

Article

Modelling Profitability Determinants in the Banking Sector: The Case of the Eurozone

Vera Mirović, Branimir Kalaš, Nada Milenković , Jelena Andrašić and Miloš Đaković * 

Faculty of Economics in Subotica, University of Novi Sad, 24000 Subotica, Serbia; vera.mirovic@ef.uns.ac.rs (V.M.); branimir.kalas@ef.uns.ac.rs (B.K.); nada.milenkovic@ef.uns.ac.rs (N.M.); jelena.andrasic@ef.uns.ac.rs (J.A.)

* Correspondence: milos.djakovic@ef.uns.ac.rs; Tel.: +381-24-628-068

Abstract: The aim of this study is to analyze which factors affect the profitability of banks in the eurozone and to make recommendations for supporting them to achieve higher levels of profitability in particular eurozone countries. The banks operating in the eurozone are specific that they are under one monetary policy. The main purpose of the banks' profitability analysis is to identify main bank-specific and macroeconomic determinants and help bank management to more fully comprehend their importance of bank-specific determinants and macroeconomic determinants' influence when measuring and evaluating bank profitability. For the purpose of this research, we analyze the impact of bank-specific determinants (NPL, CIR, NIM, NIF and NIT) and macroeconomic determinants (GDP, INF, UNM and DEBT) on bank profitability in the eurozone for the period of 2015–2020 using a random effects model, fixed effects model, and the general method of moments (GMM). This empirical research analyzed quarterly data series from Eurostat for eighteen countries in the eurozone. We came to the results that on the eurozone-level NPL, the cost-to-income ratio has a negative impact on the banks' profitability, while the net interest income to the operating income, the net income for trading assets to the operating income and the net fee and commission income to the operating income have a positive impact on the banks' profitability. Considering the macroeconomic variables, we found a positive impact only in the case of GDP, while the inflation rate, unemployment rate and gross government debt have shown a negative impact on the banks' profitability. The main contribution of this study implies different panel techniques with two uncommonly used macroeconomic variables such as the unemployment rate and debt ratio. The results on the country level differ from country to country and these findings can give a lead to policy makers on the national level on how to enhance the banks' profitability levels.

Keywords: banks' profitability; bank-specific determinants; macroeconomic determinants; eurozone; panel regression modeling

MSC: 62P05; 91B74



Citation: Mirović, V.; Kalaš, B.; Milenković, N.; Andrašić, J.; Đaković, M. Modelling Profitability Determinants in the Banking Sector: The Case of the Eurozone. *Mathematics* **2024**, *12*, 897. <https://doi.org/10.3390/math12060897>

Academic Editor: Larissa Margareta Batrancea

Received: 30 January 2024

Revised: 23 February 2024

Accepted: 29 February 2024

Published: 18 March 2024



Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

The financial market involves a large number of participants who play an important role in regulating the operation of the financial market and providing a sufficient amount of financial resources to economic entities and individuals. In developing countries, banks continue to dominate as the main participants in the financial markets. In developed countries, the situation is slightly different, because other financial institutions appear as competitors of banks. Banks in those situations need to secure and maintain their market share to make profit and operate stably long term. On the other side, the profitability of the banking institutions has a positive impact on the economic growth in the short term as well as in the long term [1] (pp. 183–199).

A bank, like any business entity in the conditions of a market economy, must cover its expenses with its income and make a profit. Since the bank, as a financial intermediary,

performs the process of receiving, transforming and lending funds, it also has certain operating expenses, administrative expenses, other expenses, contributions and taxes. During its operations, the bank must ensure incomes to cover the expenses, and make a profit for its shareholders, accumulation and reserves. Similarly, Batrancea [2] (p. 260) indicated that commercial banks play an essential role in mobilizing and distributing funds by loans and deposits to their clients. Accordingly, the banking system can be identified as one of the most important economic sectors [3] (p. 2761), where banks play an active role in the financial markets of any nation [4] (pp. 44–60).

Forming an adequate rate of return on capital, as well as maximizing market value, is the goal of every financial institution. By achieving an adequate rate of return, the entire profit is usually distributed in a smaller part for dividends to shareholders, while a larger part is attributed to the bank's capital. On the other hand, achieving an adequate rate of return leads to an increase in the market prices of the bank's shares, as well as to an increase in the interest of investors in investing capital in the bank. Investors can invest their funds in the bank's capital when it issues new shares to strengthen its capital. According to the Basel principals [5] (pp. 49–60), banks cannot increase their investments in risky assets insofar as they do not recapitalize. High levels of bank profitability are crucial, as seen, for several reasons.

Our aim is to determine which factors affect the profitability of banks in the eurozone and to make recommendations for improving them to achieve higher levels of profitability in individual eurozone countries. Accordingly, the main purpose of the banks' profitability analysis is to ensure bank management information about the potential implications of selected determinants from the aspect of estimating bank profitability. The novelty and contribution of this research is the presenting of different panel techniques with two not-usually used macroeconomic variables such as the unemployment rate and debt ratio in the context of measuring bank profitability.

Banks operating in the eurozone are specific that they are under one monetary policy, specifically from 2012, when the eurozone countries embraced a transfer of banking supervision to the supranational level [6,7]. Despite that, the levels of banks' profitability in the member states of the zone differ [8] (pp. 277–293).

One reason for that could be that there is a group of countries that show different economic responses to the monetary policy of the ECB [9,10], and these differences are expressed only in specific periods [11] (pp. 56–76). Especially during the pandemic crisis, countries with a higher pre-COVID level of the debt-to-GDP ratio had a significant rise in interest rate levels and greater perceived risks of default [12] (pp. 521–542). This proves that sovereign risk has impacted the banking risk in the eurozone [13]. Such macroeconomic asymmetry was also seen before and after the global financial crisis [14] (pp. 184–202).

The second reason for the differences in the profitability levels could be the bank-specific determinants. The main question is which determinants are affecting profitability levels the most. Whether there is a stronger impact of the bank-specific or country-specific determinants of bank profitability is the main research question.

Our research is structured in five segments. First, in the introduction, the motivation of the research is explained. In the next, second part, a theoretical background is given for the conceptualization of the hypothesis. The third part is devoted to the explanation of the methodology used and the data collection. The fourth part reveals the results of our study with a discussion at the end of this segment. The last part gives the conclusions of our research, limitations, and the recommendations for further research.

2. Literature Review

Banking institutions' profitability, like any other companies' profitability, depends on the entities' specific or country's specific macroeconomic determinants. The macroeconomic determinants are approximately the same in contrast to the entities' specific determinants which are different in financial institutions because of the intermediary function of those

entities. The Stata version 13.0 (StataCorp LLC, College Station, TX, USA) statistical software was used.

The issue of banks' profitability is significant because of the successful functioning of the financial system, but also because of the general economic growth and prosperity of a certain country [1] (pp. 183–199). Most common measures for banks' profitability are their return on assets, return on capital and their net interest income. Considering the existing literature, there are a lot of single-country studies but only a few focusing on the eurozone. Our intention is to contribute by filling this gap in the literature. We consider the bank-specific and country-specific determinants of the banks' profitability in the eurozone in the period from 2015 to 2020.

When it comes to bank-specific determinants, non-performing loans are indeed one of the most considered internal determinants of a bank's profitability. This indicator is often used as a measure of credit risk management, where banks with a higher level of non-performing loans are less profitable than their counterparts [15]. Non-performing loans, as a percentage of the gross total loans, have a negative impact [1,16–19] on the bank's profitability. Since the NPL is a proxy for banks' credit risk, there are further studies [20–25] proving that higher levels of credit risks lead to the lowering of banks' profitability levels. In the corporate theory [26], it is not unusual that higher risk levels can lead to higher levels of profitability, but in the banking industry, higher risk levels usually end up in the higher levels of the NPL which leads to credit default risk.

The cost-to-income ratio is one of the specific determinants in the banks which shows management efficiency. If efficiency is lower, the bank profitability is jeopardized. As this ratio is higher, the bank profitability levels are expected to be lower. Efficiency levels can be approached in many ways [27,28]; in this case, we are using cost management efficiency in banks. Studies [16,19,29,30] considering this ratio as a determinant of profitability levels have shown a negative correlation of this ratio to the ROA or ROE. Olson and Zoubi [31] have shown that cost efficiency has little impact on profitability in the MENA countries. Dietrich and Wanzenried [21] pointed out that regardless of whether the banking sector is in crisis or not, the negative influence of this determinant is permanent.

Between the two considered bank-specific determinants a trade-off needs to be made because the reduction of NPL levels results in an increase in a bank's operating costs [32], which leads to an increase of the cost-to-income ratio.

Bank diversification is important in reducing loss levels if any of them occurs in banks. Banks have lately increased their non-interest incomes to achieve this diversification. How the diversification level impacts the bank's profitability is shown by [33,34]. These authors claim that diversification has a positive relationship between different revenues and profitability levels. Elekdag et al. [30] have shown that non-interest incomes have had a negative impact on the ROE from the 10th to the 50th quantile while they have a positive impact from the 70th to the 90th quantile. On the other hand, [25] showed that non-traditional activity leads to lower profitability. For this research, we are using the following ratios: the net interest income-to-the operating income, net fee and commission income-to-the operating income and the net income for trading assets-to-the operating income.

Considering the macroeconomic determinants, the most robust determinant of bank profitability across the euro area appears to be the real GDP growth [30] as a general measure and proxy for economic growth [35,36]. Petria et al. [19] claim that the economic growth expressed by GDP growth increases bank activity, which has a positive impact on a bank's profitability. The same finding about the positive effect of the GDP on the profitability of banks is shared by many authors [17,20,23,29,33,34,37,38] who, among other determinants, examined the impact of this macroeconomic determinant on the profitability of banks. Guillén et al. [39] have shown that changes in the GDP have positively influenced the banks' profitability measured by the ROE in Latin America.

Contrary to the GDP, Khue and Lai [40] indicated that inflation might have a negative impact on banking sector performance and this harmful implication could spill over to the economy. Dietrich and Wanzenried [29] have shown different implications of inflation

on profitability depending on the countries' income category and depending on the profit indicator used. Namely, they found that inflation has a positive impact in low-income and middle-income countries and a negative impact in the high-income countries when profitability is measured by the ROAA (net profits over average total assets). When using the ROAE (net profits over average total capital) and the NIM (net interest margin) as dependent variables, they showed a positive impact of inflation on all income category countries. Athanasoglou et al. [20] showed that inflation is positively affecting the profitability rate in the Greek banking sector, the same as it is in China as shown by Tan and Floros [25]. The same positive, but insignificant, impact of inflation on the ROA has been shown by Demirguc-Kunt and Huizinga [34] on a sample of 1334 banks in 101 countries. Petria et al. [19] showed a negative impact of inflation on the ROAE and a positive impact on the ROAA, but in all two cases the impact was shown to be insignificant. A positive impact on the ROA and ROE has been shown by Căpraru and Ihnatov [16]. In contrast, Horobet et al. [17] have shown a negative influence of inflation on the banks' profitability in the CEE region. As seen, the inflation depends on the profit measure used and the countries' income and geographical location.

The unemployment rate and debt-to-GDP ratio are not commonly used macroeconomic determinants of banks' profitability, but in our opinion, they are particularly important ones. Namely, the unemployment rate has an important impact on the ability for loan repayment [26]. If the employment rate is growing, the creditworthiness is increasing, and in the case of a decline in employment, there is a shrinkage in the ability to repay loans and thus leads to a rise in non-collectible placements, which causes bank losses. This is proven by Horobet et al. [17] in the case of the CEE countries.

The debt-to-GDP ratio has an indirect impact on the banks' profitability. Sovereign debt has a significant impact on the banking crisis [38,41]. Furthermore, the debt-to-GDP ratio has a positive impact on the levels of the NPL as shown by Louzis et al. [42]. This means that with the rise of the debt ratio, the credit default risk is higher and the potential losses for banks could increase [12]. Horobet et al. [17] have shown that a sovereign deficit has a significantly negative impact on the banks' profitability (ROA, ROE and NIM) in the CEE region based on a Generalized Method of Moments approach.

According to the existing literature, we extend our model with two determinants: the unemployment rate and debt-to-GDP ratio; this is in order to better explain the variations of banks' profitability expressed by the ROA and ROE. The variable selection and hypotheses are shown in the next section.

3. Materials and Methods

The main goal of this research is to evaluate the impact of bank-specific determinants (NPL, CIR, NIM, NIF and NIT) and macroeconomic determinants (GDP, INF, UNM and DEBT) on bank profitability in the eurozone for the period of 2015–2020. The empirical research has analyzed quarterly data series from Eurostat for eighteen countries in the eurozone (Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain). The variable explanation is manifested in Table 1.

Based on the determined goal of the study, the following hypothesis was developed as the null hypothesis:

Hypothesis 0 (H0): *There is a statistically significant effect of bank-specific and macroeconomic determinants on bank profitability in the eurozone.*

For the purpose of a more detailed analysis and the answer to the research question, an auxiliary hypothesis was defined for each individual determinant. In such a way, we can answer the main research question.

Table 1. Variable selection.

Variable	Symbol	Description	Expected Effect
Dependent variables			
Return on assets	ROA	Net income/Total assets	/
Return on equity	ROE	Net income/Total equity	/
Independent variable			
Non-performing loans	NPL	% of total gross loans	-
Cost-to-income ratio	CIR	Total loans/Total deposit	-
Net interest income-to-operating income	NIM	Net interest income/Operating income	+
Net fee and commission income-to-operating income	NIF	Net fee and commission income/Operating income	+
Net income for trading assets-to-operating income	NIT	Net income for trading assets/Operating income	+
Gross domestic product	GDP	Annual growth rate	+
Inflation	INF	Annual rate	—
Unemployment	UNM	Annual rate	—
Gross government debt	DEBT	% of GDP	—

Considering the bank-specific determinants and in accordance with the results of earlier studies [1,16–19], when it comes to NPLs, we expect that their negative impact on the profitability of banks in the eurozone will be confirmed. Our H1 hypothesis is:

Hypothesis 1 (H1): *Non-performing loans negatively affect bank profitability in the eurozone.*

The cost management ratio, more precisely the cost-to-income ratio, has been proven [16,19,29,30] to influence the banks' profitability negatively, as this ratio increases a decline in profitability is expected. According to that, is our H2 set:

Hypothesis 2 (H2): *The cost-to-income ratio negatively affects the bank profitability in the eurozone.*

Portfolio diversification's impact on a bank's profitability is not so unequivocal. There has been proof that its impact is positive [33,34], but some studies [25,30] have also shown a negative impact on a bank's profitability. We assume that in the banks operating in the eurozone, using diversification in their portfolios has a positive impact on the banks' profitability, so H3, H4 and H5 are set as follows:

Hypothesis 3 (H3): *The net income from the interest rate positively affects bank profitability in the eurozone.*

Hypothesis 4 (H4): *The net income from fees and commissions positively affects bank profitability in the eurozone.*

Hypothesis 5 (H5): *The net income from trading assets positively affects bank profitability in the eurozone.*

When it comes to the macroeconomic determinants, our study considers two more, uncommonly used variables (UNM and DEBT), which enhances the current knowledge. When it comes to the GDP, findings from previous studies [17,19,20,30,34,38] have shown that there is a positive impact on bank profitability. According to that, our expectation regarding this variable is set in H6:

Hypothesis 6 (H6): *The gross domestic product positively affects the bank profitability in the eurozone.*

When it comes to inflation, the findings are divided. Some previous studies [20,25,34,41,43] have shown that there is a positive impact on banks' profitability. The same

positive finding was found in low- and middle-income countries, while in high-income countries, a negative impact was detected [29]. Also, the findings vary depending on the profit measurement used or the region, as shown in the literature review. Bearing in mind that the eurozone countries also fall into the category of high-income countries, our hypothesis is based on Dietrich's and Wanzenried's [29] findings, and we develop the following hypothesis:

Hypothesis 7 (H7): *Inflation negatively affects bank profitability in the eurozone.*

The unemployment rate and the debt-to-GDP ratio are not commonly used in the studies undertaken thus far, but their significance as macroeconomic determinants are undeniable. We assume that these two determinants have a negative impact on the banks' profitability in the considered region. Therefore, our H8 and H9 are defined as follows:

Hypothesis 8 (H8): *Unemployment negatively affects bank profitability in the eurozone.*

Hypothesis 9 (H9): *Debt negatively affects bank profitability in the eurozone.*

According to the previously defined variables and the developed hypotheses, the following model construction has been set (Figure 1).

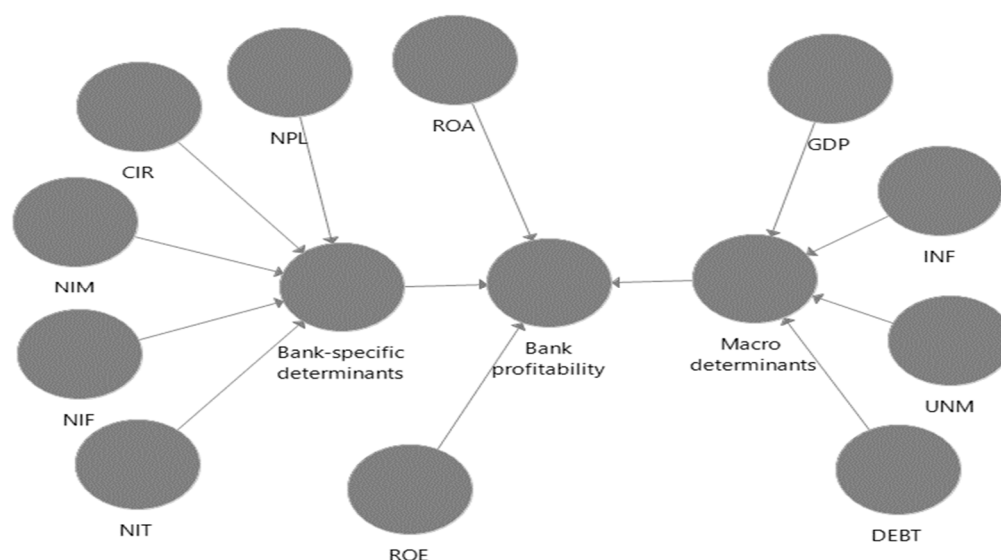


Figure 1. Model construction.

The proper panel data are longitudinal data that are two-dimensional in which cross-sectional measurements are observed over time [44]. An analysis of data with multiple levels, including longitudinal data, can apply various methods [45]. Brooks [46] defined a basic structure for panel data estimation:

$$Y_{it} = \alpha + \beta x_{it} + \varepsilon_{it} \quad (1)$$

where ε_{it} is an error, α is constant, the βx_{it} are the coefficients of the independent variables, i —the number of panels, and t —the time period.

The empirical study includes static and dynamic panel models to provide a comprehensive analysis of the bank profitability determinants in the eurozone. Besides the random effects model and fixed effects model, this study applied the general method of moments (GMM) to control for a potential endogeneity problem [47]. Typically, it is believed that panel model disturbances are cross-sectionally independent [48].

Based on a Hausman test, the random effects model was manifested as an adequate model to estimate the effect of explanatory variables [49]:

$$Y_{it} = \beta_0 + \mu_i + \beta_1 x_{it1} + \dots + \beta_n x_{itn} + \varepsilon_{it} \quad (2)$$

The Breusch–Pagan LM test and Pesaran-scaled LM test both estimate cross-sectional dependence and can be modelled as follows [50]:

$$LM_{BP} = T \sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{P}_{ij} \quad (3)$$

where the residual correlation coefficient appears in the Pesaran-scaled LM test, which is calculated like so:

$$LM_P = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N (T \hat{P}_{ij}^2 - 1) \quad (4)$$

The designed models of bank profitability can be expressed as:

Bank profitability model 1:

$$ROA_{it} = \beta_0 + \mu_i + \beta_1 NPL_{it} + \beta_2 CIR_{it} + \beta_3 NIM_{it} + \beta_4 NIF_{it} + \beta_5 NIT_{it} + \beta_6 GDP_{it} + \beta_7 INF_{it} + \beta_8 UNM_{it} + \beta_9 DEBT_{it} + \varepsilon_{it} \quad (5)$$

Bank profitability model 2:

$$ROE_{it} = \beta_0 + \mu_i + \beta_1 NPL_{it} + \beta_2 CIR_{it} + \beta_3 NIM_{it} + \beta_4 NIF_{it} + \beta_5 NIT_{it} + \beta_6 GDP_{it} + \beta_7 INF_{it} + \beta_8 UNM_{it} + \beta_9 DEBT_{it} + \varepsilon_{it} \quad (6)$$

4. Results and Discussion

There is an econometric analysis that implies descriptive statistics, panel unit root tests, a different regression model, as well as a causality test to identify the significance of the selected macroeconomic and bank-specific determinants on the bank profitability in the eurozone from 2015 to 2020 on a quarterly basis (Table 2). We employed STATA version 13 as a statistical software for conducting our research.

Table 2. Descriptive statistics.

Variable	Mean	Std.dev.	Minimum	Maximum	Skewness	Kurtosis	Jarque-Bera Test
ROA	0.509	0.767	−4.7	5.4	−0.397	15.082	108.22 ***
ROE	5.538	6.755	−44	39.2	−2.068	18.227	248.78 ***
NPL	8.058	11.168	0	50	2.350	7.676	213.31 ***
CIR	59.139	15.089	0	150.6	−0.961	10.429	123.53 ***
Nlinterest	60.470	30.916	0	614.7	13.181	240.675	851.88 ***
Nlfee	27.334	10.423	0	62.9	0.097	4.085	11.90 **
Nltrade	3.948	7.039	−71.5	36.8	−4.152	48.180	440.52 ***
GDP	0.551	3.584	−17.7	23.9	0.349	15.827	108.90 ***
INF	1.727	3.669	−3.3	22.48	3.217	13.704	311.72 ***
UNM	8.506	4.563	2.9	25.7	5.746	1.698	143.43 ***
DEBT	79.662	42.564	7.9	206.3	0.548	3.004	19.76 ***

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

The bank profitability is measured via the return on assets and return on equity (ROE) in the eurozone for the period of 2015–2020. Firstly, the average bank profitability measured by ROA was 0.51% in these economies. More precisely, banks in Slovenia had the greatest ROA level of 2.02%, while banks in Greece and Portugal achieved the negative average values of 0.47% and 0.22%. Specifically, banks in Austria, Estonia, Finland, Ireland, Luxembourg, the Netherlands and Spain recorded an average ROA range between 0.4% and 0.6%. Likewise, banks in Belgium, Cyprus, France, Germany, and Italy registered a mean ROA range between 0.1% and 0.4% for the observed period. Secondly, the average

return on equity was 5.54%, where banks in Slovenia and Latvia registered double rates of 14.85% and 10.23%. This is far more than that of the banks in Greece and Portugal that had negative average values of 5.96% and 0.71%. The banks in Austria, Belgium, Finland, France, Ireland, Latvia, Lithuania, Malta, the Netherlands, Slovenia and Spain achieved ROE values above the mean level for the observed period. Contrarily, Cyprus, Estonia, Germany, Greece, Italy, Luxembourg and Portugal registered ROE values below the average level in the eurozone. The average share of non-performing loans was 8.06%, while the cost-to-income ratio was 59.14% at the average level. Banks in Greece recorded the highest share of the NPL (41.26%), which is far more than that of banking sectors in Estonia, Finland, Germany, and Luxembourg (where the mean share of the NPL was below 2%). Analyzing the net income generating from the interest rate, fees and commissions, as well as trading assets, we can see that banks had a mean net interest income that was 60.47% of the operating income, while the net incomes from fees and commissions were 27.33% and 3.95% of the operating income for the analyzed period. When it comes to macroeconomic variables, the economies in the eurozone registered an average GDP growth rate of 0.55% with a mean inflation rate of 1.73% from 2015 to 2020. This implies that the real gross domestic product drops in the observed period. Also, the average unemployment rate was 8.51%, while the mean debt level was 79.66%. The study includes different panel unit root tests such as the Levin–Lin–Chu test, Im–Pesaran–Shin test and the Breitung test to provide information about stationarity. Panel unit root tests are vital instruments in directly testing economic hypotheses that imply the stationarity of specific variables [51].

These numbers indicate that the eurozone area should focus on a higher growth rate with an acceptable inflation and unemployment, but also, it should consider public debt management to avoid harmful implications to economic activity. Based on a Jarque–Bera test, we are able to check whether data are normally distributed [52]. It can be concluded that all variables are significantly non-normally distributed at 1% and 5%.

Applying different panel unit root tests, we checked the stationarity at level and at the first difference for all variables in Table 3. The results of the first panel unit root tests showed that all variables are stationary at level, except for inflation and debt. However, all selected variables become stationary after the first difference. Considering cross-sectional dependence, the study included a second batch of panel unit root tests in Table 4 and the results of the conducted tests manifested that variables NIF, INF, UNM and DEBT are non-stationary at level. Like the first panel unit root tests, each observed variable turns stationary at the first difference.

Table 3. Panel unit root tests—1st generation.

Variable	LLC Test (<i>p</i> -Values)		IPS Test (<i>p</i> -Values)		Breitung Test (<i>p</i> -Values)	
	Level	Firs diff.	Level	Firs diff.	Level	Firs diff.
ROA	0.0010	0.0000	0.0060	0.0000	0.0000	0.0000
ROE	0.0000	0.0000	0.0390	0.0000	0.0060	0.0000
NPL	0.0000	0.0000	0.5940	0.0000	0.9920	0.0000
CIR	0.0000	0.0000	0.0000	0.0000	0.0190	0.0000
NIM	0.0000	0.0000	0.0000	0.0000	0.0730	0.0000
NIF	0.0000	0.0000	0.0030	0.0000	0.3710	0.0000
NIT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
GDP	0.0000	0.0030	0.0000	0.0000	0.0000	0.0000
INF	0.7010	0.0000	0.0220	0.0000	0.0000	0.0000
UNM	0.0000	0.0000	0.0270	0.0000	0.9750	0.0000
DEBT	0.6750	0.0000	0.9920	0.0000	0.6980	0.0000

Table 4. Panel unit root tests—2st generation.

Variable	Pesaran CADF Test (<i>p</i> -Values)		CIPS Test (<i>p</i> -Values)	
	Level	Firs diff.	Level	Firs diff.
ROA	0.0040	0.0000	0.2140	0.0000
ROE	0.0030	0.0000	0.0000	0.0000
NPL	0.0590	0.0000	0.0000	0.0000
CIR	0.0000	0.0000	0.5050	0.0000
NIM	0.0050	0.0000	0.0010	0.0000
NIF	0.0930	0.0000	0.2480	0.0000
NIT	0.0000	0.0000	0.0000	0.0000
GDP	0.0000	0.0000	0.0000	0.0000
INF	0.9570	0.0000	0.7720	0.0000
UNM	0.7670	0.0000	0.1250	0.0000
DEBT	0.9570	0.0000	0.0590	0.0000

To enable information about an adequate selection of explanatory variables, we applied the VIF test in Table 5. The mean value of the VIF is 1.62, which is far less than the 10 of VIF test in [13,52]. Based on the obtained results, it can be concluded that there is no multicollinearity problem among the independent variables. After checking multicollinearity, the next table presents the heteroskedasticity test using the Breusch—Pagan test.

Table 5. VIF test.

Variable	VIF	1/VIF
NPL	2.27	0.441
NIF	2.15	0.4643
CIR	2.12	0.4718
UNM	2	0.5
INF	1.18	0.8474
NIM	1.15	0.8669
NIT	1.08	0.9287
GDP	1.02	0.9818
Mean VIF	1.62	

Based on the results from Table 6, it can be confirmed that the null hypothesis of constant variance cannot be rejected, which implies there is no presence of heteroskedasticity in the residuals. In many cross-country analyses, time series are contemporaneously correlated [48], so cross section dependence tests are presented in Table 7.

Table 6. Heteroskedasticity test.

Breusch–Pagan Test	ROA	ROE
Results	Chibar 2(1) = 1.54	Chibar 2(1) = 2.07
	Prob > chibar2 = 0.2149	Prob > chibar2 = 0.1507

Table 7. Cross section dependence test.

Test	Statistic	Prob.
Breusch–Pagan LM	567.122	0.000
Pesaran-scaled LM	23.674	0.000
Pesaran CD	4.144	0.000

The results of the cross section dependence tests determined spatial spillover effects among the observed economies in the eurozone. This implies that when shock appears in one country, it usually affects the other economies. This is expected due to their economic

interconnectedness and dependence, as well as the countries using the same currency and operating within a unique European area. The study applied various regression models such as pooled least squares (POLS), a random effects model (RE), a fixed effects model (FE) and the generalized method of moments (GMM). The estimated effects of the selected bank-specific and macroeconomic determinants on bank profitability are presented in Tables 8 and 9.

Table 8. Difference modelling of ROA determinants.

Variable	POLS	RE	FE	GMM
Panel A: Bank-specific determinants				
ROA _{lag}	/	/	/	0.473 (0.000)
NPL	−0.013 (0.006)	−0.029 (0.000)	−0.04 (0.000)	−0.083 (0.000)
CIR	−0.019 (0.000)	−0.012 (0.008)	−0.008 (0.093)	−0.019 (0.000)
NIM	0.004 (0.0010)	0.011 (0.023)	0.011 (0.002)	0.044 (0.000)
NIF	0.029 (0.000)	0.024 (0.010)	0.019 (0.016)	0.209 (0.000)
NIT	0.012 (0.081)	0.014 (0.030)	0.039 (0.035)	0.016 (0.008)
Panel B: Macroeconomic determinants				
GDP	0.014 (0.026)	0.012 (0.078)	0.01 (0.081)	0.121 (0.031)
INF	−0.006 (0.057)	−0.003 (0.097)	−0.004 (0.078)	−0.014 (0.038)
UNM	−0.048 (0.000)	−0.065 (0.002)	−0.084 (0.001)	−0.048 (0.000)
DEBT	−0.003 (0.025)	−0.012 (0.081)	−0.009 (0.080)	−0.013 (0.025)
Obs.	432	432	432	432
Prob > F	0	0	0	0
R-squared	0.217	0.148	0.187	0.585
Hausman test		8.78 (0.4580)		
Sargan test		3.644 (0.703)		

Table 8 shows static and dynamic modelling effect of selected bank-specific and macroeconomic determinants on bank profitability measured by ROA. The results of Hausman test highlighted that the random-effects model is an appropriate model in this analysis. The obtained findings confirmed that bank-specific and macroeconomic determinants have significant impact on ROA for the observed period. Namely, NPL and CIR negatively affect the ROA at significance level of 5%, while NIM, NIF and NIT have positive impact on ROA for the analyzed period. Precisely, the growth of NPL and CIR for 1% declines ROA for 0.029% and 0.012%, while NIM, NIF and NIT positively affects ROA for 0.011%, 0.024% and 0.014%. When it comes to macroeconomic determinants, the effect of GDP, INF and DEBT are significant for ROA at significance level of 10%, while UNM inversely affects the ROA at significance level of 1%. Specifically, the growth of GDP by 1% improves ROA by 0.012%, while an increase in INF, UNM and DEBT reduces ROA by 0.003%, 0.065% and 0.012%, respectively. Analyzing the results of dynamic model (GMM), we can see a significant effect of bank-specific and macroeconomic determinants on bank profitability measured by ROA. The obtained findings indicate that net interest income, net income from fees and commissions, net income from trading assets and gross domestic product

have a positive effect on ROA. Conversely, the non-performing loans, cost to income ratio, inflation, unemployment, debt, negatively affect the ROA in eurozone for the analyzed period. Likewise, lagged ROA value significantly affects the ROA level for the observed period. Considering the negative effects of NPL and CIR, banks with smaller share of these indicators can anticipate greater ROA in their business. Banks should focus on net income from interest rate and fees and commission, as well as net income from trading assets to improve their profitability. Precisely, an increase in net income from interest rate, fees and commissions and trading assets enables greater ROA for 0.04%, 0.21% and 0.02%, respectively. Furthermore, the negative effect of NPL and CIR illustrates that their growth of 1% reduce ROA by 0.08% and 0.02%. Specifically, an increase in GDP by 1% contributes higher values of ROA (0.12%), where the greater inflation, unemployment and debt level reduce ROA for 0.01%, 0.05% and 0.003%, respectively.

Table 9. Difference modelling ROE determinants.

Variable	POLS	RE	FE	GMM
Panel A: Bank-specific determinants				
ROElag	/	/	/	0.372 (0.000)
NPL	−0.031 (0.047)	−0.176 (0.015)	−0.328 (0.000)	−0.013 (0.045)
CIR	−0.158 (0.000)	−0.144 (0.000)	−0.104 (0.022)	−0.158 (0.000)
NIM	0.03 (0.003)	0.019 (0.088)	0.018 (0.061)	0.019 (0.000)
NIF	0.201 (0.000)	0.171 (0.039)	0.084 (0.440)	0.043 (0.000)
NIT	0.025 (0.504)	0.038 (0.072)	0.035 (0.056)	0.013 (0.048)
Panel B: Macroeconomic determinants				
GDP	0.176 (0.036)	0.148 (0.034)	0.128 (0.069)	0.073 (0.036)
INF	−0.005 (0.095)	−0.061 (0.074)	−0.104 (0.023)	−0.013 (0.049)
UNM	−0.395 (0.000)	−0.582 (0.000)	−0.843 (0.000)	−0.395 (0.000)
DEBT	−0.009 (0.415)	−0.014 (0.093)	−0.131 (0.006)	−0.157 (0.000)
Obs.	432	432	432	432
Prob > F	0	0	0	0
R-squared	0.217	0.148	0.304	0.585
Hausman test	9.31 (0.4088)			
Sargan test	3.7 (0.629)			

The results of the Hausman test identified random-effects model as an appropriate model to measure bank-specific and macroeconomic determinants on bank profitability measured by ROE. The obtained findings confirmed that bank-specific and macroeconomic determinants significantly affect the ROE for the observed period. Additionally, NPL, CIR and NIF had effects on ROE at significant level of 5%, while NIM is significant at level of 10%. Precisely, the growth of NPL and CIR for 1% reduces ROE by 0.176% and 0.144%, whereas NIM, NIF and NIT positively affects ROE for 0.019%, 0.171% and 0.038%. Looking at the macroeconomic determinants, the effect of GDP, INF and DEBT are significant for ROA at significance level of 10%, while UNM inversely affects the ROA at significance level of 1%. Specifically, the growth of GDP by 1% enhances ROE for 0.148%, while an increase in

INF, UNM and DEBT declines ROE for 0.061%, 0.582% and 0.014%, respectively. The results of GMM confirm a significant effect of bank-specific and macroeconomic determinants on bank profitability measured by ROE. Based on the findings, it can notice the positive impact of net income from interest rate, fees and commissions and trading assets on ROE, while NPL and CIR negatively affect the ROE. The growth of NIM, NIF and NIT of 1% contributes to higher ROE of 0.009%, 0.04% and 0.01%, respectively. Moreover, an increase in NPL and CIR of 1% reduced ROE by 0.01% and 0.16%. As in the previous model with ROA, similar findings are related to ROE, where growth of GDP improves ROE by 0.07%. On the other side, growth of INF, UNM and DEBT of 1% declines ROE for 0.002%, 0.39% and 0.06%, respectively. These results imply that banks can achieve higher profitability in conditions of greater economic growth rate and smaller inflation, unemployment and debt level at significance level of 5%.

After presenting panel data estimation of bank profitability measured by ROA and ROE, there is cross-country analysis in eurozone in Table 10. The significant effect of bank-specific determinants on ROA is registered in Belgium, Cyprus, Germany, Greece, Italy, Latvia, Lithuania, Portugal and Slovenia. The greatest effect of NPL is identified in Cyprus, Greece, where their growth leads to smaller ROA for 0.96%, 1.78% and 1.21%. When it comes to CIR, it can notice that this indicator is not significant for ROA in countries such as Austria, Estonia, Finland, France, Ireland, Italy, Luxembourg, Malta, Netherlands and Spain. The effect of CIR on ROA is most visible in Greece, Portugal and Slovenia, where growth of CIR by 1% declines ROA for 1.16%, 0.90% and 1.34%. Net income from interest significantly affects the ROA in Belgium, Cyprus, Germany, Greece, Italy, Latvia, Lithuania, Portugal and Slovenia at significance levels of 5% and 10%. Similarly, significant effects of net income from fees and commissions are registered in Belgium, Cyprus, France, Germany, Greece, Italy, Latvia, Lithuania, Portugal and Slovenia at different significance levels of 5% and 10%. It is noticeable that banking sectors in Greece, Portugal and Slovenia are the most sensitive to potential impact of bank-specific determinants on bank profitability measured by ROA. The macroeconomic determinants significantly affect the ROA in Belgium, Cyprus, France, Germany, Greece, Italy, Latvia, Lithuania, Portugal and Slovenia at significance level of 5% and 10%. The greatest effect of GDP on ROA is recorded in Greece (1.54%), while INF and UNM mostly decreased ROA in Slovenia (−1.15%) and (−1.14%). Finally, the relative impact of DEBT by 1% mostly declined ROA in Greece (−1.73%), Italy (−0.83%), Portugal (−1.16%), Slovenia (−1.36%) and Spain (−0.87%).

Table 10. Modelling ROA determinants by countries.

Country	Panel A:					Panel B:			
	Bank-Specific Determinants					Macroeconomic Determinants			
	NPL	CIR	NIM	NIF	NIT	GDP	INF	UNM	DEBT
Austria	−0.017 (0.013)	−0.001 (0.677)	0.001 (0.211)	0.005 (0.439)	0.004 (0.293)	0.011 (0.170)	−0.067 (0.468)	−0.013 (0.413)	−0.057 (0.251)
Belgium	−0.332 (0.041)	−0.351 (0.033)	0.356 (0.030)	0.37 (0.025)	0.365 (0.026)	0.359 (0.028)	−0.358 (0.027)	−0.339 (0.040)	−0.508 (0.015)
Cyprus	−0.957 (0.000)	−0.529 (0.001)	0.527 (0.001)	0.457 (0.013)	0.521 (0.002)	0.528 (0.001)	−0.509 (0.000)	−0.455 (0.013)	−0.654 (0.001)
Estonia	−0.104 (0.524)	−0.211 (0.279)	0.121 (0.470)	0.072 (0.726)	0.176 (0.283)	0.172 (0.291)	−0.166 (0.309)	−0.161 (0.328)	−0.227 (0.550)
Finland	−0.097 (0.551)	−0.158 (0.340)	0.125 (0.445)	0.128 (0.438)	0.184 (0.270)	0.148 (0.364)	−0.152 (0.352)	−0.109 (0.517)	−0.048 (0.792)
France	−0.268 (0.099)	−0.278 (0.092)	0.261 (0.113)	0.312 (0.061)	0.324 (0.053)	0.288 (0.077)	−0.322 (0.058)	−0.237 (0.175)	−0.408 (0.036)
Germany	−0.522 (0.001)	−0.549 (0.000)	0.543 (0.001)	0.577 (0.001)	0.594 (0.000)	0.563 (0.001)	−0.61 (0.000)	−0.587 (0.000)	−0.488 (0.006)
Greece	−1.777 (0.000)	−1.158 (0.000)	1.149 (0.000)	1.059 (0.000)	1.143 (0.000)	1.139 (0.000)	−1.132 (0.000)	−0.933 (0.002)	−1.727 (0.001)

Table 10. Cont.

Country	Panel A:					Panel B:			
	Bank-Specific Determinants					Macroeconomic Determinants			
	NPL	CIR	NIM	NIF	NIT	GDP	INF	UNM	DEBT
Ireland	−0.112 (0.507)	−0.007 (0.965)	0.016 (0.924)	0.057 (0.745)	0.016 (0.923)	0.015 (0.927)	−0.017 (0.918)	−0.028 (0.864)	−0.058 (0.730)
Italy	−0.416 (0.014)	−0.293 (0.073)	0.269 (0.101)	0.334 (0.051)	0.304 (0.063)	0.294 (0.071)	−0.289 (0.078)	−0.224 (0.228)	−0.634 (0.060)
Latvia	−0.567 (0.000)	−0.293 (0.000)	0.561 (0.001)	0.521 (0.002)	0.506 (0.003)	0.545 (0.001)	−0.549 (0.000)	−0.589 (0.000)	−0.783 (0.003)
Lithuania	−0.437 (0.007)	−0.534 (0.001)	0.432 (0.009)	0.406 (0.014)	0.398 (0.016)	0.414 (0.011)	−0.419 (0.010)	−0.448 (0.007)	−0.655 (0.013)
Luxembourg	−0.171 (0.297)	−0.401 (0.019)	0.179 (0.282)	0.333 (0.128)	0.245 (0.138)	0.225 (0.168)	−0.219 (0.181)	−0.212 (0.195)	−0.108 (0.743)
Malta	−0.176 (0.279)	−0.212 (0.201)	0.177 (0.279)	0.134 (0.438)	0.196 (0.234)	0.186 (0.256)	−0.173 (0.290)	−0.191 (0.247)	−0.011 (0.960)
Netherlands	−0.201 (0.217)	−0.244 (0.137)	0.248 (0.130)	0.17 (0.358)	0.247 (0.131)	0.239 (0.143)	−0.236 (0.148)	−0.233 (0.155)	−0.112 (0.569)
Portugal	−0.898 (0.000)	−0.885 (0.000)	0.873 (0.000)	0.888 (0.000)	0.908 (0.000)	0.889 (0.000)	−0.882 (0.000)	−0.839 (0.000)	−1.164 (0.000)
Slovenia	−1.208 (0.000)	−1.341 (0.000)	1.354 (0.000)	1.342 (0.000)	1.339 (0.000)	1.341 (0.000)	−0.135 (0.000)	−1.358 (0.000)	−1.364 (0.000)
Spain	−0.241 (0.138)	−0.248 (0.138)	0.234 (0.152)	0.206 (0.218)	0.242 (0.139)	0.235 (0.150)	−0.227 (0.166)	−0.074 (0.770)	−0.376 (0.067)

Similar findings are registered at measuring effects of bank-specific and macroeconomic determinants on ROE in eurozone in Table 11 from 2015 to 2020. The significant effect of NPL and CIR is recorded in Austria, Cyprus, Estonia, Germany, Greece, Ireland, Italy, Portugal, Slovenia and Spain at significance level of 5% and 10%. The highest effect of NPL is registered in Greece and Cyprus, where their growth declines ROE for 19.08% and 9.96%. Further, an increase in CIR by 1% leads to the highest change in ROE in Greece (−14.88%) and Portugal (−8.59%). When it comes to net income from interest, fees and commissions and trading assets, it can be seen that these factors significantly affect the ROE in only eight economies (Cyprus, Estonia, Germany, Greece, Ireland, Italy, Portugal and Slovenia) at significance levels of 5% and 10%. The growth of NIM, NIF and NIT for 1% mostly improves return on equity in Greece (14.40%) and Portugal (8.73%) at average level. Analyzing the macroeconomic determinants, it can be noticed that GDP significantly affects the ROA in Austria, Cyprus, Estonia, Finland, Germany, Greece, Ireland, Italy, Luxembourg, Portugal and Slovenia. The greatest effect of GDP is registered in Germany and Greece, where GDP growth rate of 1% enables higher ROE for 9.08% and 13.91%. The effect of inflation, unemployment and debt is not significant for ROE in economies such as Austria, Belgium, Finland, Ireland, Latvia, Lithuania, Luxembourg, Malta, Netherlands and Spain.

Table 11. Modelling ROE determinants by countries.

Country	Panel A:					Panel B:			
	Bank-Specific Determinants					Macroeconomic Determinants			
	NPL	CIR	NIM	NIF	NIT	GDP	INF	UNM	DEBT
Austria	−0.139 (0.031)	−0.066 (0.012)	0.004 (0.658)	0.082 (0.180)	0.045 (0.257)	0.148 (0.036)	−0.093 (0.277)	−0.108 (0.474)	−0.102 (0.025)
Belgium	−2.096 (0.163)	−1.879 (0.212)	2.296 (0.128)	2.125 (0.159)	2.367 (0.116)	2.317 (0.122)	−2.306 (0.126)	−2.155 (0.156)	−5.007 (0.009)
Cyprus	−9.963 (0.000)	−6.903 (0.000)	6.451 (0.000)	7.449 (0.000)	6.433 (0.000)	6.548 (0.000)	−6.271 (0.000)	−5.904 (0.000)	−8.833 (0.000)

Table 11. Cont.

Country	Panel A:					Panel B:			
	Bank-Specific Determinants					Macroeconomic Determinants			
	NPL	CIR	NIM	NIF	NIT	GDP	INF	UNM	DEBT
Estonia	−3.689 (0.015)	−6.649 (0.000)	4.043 (0.009)	5.707 (0.003)	4.283 (0.005)	4.269 (0.005)	−4.185 (0.006)	−4.139 (0.006)	−2.881 (0.408)
Finland	−0.727 (0.629)	−0.381 (0.802)	0.404 (0.789)	0.055 (0.971)	0.051 (0.974)	0.308 (0.837)	−0.248 (0.869)	−0.629 (0.687)	−1.851 (0.304)
France	−1.631 (0.277)	−1.249 (0.408)	1.702 (0.262)	1.389 (0.364)	2.155 (0.162)	1.805 (0.229)	−2.265 (0.149)	−1.381 (0.391)	−1.364 (0.000)
Germany	−5.689 (0.000)	−4.989 (0.001)	5.952 (0.000)	5.79 (0.000)	6.327 (0.000)	6.028 (0.000)	−6.674 (0.000)	−6.215 (0.000)	−7.179 (0.000)
Greece	−19.08 (0.000)	−14.84 (0.000)	13.976 (0.000)	15.255 (0.000)	13.972 (0.000)	13.913 (0.000)	−13.82 (0.000)	−12.27 (0.000)	−4.68 (0.013)
Ireland	−3.438 (0.028)	−2.531 (0.091)	2.541 (0.094)	3.236 (0.045)	2.704 (0.075)	2.792 (0.064)	−2.344 (0.120)	−2.302 (0.131)	−1.566 (0.312)
Italy	−4.363 (0.005)	−3.252 (0.030)	3.303 (0.030)	2.783 (0.077)	3.473 (0.021)	3.369 (0.025)	−3.294 (0.000)	−2.808 (0.101)	−9.452 (0.002)
Latvia	−2.383 (0.112)	−1.356 (0.377)	2.281 (0.131)	2.707 (0.080)	1.807 (0.245)	2.186 (0.145)	−2.245 (0.136)	−2.558 (0.103)	−6.435 (0.007)
Lithuania	−2.092 (0.163)	−0.853 (0.584)	1.994 (0.186)	2.198 (0.147)	1.741 (0.251)	1.867 (0.213)	−1.939 (0.197)	−2.181 (0.156)	−6.172 (0.010)
Luxembourg	−2.148 (0.155)	−2.023 (0.180)	2.419 (0.116)	0.762 (0.705)	2.795 (0.066)	2.614 (0.081)	−2.523 (0.094)	−2.487 (0.100)	−3.354 (0.267)
Malta	−1.176 (0.432)	−1.341 (0.370)	1.176 (0.435)	1.834 (0.247)	1.38 (0.362)	1.321 (0.378)	−1.142 (0.448)	−1.296 (0.392)	−1.774 (0.372)
Netherlands	−0.112 (0.940)	−0.76 (0.612)	0.437 (0.772)	1.477 (0.386)	0.503 (0.738)	0.428 (0.775)	−0.395 (0.793)	−0.365 (0.808)	−1.851 (0.304)
Portugal	−8.782 (0.000)	−8.593 (0.000)	8.646 (0.000)	8.667 (0.000)	8.901 (0.000)	8.702 (0.000)	−8.614 (0.000)	−8.299 (0.000)	−13.65 (0.000)
Slovenia	−5.751 (0.000)	−6.608 (0.000)	6.885 (0.000)	6.925 (0.000)	6.789 (0.000)	6.78 (0.000)	−6.924 (0.000)	−6.954 (0.000)	−7.179 (0.000)
Spain	−2.186 (0.145)	−2.945 (0.055)	2.127 (0.158)	2.558 (0.096)	2.214 (0.142)	6.781 (0.000)	−2.041 (0.176)	−0.844 (0.718)	−4.68 (0.013)

5. Conclusions

Aiming to fill the gap in the literature regarding the determinant of the banks' profitability in the eurozone our empirical study has measured bank-specific and macroeconomic determinants of banks' profitability in eurozone for quarterly data 2015–2020. The empirical analysis has included descriptive statistics, panel unit root tests and cross-section dependence tests. Within this empirical study, there are static and dynamic panel models that include pooled least squares, random-effects model and fixed-effects model and generalized method of moments.

The results of the Hausman test have confirmed that the random effects model is an adequate model to measure bank profitability determinants in the eurozone. The selected model's findings have identified a significant impact of bank-specific and macroeconomic determinants on the bank profitability measured by the ROA and ROE.

This implies that hypothesis H_0 can be accepted. The growth of the NPL by 1% leads to a smaller ROA and ROE for 0.03% and 0.18%, which means that hypothesis H_1 can be accepted. Our findings match the results of previous published studies [17,20,23,29,33,34,37,38]. Furthermore, if the CIR increases by 1%, the bank profitability indicators ROA and ROE will reduce by 0.01% and 0.14%, so H_2 can be accepted. The same inverse impact of this ratio was presented by Căpraru and Ihnatov [16] on a sample of banks in the CEE region. Dietrich and Wanzenried [29] confirmed that the cost-to-income ratio has a negative impact on banks' profitability in low-, middle- and high-income countries. The same finding as ours was shown also by Elekdag et al. [30] and Petria et al. [19]. The obtained results

have verified the positive impact of the net income from interest, fees and commissions and trading assets on bank profitability, thus we can accept hypotheses H3, H4 and H5. The growth of the NIM, NIF and NIT by 1% improves the ROA and ROE by 0.06% and 0.08% at an average level. A positive impact of diversification was also shown by Carbó Valverde and Rodríguez Fernández [33] and Demircuc-Kunt and Huizinga [34]. Analyzing the effect of macroeconomic determinants, the GDP growth of 1% enhances the ROA and ROE by 0.01% and 0.15%, which implies that H6 can be accepted. Our findings confirm previous study results. Conversely to the GDP, an increase of 1% in the INF, UNM and DEBT leads to smaller values of the ROA and ROE for 0.03% and 0.22% at an average level. Therefore, the developed hypotheses H7, H8 and H9 can be accepted. The impact of inflation was confirmed only in high-income countries by Dietrich and Wanzenried [29], other studies have shown a positive impact for this determinant. Unemployment rates and the debt ratio as determinants which are not considered by other studies, as expected, had a negative impact on the banks' profitability. Analyzing by country, the significant influence of bank-specific determinants on the ROA is registered in Belgium, Cyprus, Germany, Greece, Italy, Latvia, Lithuania, Portugal and Slovenia. The macroeconomic determinants significantly influence the ROA in Belgium, Cyprus, France, Germany, Greece, Italy, Latvia, Lithuania, Portugal and Slovenia at significance levels of 5% and 10%. When it comes to an influence on the ROE, a significance of bank-specific determinants was found in Cyprus, Estonia, Germany, Greece, Ireland, Italy, Portugal and Slovenia. On the other side, the selected macroeconomic determinants significantly affect the ROE in the economies of countries such as Cyprus, Germany, Greece, Portugal and Slovenia.

Bank profitability has implications for shareholders, customers, financial stability, regulatory compliance and investor confidence. Specifically, it plays a significant role in shaping the overall performance and stability of the banking sector. Bank profitability directly affects shareholders as it determines the return on their investment. Likewise, higher profitability may enable banks to offer competitive interest rates on deposits and lower borrowing costs which could have positive effects on their customers. Keeping in mind that the banking sector represents the most important sector in the financial system, bank profitability is crucial for financial stability. Adequate profitability enables banks to maintain a capital adequacy ratio, liquidity ratio and other regulatory requirements. Finally, profitability is a main indicator of a bank's financial state and can affect investor confidence.

The main contributions of this study are that by using a sample of banks operating in the eurozone, we are filling the gap in the literature on banks' profitability determinants, and furthermore, we introduce in our model two uncommonly used macroeconomic variables. On the national level, the findings of this study can be useful to policy makers and bank managers, since it gives them information on the most influencing determinants of the banks' profitability. Accordingly, banks must create procedures, policies and strategies in line with their macroeconomic environment [53]. The limitation of this research is that we have not included the effects of cycles in our analysis. Our recommendation for further research is to split the time series into three parts before, during and after the pandemic crisis in order to determine whether those findings are consistent with the findings of this research.

Author Contributions: Conceptualization, V.M., B.K., N.M., J.A. and M.D.; methodology, V.M. and J.A.; software, B.K.; validation, B.K., N.M. and M.D.; formal analysis, V.M., N.M. and J.A.; investigation, V.M., B.K., N.M., J.A. and M.D.; resources, B.K. and N.M.; data curation, N.M.; writing—original draft preparation, V.M., B.K., N.M., J.A. and M.D.; writing—review and editing, B.K. and M.D. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: Data are available on the websites of the National banks and on the World Bank Open Data database.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Klein, P.O.; Weill, L. Bank profitability and economic growth. *Q. Rev. Econ. Financ.* **2022**, *84*, 183–199. [\[CrossRef\]](#)
2. Batrancea, L.; Rathnaswamy, M.M.; Batrancea, I. A Panel Data Analysis of Economic Growth Determinants in 34 African Countries. *J. Risk Financ. Manag.* **2021**, *14*, 260. [\[CrossRef\]](#)
3. Peykani, P.; Sargolzaei, M.; Botshekan, M.H.; Oprean-Stan, C.; Takaloo, A. Optimization of Asset and Liability Management of Banks with Minimum Possible Changes. *Mathematics* **2023**, *11*, 2761. [\[CrossRef\]](#)
4. Saif-Alyosfi, A.Y.H. Determinants of bank profitability: Evidence from 47 Asian countries. *J. Econ. Stud.* **2022**, *49*, 44–60. [\[CrossRef\]](#)
5. Milojević, N.; Redžepagić, S. Expected effects of the revised exposure to banks Basel credit risk weighted assets standard. *Strateg. Manag.* **2021**, *26*, 49–60. [\[CrossRef\]](#)
6. De Rynck, S. Banking on a union: The politics of changing eurozone banking supervision. *J. Eur. Public Policy* **2016**, *23*, 119–135. [\[CrossRef\]](#)
7. Glöckler, G.; Lindner, J.; Salines, M. Explaining the sudden creation of a banking supervisor for the euro area. *J. Eur. Public Policy* **2017**, *24*, 1135–1153. [\[CrossRef\]](#)
8. Koutsomanoli-Filippaki, A.; Margaritis, D.; Staikouras, C. Profit efficiency in the European Union banking industry: A directional technology distance function approach. *J. Product. Anal.* **2012**, *37*, 277–293. [\[CrossRef\]](#)
9. Boeckx, J.; Dossche, M.; Peersman, G. Effectiveness and transmission of the ECB's balance sheet policies. *Int. J. Cent. Bank.* **2017**, *13*, 297–333. [\[CrossRef\]](#)
10. Burriel, P.; Galesi, A. Uncovering the heterogeneous effects of ECB unconventional monetary policies across euro area countries. *Eur. Econ. Rev.* **2018**, *101*, 210–229. [\[CrossRef\]](#)
11. Dominguez-Torres, H.; Hierro, L.Á. Are there monetary clusters in the Eurozone? The impact of ECB policy. *J. Policy Model.* **2020**, *42*, 56–76. [\[CrossRef\]](#)
12. Carnazza, G.; Liberati, P. The asymmetric impact of the pandemic crisis on interest rates on public debt in the Eurozone. *J. Policy Model.* **2021**, *43*, 521–542. [\[CrossRef\]](#)
13. González-Velasco, C.; García-López, M.; González-Fernández, M. Does sovereign risk impact banking risk in the Eurozone? Evidence from the COVID-19 pandemic. *Financ. Res. Lett.* **2022**, *47*, 102670. [\[CrossRef\]](#)
14. Castañeda, J.E.; Cendejas, J.L. Macroeconomic asymmetry in the Eurozone before and after the Global Financial Crisis: An appraisal of the role of the ECB. *J. Policy Model.* **2022**, *44*, 184–202. [\[CrossRef\]](#)
15. Kumar, V.; Thrikawala, S.; Acharya, S. Financial inclusion and bank profitability: Evidence from a developed market. *Glob. Financ. J.* **2022**, *53*, 100609. [\[CrossRef\]](#)
16. Câpraru, B.; Ihnatov, I. Banks' Profitability in Selected Central and Eastern European Countries. *Procedia Econ. Financ.* **2014**, *16*, 587–591. [\[CrossRef\]](#)
17. Horobet, A.; Radulescu, M.; Belascu, L.; Dita, S.M. Determinants of Bank Profitability in CEE Countries: Evidence from GMM Panel Data Estimates. *J. Risk Financ. Manag.* **2021**, *14*, 307. [\[CrossRef\]](#)
18. Le, T.D.; Ngo, T. The determinants of bank profitability: A cross-country analysis. *Cent. Bank Rev.* **2020**, *20*, 65–73. [\[CrossRef\]](#)
19. Petria, N.; Capraru, B.; Ihnatov, I. Determinants of Banks' Profitability: Evidence from EU 27 Banking Systems. *Procedia Econ. Financ.* **2015**, *20*, 518–524. [\[CrossRef\]](#)
20. Athanasoglou, P.; Brissimis, S.; Delis, M.M. Bank-specific, industry-specific and macroeconomic determinants of bank profitability. *J. Int. Financ. Mark. Inst. Money* **2008**, *18*, 121–136. [\[CrossRef\]](#)
21. Dietrich, A.; Wanzenried, G. Determinants of bank profitability before and during the crisis: Evidence from Switzerland. *J. Int. Financ. Mark. Inst. Money* **2011**, *21*, 307–327. [\[CrossRef\]](#)
22. Goddard, J.; Molyneux, P.; Wilson, J.O.S. The profitability of european banks: A cross-sectional and dynamic panel analysis. *Manch. Sch.* **2004**, *72*, 363–381. [\[CrossRef\]](#)
23. Kanas, A.; Vasiliou, D.; Eriotis, N. Revisiting bank profitability: A semi-parametric approach. *J. Int. Financ. Mark. Inst. Money* **2012**, *22*, 990–1005. [\[CrossRef\]](#)
24. Sufian, F. Profitability of the Korean Banking Sector: Panel Evidence on Bank-Specific and Macroeconomic Determinants. *J. Econ. Manag.* **2011**, *7*, 43–72.
25. Tan, Y.; Floros, C. Bank profitability and inflation: The case of China. *J. Econ. Stud.* **2012**, *39*, 675–696. [\[CrossRef\]](#)
26. Figlewski, S.; Frydman, H.; Liang, W. Modeling the effect of macroeconomic factors on corporate default and credit rating transitions. *Int. Rev. Econ. Financ.* **2012**, *21*, 87–105. [\[CrossRef\]](#)
27. Marcikic Horvat, A.; Milenković, N.; Radovanov, B.; Zelenović, V.; Milić, D. DEA efficiency of Serbian banks- comparison of three approaches. *Ann. Fac. Econ. Subot.* **2022**, *59*, 19–35. [\[CrossRef\]](#)
28. Milenković, N.; Radovanov, B.; Kalaš, B.; Horvat, A.M. External Two Stage DEA Analysis of Bank Efficiency in West Balkan Countries. *Sustainability* **2022**, *14*, 978. [\[CrossRef\]](#)
29. Dietrich, A.; Wanzenried, G. The determinants of commercial banking profitability in low-, middle-, and high-income countries. *Q. Rev. Econ. Financ.* **2014**, *54*, 337–354. [\[CrossRef\]](#)
30. Elekdag, S.; Malik, S.; Mitra, S. Breaking the Bank? A Probabilistic Assessment of Euro Area Bank Profitability. *J. Bank. Financ.* **2020**, *120*, 105949. [\[CrossRef\]](#)
31. Olson, D.; Zoubi, T.A. Efficiency and bank profitability in MENA countries. *Emerg. Mark. Rev.* **2011**, *12*, 94–110. [\[CrossRef\]](#)

32. Chiesa, G.; Mansilla-Fernández, J.M. The dynamic effects of non-performing loans on banks' cost of capital and lending supply in the Eurozone. *Empirica* **2021**, *48*, 397–427. [\[CrossRef\]](#)
33. Carbó Valverde, S.; Rodríguez Fernández, F. The determinants of bank margins in European banking. *J. Bank. Financ.* **2007**, *31*, 2043–2063. [\[CrossRef\]](#)
34. Demircuc-Kunt, A.; Huizinga, H. Bank activity and funding strategies: The impact on risk and returns. *J. Financ. Econ.* **2010**, *98*, 626–650. [\[CrossRef\]](#)
35. Batrancea, L.M.; Balci, M.A.; Akguller, O.; Gaban, L. What Drives Economic Growth across European Countries? A Multimodal Approach. *Mathematics* **2022**, *10*, 3660. [\[CrossRef\]](#)
36. Batrancea, L.M.; Rathnaswamy, M.K.; Batrancea, I. A Panel Data Analysis o Determinants of Economic Growth in Seven Non-BCBS Countries. *J. Knowl. Econ.* **2022**, *13*, 1651–1665. [\[CrossRef\]](#)
37. Davis, E.P.; Karim, D.; Noel, D. The effects of macroprudential policy on banks' profitability. *Int. Rev. Financ. Anal.* **2022**, *80*, 101989. [\[CrossRef\]](#)
38. Ramlall, I. Does geographical proximity matter in determining the profitability of banks? *J. Policy Model.* **2022**, *44*, 1251–1279. [\[CrossRef\]](#)
39. Guillén, J.; Rengifo, E.W.; Ozsoz, E. Relative power and efficiency as a main determinant of banks' profitability in Latin America. *Borsa Istanbul. Rev.* **2014**, *14*, 119–125. [\[CrossRef\]](#)
40. Khue, N.N.D.; Lai, Y.-W. Threshold Effects of Inflation on the Banking Sector Performance. *Rom. J. Econ. Forecast.* **2020**, *23*, 117–133.
41. Lane, P.R. The European Sovereign Debt Crisis. *J. Econ. Perspect.* **2012**, *26*, 49–68. [\[CrossRef\]](#)
42. Louzis, D.P.; Vouldis, A.T.; Metaxas, V.L. Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. *J. Bank. Financ.* **2012**, *36*, 1012–1027. [\[CrossRef\]](#)
43. Djalilov, K.; Piesse, J. Determinants of bank profitability in transition countries: What matters most? *Res. Int. Bus. Financ.* **2016**, *38*, 69–82. [\[CrossRef\]](#)
44. Hamiye Beyaztas, B.; Bandyopadhyay, S. Robust estimation for linear panel data models. *Stat. Med.* **2020**, *39*, 4421–4438. [\[CrossRef\]](#) [\[PubMed\]](#)
45. Bell, A.; Fairbrother, M.; Jones, K. Fixed and random effects models: Making an informed choice. *Qual. Quant.* **2018**, *53*, 1051–1074. [\[CrossRef\]](#)
46. Brooks, C. *Introductory Econometrics for Finance*, 4th ed.; Cambridge University Press: Cambridge, UK, 2019.
47. Arellano, M.; Bond, S. Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *Rev. Econ. Stud.* **1991**, *58*, 277–291. [\[CrossRef\]](#)
48. Breitung, J.; Pesaran, M.H. Unit Roots and Cointegration in Panels. In *The Econometrics of Panel Data. Advanced Studies in Theoretical and Applied Econometrics*; Mátyás, L., Sevestre, P., Eds.; Springer: Berlin/Heidelberg, Germany, 2008; Volume 46, pp. 279–322. [\[CrossRef\]](#)
49. Bell, A.; Jones, K. Explaining Fixed Effects: Random Effects Modeling of Time-Series Cross-Sectional and Panel Data. *Political Sci. Res. Methods* **2015**, *3*, 133–153. [\[CrossRef\]](#)
50. Baltagi, B.H.; Feng, Q.; Kao, C.A. Lagrange multiplier test for cross-sectional dependence in a fixed effects panel data model. *J. Econom.* **2012**, *170*, 164–177. [\[CrossRef\]](#)
51. Herwartz, H.; Siedenburg, F. Homogenous panel unit root tests under cross sectional dependence: Finite sample modifications and the wild bootstrap. *Comput. Stat. Data Anal.* **2008**, *53*, 137–150. [\[CrossRef\]](#)
52. Batrancea, I.; Batrancea, L.; Rathnaswamy, M.M.; Tulai, H.; Fatacen, G.; Rus, M.I. Greening the Financail System in USA, Canada and Brazil: A Panel Data Analysis. *Mathematics* **2020**, *8*, 2217. [\[CrossRef\]](#)
53. Radovanov, B.; Milenković, N.; Kalaš, B.; Marcikić Horvat, A. Do the Same Determinants Affect Banks' Profitability and Liquidity? Evidence from West Balkan Countries Using a Panel Data Regression Analysis. *Mathematics* **2023**, *11*, 4072. [\[CrossRef\]](#)

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.