РЕГИОНАЛЬНАЯ И ОТРАСЛЕВАЯ ЭКОНОМИКА

Подходы к оценке рыночного и кредитного риска в современной банковской системе

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Аннотация. В статье представлены результаты исследования теоретических и прикладных аспектов рыночного и кредитного риска в современной банковской системе. Во введении обоснована актуальность темы исследования в условиях роста финансовой нестабильности, усиления регуляторных требований и увеличения влияния внешних шоков на деятельность банков. Особое внимание уделено роли банков как ключевых посредников между заемщиками и инвесторами и высокой уязвимости банковского сектора к системным рискам. В разделе «Материалы и методы» использованы методы анализа и обобщения научных источников, сравнительный подход к оценке различных видов банковских рисков, а также систематизация классических и современных моделей управления рисками. В качестве методологической базы применены концепции рыночного риска, кредитного риска, а также методы их количественной оценки, включая Value at Risk (VaR) и показатели вероятности дефолта, используемые в банковской практике. В результате исследования выявлены ключевые особенности проявления рыночного и кредитного риска в банковской системе, а также показана их взаимосвязь и влияние на финансовую устойчивость банков. Установлено, что кредитный риск остается доминирующим источником потенциальных потерь, тогда как рыночный риск в большей степени влияет на краткосрочные финансовые результаты банков. В обсуждении подчеркивается значимость комплексного подхода к управлению банковскими рисками и необходимость совершенствования инструментов их оценки в условиях возрастающей неопределенности. Сделан вывод о практической значимости систематизации методов оценки рыночного и кредитного риска для повышения устойчивости банковской системы в целом.

Ключевые слова: *банковская система, рыночный риск, кредитный риск, управление рисками, финансовая устойчивость, Value at Risk, дефолт*

REGIONAL AND SECTORAL ECONOMIC STUDIES

Market and credit risk in the modern banking system

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Abstract. The article presents the results of a study of theoretical and applied aspects of market and credit risk in the modern banking system. In the introduction, the relevance of the research is justified in the context of increasing financial instability, tightening regulatory requirements, and the growing impact of external shocks on banking activities. Particular attention is paid to the role of banks as key intermediaries between borrowers and investors and to the high vulnerability of the banking sector to systemic risks. The materials and methods section is based on the analysis and generalization of scientific literature, a comparative approach to assessing different types of banking risks, and the systematization of classical and modern risk management models. The methodological framework includes concepts of market risk and credit risk, as well as quantitative approaches to their measurement, including Value at Risk (VaR) and probability of default indicators widely used in banking practice. The results of the study reveal the key characteristics of market and credit risk manifestation in the banking system and demonstrate their interrelationship and impact on banks' financial stability. It is shown that credit risk remains the dominant source of potential losses, while market risk primarily affects short-term financial performance of banks. The discussion emphasizes the importance of an integrated approach to banking risk management and the need to improve risk assessment tools under conditions of growing uncertainty. The study concludes that the systematization of market and credit risk assessment methods has practical significance for enhancing the overall stability of the banking system.

Key words: *banking system, market risk, credit risk, risk management, financial stability, Value at Risk, default*

Introduction

Today, the global economy faces numerous challenges. In addition to predictable risks, there are unpredictable events that are highly unlikely to occur but can cause severe consequences when they do. These events are commonly referred to as "Black Swans." Although the term sounds poetic, it encompasses serious occurrences such as the recent COVID-19 pandemic, political instability, military conflicts, the 9/11 attacks in New York, the 2001 dot-com bubble, and the 2008 financial crisis, among others. Both predictable and unpredictable challenges primarily impact the global financial system, including banking institutions, stock exchanges, and other financial markets. Given that every country typically has at least one major bank capable of serving thousands, if not millions, of clients, it becomes essential first to identify and then to mitigate these risks (Jorion, 2007).

While the concept of a challenge is relatively straightforward, defining risk is more complex. Risk can be defined as the volatility of unexpected outcomes, which can, in turn, affect the value of earnings, assets, or equity (Bohdalová, 2007: 1-4). Risk is often perceived negatively; however, it can be classified into two types: good and bad. A "good" risk represents an opportunity to find and implement a solution even if the worst-case scenario occurs. Conversely, a "bad" risk indicates the impossibility of identifying a feasible solution if the worst-case scenario materializes (Scott McGillivray, 2023). It is also important to note that higher-risk investments tend to be more profitable, whereas lower-risk investments generally yield lower returns compared to riskier alternatives.

Among all institutions, financial organizations are particularly exposed to risk, especially banks and investment firms. Clients of these institutions risk losing their funds, except for deposit insurance, which typically covers only a limited amount—for example, in the European Union, deposit insurance covers up to 100,000 euros. This means that if a bank fails, depositors with balances below this threshold recover all their funds, while those with higher balances recover only up to 100,000 euros. Moreover, financial transactions carry the potential for "negative profit," whereby clients can not only lose their assets but also incur debt. This raises a fair question: is there a meaningful difference between banks and financial pyramids? While financial pyramids promise exceptionally high returns with a similar risk structure across low, medium, and high-risk vehicles, banks generally offer lower returns, yet clients may still lose their assets in certain circumstances (Corporate Finance Institute, 2023).

Beyond "Black Swans" and other adverse factors, the primary risks faced by the banking sector include liquidity, operational, market,

credit, and currency risks (Corporate Finance Institute, 2023).

Liquidity risk arises when a financial institution is unable to meet payment obligations on time or cannot do so at a sustainable cost. It occurs when investors, companies, entrepreneurs, or other financial institutions fail to fulfill short-term debt obligations (COE Bank, 2023).

Operational risk refers to losses resulting from human errors, system failures, procedural mistakes, or other internal factors. While operational risk is generally low for standard banking activities, such as retail banking, it is higher in areas like sales and trading. For example, if a customer accidentally transfers an excessive amount of money, it may seem minor, as the transaction could potentially be reversed. However, cybersecurity threats significantly amplify the risk. If hackers bypass security measures, clients may lose not only their personal data but also their funds, while the bank faces financial losses and reputational damage (Corporate Finance Institute, 2023).

Market risk stems from banks' activities in capital markets, where factors such as credit spreads, interest rates, and equity markets are highly unpredictable. Market risk is further compounded by unforeseen global events that influence the financial system, particularly capital markets (Corporate Finance Institute, 2023).

Credit risk, also known as default risk, represents the most significant risk faced by banks. It arises when counterparties or borrowers are unable to fulfill their contractual obligations—for example, when a borrower defaults on a loan's interest payment or fails to repay credit card debt (Corporate Finance Institute, 2023).

Currency risk occurs due to fluctuations in exchange rates and affects banks both directly and indirectly. The direct impact arises when banks hold assets or liabilities with net payments denominated in a foreign currency, as changes in exchange rates alter the domestic currency value of these positions. This form of currency risk is relatively easy to identify and can often be hedged. Indirect currency risk, however, is more complex but equally important. Even a bank without foreign assets or liabilities can experience currency risk if exchange rate movements affect the profitability of its domestic operations (Scott McGillivray, 2023).

Households also face financial risks, which can have a more pronounced negative effect on the economy than those within the banking sector (Volgograd State University, 2019: 280-284). The risks faced by households and banks are interconnected; for instance, if a borrower loses their job, they may fail to repay a credit card debt. While banks employ professional economists and financial experts, most households lack basic financial literacy. Consequently, banks sometimes offer services

that are knowingly unprofitable to financially inexperienced clients or present additional products, such as life insurance, as if they are mandatory.

Market risk, in contrast, is a composite of various risks, including liquidity, interest rate, foreign exchange, commodity, and equity price risks (Bezawada, 2022: 68-72). The combination of these risks and the inherent instability of market dynamics compels banks to focus heavily on market risk management. Institutions are required to enhance existing methods and develop new techniques to estimate interest rate, liquidity, foreign exchange, equity price, and overall market risk. The global financial crisis underscored the need for increased capital buffers, ultimately resulting in the Basel III framework, which mandates additional capital for the trading book (Trenca, Pece, & Mihuţ, 2015: 1391–1406).

The primary objective of risk management is to quantify and forecast potential negative consequences, enabling banks to adopt flexible strategies that minimize losses when risks materialize. Numerous statistical methods exist for quantifying market and other financial risks, with Value at Risk (VaR) remaining the most widely used. VaR summarizes potential losses over a target horizon that are not expected to be exceeded at a specified confidence level, providing a quantile of the projected distribution of gains and losses (Jorion, 2007).

VaR can be calculated using three main approaches: Monte Carlo simulation, historical simulation, and parametric methods. The Monte Carlo method generates scenarios for future prices, taking into account asset volatility and correlations, and calculates portfolio values for each scenario to report final risk measures (Trenca, Pece, & Mihuţ, 2015: 1391–1406; COE Bank, 2023). The historical simulation approach evaluates hypothetical changes in the current portfolio based on past fluctuations in risk factors, without assuming any specific return distribution (Trenca, Pece, & Mihuţ, 2015: 1391–1406). The parametric method assumes that daily returns follow a normal distribution. However, it may underestimate significant losses due to the "fat tails" phenomenon, which captures sudden, extreme events not represented in the normal distribution (Corporate Finance Institute, 2023; Scott McGillivray, 2023).

Materials and Methods

Considering mathematical definition of VaR its fair to define it as: confidence level of $p \in (0,1)$ that is given, and the time index that is assumed of t and $t + \alpha$, finding the change asset of the $\Delta V (\alpha)$ in the financial position within a period of time α. Let $F_\alpha (x)$ be the cumulative distribution function (CDF) of $\Delta V(\alpha)$. As long as the financial position is $\Delta V(\alpha) \leq 0$, then its possible to define VaR of a long position above the time horizon α for a given p as:

$$p = \mathbb{P}[\Delta V(\alpha) \leq VaR] = F_\alpha(VaR) \qquad (1)$$

Considering the holder of a short position, in a given time α with probability p, and the financial position ΔV(α)≥0, VaR defined as

$$p = \mathbb{P}[\Delta V(\alpha) \geq VaR] = 1 - \mathbb{P}[\Delta V(\alpha) \leq VaR] = 1 - F_\alpha(VaR) \qquad (2)$$

Then, p-quantile of F_α (x) to be defined, that for any CDF of F_a (x) and the given confidence level of p ∈(0,1) is:

$$VaR_p = x_p = \inf\{x | F_\alpha(x) \geq p\} \qquad (3)$$

Where:

inf is the smallest real number

x_p that can be written as 〚VaR〛_p if F_α (VaR) is known

An example of the historic method usage of VaR is displayed on the figure 1.
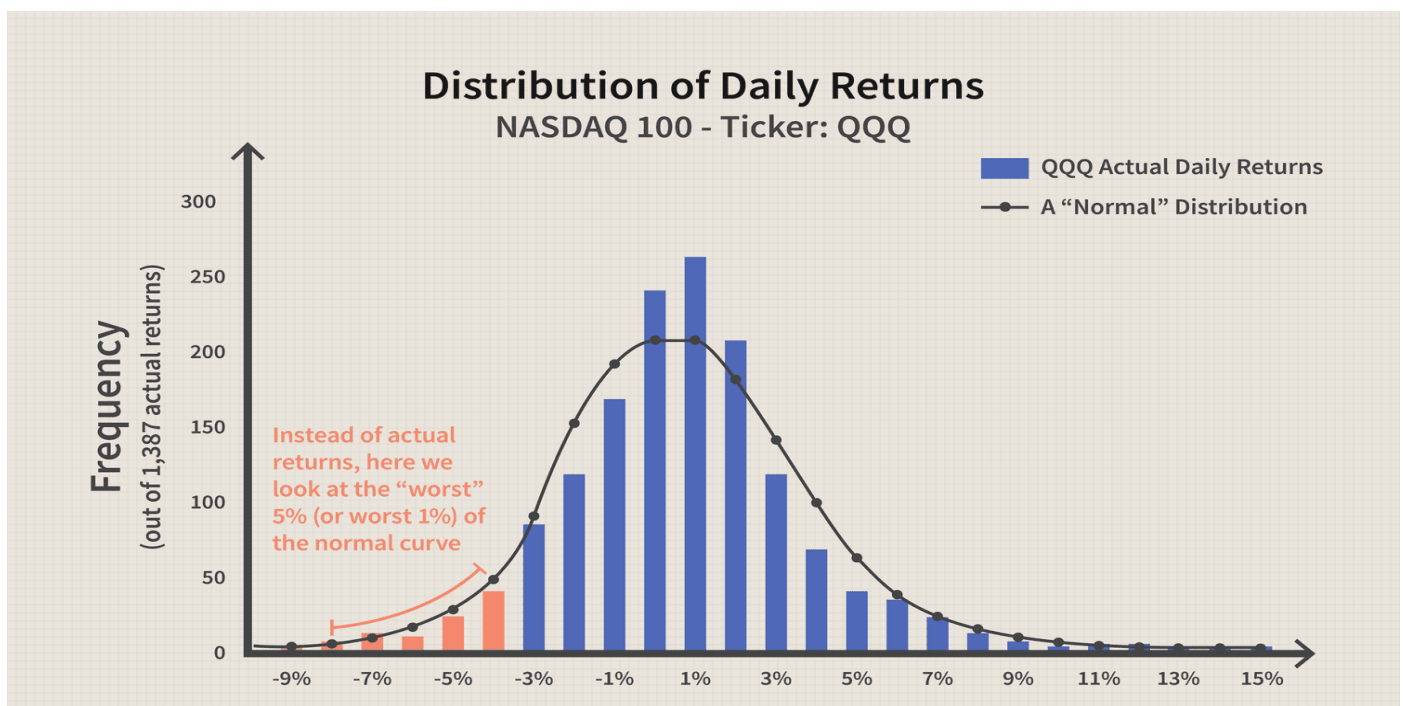

Figure 1. **Distribution of daily returns. Historical method of VaR** (Investopedia, 2023).

Among all existing approaches, the Basel Committee recommends using VaR with a confidence level of 99%, combined with an immediate shock equivalent to the price fluctuation over a 10-day period (Trenca, Pece, & Mihuţ, 2015: 1391–1406).

Although numerous methods exist to measure market risk, default risk remains the most critical risk for banks. Comparing default risk and market risk highlights their differences. In the case of market risk, banks may lose profits or clients' funds but can often continue operations despite the occurrence of the risk. This allows banks the opportunity to mitigate losses and restore financial stability.

By contrast, default risk is significantly more challenging to manage. When banks lend money, those funds are no longer available for investment. Moreover, default risk exposes banks not only to the loss of interest but also to the potential loss of the principal amount. Managing defaults often involves additional costs and operational efforts. For instance, if a debtor refuses to pay, a bank may need to file a legal claim, which entails hiring lawyers and incurring unknown time and financial expenses. Even then, if the debtor declares bankruptcy, they may be unable to fulfill their obligations. Other circumstances, such as a debtor's death, disappearance, or illness, can similarly prevent repayment.

This raises a critical question: how can credit or default risk—the greatest risk for banks—be effectively measured? It is also important to consider the default risk of the bank itself. While banks offer numerous services, they can also face insolvency. In such cases, clients risk losing both interest payments and their principal funds.

Default risk for a bank may also arise from external constraints. For example, in 2022, sanctions imposed on the Russian financial system forced the central bank to limit foreign currency withdrawals. Since March 9, 2022, clients were only allowed to withdraw a maximum of $10,000 (or its equivalent) from foreign currency accounts if the funds had been deposited prior to that date. Any amounts exceeding $10,000 could only be accessed through currency exchange at unfavorable rates, while deposits made after March 9 could only be withdrawn in the local currency (AA, 2023).

According to the definition of default— "to fail to do something you are legally obliged to do"—it can be argued that, in this situation, banks themselves effectively defaulted by failing to fulfill their contractual obligations (Cambridge Dictionary, 2023).

Numerous measures exist to estimate both the probability of default and market risk. One of the earliest approaches was developed by Merton in 1974, who introduced a method applicable to pricing almost any type of financial instrument and applied it to risky

discount bonds to derive the risk structure of interest rates (Merton, 1974: 449–470).

Another important contribution was made by Darrell Duffie and Kenneth Singleton in their 2003 book, Credit Risk: Pricing, Measurement, and Management, which provides a combination of empirical, practical, and conceptual foundations for understanding default risk and risk management in general (Duffie & Singleton, 2003).

Campbell, Hilscher, and Szilagyi (2008: 2899–2939) explored corporate failure factors and the pricing of financially distressed shocks using a logit model that incorporates both market and accounting variables. Basurto and Espinoza (2011) proposed an original method for estimating the market price of risk under stress conditions, based on a one-factor asset pricing model.

Chan-Lau and Sy (2007: 14–24) introduced the concept of distance-to-default, which incorporates pre-default actions. They argued that both distance-to-default and traditional risk measures can be analyzed within similar frameworks, though differences arise depending on asset volatility and capital adequacy thresholds.

In academic literature, however, the Z-score index has become increasingly popular as a measure of a bank's "distance to default." The Z-score estimates the extent to which a bank's equity can absorb potential losses (Wagner, 2007: 121–139). It can be calculated using balance sheet and profit-and-loss data, without relying on market valuations, and is computed as follows:

$$Z-score_{it} = \frac{\frac{E_{it}}{A_{it}} + ROA_{it}}{sd(ROA_{it})} \qquad (4)$$

Where:

E_it– banks i's tier 1 capital at time t

A_it-total assets

Meaning$\frac{E_{it}}{A_{it}} - is\ the\ capital -$

$assets\ ratio\ (CAR)$

ROA_{it} is the return on assets calculated as after tax profits

devided by total assets and sdROA_{it}

and is a standart deviation of ROA_{it} (Giordana & Schumacher,2017: 1-21)

Results

The analysis of the banking sector highlights several critical risks that institutions face today. Among the most significant are liquidity, operational, market, credit (default), and currency risks. Liquidity risk arises when a bank is unable to meet its short-term obligations at a sustainable cost, while operational risk, although generally low in retail banking, can lead to substantial losses in areas such as trading, particularly in the case of cyberattacks or errors in transaction processing (Corporate Finance Institute, 2023; COE Bank, 2023). Market risk reflects banks' exposure to fluctuations in credit spreads, interest rates,

foreign exchange rates, commodity prices, and equity markets, and it remains a key focus for risk management (Bezawada, 2022: 68–72).

Credit and default risk are considered the most critical threats for banks. Default occurs when borrowers fail to meet their contractual obligations, which directly affects both interest payments and principal repayment. Factors such as unemployment, low financial literacy, and deliberate non-compliance by borrowers amplify this risk, while banks themselves can also be exposed to default, particularly in situations involving regulatory restrictions or sanctions (Corporate Finance Institute, 2023; AA, 2023; Cambridge Dictionary, 2023).

To quantify and manage these risks, a variety of methods are employed. Value at Risk (VaR) is one of the most widely used techniques for measuring market risk, and it can be calculated using Monte Carlo simulation, historical simulation, or parametric methods (Jorion, 2007; Trenca, Pece, & Mihuţ, 2015: 1391–1406; COE Bank, 2023). Several models have been proposed to assess default risk, including the Merton model, which applies to pricing risky financial instruments (Merton, 1974: 449–470), as well as the frameworks developed by Duffie and Singleton, which combine empirical, practical, and conceptual approaches to credit risk (Duffie & Singleton, 2003). Other notable approaches include logit models by Campbell, Hilscher, and Szilagyi (2008: 2899–2939), the

one-factor asset pricing model for stressed market conditions by Basurto and Espinoza (2011), and the distance-to-default concept introduced by Chan-Lau and Sy (2007: 14–24). In academic practice, the Z-score index is increasingly used as a measure of a bank's ability to absorb losses, calculated using balance sheet and profit-and-loss data and incorporating the standard deviation of return on assets (〖ROA〗 _it) (Wagner, 2007: 121–139; Giordana & Schumacher, 2017: 1–21).

The results also indicate that global financial instability is increasing. Events often considered "Black Swans," along with technological disruption, cryptocurrency market volatility, and economic sanctions, contribute to systemic instability. Banks, acting as intermediaries between lenders and borrowers, transmit these risks to households and businesses, highlighting the importance of comprehensive risk management.

Discussion

The interconnectedness of financial risks is evident from the findings. Market, credit, liquidity, and currency risks do not exist in isolation; disruptions in one area can propagate through the system, causing widespread effects. For instance, the bankruptcy of a major bank can trigger panic that affects other institutions, particularly in digital markets, where prices are highly sensitive to investor psychology and media influence. The rise of digital assets, such as cryptocurrencies, further

amplifies these risks. While these markets offer substantial short-term profit potential, their volatility and susceptibility to rapid price swings make them significantly riskier than traditional investments.

Credit risk is particularly challenging to manage because banks cannot redeploy funds that have been lent out. Defaults not only cause the loss of interest but may also lead to the loss of principal. Recovering debts often requires legal action, which is costly and uncertain, and may ultimately fail if the debtor becomes bankrupt, falls ill, or dies. Banks themselves are also exposed to default risk. Regulatory constraints, economic sanctions, or operational failures can prevent a bank from fulfilling its obligations, as exemplified by the 2022 restrictions on foreign currency withdrawals in Russia, which effectively limited clients' access to funds and demonstrated potential default on the part of banks (AA, 2023; Cambridge Dictionary, 2023).

The study also highlights the role of financial literacy. Low financial awareness among households increases exposure to risk, as clients may misunderstand complex banking products or enter agreements with hidden costs. Banks, knowingly or not, may exploit this lack of knowledge, further amplifying default risk within the economy.

The results underscore the necessity for integrated, sophisticated risk management strategies. Tools such as VaR, credit risk models, and the Z-score index are essential for quantifying exposure and predicting potential losses. Effective risk management enables banks to mitigate the effects of systemic instability, protect clients, and maintain operational resilience. Policymakers and regulators must also consider the systemic connections between risks and the impact of external shocks, including technological disruption, digital market volatility, and "Black Swan" events, to ensure broader financial stability.

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