empirical results, the findings for the second model (ROA) indicate the following:
 - The credit risk ratio, measured by total loans to total assets, has no statistically significant impact on the Return on Assets (ROA) of the studied banks during the period (2010–2024). Consequently, the fifth hypothesis (H5) is Rejected.
 - The liquidity risk ratio, measured by total loans to total deposits, has a statistically significant impact on the Return on Assets (ROA) of the studied banks during the period (2010–2024). Consequently, the sixth hypothesis (H6) is Accepted.
 - The solvency risk ratio, measured by total equity to risk-weighted assets, has no statistically significant impact on the Return on Assets (ROA) of the studied banks during the period (2010–2024). Consequently, the seventh hypothesis (H7) is Rejected.
 - The interest rate risk ratio, measured by interest-rate-sensitive assets to total assets, has a statistically significant impact on the Return on Assets (ROA) of the studied banks during the period (2010–2024). Consequently, the eighth hypothesis (H8) is Accepted.

Table (09): Summary of Hypothesis Testing Results

Symbol	Hypotheses Tested	Results
H1	There is a statistically significant impact of LTA on ROE	Rejected
H2	There is a statistically significant impact of LTD on ROE	Rejected
H3	There is a statistically significant impact of ERA on ROE	Rejected
H4	There is a statistically significant impact of IRR on ROE	Accepted
H5	There is a statistically significant impact of LTA on ROA	Rejected

H6	There is a statistically significant impact of LTD on ROA	Accepted
H7	There is a statistically significant impact of ERA on ROA	Rejected
H8	There is a statistically significant impact of IRR on ROA	Accepted

Source: Prepared by the researcher based on empirical results

4. DISCUSSION

The primary objective of this study was to examine the extent to which financial risks influence the financial performance of private banks operating in Algeria during the period 2010–2024. The empirical findings reveal that not all dimensions of financial risk affect profitability in the same manner. While interest rate risk exhibited a significant influence on both ROE and ROA, liquidity risk was significant only in the ROA model. In contrast, credit risk and solvency risk did not demonstrate statistically significant effects on either measure of financial performance.

One of the most notable findings concerns the role of interest rate risk. The results indicate that increases in interest rate exposure are associated with lower levels of profitability. This finding is consistent with the view that fluctuations in interest rates directly affect banks' net interest margins, funding costs, and investment returns. Given that private banks in Algeria operate within a financial environment that remains highly sensitive to monetary conditions, changes in interest rates may create uncertainty regarding future earnings. The significant negative coefficients obtained in both models suggest that interest rate movements continue to represent one of the most important challenges facing bank managers.

The study also found that liquidity risk positively influences Return on Assets but does not significantly affect Return on Equity. This result may indicate that effective liquidity management contributes to more efficient utilization of bank assets, allowing institutions to maintain operational flexibility and respond to funding needs without disrupting their normal activities. However, the absence of a significant relationship with ROE suggests that shareholders' returns are influenced by additional factors beyond liquidity conditions alone. This finding supports the argument that liquidity management primarily affects operational efficiency rather than the profitability generated for shareholders.

An unexpected result of the study is the lack of a statistically significant relationship between credit risk and financial performance. In many banking studies, deteriorating credit quality is associated with lower profitability due to rising loan losses and provisioning expenses. However, the findings obtained here may reflect the relatively conservative lending policies adopted by the selected private banks. It is possible that effective credit screening procedures and prudent risk management practices have limited the adverse effects of credit risk during the study period. Another explanation may be that the selected measure of credit risk does not fully capture variations in loan quality and non-performing assets across banks.

Similarly, solvency risk did not exhibit a significant impact on either ROA or ROE. This finding may suggest that the sampled banks maintained capital levels above regulatory requirements throughout most of the study period, reducing the direct influence of solvency considerations on profitability. In such circumstances, variations in capital adequacy may not be large enough to generate measurable differences in financial performance. While adequate capitalization remains essential for financial stability, its effect on short-term profitability may be less pronounced than that of liquidity or interest rate conditions.

The findings of this study partially support previous empirical research. The significant effect of interest rate risk is consistent with the conclusions of Nguyen (2024) and Khan and Ahmed (2024), who emphasized the importance of financial risk management in sustaining banking profitability. Likewise, the positive role of liquidity management aligns with the findings of Abdelhamid and Kadem (2020). However, the insignificant effects of credit risk and solvency risk differ from several earlier studies, highlighting the possibility that institutional characteristics and country-specific conditions influence the relationship between risk and performance.

These results should also be interpreted in light of certain limitations. The analysis is based on a relatively small sample of five private banks, which may limit the generalizability of the findings to the entire Algerian banking sector. Furthermore, financial performance is influenced by numerous internal and external factors, including macroeconomic conditions, regulatory changes, competition, and managerial practices, which were not explicitly incorporated into the empirical models. Future research may therefore benefit from larger samples, additional explanatory variables, and more advanced econometric techniques capable of capturing dynamic relationships over time.

Overall, the findings suggest that while private Algerian banks appear relatively resilient to credit and solvency risks, their profitability remains particularly sensitive to interest rate movements and, to a lesser extent, liquidity conditions. Consequently, strengthening asset-liability management practices, improving liquidity planning, and enhancing risk monitoring systems may contribute to greater financial stability and sustainable profitability within the Algerian banking sector.

5. CONCLUSION

Through this study, we aimed to investigate the impact of financial risks on the financial performance of commercial banks, applying the empirical analysis to a sample of five private banks operating in Algeria during the period (2010–2024). Financial performance, the dependent variable, was measured using Return on Equity (ROE) and Return on Assets (ROA). Meanwhile, financial risk, the independent variable, was captured through four proxy indicators: total loans to total assets, total loans to total deposits, total equity to risk-weighted assets, and interest rate-sensitive assets to total assets. To achieve the primary objective of the study, panel data models were employed. The study yielded several key findings, most notably:

- The results of the first model, which examined the impact of financial risks on Return on Equity (ROE), identified the Fixed Effects Model as the most appropriate estimation technique. The findings revealed that credit risk, liquidity risk, and solvency risk have no statistically significant impact on financial performance. Conversely, interest rate risk demonstrated a statistically significant impact on the financial performance of the studied sample of private banks during the period (2010–2024).
- The results of the second model, which evaluated the impact of financial risks on Return on Assets (ROA), also selected the Fixed Effects Model as the optimal model. The empirical evidence indicated that credit risk and solvency risk do not exert a statistically significant impact on financial performance. On the other hand, both liquidity risk and interest rate risk proved to have a statistically significant impact on the financial performance of the selected private banks during the period (2010–2024).

6. RECOMMENDATIONS

- Hedging Interest Rate Risk: Activate Asset-Liability Management (ALM) frameworks to forecast rate fluctuations and bridge maturity gaps.
- Enhancing Liquidity Management: Innovate new saving products to mobilize stable deposits and reduce reliance on volatile short-term funding.
- Maintaining Prudential Policies: Sustaining strict creditworthiness assessments and international solvency benchmarks (Basel III) to shield profitability from defaults.
- Diversifying Income Sources: Expand digital banking and fee-based services to reduce near-total dependence on risk-sensitive traditional interest margins.

7. DECLARATIONS

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Informed Consent Statement

Not applicable.

Data Availability Statement

The data used in this study were obtained from publicly available annual reports and financial statements of the selected private banks operating in Algeria. Additional information may be available from the corresponding author upon reasonable request.

Conflicts of Interest

The author declares no conflict of interest regarding the publication of this study.

Ethical Approval

This research did not involve human participants, animals, clinical trials, or confidential personal data. Therefore, formal ethical approval was not required.

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Artificial Intelligence (AI) Use Disclosure

The author declares that no artificial intelligence tools were used to generate, analyze, interpret, or manipulate the research data. Any use of digital tools was limited to language editing and formatting assistance, and all intellectual content, analysis, interpretations, and conclusions remain the sole responsibility of the author.

Consent for Publication

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