



MEASURING BANKING SYSTEM RESILIENCE BY USING THE TEXAS RATIO¹

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Abstract:

The issue of banking sector resilience is one of the most exploited after the global financial crisis. Competent authorities and central banks worldwide conducted a series of actions to strengthen their systems and made them more resilient to extraordinary events. For that purpose, there were conducted stress tests leading to results for the improvement of the central bank's supervisory activities and practices. Also, the analysis of banking sector resilience should be complemented with other measures, which are also treated as early warning indicators. Texas ratio is one of the early warning indicators that could indicate the banking system's stability through the analysis of non-performing loans as a portion of "toxic" assets in banks. A high percentage of non-performing loans poses a serious threat to banking institutions' ability to survive, hence it is crucial to monitor them and find effective solutions. The authors of the research stress the importance of using the Texas ratio when evaluating the resilience of the banking industry. The main findings of the paper are reflected in a positive correlation between NPL and Texas ratio and recommendation for Texas ratio's widespread usage in practice.

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INTRODUCTION

Regulators and market participants in general were faced with a lot of challenges in the period after the last global financial crisis. They had to react adequately and strengthen the banking sector's resistance to unexpected events in the prospective period (Mirković & Knežević, 2013a, p. 404). Also, reforms in the banking industry conducted through the implementation of Basel standards were directed at increasing the level of financial system stability and constituting market discipline in the financial sector (Mirković & Knežević, 2013b, p. 185). Besides the engagement of regulatory bodies made to prevent the negative effects of the crisis, the fact is that the significance of the risk management function in the period of crisis escalation was not recognized. Also, the non-existence of adequate methodologies and procedures for risk exposure monitoring, made the situation even worse especially from the point of view of emerging countries that were on a long-term path to market-oriented economies.

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The stability of the worldwide financial services sector depends upon banks' capacity to establish early warning systems and strengthen their risk management functions. The risks that contain hidden moral hazard are among the most challenging to recognize. Taking on excessive risk without sufficient repercussions causes moral hazard and compromises the stability of financial institutions (Knežević & Mirković, 2015, p. 82). Basel regulations for banks are crucial for the establishment of a well-organized banking system as well as for preventing future crises.

Nevertheless, Djukić (2012) elaborated that "the strategy of maintaining allegedly healthy and successful banking and financial sector in general, in circumstances of obvious distortion in the real economy, is a priori adjudged to catastrophe". The linkage between the real economy and the financial sector is almost perfectly reflected via the category of non-performing loans (hereinafter: NPLs). NPLs represent a huge barrier to the further development of the banking sector, due to their impact on loan expansion. The main challenge for those countries, that experienced the highest credit boom in the period before the global crisis, was reflected in the achievement of the main objective i.e. lowering the gross NPL ratio (Mirković & Knežević, 2014b). A stable banking system is mostly dependent on a low level of NPLs; nonetheless, an abnormally high level of NPLs has the potential to significantly undermine financial stability. Long-term observations show that NPLs at unacceptably high levels are the primary issue that countries must promptly address by choosing a suitable resolution strategy. Various resolution techniques were used in different countries, and the net NPL ratio dramatically decreased as a visible, beneficial outcome.

The structure of this document is as follows. The first title, which emphasizes events in the Republic of Serbia and the CESEE countries, is devoted to the key findings of NPL trends and the resolution of this issue in the banking industry. The Texas ratio is discussed as a helpful tool for assessing the resilience of banking systems in the second and major section of the study. The research findings produced by the Statistical Package for Social Sciences, or SPSS 21.0 (Armonk, NY: IBM Corporation), are the focus of the third title. Starting from the balance sheet data of banks in the Serbian banking industry in a period between Q1 2015 and Q4 2022, the authors were focused on testing the main hypothesis: whether there exists a correlation (and what kind of correlation, if the answer is positive) between well known NPL ratio and Texas ratio, which has not been widely used in the Republic of Serbia. The authors attempt to realize pioneer research on the Texas ratio implementation in the banking industry of the Republic of Serbia, encompassing all banks in the country in almost eight years.

REVIEW OF NPLS TREND IN THE BANKING INDUSTRY

The following facts about NPLs and their global prevalence in banking systems should be taken into consideration. In addition to the previously discussed issues of the lack of a specific definition and the need for a standardized strategy when it comes to NPLs (Mirković & Knežević, 2014), most countries used the IMF's definition of NPLs (IMF, 2005). The National Bank of Serbia adopted a definition of NPLs that is like the IMF's definition (National Bank of Serbia, 2019), with the most important aspect being the 90-day or longer past due degree.

Apart from different definitions and views regarding NPLs, there are some common characteristics in terms of main drivers, circumstances, and origin of NPLs emergence. NPLs increased in CESEE countries mainly after a period of the credit boom, while the situation worsened when the recession in 2009 hit those countries' ratios. Among the main drivers for NPLs in the CESEE group of countries are recognized following: significant decrease of GDP, high unemployment rate, real estate prices decline,



inadequate maturity structure of loans, insufficient implementation of risk management techniques and models in the process of creditworthiness assessment, liquidity problems in banking industry after the global crisis, large portion of indebtedness in foreign exchange clause, issuance of government bonds and sovereign debt enlargement, etc. (Mirković & Knežević, 2014b).

Additionally, in the 2014 document "Final Draft Implementing Technical Standards on Supervisory Reporting on forbearance and non-performing exposures," the European Banking Authority (hereinafter: EBA) introduced the terms of non-performing and forbearance exposures. Also, the document distinguished between the implementation of the debtor approach and the transaction approach, and it outlined the rules for dividing priorities between the two (Mirković & Knežević, 2014b). The banking sector could experience a catastrophic loss because of the unusually high percentage of NPLs and inadequate risk management. NPLs have risen to such levels that they negatively impact loan supply channels and deteriorating financial stability indicators of the banking sector in numerous countries (Budianto & Dewi, 2024).

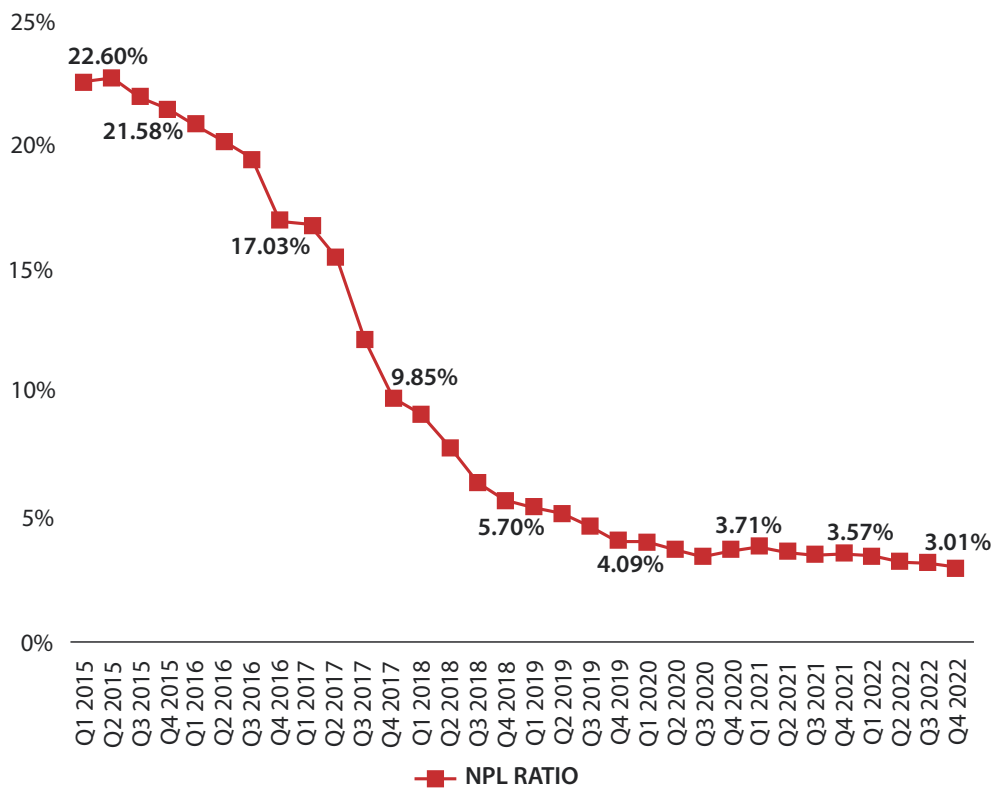
Due to the potential that NPLs could pose a systemic risk, the Government and National Bank of Serbia, as well as other state authorities in the Republic of Serbia, have recognized the need to deal with this issue as an important task which requires the development of a comprehensive strategy involving all relevant institutions (Pravno-informacioni sistem, Republike Srbije, 2015). At the end of September 2017, the National Bank of Serbia adopted a "Decision on the accounting write-off of bank balance sheet assets," which ultimately represented the bank's focus and efforts to fully match with the Action plan and Strategy for NPL resolution (National bank of Serbia, 2023). Besides the above-mentioned National Bank of Serbia's Decision, each bank conducts write-offs in accordance with the internal proscribed rulebook and transfers receivables from on-balance to off-balance when accounts when all instruments of collection are exhausted (Radojević *et al.*, 2023).

The Republic of Serbia stated that it has a focus on a comprehensive, strategic solution based on market principles to address the NPL issue in the long run. The previously mentioned approach seeks to create soundness in the capacity of the bank to "clean" the balance sheet and enable an entirely new lending cycle with a solid basis. This strategy could only be used if there is a common mindset, or agreement amongst all parties involved in actively removing the primary causes of the increase in NPLs throughout the preceding time frame (Mirković & Vujičić, 2018).

The Republic of Serbia's systemic approach to NPL resolution has produced obvious outcomes, resulting in the gross NPL ratio moving downward and reaching a single-digit percentage historical low. Nearly over a period of eight years, from Q1 2015 to Q4 2022, the gross NPL ratio in the Serbian banking sector dropped by roughly 19.5 percentage points, from 22.6% to just 3.01%. Figure 1 (National Bank of Serbia, 2023) illustrates a decrease in the gross NPL ratio in the Serbian banking sector. Two methods, such as direct write-offs and receivables assignment (i.e., NPL sale), have been employed for lowering NPLs. Analyzing data solely in 2022, RSD 15.1 billion of gross NPLs were written off while RSD 6.3 billion were sold (National Bank of Serbia, 2023).



Figure 1. Gross NPL ratio trend in the Serbian banking industry between 2015 and 2022

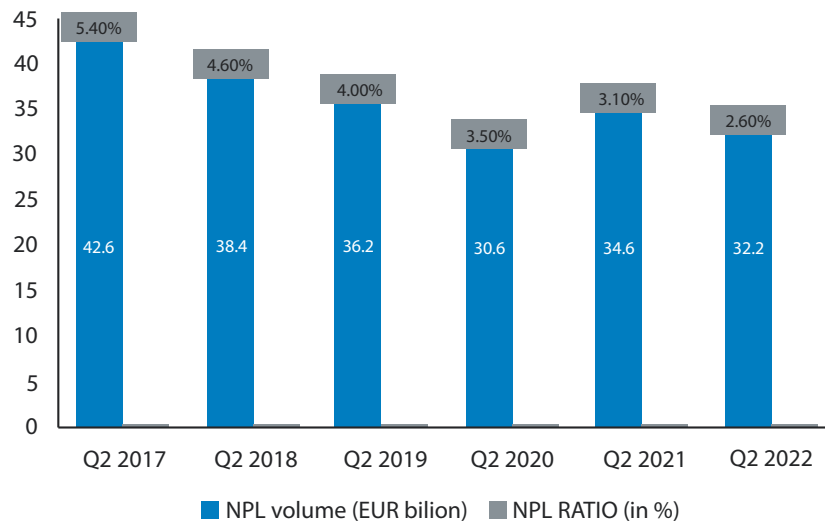


The continuous reduction of the gross NPL ratio (which was justified in 2022) indicates that the global geopolitical situation, starting from the COVID-19 pandemic followed by the Ukraine-Russia conflict, did not influence negatively asset quality in the banking sector even in the case of increasing interest rates. The above also signals that measures of the Republic of Serbia Government and the National Bank of Serbia were appropriate and done in a timely manner as they prevented stronger negative effects on the corporate and retail sector, preserving the stability of the financial system. Those showed that the National Bank of Serbia has sufficient capacity and experience to keep the financial system stable during the COVID-19 pandemic and later during geopolitical dramatic changes caused by conflict between Ukraine and Russia. Additionally, the measures of the National Bank of Serbia in period of COVID-19 pandemic have encouraged companies to further borrow funds from banks through introduced guaranteed schemes. In this way, credit activity was temporarily preserved, but for valid conclusions regarding prospective NPL trajectory, it should consider a longer period and more cautious approach in terms of measures effect on asset quality and financial system stability (Mirković & Andonović Brmalj, 2020).

Among EU authorities, a variety of efforts related to the NPL subject were introduced. Such incentives' main objective is to bring new member states of the EU into accordance with best practices across the continent, giving them a significant competitive edge. Figures 1 and 2 demonstrate respectively, how a strategic approach to NPL resolution has resulted in a reasonable rate of NPL shrinkage in Serbia and the CESEE countries. The average non-performing loan (NPL) ratio for the CESEE group of countries was 2.60 percent as of June 2022, the lowest recorded amount in history (Vienna Initiative, 2023). This suggests that there has not been an overall drop in the overall quality of bank assets.



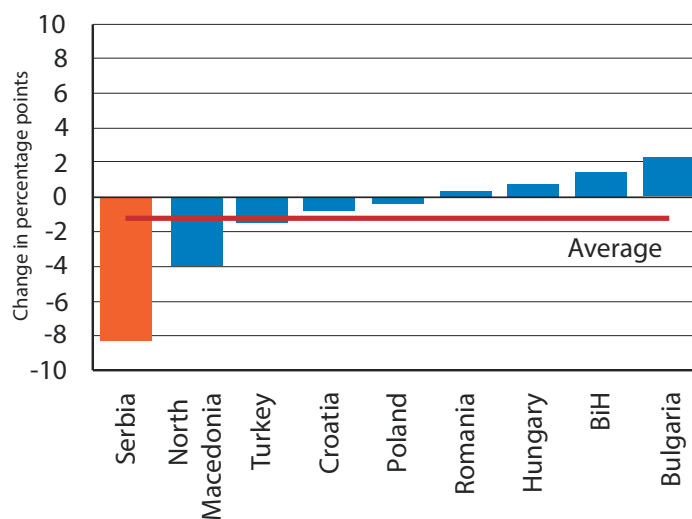
Figure 2. Gross NPL ratio in CESEE countries



Source: Vienna Initiative, 2023

Observing longer trend and analyzing data series of NPL ratio in the time frame of 15 years as well as including NPL ratio movement in countries of the region, the Republic of Serbia is the leader among the countries that mostly decreased NPL ratio (on average by 8.3 percentage points). It is followed by North Macedonia (average decrease by 3.9 percentage points), then Turkey (average decrease by 1.5 percentage points), Croatia (average decrease by 0.7 percentage points) and Poland (average decrease by 0.2 percentage points), whilst Romania, Hungary, Bosnia and Herzegovina and Bulgaria in observed 15-years long period recorded the increase of NPL ratio in range from 0.1 (assigned to Romania) to 2.2 percentage points (assigned to Bulgaria). The described trend is presented in Figure 3 (National Bank of Serbia, 2023).

Figure 3. Change in the NPL ratio, countries of the region: 2022 relative to 2008 in percentage points



Source: NBS and IMF: GFSR, 2023



TEXAS RATIO: DEFINITION AND IMPLEMENTATION

Throughout time, bank collapses have regularly generated panic and an enormous amount of nervousness in the global banking markets. Analysts were busy creating metrics, a sort of early warning system for upcoming bank crises, to react preventively. One of the most prominent measures which should measure the level of NPLs and give the signal regarding the real threat of new bad loans inflow (Anjum, 2023) for the economy is the Texas ratio. It was developed in the 1980s to identify potential issues for banks in the Texas economy.

The Texas ratio might be seen as an indicator of a bank's creditworthiness. To be more precise, it is determined by dividing the bank's tangible common equity (TCE) and loan loss provisions (LLP) by the total non-performing assets (NPA) and real estate held (RE) (variable: RE). When banks suffer financial difficulties, assessing their financial buffer - which has the capacity to absorb future losses from non-performing assets - becomes critical. The formula used for calculating the Texas ratio is as follows:

$$TR = \frac{NPA + RE}{TCE + LLP} \quad (1)$$

where: TR = Texas Ratio

NPA = Non-Performing Assets

RE = Real Estate owned

TCE = Tangible Common Equity

LLP = Loan Loss Provisions

The Texas ratio was established mainly to tackle the large proportion of clients who were overdue on their loan payments. Banks are more likely to fail when their non-performing asset holdings exceed their ability to sustain any possible future losses on such assets, as indicated by a Texas ratio greater than 1 or 100% (Property Metrics, 2023). Analysts might determine whether an institution has sufficient capital and funds to cover NPLs via the Texas ratio. Put alternatively, it delivers an answer to a specific question does a bank possess sufficient capital reserves to cover loan losses while meeting its obligations to deponents?

Real estate-owned and non-performing assets make up the numerator of the Texas ratio. The group of loans that are not being repaid on schedule is known as non-performing assets. Only loans in default on which regular monthly payments are overdue by ninety days or more are subject to variable non-performing assets (NPAs). The real estate that the bank acquired through foreclosure is the second variable in the numerator; these are assets that might eventually result in costs for the bank. The variable Loan Loss Provisions, which can be seen as funds set aside for potential future losses, and the variable Tangible Common Equity, which is a measure of a bank's physical capital, are included in the denominator of the Texas ratio.

Even though the Texas Ratio can differ considerably all over banks, analysts are still able to obtain a clear picture and a driving force for evaluating the stability and soundness of the banking system by considering all of the variables that are included in the ratio. The Texas ratio calculation could help clients and investors alike. Customers might discover that understanding the Texas ratio provides a clear indication of how secure their money is. The latter is directly tied to the defence of deponents



and their rights, with the appropriateness of equal insurance rates being the key concern. The goal of creating a premium differential is mirrored in the supervisor's avoidance of taking on excessive risk and in the corrective actions they implement.

The Law on Deposit Insurance in Serbia employs a linear approach for banks' needs to pay an initial premium equal to 0.3% of the cash part of the bank's minimum beginning capital, as the Deposit Insurance Agency (2023) points out. As opposed to the previously outlined methodology, Djukić (2013) provided a proposal for the differentiation of insurance premiums, employing the observation of specific banks achieved capital adequacy ratios (CARs) in relation to the required threshold for CARs as the main criteria. With the introduction of this strategy, banks with and without adequate risk management are now clearly distinguished from one another. The suggestion of Djukić (Table 1) aims to precisely assign responsibility for inadequate leadership in specific banks (Mirković, 2015).

Table 1. Difference among insurance premiums – proposal

Achieved CAR vs. Average CAR	Haircut
If reached CAR exceeds an average CAR not more than 15%	50%
If reached CAR exceeds an average CAR not more than 30%	60%
If reached CAR exceeds an average CAR more than 30%	70%

Source: Djukić (2013, p.p. 168)

As per National Bank of Serbia projections aimed for solvency stress tests conducted, there is determined the level of NPLs which bring the banking sector capital adequacy ratio down to the threshold. Namely, if the portion of gross NPLs in total loans went up by 4.33 percentage points then the regulatory capital adequacy ratio for the Serbian banking sector drops from an initial 20.15% to the threshold level of 17.10% (National Bank of Serbia, 2023). Also, it should be noted that this scenario is only theoretical, with a very low probability of happening.

Finally, when combined with other financial factors, the Texas ratio performs well. It is essential to keep in mind that a high Texas ratio is not a guarantee that a bank will fail; in fact, several banks with high ratios have been known to stay solvent, and even seemingly stable firms sometimes face buffer issues. Figure 4 displays the Texas ratio's evolution and decreasing trend in the Serbian banking sector between Q1 2015 and Q4 2022.

Figure 4. Evolution of the Texas ratio in Serbian banking industry between 2015 and 2022

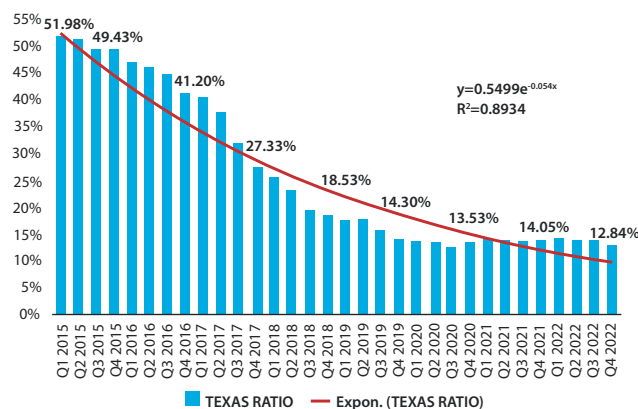




Figure 4 shows that in the same period, NPLs - one of the components of the Texas proportion - declined by over 19.5 percentage points, while the Texas ratio in the Serbian banking sector grew by nearly 40 percentage points. Owing of the extension attempts, which include involving all relevant authorities and market participants who are actively engaged in the NPL resolution process as well as prohibiting the influx of freshly generated NPLs, further contracting of NPLs is a feasible option.

RESEARCH RESULTS AND DISCUSSION

In response to additional analysis, data series related to the Texas and NPL ratios for the period between Q1 2015 and Q4 2022 have been imported into the Statistical Package for Social Sciences - SPSS 21.0. Having a Cronbach alpha coefficient of 0.893, the research indicated strong validity and reliability. Before this study, the contingency coefficient was calculated, and it ended out being 0.984, which is extremely close to zero. This suggests that the two variables have a relationship, but other variables should be included for a more precise dependence. The following should be noted considering the relationship between the NPL ratio and the Texas ratio:

- Pearson correlation between observed variables equals 0.999 (indicated that values from 0.75 to 1 could be assessed from very good to excellent correlation);
- Kendall's tau_b coefficient is 0.859 meaning that the coefficient is very close to 1, i.e., signaling an almost perfect positive monotonous relation;
- Spearman's rho coefficient stands at 0.947 indicating a high positive relationship between variables.

Figure 5 illustrates the point at which the variables have the highest correlation (lag 0). In Table 2, the correlation value is 0.917. The data above shows the significant immediate correlation between the NPL and Texas ratio-related series. Additionally, a significant positive correlation suggests that the two series exhibit similar behaviour to other exogenous influences. Additionally, data indicating negative cross-correlations at delays -6 and +5 and +6, respectively, are shown in Figure 5. Lastly, even though those two series responded well to contemporaneous influences, they also have a minor negative correlation with one another over time.

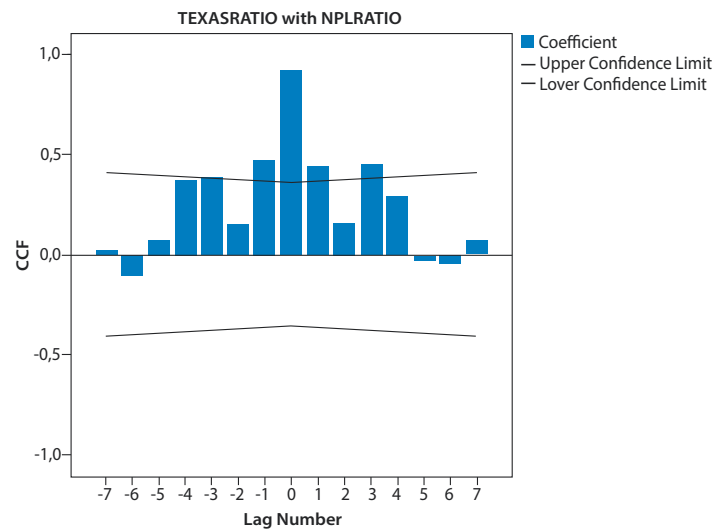
Table 2. Cross-correlation between NPL and Texas ratio

Lag	Cross-Correlation	Std. Error
-7	.016	.204
-6	-.098	.200
-5	.067	.196
-4	.371	.192
-3	.386	.189
-2	.150	.186
-1	.474	.183
0	.917	.180
1	.443	.183



Lag	Cross-Correlation	Std. Error
2	.155	.186
3	.444	.189
4	.289	.192
5	-.015	.196
6	-.037	.200
7	.067	.204

Figure 5. Cross-correlation between NPL and Texas ratio



In terms of the degree of lack of symmetry (skewness) as well as the measuring the frequency of outliers occurring tested in relation to a normal distribution (kurtosis), via the usage of SPSS 21.0 authors obtained the following results, as presented in Table 3:

Table 3. Skewness and kurtosis for variables

Type	Texas Ratio	NPL Ratio
Skewness	0.70	0.75
Kurtosis	-1.23	-1.18

Source: Authors, SPSS 21.0

Considering that skewness for both, NPL and Texas ratio, stands between 0.5 and 1 we are considering that the distribution is moderately skewed, whilst kurtosis reference values for the Texas ratio (-1.23) and NPL ratio (-1.18) pinpoint on *platykurtic* distribution (lighter tails that are shorter and contain fewer outliers).



CONCLUSION

Relatively high non-performing loan levels were acknowledged as an important threat to the economies of the EU and the Republic of Serbia. Long-term trends indicate that non-performing loans (NPLs) at unacceptably high levels are the primary issue that countries must quickly tackle by selecting an appropriate method. Inter-correlation between the real and financial sectors of each economy imposed the necessity for central banks worldwide to react urgently to diminish the impact of NPLs. A lot of efforts were made in the direction of NPLs decreasing to acceptable levels taking into account that aggravating circumstances in the previous decade were impersonated by: the global financial crisis in 2008 and its prolonged effects, then the COVID-19 pandemic beginning in 2020 and finally geopolitical tensions that resulted in Ukraine-Russia conflict with uncertain outcome yet. Central banks of countries which were faced with NPLs issue were actively engaged in the adoption of strategies and plans directed to resolution. Through resolution via private equity fund formations specialized in NPLs, or alternatively, there were created prerequisites for removing the obstacles that deteriorate economic growth.

This paper presents a summary of the NPL resolution procedures implemented in the EU and the Republic of Serbia, which led to a remarkable decrease in the gross NPL ratio, ultimately reaching a level never seen before. The Texas ratio, which includes NPLs as one of its calculation components, was also offered by the authors as a highly useful instrument that, despite its potential for broad variation among banks, provided us with an overview and a visible driver for the examination of stability and soundness within the banking system. Customers and investors benefited from the Texas ratio since it was seen as a strong indicator of the degree of security of their money.

The NPL ratio and the Texas ratio showed an established positive connection, based on the authors' actual correlation and cross-correlation analyses done with SPSS 21.0. Also, empirical data demonstrated a downward trend for the NPL ratio variable during the time frame in question in the cases of the Republic of Serbia and EU countries, respectively. In the Serbian banking industry, the Texas ratio data was also investigated and revealed a decreasing pattern, suggesting a positive connection with the NPL ratio variable. Despite being rare, the study's findings on the application of the Texas ratio in the banking industry are highly helpful, and it implies that economists may find the option it describes useful. This paper's primary limitation may stem from its analysis's specific focus on the banking sector in the Republic of Serbia. Peer examination with other banking sectors at similar stages of growth and comprehensive investigation inside one banking sector amongst peer groups of banks should be the basis of future research.



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MERENJE OTPORNOSTI BANKARSKOG SISTEMA PRIMENOM TEKSAS RACIJA

Rezime:

Pitanje otpornosti bankarskog sektora jedno je od najčešće analiziranih nakon globalne finansijske krize. Nadležni organi i centralne banke širom sveta sproveli su niz akcija kako bi ojačali svoje sisteme i učinili ih otpornijim na vanredne događaje. U tu svrhu sprovedeni su stres testovi koji su rezultirali unapređenjem supervizorskih aktivnosti i praksi centralnih banaka. Takođe, analizu otpornosti bankarskog sektora treba upotpuniti drugim merama, koje se tretiraju kao indikatori ranog upozorenja. Teksas racio predstavlja jedan od indikatora ranog upozorenja koji bi mogao da ukaže na stabilnost bankarskog sistema kroz analizu nenaplativih kredita kao dela „toksične” aktive u bankama. Visok nivo nenaplativih kredita predstavlja značajnu pretnju za opstanak bankarskih sistema, pa je njihovo praćenje i efikasno rešavanje imperativ. U radu autori ističu značaj upotrebe Teksas racija u procesu evaluacije otpornosti bankarskog sektora. Ključni nalazi ovog rada su postojanje pozitivne korelacije između NPL i Teksas racija kao i preporuka za široku primenu Teksas racija u praksi.

Ključne reči:

otpornost,
bankarski sektor,
nenaplativi krediti,
Texas racio,
Republika Srbija

JEL klasifikacija:

G21, E58