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Basel III as a regulatory framework for risk management

Bazel III kao regulatorni okvir za upravljanje rizicima

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Abstract

The stability of the economic system, which directly depends on the reliability of the country's financial sector, is crucial for growth and development. Therefore, effective risk management is of paramount importance for both banks and other financial institutions. In a turbulent and unpredictable business environment, banks are constantly exposed to risks. For this reason, it is necessary to continuously improve control systems. Basel III refers to a set of global regulatory standards for banks, introduced in 2010 by the Basel Committee on Banking Supervision (BCBS). The aim of the defined standards is to ensure the resilience and stability of banks and prevent financial shocks. On the other hand, this new regulatory framework imposes stricter criteria on commercial banks, which affects credit policy. In addition to a theoretical overview of the new regulatory framework, the paper analyzes the indicators of capital adequacy and the impact of changes in the macroeconomic environment on the exposure of domestic banks to liquidity risk.
Keywords: *Basel III, National Bank of Serbia (NBS), risk management, capital requirements, liquidity*

Sažetak

Stabilnost ekonomskog sistema koja direktno zavisi od pouzdanosti finansijskog sektora u zemlji, ključna je za rast i razvoj. Zbog toga je efikasno upravljanje rizikom od izuzetnog značaja kako za banke, tako i za druge finansijske institucije. U turbulentnom i nepredvidivom poslovnom okruženju banke su stalno izložene rizicima. Iz tog razloga je neophodno neprekidno unapređenje sistema kontrole. Pod Bazelom III se podrazumeva skup globalnih regulatornih standarda za banke, uveden 2010. godine od strane Bazelskog komiteta za superviziju banaka (Basel Committee on Banking Supervision – BCBS). Cilj definisanih standarda je da obezbede otpornost i stabilnost banaka i sprečavanje finansijskih šokova. S druge strane, ovaj novi regulatorni okvir nameće strože kriterijume poslovnim banaka, što utiče na kreditnu politiku. Pored teorijskog pregleda novog regulatornog okvira, u radu su analizirani pokazatelji adekvatnosti kapitala i uticaj promena u makroekonomskom okruženju na izloženost domaćih banaka riziku likvidnosti.
Ključne reči: *Bazel III, Narodna banka Srbije, upravljanje rizicima, adekvatnost kapitala, likvidnost.*

1. Introduction

In the period following the Great Depression of 1929, in response to the need to strengthen confidence in the banking system and protect depositors, the first legal regulations and institutions were established to monitor and analyze risks in financial institutions. Among them, the Federal Deposit Insurance Corporation (FDIC) in the United States stands out. However, the most significant contribution to institutional risk management in banks and other financial institutions belongs to the Basel Committee on Banking Supervision (BCBS), which was founded in late 1974 as an agreement of the governors of the central banks of the G-10 countries following major market disturbances, particularly caused by the bankruptcy of one of the largest banks of that time - Herstatt Bank in West Germany.

Basel I (Basel Capital Accord), the first international agreement on banking capital, was introduced in 1988 by the BCBS. The aim of this agreement was to improve the stability of the global banking system by introducing

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minimum standards for capital adequacy. However, Basel I was accompanied by numerous weaknesses arising from its focus on credit risk, neglecting market and other types of risks. The lack of differentiation among different types of loans, applying the same standard to all, was also a challenge, especially in countries with higher risk exposures. In these countries, the 8% ratio, as stipulated, should have been higher (Basel Committee on Banking Supervision, 1988). Additionally, Basel I allowed banks to use internal models to calculate capital requirements weighted according to systemic risk, which enabled banks to mask their actual risk exposure and develop "creative" accounting.

To overcome the aforementioned limitation, the Basel Committee developed a series of non-binding standards focused on market risk, representing a turning point. This led to Basel II. This evolution included recommendations related to market risk management, acknowledging the need to adjust capital requirements to different types of risk. Basel II (International Convergence of Capital Measurement and Capital Standards), adopted in 2004, introduced significant innovations, including capital requirements for operational risk. The first steps towards amendments and improvements to the aforementioned Basel standards began after the recognition of the weaknesses of the Basel II standards, which were particularly evident during the financial crisis that began in 2007 in the United States and, from the real estate market, through uncontrolled granting of mortgage loans and trading of mortgage-backed securities in the United States, triggering a chain reaction, spread to the global economy and led to a global economic crisis. In this regard, the Basel Committee on Banking Supervision published the following documents in July 2009: Enhancements to the Basel II framework, Revisions to the Basel II market risk framework and Guidelines for computing capital for incremental risk in the trading book. These documents, which represent a set of reform measures known as Basel II.5, improved the then current international regulatory Basel II framework, which was later supplemented and presented in the form of the Basel III regulatory framework. Basel II.5 introduced certain transitional adjustments and additions that contribute to greater stability of financial institutions and better preservation of the integrity of the banking system (BCBS, 2016). Basel III is not merely a direct response to the global financial crisis but also represents the Basel Committee's ongoing efforts to strengthen the regulatory framework for banks, enhance banking supervision, and improve risk management practices within banks (Matić, 2011).

Significant and comprehensive modifications to the Basel standards, known as the Basel III standards, were presented in a set of documents published in December 2010, after being approved at the G-20 summit in Seoul. These innovations, particularly in relation to capital adequacy ratios, focus on regulatory capital to achieve greater resilience of banks and banking systems worldwide (BCBS, 2011). Also, for the first time, minimum standards were introduced to regulate bank liquidity, which further contributes to the stability of the banking sector (BCBS, 2010). In January 2013, the full text of the updated document entitled "Basel III: The Liquidity Coverage Ratio" was published, which is dedicated to the liquidity ratio known as the Liquidity Coverage Ratio (LCR). In addition, a positive impact has been made on the sustainability of the financial system and, globally speaking, on strengthening the stability of the international banking system.

2. Basel III: a regulatory framework for a sustainable financial system

One of the main objectives of the new regulatory framework Basel III is to strengthen two complementary approaches that support the underlying concept of bank stability: macro- and microprudential regulation. Microprudential regulation focuses on individual banks and is implemented through the setting of regulatory standards and requirements relating to capital, liquidity and other key aspects of bank operations. The goal is to ensure that each bank has sufficient capital and liquidity to withstand potential losses and challenges. Macroprudential regulation has a broader scope and focuses on the entire financial system. The aim is to identify and mitigate systemic risks that may arise from interdependencies between banks and other financial institutions. Through a combination of micro- and macroprudential measures, Basel III affects the resilience of individual banks while simultaneously reducing risks arising from the interconnections and dynamics of the entire financial system.

According to Abuzarqa (2019), it is possible to identify a large number of innovations introduced by Basel III. Characteristically, they can be identified both as structural measures and as the development of completely new parameters for monitoring and improving the functioning of the financial sector. In terms of structural innovations, the new regulatory framework has three new elements:

– somewhat higher capital requirements;
– better quality of capital; and
– stricter liquidity requirements.

To strengthen the resilience of banks to financial challenges, the Basel III regulation introduces the following two ratios: the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). The LCR is calculated as the ratio of high-quality liquid assets to net cash outflows over a 30-day period. Banks are required to maintain an LCR of at least 100%, indicating that they have sufficient high-quality liquid assets to cover their short-term liquidity needs (Central Banking Publications, 2014). On the other hand, the NSFR measures structural liquidity in the medium and long term and aims to provide banks with stable funding sources for their activities (Financial Stability Board, 2014). It is calculated by comparing the total amount of available stable funding (ASF) with the total required amount of stable funding (RSF). Banks are required to maintain an NSFR of at least 100%, indicating that they have sufficient stable funding sources to cover their medium- and long-term liabilities. ASF is measured based on the characteristics of the relative stability of a bank's funding sources, including

maturity and differences in the propensity of different creditors to withdraw funds. RSF is measured based on the characteristics of a bank's assets and off-balance sheet exposures. In the regulators' desire to form capital reserves that would be available in crisis periods, thereby strengthening the ability of banks and financial institutions to face challenges in turbulent economic conditions and resistance to various types of market fluctuations, measures have been introduced to form adequate capital buffers.

One of the key standards introduced in Basel III pertains to new capital requirements, designed to improve risk management processes and ensure adequate capital coverage for all types of risks. In this regard, the Basel Committee has increased the minimum capital for ordinary activities, i.e., Common Equity Tier 1 (CET1) capital as a percentage of risk-weighted assets (RWAs), which is the highest quality capital capable of absorbing losses, from 2% to 4.5%. This means that banks must now maintain a higher level of capital relative to their risk-weighted assets. CET1 represents the highest quality form of capital, comprising retained earnings and capital raised from the sale of common stock, while RWAs encompass the total risk associated with all bank activities. The requirements for CET1, which includes capital and certain other eligible instruments, will be increased from 4% to 6%. The reforms have led to the emergence of a new type of capital, additional conservation buffers, which banks hold at a rate of 2.5% plus a minimum that, according to existing regulations, must consist of common equity capital. In this sense, CET1 will be 8.5% (6% for CET1 capital and 2.5% for the capital conservation buffer). The ratio of total capital requirements after the implementation of the proposed reforms will be 10.5% (this is the conservation or buffer capital) compared to 8% in previous agreements. This change aims to increase the safety of banks in the fight against credit gaps and better protection against potential losses.

In addition to liquidity ratios, Basel III regulation introduces the leverage ratio as an additional indicator of bank business activities. The primary purpose of the leverage ratio is to limit bank borrowing and prevent excessive risk-taking. The leverage ratio is calculated as the ratio of a bank's capital (Tier 1) to its exposure measure, and an upper limit of 3% is set to ensure adequate capitalization and prevent excessive leverage. These measures have been introduced to protect banks from financial stress, prevent crises, and ensure the stability of the financial sector.

3. Specificities of Basel III capital requirements - VaR and CVaR methods

VaR (Value-at-Risk) and CVaR (Conditional Value-at-Risk) are key measures in measuring extreme risks, often known as extreme quantile risk measures (Drenovak, 2021). These measures are used in the financial sector, especially for quantifying market risk, to assess the potential exposure of a portfolio or institution to certain losses in extreme scenarios that pose the greatest danger to the financial system.

Basel II and Basel II.5 relied on VaR (Value-at-Risk) as the foundation for setting capital requirements across the banking sector. Initially developed for managing market risk, the VaR methodology was adapted and expanded by the Basel Committee to encompass an integrated approach to valuing credit, market, and operational risks within the banking sector. Consequently, risk managers must have an advanced understanding of financial markets, instruments, securities valuation, accounting, statistics, and mathematics.

By definition, VaR is a statistical measure that quantifies the maximum expected loss on a portfolio or investment over a specific time period, most commonly 10 days, with a given confidence level. Basel II regulations stipulated that VaR should be measured at a 1% significance level, meaning a 99% confidence interval, and over a 10-day time horizon. The general assumption was that a 10-day period is sufficient to exit an existing position (Drenovak, 2021). However, this period may be inappropriate in situations of reduced liquidity and market challenges. Therefore, Basel III regulations introduce significant changes to better reflect market dynamics and increase the accuracy of risk measurement. Instead of a fixed 10-day period, this period is now variable and depends on the specific characteristics of the assets in the portfolio. This period can now take one of five values in the interval from 10 to 120 days. This change in Basel III provisions reflects the regulators' efforts to align risk measurement with actual market conditions, providing better protection for the financial system from potential disruptions.

Table 1. Calculation of Value at Risk

Percentage loss	Monetary loss
$VaR = -r_\alpha$	$VaR = -r_\alpha P$

Source: Author

Table 1 presents formulas for calculating VaR, where α represents the significance level (from 0 to 1) and r_α is the α-quantile of the return distribution of the analyzed portfolio P at time t when VaR is calculated.

VaR methods are useful in providing a quantitative assessment of risk, but it is important to be aware of their limitations. These relate primarily to the sensitivity to the choice of risk factors, the choice of time period, and the assumptions about the data distribution. Combining VaR with other risk measures can contribute to a better understanding of the complexity of financial portfolios. Also, a weakness of VaR is that it is unknown what the distribution of losses is above a certain threshold (tail risk), greater than the loss determined by VaR. This was one of the drivers of the development of a new, more precise risk measure known as CVaR (Conditional Value-at-risk, expected tail loss) which is included in the regulatory provisions of Basel III. It is used together with VaR for better management of market risk and to encompass extreme scenarios. CVaR, also known as expected shortfall, is more sensitive to the tails, or lower ends of the loss distribution, and can provide deeper insight into extreme events.

CVaR is defined as the expected value of loss conditional on the loss being greater than the value specified by VaR.

$$CVaR_{t+1}^{\alpha} = -E[r|r < -VaR_{t+1}^{\alpha}] = -E[r|r < r_{\alpha}]$$

By introducing the CVaR method in Basel III, the shortcomings that characterized the ordinary VaR method have been overcome. Primarily, the subadditivity condition is satisfied, which means that the total CVaR of a portfolio doesn't exceed the sum of the CVaR of the individual portfolio components, contributing to the coherence of this risk measure. Additionally, the new method provides further information about more severe loss scenarios, enriching risk analysis and allowing for a better understanding of potential consequences.

4. Serbian regulatory framework and risk management

Banking regulations, as well as the banking environment itself, vary from country to country. Ensuring and improving a stable financial system, particularly the banking sector, is a prerequisite for a development-oriented real sector. In countries with developed capital markets, such as the United States, the United Kingdom, and Japan, monetary policy is primarily conducted through controlling interest rates and liquidity in the financial market. In contrast, in bank-centric countries, where the Republic of Serbia is also classified, banks play a key role as institutions through which the central bank's monetary policy is implemented. These countries rely on direct cooperation between the central bank and commercial banks. In this sense, the global financial crisis required the National Bank of Serbia (NBS) to take measures to preserve the financial system, with a particular focus on the banking sector as a key and vital part of that system. The failure of a commercial bank can pose a threat to the stability of the entire financial system, with potentially wide-ranging negative consequences. In this regard, the NBS has a well-established role as a regulator and supervisor of a significant portion of the Serbian financial sector, including banks, with the aim of ensuring and maintaining the efficient functioning of the financial system.
The fundamental document regulating the financial system in the Republic of Serbia is the Law on Banks ("Službeni glasnik RS", No. 107/2005, 91/2010 and 14/2015). This normative act provides regulations related to credit risk management, necessary bodies and their responsibilities, as well as the procedures that domestic commercial banks must comply with.

Under our regulations, banks are required to calculate a variety of ratios and maintain them above the minimum prescribed levels at all times. These indicators include:

- the Common Equity Tier 1 capital ratio, which is Common Equity Tier 1 capital of the bank expressed as a percentage of the total risk exposure amount – 4,5%;
- the Tier 1 capital ratio which is Tier 1 capital of the bank expressed as a percentage of the total risk exposure amount – 6%;
- the total capital ratio, which is the capital of the bank expressed as a percentage of the total risk exposure amount – 8%.

The bank is obliged to maintain the level of liquidity as follows:

- the liquidity ratio[1] is at least 1.0 – when calculated as the average of liquidity ratio for every business day in a month, is no less than 0.9 for longer than three business days in a row, is no less than 0.8 when calculated for one business day;
- the narrower liquidity ratio[2] is is at least 0.7 – when calculated as the average liquidity ratio for every business day in a month; should not be below 0.6 for longer than three consecutive business days; is no less than 0.5 when calculated for one business day.

The liquidity ratio and narrow liquidity ratio are used to monitor on a daily basis whether a bank has sufficient liquid assets to cover its obligations falling due within the next month. These indicators help ensure the bank's ability to meet its short-term financial commitments.

Analysis of the National Bank of Serbia's actions over the past two decades indicates that their comprehensiveness and rigor have contributed to the Serbian banking sector's preparedness for the global financial crisis of late 2008. Domestic banks demonstrated sound capitalization, and credit growth was based on a prudent balance between equity capital, deposits, and provisions for loan losses. Additionally, the NBS undertook specific activities related to legal amendments concerning bank restructuring. The aim of these amendments was to minimize the use of budgetary and other public funds to preserve financial stability, implying that shareholders and creditors would bear potential losses in case of bank failure, subject to prescribed limitations, with the goal of achieving market discipline.

As part of the implementation of the latest Basel III standards, the NBS has adopted a macroprudential framework (National Bank of Serbia, 2015). In line with the proposed macroprudential instruments, a capital conservation buffer is introduced to enhance the resilience of commercial banks to losses, mitigate excessive or inadequately assessed exposures, and limit capital distribution. The first instrument comprises a capital conservation buffer set at a level of 2.5% of a bank's capital. The second instrument involves a requirement to establish a countercyclical capital buffer, set at a level of 0% based on the assessment of the domestic regulatory body, to avoid restricting credit activity.

[1] The bank's liquidity ratio represents the ratio between the sum of the bank's first and second-order liquid assets, on the one hand, and the sum of the bank's demand liabilities and liabilities maturing within the next month from the date of calculation of the liquidity ratio, on the other hand.

[2] The narrow liquidity ratio of a bank is calculated as the ratio of the bank's first-order liquid assets to the sum of its demand liabilities and liabilities maturing within the next month from the date of calculation.

The NBS has signed a multilateral cooperation agreement with the European Banking Authority (EBA) and the supervisory authorities of Southeast European countries. This agreement establishes a framework for cooperation and information exchange in the area of banking supervision. However, as a non-EU member state, the Republic of Serbia is not part of the Single Supervisory Mechanism (SSM). This situation places Serbia in a challenging and unenviable position, as local banks owned by international banks headquartered in the EU are not under the supervision of the European Central Bank (ECB), nor are banks in domestic ownership or owned by banks headquartered outside the EU (Drvendžija, 2015). Due to the lack of "dual" supervision – national and international, it is of paramount importance that supervision in Serbia is conducted operationally according to the same criteria as in the EU. There is reason for optimism regarding these challenges, as some banks have timely developed internal risk management mechanisms in line with Basel III regulations, especially those that are members of international banking groups.

Table 2. Capital Adequacy Ratios of the Serbian Banking Sector, 2008-2023

In %	Regulatory capital to risk-weighted assets ratio – VAR1	Tier 1 capital to risk-weighted assets ratio – VAR2	Net non-performing loans to regulatory capital ratio – VAR3	Tier 1 capital to total assets ratio – VAR4	Large exposures to regulatory capital ratio – VAR5	Regulatory capital to total assets ratio – VAR6
2008.	21.9	17.9	15.5	16.8	-	20.5
2009.	21.4	16.5	26.9	13.1	-	17.1
2010.	19.9	15.9	35.5	12.8	-	16.1
2011.	19.1	18.1	52.1	11.5	110.1	12.2
2012.	19.9	19	52.3	11.6	104.5	12.2
2013.	20.9	19.3	55.9	11.2	90.4	12.2
2014.	20	17.6	56	10.1	130.5	11.4
2015.	20.9	18.8	44	10.7	115.7	11.9
2016.	21.8	20	27.1	11.6	86	12.7
2017.	22.6	21.6	17.7	13.7	69.3	14.4
2018.	22.3	21.1	9.7	13.5	77.4	14.2
2019.	23.4	22.4	6.3	14.4	66.5	15.1
2020.	22.4	21.6	6.7	13.1	73.8	13.6
2021.	20.8	19.7	7.6	11.8	86	12.4
2022.	20.2	18.8	6.5	11	86.7	11.7
2023.	21.6	20	6.2	11.3	78.4	12.2

Source: National Bank of Serbia

Although the Serbian banking sector was exposed to shocks during the crisis period, thanks to the conservative policy of the National Bank of Serbia, the accumulated reserves were sufficient to withstand all current and potential negative effects of the crisis period. Table 2 presents the capital adequacy ratios of the Serbian banking sector for the period from 2008 to 2023. The analysis showed that all indicators were above the minimum prescribed values (4.5%, 6%, and 8%, respectively), so we can conclude that the banking system of the Republic of Serbia is well capitalized. The results of descriptive statistics of capital adequacy ratios are presented in Table 3. Thus, for example, according to the presented statistics, the highest exposure to business risks relative to regulatory capital in the Serbian banking sector was in 2014 (130.5%), and the lowest in 2017 (69.30%). The results of empirical research using the LMAW-DNMA method, which provides more realistic information about the achieved capital adequacy, show that the top five years in terms of capital adequacy of the banking sector in the period 2008-2022. include, in order: 2016, 2012, 2015, 2017, and 2013. The worst capital adequacy in Serbia was in 2008. In other words, this means that in that year the banking sector was most exposed to business risks (Lukić, 2023). Undoubtedly, in the period from 2019 to 2022, capital adequacy of the banking sector was also affected to some extent by the pandemic caused by the SARS-CoV-2 virus, as economic activities were reduced worldwide, and thus banking activities as well.

Monitoring the trend and level of non-performing loans (NPLs) is of paramount importance for defining potential problems in collecting receivables. By analyzing the variables from Table 3, we observe that the NPL coverage increased in 2010 due to an increase in the calculated provisioning for estimated losses, as well as a slight decrease in NPLs compared to the previous year. Structurally speaking, more than half of the non-performing loans in 2012 were also granted to business entities (National Bank of Serbia, 2024). Namely, in those years, a large number of companies went bankrupt, which is why a sector was formed in the structure of NPLs consisting mainly of bankrupt businesses and in 2012 accounted for 22.9% of NPLs. The trend of growth of these loans was present until 2015. 2017 was marked by the obligation of banks to write off low-recoverability assets from the balance sheet, i.e., to transfer this asset from balance sheet items to off-balance sheet positions, in accordance with the Decision on Accounting Write-Off of Balance Sheet Assets ("Službeni glasnik RS", No. 77/2017). The consequence of this Decision is a decrease in NPLs in total loans, so it amounts to 9.7% in 2018, with a declining trend until the end of the analyzed period. Since capital adequacy is the ratio between capital and risk-weighted assets, it broadly represents the bank's ability to absorb potential losses, which means that the higher the capital, the greater the capacity to absorb losses incurred from bad placements, thereby protecting bank customers, primarily depositors, from bad payers

Table 3. Descriptive Statistics of Capital Adequacy

	Minimum	Maximum	Mean	Std. Deviation
VAR1	19.10	23.40	21.1938	1.18517
VAR2	15.90	22.40	19.2688	1.84091
VAR3	6.20	56.00	26.6250	19.82118
VAR4	10.10	16.80	12.3875	1.68597
VAR5	69.30	130.50	90.41	19.349
VAR6	11.40	20.50	13.7437	2.45573

Source: author's calculation using SPSS

By applying Pearson's correlation coefficient to the aforementioned six capital adequacy ratios, it can be concluded that at the 5% significance level, the lowest degree of linear dependence is present between Tier 1 capital to risk-weighted assets - VAR1 and net non-performing loans to regulatory capital - VAR3 (r=0.518), while the highest degree of linear dependence is present between Tier 1 capital to total assets - VAR4 and regulatory capital to total assets - VAR6 (r=0.905).

Given the connection between the application of mathematical and statistical models and big data, we must use appropriate models for the analytics of such data. Data mining is the process of exploring and analyzing large amounts of data to discover specific trends, which can then be used to make business decisions, improve performance, enhance operational efficiency, and so on. Due to the influence of numerous factors, multiple linear regression stands out as an effective statistical technique in analyses (Shrut et al. 2018). It allows for the inclusion and analysis of the impact of multiple variables on market movements. To analyze the impact of key macroeconomic indicators on the liquidity of the banking sector in this part of the paper, panel data was used. The analyzed sample covers 16 years, from 2008 to 2023, and can be mathematically represented as follows:

$$Yt = \alpha + \beta 1bdp + \beta 2unyp + \beta 3inf + \beta 4dpb + \varepsilon$$

where Y represents the mean monthly liquidity indicator of the banking sector in year t; α is the intercept term, representing the value of Y when all independent variables are zero; β1, β2, ..., βk are the regression coefficients that quantify the change in Y associated with a one-unit change in each corresponding independent variable (GDP, unemployment, inflation, balance of payments deficit), respectively; and ε represents the error term, accounting for the unexplained variation in Y that is not captured by the independent variables.

Table 4. Liquidity Ratios and Key Macroeconomic Indicators for the period 2008-2023.

In %	Narrow liquidity indicator	Liquidity indicator	GDP	Unemployment	Inflation	Balance of payments deficit
2008.	1.80	1.20	5.70	-	8.60	-20.00
2009.	1.90	1.20	-2.70	-	6.60	-6.30
2010.	2.00	1.30	.70	21	10.30	-6.50
2011.	2.20	1.50	2.00	25	7.00	-10.30
2012.	2.10	1.60	-.70	26	12.20	-10.90
2013.	2.40	1.80	2.90	24	2.20	-5.80
2014.	2.20	1.70	-1.60	21	1.70	-5.60
2015.	2.10	1.70	1.80	19	1.50	-3.50
2016.	2.10	1.70	3.30	16	1.60	-2.90
2017.	2.00	1.70	2.10	15	3.00	-5.20
2018.	2.00	1.70	4.50	14	2.00	-4.80
2019.	2.20	1.80	4.30	11	1.90	-6.90
2020.	2.20	1.90	-.90	10	1.30	-4.10
2021.	2.10	1.70	7.70	11	7.90	-4.20
2022.	2.20	1.70	2.50	10	15.10	-6.90
2023.	2.40	1.70	2.50	10	7.60	-2.60

Source: National Bank of Serbia

Based on the macroeconomic indicators and liquidity ratios presented in Table 4, the following hypothesis is defined: H1: There is a statistically significant impact of key macroeconomic indicators on the exposure of domestic banks to liquidity risk. This general research hypothesis can be decomposed into four sub-hypotheses, one for each of the four selected macroeconomic predictors. In statistical analyses and scientific research, the significance level is most commonly set at 0.05, meaning there is a 5% probability of rejecting the null hypothesis when it is actually true. By applying linear regression to the proposed model in the analyzed time period, we obtained a result showing that approximately 48.8% (R^2) of the variability of our dependent variable is explained by the regression model. The research results confirm that the initial shock of the economic crisis left a mark on the economy of our country, as the business cycle entered a recessionary phase, which consequently led to a decline in economic activity and an increase in the share of NPLs. Namely, during economic crises, companies typically reduce investments and, consequently, costs, while households become more cautious in borrowing. This can lead to a decrease in demand for loans from corporate clients and households, which increases bank liquidity. On the other hand, in periods of economic uncertainty, households and firms may increase savings

and reduce consumption, which can result in larger deposits in banks and increased liquidity in the banking sector. In the analyzed period, a trend of declining GDP was evident in our country, which affected the decrease in lending activity and the increase in the share of liquid reserves in assets, thus reducing banks' exposure to liquidity risk. The research has resulted in an assessment that there is a negative correlation between GDP and liquidity indicators. In this way, the sub-hypothesis that there is a statistically significant impact of gross domestic product on the exposure of domestic banks to liquidity risk has been proven.

Besides the GDP growth rate, the decrease in the unemployment rate during the analyzed period led to an increase in liquidity. While this relationship may seem counterintuitive, it can be attributed to an increase in bank deposits and savings. Following a period of economic downturn, as the economy recovers, employment levels rise, leading to higher incomes and improved financial conditions for households. Consequently, there is an increase in deposits, which in turn boosts the liquidity of the banking sector. This, in turn, stimulates overall consumption and accelerates the circulation of money within the banking system, further contributing to the growth of liquidity. Therefore, the sub-hypothesis that unemployment has a statistically significant impact on domestic banks' liquidity risk exposure has been supported by the findings.

The increase in liquidity during the analyzed period was also influenced by the decline in inflation, which was observed almost continuously until 2021. When inflation decreases, central banks typically reduce interest rates to stimulate consumption and investment. This mechanism was also applied by the National Bank of Serbia in its monetary policy, where interest rates were either decreasing or stagnating until 2022. Additionally, when inflation is stable, people do not spend money relatively quickly because they expect prices to remain stable, which further encourages people to save more but also leads to an increase in aggregate demand. In this regard, the National Bank of Serbia will continue to strive to achieve the targeted inflation rate through changes in the reference interest rate (Hafner & Hafner, 2011). Thus, the sub-hypothesis that there is a statistically significant impact of inflation on domestic banks' exposure to liquidity risk is confirmed.

Throughout the analyzed period, the balance of payments in our country was in deficit. The results of the conducted research show that an increase in the balance of payments deficit leads to a decrease in banks' lending activity and, consequently, to an increase in the share of liquid reserves in assets. Higher imports relative to exports confirm the weaker competitiveness of domestic products, which, among other things, also leads to a decline in aggregate demand for our products. Reduced demand for domestic products affects the decline in economic activity, which is why the intervention of the banking sector is necessary. Based on the above, the sub-hypothesis that there is a statistically significant impact of the balance of payments deficit on the exposure of domestic banks to liquidity risk at the 5% significance level has been proven.

The issue of analyzing the liquidity of the banking sector is very challenging but also significant. The results of the research on the liquidity of the banking sector in Serbia based on the TOPSIS method (Technique for Order Preference by Similarity to Ideal Solution) for the period 2008-2022 show that the top five years in terms of banking sector liquidity are, in order: 2013, 2020, 2014, 2019, and 2015, with the worst liquidity recorded in 2010 (Lukić, 2023). It is evident that in recent years there has been an increase in liquidity, which was influenced by macroeconomic factors.

5. Conclusion

Risk management plays a crucial role in ensuring the stability of banks and the financial system of a country. Particularly after the recent global financial crises, risk management has become indispensable for the maintenance and development of financial institutions. In our country, this responsible role has been assigned to the National Bank of Serbia. The NBS defines financial stability as the presence of healthy and stable financial institutions that effectively manage risks in their operations and withstand external pressures. The goal of risk management is to identify existing and potential threats to the financial system, especially the banking sector, and to assess the system's ability to absorb them, while maintaining stability and the ability to function smoothly.

In light of the continuous changes in the banking sector, risk management is an integral part of overall efforts to maintain efficient operations while preserving financial system stability. The digitization and virtualization of banking services open up new avenues for innovation but also increase banks' exposure to cyber risks.

When considering Serbia's position in the international context, there is a risk that the Serbian financial sector, amid the absence of closer economic and political integration, is not attractive enough for foreign investment. The reason for this lies in the fact that banking groups that are supervised by the ECB may be motivated to strategically reduce their exposure to smaller markets, such as the Serbian one. In this context, it is crucial that supervision in Serbia is carried out according to the same standards as in the EU. It can be concluded that Serbia is converging towards Basel III standards, but not fast enough. It is also essential to focus on developing the competencies of financial experts who are responsible for overseeing the entire banking sector and financial market. By doing so, alignment with international standards would be ensured and investor confidence in the stability and efficiency of the banking system would be strengthened. Research results support the assessment that the Serbian banking sector is well capitalized. On the other hand, the movement of key macroeconomic indicators has significantly contributed to the liquidity of the domestic banking sector.

Risk management in the banking sector is becoming more complex and requires continuous adaptation to the needs and dynamics of the market. In this way, banks can ensure not only their stability but also actively participate in shaping the future of the financial sector. The harmonization of national regulations with international standards is an important prerequisite, but the existence of a strong national supervisory system, in synergy with these regulations, is the key condition for the sustainable development of the financial sector and the national economy as a whole.

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