

# Risk management and internal control system of the Moldovan banks

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**To cite this article:**

Cara, I. (2023). Risk management and internal control system of the Moldovan banks. *Romanian Journal of Economics*, 57(2), pp. 85- 98

**Abstract.** *The main purpose of this research is to examine the interdependencies between the internal control system and risk management in the Moldovan banking industry. This subject matter is crucial and relevant to the Republic of Moldova because the continuous development of the banking internal control system is imperative. Method: The research investigates a range of indicators that are considered representative for the internal control system and representative indicators for risk management to evaluate how well risk is managed. The study employs mainly quantitative methodology, with a focus on deductive statistical analysis to identify causal connections and consider the significance level. Results: The results determined that a well-structured internal control system has a direct relationship with risk management in the Moldovan banking sector that was represented in current study by the four systemically important banks. Specifically, the results demonstrate an inverse correlation between both credit risk and market risks and internal control, while a direct correlation is observed between both liquidity and operational risk and internal control. Therefore, the research suggests that banks should adopt appropriate measures to evaluate potential risks and establish effective control mechanisms to govern their operations. Originality: It is noteworthy to mention that no investigations have been discovered on how the internal control mechanism influences the risk management of the banking industry in Moldova. Hence, the scientific novelty of this study lies in the development of an econometric model aimed at enhancing the examination of the interplay between risk management and internal control in Moldovan banks. Nevertheless, what truly distinguishes this article's innovation is its expansion of the analysis to assess the distinct risks faced by banks, with a comprehensive exploration of possible dependencies between credit risk, market risk, liquidity risk and operational risk and internal control systems in Moldovan banks.*

**Keywords:** credit risk, liquidity risk, market risk, operational risk, internal control

**JEL classification:** G21, G32, M42

## 1. Introduction

In recent years, the banking industry in the Republic of Moldova has undergone significant changes, including increased competition, regulatory changes, technological advances and economic uncertainty. These changes have brought new risks to the banking sector, therefore, risk management and internal control could be considered as critical elements in the banking industry, where financial institutions play a vital role in supporting the economy.

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Based on the traditional literature on risk management, the term internal control has been used to denote a particular concept that „directly involves accountants in risk management” (Williams and Heins, 1976). The fields of risk management and internal control have developed considerably in modern times, and their interrelationship has become increasingly important as a result of the growing need to avoid corporate scandals. Internal control is now considered as one of the 37 components of risk management, and it was previously considered a part of accounting risk management. However, the relationship between the two may not be so straightforward in modern risk management. Exploring the meaning and context of this relationship, one can provide guidance for the effective implementation of risk management and internal control.

According to researchers around the world, risk has emerged as the additional facet of business, following individuals, process, and science, and has gained popularity. They have found that companies that effectively turn risk into an opportunity can create a competitive advantage for themselves (Suleri and Cavagnaro, 2016).

Macey and O’Hara (2003) underscored the crucial nature of preserving the banking industry’s health, as did Adams and Mehran (2003), as its failure can lead to severe economic downturns and costly consequences for nations. For this reason, banking activities are subject to strict regulations in comparison to other industries (Bunea and Dinu, 2020).

Studies investigating the underlying factors that lead to challenges in the banking sector, as studied by Akwaa-Sekyi and Gene (2016) and the research conducted by Bayyoud and Sayyad (2015), have essentially identified the implementation of a proficient internal control mechanism as having the potential to mitigate financial costs. Bank failures have significant and undesirable effects, not only on depositors but also on investors, the wider banking public, and the economy as a whole. Nevertheless, banking authorities face challenges in improving risk management because the ultimate duty of determining the banks’ strategy, appointing managers, and formulating operational policies rests with the board of directors, as articulated by Van Greuning and Bratanovic (2003). To prevent potential shortcomings and ensure effective risk management, it is imperative to establish strong regulations that are consistent with bank governance, and enable banks to identify, assess, and manage risks competently. This is a high priority for policy makers. Moreover, effective risk management has become a source of profit, leading to growth in banking asset portfolios and reduction in operational expenses. This confirms previous investigations into the impact of studies on the role of corporate management mechanisms on the management of risks (Negrei and Istudor, 2018).

There are researchers such as Miller (1992) as well as Miccolis and Shaw (2000), along with Cumming and Mirtle (2001), Nocco and Stulz (2006) and Sabato (2010), who have investigated corporate governance practices within the banking industry. Their studies shed light on the risks tied to corporate administration and effective risk control measures within corporate governance procedures.

The fundamental goal of this investigation is to appraise the interdependencies between risk management and internal governance tools used by the systemically important banks in Moldova, following the Law on Banking Activity, as of December 31, 2022. This matter holds significant relevance and urgency for Moldova, given the essential need for the continual advancement of banks’ internal control systems. According to Ciobu and Cara (2022), links have been identified among the internal controls and default risk, as well as its impact on the overall financial effectiveness of the Moldovan banking system.

Therefore, the novelty of this article is the extension of the previous analysis to assess the different risks faced by banks, with a comprehensive exploration of possible interdependencies between internal control systems and financial risks in systemically important Moldovan banks. In addition, this is the first study at the level of the Moldovan banking system that attempts to capture the association between internal controls and management of risk.

The originality of this paper can be highlighted by (1) Innovative analysis: the study introduces an innovative approach by conducting an econometric analysis of the dependency of the internal control framework and risk management of Moldavian banks. This approach provides a deeper understanding of how these critical components of the banking sector interact; (2) The research focuses specifically on the Moldovan banking sector, contributing to a more localised understanding of the dynamics of risk management and internal control. This specificity adds value to the literature as it takes into account the unique circumstances and regulations in Moldova; (3) The study takes into account recent developments in the Moldovan banking sector, providing timely insights into the current state of

internal control mechanisms and management of risks, which is essential in addressing the existing challenges and opportunities in the industry. (4) The paper's focus on the interplay between internal control framework and financial risks addresses a critical area in banking. It is consistent with the argument of Acharya and Richardson (2009) that efficient risk management is essential to prevent excessive risk exposure in banks. Therefore, this study is expected to provide valuable perspectives on the efficient handling of financial risks.

It is worth acknowledging that there is a lack of research on the impact of the internal control mechanism on risk management within the Moldovan banking industry. Consequently, this issue will be the central subject of investigation in this study. However, the scope of the study is not sufficient to draw conclusions that are widely applicable.

The subsequent parts of the research are organized as follows: Section 2 delivers a summary of the literature approach and research hypotheses, while Section 3 delineates the study's methodology. Section 4 explores the findings, and Section 5 encapsulates the study's conclusions.

## **2. Literature approach and research hypotheses**

Within the banking sector, it is crucial to establish a robust internal control system in place to achieve business objectives and protect against risks. The internal control system should be continuously evaluated and adapted to changing business conditions and evolving best practices. This guarantees the identification and assessment of all risks encountered by the bank, with the implementation of necessary measures for mitigation. Additionally, adherence to laws and regulations constitutes a pivotal facet of the internal control system. Ultimately, strong internal controls contribute to enhancing the overall economic performance of banking institutions. According to Biciulaitis (2001), internal control is responsible for coordinating efforts to manage and reduce risks in the business environment. However, Lakis (2007) argues that its purpose is to align the organization's strategies with the desired performance objectives to ensure that resources are used appropriately and efficiently. Millichamp (2002) defines the internal control system as a mechanism, whether financial or otherwise, instituted by administration to protect assets and ensure the utmost completeness and accuracy of financial reports to the best of its ability. Pfister (2009, p.245) suggests that internal control enables companies to prevent, detect and correct potential discrepancies in information processing. Olatunji (2009), in his examination of the influence of internal control framework in the banking sector, contends that inadequate internal control systems are the predominant factors behind the fraudulent activities within Nigerian banks. Similarly, a study by Adeyemi and Adenugba (2011) found that poorly functioning internal control systems lead to poor bank performance because they fail to identify and prevent fraudulent activities within the system.

In order to properly manage risks at the bank level, it is crucial to institute an internal control system capable of recognizing and assessing risks, ensuring conformity with legal mandates, and appraising the internal controls' efficiency and effectiveness.

According to Akwaa-Sekyi and Gené (2017), banks have specific firm characteristics that can either increase or decrease credit risk. Their study indicates that proficient internal control systems play a crucial role in attaining the goals of internal control, exerting a noteworthy influence on the assessment of credit risk. This risk category concerns the magnitude of unrecovered loans, loans that are considered problematic, or the funds reserved for potential defaulted loans (Jimenez and Saurina, 2006). Cho and Chung (2016) examined the correlation between internal control vulnerabilities in banks and provisions for loan losses, discovering that credit institutions with sound policies but internal control weaknesses were able to reduce their loan loss provisions over time. Similarly, Akwaa-Sekyi and Gené (2016) conducted a study that explored how internal controls influence Spanish banks' credit risk. The study focused on assessing the effectiveness of internal controls in identifying default risk and establishing the link between credit risk and internal controls. Results demonstrated that, despite the presence of internal control systems, their effectiveness was not guaranteed, leading Spanish banks into a significant default situation. Dedu and Chitan (2013) found that the performance and risk mitigation of a bank was influenced by its internal governance, when used for internal controls. A study on the impact of corporate governance on market risk was conducted by Permatasari (2020), which showed that the adoption of effective corporate governance practices in Indonesia had an impact on bank risk. The

researches of Khan, Al-Jabri, Saif, (2021) and Alabdullah et al. (2022) found that there is a notable impact of board size, board independence and board duality on bank performance and risk management. However, banks with varying governance ratings displayed variations in credit, liquidity, and operational risks, but not in market risk. According to Trenca and Caba-Maria (2008), the current emphasis on managing operational risk reflects the overall regulatory focus on enhancing internal control systems within organizations. As well, drawing from Nguyen and Dang (2022) research, which examined the impact of risk governance effectiveness of a bank's risk administration, utilizing a risk governance effectiveness index have concluded that regulatory authorities can formulate directives concerning risk governance to oversee a bank's risk management operations and uphold the stability of banks. It becomes evident that the integration of robust risk governance practices within the internal control framework of banks is pivotal in ensuring effective risk management, thereby safeguarding the financial stability of banking institutions (Barr-Pulliam, Brown-Liburd, and Sanderson, 2022).

In the national literature, there are inquiries into the connection between corporate governance and risk administration in banks, with an exclusive focus on qualitative investigations. For example, Girlea (2013) concluded in his research that it is crucial for local commercial banks to clearly distinguish between their control, internal audit and bank risk management activities. To do this, these banks need to identify and establish their risk profile and set objectives and strategies for each significant risk they face. They must also be willing to take risks and determine the threshold at which a risk becomes significant. In turn, Postolache and Curac (2018), in their research on risk management in the process of corporate management of banking activities, mentioned that the Moldovan banking sector is focused on two main issues: improving its efficiency and addressing existing shortcomings through restructuring. The National Bank of Moldova has set limits and restrictions to address specific issues within the sector. Violation of these limits can have a negative impact on a bank's activities, posing a threat to the entire banking sector in Moldova.

Given the study's objective to ascertain the impact, if any, of internal control characteristics on banks' risk exposure levels, the author has formulated the subsequent four hypotheses in their null state:

H01: The effectiveness of the internal control system in Moldovan banks does not exhibit significant dependence with the credit risk of the banks.

H02: The effectiveness of the internal control system in Moldovan banks does not exhibit significant correlation with the market risk of the banks.

H03: The effectiveness of the internal control system in Moldovan banks does not exhibit significant correlation with the liquidity risk of the banks.

H04: The effectiveness of the internal control system in Moldovan banks does not exhibit significant correlation with the operational risk of the banks.

### **3. Methodology of research**

The aim of the present study is investigation of the risk administration and internal controls of Moldova's banking industry, focusing on the banks of systemic importance, i.e. CB "Moldova - Agroindbank", JSC, CB "Moldindconbank" JSC, CB "Victoriabank" JSC, OTP Bank JSC in order to receive more reliable results. The primary research approach involves quantitative methods, utilizing deductive statistical analysis to examine proposed hypotheses and discern causal interactions.

Data collection and calculations were carried out using Excel spreadsheet software. The study relies exclusively on secondary data, including statistical information sourced from the official National Bank of Moldova website and published information on economic and financial activity, bank governance, semi-annual and yearly financial reports of four systemically important Moldovan banks, during 2020-2022. For data processing, EViews 13 Student Version, an econometric analysis software for conducting correlation tests and regression analysis, was employed. The study identified and clearly defined measurable dependent and independent variables. The dependent variables (Table 1) are represented by selected indicators to represent credit, liquidity, market and operational risks, similar to the representations found in the research of Temile et al. (2019), Pham (2020) and Permatasari (2020).

*Table 1. Dependent variables*

Variables	Acronym	Definition	Previous studies	Representative indicators
<b>Credit Risk</b>	CR_RISK	Ratio of non-performing loans (NPL)	Akwaa-Sekyi and Gené (2017), Pham (2020)	Non-performing Loan/ Total Loans
<b>Market Risk</b>	MK_RISK	The share of loans in foreign currency out of total loans	Permatasari (2020)	Loans in foreign currency/Total loans
<b>Liquidity Risk</b>	LQ_RISK	Liquidity ratio	Temile et. al. (2019)	Long term liquidity ratio (principle I)
<b>Operational Risk</b>	OP_RISK	The share of risk weighted assets for operational risk out of total assets	Permatasari (2020)	Risk Weighted Assets for Operational Risk/ Total Assets

Source: Developed by the author, based on review of scientific literature

Following an extensive literature review, it was decided to employ the independent variables aligning with the components of the internal control as outlined in the COSO model, along with their corresponding indicators. Table 2 elucidates the breakdown, symbols, calculation, and definitions of the independent variables utilized in the analysis, similar to the categorization approach taken by Ciobu and Cara (2022). Additionally, the indicator representing the size of the bank was selected as a control variable. To mitigate variability among the variables, the logarithm of the variables was calculated, considering the nature of the data used.

*Table 2. Independent variables*

Internal control elements	Acronym	Definition	Previous studies	Representative indicators
<b>Control environment</b>	DIM_CB	Size of the Bank Board	Zhang et al. (2007), Adams and Mehran (2012), Aebi et al. (2012)	Total number of members of the Bank Board at the end of the financial year.
	GEN_CB	Gender diversity	Stefanescu (2011), McKinsey et al. (2007)	The proportion of women among the total members of the boards.
<b>Risk assessment</b>	PD_IND	Board independence	Cornett et al. (2009)	Percentage of independent members among the total number of Bank Board members.
	ANV_TA	Asset utilization efficiency	Akwaa-Sekyi & Gené (2016, 2017)	Non-income producing assets / Total assets
	CAR	Capital adequacy ratio	Akwaa-Sekyi & Gené (2016, 2017)	(Tier I capital + Tier II capital) / Risk Weighted Assets
<b>Control activities</b>	CR_TA	Ensuring credit limits	Akwaa-Sekyi and Gené (2016, 2017)	Loans to assets ratio
<b>Monitoring</b>	AUD	Using one of the foremost six audit firms.	Zhang et al. (2007), Tang et al. (2014), Koutoupis and Malisiovas (2019)	Binary variable assigned if the financial statements are audited by one of the leading six audit entities "0" otherwise.
<b>Communication and information systems</b>	FRF	Reliability of financial reporting	Zhang et al. (2007), Koutoupis and Malisiovas (2019)	Binary variables assigned the value "1" if the bank has complied with international standards and submitted financial reports promptly, and "0" otherwise.

Source: Formulated by the author, drawing upon a review of scholarly literature.

Hence, incorporating both time series and adopting a cross-sectional research design, the data were structured into a panel, facilitating the exploration of the relationship between the independent and dependent variables. Model of the study has been defined in its functional format, which aligns with previous studies conducted by Permatasari (2020) and Ciobu and Cara (2022), therefore, multiple regression models of the following type were employed:

$$Y_{it} = \beta_0 + \beta_1 \times X_{1t} + \beta_2 \times X_{2t} + \beta_n \times X_{nt} + \varepsilon_{it} \quad (1)$$

where,  $Y_{it}$  is the vector of dependent variables,  $i$  being in turn, CR\_RISK, MK\_RISK, LQ\_RISK and OP\_RISK;  $\beta_0$  is the intercept term;  $\beta_1, \beta_2, \dots, \beta_n$  are the coefficients of the independent variables;  $X_{1i}, X_{2i}, \dots, X_{ni}$  represent the independent variables;  $\varepsilon_{it}$  stands for the stochastic error term pertaining to banks, reflecting the risk that other unaccounted factors in the econometric model may impact banks' risk management;  $i$  signifies the cross-sectional observation unit, and  $t$  signifies the time period.

Therefore, panel unit root tests (as the data were organized in panels) were performed to check whether the underlying data series were stationary and to ensure that the statistical model used in the time series analysis produced reliable results. Since EViews offers various panel unit root tests, the most prevalent ones, namely the Levin-Lin-Chu test, the Im-Pesaran-Shin test, and the Fisher-type panel unit root test, were employed.

In addition, to assess the measurement and structural models, a multiple regression equation was established utilizing the least squares method (as a common technique to find the best fitting line through the data points). Once the coefficients were estimated, their values were interpreted. These coefficients, revealing the magnitude and direction of connections between the independent and dependent variables, were analyzed. Simultaneously, the author evaluated the models' accuracy in representing the data, using common measures such as R-squared (depicting the proportion of variance in the dependent variable explained by the independent variables) and significance tests for the coefficients.

#### 4. Research results and discussion

Within this part, the results derived from the gathered information are presented, being used as descriptive as well as empirical analysis.

Estimators are inefficient if the variables in a panel data are nonstationary unless they are cointegrated. Hence, to examine the stationarity of the dependent variables, a unit root test was carried out, as indicated in Table 3. The null hypothesis in the panel unit root test assumes the stationarity of variables, while the alternative hypothesis posits the nonstationarity of variable series.

*Table 3. Analysis of stationarity of variables*

Variables	CR_RISK		MK_RISK		LQ_RISK		OP_RISK	
	Statistic	Prob	Statistic	Prob	Statistic	Prob	Statistic	Prob
Levin, Lin, Chu	-2.728	0.003	0.873	0.002	3.172	0.000	0.439	0.000
ADF- Fisher Chis square	3.140	0.000	-0.225	0.000	0.029	0.000	0.028	0.000
PP- Fisher Chi square	464.210	0.000	-0.228	0.000	-0.479	0.001	0.034	0.000

Source: Prepared by the author utilizing results derived from the econometric analysis software EViews 12 Student Version.

Considering the stationarity tests, the inference drawn is that all four variables (CR\_RISK, MK\_RISK, LQ\_RISK, and OP\_RISK) are stationary, which is an essential assumption for time series analyses and modeling techniques. These results provide confidence in the stability and reliability of the data for further analysis and modeling. The null hypotheses of the unit root for all variables were dismissed, and all three tests exhibit statistically significant results with p-values below 0.05.

#### 4.1 Descriptive statistics

Based on the findings shown in Table 4, it can be inferred that the mean and median values of all variables are similar, indicating a reduction in the heterogeneity of the sample.

The mean value of the NPL ratio was 10.1%, the standard deviation of the indicator recorded a value of 6.7%, while the difference between the minimum and maximum value is about 26.5 p.p., indicating a considerable variation in credit risk among systemic banks in Moldova. Liquidity ratio had an average value of 0.73, suggesting that Moldovan banks are highly liquid, as expected given the nature of their business. The level of this indicator is also below the limits set by the National Bank of Moldova, being less than or equal to one. The minimum market risk value is 18.4%, while the maximum is 42.5%, suggesting a notable disparity in the proportion of foreign currency loans within the total loans of banks in the Republic of Moldova. The standard deviation of most variables from their respective means was found to be high, except for the operational risk indicator, credit risk, and the percentage of women among the total number of board members, which showed a narrow dispersion.

The results of the study show that the average board size for the period under review was around 6.150, with the maximum and minimum board size being 4 and 7 respectively. This means that the smallest board size observed in the banks was four members, while the largest was eight members. Similarly, the gender diversity indicator for boards reveals an average of approximately 11% women among the total board members in the analyzed banks. In contrast, the average value for the proportion of independent members among the total number of bank board members is 86%, which means that the boards of Moldovan banks have a high level of independence.

*Table 4. Descriptive statistics*

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
CR_RISK	0.101	0.078	0.312	0.047	0.067	1.878	6.094	19.729
MK_RISK	0.300	0.293	0.425	0.184	0.067	0.042	2.105	0.673
LQ_RISK	0.738	0.730	0.980	0.510	0.110	0.005	3.177	0.056
OP_RISK	0.081	0.078	0.101	0.064	0.011	0.468	2.170	1.306
DIM_CB	6.150	7.000	7.000	4.000	1.089	-0.802	2.182	2.704
GEN_CB	0.108	0.083	0.286	0.000	0.115	0.215	1.337	2.459
PD_IND	0.862	0.929	1.000	0.571	0.170	-0.797	2.053	2.866
ANV_TA	0.193	0.160	0.414	0.094	0.090	1.066	3.222	3.828
CAR	0.272	0.242	0.447	0.189	0.081	0.888	2.555	2.792
CR_TA	0.441	0.479	0.552	0.253	0.101	-0.644	1.920	2.356
AUD	0.800	1.000	1.000	0.000	0.470	-0.873	1.762	3.817
FRF	0.950	1.000	1.000	0.000	0.224	-4.129	18.053	245.660
LOG(DIM_B)	23.700	23.637	24.485	23.120	0.359	0.545	2.641	1.099

Source: Prepared by the author utilizing results derived from the econometric analysis software EViews 12 Student Version.

The average efficiency of asset utilization stands at 19.3%, with a standard deviation of 9%. A high value of this indicator implies low efficiency in asset utilization, and the variation between the maximum and minimum values can be attributed to shifts in the banks' shareholder structure and governance. Despite the broad range, the capital adequacy ratio spans from 18.9% to 44.7%, averaging at 27.2%. The average suggests that the banks are adequately capitalized, exceeding the minimum requirement of 10% for the risk-weighted capital adequacy ratio as per the new Basel III calculation. This means that banks are unlikely to engage in risky activities that could lead to financial losses.

Overall, the Moldovan banking system is overcapitalized and can meet its payment obligations (Ciobu and Cara, 2022).

As an indicative measure of control activities, the ratio of loans to total assets varied between 25.3% and 55.2%, averaging at 44.1%. Elevated values signify increased susceptibility to credit risk, and the standard deviation of 10.1% indicates some volatility in this variable across banks. In addition, the econometric analysis shows that certain variables representing the risk assessment and control environment have a positive skewness trend. In terms of kurtosis, some variables have a coefficient greater than 3, i.e. credit risk, liquidity risk, asset utilization efficiency and reliability of financial reporting, showing a leptokurtic distribution, implying a higher likelihood of extreme events than expected in a normal distribution. The remaining variables exhibit a flatter distribution with a flattening coefficient less than 3. Jarque-Bera test results suggest that all variables are normally distributed, given their probabilities exceeding 0.05. These results for the independent variables show the same trend as the research by Ciobu and Cara (2022). Once the preliminary analysis was completed, the study proceeded to the empirical analysis.

To examine the link among the variables employed in current research, a correlation analysis using the Pearson correlation technique was performed (Table 5).

*Table 5. Correlation matrix of variables*

Variables	CR_RISK	MK_RISK	LQ_RISK	OP_RISK	DIM_CB	GEN_CB	PD_IND	ANV_TA	CAR	CR_TA	AUD	FRF	LOG (DIM_B)
CR_RISK	1.000	0.285	-0.450	0.086	0.120	-0.460	0.139	0.847	0.356	-0.737	-0.376	0.059	-0.444
MK_RISK		1.000	0.073	0.602	-0.042	-0.276	-0.543	-0.006	-0.374	0.138	0.319	0.244	-0.001
LQ_RISK			1.000	0.394	-0.032	-0.223	-0.133	-0.397	-0.374	0.539	0.211	0.209	0.063
OP_RISK				1.000	0.149	-0.533	-0.109	-0.134	-0.288	0.174	-0.092	0.082	-0.139
DIM_CB					1.000	-0.113	-0.296	0.156	0.412	-0.292	-0.113	-0.184	0.201
GEN_CB						1.000	-0.270	0.483	-0.022	0.287	0.273	-0.190	0.553
PD_IND							1.000	0.290	0.164	-0.207	-0.450	-0.190	-0.684
ANV_TA								1.000	0.614	-0.863	-0.189	0.111	-0.621
CAR									1.000	-0.849	-0.085	-0.132	-0.234
CR_TA										1.000	0.256	0.134	0.418
AUD											1.000	0.350	-0.005
FRF												1.000	-0.053
LOG (DIM_B)													1.000

Source: Prepared by the author utilizing results derived from the econometric analysis software EViews 12 Student Version.

The relationship between liquidity ratio and credit risk is mixed, with a negative correlation suggesting that higher liquidity corresponds to lower credit risk and vice versa, like the findings of Temile et al. (2019). In addition, negative correlations are observed between credit risk and control environment, control activities and monitoring elements of internal control, indicating that higher internal control leads to lower credit risk. Similarly, there is a negative correlation between market, liquidity and operational risks as well as the control environment and risk assessment elements, also suggesting that better internal control minimizes these risks.

Conversely, there exists a positive correlation between control activities, monitoring, communication and information systems elements and market, liquidity and operational risks. This suggests that improved internal control is associated with higher risk indicators.



Overall, the findings indicate that, during the period 2018-2022, there is a direct correlation between the augmentation of specific indicators and a reduction in financial and operational risks within the banking system of Moldova. However, the correlation matrix analysis showed that most of the correlations between variables are low (less than 0.8), which indicates the absence of multicollinearity problems and allows further data processing. In addition, the significance of the correlation coefficient between variables was tested using EViews and the result indicated that the correlation coefficient was significant at the level of 0.001.

#### 4.2 Analysis of the internal control system effects on risk management in banks in the Republic of Moldova

By analyzing the four dependent variables presented in Table 6, a test of least squares regression analysis was performed. Model no. 1, which focuses on credit risk, has a very high  $R^2$  value of 0.915. This suggests that approximately 91.5% of the variation in credit risk across banks can be attributed to variations in the control environment, risk assessment, control activities and monitoring. A robust positive correlation of this magnitude suggests a substantial impact of these elements of the internal control system on shaping credit risk. The low probability linked to the F-statistic further confirms the overarching significance of the model.

For model no. 2, which examines market risk, the  $R^2$  value is 0.777. This indicates that around 77.7% of the variations in market risk can be accounted for by variations in the analyzed internal control system's components. Again, this reflects a robust positive correlation among the internal control and market risk. Additionally, this indicates that nearly all internal control components, except for information and communication, have a significant impact on market risk within these banks.

Model no. 3 explores liquidity risk and reveals that the internal control system variables explain 65.6% of the variation in liquidity risk. The slightly lower  $R^2$  compared to the previous models indicates that nearly all internal control components, except for information and communication, play a significant role in managing liquidity risk within the analyzed banks.

Model no. 4 focuses on operational risk and demonstrates a strong positive correlation with the internal control system variables. The  $R^2$  of 0.705 suggests that these variables explain 70.5% of the variation in operational risk. This indicates that the control environment, control activities, risk assessment, and monitoring are essential for managing and mitigating operational risk within these banks.

Table 6. Regression analysis

Variables	Model no. 1 (CR_RISK dependent variable)			Model no. 2 (MK_RISK dependent variable)			Model no. 3 (LQ_RISK dependent variable)			Model no. 4 (OP_RISK dependent variable)		
	Coef.	Std. error	Prob	Coef.	Std. error	Prob	Coef.	Std. error	Prob	Coef.	Std. error	Prob
C	2.728	1.418	0.043	0.873	0.302	0.030	3.873	0.531	0.429	1.176	0.439	0.023
DIM_C B	0.001	0.008	0.023	-0.007	0.016	0.046	-0.023	0.028	0.007	0.001	0.002	0.028
GEN_ CB	0.140	0.091	0.047	-0.225	0.142	0.024	0.529	0.303	0.011	-0.036	0.028	0.032
PD_IN D	-0.210	0.111	0.038	-0.228	0.110	0.011	-0.479	0.367	0.022	-0.074	0.034	0.056
ANV_ TA	0.372	0.214	0.003	0.004	0.384	0.012	0.257	0.709	0.023	-0.136	0.066	0.067
CAR	-0.414	0.250	0.128	-0.573	0.430	0.038	1.797	0.827	0.045	-0.024	0.077	0.045
CR_T A	-0.384	0.288	0.001	-0.363	0.516	0.026	2.313	0.956	0.036	0.003	0.089	0.028

Variables	Model no. 1 (CR_RISK dependent variable)			Model no. 2 (MK_RISK dependent variable)			Model no. 3 (LQ_RISK dependent variable)			Model no. 4 (OP_RISK dependent variable)		
	Coef.	Std. error	Prob	Coef.	Std. error	Prob	Coef.	Std. error	Prob	Coef.	Std. error	Prob
AUD	-0.075	0.031	0.038	0.036	0.034	0.335	-0.081	0.103	0.453	-0.017	0.009	0.997
FRF	0.036	0.038	0.369	-0.021	0.070	0.971	-0.058	0.126	0.653	0.007	0.011	0.561
LOG (DIM_B)	-0.094	0.058	0.133	-0.201	0.093	0.005	-0.167	0.191	0.402	-0.043	0.017	0.039
<b>R<sup>2</sup></b>	0.915			0.777			0.656			0.705		
<b>Adjusted R<sup>2</sup></b>	0.839			0.578			0.346			0.439		
<b>F-statistic</b>	12.017			3.892			2.120			2.656		
<b>Prob. (F-stat)</b>	0.000			0.000			0.000			0.000		

Source: Prepared by the author utilizing results derived from the econometric analysis software EViews 12 Student Version.

The results consistently show that variables related to the internal control system have a substantial and positive influence on various types of financial risks within the analyzed banks. The high R<sup>2</sup> values and statistically significant F-statistics emphasize the crucial role of a well-structured internal control system in effective risk management. These findings provide valuable insights for banks and regulators in enhancing risk governance and stability.

Based on the findings from the regression analysis, the board size control environment variables exhibit a positive impact on credit risk, aligning with the conclusions drawn by Bunea and Dinu (2020), but differ from what the author discovered in the previous research. However, there was observed an inverse relationship between size of the board and market risk and liquidity risk. Thus, it is concluded that a larger board size is associated with better risk management. As well there was recorded a direct relationship between the “proportion of women among the total board members” indicator and both liquidity and market risks. Therefore, gender diversity emerges as a significant factor in the management of these risks.

Concerning risk assessment, the percentage of independent members among the overall bank board members exhibits a negative relationship with all the analyzed risks. These results contradict the findings of Tsorhe et al. (2011), suggesting that there is no statistical variability in the Ghana's bank boards' effectiveness, and the board's effectiveness has no significant impact on credit, capital or liquidity risks. Thus, in their opinion, board strength has no significant effect on credit, capital risk and liquidity risks (El-Masry et al., 2016). Asset utilization efficiency is positively related to credit, market and liquidity risk, such that, keeping all other variables constant, a one-unit rise in the proportion of non-income generating assets in total assets results in a credit risk increase of 0.372, in market risk by a coefficient of 0.004 and in liquidity risk by a coefficient of 0.257, while a unit increase in asset utilization efficiency leads to a decrease in operational risk by a coefficient of 0.136.

A recent study by Ciobu and Cara (2022), in their estimation of the regression between credit risk and financial performance they also used credit risk as the dependent variable and the percentage of assets that do not generate income in the total assets, audit committee independence and the percentage of independent directors as independent variables. However, the main difference between the results is the intensity of the relationship. In the present study, the coefficient for the share of non-income producing assets in total assets is lower, indicating that variations in this factor may have a relatively weaker influence on credit risk compared to other studies. On the other hand, this research

implies that greater audit committee independence and a higher percentage of board independence are associated with lower credit risk. It is important to note that the above research included a broader dataset covering the entire Moldovan banking system, rather than focusing only on the four systemic banks (as in the current research).

As well, holding all other factors constant, a one-unit increase in the capital adequacy ratio results in a coefficient of: 0.414 decrease in credit risk (non-significant), 0.573 decrease in market risk and 0.024 decrease in operational risk, while a one-unit increase in the capital adequacy ratio results in a coefficient of 1.797 increase in liquidity risk. The first model's results indicate that a unit increase in credit risk is likely to occur with a negative change in the monitoring and control activities elements of the internal control, as demonstrated by a coefficient of 0.384 and 0.036 respectively. However, a one-unit rise in credit risk could result in a positive change in communication and information systems. The findings of the second model show that a one-unit rise in market risk is likely to be associated with a negative change in control activities, as indicated by a coefficient of 0.363. However, the p-values suggest a non-significant relationship between market risk and the monitoring and communication and information systems component of internal control. The Model No. 3 suggests a non-significant connection with the monitoring and communication and information systems elements, but the p-values suggest a significant relationship between liquidity risk and the control activities component of internal control. Regarding the fourth model result, a unit increase in operational risk is likely to occur with a positive change in control activities, as indicated by a coefficient of 0.003. The overall results show a correlation between the independent and constant variables. Thus, the alternative hypotheses of the study have been accepted and it should be mentioned that there is a correlation between financial risks and the internal control system of Moldovan banks.

Additionally, for all four models, the probability of the F-statistic test is zero, signifying that the models hold statistical significance at the 1% threshold and are free from any omitted specifications. If banks fail to implement effective credit risk management strategies, they can suffer significant financial losses, but when these practices are utilized, they can improve their financial positions.

## 5. Conclusions

According to this research, an adequate internal control system of Moldovan banks could reduce the likelihood of commercial banks being exposed to different types of financial risks. To obtain reliable results, the significance of the correlation coefficient between variables was tested, and according to the stationarity tests, all four dependent variables are stationary.

The results show that there are significant correlations between internal control and credit, liquidity, market and operational risks. In particular, the findings reveal a negative association between credit and market risks and internal control, whereas a positive correlation is evident between liquidity and operational risks and internal control. Consequently, it can be asserted that all four null hypotheses, positing that the effectiveness of the internal control system in Moldovan banks has no significant relationship with credit, market, liquidity and operational risks, have been refuted: (1) increased credit risk is associated with lower internal control in Moldovan banks. (2) a heightened market risk corresponds to a diminished impact of the current internal control in the Moldovan banking system; (3) implementation of more effective internal control measures leads to an increase in the liquidity ratio; (4) The effectiveness of existing internal control measures is compromised by high operational risk.

Based on the findings, the study recommends that banks in Moldova should implement reliable and proven internal control strategies and explore methods to improve their effectiveness, but risk management should be prioritized. In addition, The National Bank of Moldova should enhance its supervisory initiatives to ensure that banks adhere to optimal risk management practices.

This study represents the first attempt at the Moldovan banking system level to explore the correlation between risk management and the internal control system. Nevertheless, it is essential to recognize several limitations associated with this study. First, the relatively limited number of samples of representative banks and the limited data span of five years may limit the generalizability of the findings. Second, the study's focus on a selected group of systemic banks may not fully capture the broader dynamics of the Moldovan banking sector. Third, as with any empirical research, the study's findings may be affected by unobserved factors or unaccounted for variables that could influence the

results. To address these limitations and further the authors' understanding, future research could examine an expanded dataset that includes a wider range of Moldovan banks over a longer period of time. In addition, researchers could delve deeper into specific risk management and internal control indicators to uncover nuanced relationships and causal factors. Comparative studies with international banks or examining the impact of regulatory changes on internal controls could also provide valuable insights. In addition, researchers may choose to use qualitative approaches and/or a mix of research methods to collect data for future research.

The study offers concrete lessons for Moldovan banks and regulators. Banks are encouraged to prioritize the risk management as well as the internal control, emphasizing the realization of reliable control strategies while fostering an environment conducive to risk mitigation. The National Bank must enhance its supervisory efforts to ensure that banks adhere to optimal practices in risk management and internal control, fostering stability within the financial sector. In conclusion, while this study provides important insights into the critical interplay between internal control and risk management, it should be viewed as a foundational step. Future research, building on these findings and addressing the limitations identified, promises to provide even more refined guidance for Moldovan banks and regulators alike.

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