

Determinants of credit risk: Case of commercial banks in Albania

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To cite this article:

Hasa, B., & Hysaj, A. (2025). Determinants of credit risk: Case of commercial banks in Albania. *Romanian Journal of Economics*, 61(2), pp. 160-173.

Abstract. The financial system in Albania has experienced substantial change. With the banking system being the cornerstone of Albania's financial system and operating in a global setting, this industry is evolving quickly. The foundation of the health of the financial system is the assessment of banks' credit risk. Since the global financial crisis, many professionals have been much more interested in credit risk. Analysing the variables that affect credit risk in the banking system is an essential part of managing credit risk. Using panel analysis, this article aims to evaluate the credit risk of ten banks doing business in Albania between 2012 and 2022. This article employs secondary data, and the data were analysed using the random effect model. According to the model's outcome, three of the four factors are statistically significant in predicting an Albanian bank's credit risk. The model outcomes imply that the capital adequacy ratio positively influences credit risk, while increased profitability and greater cost inefficiency work to lower credit risk exposure. Bank size is determined to be a non-significant driver of credit risk, regardless of the confidence level used. At the 90 and 95% significance levels, the model is statistically significant overall. Moreover, this research will improve the incentives for many individuals, including bank supervisory authorities, bankers, and the financial sector at large.

Keywords: credit risk; banking system; non-performing loans (NPL); Albania; bank specific factors
JEL classification: G21, G33, E44, C33

1. Introduction

This article seeks to analyse the bank specific factors impacting credit risk of the banking system in Albania. The financial system in Albania has gone through great changes. Operating in a global environment and because the banking system serves as the cornerstone of Albania's financial system, this industry is changing and growing rapidly. Credit risk is an important factor when it comes to determining financial stability for the country as a whole and consequently affecting economic growth and progress. Based on other studies done by Zheng et al. (2018) and ALrfai et al. (2022) the Non-Performing Loans (NPL) is the most commonly used measure regarding credit risk. Thus, NPLs will be utilized as the proxy of credit risk. The factors impacting NPLs in the literature are classified to macroeconomic and bank-specific factors but given the composition of our sample this study focuses on micro factors, as all banks are operating in Albania, hence subject to the same macro climate.

Many authors have given their definitions when it comes to credit risk, and one of the most common definitions is by the Basel Committee on Banking Supervision (2016). According to that, the credit risk is the probability that the counterparty or else bank borrower defaults paying its bills according to the terms agreed upon, which would result in a loss for the lender. Risk is defined by Merton (1974), as "the likelihood of loss". Credit risk entails the potential loss of income resulting from the counterparty's failure to make payments on time or in full as stipulated in the contractual agreement. Credit risk stands out as the primary factor leading to the downfall of banks, representing the most apparent challenge targeting bank executives (Poon et al., 2009). As stated by Rose & Hudgins (2018),

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the potential for certain assets of a financial organization, especially its loans, will decrease in value and potentially become valueless. According to Basel Committee on Banking Supervision (2016), NPLs are defined as loans, for which the borrowers have not succeeded to meet expected liabilities in the determined periods.

In Albania private and state-owned banks. The first privately owned bank was created after the fall of the previous system in 1993 and their number has grown significantly since then. According to the Bank of Albania, as of 2024, In Albania, there are 11 private banks. This study will focus on 10 banks because of a lack of historical information.

There are many papers that aim to analyse the credit risk in the Albanian banks. However, many of them focus mostly on macroeconomic variables or they do not include into analysis the past years. A better understanding of factors determining the credit risk is crucial given the dynamism of the financial industry and the advancement of financial technology. Out of 11 operating banks, 10 banks are subject of this study, because OTP Bank is a new bank in Albania and there is a lack of historical data.

This paper is aimed to answer questions regarding the determining factors of credit risk and factors affecting NPLs. This article seeks to evaluate and pinpoint the factors that influence credit risk, when we use NPLs as proxy, and check if there are any significant relationships between banks specific factors and NPLs. Consequently, the study's objective is to determine how bank-specific characteristics influence non-performing loans for Albania's secondary banks. By achieving this objective, the study contributes valuable insights to practitioners, policymakers, and scholars aiming to gain a more profound insight into the variables influencing credit risk.

2. Literature review

This section provides a broad outline and description of the studies focusing on the major factors affecting credit risk. Since the primary objective of this study is to analyse credit risk and its determinants, this section is particularly focused on the review of research articles on this topic. Considering the fact that the developing world's financial system is mainly represented by the banking system, effective credit risk management is a necessity for the stable functioning of the financial economy. Albania's financial sector comprises banks, investment funds, pension funds, savings and loan organizations, and non-banking financial entities (Gjini & Koprencka, 2021). In Albania, financial intermediation primarily occurs through the banking system, as there is not a stock exchange for trading shares and bonds issued by companies (Baholli et al., 2015).

Previous literature takes into consideration four measures of banks' asset quality used as proxy. Beck et al. (2013) stated that these measures are the creation of loan loss provisions (LLPs), loss given default (LGD), and expected default frequencies (EDF) and non-performing loans. According to the same authors, the most commonly used indicators or substitutes for credit risk found in the previous literature are LLPs and NPLs. This article uses the last one because of data accessibility. In regards to the study, NPLs will be utilized as the representation for credit risk. NPLs are loans for which the borrowers have failed to repay the principal and interest as per the agreed terms (Beck et al., 2013). An analysis of the ratio of non-performing loans defines the evaluation of the quality of the loan portfolios of banks as well as its capacity to effectively control the credit risk (Nyong'o, 2014). From certain issues pertaining to the banks themselves to wider macroeconomic conditions, credit risk in commercial banks is modelled by a range of factors (Twum et al., 2021). Additional factors are related to GDP growth rate, prices, interest rates and exchange rates changes which are likely to impact the credit risk significantly.

Louzis et al. (2014) highlights that the conduction of further research of both internal and external factors affecting credit risk contributes in having a better insight. They highlight the significant effect of macroeconomic variables on credit risk. Additionally, they highlight specific bank-related factors such as banks total assets, profitability ratio, capital ratio, net interest margin, return on equity (ROE), inefficiency, return on assets (ROA), ownership concentration, debt, and others. Many research papers about factors that determine credit risk have been conducted in Albania (Baholli et al., 2015; Gabeshi, 2017; Gremi, 2015; Hysaj, 2023; Koprencka et al., 2018; Kurti, 2016; Shingjergji and Shingjergji, 2013).

Bank-specific factors

Extensive research in literature has examined the relationship between characteristics specific to banks and the level of credit risk they face. Chaibi & Ftiti (2015) examined how a set of commercial banks' specific factors affected their non-performing loans (NPLs). When assessing credit risk, it is essential to examine bank-specific characteristics as they have a direct impact on a bank's capacity to control and reduce the risks connected to its lending operations.

The profitability ratio

Profitability ratios are financial indicators utilized to measure a company's capacity to make profits comparative to its income, equity, assets, and other variables. Profitability ratios give information regarding a company's operational efficiency and overall financial health. Profitability is a significant factor in assessing credit risk. Louzis et al. (2014) investigated the link between profitability and non-performing loans (NPLs) through the bad management hypothesis, which demonstrates a reverse connection between banks' profitability and NPLs. Similarly, studies by Asfaw & Veni (2015) and Zheng et al. (2018) identified an inverse correlation among bank profitability and credit risk. Research by Naili and Lahrichi (2022) and Gabeshi (2017) further supports these findings, suggesting that higher profitability can contribute to the deduction of the credit risk. Profitable banks are more likely to avoid excessive risks, thereby enhancing their credit quality (Ghosh, 2015).

Alternatively, a study of García-Marco & Robles-Fernández (2008) indicated a positive association among profitability ratio and non-performing loans. Other researchers, Jabbouri & Naili (2019), Louzis et al. (2012), Muhammed et al. (2023), Naili & Lahrichi, (2022) have concluded that the profitability ratio and NPLs have a significant positive relation. The conflicting perspectives highlight the issue of whether the level of bank profitability has an impact on the number of NPLs, so there is the need for this relationship to be studied further and necessitating a more thorough analysis.

The existing literature commonly indicates a negative significant connection between ROA and NPLs. Allayannis (2001) implies that companies with higher ROA are less prone to insolvency. Studies conducted demonstrate a significant negative relationship of ROA on credit risk and NPLs (Al-Eitan & Bani-Khalid, 2019). Similarly, analysing the Turkish banking system shows a negative correlation among credit risk and ROA (Ekinci, 2019). Ozili (2019) demonstrates the existence of a significant correlation between ROA and NPLs, where a high ROA shows that the bank is profitable, but this profit can indicate a low NPLs level. Similarly, according to Nugrohowati & Bimo (2019), ROA has a negative impact on NPL. These conclusions are corroborated by research carried out by Radivojevic and Jovovic (2017) and Messai and Jouini (2013).

Other researchers such as Barra & Ruggiero (2023) in their study conducted about Italy, found a positive relationship between ROA and NPLs. The reason for this positive correlation is that banks with high ROA could use aggressive lending practices in an effort to increase profits. This could involve lending to even riskier borrowers or sectors, which may result in higher NPLs over time. Additionally, a strong economy could lead to higher ROA and greater borrower confidence, encouraging more borrowing. However, this also increases the risk of default if economic conditions suddenly decline (Berger & Udell, 2002).

The capital adequacy ratio

The capital adequacy ratio gauges a bank's financial stability by assessing its capital in relation to its risk-adjusted assets. CAR is computed by separating the bank's capital by its risk-weighted assets and is designed to ensure that the bank can absorb potential losses (El-Ansary & Hafez, 2015). Banks with lower levels of capital are more exposed to risks than those with stronger financial foundations (Martínez-Malvar & Baselga-Pascual, 2020). The CAR is a significant indicator when analysing the factors influencing credit risk (Mekonnen et al., 2020).

It is theorized that CAR has a negative significant impact on NPLS, which is backed up by a study done by Tangngisalu et al. (2020) and Afriyanto et al. (2021). On the other hand, a study done by Irawan & Syarif (2019) showed that CAR had no significant effect on NPLs in the banking sector. Also, this result is related to similar conclusions previously conducted by Malimi (2017) and Shingjergji and Shingjergji (2013) when the last researcher did a study regarding Albania, and this study will test the same relationship with new and updated data. Also, studies conducted by Naili & Lahrichi (2022) and

Jabbouri & Naili (2019) support the fact that the capital adequacy ratio and non-performing loans have a substantial negative relationship.

But on the other hand, there are studies showing a positive significant effect between the capital adequacy ratio and NPLs (Barra & Ruggiero, 2023; Muhammed et al., 2023; Radivojevic & Jovovic, 2017). This can be explained as banks with higher capital adequacy ratio might feel more comfortable taking on riskier loans, assuming that their ample capital buffers can absorb potential losses. Or banks with strong capital positions might delay recognizing non-performing loans on their balance sheets, as they have the financial capacity to absorb potential losses without immediate repercussions. This delay in recognizing NPLs could artificially inflate the reported CAR while masking underlying credit quality issues (Parrado-Martínez et al., 2019).

The bank size

Bank size generally pertains to the total assets or the overall scope of a bank's operations, commonly assessed by the value of the assets it manages. This indicator, calculated as the log of total assets, is anticipated to positively influence bank profitability, as it reflects the extent of banking activity within the country (Kishan & Opiela, 2000). Bank size typically includes different elements of a bank's operations and resources. It is commonly measured by factors such as total assets, deposits, loans, and the number of branches or employees (Berger & DeYoung, 1997). Sinkey Jr (2000) proposes that the primary factor determining why trading activities are most of the time confined or more dominated by the largest banks and why only banks of a certain magnitude can enter the banking market is bank size. According to Bhagat et al. (2015), big banks possess a wide range of borrowers spanning multiple industries, which helps with lowering total risk. The diversified portfolio of customers reduces the influence of potential default by individual borrowers or businesses and lessens banks' vulnerability to specific risks. As a result, bigger banks are more capable of preserving the steadiness of their lending portfolios while controlling credit risk.

Numerous researchers have analysed the connection between bank size and non-performing loans (NPLs). The size of a bank is a commonly used term that refers to the scale of a financial institution and it is measured by its total assets. Bank size is an important component of its activities, power and even influence on the financial system and it is regarded by total assets, total profits, total sales, and other metrics (Brigham & Houston, 2013).

Prior studies conducted conclude that bank size has positive relationship with NPLs (Barus, 2016; Gabeshi, 2017; Irawan & Syarif, 2019; Muhammed et al., 2023). This is because larger institutions have a larger number of clients and hence have a larger number of loans which are done by people in different states, markets and sectors. This diversification may lead to an increase in operational management problems and in the decentralization of credit risks and hence worse credits that may raise the NPLs ratio (Berger & DeYoung, 1997).

Conversely, existing literature suggests that several other studies report a significant negative relationship. Between bank size and NPLs (Antony & Suresh, 2023; Jabbouri & Naili, 2019; Louzis et al., 2012; Naili & Lahrichi, 2022; Salas & Saurina, 2002). Larger banks are found to have more resources and capacity to extend their loans across a number of industries and regions. This diversification should lessen the impact of downturn in one particular industry. This diversification should lessen the impact of downturn in one particular industry or regional shocks, reducing the overall level of NPLs (Bikker, 2002).

The cost inefficiency

In the context of banks, inefficiency implies misappropriation of resources leading to increased costs and reduced productivity across the industry. Such a bank is said to be inefficient as it lacks the managerial and organizational capability to operate effectively which arrested the performance of the institution on the whole. It has been pointed out that inefficiency can occur in various processes and functional aspects of a bank's activities and operations Acemoglu (2006); Mekonnen et al. (2020) further 'investigated the efficiency ratio and its importance' in their work.

The bad luck hypothesis is a theory arguing that some unpredictable events like the recession cause the NPLs rise. This theory aligns with the proposed relationship between ineffectiveness and the variables of interest. Banks during these economic recessions have been noted to have their cost

efficiency level lowered due to increase in management efforts leading to more cost of operation (Berger & DeYoung, 1997). This further validates the presence of a meaningful and negative causal connection between inefficiency and non-performing loans (NPLs).

In contrast with the two the skimping hypothesis has equally different views where it indicates a negative correlation between non-performing loans (NPLs) and the efficiency of banks. This theory indicates that well performing banks practice economising where they spend little effort on the adequate amount necessary to maintain the quality of loans and enhance the customer evaluation (Louzis et al., 2012). The authors state that poor management in banks may result in ineffective strategies leading to high levels of NPLs. This could include lack of adequate collaterals, poor credit rating, and little supervision of the borrowers.

Kwan & Eisenbeis (1997) pointed out a link between bank risk and its capital, as well as its efficiency. They concluded that there is a direct connection between inefficiency and both the risk taken by the bank and the capital held. The findings by Muhammed et al. (2023), Naili & Lahrichi (2022), and Louzis et al. (2012) demonstrate a negative correlation between inefficiency and non-performing loans. For example, credit-rationing inefficient banks tend to spend more resources on monitoring and analysing credit than allocative efficient banks. This enhanced focus on risk management can deduct the NPLs (Casu et al., 2006).

However, there are other studies such as Jabbouri & Naili (2019) or Salas & Saurina (2002) which have identified a positive relationship between these two factors and growth of banks. The inappropriate amount of administrative costs or poor use of new technology leads to leakage of bank resources which negatively affects credibility of the bank without maintaining adequate costs (Brigham, & Houston, 1996).

To address the gaps identified in the literature review the following hypotheses will be tested:

- H1: There is a significant relationship between ROA and non-performing loans.
- H2: There is a significant relationship between the capital adequacy ratio and non-performing loans.
- H3: There is a significant relationship between bank size and non-performing loans.
- H4: There is a significant relationship between inefficiency and non-performing loans.

3. Methodology and data

This section aims to describe the research methods applied to the study. The research's data set is quantitative. This research analyses ten out of eleven commercial banks operating in Albania. To determine the factors influencing credit risk, a linear regression analysis will be conducted using data from the periodical reports published by banks. The study includes a total of 110 observations and covers the years 2012 through 2022. Panel data will be used to estimate the regression. The utilization of panel data is recommended because this model allows the combination of data for several banks (cross section effect) and various periods (time series). The choice between a fixed effect model (FEM) and a random effect model (REM) will be determined through the Hausman test. The difference between the random and fixed effect model stands on the fact that REM considers the unobserved effect of independent variables as part of the error term, while FEM considers the unobserved effect of independent variables as correlated with independent variables.

The random effect model was found to fulfil all of the basic assumptions related to panel data analysis after the gathered data was examined and statistical tests were run. Excel is used for information analysis to compute the necessary financial ratios, and E-views 10 is utilized to estimate regression.

According to the theory and the empirical literature examined by the authors, Non-Performing Loans (NPL) serve as an indicator of credit risk. The nonperforming loans ratio is calculated by dividing the total NPLs of the bank by the total gross loans (Salas & Saurina, 2002). The regression model of the present study, which is specific to the banks, is built using the four explanatory variables which include return on assets, capital adequacy ratio, size of the bank and cost-inefficiency ratio.

- The ratio of nonperforming loans is determined by dividing the entire amount of NPLs in the bank by the total gross loans (Salas & Saurina, 2002).
- Size of bank: A bank's size is computed by the natural logarithm of its total assets (Zheng et al., 2018).

- The capital adequacy ratio reflects the amount of capital a bank must set aside in relation to its riskier assets. It is computed by dividing the total capital by the total risk-adjusted assets (ALrfai et al., 2022).
- Cost inefficiency: Bank inefficiency is the operational profit to operating expense ratio (Louzis et al., 2012).
- Return on assets: The ROA is computed by dividing earnings by the total assets (Zheng et al., 2018).

Descriptive statistics

Table 1 provides information on each variable, with the mean (which represents the dataset's average or central value), the standard deviation, and the lowest and highest values (which shows how each variable's dataset deviates from its corresponding mean) all provided.

Table 1. Descriptive statistics

	NPL	SIZE	CAR	ROA	INEFFICIENCY
Mean	0.3588	7.8796	0.1823	0.0083	0.6503
Median	0.1151	7.9110	0.1722	0.0090	0.5600
Maximum	22.7600	8.7781	0.4213	0.0353	1.9019
Minimum	0.0081	6.7927	0.1010	-0.0370	0.3320
Std. Dev.	2.2541	0.5253	0.0544	0.0112	0.2939

Source: Authors' calculations.

ROA: The typical second-tier bank in Albania, has a return on assets of 0.83%, meaning that for each ALL in the total assets of the bank, a return of 0.0083 ALL is generated for shareholders. The median for ROA is 0.0090, capturing the middle value once observations are ranked in increasing order. The best performance in terms of profitability is recorded at ROA equal to 3.53 % points. The worst performance in terms of profitability is recorded at ROA equal to -3.70 % points, meaning a negative return. The standard deviation is considerable, which is also reflected by the range - the difference between the minimum and maximum values. This suggests a diverse, heterogeneous sample.

CAR: A bank's current capital is determined and presented as a proportion of its risk-weighted credit exposures using the capital adequacy ratio (CAR). The capital adequacy ratio for commercial banks in Albania has a mean of 0.1823. The max value for this ratio is 0.4213 and the minimum value is 0.101.

SIZE: For the calculation of the bank's size is used the log of its total assets. 7.778 is the average value for this variable and the highest value of 8.78 and the lowest value of 6.7927. The standard deviation has a value of approximately 0.5253 which is lower compared with the minimum and maximum values.

INEFFICIENCY: A crucial financial metric that is primarily employed in the appraisal of banks is the cost-to-income ratio. It displays the expense-to-income ratio of a business. This regressor displays a mean value of 0.6503. From lowest to highest, the values are as follows: min: 0.3320, max: 1.9019. The variable's standard deviation is 0.2939.

NPL: An outstanding debt for which the borrower has not made any scheduled payments or interest payments for a predetermined amount of time is known as a nonperforming loan (NPL). It has a standard deviation value equal to 2.254 which is between minimum and maximum even though the highest and lowest locations are significantly different from one another, indicating high variability of the credit risk among banks.

Random Sampling and Normality Assumption

The traditional linear model's normality assumption asserts that error terms are uniformly distributed and independent across the model. The Jarque-Bera test and histogram analysis can be used to verify this theory.

The total sample size for the empirical analysis consists of 110 observations. That said, the Law of Large Numbers, and especially to the Central Limit Theorem, infers the bell-shaped distribution of our variables (especially NPL which is the dependent variable). As such theorems suggest, for samples

of more than 30 observations normal distribution can be inferred. Also, in terms of random sampling, this study is considering all second-tier banks currently operating in the Republic of Albania with one exception: OTP, as it is established only in 2018 hence it would shrink our sample size.

The model

The connection between credit risk and its factors will be assessed using the random effect model:

$$NPL_{it} = \beta_0 + \beta_1 * CAR_{it} + \beta_2 * SIZE_{it} + \beta_3 * INE_{it} + \beta_4 * ROA_{it} + u_{it} + \epsilon_{it} \quad (1)$$

where *i* represents the banks; *t* denotes the years; NPL - nonperforming loans ratio (%) is the dependent variable; regressors are: CAR - capital adequacy ratio (%), Size - logarithm of total assets which are shown in ALL currency, ROA - return on assets, profitability ratio (%), and INE - inefficiency ratio - cost to income ratio (%). Also, β_0 represents the constant term, $\beta_1, \beta_2, \beta_3, \beta_4$ represent the coefficients of the independent variables, μ_i represents the bank-specific unobserved effect and ϵ_{it} represents the error term.

As data sources are used the annual financial reports or financial statements that each bank has published from 2012 until 2022. The statements are prepared in Albanian Lek (ALL) currency

4. Research results and comments

The results of the regression model are evaluated and discussed in this chapter. There are two parts. The required robustness check for our model is covered in the first part. The econometric model for normal distribution, stationarity, heteroskedasticity, serial correlation, and correlation will be tested. The analysis and interpretation of estimation output will be the main topics of this section.

Preliminary checks

Unit Root

Out of the eleven second-tier banks that are operating in Albania, ten banks are chosen. The chosen variables in E-Views10 are renamed, and then each one is opened separately to produce the Unit Root test under the View category.

Table 2. Unit root output

Variable	Test	T-stat	Prob. Value
CAR	Philips Perron	30.22	0.066
Inefficiency	Philips Perron	36.43	0.013
ROA	Philips Perron	56.59	0
Bank Size	Philips Perron	60.08	0
NPL (credit risk)	Philips Perron	50.44	0

Source: Authors' calculations.

Before moving on to the proper regression form, the first assumption is the stationarity of variables, which indicates that the variance and mean of the variables demonstrate stability. This paper uses an unbalanced data set, collected for 10 banks and 11 years, hence one concern is to check whether variables exhibit long-term memory behaviour. The Philips Perron Test will be used to look for a unit root or non-stationarity in the series. Each of the five variables is tested, and the findings indicate that the null hypothesis supporting a unit root may be rejected in the following ways: for the capital adequacy ratio, it can be rejected with 90% confidence. It can be rejected with 90 and 95% confidence at the cost inefficiency level. The null hypothesis supporting non-stationarity for ROA may likewise be disproved at any of the standard significance levels, including 90, 95, and 99%. The logarithm of assets, which measures bank size, requires differentiation. For the dependent variable, the null hypothesis of

nonstationary can be rejected at all conventional significance levels. Therefore, the spurious regression problem is unlikely to arise.

Multicollinearity

Using EViews 10, the correlation matrix has been created to check whether there are any traces of perfect collinearity between the regressors. Four regressors were chosen for the final regression equation: size, which was represented by the logarithm of total assets; profitability, which was represented by ROA; cost inefficiency, which was represented by costs relative to revenues; and capital adequacy ratio. As Table 3 shows, there are no indications of multicollinearity among the four independent variables because the correlation coefficient for each pair is less than 0.8, the threshold established by the literature. This assumption is fulfilled, nevertheless.

Table 3. Multicollinearity

	Sized	Inefficiency	ROA	CAR
Sized	1.000			
Inefficiency	-0.075	1.000		
ROA	0.063	-0.579	1.000	
CAR	-0.065	0.082	-0.129	1.000

Source: Authors' calculations.

Hausman test

As the results of the Hausman test suggest, regardless of the significance level employed for the analysis (1,5,10 %), the final verdict remains the same: in favour of running a Random Effects Model. Hence, REM is preferred over FEM (fixed effects model) for the sake of our empirical analysis in the case of the banking sector in Albania.

H0: The Random Effect Model is appropriate.

Ha: The Fixed Effect Model is appropriate.

Table 4. Hausman test

Correlated Random Effects – Hausman Test

Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	5.3491	4	0.2533

Source: Authors' calculations.

Zero conditional mean

The exogeneity of the explanatory variables is the main focus of this assumption. The expected error value through this test should be very near to zero. It will be evident from this test whether or not unbiased estimators are obtained. The sum of the residuals seems to be close to zero, indicating that cases of overestimation and underestimation tend to cancel each other out. Also, the residuals exhibit approximately 0 correlations with the regressors of our equation. This implies that the model has no hints of any forms of misspecification. Zero conditional mean assumption is also satisfied.

Table 5. Mean value of residuals

RESID01	
INEFFICENCY	-0.003
ROA	-0.005
SIZED	0.001
CAR	0.004
RESID01	

Mean	-9.02E-05
Sum	-0.0084

Source: Authors' calculations.

Heteroscedasticity

The next assumption to be tested is heteroskedasticity. If the model demonstrates homoscedasticity, it indicates that it is unbiased, with the error term maintaining a consistent variance across the range of the explanatory variable.

Table 6. Heteroscedasticity test

Breuch Pagan heteroscedasticity test	
F-statistic	0.1072

Source: Authors' calculations.

Serial correlation

Serial correlation measures the dependency among residuals. If our model exhibits correlation with its lagged values over time, it is affected by autocorrelation.

Table 7. Test of residuals autocorrelation

Serial correlation LM test	
F-stat	0.5025

Source: Authors' calculations.

The estimation of the final model is done using heteroscedasticity autocorrelation consistent standard errors, hence both assumptions are automatically satisfied. It was needed to convert from OLS, to consistent standard error due to initial problems with heteroscedasticity. As the probability values above show, finally, both assumptions were satisfied, regarding serial correlation and heteroscedasticity.

Empirical results

The estimation is carried out using the Random Effect Model, which is deemed the most appropriate. This study uses consistent standard errors hence accounting for potential heteroscedasticity and serial correlation.

Table 8. Estimation output

Dependent Variable: NPL				
Method: Panel EGLS (Cross-section random effects)				
White cross-section standard errors & covariance (d.f. corrected)				
Variable	Coeff	Std. Error	t-Stat	Prob.
SIZE	-0.019	0.018	-1.059	0.292
CAR	0.175	0.098	1.779	0.079
ROA	-3.408	1.477	-2.307	0.023
Cost Inefficiency	-0.097	0.037	-2.614	0.01
C	0.186	0.037	4.944	0
Weighted Statistics				
R-sqr	0.149			
Adj R-sqr	0.111			
F-stat	3.874			
Prob(F-stat)	0.006			

Unweighted Statistics				
R-sqr	0.157			
Sum sqr resid	0.569			

Source: Authors' calculations.

The primary factors that significantly affect credit risk for banks operating in the Republic of Albania are examined using the random effects model (REM), which is proxied by the ratio of non-performing loans to total loans. Any possible issues with serial correlation or heteroscedasticity are completely mitigated because the model is estimated using robust standard errors. According to the estimation results, the model's explanatory ability is around 16%, as shown by the coefficient of determination (R-squared). Additionally, the model's overall significance and capacity to illuminate the variability of NPL are demonstrated by the Probability F-statistic. This is at any of the standard significance levels (1, 5, 10%). Size appears to be the only explanatory variable that is statistically insignificant out of the four. Size is meaningless for any strategy aimed at credit risk because it appears to have no effect on NPL, as measured by the logarithm of total assets.

The results indicate that the capital adequacy ratio positively influences credit risk, a conclusion similarly drawn by Muhammed et al. (2023), Radivojevic & Jovovic (2017), since banks that have greater capital adequacy ratios may be more willing to take on riskier loans as long as they have sufficient capital buffers to cover any losses.

On the other hand, higher cost inefficiency decreases the credit risk exposure for the banks (Acemoglu, 2006; Mekonnen et al., 2020). Additionally, the "bad luck hypothesis" suggests that unexpected events, like a recession, are primary drivers of increases in non-performing loans. In times of economic recessions, banks experience a reduction in cost efficiency due to increased managerial efforts, which in turn raise operating expenses (Berger & DeYoung, 1997). Also, Casu et al. (2006) say that, in comparison with better-run banks, inefficient banks could devote a greater percentage of their resources to risk management tasks like credit monitoring and analysis.

Additionally, banks' exposure to credit risk is reduced by the profitability ratio (ROA). According to Allayannis (2001), businesses with more return on assets (ROA) are less likely to go bankrupt. According to a study by Ozili (2019), there is a significant relationship between ROA and NPLs; a high ROA suggests the bank's profitability, which could also indicate lower non-performing loans (NPLs).

With respect to CAR, we observe that for one percentage point change in CAR, NPL is expected to change by 0.1751percentage point, *ceteris paribus*. This holds at 90% confidence level. Secondly, regarding ROA, if return on assets changes by 1percentage point, NPL is expected to change by -3.4080 percentage point, *ceteris paribus*. This makes sense and supports the expectations of an inverse relationship between ROA and NPL at both 90% and 95% confidence levels. Lastly, cost inefficiency seems to have a significant impact at the 90% and 95% confidence levels. It appears that for each increase by 1 percentage point in cost inefficiency of the bank, NPL drops by 0.0973 percentage points, *ceteris paribus* (Acemoglu, 2006).

5. Conclusion

Albania is a bank-based, transitional economy that is still attempting to promote financial development and stability. Given the lack of an active stock exchange, banks play the main role in the economy as financial intermediaries that channel funds, promote investments and support private entities. In this regard, we have used 11 years of observation starting from 2012-2022 to study the performance of 10 second-tier banks in the Republic of Albania with respect to credit risk. The goal is to identify the variables that affect the ratio of non-performing loans to total loans—a measure of the credit risk for banks. Four variables are used in a panel data analysis which was conducted by using a fixed effects model. The final result of the model suggests that three out of four variables have a statistical significance in predicting the credit risk for Albanian banks. It is noted that the bank size does not define the credit exposure for the banks; however, capital adequacy, return on assets and cost inefficiency are the main factors which determine the risk exposure for banks.

The results suggest that capital adequacy ratio has a positive impact on credit risk. The same conclusion was reached by Muhammed et al. (2023), Radivojevic & Jovovic (2017), since banks that have higher capital adequacy ratios may be more willing to take on riskier loans as long as they have sufficient capital buffers to cover any losses.

While on the other hand, higher cost inefficiency decreases the credit risk exposure for the banks (Acemoglu, 2006; Mekonnen et al., 2020). The 'bad luck' hypothesis is a concept that suggests unexpected events, like a recession, are what lead to the rise in non-performing loans. In times of economic recession, banks experience a reduction in cost efficiency due to increased managerial efforts, which in turn raises operating expenses (Berger & DeYoung, 1997). Moreover, Casu et al. (2006) state that in comparison with better-run banks, inefficient banks could devote a greater percentage of their resources to risk management tasks like credit monitoring and analysis.

Additionally, banks' exposure to credit risk is reduced by the profitability ratio (ROA). According to Allayannis (2001), businesses with higher return on assets (ROA) are less likely to go bankrupt. According to a study by Ozili (2019), there is a substantial correlation between ROA and NPLs; a high ROA indicates profitability for the bank, but this profitability may also point to low NPLs.

The model explains approximately 16% of the variation in NPLs and is statistically significant at the 90% and 95% confidence levels. This paper will contribute to the current literature regarding the determinants of credit risk in the banking sector, specifically secondary banks, focusing on bank-specific factors' impact on NPLs, and investigating the significance of these relationships. This study may serve as a catalyst for advancements in credit risk assessment methodologies, it may be helpful for academics, academic and financial institutions, banks, policymakers, students, customers, businesses, investors and experts.

The findings of this study may provide significant insight for bank managers and decision-makers within banks, particularly concerning the cost efficiency management. Additionally, based on the findings of this study, the supervisory authorities should also pay special attention to the capital adequacy of the commercial banks, as a higher capital adequacy may increase risk-taking behaviour of the banks. This study is focused on the bank specific factors and provides relevant recommendations for decision makers within the bank, distinguishing this study from the other studies focused on the macroeconomic variables.

One of the limitations of the study is data availability which constrained the scope of the research. Given that this study relies on secondary data, it was necessary to exclude OTP from the sample, as its inclusion would shrink further the explanatory power due to missing data for all years prior to 2018. Moreover, the findings of the study are specific to the Albanian banking system, and they may not be generalized for other developing countries. Therefore, for further analysis, a panel data empirical analysis for the Western Balkans, including the macroeconomic variables could be employed.

Authors' contribution: *Introduction, B.H and A.H.; Literature review, B.H and A.H.; Methodology, B.H and A.H.; Research results, B.H and A.H.; Conclusion, B.H and A.H.*

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