**The impact of the implementation of sustainability principles on financing risk**

**Summary**

Environmental, social and governance (ESG) risks, considered a component of operational risk, can also generate the materialization of credit risk. The issue of implementing ESG factors in the lending process and developing products based on sustainability principles, with positive effects on both the environment and society, as well as banking performance, is acutely raised. Banks whose credit analysis processes include ESG risk factors report better financial performance and note that the failure of credit institutions to address environmental, social and governance factors affects the sustainability of the businesses they finance.

**Keywords:** *Sustainable Development*, *sustainable financing*, *banking risk management*, *green lending*.

**JEL classification:** G21, E42

1. **Methods of reporting the implementation of the principles of sustainable development**

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

Analyzing ESG practices in the Turkish market, Saygili, Arslan, and Birkan (2021) demonstrate that governance disclosure has a substantial positive effect on financial performance, and in Malaysia, ESG disclosure increases organizational competitiveness, while in Bangladesh, banks disclose much more information about the social dimension than the economic and environmental dimension (Sobhani, Azlan Amran, & Zainuddin, 2012). For the Malaysian banking system, Ramnarain and Pillay (2016) note that banks have not published separate reports for corporate responsibility information, including these issues in annual reports, and Javadi and Masum (2021) conclude that climate risk reporting is at least at as important as financial reporting.

Masliza, Mohammad and Wasiuzzaman (2021) encourage organizations to consider the publication of non-financial information as an important indicator of sustainable development, Fafaliou, Giaka, Konstantiuons and Polemis (2022) demonstrate that, in the United States, the reputational risk associated with ESG factors impacts negatively the growth opportunities of companies.

In this context, the Task Force for the Publication of Climate-Related Financial Information (TCFD), created in 2015 by the Stability Council Basel Financial recommended that credit institutions publish climate-related information in areas such as governance, strategy, risk management, metrics and objectives.

Thus, it is observed that most credit institutions have published in their annual reports information related to the risks and opportunities identified in the context of climate change (127 banks), about their impact on the organization's activity (99 banks) and information about indicators used by banks to assess climate risks and opportunities (99 banks). Regarding the resilience of banks' strategies (in the sense of developing and applying viable strategies and in periods of economic turmoil), after testing adverse climate-related scenarios, we note that only 42 credit institutions published such information and only 48 banks, out of 282, included information on management's role in assessing and managing climate-related risks and opportunities in their reports. We conclude, thus, that the banking system is in an early phase of aligning the information published in the annual reports with the recommendations formulated by the Task Force for the Publication of Climate-Related Financial Information.

The European Banking Authority (2021) notes that the publication of environmental, social and governance information improves the discipline of the banking sector and allows stakeholders to assess the sustainable financing strategies of credit institutions. Thus, banks are expected to disclose information about the climate risks to which they are exposed, how climate change can materialize other risks, the actions they undertake to reduce these risks and, we consider the most important indicator, the ratio of ecological assets.

Studying companies' perception of ESG risks, Pricewaterhouse Coopers (2021) notes that, an important barrier to sustainable progress is represented by the lack of reporting standards, with 37% of survey participants saying they are uncertain about adopting the best way of reporting to meet employee and customer expectations. BNP Paribas conducted, in 2021, a survey in which 356 respondents from around the world (commercial banks, central banks, non-banking financial institutions) participated. The results of the study note that 29% of the participants cataloged the implementation of clear ESG information disclosure requirements and regulations as an important factor in the process of transition to a sustainable activity, and in terms of technology investments, globally, 67% of the respondents noted as a priority the acquisition or development of systems for reporting ESG information. The survey reveals that, of the 356 participants, 3% implemented ESG scores only for the purpose of disclosing the information, without actually integrating it into the decision-making process.

The Association of Russian Banks (2021) reviewed ESG practices for approximately 400 credit institutions in the Russian banking system and concludes that disclosure of ESG information is extremely limited. Thus, less than 1% of banks develop and publish separate ESG reports or allocate space for this information in their annual reports. The results of a questionnaire conducted by the European Commission in 2021 show that, of the 25 responding banks, 35% included information on governance in their risk reports, 30% included information on social factors and 40% of banks reported information on risk factors. environment. An equal share of 35% is held by banks that have not included any ESG information in their reports and do not intend to disclose this information. The study notes that, overall, the global systemically important banks in the sample are much more advanced in terms of integration or planning to integrate the three pillars of sustainability in their reporting, unlike the other banks.

KPMG conducted a study on ESG risk management within the banks participating in the Single Supervisory Mechanism, the results showing that, in terms of disclosure of environmental, social and governance information, of the 32 institutions, 6 already publish such information, 5 banks are considering publication starting in 2022, and most of the credit institutions (19) expect to implement such reports in the next 2-3 years. Only two banks said they expected a longer time horizon of more than three years (KPMG, 2022).

The challenges of disclosing ESG information are also highlighted by a study by Deloitte (2022), which shows that 32% of surveyed companies consider the availability of ESG data to be the biggest impediment to the reporting process, followed by data quality (25%). Of the 300 participating organizations, 17% said they were extremely concerned about the lack of adequate technology to meet ESG disclosure requirements, while 44% were somewhat concerned and 1% of companies had no such concern. concern. Analyzing the influence of stakeholders on the disclosure of ESG information, the study shows that rating agencies rank first, followed by customers, the board of directors, investors and the government, with the least influence on the disclosure of information held by non-governmental organizations and company employees.

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

In the context where not all countries mandate the publication of such information, Yu and Luu (2021) demonstrate that the larger an organization is overseen by a board of directors and the higher the number of independent directors, with both publish more ESG information, and engaging in social responsibility activities and publishing this information can reduce investors' divergence of opinion, idiosyncratic risk (He, Qin, Liu, & Wu, 2022) and managers' misconduct (He, Du, & Yu, 2022). Gender diversity also contributes to increased reporting of non-financial information. For a sample of 2,116 banks, Buallay, Hamdan, Barone and Hamdan (2020) demonstrate that the composition of a board where women occupy between 22 and 50% has a positive effect on the disclosure of environmental, social and governance information, conclusion also 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.

Countries in North Africa and the Middle East also present particularities in terms of ESG information disclosure. Buallay, Fadel, Al-Ajmi, and Saudagaran (2020) note that in the MENA (Middle East and North Africa) region, banks with lower leverage and higher asset levels tend to disclose more about sustainability. Detailed information on the governance component is presented by banks operating in countries with a higher gross domestic product growth rate, while a lower GDP growth rate leads banks to disclose more social and environment. Choosing what information to publish is also a challenge for banks. Analysis of the European banking sector reveals that there is a positive relationship between environmental disclosure and return on assets, and disclosure of corporate governance information negatively affects both return on assets and return on equity (Buallay, 2018).

Becker, Martin and Walter (2022) study the effects of the implementation of the Sustainable Finance Disclosure Regulation (SDFR)and shows that investors are driven to allocate more capital to more sustainable funds. Bose and Khan (2022) 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 in terms of the degree of fulfillment of objectives, the study shows that organizations in developing countries reported higher values ​​than those in developed countries.

1. **Overview of banks' sustainable development work**

The tendency to adopt and apply sustainable development principles and practices is also present in the Romanian banking system. Batae, Dragomir and Feleaga (2021) note that, although credit institutions are not major polluters of the environment, they can be actively involved in collective efforts, by allocating resources for the digitization of internal processes and for the creation of new products and services that meet the principles of sustainability.

Bădulescu, Bădulescu and Moruțan (2017) state that the issue of sustainability in the banking system in Romania was approached from two perspectives: by reorganizing the structures and internal processes with the aim of reducing the impact of operational activities on the environment and by implementing some environmental criteria in the evaluation processes of credit applicants with the aim of ensuring environmentally friendly financing.

The sustainability policies implemented in Romanian banks are, in general, adaptations of group-level policies, considering that most of the credit institutions present in the domestic banking system are part of such international financial groups (Baicu, 2021). The analysis of Marta (2018) shows that the main actions undertaken by banks in the context of social responsibility are represented by involvement in cultural, sports and educational activities, ecological initiatives and programs to ensure the well-being of society. In the context of the coronavirus pandemic, Caratas, Spătariu and Gheorghiu (2021) highlight new aspects of social sustainability and recommend that banks emphasize the assumption of responsibility for their own carbon footprints, the promotion of working environments that ensure the well-being of employees and involvement in the community through investments that increase living standards. Frecea (2017) analyzes the approaches of Romanian banks to social responsibility activities and concludes that most initiatives are directed towards philanthropic actions, and to achieve social objectives, banks promote employee volunteering. Recently, Baicu (2021) notes the development of Romanian banks' efforts in promoting and financing ecological projects.

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

The informational asymmetry regarding the disclosure of sustainability information is also a challenge for Romanian companies and, similar to banking systems in other countries of the world, the Romanian banking system is also characterized by a lack of transparency. Thus, only 27% of a sample of 316 companies listed on the Bucharest Stock Exchange published on their websites information about the actions undertaken in the field of sustainability, Siminică, Sichigea and Crăițar (2020) demonstrating that the publication of detailed information about social responsibility does not influences share prices for companies in Romania. However, Hațegan, Sîrghi and Curea-Pitorac (2020) note that social responsibility is not necessarily correlated with financial performance, with listed companies continuing their charitable actions even in years when they have recorded losses.

The degree of disclosure of information influences the evolution of banking performance indicators (Sinitin and Socol, 2021), and the analysis carried out by Gligor-Cimpoieru and Munteanu (2014) on the approach to non-financial reporting at the level of the banking system, shows that a third of the banks in Romania report, in various forms, social responsibility information, the conclusions recommending them to look at non-financial reporting as an activity that improves the bank's performance and relations with all stakeholders, and not just as an image benefit. The communication of social responsibility information at the level of the banking system in Romania is also studied by Frecea (2016), who notes that the social responsibility approach is perceived as a marketing tool used to strengthen the banks' image, and the publication of environmental initiatives is expected to compensate possible negative practices.

We believe that the publication of corporate social responsibility (CSR) information is correlated with the size and market share of Romanian banks, considering the fact that, out of the top 10 credit institutions in Romania, 8 dedicate a special section for social responsibility information on their websites, and, in the Romanian banking system as a whole, 13 out of 35 credit institutions publish such information (Bădîrcea, Manta, Pîrvu and Florea, 2020). A Mazars (2022) analysis of the top 10 banks in Romania notes, for the first quarter of 2022, that only two institutions have created distinct sustainability reports, more than half have not created specific functions within the organization for issues related to sustainability, and 5 out of 10 Romanian banks have included ecological loans in their product offer.

The corporate governance component is studied by Stanciu and Caratas (2015), who note that the governance needs of Romanian banks are not met by national regulations, corporate governance codes and listing requirements, highlighting the need to implement an effective legislative framework. Lupu and Nichitean (2011) divide Romanian banks into two categories (those that implement strong governance codes and those that pay less attention to corporate social responsibility) and show that large banks have invested in implementing corporate governance principles, while, for banks with a lower market share, high costs are an obstacle in the assimilation process of corporate governance. The relationship between internal corporate governance and bank performance is studied by Dedu and Chițan (2013), who highlight the main directions of action that banks must consider to increase the effectiveness of corporate governance: changing the business behavior of shareholders and increasing the number of independent members in the structure of the governing body. Ștefănescu (2011) demonstrates the positive relationship between the banking performance of Romanian banks and foreign internal corporate governance. The study notes that a fully independent board of directors and a majority ownership structure from European Union states increase bank performance.

In their study, Artene, Bunget, Dumitrescu, Domil and Bogdan (2020) study the effects of the implementation of the European Union Directive 2014/95 on non-financial reporting, whereby companies with more than 500 employees and registering a total balance sheet of more than 20 million of EUR or have a net profit of more than EUR 40 million, are required to report information on environmental, social and governance risks and their impact. Based on information published in credit institution reports, Artene et al. (2020) note the main objectives in the field of environmental sustainability 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; creation and promotion of ecological products and services; the inclusion of 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.

We can conclude, based on the results presented by Artene et al. (2020), that the directions of action in the field of environmental sustainability assumed by Romanian banks are both internal and external. Credit institutions are concerned with their own actions within the organization and, at the same time, want to promote sustainable behavior in the economy and society.

Although it is difficult to quantify the actual results of the actions undertaken by Romanian banks in the field of environmental, social and governance sustainability, especially due to the information asymmetry and the lack of a standardized reporting framework, the overview of the sustainable development activity of the Romanian banking sector highlights the growing interest and awareness of the need to implement environmental, social and governance factors in all processes, activities and products of credit institutions.

1. **The principles and strategies of banks regarding sustainable development**

The actions carried out by Romanian banks in the field of sustainable development are evaluated by numerous studies, in the context in which Bădîrcea et al. (2020) note that corporate social responsibility in the domestic banking system is in an early stage, a conclusion highlighted by the little information available, but also by the discrepancies regarding the type of this information.

The issue of the sustainable development of Romanian banks is also dealt with by Matei and Voica (2013), whose study notes that most social responsibility programs were implemented by BRD, BCR and UniCredit-Țiriac, BCR also being the first credit institution from Romania that reported according to Global Reporting Initiative (GRI) standards. Drăgan (2013) studies in detail the sustainable development activities of BCR, noting the bank's pioneering in presenting a clear and transparent vision of how the principles of sustainability are adopted in each activity function.

For 2014, Frecea (2016) shows that 60% of banks publish information about social responsibility actions only on their own websites, and for a percentage of 20% this information is found in annual reports, while 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 during 2015-2016 are analyzed by Moraru and Ghiță-Mitrescu (2016), whose study highlights the different approaches of banks in Romania. Thus, Banca Transilvania emphasizes education, culture, sports, health and entrepreneurship, and BCR is involved in the development of practical skills, the promotion of leaders and civic leadership. The activities undertaken by BRD are concentrated in fields such as culture, sports, education and civil society.

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

Based on a corporate social responsibility index built by the authors, Bădîrcea et al. (2020) makes a ranking of the banks, the highest score being recorded by Raiffeisen Bank (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.

Gender diversity is an important pillar of the implementation of sustainable development principles. For 13 banks in Romania, in the period 2010-2019, Oanea, Tiliuță and Diaconu (2021) study the impact of the inclusion of women in management structures on banking performance and conclude that an increase in the number of women in bank management by 10% can generate a 5% increase in return on assets, along with a 0.3% increase in return on equity.

Deliu's study (2020) analyzes the most relevant pillars of corporate governance for 4 Romanian banks: Banca Transilvania, BRD, BCR and Patria Bank. The results show that Banca Transilvania registers the highest degree of awareness, promotion and application of governance principles, followed by BCR and Patria Bank. Of the 4 analyzed banks, BRD occupies the last position, the main deficiencies identified at the level of corporate governance being represented by the incomplete or inadequate implementation of the principles of the Code of Ethics, the existence of inadequate remuneration standards for the executive committee, unclear responsibilities of the audit committee and a degree low independence of the members of the board of directors.

The specialized literature review revealed various selection criteria of the analyzed banks, such as market share, form of ownership or level of assets.

The Romanian Development Bank, Banca Transilvania and Raiffeisen Bank published separate sustainability reports for 2021 (OTP Bank's report is for 2020), in which environmental, social and governance aspects were detailed, and Alpha Bank is the only institution that published the information in the form of a non-financial statement, according to the European Union Directive 2014/95. Banca Comercială Română is the first bank in Romania to report non-financial information according to GRI standards, in 2011. In 2021, together with the two banks with majority state ownership, EximBank and CEC Bank, BCR decided to include sustainability information in the the annual report, and UniCredit Bank presents its sustainability objectives on its website and makes references to the sustainability report of the entire group.

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

The study by Nițescu and Cristea (2020) provides a series of answers regarding the factors that lead Romanian banks 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-deposit ratio, the return on assets, the leverage multiplier, the number of members of the management body and macroeconomic indicators (specific to the economy) - the inflation rate , the growth rate of the gross domestic product and the unemployment rate, and the banks' involvement in sustainability activities is considered a dummy variable, with a value of 1 in the case of banks that have undertaken concrete sustainable development actions and a value of 0 otherwise.

The logit regression results show that there is no correlation between macroeconomic indicators (inflation rate, unemployment rate, gross domestic product growth rate) and the decision to engage in sustainable activities. The probability of a credit institution engaging in sustainable development activities decreases with increasing return on assets and leverage multiplier, with a negative correlation between them, while the ratio of loans to deposits is not statistically significant in the model. The size of the management structure influences the decision to adopt sustainable practices, so that, unlike small banks, large banks with complex activities and diversified portfolios are more involved in sustainable development activities, a result also validated by other studies.

We conclude, based on the indicators used and the results obtained, that at the level of the first 12 banks in Romania, the adoption of sustainability principles and involvement in environmental, social and governance activities is negatively correlated with the return on assets and the leverage multiplier, and the size of the management structure influences positive sustainability actions. Likewise, the banks in the domestic banking system are not influenced, in the decision to integrate the principles of sustainable development, by the rate of unemployment and inflation or the rate of GDP growth.

1. **The relationship between credit risk and environmental, social and governance factors**

The size and ownership form of banks can impact the level of credit risk reduction through green lending, as Zhou, Caldecott, Hoepner, and Wang (2022) note. Their study shows that for China's banking system, increasing the share of green loans reduces the credit risk of large state-owned banks, while for regional, small, and privately owned banks, credit risk increases with the share of loans. ecological in the portfolio. In the same context, Cui, Geobey, Weber and Lin (2018) 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 structure of banks' loan portfolios. Basu, Vitanza, Wang, and Zhu (2022) note that banks more involved in environmental, social, and governance activities make fewer mortgage loans, both in number and value, than banks that do not practice sustainability activities. Analyzing the banking system in Pakistan, Mohammad and Khan (2022) demonstrate that the implementation of a green lending policies positively influence quality loans, and in Bangladesh, the integration of sustainability criteria in credit assessments contributes to a better prediction of the default probability of potential borrowers and, implicitly, to the decrease of loan losses (Weber, Hoque and Islam, 2015). the‑Qudah, Hamdan, AlOkaily, and Alhaddad (2022) study the impact of green lending on credit risk and demonstrate, for the United Arab Emirates, that the share of green loans significantly influences the NPL ratio, while Cui et al. (2018) note the same effects for the Chinese market—banks with high shares of green lending activity have lower NPL ratios.

Dunz, Naqvi and Monasterolo (2021) study the effects of a carbon tax and note that for green investments to generate a positive impact, interest rates on green loans need to drop significantly.

Different from green loans, which are granted specifically to finance 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 the fact that borrowers' ESG scores decrease after ESG loans are granted.

Danisman and Harazi (2022) study, for 83 European banks listed on the stock exchange, the links between their lending activity and the ESG activities in which they are involved, demonstrating that the impact of financial turmoil on lending is diminished by involvement in environmental, social and environmental activities governance. Their study also points out that banks operating on the basis of ESG principles experience less growth in credit risk, less decline in profitability, and their depositors demand lower rate increases interest on deposits in times of crisis.

1. **Lending and environmental, social and governance factors in Romania**

The development opportunities for the green lending segment are considerable in our country, an analysis by the National Bank of Romania showing that, in June 2021, green loans amount to 4% of the entire banking portfolio (BNR, 2021). The domestic banking system marks the first concrete actions in the field of green financing in 2020, with the creation, at the level of the National Committee for Macroprudential Supervision (CNSM), of a working group to support green financing (BNR, 2021). During the presentation of the working group's report, Neagu (2021) notes the measures identified in order to increase transparency and the degree of awareness of the impact of climate change, such as building a table of monitoring the risks to the banking sector arising from climate change and the annual running of a stress test exercise and the completion of the Credit Risk Center within the BNR with information on green loans. Thus, in December 2021, the National Bank of Romania publishes the first *Monitoring table of climate risks on the banking sector in Romania*, and, starting from June 2022, the banks active in the banking sector report, to the Credit Risk Central, the green financings.

The measures recently adopted in Romania mark the authorities' interest in mitigating the effects of climate change and the need to include environmental, social and governance factors in the activities of credit institutions.

The literature review highlighted the lack of research on the correlation between credit risk and environmental, social and governance factors in the banking sector Romanian. The study aims to provide an answer to the question: *What are the determining factors of non-performing loans in Romania?*  and, implicitly, create a picture of how banks' adoption of ESG factors and engagement in sustainable activities impact credit risk (measured through the NPL ratio). Thus, in correlation with the rate of non-performing loans, other indicators specific to the banking system, highlighted in the specialized literature, will be analyzed.

To provide the framework for an answer, this article proposes the following hypotheses: banks involved in sustainable activities register a 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 rate and leverage; better bank performance impacts the level of credit risk.

1. **Methodology**

The research is based on the data of 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, since the market shares according to the value of net assets, on 31.12.2022, represent a weight of 87.84%.

The first stage for carrying out the study is represented by extracting the necessary information from the financial statements and annual reports of the 26 banks, for the period 2016-2022. In this regard, for each credit institution we have collected total assets, net profit, total equity, total loans, non-performing loans rate, total deposits, operating expenses and income, and total liabilities. Based on these data, we calculated financial indicators, such as return on assets, return on equity, rate of liquidity (loans-deposits ratio) and cost-income ratio.

Additionally, for each credit institution, we collected information on the weight of the largest shareholder, the market share and considered binary variables the sustainability of the activity (1 if the bank undertook and reported concrete actions in the field of sustainability, 0 otherwise), the status of systemic bank (1 if the institution is a systemic bank, 0 otherwise), the capital structure (1 if the bank has foreign capital, 0 if the bank has domestic capital) and the granting of sanctions by the National Bank of Romania (1 if the bank was sanctioned, 0 otherwise).

Most regression models are focused on analyzing the conditional mean of a dependent variable. For this reason, the article is based on regression on quantiles, an approach that allows modeling the quantiles of the dependent variable (the rate of non-performing loans) and which provides estimates of the linear relationship between the independent variables and a certain quantile of the dependent variable, the regression equation being presented as follows:

$$Q\_{τ}\left(y\_{i}\right)=β\_{0}\left(τ\right)x\_{i1}+…+β\_{p}\left(τ\right)x\_{ip};i=1,…,n$$

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

$$MAD=\frac{1}{n}\sum\_{i=1}^{n}ρ\_{τ}\left(y\_{i}-\left(β\_{0}\left(τ\right)+β\_{1}x\_{i1}\left(τ\right)+…+β\_{p}\left(τ\right)x\_{ip}\right)\right)$$

where ρ has the form shown in the equation:

$$ρ\_{τ}\left(u\right)=τmax\left(u,0\right)+\left(1-τ\right)max\left(+u,0\right)$$

1. **result**

Using the specialist program Eviews 9*,* the first step is to test the stationarity of the data series. A time series is stationary if a change in time does not cause a change in the shape of the distribution and the null hypothesis is generally defined as the presence of a unit root. Thus, considering a significance level of 10%, it is observed that this condition is not met in the case of the data series related to the variables RD (0.1449), RCV (0.2987), SB (0.1322) and ACT (1).

Table no. 1. Stationarity of data series

|  |  |  |
| --- | --- | --- |
| **vary** | **Statistical** | **Prob** |
| RCV | -0.52801 | 0.2987 |
| RD | -1.05842 | 0.1449 |
| **HE** | -5.24747 | 0 |
| **ESG** | -1.53372 | 0.0625 |
| **R** | -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 |

Source: author processing

The article aims to evaluate the impact of the considered variables on the dependent variable - the rate of non-performing loans (NPL). After testing the stationarity of the series, the independent variables considered are: leverage effect (EL), sustainable activities (ESG), liquidity ratio (RL), market share (CP), sanctions applied 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, in the case of regressions determining the correlation coefficients between all independent variables. The correlation matrix, shows that the coefficient values ​​of correlation are lower than 60% in absolute values, for all variables.

An important stage is represented by ordering the values ​​of the non-performing loans rate with the aim of fitting them into the amounts. From the total of 182 observations, the lowest value of non-performing loan rates is 0.05%, and the highest is 32.37%.

Table no. 2. The inclusion of the rate of non-performing loans in the amounts

|  |  |
| --- | --- |
| **Quantile** | **The 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% |

Source: author processing

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



Figure no. 1. Estimation of the quantum process

Source: author processing

The graph shows the estimation of the process by the amounts, respectively the evolution of the non-performing loan rate in correlation with each independent variable and the trends followed by the non-performing loan rate according to the impact each variable on the NPL quantiles (the OX axis represents the quantiles of the dependent variable, and the OY axis shows the recorded values ​​of the independent variables).

1. **Discussions**

The quantile regression results 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, the sign of the coefficient being negative (changing the independent variable in one direction causes the dependent variable to change in the opposite direction), while return on assets (ROA) is significant for quantiles Q40 and Q50, cases where the signs of the coefficients are positive (the change of the independent variable in one direction causes the change of the dependent variable in the same directions). Thus, an increase in the return on assets leads to an increase in the NPL ratio for those credit institutions that record average NPL rates (between 4% and 5.74%), while the increase in the return on equity only lowers the very high rates of non-performing loans, over 13.16%. The hypothesis is validated, given that bank performance variables, measured by both return on equity (ROE) and return on assets (ROA), influence credit risk. This conclusion is in line with Messai and Jouini (2013) and Ahmad and Bashir (2013), whose studies highlight correlations between ROA, ROE and NPL ratio for banks in Italy, Greece, Spain and Pakistan.

The hypothesis is validated, considering that the variable defining the market share (CP) is statistically significant only for the Q10 quantile, and its coefficient is positive. We can conclude, thus, that an increase in the share of market causes an increase in credit risk only for those banks that register a very low non-performing loan rate, below 0.96%. In the same context, Tarchouna, Jarraya and Bour (2017) conclude that the size of a bank impacts the level of non-performing loans.

The liquidity ratio (RL), measured as the ratio of total loans extended to total deposits attracted, is statistically significant for the Q50, Q60 and Q80 quantiles. The positive coefficients of the values ​​demonstrate a direct relationship, so that an increase in the ratio of loans to deposits, either by increasing lending or by decreasing the attraction of funds from depositors, leads to an increase in the rate of non-performing loans for credit institutions that register weights above the average, between 4.79% (the first NPL rate related to Q50) and 7.42% (the last NPL rate related to Q60) and between 9.75 % and 12.88% (first and last NPL rate related to Q80). A similar result is noted by Ahmad and Bashir (2013), whose study concludes the direct relationship between loan-deposit ratio and NPL ratio for the 30 analyzed banks in Pakistan. It is also noted the increase in the values ​​of the coefficients from the Q50 quantile (0.03807) to the Q80 quantile (0.06616), which means that the impact of the liquidity ratio increases with the recording of higher values ​​of the NPL ratios.

Regarding leverage (EL), the variable is statistically significant for the Q40, Q60, Q80 and Q90 quantiles, and the signs of the coefficients are negative, with a negative relationship between the NPL ratio and this independent variable. The coefficient values, from -0.1509 for Q40 to -0.5395 for Q90, show that the higher the NPL ratio, the stronger the impact of the leverage indicator. Thus, the hypothesisconformable whose credit risk is influenced by the liquidity rate and the leverage effect, is validated.

The credit risk is directly correlated with the sanctions imposed by the National Bank of Romania (BNRS) following the supervision and evaluation process, the variable being statistically significant for the Q60, Q70 and Q80 quantiles. The results show that, in the case of credit institutions that register high rates of non-performing loans, between 5.75% (the first NPL rate related to Q60) and 12.88% (the last NPL rate related to Q80), the probability of applying sanctions from the authority surveillance is all the greater. The values ​​of the coefficients related to the 3 quantiles are similar, so the level of correlation between the rate of non-performing loans and the sanctions of the supervisory authority does not differ significantly for the quantiles Q60, Q70 and Q80. The hypothesis is thus validated.

Finally, the variable that defines the involvement and reporting by Romanian banks of concrete actions in the field of sustainability (ESG) is statistically significant for the Q70, Q80 and Q90 quantiles, and the signs of the coefficients are negative, which outlines an inverse relationship between credit risk and sustainable bank activities. Credit institutions with high NPL ratios ranging from 7.44% (first NPL ratio Q70) to 32.37% (last NPL ratio Q90) can reduce these levels by adopting sustainability strategies and including environmental, social and governance factors in their activities. The values ​​of the coefficients (-0.0229 for the Q70 quantile; -0.0281 for the Q80 quantile and -0.0684 for the Q90 quantile) show that the impact of sustainability activities on non-performing loan rates is all the more pronounced as banks register higher levels of NPL rates. Based on these results, the hypothesis is validated. The impact of the factors of environment is noted by Bayangos, Cachuela and Del Prado (2021), whose study shows that bank units affected by extreme climate events have a higher rate of non-performing loans. In line with the results obtained, Danisman and Harazi (2022) show that banks operating on the basis of ESG principles register a lower increase in credit risk in periods of financial turmoil.

Table no. 3. Summary of results

|  |  |  |
| --- | --- | --- |
| **Quantile** | **The 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% | HE (-). RL (+), BNR\_S (+) |
| Q70 | 7.44% | ESG (-), BNR\_S (+) |
| Q80 | 9.75% | ESG (-), EL (-), LR (+), BNR\_S (+) |
| Q90 | 13.16% | ESG (-), EL (-), ROE (-) |

Source: author processing

We observe that none of the considered variables impact the non-performing loan rates when their level is in the Q20 and Q30 quantiles (greater than 2.10% and less than 4%), and the increase in market share (CP) leads to the increase in loan rates non-performing only when they register very low weights, related to the Q10 quantile. Also, the increase in return on equity only decreases the rate of non-performing loans in the Q90 quantile. Most of the independent variables are correlated with the rate of non-performing loans, it registering high values, related to the Q80 quantile (liquidity rate, the leverage effect, the presence of sanctions issued by the NBR and sustainability).

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