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Do rising interest rates matter for bank profitability? Evidence from Portuguese banks

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Abstract. The purpose of this paper is to analyse the profitability determinants of seventeen banks operating in Portugal from 2013 to 2023. The banking market has changed significantly, particularly since 2021, when Euribor grew rapidly to control inflation target. Methodologically, a hypothetical-deductive approach was used based on panel data collected from banks' published accounts. To generate results, grouped ordinary least squares were applied, as the Breusch-Pagan test confirms homoscedasticity, an essential assumption in this regression model. Internal variables considered include credit quality, capital adequacy, management quality, financial margin, and bank size, alongside an external variable, the Euribor. The findings reveal that credit risk, capital adequacy, management capacity, and Euribor are the most statistically significant for both return on equity and return on assets, with Euribor emerging as the greatest statistically significant variable. The analysis of Euribor as an explanatory variable represents the key contribution of this study relative to the existing and reviewed literature.

Keywords: banks; profitability; Euribor
JEL classification: G01 ; G21 ; G28

1. Introduction

Studies around bank profitability have received a lot of attention from researchers. From the financial crisis that began in 2007 in the United States to subprime loans (triggered by the granting of high-risk mortgage loans to low-income families), the pandemic, and recent wars, Portuguese banking has shown that it is not indifferent to the risk factors that have affected national banking at various levels, particularly in terms of profitability. For example, it is very present in the insolvency of BPN, BANIF, and BPP Banks. The BES Bank in 2014 had major state intervention so that the consequences of its collapse would not translate into a disaster for the Portuguese economy.

In this sense, banking supervision has become much more demanding, in compliance with more rigorous and robust ratios in terms of capital adequacy, liquidity, credit quality and market discipline; hence the importance of constant improvements and requirements imposed by the Basel Accords (BCBS, 2013; BCBS, 2014; BCBS, 2017).

According to the European Central Bank (BCE), 2021 was the turning point in the monetary policy that followed over the last decade (European Central Bank, 2024). A period of negative interest rates has ended. In this regard, during the second half of 2023, the BCE increased Euribor (EUR) by a total of 250 basis points. The EUR increase occurred following rapid growth in inflation. In the eurozone, inflation rose to 8.4% on average in 2022, compared to 2.6% in 2021.

According to the BCE, the growth in inflation was due to two types of shock. On the supply side, there was a significant increase in the costs of production factors in all sectors of the economy. This increase in the costs of production factors was the result of import problems resulting from COVID-19 and the energy crisis resulting from the Russia-Ukraine war. On the demand side, the reopening of the economy after the pandemic allowed companies to reflect increased costs in prices more quickly and sharply.

The evolution of inflation, with projections above the 2% objective in the medium term, led the BCE to increase EUR considerably and at a constant pace as a way of dampening demand and ensuring that inflation remained under control. From this perspective, we analyse the impact of the increase in EUR on the profitability of 17 banks operating in Portugal in the period between 2013 and 2023. This sample represents about 98% of the Portuguese banking product (Appendix I).

This paper is structured as follows. Section 2 presents a brief literature review. The methodology, econometric approach, and data used are detailed in section 3. Section 4 presents the results and discussions, and section 5 provides the main conclusions.

2. Literature review

There is a lot of research in this area, and it is quite diverse. There are researchers interested in this topic on all continents. In this sense, given the difference in legislation, supervisory rules, and cultural aspects, it is not always easy to carry out a comparative analysis of the results obtained. Table 1 presents the main authors of papers where it was possible to obtain information and compare it with the results of our investigation.

Table 1. Fundamental literature review: data, variables, and main conclusions.

		Variables		
Authors	**Data**	**Dependent**	**Independent**	**Conclusions**
(Carvalho & Ribeiro, 2016)	29 banks in Portugal between 2002 and 2012.	ROA.	Capital adequacy; non-performing assets and credit risk.	The capital adequacy, non-performing assets and credit risk are statistically significative in profitability, measured by ROA.
Haddad et al. (2019)	12 banks in Jordan between 2009 and 2019.	ROA; ROE and NIM.	Assets size; capital adequacy; assets quality; liquidity; deposit; economic activity; inflation; interest rate.	The results show that capital adequacy, asset quality, liquidity, deposit, net interest margin, and asset size are important factors that affect the profitability of the banking industry in Jordan.
(Mota et al., 2019)	12 banks in Portugal in the period 2006-2016.	ROA; ROE and NIM.	Sector concentration; Cost-income; Liquidity risk; Deposit growth;	Credit risk, cost-income, financial leverage and deposit growth stand out as the internal determinants of banks that best explain profitability.

		Variables		
Authors	**Data**	**Dependent**	**Independent**	**Conclusions**
			financial leverage and GDP.	
(Neves et al., 2020)	66 Portuguese and Spanish banks were analysed.	ROA and ROE.	Size; GDP; Cost-income; Bank capitalization and Annual Deposit Growth.	The result shows a positive and negative non-linear relationship between bank size and their levels of profitability, measured by ROA and ROE.
Nunes (2021)	40 Portuguese banks from the first quarter of 2010 to the last quarter of 2019.	ROE and ROA.	Capital adequacy; loan loss provisions; bank size; cost-income; loans; deposit ratio; GDP and Euribor.	The findings support the notion that banks with enough capitalization outperform those with insufficient capitalization. The size significantly reduces the profitability of Portuguese banks when measured by ROA and ROE. Loan loss provisions reduced the Portuguese banks' profitability.
Yuan et al. (2022)	20 banks in Bangladesh and 20 banks in India from 2010 to 2020.	ROA and ROE.	Deposit to asset; loan to deposit; bank size; debt to asset; inflation target and GDP.	Deposit to asset ratio and loan to deposit ratio were found to, significantly and negatively, impact ROA for both countries. Bank size, debt to asset ratio, inflation rate, and GDP were shown to have a favourable impact. Deposit to asset ratio, inflation rate, and debt to equity ratio were negative and significant for ROE. GDP and bank size were positive and significant.
Kasanaa et al. (2023)	50 international banks in the period (2008–2020).	ROA; ROE and NIM.	Interest rate; spread; capital adequacy; non-performing assets; liquidity management; size; concentration and inflation target.	The profitability of banks is positively correlated with the interest spread. While non-performing assets and concentration have a strong negative influence on ROA, capital sufficiency, net interest margin and liquidity management have a considerable positive association.
Mashamba and Chikutuma (2023)	11 Zimbabwean banks in the period (2011-2020).	ROA; ROE and NIM.	Income diversification; liquidity; cost-to-income; capital adequacy; credit risk; GDP; inflation target; market structure and bank stability.	This research considers a positive relationship between the cost-to-income ratio and bank profitability. The study reports that GDP and inflation do not have a significant effect on bank profitability in Zimbabwe.
Puci et al. (2023)	12 Albanian banks between 2011 and 2020.	ROA and NIM.	GDP growth rates; unemployment rates; interest rates; inflation target and loan loss reserves.	The study looked at ROA. Although there has been some fluctuation in Albania's financial industry over the past four years, the ROA has improved dramatically. Albanian banks' profitability was significantly negatively impacted by GDP growth, inflation target, and interest rates between 2011 and 2020.
Qehaja-Keka et al. (2023)	400 Banks of Kosovo and Albania in the period (2010 - 2020).	ROA and ROE.	Number of loans; number of employees; non-performing loans and interest rate.	The research concluded that number of workers, interest rate on loans, and percentage of loans in default affected the banks' profitability. However, the number of bank employees did not.
Lamothe et al. (2024)	2091 banks from 110 countries	ROE; ROA; NIM.	Non-performing loans; efficiency ratio; gross margin;	The findings show that default loans, efficiency, gross margin, capitalization, interest rates and GDP growth have a

		Variables		
Authors	**Data**	**Dependent**	**Independent**	**Conclusions**
	(Moody's database).		cash liabilities ratio; customer deposits; customer loans; inflation target; Capitalization; unemployment; GDP and interest rates.	negative and statistically significant impact on banks' profitability.
Martinho et al. (2024)	110 European banks (Bankscope database).	ROA and NIM.	Interest income; interest expenses; Tier; cost-to-income; impairments; bank size; GDP growth; three-month Euribor.	Substantial declines in average bank ROA can be attributed to unfavourable economic situations and variations in interest rates. Notably, bank profitability is positively impacted by GDP. The three-month Euribor has a positive and significant impact on ROA.

Source: own elaboration.

The literature review found that, like our study, many authors used return on equity (ROE) and return on assets (ROA) to explain banking profitability (e.g., Neves et al., 2020; Nunes, 2021; Yuan et al., 2022; Qehaja-Keka et al., 2023). Usually, the dependent variables used to measure profitability are the return on equity (ROE) and the return on assets (ROA). While ROE expresses the net return of the capital invested by the shareholders, the ROA shows the net relative profit produced by the bank's total assets and is considered a measure of management efficiency (Petria et al., 2015). In our study, we apply ROE and ROA to measure the profitability of Portuguese banks (Pires, Basílio & Borralho,2021).

Some researchers applied ROE, ROA and NIM as the dependent variable (e.g. Haddad et al., 2019; Mota et al., 2019; Kasanaa et al., 2023; Mashamba and Chikutuma 2023 and Lamothe et al., 2024). On the other hand, about explanatory variables, most researchers in Table 1 applied internal variables related to credit quality, bank size, and capital adequacy or bank solvability. Regarding external variables, the literature review showed that inflation target and GDP are the most applied. In our study, we decided to apply the 12-month Euribor rate. Table 2 lists articles whose reading proved to be very important for understanding this topic but where it was difficult to establish a comparative analysis with the results obtained in this study.

Assessing the profitability of banks using panel data is a consolidated practice in the literature. Although different econometric methods may be used, all have associated advantages and disadvantages. Thus, in addition to the works contained in the two previous tables, it is possible to observe in these works of, among others, Adem (2023), Akther et al. (2023), Dogan and Yildiz (2022), Jílková and Kotěšovcová (2022), Kotte et al. (2022), and Lekpek and Šabotić (2023). In this study, we chose to use the classic pooled ordinary least squares (OLS) model, as it is one of the most tested and used, as detailed in the methodology.

Table 2. Additional literature review: data, variables, and main conclusions

Authors	Data	Variables		Conclusions
		Dependent	**Independent**	
Jadah et al. (2020)	80 Iraqi banks during the period (2005 - 2017).	ROA, ROE and NIM.	Bank size; credit risk; liquidity; total loans to total assets; GDP; inflation target; interest rate; unemployment; regulatory quality; political instability and government effectiveness.	The results reveal that most bank-specific characteristics, economic conditions, and government variables have a statistically significant impact on the performance of Iraqi commercial banks. The study suggests that the size of Iraqi banks and the total equity to total assets ratio are among major drivers of Iraqi banks' profitability.
Boto-García et al. (2021)	Spanish banking sector during the period 1995–2016.	ROA and ROE.	12-month Euribor; GDP and Herfindahl-Hirschman (HH) index.	The profitability rises with the long-term interest rate and falls with the 12-month Euribor rate. The GDP variable increases ROA. There is no proof that market concentration has a major impact on profitabil ity.
ꞁukwuogor al. (2021)	European Banks from the period 1996 - 2019.	NIM.	GDP rates; unemployment rates; interest rates; inflation rates and loan loss reserves.	The findings show that the US economy's growth, inflation rate, net interest margin, percentage of non-performing loans, and unemployment rate all considerably boost banks' profitability.
Kozak and Wierzbowska (2022)	40 European nations in the years 2019 and 2020.	ROA	Diversification; bank size; asset growth; loan-to-asset; tier; GDP growth; interest rate; lockdown; economic support; income support; debt relief and COVID-19 pandemic.	The findings show that the profitability of European banks was positively and statistically significantly impacted during the COVID-19 epidemic by the growth in non-interest income as a percentage of total income.
Shahin et al. (2022)	22 Kuwait banks. The sample period covers 2011 to 2020.	ROE	Interest rate; tier and bank size.	Bank profitability is lowered by low interest rate. Capital levels above a certain threshold improve banks' profitability. Most notably, the results demonstrate that banks with larger levels of prudential capital are less vulnerable to the negative impacts of low interest rates on profitability.
(Ho et al., 2023)	1231 banks of 90 countries, from 2008 to 2020.	NIM and ROA.	Bank size; cost-income; bank liquidity; loan-to-deposit; non-performing loan; market power; inflation target; GDP growth and money supply.	The results indicate that bank size, ROA, operational cost to operating income ratio, loan-to-deposit ratio, and non-performing loan positively affect the net interest margin of banks.
Son (2024)	13 banks Vietnamese stock market between 2010 and 2022.	NIM	Credit quality; bank size; GDP and inflation target.	The empirical findings show that increasing a bank's net interest margin (NIM) is essential to increasing profits. Greater profitability is indicated by a higher NIM level.

Source: Own elaboration.

The following section outlines the institutions under study, the dependent and independent variables selected, and the methodology that allowed us to draw conclusions from our investigation.

3. Data and methodology

The methodology used is a panel data model, a pooled OLS over the period 2013 - 2023. By using a balanced panel in the present study, it was possible to identify the variables of all companies throughout the entire period under analysis. The pooled model was chosen because it achieves the best results, given the small size of our sample. The software chosen to analyse the empirical model was R Studio.

3.1 Sample

The main objective of this study is to analyse the impact of an increase in Euribor on the profitability of banks operating in Portugal over the period 2013 - 2023. The panel dataset is composed of annual data retrieved from the banks' annual reports on management efficiency, credit quality, capital adequacy, size, financial margin, banking product and profitability. The sample of 17 banks includes BPI, BCP, CGD, SICAM, STD, MTP, NB, BIC, BIG, CTT, BAI, FNT, CTL, BKT, DB, BEST and ATL, representing about 98% of the Portuguese banking product (see Appendix I). The variable EURIBOR was obtained online via Portugal Bank´s databases.

3.2 Study variables

The dependent variables are return on equity (ROE) and return on assets (ROA). These variables are applied to measure the banks' profitability.

The independent variables are credit quality (ICV and CVCT), management efficiency (CTIN), capital adequacy (Tier 1), bank size (LOGAT), financial margin (MF), banking product (PB) and Euribor (EUR).

- In line with Nunes (2021), impairment on non-performing loans (ICV) is a proxy for credit risk. In practice, the higher this ratio, the lower the banks' credit quality, having a negative impact on their profitability.
- In line with Kasanaa et al. (2023), Lamothe et al. (2024), Qehaja-Keka et al. (2023) and Yuan et al. (2022), overdue loans over total loans (CVCT) or non-performing loans are a proxy for credit risk, like a ICV variable. Typically, an increase in the ratio of non-performing loans will reduce banks' profitability.
- The cost-income ratio (CTIN) is defined as operating expenses over total gross profits. It is a proxy for management capacity and measures a bank's operating costs as a proportion of its total profits. In general, it measures the efficiency of a bank's management. An increase in operating expenses is expected to have a negative impact on banks' profitability if everything remains constant. This contrasts with Mashamba and Chikutuma (2023), where cost-income ratio had a positive impact on ROA and ROE.
- The solvability ratio (Tier 1) is defined as basic own funds or highest quality own funds over risk-weighted assets. This ratio is a proxy of capital adequacy and measures financial strength. In general, banks with higher solvability ratios are considered safer, with a positive impact on banks' profitability (Haddad et al., 2019; Kasanaa et al., 2023).

- Bank size (LOGAT) is calculated as the logarithm of the bank's total assets. This proxy has been widely used in previous literature, and its impact on bank profitability is not predictable. However, according to other studies (Haddad et al., 2019; Yuan et al., 2022), a positive correlation is expected between the size of the bank and its profitability. In contrast, Nunes (2021) concluded that bank size has a positive impact on ROA and ROE.
- Financial margin (MF) is the term used in the analysis of banks and results from the difference between the interest charged on credits granted (calculated using the active interest rate) and the interest paid to holders of funds deposited in banks (calculated using the passive interest rate). It is expected to have a positive impact on banks' profitability.
- Banking product (PB) corresponds to the gains achieved directly from banking activities.
- Euribor (EUR) is an abbreviation for Euro Interbank Offered Rate; it represents the average interest rate charged on loans between a specific group of banks in euros. Puci et al. (2023) show a negative impact on banks' profitability before the year 2020. In our study, we expect a positive impact of Euribor on banks' profitability after 2021. It should be noted that the behaviour of Euribor has changed significantly after this year.

Table 3 summarises the independent variables used and the expected effect on ROE and ROA.

Table 3. Independent variables, definition, and expected effects

Variable	Definition	Expected effect
ICV	Impairment on non-performing loans	−
CVCT	Overdue loans over total loans	−
CTIN	Operating expenses over total gross profits	−
TIER	Highest quality own funds over risk-weighted assets	+
LOGAT	Logarithm of the bank's total assets	+
MF	Difference between active and passive interest rate	+
PB	Gains achieved directly from banking activities	+
EUR	Average interest rates charged on loans	+

Source: Own elaboration.

We expect a negative effect of credit quality (ICV and CVCT) and management quality (CTIN). In contrast, we expect a positive impact of capital adequacy (TIER), size and Euribor. This expected effect has to do with the institutions that are currently active in Portugal. The greatest requirements of supervisory rules resulting from the tree Basel Accords, particularly the third agreement, through which capital requirements, to address banking risks, namely liquidity, became much more stringent.

As we know, we have lived through years in which Euribor has presented negative values and banks have presented lower returns. However, families benefitted, particularly in the amount paid for loans obtained. Since 2021, the Euribor rate has been increasing. As a result, families have suffered thanks to an increased amount to be paid for loans obtained. However, we anticipate that banks expect the opposite - a benefit resulting from an increased Euribor.

3.3 Econometric model

We present balanced panel data because information is available for all 17 banks for the ten years under study. The model is as follows:

$$Y_{i,t} = \beta_0 + \sum_{k=1}^{7} \beta_k X_{ki,t} + \epsilon_{i,t}$$

where:

$Y_{i,t} = ROE$ and ROA from bank i = 1, ..., 17 and year t = 1, ...,11 (2013–2023)

β_0 = constant

β_k = coefficients to be estimated by the model

$X_{ki,t}$ = vector of the explanatory variables

$\epsilon_{i,t}$ = random error

We applied pooled OLS employing R Studio. The Breusch-Pagan test was applied to analyse the existence of heteroscedasticity. Based on the test carried out, we concluded that it does not exist. The random-effects model was therefore not chosen. The most appropriate model for our sample (17 banks) was the pooled OLS (Breusch & Pagan, 1979; Koenker, 1981).

4. Results and discussion

At this point, the statistical data, the results obtained and the comparative analysis with the literature review are presented.

4.1 Statistical data

Our model considered ten variables. Descriptions of these variables are presented in the following Table 4. For each of the variables, the mean, standard deviation, minimum and maximum value are presented. On average, the 17 selected banks have a return on equity (ROE) of 5.20% with a standard deviation of 12.74%. Regarding return on assets (ROA), the banks present an average indicator of 0.36% with a standard deviation of 2.38%. Standard deviation shows large profitability heterogeneity among the banks in our sample in both ROE and ROA.

The Euribor variable (EUR) presented negative values for several years (the minimum rate was -0.51%). This rate began to increase in 2021 to its maximum value in 2023, with a rate of 4.07%. The average Euribor was 0.55% and the standard deviation 1.38%.

Table 4. Summary statistics

Variable	N	Mean	Std. Dev.	Min	Max
ROA	187	0.36	2.38	-19.00	5.30
ROE	187	5.20	12.74	-37.00	48.00
ICV	187	86.41	62.78	27.60	430.20
CVCT	187	4.78	4.38	3.2	18.70
CTIN	187	56.08	15.64	27.60	100.60
TIER 1	187	18.33	9.89	8.10	82.30
LOGAT	187	3.91	1.00	1.49	8.01
MF	187	2.65	1.61	-0.74	6.12
PB	187	3.54	1.54	1.04	6.99
EUR	187	0.55	1.38	-0.51	4.07

Source: Own elaboration employing R Studio.

According to Table 5, we observe that only two variables (PB and MF) present values very close to 3. However, according to the literature, the variance inflation factor (VIF) values would only be problematic if they were greater than 5 (Fox & Monette, 1992). In this sense, we verified that there are no collinearity problems between the independent variables.

Table 5. Variance inflation factors

ICV	CVCT	CTIN	TIER	LOGAT	MF	PB	EUR
1.299	1.365	1.346	1.654	1.465	3.529	3.171	1.141

Source: Own elaboration employing R Studio.

According to the Pearson's correlation matrix (Table 6) for the independent variables, the banking product (PB) and financial margin (MF) variables had a high correlation (0.7972). The two variables that show the highest correlation also show the highest collinearity. It was decided to remove the PB variable from the explanatory model of banks' profitability because our model improved without the PB variable. On the other hand, the MF variable is statistically more significant than the PB variable: this is the reason for eliminating the PB variable.

Table 6. Pearson's correlation matrix for the independent variables

	ICV	CVCT	CTIN	TIER	LOGAT	MF	PB	EUR
ICV	1							
CVCT	-0.1806	1						
CTIN	0.1252	0.1497	1					
TIER	0.0822	-0.2769	-0.1669	1				
LOGAT	0.0993	-0.0221	0.0530	-0.3554	1			
MF	0.3898	0.2256	0.1936	-0.5085	0.4628	1		
PB	0.3455	0.3208	0.1943	-0.4105	0.4572	0.7972	1	
EUR	0.1964	-0.0868	-0.0650	0.0669	0.1904	0.2215	0.2191	1

Source: Own elaboration employing R Studio results.

4.2 Estimation results

The results are presented in Table 7 and Table 8. Table 7 shows that the pooled model is considered appropriate given the results of the F statistic, which is significant at the 1% level (p-value: 7.4307e-14). The R-squared is 64%, meaning that 64% of the variance of ROE is explained by the set of exploratory variables applied.

The test statistic BP=4.8074 follows a chi-square distribution with 7 degrees of freedom (number of independent variables) with a p-value of 0.6835. Thus, we do not reject the null hypothesis, in this way being able to consider the validity of the premise of homoscedasticity and, as such, do not compromise the validity of the results obtained by the OLS Pool model.

CVCT (credit quality), CTIN (management capacity), TIER (capital adequacy) and EUR (Euribor) show great statistical significance (at 1% level). The CVCT variable presents the expected sign and shows that banks with a higher level of non-performing loans will have lower profitability (ROE). Higher default also involves the establishment of a greater impairment level, which implies a lower net result.

The CTIN variable exhibits the expected sign and confirms that an increase in operating expenses has a negative impact on banks' profitability. The TIER variable result confirms the idea that the higher the solvability ratio, the higher the banks' profitability. Usually, it shows that the bank with its robust own funds has higher ROE. Finally, when Euribor increases by 1%, the bank's profitability (ROE) improves by 2.303%, following the increase in the bank's financial margin. The Euribor variable presents the expected sign and confirms that the increase since 2021 has had a very positive impact on the banks' equity capital profitability.

Table 7. Regression results

Y = ROE	Coef. (β)	Cluster robust standard error	t	p-value
ICV	-0.024	0.015	1.587	0.1143
CVCT	-0.852***	0.020	-4.344	0.0000
CTIN	-0.228***	0.051	-4.552	0.0000
TIER	0.358***	0.010	-3.563	0.0005
LOGAT	2.445**	0.945	2.7034	0.0375
MF	1.816*	0.018	-2.499	0.1003
EUR	2.303***	0.727	3.843	0.0001
Constant	20.56***	5.379	3.382	0.0001
R-Squared:		0.64084		
p-value: F stat:		7.4307e-14		

Note: *, **, *** represent significance at the 10%, 5% and 1% level. *Source*: Own elaboration employing R Studio.

On the other hand, the LOGAT (bank size) variable is statistically significant at the 5% level and the MF (financial margin) variable is statistically significant at 10%. The LOGAT variable shows a positive correlation between the size of the bank and its profitability. This result was expected in our study.

The MF variable has the lowest level of statistical significance. However, it is interesting to verify that our expectations regarding its behaviour were met.

Table 8 shows that the pooled model is considered appropriate, given the results of the F statistic, which is significant at the 1% level (p-value: 5.3199e-10). The R-squared is 54%, meaning that 54% of the variance of ROA is explained by the set of independent variables applied.

As for the test statistic, BP=9.5798 follows a chi-square distribution with 7 degrees of freedom (number of independent variables) with a p-value of 0.2958. Thus, we do not reject the null hypothesis, consequently being able to consider the validity of the premise of homoscedasticity and as such do not compromise the validity of the results obtained by the OLS Pool model.

Table 8. Regression results

Y = ROA	Coef. (β)	Cluster robust standard error	t	p-value
ICV	0.007**	0.003	2.419	0.0343
CVCT	-0.829**	0.039	-2.147	0.0298
CTIN	-0.012**	0.010	-1.212	0.0476
TIER	-0.119***	0.020	-6.054	0.0000
LOGAT	0.373**	0.178	2.093	0.0475
MF	0.302	0.143	-2.118	0.0892
EUR	1.304**	0.118	2.570	0.0335
Constant	2.197*	1.058	2.075	0.0106
R-Squared:		0.54064		
p-value: F stat:		5.3199e-10		

Note: *, **, *** represent significance at the 10%, 5% and 1% level. Source: Own elaboration employing R Studio.

Of particular significance, at the 1% level, is the capital adequacy variable (TIER). This variable result corroborates the idea that the higher the ratio, the lower the need for external funding, inducing lower asset profitability. The implication is that as capital adequacy increases, ROA decreases. Higher capitalisation has a negative impact on the asset capital profitability of banks.

The credit risk variables (ICV and CVCT) are statistically significant at the 5% level. The CVCT variable presents the expected sign to explain the ROA. Like the impact on ROE, banks with a higher level of non-performing loans will have lower ROA. On the other hand, the ICV variable shows that an increase in impairment on non-performing loans has a positive impact on ROA.

The CTIN variable is statistically less significant in ROA than in ROE. However, it presents the same sign: the increase in operating expenses has a negative impact on banks' profitability. The LOGAT variable presents the same behaviour in ROA and ROE, as well as the same statistical significance (at the 5% level). It shows a positive correlation between the size of the bank and its return on assets.

We show lower statistical significance in ROA than in ROE, the Euribor variable present the expecting sign. This confirms that the increase after 2021 had a very positive impact on the asset capital profitability of banks.

4.3 Comparative analysis

By carrying out a comparative analysis between our results and the literature review, we have been able to verify the existence of some very similar conclusions. Puci et al. (2023) show the negative impact that the decrease in interest rates had on Albanian banks' profitability until 2020. Our work demonstrates that Euribor increased profitability after 2021. This variable has a positive impact on the profitability of Portugal banks.

In line with Yuan et al. (2022), bank size has a positive and significant impact on ROA and ROE. In the same way, non-performing loans have a negative and significant impact on ROE. According to Haddad et al. (2019), capital adequacy (solvability), asset quality and bank size have a positive and significant impact on banks' profitability. We arrived at the same conclusions.

As in Kasanaa et al. (2023) work, non-performing loans had a negative influence on ROA. On the other hand, capital adequacy had a positive impact. Lamothe et al. (2024) and Qehaja-Keka et al. (2023) reached the conclusion that non-performing loans had a negative impact on ROA and ROE.

Our research is not in line with that of Mashamba and Chikutuma (2023), where cost-income has a positive impact on ROA and ROE. In our work, we see that the cost-income variable (management assets) had a negative impact on profitability among Portugal's banks, measured by ROA and ROE. Contrary to Nunes (2021), bank size had a positive impact on ROA and ROE. However, the impairment of non-performing loans had a negative impact on banks' profitability. Similarly, Martinho et al. (2024) show that interest rates have a positive and significant impact on ROA.

In terms of comparability of results, our work is in line with Yuan et al. (2022), showing that bank size has a positive and significant impact on ROA and ROE. According to Haddad et al. (2019), capital adequacy (solvability), asset quality and bank size have a positive and significant impact on banks' profitability. Like Kasanaa et al. (2023), our work shows that non-performing loans had a negative influence on ROA. On the other hand, capital adequacy had a positive impact.

5. Conclusions

The main goal of this study was to obtain the determinants of banks' profitability in Portugal over the period 2013 to 2023. Above all, we sought to analyse the extent to which the increase in the Euribor rate had an impact on Portuguese banks' profitability, measured by ROE and ROA.
As in much of the literature (among others, Haddad et al., 2019; Lamothe et al., 2024; Yuan et al., 2022), ROE and ROA were considered to measure the banks' profitability. Impairment of non-performing loans, overdue loans over total loans, cost-income ratio, solvability ratio, bank size, financial margin and Euribor were considered as explanatory variables. This choice is in line with the work of Kasanaa et al. (2023), Mashamba and Chikutuma (2023), Martinho et al. (2024), Nunes (2021) and Qehaja-Keka et al. (2023).

Our results show that the variables that represent credit quality (CVCT and ICV), capital adequacy (Tier 1), management capacity (CTIN) and 12-month Euribor present the expected sign. On the other hand, the range of exploratory variables in this study explains ROE more adequately than ROA. We were able to verify that 64% of the variance of ROE is explained by the set of

independent variables applied. On the other hand, 54% of the variance of ROA is explained by the set of exploratory variables employed. This conclusion is in line with the literature (Petria, 2015). ROE is computed as the ratio between the bank's net profit and equity: hence, to study the impact on banks' profitability, the measure of profitability chosen was ROE. The ROA shows the net profit generated by banks' total assets and is more appropriate for evaluating management efficiency.

However, the main conclusion of this work concerns the Euribor rate. When Euribor increases by 1%, the banks' profitability (ROE) improves by 2.303%. In the same way, when Euribor increases by 1%, the bank's profitability (ROA) improves by 1.304%. So, despite the lower statistical significance for ROA than for ROE, the Euribor variable presents the expected sign. This confirms that the Euribor increase after 2021 had a very positive impact on the asset capital profitability of banks. This study sought to contribute to future research and show researchers the importance of this topic. In particular, the external variable (Euribor) had not previously been tested in relation to Portuguese banking profitability. Compared to other studies focused on banking profitability, our significant contribution involves studying the effect of Euribor on the Portuguese banking sector.

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Appendix 1

Bank	Banking Product *
BPI	1423
BCP	1245
CGD	1465
SICAM	675
STD	656
MTP	1920
NB	876
BIC	1802
BIG	623
CTT	678
BAI	276
FNT	897
CTL	697
BKT	988
DB	998
BEST	487
ATL	456
Total of Banking Product	16495
Total sample of Banking product	16162

* Millions of Euros

Source: Banco de Portugal (2023).

The sample used has a weight corresponding to 0.9798 of the Total of Banking Product, concerning the year 2023 and indicated in the previous table.