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Research article

Determinants of bank profitability in Portugal: Insights from a period of sectoral transformation

Luís Almeida[1,2] and Francisco Sousa[2,*]

[1] GOVCOPP Unit Research, Aveiro University, Aveiro, Portugal

[2] Higher Institute of Accounting and Administration of Aveiro, University of Aveiro, Aveiro, Portugal

* **Correspondence:** Email: franciscosousa@ua.pt.

Abstract: This study aimed to analyze the determinants of banking profitability in Portugal within the context of a transforming financial sector marked by the sovereign debt crisis, the Troika, and the COVID-19 pandemic. The primary objective was to identify the internal and external factors influencing bank profitability and provide recommendations for improving the sector's performance. Methodologically, panel data covering 16 Portuguese banks between 2009 and 2023 were used, enabling a dynamic analysis of the relationship between microeconomic and macroeconomic variables. The empirical approach was based on the generalized method of moments (GMM), ensuring robustness in the estimates by addressing endogeneity and unobserved heterogeneity. The variables analyzed included internal indicators such as operational efficiency, asset quality, and asset management, as well as macroeconomic factors like GDP growth, inflation, and unemployment. The results highlight that operational efficiency and unemployment negatively impact banking profitability, while asset quality and branch reduction have positive effects. Moreover, the sovereign debt crisis showed a significant adverse effect, contrasting with the pandemic crisis's absence of a statistically significant impact. This study contributes to the literature by deepening the understanding of the determinants of banking profitability in peripheral economies of the Eurozone. Practically, it provides insights for investors, policymakers, and banking managers in formulating strategies to strengthen the sector's resilience.

Keywords: bank profitability; determinants; sovereign debt crisis; COVID-19 pandemic; branch dynamics

JEL Codes: G20, G21, G28

1. Introduction

Studying and understanding bank profitability in the global context is significant for assessing the health and stability of the financial system, especially in an economic landscape marked by various economic and financial crises. The recurrence of these crises has exposed structural vulnerabilities in banking systems, highlighting the need to ensure sustainable profitability that allows the financial sector to withstand external shocks and preserve its stability. Almeida (2020) pointed out that an efficient and sustainable capital market indicates economic maturity and stability. In this vein, among others, Antony (2023) and Klein and Weill (2022) stressed that the banking system plays a crucial role in financing economic activity and is, therefore, one of the fundamental pillars of modern economies. In the context of profound transformations in the banking sector, profitability and resilience have become key economic priorities. As a fundamental indicator of efficiency and soundness, bank profitability is crucial for academic research, regulatory supervision, and sector management. Understanding its determinants is essential to strengthening macroeconomic stability, particularly in economies where the banking sector is central in financing the real economy.

The ability of financial institutions to generate profitability reflects their ability to adapt to rapid changes in the markets and to face periods of uncertainty, thus ensuring the continuity of their operations. As a result, the stability and efficiency of the banking system are crucial to fostering growth and economic development in countries. Given its transversal impact on the global economy, this relationship reinforces the need for a continuous and in-depth analysis of the banking sector (Antony, 2023). A deeper understanding of the factors driving profitability is crucial to assessing the robustness of banking institutions, making it possible to categorize these factors as internal, related to the bank's management and structure, and external, associated with the macroeconomic environment, which significantly influences financial performance. Despite the extensive literature on bank profitability, there remain gaps regarding the factors influencing profitability in particular national contexts, especially in peripheral and less developed economies within the Eurozone, such as Portugal. Exploring profitability dynamics in smaller, peripheral economies is relevant, as these banking systems are more vulnerable to external shocks, exhibit lower risk diversification, and rely heavily on bank financing for economic growth. Financial crises have highlighted that the banking system in Portugal was less resilient than in other economies, showcasing structural weaknesses that made the sector more susceptible to periods of instability.

In eurozone countries, the banking sector is essential for economic stability and has played a crucial role in recovering from recent financial crises (Klein & Weill, 2022; Mkaro et al., 2023). The study of bank profitability is particularly relevant in the current context, given that this sector has faced many crises and challenges in recent decades. In Portugal, the banking sector has undergone profound transformations in recent years, particularly following the sovereign debt crisis (2010–2013) and the COVID-19 pandemic crisis (2020–2021). During the Troika period (2011–2014), the Portuguese banking system underwent a restructuring process involving strict recapitalization requirements, mergers and acquisitions, and a significant reduction in non-performing loans. The need to strengthen capital ratios and adjust balance sheets directly impacted bank profitability. Furthermore, the pandemic introduced new challenges, including abrupt economic contraction, credit moratoria, and a historically low-interest rate environment.

The relevance of this topic is amplified by the impact of the successive economic and financial crises that have shaped the contemporary landscape, for example, the sovereign debt crisis (2010–2013), the COVID-19 pandemic (2020–2021), and, more recently, the conflict between Russia and Ukraine. These events have put the banking system under pressure, further stressing the need to understand the factors influencing its efficiency and stability globally. Thus, this study aims to fill a gap in the literature by analyzing the determinants of bank profitability in Portugal, considering the structural changes imposed by recent crises. It seeks to provide practical recommendations to optimize the performance of the national banking sector. The analysis of the Portuguese case, in comparison with trends observed in other economies, offers a comprehensive perspective on the determinants of banking profitability and efficiency.

This study examines the impact of internal factors and macroeconomic variables on banking institutions' profitability, particularly emphasizing the relevance of opening and closing bank branches for sector profitability. This is the first study to explore these dynamics within the Portuguese context, addressing their evolution over the past 15 years and examining the effects of the sovereign debt crisis and the pandemic. An empirical methodology based on panel data was applied to a sample of 16 banks that remained active throughout the study period from 2009 to 2023 to achieve this objective.

The results demonstrate that operational efficiency and unemployment significantly negatively impact bank profitability. At the same time, asset quality and fewer branches exhibit positive effects. The sovereign debt crisis had a considerable adverse impact, contrasting with the pandemic's lack of a statistically significant effect. This study contributes to the literature by deepening the understanding of the determinants of bank profitability in peripheral economies of the Eurozone, providing valuable insights for bank managers, investors, and policymakers. The findings highlight the importance of innovation and digital transformation. Managers should prioritize digitalization, process automation, and organizational structure optimization, while investors should focus on institutions with low cost-efficiency ratios.

For policymakers, the analysis emphasizes the importance of promoting the modernization of the banking sector without imposing excessive administrative costs and ensuring regulation that fosters economic growth and access to credit, especially in crisis scenarios. The results highlight the need to strengthen the banking system's resilience by diversifying revenue sources and adjusting capital ratios to withstand external shocks better. This study further reflects on adapting the Portuguese banking sector within a global context, contributing to the debate on financial stability in vulnerable economies and offering potential recovery and banking sustainability strategies that could be relevant to other countries in similar situations.

The paper is structured as follows: The next section presents the literature review, identifying the main theories and empirical evidence on bank profitability. The third section describes the research variables and the hypotheses formulated. The fourth section describes the sample and methodology used. The fifth section presents and discusses the main findings. Finally, the sixth section outlines the conclusions, limitations of the study, and suggestions for future research.

2. Literature review

The study of bank profitability has received considerable attention in the economic literature, given its importance for financial stability, banking system efficiency, and economic development. Profitability is a key indicator of the financial health of banking institutions and plays a crucial role in the attractiveness of the banking sector to investors and other stakeholders. Various studies have

attempted to identify the determinants of bank profitability, which can be grouped into internal factors (endogenous to the institution) and external factors (related to the macroeconomic context).

Internal factors

Initial literature on bank profitability pointed to cost control as the primary determinant of this variable. Molyneux and Thornton (1992) were the first to find a positive relationship between the quality of management decisions and profitability, based on a sample of 18 European countries. Other authors, such as Bourke (1989) and Molyneux and Thornton (1992), highlighted that market concentration and management decisions regarding credit granting positively affect bank profitability.

Credit risk is another relevant factor highlighted in the literature; non-performing loans (NPLs) are considered credit risk indicators and tend to reduce bank profitability (e.g., Figlewski et al., 2012; Kumar et al., 2022; Mirović et al., 2024). However, there is no universal consensus on its relationship with bank profitability. Some studies show a positive correlation between banks in Palestine and Malaysia (Oleiwi et al., 2019; Saleh & Paz, 2023).

Cost efficiency, typically measured by the cost-to-income ratio, is widely recognized as a critical determinant of bank profitability, generally exerting a negative influence. Operational inefficiencies can significantly undermine a bank's financial performance by increasing overheads and reducing margins. Income diversification, particularly through non-interest income, is often associated with enhanced profitability. However, an excessive reliance on such income streams may introduce greater earnings volatility and potential instability. As indicated by the level of non-performing loans (NPLs), asset quality also negatively affects profitability. Elevated impairment levels necessitate higher loan loss provisions, thereby reducing banks' net returns (Heitmann et al., 2023; Jigeer & Koroleva, 2023). Effective asset management plays a vital role in ensuring the financial soundness of banking institutions by maintaining adequate reserves and implementing robust funding strategies to withstand liquidity pressures. Both asset management quality and operational efficiency are considered key drivers of bank profitability. Banks with superior asset management practices and greater cost efficiency tend to achieve higher profitability levels (Al-Matari, 2023; Khan, 2022a).

Authors like Dietrich and Wanzenried (2011) and Jigeer and Koroleva (2023) consider efficiency as the result of a relationship between operational costs and total income, pointing to a negative relationship between operational costs and bank profitability. Financial literature widely discusses the relationship between liquidity and bank profitability, representing a critical study area in financial management. While some studies show a positive correlation (e.g., Belcaid & Al-Faryan, 2023; Gržeta et al., 2023; Thinh et al., 2022), other investigations suggest that banks creating more liquidity tend to have lower profits (e.g., Abdelaziz et al., 2020; Al-Homaidi et al., 2018; Huong et al., 2021). This divergence can be explained by factors such as bank size, economic conditions, and the regulatory environment, which significantly shape this relationship. Understanding how these factors interact can help banks optimize their financial strategies and ensure sustainable growth.

The equity ratio is widely recognized as a determinant of profitability, since a higher level of capitalization can improve a bank's resilience and reduce funding costs (Athanasoglou et al., 2008; Bourke, 1989). However, excessive equity levels can also indicate underutilization of resources and lower leverage, negatively impacting profitability (Demirgüç-Kunt et al, 2021).

Early studies by Short (1979) and Bourke (1989) highlighted that the structure of financial markets and barriers to entry are important factors in driving bank profitability. However, these studies did not focus much on specific bank factors or consider macroeconomic influences. Later investigations have

widely used the "structure-conduct-performance" hypothesis, arguing that greater market power generates monopoly profits. Market concentration in the banking sector reduces competition, allowing for higher profit margins (e.g., Bourke, 1989; Molyneux & Thornton, 1992; Nguyen, 2018).

Bank size is often included in analyses to study economies of scale, as larger banks tend to have lower costs of raising capital and processing information. Although the literature finds a positive correlation between the institution's size and profitability, the results are mixed, with larger and better-capitalized banks having higher profits (Menicucci & Paolucci, 2016; Molyneux & Thornton, 1992). Some studies suggest the existence of economies of scale and competitive advantages in large banks (Menicucci & Paolucci, 2016), while others point to diminishing returns due to operational complexity and agency costs (Djalilov & Piesse, 2016; Neves et al., 2020). Size and capital ratios correlate positively with bank profitability, suggesting that larger and better capitalized banks are more profitable (e.g., Menicucci & Paolucci, 2016; Molyneux & Thornton, 1992). However, Djalilov and Piesse (2016) and Neves et al. (2020) observed a nonlinear relationship between the size and profitability of banks in the UK. The most frequently analyzed internal factors include capital structure, liquidity, operating costs, credit risk, management efficiency, and the institution's size.

Banking concentration, as measured by the Herfindahl–Hirschman Index (HHI), directly impacts financial institutions' profitability. In more concentrated markets, where a few banks dominate, they tend to obtain higher profit margins due to their greater market power, allowing them to control prices and reduce competition. However, high concentration can also generate inefficiencies and high operating costs, which can harm profitability in the long term. Studies indicate that the relationship between concentration and profitability is complex, and markets with excessive concentration can reduce efficiency and negatively affect banks' financial performance (Dietrich & Wanzenried, 2011; Nguyen, 2018).

Macroeconomic factors such as GDP, inflation, interest rates, and unemployment are frequently identified in the literature as determinants of bank profits, as economic growth promotes credit. In contrast, unexpected inflation can increase costs, and unemployment reduces household income. GDP growth favors increased lending and interest rates, improving bank profitability (Al-Homaidi et al., 2018; Huong et al., 2021). Inflation, in turn, can have a positive or mixed impact, depending on the bank's ability to adjust its rates, directly affecting sector revenues and expenses (Al-Homaidi et al., 2018; Jacobs & Sensenbrenner, 2018; Xu et al., 2023). The impact of GDP on profitability is widely recognized as robust, as it drives banking activity and enhances profitability (e.g., Argimon et al., 2023; Athari & Bahreini, 2023; Belcaid & Al-Faryan, 2023; Chukwuogor et al., 2021; Heitmann et al., 2023; Iqbal et al., 2022; Jigeer & Koroleva, 2023).

The impact of inflation is more ambiguous, possibly positive or negative, depending on the location and the profitability measure used. Studies by Gržeta et al. (2023), Hossain & Ahamed (2021), and Jigeer & Koroleva (2023) indicated a negative relationship between inflation rate and bank profitability, while those by Athari & Bahreini (2023), Belcaid & Al-Faryan (2023), Chukwuogor et al. (2021), Iqbal et al. (2022), Khan (2022b), and Korytowski (2018) suggested a positive relationship. The unemployment rate is another frequently analyzed external determinant in the literature. Several studies explore how changes in unemployment rates affect bank profitability, often focusing on different regions and methodologies. An increase in local unemployment rates tends to reduce bank profitability, mainly due to the reduction in net interest income, which is affected by local labor market conditions (e.g., Chukwuogor et al., 2021; Jadah et al., 2020).

International studies indicate that lower interest rates reduce net interest margins and global bank profitability. The specific impact of these rates varies according to each bank's characteristics and the

country's economic structure, such as the predominance of fixed interest rates and the level of competition (e.g., Claessens et al., 2017; Molyneux et al., 2022). We highlight studies focusing on different regions, examining how economic, regulatory, and structural differences influence bank profitability. Korytowski's (2018) analysis of bank profitability in European commercial banks between 2011 and 2015 suggests that efficiency, product diversification, market concentration, and inflation negatively affect bank profitability. Gržeta et al. (2023) also investigated the impact of Basel II and III regulations in Europe between 2006 and 2015, concluding that larger banks adapted better to these regulations, while smaller ones faced adverse effects on profitability.

Exogenous events, such as financial crises, pandemics, and sovereign debt crises, directly affect bank profitability. The COVID-19 pandemic, for example, caused a sharp drop in economic activity, reduced demand for financial services, deterioration in asset quality, and increased operating costs, resulting in a general decrease in profitability (Kohlscheen et al., 2021; Heitmann et al., 2023). Similarly, the European sovereign debt crisis highlighted the strong interdependence between sovereign risk and banking risk, with particularly serious implications for peripheral eurozone countries. The devaluation of national government bonds increased solvency ratios, limited lending capacity, and generated the "doom loop" between public finances and financial stability, directly affecting the performance and profitability of banking institutions (Acharya et al., 2014; Agnese et al., 2024; Boitan & Marchewka, 2021).

The study by Heitmann et al. (2023) analyzed the impact of the COVID-19 pandemic on banking profitability, using a panel of 87 commercial banks in the United States between 2017 and 2021, pointing to adverse effects of the pandemic crisis on profitability in the banking sector. Argimon et al. (2023), using data from a sample of banking institutions from 31 countries between 1995 and 2018, found evidence of a positive relationship between interest rates and margins, which was more considerable in periods with lower interest rates. The interest margins of banks that are foreign subsidiaries of a banking group are less sensitive to the local interest rate. These subsidiaries are also susceptible to the interest rate of the country where the respective banking group is based.

Empirical evidence by geographic region

Several empirical studies have analyzed the determinants of bank profitability in different geographical contexts. In Europe, among other studies, Korytowski (2018) analyzed a sample of 4179 European commercial banks between 2011 and 2015 and concluded that factors such as efficiency, product diversification, market concentration, and inflation negatively affect bank profitability, while risk propensity and economic growth are positively associated with profitability. Qehaja-Keka et al. (2023) pointed out that factors such as the number of employees, the interest rate on loans, the total volume of loans, and non-performing loans (NPLs) significantly impact the profitability of banks in Kosovo and Albania, suggesting that reducing NPLs and improving the adequacy of their own resources are crucial to increasing profitability. Gržeta et al. (2023) found that the Basel regulations had a negative impact on the profitability of smaller banks, while larger banks were better able to adapt to the new regulatory requirements. In emerging economies, such as Latin America and Africa, the relevance of macroeconomic instability, exchange rate volatility, and institutional weaknesses is particularly pronounced (Flamini et al., 2009; Naceur & Omran, 2011).

Jigger and Koroleva (2023) investigated how certain internal and external factors influenced the profitability of 16 commercial banks in China between 2008 and 2010, pointing to bank size, credit quality, and operational efficiency as relevant factors, and described that regional GDP and inflation significantly impact bank profitability. The results indicated that the country's economic condition positively affects

profitability. In contrast, factors such as size and capital adequacy show signs of ambiguity despite having significant effects. Safitri et al. (2023), with a data sample of Indonesian commercial banks for 2020–2022, suggested that during the COVID-19 pandemic, there was a direct and positive influence of market power and income diversification on bank profitability.

Youngkyung et al. (2019) analyzed the relationship between real estate prices and bank profitability in South Korea between 2000 and 2018 and found that fluctuations in the real estate market affect the quality of assets that banks hold. The study also indicated that a possible decline in real estate market values could significantly harm the performance of the country's banks.

Hossain and Ahamed (2021) studied the profitability of 23 banks in Bangladesh between 2005 and 2019. The results indicated that banks with larger size and market share have access to greater liquidity, better investments, and financing facilities. However, they also face new and more complex regulations, which decrease their profit margin. In addition, the study showed that, contrary to expectations, not all deposits are profitable for banks and that efficient management, despite increasing operating costs, positively affects profitability.

For the Middle East, we point to the study by Al-Matari (2023), who studied the determinants of bank profitability in the Gulf Cooperation Council (GCC) countries between 2000 and 2018, measured by the NIM variable, and showed that the size of banking institutions has a significant negative effect on the performance of banks in the region, while asset management has an equally significant positive impact. In addition, bank liquidity plays an important role in the relationship between capital adequacy, the quality of the institution's assets, and performance. Khan (2022b) investigated the determinants of bank profitability in the same countries and within the same period (2011–2017), using ROE and ROA as a proxy for profitability. The study results, contrary to those by Al-Matari (2023), indicated that size positively impacts profitability and that capital adequacy, financial risk, operational efficiency, and asset quality have a negative relationship with ROE.

Athari and Bahreini (2023) analyzed the effects of external governance and regulatory settings on the profitability of Islamic banks in the Arab market between 2003 and 2017, indicating that external governance mechanisms and their aspects of political stability, quality of regulation, rule of law, and control of corruption have a positive impact on the profitability of Islamic banks. However, the regulatory framework and its sub-indices, particularly the degree of transparency and the greater ease with which shareholders can be sued, have the opposite effect, damaging their profitability. In the African context, some authors stand out, such as Belcaid and Al-Faryan (2023), who conducted a study on financial liberalization in Morocco, including a sample of the six banks with the largest market share in that country from 2010 to 2019. The results showed that high capital structure ratios, particularly solvency, liquidity, and capitalization ratios, adversely affect Moroccan banks' performance.

Yakubu and Bunyaminu (2022), whose work focused on the impact of globalization on the profitability of 40 banks in sub-Saharan African countries between 2008 and 2016, found a significant negative effect of globalization on banking profitability, explained by the intense competition generated in the sector. The study indicated that GDP growth and inflation significantly and positively affect bank profitability. In the United States and OECD countries, Chukwuogor et al. (2021) analyzed the determinants of bank profitability in the US banking sector between 1996 and 2019. The authors concluded that internal variables, such as the net interest margin and the ratio of non-performing loans to total loans, positively influence bank profitability. External variables, such as the average mortgage interest rate and the level of economic openness (measured by the sum of exports and imports over GDP), have a negative impact on the profitability of US banks.

Recent literature on bank profitability has increasingly focused on integrating traditional determinants with analyzing emerging factors, particularly fintech technologies. The interaction between technological innovations and classical banking management factors such as bank size, asset quality, and leverage remains central in bank profitability research. Fintech technologies play a transformative role in the financial sector, often analyzed through indicators such as digitalization, mobile banking, and electronic payments, which have been linked to improvements in bank profitability (e.g., Ben Bouheni et al., 2024; Chhaidar et al., 2022). However, further research is required to explore how these technologies impact operational efficiency, risk management, and customer experience, and how economies of scale in large banks interact with these technological innovations to influence bank stability and liquidity.

2.1. The Portuguese banking system and its evidence

The changes introduced by the Basel Agreement, particularly with the implementation of Basel III, significantly impacted the Portuguese banking system. The Basel III Accord introduced structural changes to capital and liquidity ratios, notably increasing the minimum capital ratio and implementing the leverage ratio to limit excessive indebtedness to enhance banks' resilience to financial shocks. This reform was introduced in response to the 2007–2008 global financial crisis to strengthen the banking system's stability. In the Portuguese context, these reforms had direct implications, as the banking system faced severe difficulties following the sovereign debt crisis and the intervention of the Troika (2011–2014). In Portugal, the Troika was the team formed by the International Monetary Fund (IMF), the European Central Bank (ECB), and the European Commission (EC) that oversaw the country's financial bailout program in the context of the Eurozone sovereign debt crisis. In exchange for a €78 billion loan, stringent austerity measures and structural reforms were implemented, including fiscal consolidation to reduce the public deficit, the restructuring of the financial system to strengthen bank solvency, cuts in public expenditure, tax increases, and reforms in the labor market and social security system. These measures are aimed at restoring market confidence and ensuring the long-term sustainability of public finances.

Implementing the new capital requirements led to recapitalization processes, mergers, and acquisitions. According to data from the Bank of Portugal and the Portuguese Banking Association, 26 institutions exited the Portuguese market, resulting in a 49% decrease in the number of branches in the country between 2009 and 2023. Stricter liquidity requirements and new risk assessment models forced Portuguese banks to adjust their business models and restructure their operations to ensure stability and compliance with the new regulations. While these changes were necessary to enhance the robustness of the financial system, they presented additional challenges for financial institutions, which had to adapt to a more challenging economic environment.

Dermine and Carvalho (2008) highlighted two pieces of evidence: the need for econometric studies on Portuguese banking and that provisioning for loan losses is an essential element in banking risk management, significantly impacting the profitability and solvency of financial institutions. The authors advocated for transitioning from the incurred credit losses (ICL) model to the expected credit losses (ECL) model, emphasizing that this approach offers superior predictive capabilities for identifying future risks. According to the authors, this shift would improve bank risk management, fostering more effective regulatory practices aligned with international trends.

Garcia and Guerreiro (2016) analyzed the determinants of bank profitability in Portugal using data from 27 banks between 2002 and 2011, highlighting internal and external factors. Among internal

factors, operational efficiency exhibited a significant negative impact, while annual deposit growth and the loan growth differential relative to the market exerted positive effects. The capital-to-assets ratio revealed that well-capitalized banks were more resilient during the crisis. Regarding external factors, GDP growth had a negative impact, reflecting the weak economic performance of the period, whereas the increase in household disposable income had a positive effect. These findings underscore the relevance of bank-specific and macroeconomic factors in profitability, with implications for management and policy-making in the banking sector.

Neves et al. (2020) examined profitability and banking efficiency determinants in the Iberian Peninsula from 2011 to 2016. The evidence indicates that revenue diversification, deposit growth, and operational efficiency positively influence profitability, while bank size exhibits a nonlinear relationship with diminishing marginal returns beyond a certain point. Efficiency, in turn, showed a negative relationship with size, suggesting higher efficiency in smaller banks. Despite similarities in determinants between the two countries, attributable to economic proximity and capital integration, Portuguese banks faced additional challenges related to recapitalization in the post-crisis period, limiting the impact of positive factors such as deposit growth. These contextual differences highlight the need for strategies tailored to the specific conditions of each country.

Basílio et al. (2021) described how internal and external factors influenced the profitability of Portuguese banks between 2015 and 2018. Internally, capital adequacy and high operational costs negatively impacted performance, while liquidity and operational efficiency contributed positively. Credit quality, by increasing provisions for losses, also reduced profitability. Externally, GDP growth spurred lending and reduced defaults, improving outcomes, whereas the impact of inflation was ambiguous, depending on the economic context. Factors such as bank size and macroeconomic conditions, including market concentration and unemployment rates, played significant roles. Efficient management of these determinants is essential for the competitiveness and sustainability of the Portuguese banking sector.

3. Variables and research hypotheses

The evaluation of banking profitability, extensively explored in the literature, employs diverse indicators to analyze operational efficiency, profit capacity, and the financial health of institutions. Based on the reviewed literature, variables deemed determinants of banking profitability were selected, leading to the formulation of research hypotheses supported by national and international studies. These studies highlight these variables' relevance and impact on the banking sector's performance and stability. The selected variables were chosen for their ability to provide essential insights into profit generation and the resilience of institutions under adverse economic conditions.

3.1. Dependent variables

The academic literature identifies a range of dependent variables for studying profitability, with most studies using return on equity (ROE) and return on assets (ROA) as proxies for banking profitability. ROE assesses shareholder profitability relative to invested capital, while ROA measures a bank's ability to generate profits based on its assets. These variables have been extensively used in studies such as Athari and Bahreini (2023), Belcaid and Al-Faryan (2023), Heitmann et al. (2023), Jigeer and Koroleva (2023), Kasana et al. (2023), Khan (2022a), and Qehaja-Keka et al. (2023).

3.2. Independent variables

Internal or microeconomic determinants refer to factors directly related to institutional management. These include size, management, liquidity, quality, operational efficiency, and environmental responsibility. These factors provide a detailed view of bank operations and structures, enabling a more comprehensive profitability analysis. External determinants reflect the influence of the macroeconomic, social, and legal environment in which banks operate. Government policies, industry conditions, and sector-specific characteristics shape these factors. Key external determinants include macroeconomic factors like inflation, economic growth, and unemployment rates.

Banking efficiency was quantified through the cost-to-income ratio, calculated as the ratio of operating expenses to total revenue (e.g., Dietrich & Wanzenried, 2011; Garcia & Guerreiro, 2016; Neves et al., 2020). Operating costs include personnel expenses, administrative costs, and property-related expenditures. Higher operating costs are anticipated to reduce banking profitability; in other words, a high cost-to-income ratio could negatively impact profitability (Heitmann et al., 2023; Jigeer & Koroleva, 2023). We, therefore, formulate the following hypothesis:

H1: There is a negative relationship between the cost-to-income ratio and profitability.

Liquidity risk refers to the potential inability of a bank to meet short-term obligations due to a lack of funds or liquid assets. The literature commonly calculates liquidity risk using the ratio of total deposits to total assets (e.g., Belcaid & Al-Faryan, 2023; Gržeta et al., 2023; Hossain & Ahamed, 2021). Higher deposit levels are associated with greater liquidity. Although the relationship between liquidity and profitability is somewhat ambiguous, studies such as Gržeta et al. (2023) and Korytowski (2018) suggest a positive relationship. For this reason, we have formulated the following hypothesis:

H2: There is a positive relationship between liquidity risk and profitability.

Effective management of assets, or asset productivity ratio, is critical for ensuring operational stability and safeguarding liquidity. The proxy used for asset management, as employed by Al-Matari (2023) and Khan (2022a), is the ratio of operating income to total assets. A higher ratio is expected to correlate with increased profitability. This leads us to formulate the following hypothesis:

H3: Quality of management and profitability have a positive relationship.

Asset quality is a key determinant of financial solidity and sustainable profitability. High asset quality reflects well-managed loans with low default probabilities and secure, profitable investments. Following Al-Matari (2023), the ratio of total loans to total assets was used to quantify asset quality. A positive relationship with profitability is anticipated, as secure and profitable assets enhance investor confidence. We therefore hypothesize the following:

H4: There is a positive relationship between asset quality and profitability.

Technological advancements and AI have reduced the need for physical branch visits, raising questions about the cost-efficiency of maintaining branches. Although no prior studies have examined branch openings or closures as determinants of profitability, this study explores whether these actions influence banking profitability. For this reason, we have formulated the following hypotheses:

H5A: There is a significant relationship between opening new branches and profitability.

H5B: There is a significant relationship between closing branches and profitability.

Credit risk, defined as the likelihood of borrower default on obligations to banks, is commonly measured by indicators such as the non-performing loans (NPL) ratio or the loan loss provisions ratio (Figlewski et al., 2012; Kumar et al., 2022; Mirović et al., 2024). Empirical evidence consistently reveals a negative relationship between credit risk and bank profitability, suggesting that higher NPL levels or

increased provisions reduce earnings due to greater default likelihood (Alexiou & Sofoklis, 2009; Katusiime, 2021; Le & Ngo, 2020). Furthermore, banks with higher loan-to-asset ratios often face diminished profit margins, reflecting weaker asset quality and heightened insolvency risk (Jacobs & Sensenbrenner, 2018; Kumar et al., 2022). Based on this evidence, we formulate the following hypothesis:

H6: Credit risk significantly negatively impacts bank profitability.

Market concentration in the banking sector is commonly assessed using the Herfindahl–Hirschman Index (HHI), which reflects the distribution of market share among institutions and serves as a proxy for competition and market power (Dietrich & Wanzenried, 2011; Nguyen, 2018). Despite extensive research, the impact of concentration on profitability remains inconclusive. Some studies report a positive effect, attributing higher margins to reduced competition, while others find a negative relationship, linking concentration to inefficiencies and lower performance (Alshubiri, 2022; Korytowski, 2018). In light of these divergences, the hypothesis to be tested in this study is as follows:

H7: Market concentration, as measured by the HHI, has a significant impact on bank profitability.

Inflation, quantified by the inflation rate, affects profitability variably. Some studies suggest a negative relationship, while others posit a positive effect. Here, a negative impact is anticipated, given inflation's potential to erode purchasing power.

H8: There is a negative relationship between inflation and profitability.

Table 1. Definition of variables.

Variables		Calculation method	Expected signal
Dependent variables			
Return on equity	ROE	Net profit/shareholders' equity	
Return on assets	ROA	Net profit/total assets	
Independent variables			
Operational efficiency	EFOP	Operating costs/operating revenues	-
Liquidity risk	RLIQ	Loans/deposits	+
Asset management	MQ	Operating income/total assets	+
Asset quality	AQ	Non-performing loans/total loans	+
Number of branches open	NBA	Number of branches opened annually	
Number of closed branches	NBF	Number of branches closed annually	
Credit risk	CR	Non-performing loans (NPL)/total loans	-
Market concentration	HHI	Herfindahl–Hirschman Index (HHI)	+/-
Inflation	INF	Annual inflation rate	-
Unemployment	DESP	Annual unemployment rate	-
Covid-19 pandemic	COVID	A dummy variable that takes the value 1 for the pandemic period and 0 otherwise	-
Sovereign debt crisis	SOV	Dummy variable that takes the value 1 for the sovereign debt crisis period, and 0 otherwise	-
Control variables			
Size	SIZE	The logarithm of the book value of total assets	+/-
Economic growth	GDP	Real GDP growth, %	+

Unemployment affects purchasing power and credit repayment capacity, potentially increasing default risk. Higher unemployment is expected to affect profitability negatively (e.g., Chukwuogor et al., 2021; Jadah et al., 2020). This leads us to the following hypothesis:

H9: There is a negative relationship between unemployment and profitability.

Economic crises, such as the sovereign debt crisis (2010–2013) and the COVID-19 pandemic (2020–2021), have posed unprecedented challenges to the financial sector. Dummy variables for these periods capture their impact on profitability. For this reason, we have formulated the following hypothesis:

H10: The crisis negatively impacted banking profitability.

Following the literature review, Table 1 summarizes the variables used in the study, their calculation formula, and expected relationships.

4. Research design

4.1. Sample

The sample used in this study comprises 16 banking institutions that operated continuously in Portugal between 2009 and 2023. The selection was based on operational stability, allowing for the analysis of these institutions' resilience to successive shocks and structural reforms. Financial data were obtained from the Portuguese Banking Association (APB) and complemented with macroeconomic indicators from the Pordata database.

The chosen time frame aims to capture the effects of the sovereign debt crisis and the subsequent restructuring of the banking sector. The year 2009 marks the beginning of a new cycle, preceding the international intervention under the Economic and Financial Assistance Programme (2011–2014), thus enabling a comparison between the pre- and post-crisis phases. Portugal constitutes a distinctive analytical case within the European context due to (i) the severity of the financial crisis and the Troika's intervention, (ii) the deep restructuring of the banking sector through resolution processes, public recapitalizations, and mergers, and (iii) persistently high levels of non-performing loans, often exceeding those observed in other Western European economies. These factors justify a country-specific analysis.

The number of active banks in Portugal decreased significantly during the study period. According to the Bank of Portugal, 49 banks were operating in 2009, declining to 29 by 2023, reflecting high institutional turnover. The sample includes the main retail and investment banks operating in the country, ensuring systemic relevance and data consistency. Regarding potential survivorship bias, excluding institutions with short operational lifespans or incomplete data was a deliberate methodological choice aimed at reducing distortions, preserving data continuity, and ensuring the robustness of panel data econometric estimations.

4.2. Methodology

This chapter outlines the approach adopted to validate the research hypotheses, detailing the characteristics of the sample, its suitability for the study, and the empirical methodology employed to achieve the research objectives. The methodological process follows a standard approach used in similar studies involving panel data, as seen in works such as Cancela et al. (2020), García-Herrero et al. (2009), and Neves et al. (2020).

Among econometric methods, the generalized method of moments (GMM) is robust in models with dynamic dependence between explanatory variables and the dependent variable. Initially proposed by Hansen (1982) and adapted by Arellano and Bond (1991, 1995), GMM addresses endogeneity and unobserved heterogeneity issues using variable differences as instruments. Wintoki et al. (2012) further highlighted the advantages of the GMM system in managing dynamic effects, ensuring robust estimates even in smaller samples. The generic formula for the estimation model is as follows:

$$Y_{it} = \alpha + \beta_1 X_{it1} + \beta_2 X_{it2} + \cdots + \varepsilon_{it} \quad (1)$$

where i = 1,…, N, represents the cross-sectional dimension; t =1,…, T, represents the time dimension, and NxT denotes the number of observations. Xit represents the explanatory variables for individual iii during period ttt.

The proposed models are as follows:

$$ROA = \beta_0 + \beta_1 EFOP_{it} + \beta_2 RLIQ_{it} + \beta_3 MQ_{it} + \beta_4 AQ_{it} + \beta_5 NBA_{it} + \beta_6 NBF_{it} + \beta_7 CR_{it} + \beta_8 HHI_{it} + \beta_9 INF_{it} + \beta_{10} DESP_{it} + \beta_{11} COVID_{it} + \beta_{12} SOV_{it} + \beta_{13} SIZE_{it} + \beta_{14} GDP_{it} + \varepsilon_{it} \quad (2)$$

$$ROE = \beta_0 + \beta_1 EFOP_{it} + \beta_2 RLIQ_{it} + \beta_3 MQ_{it} + \beta_4 AQ_{it} + \beta_5 NBA_{it} + \beta_6 NBF_{it} + \beta_7 CR_{it} + \beta_8 HHI_{it} + \beta_9 INF_{it} + \beta_{10} DESP_{it} + \beta_{11} COVID_{it} + \beta_{12} SOV_{it} + \beta_{13} SIZE_{it} + \beta_{14} GDP_{it} + \varepsilon_{it} \quad (3)$$

Standard tests in the literature were conducted to ensure the adequacy and validation of the GMM models (e.g., Cancela et al., 2020; García-Herrero et al., 2009; Neves et al., 2020). These include the Hansen test for instrument validity, the Wald test for the joint significance of coefficients, and the autocorrelation tests (AR1 and AR2) to check for error term consistency. These tests guarantee the consistency and robustness of the obtained estimates.

4.3. Discussion results

The following descriptive statistics table provides an overview of the key characteristics of the analyzed data, including the mean, standard deviation, minimum, and maximum values, which are essential for understanding the distribution and variability of the variables under study.

Table 2 presents the descriptive statistics, allowing for an analysis of key financial indicators. Return on equity (ROE) and return on assets (ROA) exhibit low mean values (0.0039 and 0.0287, respectively), with negative minimum values indicating periods of financial losses. ROA shows significant dispersion (standard deviation of 0.036), reflecting substantial variations in asset performance.

Operating efficiency (EFOP) is 0.5946, indicating that operating costs represent a significant proportion of revenues. Its standard deviation (0.27) indicates variability between banks or overtime. Liquidity risk (RLIQ) has a mean of 1.7063 and a relatively high standard deviation (0.7373), suggesting significant bank liquidity management differences. Asset quality (AQ) and management quality (MQ) have moderate means (0.4903 and 0.0318, respectively). AQ shows a higher dispersion (SD = 0.23), which may indicate differences in asset quality between institutions. The variable representing the number of branches closed (NBF) has a mean of 15 and a maximum of 120, with a high standard deviation (25), suggesting periods of intense restructuring within the sector.

Table 2. Descriptive statistics.

Variables	Mean	Median	Minimum	Maximum	Standard deviation
ROE	0.0039	0.0031	−0.0322	0.0564	0.0100
ROA	0.0287	0.0474	−2.9815	1.2525	0.0360
EFOP	0.5946	0.5673	0.1103	2.4929	0.2700
RLIQ	1.7063	0.8462	0.0132	4.965	0.7373
MQ	0.0318	0.0223	0.0066	0.2405	0.0300
AQ	0.4903	0.5477	0.0103	0.9671	0.2300
NBA	4	0	0	93	22
NBF	15	0	0	120	25
CR	0.5100	0.5298	0	17.9058	0.9063
HHI	0.1522	0.1425	0.1142	0.1708	0.0095
INF	0.0142	0.0100	-0.0080	0.0780	0.0208
DESP	0.1062	0.0940	0.0610	0.1710	0.0365
COVID	0.1455	0	0	1	0.3500
SOV	0.2639	0	0	1	0.4034
SIZE	6.8500	6.8900	5.3800	8.0600	0.7820
GDP	0.0067	0.0177	−0.0830	0.0683	0.0389

Market concentration (HHI) remains relatively stable, with a low standard deviation (0.0095), indicating minimal changes in the competitive structure of the Portuguese banking sector over the period analyzed. This stability is understandable, given the sample selection. Bank size has a mean of 6.85 and a standard deviation of 0.782, indicating some heterogeneity in the size of institutions.

The results of the GMM model estimations are presented in Table 3. Analysis of Table 3 reveals that, consistent with H1 and in line with the studies of Heitmann et al. (2023) and Jigger and Koroleva (2023), the cost-to-income ratio exhibits a highly significant negative effect in both models, with a 1% significance level. This result validates the first hypothesis of the research (H1), as the ratio increases with the rise in operational expenses, thereby reducing efficiency and, consequently, profit margins of the institutions. Furthermore, the impact of operational efficiency: a one percentage point increase in the proportion of operating costs to revenue has a negative impact on banking profitability, with a decrease of 0.416398 percentage points in return on assets (ROA) and 0.0267710 in return on equity (ROE).

This finding indicates that greater efficiency is directly linked to higher banking profitability. It suggests that more efficient banks are more profitable for investors, making the efficiency ratio a critical criterion in investment decision-making. For managers, it underscores the need to reduce operational costs, invest in technology, and optimize internal processes to maximize profitability. For policymakers, it highlights the importance of promoting the modernization of the banking sector, reducing regulatory barriers that increase costs, and fostering digitalization. Furthermore, it may justify monitoring less efficient banks, as they may be more vulnerable to financial crises. Thus, operational efficiency plays a crucial role in the sustainability and competitiveness of the banking sector.

Table 3. Estimation results.

Variables	Model 1: ROA coefficient	Model 2: ROE coefficient
L1.	0.0732140	0.0127568
EFOP	−0.416398***	−0.0267710***
RLIQ	−0.00133884	1.78780e-06
MQ	0.868885***	0.116079***
AQ	0.408132***	0.00370584***
NBA	−0.000839826	2.91054e-05
NBF	0.00384235***	5.87258e-05**
CR	-0.0359***	-0.0274***
HHI	0.1024501	2.98574e-05*
INF	0.00666021	−5.50354e-05
DESEP	−0.0114099**	−0.000205963*
COVID	−0.000132	−0.0094012
SOV	−0.105490***	−0.49077***
SIZE	−0.549077***	−0.0129219***
GDP	−0.000990152	0.000167595
Constant	3.97903***	0.105489***
WALD	135.23***	35.49***
Ar (1)	−0.99***	−2.15***
Ar (2)	0.11	0.17
Hansen	15.67	14.78

Note: *, **, *** represent significance levels at 10%, 5%, and 1%, respectively.

For investors, analyzing operational efficiency and asset management can provide crucial insights for selecting banks that yield higher risk-adjusted returns. The negative effect of credit risk on profitability suggests that investors should focus on the quality of the credit portfolio as an indicator of sustainable long-term returns. For regulators, liquidity and credit risk are key indicators for prudential supervision. The relationship between the non-performing loan (NPL) ratio and profitability reinforces the need for stricter regulatory policies concerning risk management and the solvency of banks. Additionally, analyzing market concentration and its positive relationship with profitability may suggest that regulators should balance concerns regarding market concentration with the need to maintain competitiveness. For academics, this analysis contributes to the literature on the impact of banking risks and asset and liability management strategies. These findings can serve as a foundation for future research on the effects of digitalization on banking business models and the management of efficiency in more competitive financial markets.

Despite showing a positive effect on ROE and a negative effect on ROA, liquidity is not statistically significant in either model, meaning that H2 is not validated. Several factors may explain this lack of significance in the Portuguese context between 2013 and 2023. First, the prolonged period of low interest rates following the sovereign debt crisis and the Troika program may have reduced the immediate impact of liquidity on profitability, as banks could rely on alternative funding sources, such as external borrowing or ECB liquidity facilities. Second, implementing Basel III standards led to significant restructuring in Portuguese banks, enhancing their liquidity positions and capital buffers, which reduced liquidity constraints on profitability. Lastly, the digital transformation of the banking sector, including

the rise of online and mobile banking, may have allowed banks to operate with more efficient cost structures, reducing reliance on traditional liquidity measures. These factors suggest that, while liquidity is important for banking stability, its direct influence on profitability in Portugal between 2013 and 2023 was less pronounced compared to other macroeconomic and sector-specific factors.

Consistent with H3, asset management is a significantly positive determinant in both Model 1 and Model 2, with a 1% significance level. This result validates the studies of Al-Matari (2023), Khan (2022a), and Hossain and Ahamed (2021), as well as the third hypothesis of the research (H3), indicating that efficient management optimizes the use of a bank's assets, thereby increasing profitability. Regarding asset quality, it shows a positive and statistically significant coefficient in both models, validating Hypothesis 4 (H4) and highlighting that good asset quality positively influences banking profitability, corroborating the findings of Al-Matari (2023). Strengthening the implementation of strategies and policies that promote sound practices in the sector, such as the efficient allocation of resources, including the optimization of the loan portfolio, the improvement of the capital structure, and the enhancement of risk management, is relevant to improving profitability. Creating policies that promote transparency, supervision, and the adoption of best practices can strengthen financial stability and improve the overall efficiency of the banking system. A bank that manages its assets effectively has more significant potential to generate sustainable returns and minimize financial risks.

The impact of opening and closing bank branches (NBA and NBF) on profitability was not statistically significant for new openings, thus not confirming hypothesis H5A. However, branch closures impacted bank profitability, confirming hypothesis H5B significantly. These results suggest that branch closures can be an effective strategy for optimizing operating costs in digital transformation. The positive relationship between branch closures and bank profitability suggests that reducing the physical network can lead to efficiency gains and increased profitability, reflecting the increasing digitalization of financial services. For managers, this finding underscores the importance of reducing operating costs, increasing digitalization, and optimizing customer experience while ensuring that the transition to more technological models does not undermine service quality. For policymakers and regulators, it highlights the need for policies that ensure financial inclusion, especially in areas where branch closures could limit access to banking services, and the need for stricter supervision regarding cybersecurity and competition in the sector. In short, this phenomenon shows that transitioning to a more digital banking model must balance operational efficiency, technological innovation, and social responsibility.

The analysis reveals key insights for investors, managers, and policymakers. For investors, efficient asset management is a crucial factor in increasing profitability, making banks with strong asset management practices more attractive for sustainable returns. Managers should focus on optimizing asset allocation, improving loan portfolios, and embracing digital transformation to reduce operational costs, particularly by closing unprofitable branches, which has positively impacted profitability. Policymakers should ensure that regulatory frameworks support sound asset management, transparency, and financial inclusion, especially in areas affected by branch closures. Additionally, they must focus on cybersecurity and fair competition. In summary, the study highlights the importance of asset management, digitalization, and operational efficiency in boosting profitability while advocating for a balanced approach that promotes both innovation and social responsibility in the banking sector.

Credit risk (CR) has a negative and significant coefficient, confirming hypothesis H6. The empirical evidence shows that an increase in the non-performing loan ratio reduces bank profitability, consistent with the studies of Alexiou and Sofoklis (2009) and Owoputi (2014). This finding

underscores the importance of prudent credit risk management to ensure the financial stability of banking institutions.

For investors, an increase in credit risk signals a higher probability of default, underscoring the need for a thorough assessment of the loan portfolio's quality when evaluating the potential returns and associated risks of a bank. Banks with efficient credit risk management should be prioritized. For managers, the findings highlight the importance of rigorous credit risk management, emphasizing careful evaluation, ongoing monitoring, and maintaining a balance between lending and portfolio quality. Policymakers are urged to establish prudent regulations that promote responsible lending practices and robust risk management, thereby supporting financial stability.

The analysis also indicates that economic instability, such as the sovereign debt crisis and the global pandemic, intensified credit risk. During these periods, many businesses and households faced financial strain, requiring higher provisions for loan losses, which negatively affected profitability. The moral hazard theory suggests that banks may adopt riskier lending practices during crises, anticipating government intervention, which can temporarily increase profits but ultimately jeopardize long-term financial stability if risks are not properly controlled.

Regarding market concentration (HHI), the results show a positive impact on profitability but only a statistically significant impact on ROE, partially confirming H7. This suggests that for the Portuguese market, greater concentration is beneficial for shareholders' profitability, which may justify merger and acquisition strategies to increase market share. However, it is important to monitor the impact of this concentration on competitiveness and operating costs, as there is less competition and, therefore, higher profit margins.

Inflation was not statistically significant for banking profitability in Portugal during the period under analysis. Between 2009 and 2021, inflation rates fluctuated between −0.84% and 2.77%, remaining relatively low even amidst the financial crisis and the adjustment program imposed by the Troika (2011–2014). In 2022, inflation surged to 7.83%, driven by external shocks, notably the economic disruption caused by the COVID-19 pandemic and the effects of the war in Ukraine. However, by this time, the Portuguese banking sector had undergone significant restructuring, implemented the Basel III regulatory framework, and adjusted its operational strategies. Specifically, banks applied high lending interest rates while maintaining deposit remuneration close to 0%. Consequently, their ability to adapt business models mitigated the impact of inflation on banking profitability.

The unemployment rate is a crucial indicator for studying the subject, as it reflects the economic health of individuals and may affect defaults and credit risk. This variable is significant for both models, validating Hypothesis 9 (H9), as shown in studies by Chukwuogor et al. (2021), Jadah et al. (2020), and Molyneux and Thornton (1992). A negative relationship between the unemployment rate and bank profitability indicates that as unemployment rises, bank profitability tends to fall, mainly due to the increased risk of default and pressure on borrowers' ability to pay. It underlines the need for prudent credit risk management and the adoption of strategies to diversify income and protect the loan portfolio. It stresses the importance of policies that promote the reduction of unemployment and economic stability to ensure that the banking sector remains resilient in times of crisis.

The pandemic crisis was not significant for the profitability of Portuguese banks, whereas the sovereign debt crisis (2010–2013) had a negative impact on banking profitability in Portugal. Portuguese banks faced increased financing costs, reduced credit supply, and higher credit risk due to their exposure to sovereign debt. This directly affected businesses, especially small ones, which faced

difficulties accessing credit. The crisis reduced bank profitability, resulting in slower economic growth, fewer jobs, and reduced investment in key sectors (e.g., Chukwuogor et al., 2021; Kiy & Zick, 2020).

The analysis of the control variables revealed that bank size (SIZE) has a negative and significant impact on profitability, suggesting that larger banking institutions face additional structural challenges, possibly due to more stringent regulations and higher operational costs. GDP growth did not show statistical significance, suggesting that macroeconomic fluctuations did not directly impact bank profitability during the analyzed period. This lack of significance can be explained by the presence of economic crises, legal changes, and internal restructuring within banks, which reduced the demand for credit. Between 2009 and 2013, a recession was observed, followed by economic growth between 2014 and 2019; however, the return to crisis conditions after this period limited the demand for credit, which could have otherwise increased banks' revenues and profitability.

The findings of this analysis offer relevant implications for bank managers, investors, and policymakers. For managers, the positive association between market concentration (as measured by the Herfindahl–Hirschman Index) and return on equity (ROE) suggests that growth strategies through mergers and acquisitions may enhance shareholder value. However, it is essential to balance these potential gains with the risks associated with reduced competition, particularly regarding operational efficiency, innovation, and regulatory oversight. The significant negative relationship between the unemployment rate and bank profitability underscores the importance of prudent credit risk management and revenue diversification, especially in adverse economic conditions.

From an investor's perspective, the superior profitability of institutions operating in more concentrated markets and the sector's resilience to inflation during periods of crisis highlight the adaptability of Portuguese banks. This robustness may signal institutional strength and stability in returns, even amid macroeconomic uncertainty. For policymakers, the negative impact of unemployment on bank profitability emphasizes the importance of policies that foster employment and ensure macroeconomic stability to support financial system soundness. While market concentration appears beneficial for profitability, its potential implications for competition and credit accessibility require close monitoring. Finally, the lack of statistical significance of inflation and GDP growth suggests that, within the Portuguese context, structural and sector-specific factors may be more decisive in shaping bank profitability, reinforcing the need for targeted regulatory and sectoral policies.

5. Conclusions

This research analyzed the determinants of banking profitability in Portugal between 2009 and 2023, a period characterized by economic crises and regulatory transformations in the financial sector. The empirical analysis, based on the generalized method of moments (GMM), allowed the identification of internal and external factors influencing banking performance, providing relevant implications for investors, managers, and policymakers.

The results for the period and market under study demonstrate that operational efficiency has a significant negative impact on profitability (H1), confirming that cost reduction and modernization of internal processes are crucial to ensuring the sector's competitiveness (e.g., Dietrich & Wanzenried, 2011; Heitmann et al., 2023). For banking managers, this evidence reinforces the need to implement strategies focused on digitalization, process automation, and optimization of organizational structure. For investors, institutions with lower cost-efficiency ratios exhibit reduced profit erosion risk, making

them more attractive options. For policymakers, this result suggests that regulation should encourage banking modernization without imposing excessive administrative costs.

The negative effect of unemployment on banking profitability (H9) highlights the importance of economic policies that promote employment and financial stability, as high unemployment levels increase default risk (Chukwuogor et al., 2021; Jadah et al., 2020). This evidence emphasizes the need for measures encouraging economic growth and access to credit, indicating the importance of diversifying income sources and strengthening responsible credit policies.

Asset quality emerged as a positive factor for profitability (H4), consistent with Al-Matari (2023), demonstrating that prudent loan portfolio management is essential for the sector's solidity. For banking managers, this result reinforces the need for advanced risk assessment models, which may include artificial intelligence and machine learning, to predict defaults. It also provides insights to investors, as banks with higher-quality assets show lower volatility and greater return predictability.

Reducing the number of branches proved favorable to banking profitability (H5B), validating the trend observed in Gržeta et al. (2023). This result initially reflects that in Portugal, the number of branches did not align with the population trend and the increasing impact of digitalization and fintech, reducing the need for physical infrastructures to provide banking services. For managers, this means that investment in digitalization and online customer experience should be prioritized. For investors, institutions that efficiently adjust their physical structure to the new digital paradigm tend to exhibit higher operational efficiency and more sustainable returns. For policymakers, this trend raises financial inclusion challenges, particularly in rural areas, requiring strategies to ensure universal access to banking services.

Regarding liquidity, the results did not show a statistically significant relationship with banking profitability (H2), consistent with studies such as those by Belcaid and Al-Faryan (2023). This suggests that excessive liquidity accumulation in a low-interest-rate environment may not be an effective strategy to boost profitability. This result underscores the need for efficient resource allocation to maximize returns for banking managers.

Market concentration (H7) was found to be statistically significant only for ROE, suggesting that mergers and acquisitions may benefit shareholders but do not always lead to operational efficiency gains, corroborating the conclusion of Le and Ngo (2020). For investors, this implies that sector consolidation can generate short-term value but should be accompanied by solid management strategies. Monitoring competition in the banking sector is essential for policymakers to avoid adverse consumer effects.

The negative impact of the sovereign debt crisis (H10) was confirmed, reinforcing the vulnerability of the Portuguese banking sector to external shocks (Kiy & Zick, 2020). This result suggests that banking resilience should be strengthened through revenue diversification, appropriate capital ratios, and improved risk management practices. For policymakers, adopting preventive measures to protect the banking sector from future crises is essential; ensuring compliance with Basel III standards does not undermine banks' ability to finance the economy.

Interestingly, the COVID-19 pandemic did not significantly impact banking profitability, suggesting that government and European Central Bank support measures mitigated its effects on the sector. This result highlights the importance of contingency policies and crisis management plans.

Although this study has provided relevant contributions to understanding banking profitability in Portugal, some gaps remain. The analysis was based on a sample of 16 banks, which may not capture all of the sector's specificities, particularly those of smaller institutions and emerging fintechs.

Moreover, digitalization and the integration of artificial intelligence in banking management were not directly addressed, representing a promising area for future research. Future studies are encouraged to explore, among other things, the impact of technological innovation on banking profitability, assessing the role of artificial intelligence, blockchain, and open banking in the efficiency of financial institutions, and the inclusion of ESG metrics in banking profitability analysis, given the growing importance of sustainability for investors and regulators.

Author contributions

Author 1 was responsible for the methodology's conceptualization, data analysis, research, and validation. Additionally, Author 1 made significant contributions to the formal writing of the study. Author 2, in turn, focused on the critical literature review, enhancing theoretical analysis, and contributed to the formal writing, ensuring clarity and coherence in the text. Both authors worked collaboratively, validating the results and ensuring the consistency and robustness of the conclusions.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in creating this article.

Conflict of interest

All authors declare no conflicts of interest in this paper.

References

Abdelaziz H, Rim B, Helmi H (2020) The Interactional Relationships Between Credit Risk, Liquidity Risk and Bank Profitability in MENA Region. *Global Bus R* 23: 561–583. https://doi.org/10.1177/0972150919879304

Acharya V, Drechsler I, Schnabl P (2014) A pyrrhic victory? Bank bailouts and sovereign credit risk. *J Financ* 69: 2689–2739. https://doi.org/10.1111/jofi.12206

Agnese P, Cerciello M, Oriani R, et al. (2024) ESG controversies and profitability in the European banking sector. *Financ Res Lett* 61: 105042. https://doi.org/10.1016/j.frl.2024.105042

Alexiou C, Sofoklis V (2009) Determinants of bank profitability: Evidence from the green banking sector. *Econ Annals* 54: 93–118. https://doi.org/10.2298/EKA0982093A

Al-Homaidi E, Tabash M, Farhan N, et al. (2018) Bank-specific and macro-economic determinants of profitability of Indian commercial banks: A panel data approach. *Cogent Econ Financ* 6: 1548072. https://doi.org/10.1080/23322039.2018.1548072

Al-Matari E (2023) The determinants of bank profitability of GCC: The role of bank liquidity as moderating variable—Further analysis. *Int J Financ Econ* 28: 1423–1435. https://doi.org/10.1002/ijfe.2485

Almeida L (2020) Technical indicators for rational investing in the technology companies: The evidence of n stocks. *J Pengurusan* 59: 75–87. http://doi.org/10.17576/pengurusan-2020-59-08

Alshubiri F (2022) The financial competition, concentration and structure of financial performance nexus in the financial sector of Oman. *Econ Chang Restruct* 55: 681–714. https://doi.org/10.1007/s10644-021-09326-8

Antony T (2023) Determinants of liquidity risk: Empirical evidence from Indian commercial banks. *Banks Bank Syst* 18: 101–111. https://doi.org/10.21511/bbs.18(3).2023.09

Arellano M, Bond S (1991) Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Rev Econ Stud* 58: 277–297. https://doi.org/10.2307/2297968

Arellano M, Bover O (1995) Another look at the instrumental variable estimation of error-components models. *J Econometrics* 68: 29–51. https://doi.org/10.1016/0304-4076(94)01642-D

Argimon I, Danton J, de Haa J, et al. (2023) Low interest rates and banks' interest margins: Does belonging to a banking group matter? *J Bank Financ* 154: 106966. https://doi.org/10.1016/j.jbankfin.2023.106966

Athanasoglou P, Brissimis S, Matthaios D (2008) Bank-specific, industry-specific and macroeconomic determinants of bank profitability. *J Int Financ Mark Institution Money* 18: 121–36. https://doi.org/10.1016/j.intfin.2006.07.001

Athari S, Bahreini M (2023) The impact of external governance and regulatory settings on the profitability of Islamic banks: Evidence from Arab markets. *Int J Financ Econ* 28: 2124–2147. https://doi.org/10.1002/ijfe.2529

Basílio S, Pires M, Borralho C (2021) Determinants of Portuguese banks' profitability: an update. *Tourism Manage Stud* 17: 63–70. https://doi.org/10.18089/tms.2021.170305

Belcaid K, Al-Faryan M (2023) Determinants of Bank Profitability in the Context of Financial Liberalization: Evidence from Morocco. *Bus Perspect Res* 12*:* 164–180. https://doi.org/10.1177/22785337221148872

Ben Bouheni F, Sidaoui M, Leshchinskii D, et al. (2024) Banking-as-a-service? American and European G-SIBs performance. *J Risk Financ* 25: 840–869. https://doi: 10.1108/JRF-10-2023-0263

Boitan I, Marchewka B (2021) The Sovereign-Bank Nexus in the Face of the COVID-19 Pandemic Outbreak Evidence from EU Member States. *J Risks* 9: 77–98. https://doi.org/10.3390/RISKS9050098

Bourke P (1989) Concentration and Other Determinants of Bank Profitability in Europe, North America and Australia. *J Bank Financ* 13: 65–79. https://doi.org/10.1016/0378-4266(89)90020-4

Cancela B, Neves M, Rodrigues L, et al. (2020) The influence of corporate governance on corporate sustainability: new evidence using panel data in the Iberian macroeconomic environment. *Int J Account Inf Manage* 28: 85–806. https://doi.org/10.1108/IJAIM-05-2020-0068

Chhaidar A, Abdelhedi M, Abdelkafi I (2023) The Effect of Financial Technology Investment Level on European Banks' Profitability. *J Knowledge Economy* 14: 2959–2981. https://doi.org/10.1007/s13132-022-00992-1

Chukwuogor C, Anoruo E, Ndu I (2021) An empirical analysis of the U.S. banks' profitability determinants. *Banks Bank Syst* 16: 209–217. https://doi.org/10.21511/bbs.16(4)2021.17

Claessens S, Coleman N, Donnelly M (2017) Low-For-Long" interest rates and banks' interest margins and profitability: Cross-country evidence. *J Financ Intermed* 35: 1–16. https://doi.org/10.1016/J.JFI.2017.05.004

Demirgüç-Kunt, A, Pedraza A, Ruiz O (2021) Banking sector performance during the COVID-19 crisis. *J Bank Financ* 133: 106305–106305. https://doi.org/10.1016/j.jbankfin.2021.106305

Dermine J, Carvalho C (2008) Bank loan-loss provisioning, central bank rules vs. estimation: The case of Portugal. *J Financ Stability* 4: 1–22. https://doi.org/10.1016/j.jfs.2007.12.001

Dietrich A, Wanzenried G (2011) Determinants of bank profitability before and during the crisis: Evidence from Switzerland. *J Int Financ Mark Institutions Money* 21: 307–327. https://doi.org/10.1016/j.intfin.2010.11.002

Djalilov K, Jenefer P (2016) Determinants of bank profitability in transition countries: What matters most? *R Int Bus Financ* 38: 69–82. https://doi.org/10.1016/j.ribaf.2016.03.015

Figlewsk S, Frydman H, Liang W (2012) Modeling the effect of macroeconomic factors on corporate default and credit rating transitions. *Int Rev Econ Financ* 21: 87–105. https://doi.org/10.1016/j.iref.2011.05.004

Flamini V, McDonald CA, Schumacher L (2009) The determinants of commercial bank profitability in Sub-Saharan Africa (IMF Working Paper No. 09/15). International Monetary Fund. https://doi.org/10.5089/9781451871623.001

Garcia MTM, Guerreiro JPSM (2016) Internal and external determinants of banks' profitability: The Portuguese case. *J Econ Stud* 43: 90–107. https://doi.org/10.1108/JES-09-2014-0166

García-Herrero A, Gavilá S, Santabárbara D (2009) What explains the low profitability of Chinese banks?. *J Bank Financ* 33: 2080–2092. https://doi.org/10.1016/j.jbankfin.2009.05.005

Gržeta I, Žiković S, Tomas Ž (2023) Size matters: analyzing bank profitability and efficiency under the Basel III framework. *Financ Innovation* 9: 43. https://doi.org/10.1186/s40854-022-00412-y

Hansen LP (1982) Large sample properties of generalized method of moments estimators. *Econometrica J Econometric Society* 50: 1029–1054. https://doi.org/10.2307/1912775

Heitmann D, Chowdhury M, Islam M (2023) Heterogeneous impact of Covid-19 on the US banking sector. *N Am J Econ Financ* 68: 101990. https://doi.org/10.1016/j.najef.2023.101990

Hossain S, Ahamed F (2021) Comprehensive Analysis on Determinants of Bank Profitability in Bangladesh. *Central Bank of Bangladesh*. Available from: https://www.bb.org.bd/fnansys/bankfi.php.

Huong T, Nga T, Oanh T (2021) Liquidity risk and bank performance in Southeast Asian countries: a dynamic panel approach. *Quant Financ Econ* 5: 111–133. https://doi:10.3934/QFE.2021006

Iqbal N, Kryeziu N, Abonazel M, Harymawan I, et al. (2022) Profitability determining factors of banking sector: Panel data analysis of commercial banks in South Asian countries. *Front Psychol* 13. https://doi.org/10.3389/fpsyg.2022.1000412

Jacobs Jr M, Sensenbrenner F (2018) A comparison of methodologies in the stress testing of credit risk–alternative scenario and dependency constructs. *Quant Financ Econ* 2: 294–324. https://doi:10.3934/QFE.2018.2.294

Jadah H, Alghanimi M, Al-Dahaan N, et al. (2020) Internal and external determinants of Iraqi bank profitability. *Banks Bank Syst* 15: 79–93. https://doi.org/10.21511/bbs.15(2)2020.08

Jigeer S, Koroleva E (2023) The Determinants of Profitability in the City Commercial Banks: Case of China. *Risks* 11: 53. https://doi.org/10.3390/risks11030053

Kasana E, Chauhan K, Sahoo B (2023) Policy Interest Rate and Bank Profitability-Scheduled Commercial Banks in India. *Financ Theory Pract* 27: 138–149. https://doi.org/10.26794/2587-5671-2023-27-1-138-149

Katusiime L (2021) COVID 19 and bank profitability in low income countries: the case of Uganda. *J Risk Financ Manage* 14: 588. https://doi.org/10.3390/jrfm14120588

Khan S (2022a) Determinants of Banks Profitability: An Evidence from GCC Countries. *J Central Bank Theory Pract* 11: 99–116. https://doi.org/10.2478/jcbtp-2022-0025

Khan S (2022b) Determinants of operational efficiency: the case of Saudi Banks. *Financ Int Q* 18*:* 11–20. https://doi.org/10.2478/fiqf-2022-0016

Kiy F, Zick T (2020) Effects of declining bank health on borrowers' earnings quality: evidence from the European sovereign debt crisis. *J Bus Econ* 90: 615–673. https://doi.org/10.1007/s11573-020-00968-0

Klein P, Weill L (2022) Bank profitability and economic growth. *Q Rev Econ Financ* 84: 183–199. https://doi.org/10.1016/j.qref.2022.01.009

Kohlscheen E, Lombardi M, Zakrajšek E (2021) Income inequality and the depth of economic downturns. *Econ Lett* 205: 109934. https://doi.org/10.1016/j.econlet.2021.109934

Korytowski M (2018) Banks' profitability determinants in post-crisis European Union. *Int J Financ Bank Stud* 7: 2147–4486. https://doi.org/10.20525/ijfbs.v7i1.847

Kumar V, Thrikawala S, Acharya S (2022) Financial inclusion and bank profitability: Evidence from a developed market. *Global Financ J* 53: 100609. https://doi.org/10.1016/j.gfj.2021.100609

Le T, Ngo T (2020) The determinants of bank profitability: A cross-country analysis. *Central Bank Rev* 20: 65–73. https://doi.org/10.1016/j.cbrev.2020.04.001

Menicucci E, Paolucci G (2016) The determinants of bank profitability: empirical evidence from European banking sector. *J Financ Report Account* 14: 86–115. https://doi.org/10.1108/JFRA-05-2015-0060

Mirović V, Kalaš B, Milenković N, et al. (2024) Modelling Profitability Determinants in the Banking Sector: The Case of the Eurozone. *Mathematics* 12: 897. https://doi.org/10.3390/math12060897

Mkaro G, Lau L, Choong C (2023) The determinants of banking sector performance in Tanzania: A pre-post Treasury Single Account analysis. *Cogent Econ Financ* 11: 2282812. https://doi.org/10.1080/23322039.2023.2282812

Molyneux P, Pancotto L, Reghezza A, et al. (2022) Interest rate risk and monetary policy normalisation in the euro area. *J Int Money Financ* 124: 102624. https://doi.org/10.1016/j.jimonfin.2022.102624

Molyneux P, Thornton J (1992) Determinants of European bank profitability: A note. *J Bank Financ* 16: 1173–1178. https://doi.org/10.1016/0378-4266(92)90065-8

Naceur SB, Omran M (2011) The effects of bank regulations, competition, and financial reforms on banks' performance. *Emerg Mark Rev* 12: 1–20. https://doi.org/10.1016/j.ememar.2010.08.002

Neves M, Proença C, Dias A (2020) Bank profitability and efficiency in Portugal and Spain: A non-linearity approach. *J Risk Financ Manage* 13: 284. https://doi.org/10.3390/jrfm13110284

Nguyen T (2018) Diversification and bank efficiency in six ASEAN countries. *Global Financ J* 37: 57–78. https://doi.org/10.1016/j.gfj.2018.04.004

Oleiwi A, Ali M, Jassim S, et al. (2019) The relationship between credit risk management practices and profitability in malaysian commercial banks. *Int J Eng Advanced Technol* 8: 53–59. https://doi.org/10.35940/ijeat.e1007.0585c19

Owoputi JA, Olawale FK, Adeyefa FA (2014) Bank specific, industry specific and macroeconomic determinants of bank profitability in Nigeria. *Eur Sci J* 10.

Qehaja-Keka V, Ahmeti S, Aliu M (2023) Bank profitability determinants: Evidence from Kosovo and Albania. *J Liberty Int Affairs* 9: 297–311. https://doi.org/10.47305/JLIA2392370qk

Safitri N, Wiksuana I, Candraningrat, I, et al. (2023) The influence of market power and revenue diversification on the profitability and stability of Indonesian banking during the COVID-19 pandemic. *Uncertain Supply Chain Manage* 11: 1495–1506. https://doi.org/10.5267/j.uscm.2023.7.019

Saleh B, Paz V (2023) Credit risk management and profitability: Evidence from Palestinian banks. *Banks Bank Syst* 18: 25–34. https://doi.org/10.21511/bbs.18(3).2023.03

Short B (1979) The relation between commercial bank profit rates and banking concentration in Canada, Western Europe, and Japan. *J Bank Financ* 3: 209–219. https://doi.org/10.1016/0378-4266(79)90016-5

Thinh T, Thuy L, Tuan D (2022) The impact of liquidity on profitability – evidence of Vietnamese listed commercial banks. *Banks Bank Syst* 17: 94–103 https://doi.org/10.21511/bbs.17(1)2022.08

Wintoki MB, Linck JS, Netter JM (2012) Endogeneity and the dynamics of internal corporate governance. *J Financ Econ* 105: 581–606. https://doi.org/10.1016/j.jfineco.2012.03.005

Xu J, Haris M, Irfan M (2023) Assessing intellectual capital performance of banks during COVID-19: Evidence from China and Pakistan. *Quant Financ Econ* 7*:* 356–370. https://doi.org/10.3934/QFE.2023017

Yakubu I, Bunyaminu A (2022) Bank profitability in Sub-Saharan Africa: does economic globalization matter? *J Econ Admin Sci* 40: 673–683. https://doi.org/10.1108/jeas-08-2021-0158

Youngkyung O, Kim J, Park Y (2019) The effect of housing prices on bank performance in Korea. *Sustainability* 11: 6242. https://doi.org/10.3390/su11226242