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The Impact of the Implementation of Sustainability Principles on Financing Risk

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Abstract
Environmental, social, and governance (ESG) risks, considered as part of operational risk, can also lead to the materialization of credit risk. The implementation of ESG factors in the credit process and the development of products based on sustainability principles, with positive effects on the environment, society, and banking performance, are crucial. Banks that incorporate ESG risk factors in their credit analysis processes demonstrate better financial performance and acknowledge that the failure of credit institutions to address environmental, social, and governance factors affects the sustainability of the enterprises they finance.

Keywords: Sustainable Development, Sustainable Finance, Bank Risk Management, Green Lending

1. Methods of Reporting on the Implementation of Sustainable Development Principles

One of the most important challenges is represented by the reporting and publication, by credit institutions, of relevant information regarding climate and environmental risks, and implicitly the contribution of credit institutions to achieving sustainable development goals. Yuan, Li, Xu, and Shang (2022) [37] note that the publication of ESG information helps improve internal control, and Yoo and Managi (2022) [35] show that including ESG information in annual reports can increase short-term profit, noting that a balance between sustainability actions and disclosure of this information helps organizations create an ideal financial strategy.

Analyzing ESG practices in the Turkish market, Saygili, Arslan, and Birkan (2021) [28] demonstrate that the disclosure of governance information has a substantial positive effect on financial performance, while in Malaysia, the disclosure of ESG information increases the organization's competitiveness, and in Bangladesh, banks disclose much more information about the social dimension than about the economic and environmental dimensions (Sobhani, Azlan Amran, and Zainuddin, 2012) [29].

For the banking system in Malaysia, Ramnarain and Pillay (2016) note that banks have not published separate reports for corporate responsibility information, including these aspects in annual reports, and Javadi and Masum (2021) [20] conclude that reporting on climate risks is at least as important as financial reporting.

Masliza, Mohammad, and Wasiuzzaman (2021) [22] encourage organizations to view the disclosure of non-financial information as an important indicator of sustainable development, while Fafaliou, Giaka, Konstantiuons, and Polemis (2022) [16] demonstrate that in the United States, the reputational risk associated with ESG factors negatively impacts firms' growth opportunities.

In this context, the Task Force on Climate-Related Financial Disclosures (TCFD), created in 2015 by the Basel Financial Stability Board, recommended that credit institutions publish climate-related information in areas such as governance, strategy, risk management, measurements, and objectives.

It can be observed that most credit institutions have published information on the risks and opportunities identified in the context of climate change in their annual reports (127 banks), about their impact on the organization's activity (99 banks), and information about the indicators used by the bank to evaluate climate-related risks and opportunities (99 banks). Regarding the resilience of bank strategies (in the sense of developing and applying viable strategies during periods of economic turmoil), after testing adverse climate-related scenarios, we observe that only 42 credit institutions have published such information, and only 48 banks out of the 282 included information in their reports about the role of management in evaluating and managing climate-related risks and opportunities. We conclude, therefore, that the banking system is in an incipient phase of aligning the information published in annual reports with the recommendations formulated by the Task Force on Climate- Related Financial Disclosures.

The European Banking Authority (2021) notes that the disclosure of environmental, social, and governance information improves the discipline of the banking sector and allows stakeholders to evaluate the sustainable financing strategies of credit institutions. Thus, banks are expected to disclose information about the climate risks they are exposed to, how climate change can materialize, and other risks, the actions they take to mitigate these risks, and what we consider the most important indicator, the rate of ecological assets. Studying companies' perception of ESG risks, Pricewaterhouse Coopers (2021) notes that a significant barrier to sustainable progress is the lack of reporting standards, with 37% of survey participants stating that they have uncertainties about adopting the best reporting method to meet the expectations of employees and customers. In 2021, BNP Paribas conducted a survey in which 356 respondents from around the world participated (commercial banks, central banks, non-bank financial institutions). The study's results note that 29% of participants rated the implementation of clear ESG disclosure requirements and regulations as an important factor in the transition to sustainable activity, and regarding investments in technology, globally, 67% of respondents noted the priority of acquiring or developing systems for reporting ESG information. The survey reveals that out of the 356 participants, 3% have implemented ESG scores only to disclose information, without actually integrating it into the decision-making process. The Association of Banks of Russia (2021) analyzed ESG practices for approximately 400 credit institutions in the Russian banking system and concluded that ESG information disclosure is extremely limited. Thus, less than 1% of banks prepare and publish separate ESG reports or allocate space for this information in annual reports. The results of a questionnaire conducted by the European Commission in 2021 show that out of the 25 respondent banks, 35% included governance information in their risk reports, 30% included information about social factors, and 40% of banks reported information about environmental factors. An equal share of 35% is held by banks that did not include any ESG information in their reports and do not intend to disclose this information. The study notes that, overall, globally systemic important banks in the sample are much more advanced in integrating or planning to integrate the three pillars of sustainability into their reporting, unlike other banks. KPMG conducted a study on ESG risk management in banks participating in the Single Supervisory Mechanism, with the results showing that, regarding the disclosure of environmental, social, and governance information, out of the 32 institutions, 6 already disclose such information, 5 banks plan to start disclosing in 2022, and most credit institutions (19) expect to implement such reports in the next 2-3 years. Only two banks stated that they anticipate a longer time horizon of more than three years (KPMG, 2022) [21].

The challenges of ESG disclosure are highlighted by a Deloitte study (2022), which shows that 32% of the interviewed companies consider the availability of ESG data as the biggest impediment in the reporting process, followed by data quality (25%). Out of the 300 participating organizations, 17% stated that they are extremely concerned about the lack of adequate technology to meet ESG disclosure requirements, while 44% are somewhat concerned, and 1% of companies do not have such a concern. Analyzing the influence of stakeholders on ESG disclosure, the study shows that rating agencies are the most influential, followed by clients, the board of directors, investors, and the government, while non-governmental organizations and company employees have the least influence on information disclosure.

Kanbaty, Hellmann, and He (2020) study how organizations present sustainability information and show that infographics (information presented in the form of graphs) are used more to impress management than to provide relevant information to interested parties, thus raising the issue of the veracity of organizational sustainability performance.

In the context where not all countries require the disclosure of such information, Yu and Luu (2021) [36] demonstrate that the larger a board of directors overseeing an organization and the more independent directors it has, the more ESG information it publishes. Involvement in social responsibility activities and the publication of this information can reduce investor opinion divergences, idiosyncratic risk (He, Qin, Liu, and Wu, 2022) [19] and manager deviations (He, Du, and Yu, 2022) [18]. Gender diversity also contributes to increasing the reporting of non-financial information. For a sample of 2,116 banks, Buallay, Hamdan, Barone, and Hamdan (2020) [12] demonstrate that a board of directors structure where women occupy between 22 and 50% has a positive effect on the disclosure of environmental, social, and governance information, a conclusion shared by Birindelli, Dell'Atti, Ianuzzi, and Savioli (2018), whose study notes the positive impact of a gender-balanced board of directors on sustainability performance.

North African and Middle Eastern countries also have particularities regarding ESG disclosure. Buallay, Fadel, Al-Ajmi, and Saudagaran (2020) [11] note that in the MENA region (Middle East and North Africa), banks with lower financial leverage and higher asset levels tend to publish more sustainability information. Detailed information on governance is presented by banks operating in countries with higher GDP growth rates, while a lower GDP growth rate leads banks to disclose more social and environmental information. The choice of information to be disclosed is also a challenge for banks. An analysis of the European banking sector reveals that there is a positive relationship between environmental information disclosure and asset profitability, while corporate governance information disclosure negatively affects both asset and equity profitability (Bully, 2018).

Becker, Martin and Walter (2022) [8] study the effects of implementing the Sustainable Finance Disclosure Regulation (SFDR) and show that investors are determined to allocate more capital towards sustainable funds. Bose and Khan (2022) [9] analyze data from 6,942 companies in 30 countries and conclude that reporting on sustainable development goals is more frequent in shareholder-oriented companies than in stakeholder-oriented ones, and regarding the level of goal achievement, the study shows that organizations in developing countries reported higher values than those in developed countries.

2. Overview of Banks's Sustainable Development Activities

The trend of adopting and implementing sustainable development principles and practices is also present in the banking system in Romania. Batae, Dragomir, and Feleagă

(2021) [6] note that although credit institutions are not major polluters, they can actively engage in collective efforts by allocating resources for the digitization of internal processes and the creation of new products and services that meet sustainability principles.

Bădulescu, Bădulescu, and Moruțan (2017) state that sustainability issues in the Romanian banking system have been approached from two perspectives: through the reorganization of internal structures and processes to reduce the impact of operational activities on the environment, and through the implementation of environmental criteria in the credit evaluation processes to ensure environmentally friendly financing.

Sustainability policies implemented in Romanian banks are generally adaptations of group-level policies, considering that the majority of credit institutions in the domestic banking system are part of such international financial groups (Baicu, 2021). Marta's analysis (2018) shows that the main actions taken by banks in the context of social responsibility are involvement in cultural, sports, and educational activities, ecological initiatives, and programs to ensure societal well-being.

In the context of the coronavirus pandemic, Caratas, Spătariu, and Gheorghiu (2021) highlight new aspects of social sustainability and recommend that banks emphasize taking responsibility for their own carbon footprint, promoting work environments that ensure employee well-being, and engaging in community investments to improve living standards.

Frecea (2017) [17] analyzes the approaches of banks in Romania regarding social responsibility activities and concludes that most initiatives focus on philanthropic actions, and to achieve social objectives, banks promote employee volunteering. Recently, Baicu (2021) notes the development of efforts by Romanian banks in promoting and financing ecological projects.

Azmi, Hassan, Houston, and Karim (2021) study the relationship between ESG activities and the value of banks in 44 emerging economies, including Romania. Their results highlight a positive relationship between environmental activities and the value of banks, as well as between environmental, social, and governance activities, cash flows, and bank efficiency.

Informational asymmetry regarding sustainability disclosure is a challenge for companies in Romania, and similar to banking systems in other countries, the Romanian banking system is characterized by a lack of transparency. Thus, only 27% of a sample of 316 companies listed on the Bucharest Stock Exchange have published information on their websites about sustainability actions, as demonstrated by Siminică, Sichigea, and Crăițar (2020), who also found that publishing detailed information on social responsibility does not influence stock prices for Romanian companies. However, Hațegan, Sîrghi, and Curea-Pitorac (2020) note that social responsibility is not necessarily correlated with financial performance, as listed companies continue their charitable actions even in years of losses.

The degree of information disclosure influences the evolution of banking performance indicators (Sinitin and Socol, 2021), and the analysis conducted by Gligor-Cimpoieru and Munteanu (2014) on the approach to non-financial reporting in the banking system shows that one-third of banks in Romania report, in various forms, social responsibility information. The conclusions recommend that banks view non-financial reporting as an activity that improves bank performance and relationships with all stakeholders, rather than just as a reputational benefit. The communication of social responsibility information in the Romanian banking system is also studied by Frecea (2016), who notes that the approach to social responsibility is perceived as a marketing tool used to strengthen the image of banks, and the publication of environmental initiatives is expected to offset any negative practices.

We appreciate that the publication of corporate social responsibility (CSR) information is correlated with the size and market share of banks in Romania. Out of the top 10 banks in Romania, 8 dedicate a special section for CSR information on their websites, and in the overall Romanian banking system, 13 out of 35 credit institutions publish such information (Bădîrcea, Manta, Pîrvu, & Florea, 2020). An analysis by Mazars (2022) on the top 10 banks in Romania notes that only two institutions have created separate sustainability reports, over half have not created specific roles within the organization for sustainability matters, and 5 out of 10 banks in Romania have included green loans in their product offerings.

The corporate governance component is studied by Stanciu and Caratas (2015), who note that the governance needs of banks in Romania are not met by national regulations, corporate governance codes, and listing requirements, highlighting the need for an efficient legislative framework. Lupu and Nichitean (2011) categorize banks in Romania into two groups (those implementing strong governance codes and those paying less attention to CSR) and show that larger banks have invested in implementing corporate governance principles, while for banks with a smaller market share, high costs represent an obstacle in the process of assimilating corporate governance. The relationship between internal corporate governance and bank performance is studied by Dedu and Chițan (2013), who highlight the main actions that banks need to consider to enhance corporate governance efficiency: changing shareholder behavior and increasing the number of independent members in the governing body structure. Ștefănescu (2011) [30] demonstrates the positive relationship between the bank performance of Romanian banks and foreign internal corporate governance. The study notes that a fully independent board of directors and a shareholder structure mainly from European Union countries enhance bank performance.

In their study, Artene, Bunget, Dumitrescu, Domil, and Bogdan (2020) [3] examine the effects of implementing the European Union Directive 2014/95 on non-financial reporting, which requires companies with over 500 employees and a total balance sheet exceeding 20 million euros or a net profit over 40 million euros to report information on environmental, social, and governance risks and their impact. Based on the information published in the reports of credit institutions, Artene *et al*. (2020) [3] note the main environmental sustainability objectives considered by banks in Romania: reducing water and paper consumption, rational use of lighting and air conditioning facilities, reducing carbon dioxide emissions, waste recycling, improving the quantification of resource consumption, creating and promoting eco-friendly products and services, including environmental criteria in the selection process of financing, investments, and suppliers, implementing and developing risk assessment tools and management processes for climate and environmental risks.

Based on the results presented by Artene *et al*. (2020) [3], we can conclude that the directions of action in environmental sustainability undertaken by banks in Romania are both internal and external. Credit institutions are concerned with their own actions within the organization and, at the same time, aim to promote sustainable behavior in the economy and society.

Although the effective results of the actions taken by banks in Romania in the field of environmental, social, and governance sustainability are difficult to quantify, especially due to informational asymmetry and the lack of a standardized reporting framework, an overview of the sustainable development activities of the Romanian banking sector highlights the increasing interest and awareness of the need to implement environmental, social, and governance factors in all processes, activities, and products of credit institutions.

3. Principles and Strategies of Banks Regarding Sustainable Development

The actions undertaken by banks in Romania in the field of sustainable development are evaluated by numerous studies. Bădîrcea *et al*. (2020) note that corporate social responsibility in the Romanian banking system is in its early stages, as evidenced by the limited available information and discrepancies regarding the type of information. Matei and Voica (2013) [23] also address the issue of sustainable development in Romanian banks, noting that most social responsibility programs have been implemented by BRD, BCR, and UniCredit-Țiriac. BCR was the first credit institution in Romania to report according to the Global Reporting Initiative (GRI) standards. Drăgan (2013) extensively studies BCR's sustainable development activities, noting the bank's pioneering role in presenting a clear and transparent vision of how sustainability principles are adopted in each area of activity.

For the year 2014, Frecea (2016) shows that 60% of banks publish information about social responsibility actions only on their own websites, while 20% of banks include this information in annual reports. Only two banks, Raiffeisen Bank and OTP Bank, have created separate corporate social responsibility reports. The practices of banks in the field of social responsibility in the period 2015-2016 are analyzed by Moraru and Ghiță-Mitrescu (2016), whose study highlights the different approaches of banks in Romania. Banca Transilvania focuses on education, culture, sports, health, and entrepreneurship, while BCR is involved in the development of practical skills, promoting leaders and civic leadership. BRD's activities are concentrated in areas such as culture, sports, education, and civil society.

Tăchiciu, Fülöp, Marin-Pantelescu, Oncioiu, and Topor (2020) [32] study the extent to which credit institutions in the Romanian banking system have adopted non-financial reporting. The analysis shows that out of the five banks in the sample, only two have published separate non-financial reports-Banca Transilvania and ING. Raiffeisen Bank covers most non-financial reporting requirements in its annual report, while BRD uses a non-financial statement as an annex to the annual report.

Based on a corporate social responsibility index constructed by the authors, Bădîrcea *et al*. (2020) rank the banks, with Raiffeisen Bank scoring the highest (80.25), followed by BCR (63.15), UniCredit Bank (41.17), Banca Transilvania (40.17), and BRD (39.29). With a social responsibility score of 37.44, ING Bank ranks last in the ranking.

Gender diversity is an important pillar of implementing sustainable development principles. Oanea, Tiliuță, and Diaconu (2021) [27] study the impact of including women in leadership structures on banking performance for 13 banks in Romania from 2010 to 2019. They conclude that a 10% increase in the number of women in bank leadership can generate a 5% increase in asset profitability, along with a 0.3% increase in return on equity.

Deliu's (2020) [14] study analyzes the most relevant pillars of corporate governance for four banks in Romania: Banca Transilvania, BRD, BCR, and Patria Bank. The results show that Banca Transilvania has the highest degree of awareness, promotion, and application of governance principles, followed by BCR and Patria Bank. Of the four banks analyzed, BRD ranks last, with the main deficiencies identified in corporate governance being the incomplete or inadequate implementation of the Code of Ethics, inappropriate executive committee remuneration standards, unclear audit committee responsibilities, and a low level of independence of board members.

The literature review has revealed various criteria for selecting the banks analyzed, such as market share, ownership form, or asset level. Banca Română pentru Dezvoltare, Banca Transilvania, and Raiffeisen Bank have published separate sustainability reports for 2021 (OTP Bank's report is for 2020), detailing environmental, social, and governance aspects, while Alpha Bank is the only institution that has published information in the form of a non-financial statement, in accordance with EU Directive 2014/95. Banca Comercială Română was the first bank in Romania to report non-financial information according to GRI standards in 2011. In 2021, along with the two banks with majority state ownership, EximBank and CEC Bank, BCR decided to include sustainability information in its annual report, while UniCredit Bank presents its sustainability objectives on its website and refers to the sustainability report of the entire group.

We conclude that all systemically important banks publicly disclose, in various forms, their environmental, social, and governance principles, objectives, and actions, with more than half of them preparing separate reports. We observe an increase in interest in reporting sustainability information in 2021 among systemically important credit institutions in Romania compared to the studies mentioned.

Nițescu and Cristea's (2020) [26] study provides a series of answers regarding the factors that drive banks in Romania to engage in environmental, social, and governance activities. For the first 12 banks in the domestic banking system, the analysis uses microeconomic indicators (specific to credit institutions), such as the loan-to-deposit ratio, asset profitability, leverage multiplier, number of board members, and macroeconomic indicators (specific to the economy) - inflation rate, GDP growth rate, and unemployment rate, and bank involvement in sustainability activities is considered a dummy variable, with a value of 1 for banks that have taken concrete sustainable development actions and a value of 0 otherwise.

The results of the logit regression show that there is no correlation between macroeconomic indicators (inflation rate, unemployment rate, GDP growth rate) and the decision to engage in sustainable activities. The probability of a credit institution getting involved in sustainable development activities decreases as the asset profitability and leverage multiplier increase, indicating a negative correlation. The loan-to-deposit ratio is not statistically significant in the model. The size of the management structure influences the decision to adopt sustainable practices, with larger banks with complex activities and diversified portfolios being more involved in sustainable development activities, a result validated by other studies.

Based on the indicators used and the results obtained, we conclude that among the top 12 banks in Romania, the adoption of sustainability principles and involvement in environmental, social, and governance activities is negatively correlated with asset profitability and leverage multiplier. The size of the management structure positively influences sustainability actions. Additionally, banks in the domestic banking system are not influenced by the unemployment rate, inflation rate, or GDP growth rate in their decision to integrate sustainable development principles.

4. The Relationship between Credit Risk and Environmental, Social, and Governance Factors

The size and ownership structure of banks can impact the level of credit risk reduction through green lending, as noted by Zhou, Caldecott, Hoepner, and Wang (2022) [38]. Their study shows that, for the banking system in China, the increase in the proportion of green loans reduces the credit risk of large state-owned banks, while for regional, small, and privately-owned banks, the credit risk increases with the growth of the proportion of ecological loans in their portfolios. In the same context, Cui, Geobey, Weber, and Lin (2018) [13] show that state-owned credit institutions grant more green loans than banks with other forms of ownership.

The implementation of sustainable practices and involvement in sustainable development activities can lead to changes in the loan portfolio structure of banks. Basu, Vitanza, Wang, and Zhu (2022) [38] note that banks more involved in environmental, social, and governance activities grant fewer mortgage loans, both in terms of number and value, compared to banks that do not practice sustainability activities. Analyzing the banking system in Pakistan, Mohammad and Khan (2022) [25] demonstrate that the implementation of a green lending policy positively influences the quality of loans, and in Bangladesh, the integration of sustainability criteria in credit assessments contributes to better prediction of the probability of default of potential borrowers and, consequently, to a decrease in credit losses (Weber, Hoque, and Islam, 2015) [34]. Al Qudah, Hamdan, Al Okaily, and Alhaddad (2022) [2] study the impact of green lending on credit risk and demonstrate, for the United Arab Emirates, that the proportion of green loans significantly influences the non-performing loan ratio, while Cui *et al*. (2018) [13] note the same effects for the Chinese market-banks with higher proportions of green lending activity have lower non-performing loan rates.

Dunz, Naqvi, and Monasterolo (2021) [15] study the effects of implementing a carbon tax and note that for green investments to have a positive impact, a significant decrease in interest rates for green loans is necessary.

Different from green loans, which are granted specifically for financing specific green projects, ESG loans are granted based on contractual conditions of ex-post ESG performance of the borrower, as studied by Kim, Kumar, Lee, and Oh (2022), whose results highlight that the ESG scores of borrowers decrease after the granting of ESG loans.

Danisman and Harazi (2022) study the links between lending activity and ESG activities for 83 publicly listed European banks, demonstrating that the impact of financial disruptions on lending is mitigated by involvement in environmental, social, and governance activities. Their study also emphasizes that banks operating based on ESG principles experience a lower increase in credit risk, a smaller decrease in profitability, and their depositors demand smaller increases in deposit interest rates during crisis periods.

5. Lending and Environmental, Social, and Governance Factors in Romania

The development opportunities for green lending in our country are considerable, with an analysis by the National Bank of Romania showing that green loans accounted for 4% of the entire banking portfolio in June 2021 (NBR, 2021). The domestic banking system took its first concrete actions in green financing in 2020, with the establishment of a working group to support green financing at the National Committee for Macroprudential Supervision (NBR, 2021). In the presentation of the working group's report, Neagu (2021) outlines measures identified to increase transparency and awareness of the impact of climate change, such as creating a risk monitoring framework for the banking sector arising from climate change and conducting an annual stress testing exercise, as well as including information on green loans in the Credit Risk Central Database at the NBR. As a result, in December 2021, the National Bank of Romania published the first Climate Risk Monitoring Dashboard for the banking sector in Romania, and starting from June 2022, banks active in the banking sector report their green financing to the Credit Risk Central Database.

The recent measures adopted in Romania demonstrate the authorities' interest in mitigating the effects of climate change and the need to incorporate environmental, social, and governance factors into the activities of credit institutions.

The literature review has highlighted the lack of research on the correlation between credit risk and environmental, social, and governance factors in the Romanian banking sector. This study aims to provide an answer to the question: What are the determinants of non-performing loans in Romania? and, implicitly, to shed light on how the adoption of ESG factors by banks and their involvement in sustainable activities impact credit risk (measured through the non-performing loan ratio). In correlation with the non-performing loan ratio, other specific indicators of the banking system highlighted in the literature will also be analyzed.

To provide a framework for an answer, this article proposes the following hypotheses: banks involved in sustainable activities experience lower credit risk; high credit risk increases the probability of sanctions from the National Bank of Romania; there is a correlation between market share and credit risk; credit risk is influenced by liquidity ratio and leverage effect; better bank performance impacts the level of credit risk.

6. Methodology

The research is based on data from all banks active in the banking system in Romania at the end of 2022, excluding branches of foreign banks. We consider the sample to be

significant, as the market share by net assets value as of December 31, 2022 represents a weight of 87.84%.
The first stage of the study involves extracting the necessary information from the financial statements and annual reports of the 26 banks for the period 2016-2022. For each credit institution, we collected total assets, net profit, total equity, total loans, non-performing loan ratio, total deposits, operating expenses and revenues, and total liabilities. Based on this data, we calculated financial indicators such as return on assets, return on equity, liquidity ratio (loans-to-deposits ratio), and cost-to-income ratio.
Additionally, for each credit institution, we collected information on the share of the largest shareholder, market share, and considered binary variables such as sustainability of activity (1 if the bank has undertaken and reported concrete actions in the field of sustainability, 0 otherwise), systemic bank status (1 if the institution is a systemic bank, 0 otherwise), capital structure (1 if the bank has foreign capital, 0 if the bank has domestic capital), and the imposition of sanctions by the National Bank of Romania (1 if the bank has been sanctioned, 0 otherwise).
Most regression models focus on analyzing the conditional mean of a dependent variable. Therefore, the article is based on quantile regression, an approach that allows modeling the quantiles of the dependent variable (non-performing loan ratio) and provides estimates of the linear relationship between the independent variables and a certain quantile of the dependent variable, with the regression equation presented as follows:

$$Q_\tau(y_i) = \beta_0(\tau)x_{i1} + \cdots + \beta_p(\tau)x_{ip};$$

$$i = 1, \ldots, n$$

In this case, the coefficients β do not have constant values, but are functions that depend on the quantiles, and estimating their values involves minimizing the absolute median deviation, using the equation:

$$MAD = \frac{1}{n}\sum_{i=1}^{n} \rho_\tau \left(y_i - (\beta_0(\tau) + \beta_1 x_{i1}(\tau) + \cdots + \beta_p(\tau)x_{ip}) \right)$$

where ρ takes the form presented in the equation:

$$\rho_\tau(u) = \tau max(u, 0) + (1 - \tau)max(+u, 0)$$

7. Results

Using the specialized software Eviews 9, the first step is to test the stationarity of the time series. A time series is considered stationary if changes over time do not affect the shape of the distribution, and the null hypothesis is generally defined as the presence of a unit root. Therefore, considering a significance level of 10%, it is observed that this condition is not met for the time series corresponding to the variables RD (0.1449), RCV (0.2987), SB (0.1322), and ACT (1).

Table 1: Stationary of time series

Variable	Statistic	Prob
RCV	-0,52801	0,2987
RD	-1,05842	0,1449
EL	-5,24747	0
ESG	-1,53372	0,0625
RL	-60,574	0
CP	-5,26466	0
BNR_S	-2,80819	0,0025
NPL	-22,5142	0
ROA	-14,3296	0
ROE	-14,2274	0
SB	-1,11586	0,1322
ACT	3,40E+15	1

The article aims to evaluate the impact of the considered variables on the dependent variable-non-performing loan (NPL) rate. After testing the stationarity of the series, the independent variables considered are: leverage effect (EL), sustainable activities (ESG), liquidity rate (RL), market share (CP), sanctions imposed by the National Bank of Romania (BNRS), return on assets (ROA), and return on equity (ROE).
The correlation matrix describes the correlation between all possible pairs of values, with regression determining the correlation coefficients between all independent variables. The correlation matrix shows that the absolute values of the correlation coefficients are less than 60% for all variables.
An important step is the ordering of non-performing loan rate values in order to classify them into quantiles. Out of a total of 182 observations, the smallest value of non-performing loan rates is 0.05%, while the largest is 32.37%.

Table 2: Classification of non-performing loan rate into quantiles

Quantile	First value of the quantile
Q10	0,96%
Q20	2,1%
Q30	3,25%
Q40	4%
Q50	1,79%
Q60	5,75%
Q70	7,44%
Q80	9,75%
Q90	13,16%

The results show the quantiles in which the independent variables are statistically significant (for example, the liquidity rate has a probability of less than 10% only for quantiles Q50, Q60, and Q80).

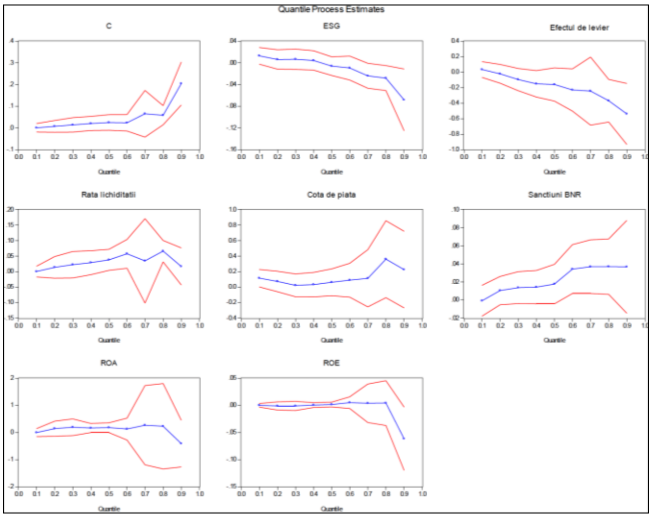

Fig 1: Estimation of the process by quantiles

The graph presents the estimation of the process by quantiles, showing the evolution of the non-performing loan rate in correlation with each independent variable and the trends followed by the non-performing loan rate based on the impact of each variable on the NPL quantiles (the X-axis represents the quantiles of the dependent variable, while the Y-axis represents the recorded values of the independent variables).

8. Discussions

The regression results by quantiles show that all independent variables are statistically significant for at least one of the quantiles. Return on Equity (ROE) is statistically significant only for the Q90 quantile, with a negative coefficient (indicating that an increase in the independent variable leads to a decrease in the dependent variable), while Return on Assets (ROA) is significant for the Q40 and Q50 quantiles, with positive coefficients (indicating that an increase in the independent variable leads to an increase in the dependent variable). Thus, an increase in asset profitability leads to an increase in the non-performing loan rate for institutions with average NPL rates (between 4% and 5.74%), while an increase in equity profitability only reduces the very high non-performing loan rates, above 13.16%. This hypothesis is validated, as it aligns with the studies conducted by Messai and Jouini (2013) [24] and Ahmad and Bashir (2013) [1], which highlight correlations between ROA, ROE, and non-performing loan rates for banks in Italy, Greece, Spain, and Pakistan.

The hypothesis is validated, as the market share (MS) variable is statistically significant only for the Q10 quantile, with a positive coefficient. Therefore, we can conclude that an increase in market share leads to an increase in credit risk only for banks with very low non-performing loan rates, below 0.96%. In the same context, Tarchouna, Jarraya, and Bour (2017) [31] conclude that the size of a bank impacts the level of non-performing loans.

The liquidity ratio (LR), measured as the ratio of total loans to total deposits, is statistically significant for the Q50, Q60, and Q80 quantiles. The positive coefficients demonstrate a direct relationship, indicating that an increase in the loan-to-deposit ratio, either through increased lending or decreased deposit attraction, leads to an increase in the non-performing loan rate for institutions with above-average weights, ranging from 4.79% (first NPL rate for Q50) to 7.42% (last NPL rate for Q60) and between 9.75% and 12.88% (first and last NPL rates for Q80). A similar result is noted by Ahmad and Bashir (2013) [1], whose study concludes a direct relationship between the loan-to-deposit ratio and the non-performing loan rate for the 30 analyzed banks in Pakistan. Additionally, there is an increase in the coefficient values from the Q50 (0.03807) to the Q80 (0.06616) quantiles, indicating that the impact of liquidity ratio increases with higher non-performing loan rate values.

Regarding the leverage effect (LE), the variable is statistically significant for the Q40, Q60, Q80, and Q90 quantiles, with negative coefficients, indicating a negative relationship between the non-performing loan rate and this independent variable. The coefficient values, ranging from -0.1509 for Q40 to -0.5395 for Q90, show that the higher the non-performing loan rate, the more pronounced the impact of the leverage effect indicator. Thus, the hypothesis that credit risk is influenced by liquidity ratio and leverage effect is validated.

The credit risk is directly correlated with the sanctions imposed by the National Bank of Romania (NBR) following the supervision and evaluation process. The variable is statistically significant for the Q60, Q70, and Q80 quantiles. The results show that for credit institutions with high non-performing loan rates, ranging from 5.75% (first NPL rate for Q60) to 12.88% (last NPL rate for Q80), the probability of being sanctioned by the supervisory authority is higher. The coefficient values for the three quantiles are similar, indicating that the correlation between non-performing loan rates and sanctions does not significantly differ for the Q60, Q70, and Q80 quantiles. Therefore, the hypothesis is validated.

Finally, the variable defining the involvement and reporting of concrete actions in the field of sustainability (ESG) by banks in Romania is statistically significant for the Q70, Q80, and Q90 quantiles. The coefficients have negative signs, indicating an inverse relationship between credit risk and sustainable activities of banks. Credit institutions with high non-performing loan rates, ranging from 7.44% (first NPL rate for Q70) to 32.37% (last NPL rate for Q90), can reduce these levels by adopting sustainability strategies and incorporating environmental, social, and governance factors into their activities. The coefficient values (-0.0229 for Q70, -0.0281 for Q80, and -0.0684 for Q90) indicate that the impact of sustainability activities on non-performing loan rates is more pronounced for banks with higher NPL rates. Based on these results, the hypothesis is validated. The impact of environmental factors is noted by Bayangos, Cachuela, and Del Prado (2021) [7], whose study shows that bank units affected by extreme weather events have higher non-performing loan rates. Consistent with the obtained results, Danisman and Harazi (2022) demonstrate that banks operating based on ESG principles experience a lower increase in credit risk during financial disruptions.

Table 3: Summary of results

Quantile	First value of the quantile	Impact of independent variables and relationship with NPL
Q10	0,96%	CP (+)
Q20	2,10%	-
Q30	3,25%	-
Q40	4%	EL (-), ROA (+)
Q50	4,79%	RL (+), ROA (+)
Q60	5,75%	EL (-). RL (+), BNR_S (+)
Q70	7,44%	ESG (-), BNR_S (+)
Q80	9,75%	ESG (-), EL (-), LR (+), BNR_S (+)
Q90	13,16%	ESG (-), EL (-), ROE (-)

We observe that none of the considered variables have an impact on non-performing loan rates when they are in the Q20 and Q30 quantiles (above 2.10% and below 4%), and the market share (MS) only leads to an increase in non-performing loan rates when they have very low weights, corresponding to the Q10 quantile. Additionally, the increase in return on equity (ROE) only reduces the non-performing loan rate in the Q90 quantile. Most of the independent variables are correlated with the non-performing loan rate, which records high values in the Q80 quantile (liquidity ratio, leverage effect, presence of sanctions issued by the NBR, and sustainability).

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