BANKING INSTABILITY AND CONSEQUENCES IN THE SOVEREIGN RISK CONTEXT - EUROPEAN ECONOMIES[1]

1 Adina-Ionela Străchinaru, Bucharest University of Economic Studies,
Money and Banking Department, Romania
*Corresponding author's e-mail: adina.strachinaru@fin.ase.ro
1 ORCID: 0000-0003-0302-3358

ARTICLE INFO

Review Scientific Paper
Received: 27.07.2024
Revised: 16.06.2025
Accepted: 10.07.2025
DOI 10.63356/ace.2025.015
UDK
336.71:316.323.6(4.672EU)
COBISS.RS-ID 143724289

Keywords: *banking instability, exercise stress test, financial shocks, nonperforming loans, scenarios, sovereign risk*

JEL Classification: C58, E61, F33

ABSTRACT

Banking instability, as a result of the sovereign risk emergence, triggered, over time, the need for a detailed diagnosis by decision-makers from the monetary authorities, being a theme of permanent relevance and complexity among economic policies. The main issue is related to the existence of a very close, dependent link between the probability of banking instability and sovereign risk. The rigor of the issue requires an in-depth analysis; therefore, this paper aims to capture aspects of micro and macroprudential, based on a panel data set for European Union countries, starting from 2005. In this context, the research identifies liquidity and solvency as the main vulnerabilities to macroeconomic stability, based on its objectives. This is achieved through a micro-level analysis of credit institutions and the use of macroprudential assessment tools, applying multivariate regression and vector autoregressive models, and complemented by unifactorial and multifactorial resilience scenarios to extreme but plausible events. Another objective is to develop a diagnostic framework that enables the assessment of banking performance sensitivity to government bond yield dynamics through both market and credit risk channels. The importance of this research and the estimated results lie in identifying the negative impact of rising government bond yields on banking profitability, particularly on capital adequacy. On the other hand, the originality of this research lies in the estimates that contribute to shaping a set of policy options within the economic policy mix and to formulating proposals for preventive measures aimed at mitigating systemic risks arising from the interaction between sovereign risk and the likelihood of banking instability.

1. INTRODUCTION

The last decades have been characterised by financial ties development, an increase in capital flows between countries, but also the emergence of financial-banking crises, pandemic crises and armed conflicts, which required special attention from the monetary authorities.

The particularities of emerging economies and not only, such as inconsistencies in the mix of economic policies, the expansion of the phenomenon of monetary substitution, uncertainties at the legislative and prudential level, the deterioration of investor dynamics, the structure and cost of financing the twin deficits, the risk of default on non-governmental loans, contribute to increasing the complexity of channels interaction between the banking sector, public administration and the real economy.

The motivation for researching this topic stems from a growing concern highlighted in the specialized literature, particularly among monetary authorities such as the International Monetary Fund, the European Banking Authority, the Bank for International Settlements, and the European Central Bank. This concern relates to the connection between sovereign risk and the probability of banking instability, as reflected in the potentially severe implications of shock propagation in both directions—between public finances and the financial sector—on the dynamics of the real economy.

The justification for this research lies in the vulnerability of the banking sector to sovereign risk, which has become a central topic on the agenda of monetary authorities, particularly after recent crisis episodes, given its systemic importance for the overall economy. Furthermore, banking crises—often occurring alongside other types of crises, such as financial, pandemic, or geopolitical shocks—have underscored the need to develop models based on the key determinants of the interaction between sovereign risk and the probability of banking stress episodes.

The purpose of research is to identify solutions/remedies to compress the interaction channels between sovereign risk and the probability of banking instability.

Regarding the main objectives of the paper, we capture several stages. The first objective refers to analytical framework and preventive/corrective measures and the second one is the construction of macro and micro prudential assessment tools. As a substage of this objective, we analysed the development of analytical framework for sovereign risk propagation at the credit institutions level - Model for quantifying the impact of sovereign risk on the credit institutions solvency. The third objective aims to develop a diagnosis and the substage - Quantification of the impact of extreme but plausible scenarios.

The second substage is the selection of systemic vulnerabilities for hierarchisation of systemic vulnerabilities. The fourth objective consists of proposals for preventive measures and the main substage refers to configuring the set of options at the level of the economic policy mix to mitigate the systemic risk associated with the interaction between sovereign risk and the probability of banking instability.

The research question investigates whether a dependent relationship exists between sovereign risk and the probability of banking instability, and whether increases in government bond yields negatively affect banking profitability, particularly capital adequacy.

As methodology, we use the multivariate regressions and autoregressive vector models, complemented with unifactorial and multifactorial scenarios of resilience to extreme but plausible events. We start from a model for quantifying the sovereign risk impact on the credit institutions solvency through market (interest) risk; respectively, of credit risk. The results refer to the reaction of bank profitability, which is expected to be negative, and of capital adequacy, which is reflected in the increase in government bond yields. The first part of the research aims to assess the sensitivity of banking performance to the dynamics of government bond yields.

Moreover, the results indicate that banking instability can affect the state's solvency and ability to pay its debts on time. This, in turn, has a major impact on the liquidity and solvency of credit institutions, through the lens of performance and risk indicators.

The originality of this research lies in its assessment of the potential severity of existing banking vulnerabilities through the quantification of the effects of financial and fiscal-budgetary shocks on macro-financial dynamics. Thus, capturing some scenarios on a medium time horizon, helps to identify systemic vulnerabilities to formulate proposals and preventive measures to mitigate the severity developed by the connection between sovereign risk and banking instability.

In conclusion, scenario analysis was conducted based on the forecasted results, following the European framework for stress-testing resilience to extreme but plausible events.

The paper continues with the description of the specialised literature review, the methodology and the data used, followed by the estimated results and the conclusions drawn.

2. LITERATURE REVIEW

Banking instability increases sovereign risk through the state's inability to honor its obligations arising from commercial relations. This implies an adequate degree of liquidity and solvency of the state and, implicitly, the balance of the state budget, external debt and current account deficit (Fouejieu, 2017). Absorption of sovereign debt issuance by the financial sector is fundamental to financial stability. Sovereign bonds are used on the financial markets, being considered high-quality liquid assets, but also of the last rank in case of low solvency. The ability of investors to absorb additional issues is an important barometer for the discipline of sovereign bond markets (Longaric et al., 2023).

In this context, financial stability can be disturbed due to absorption limits from different sectors of activity (Ortmans and Tripier, 2020). Despite the absence of net purchases of sovereign debt since June 2022 (PSPP), by the Eurosystem, it aims to reinvest maturing bonds under the pandemic emergency purchase program (PEPP) until at least 2024, according to the last Financial Stability Review (European Central Bank, 2023). However, the newly issued government debt was absorbed in 2023, according to models and empirical evidence from the literature. Thus, investors are tempted to purchase bonds, as yields are higher (Koijen, R. et al., 2021).

On the other hand, in situations of uncertainty and high volatility on the financial markets, the absorption capacity of different activity sectors, including non-bank investors or risk-averse sectors, such as insurers, tends to register a downward trend (Fache & Giuzio, 2019), with the exception of credit institutions.

Therefore, the government has strengthened its position regarding the market share of the credit institutions which are the majority of shareholders. The share of these banks' assets increased, from 5% in 2008 to 12.6% in September 2023, according to the Financial Stability Report (National Bank of Romania, 2023).

Consequently, both nationally and internationally, the importance of the interactions between fiscal policy and financial stability is emphasised, as well as the reduction of the less favorable impact of sovereign risk on the solvency of credit institutions, as a result of the strong connection (Holopainen and Sarlin, 2017).

More than that, the interaction between the banking crisis likelihood and the sovereign risk premium are captured using macro and micro prudential assessment tools (Balima, Combes, & Minea, 2017). The crises identification, based on quantitative approaches, can also be substantiated by using a financial stress index, recommended by national and European authorities (European

Banking Authority, 2023). This approach ensures a more precise definition of the crisis period and allows the adjustment and separation of the crisis period and the post-crisis period, facilitating the model estimation and calibration.

External and internal imbalances can affect the accuracy of the data set, and this information is fundamental in selecting the relevant set of events for calibrating or estimating models designed to study specific aspects of banking crises (Wijayanti and Rachmanira, 2020). Thus, based on the CDS quotes, together with other specific determining factors, the dynamics of economic growth and the probability of a banking crisis are forecasted.

The macroeconomic context, following the pandemic crisis (Ortmans and Tripier, 2020), armed conflicts, combined with the high level of uncertainty in the market, led to the development of adverse scenarios that surprised the ability of the banking sector to cope with losses.

Systemic risk can be influenced by the bonds demand and supply on the financial markets. The Eurosystem has stopped net purchases of sovereign debt since June 2022 (PSPP), but government debt continues to be absorbed until 2023. Thus, in the first half of the year, banks, investment funds, pension funds and households register an upward trend in the sovereign bonds purchase from the euro area, opposite the effect observed in the insurance companies.

The European Banking Authority, in cooperation with the Systemic Risk Board (SRB), develops and coordinates EU-wide stress tests to assess the resilience of the banking sector to shocks, capturing EU-wide systemic risk. The methodology used assumes the existence of two macro-financial scenarios - basic, which contains the narrative part and adverse, which captures the severity of the phenomenon - which the banks use in order to carry out the testing exercise. The central (basic) macro-financial scenario for EU countries is based on historical data and projections from December 2020, carried out by central banks (ECB, 2021). The adverse scenario involves the development of hypothetical situations of the triggering and materialisation of the European banking sector risks in order to identify and prioritise systemic vulnerabilities. At the same time, it reflects the concerns of the monetary authorities regarding the developments of the Covid-19 pandemic, with a negative impact on the population confidence and refers to a low interest rates environment, when negative shocks accentuate and prolong the economic contraction.

The stress test involves making a diagnosis, based on scenarios that capture the potential trends in economy and not necessarily the potential negative shocks assessment on the financial system (Longaric et al., 2023).

The methodology proposed by the EBA contains scenarios with information on the dynamics of real GDP, interest rates, the unemployment rate, the inflation rate, the shares price and extends over a 3 years' time horizon, respectively 2021-2023.

The exercise tests the adverse scenarios impact on the EU banks' solvency, in the sense that they are able to build up enough buffers to cover losses for the economy recovery in times of stress. Its results help to develop strategies that allow exit from the flexibility measures granted to banks during the pandemic or additional measures if the macroeconomic context deteriorates more (Garcia et al., 2021). The baseline scenario contains the EU national central banks projections, and the adverse scenario captures the manifestation of the main financial stability risks.

In order to test the banking sector resilience in the European Union, on a common macroeconomic basis, the monetary authorities (EBA, ECB, ESRB) propose a series of scenarios, covering the period 2021-2023. Despite the low level of interest rates, the severity of the contraction both globally and at the EU level of economic activity, in the adverse scenario, leads to a significant equity revaluation. In 2021, stock prices dropped sharply by 50% in advanced economies and by 65% in emerging economies. According to the EBA (2021), the recovery appeared, to some extent, between 2022 and 2023, so in 2023 share prices were still 35% below their starting point. The increase in the asset revaluation margin is limited to a proportion of the spreads increase in sovereign bonds (Ardakani, Kishor & Song, 2018).

In the following, a model will be developed to quantify the impact of sovereign risk on the solvency of credit institutions through the lens of market (interest) risk and credit risk, respectively. The reaction of bank profitability, which is expected to be negative, and of capital adequacy, respectively, to the upward change in government bond yields is captured.

The hypotheses aim to assess the sensitivity of banking performance to the evolution of government bond yields through the lens of: (i) market (interest) risk and (ii) credit risk and capture the negative reaction of banking profitability and, implicitly, capital adequacy to the increase in government bond yields.

In other words, we evaluate the consequences of changing the sovereign risk premium on the value of government securities portfolios, as well as on the quality of the loan portfolio (non-performing loan rate), due to the increase in the cost of financing and the impact on repayment capacity, along with the negative effect on economic development.

Some of the systemic vulnerabilities caught by the European Banking Authority are also identified in the current research. The research aims to make a diagnosis, by running scenarios similar in profile to those applied in the European exercise to test resilience to extreme but plausible events.

3. MATERIALS AND METHODS

A. Methodology and estimates in order to capture sovereign risk impact quantification on credit institutions solvency

The methodological framework involves the use of multivariate regression on *annual panel data* to study the multidimensional impact of the variation in government bond yields on bank profitability, as a result of the effects on the government bond and bank portfolios.

The main mechanism through which sovereign risk affects bank solvency is considered, namely the channel represented by the quality of bank assets, expressed by the rate of non-performing loans under the impact of economic growth, which in turn is influenced by the dynamics of the sovereign risk premium (Beutel, List & von Schweinitz, 2018).

The aim of the paper is to identify, based on annual panel data for 28 countries in the European Union, starting with the year 2005, with a number of 349 observations, respectively 400 observations recorded, the main vulnerabilities to macroeconomic stability by running unifactorial (first model) and multifactorial models (second model) of resilience to extreme but plausible events. The results obtained in this way will facilitate the configuration of the set of options at the level of the economic policy mix to mitigate the systemic risk associated with the interaction between sovereign risk and the probability of banking instability.

The scope of the analysis is to capture systemic vulnerabilities, the consequences of the change in the sovereign risk premium on the value of government securities portfolios, as well as on the quality of the credit portfolio (non-performing loans rate), due to the increase in the cost of financing, and the impairment of repayment capacity, along with the negative effect, is evaluated on economic development.

As exogenous variables for the explanatory model of the non-performing loans rate (BANK_NONPERFORMING_LOANS), we consider, in the first instance, factors such as: economic growth (GDP_GROWTH), the unemployment rate among young people (YOUTH_UNEMPLOYMENT_RATE), the ratio of loans to deposits (LOANS_TO_DEPOSITS_RATIO) (*first regression model on panel data, with 349 observations*) (Table 1).

Table 1: Description of indicators - first part

Variables	Specification	Data source
The dependent variable		
BANK_NONPERFORMING_LOANS	Bank nonperforming loans to total gross loans (%) (quality of the credit portfolio)	World Bank
The independent variable		
GDP_GROWTH	GDP growth (%) (real GDP variation)	Eurostat
YOUTH_UNEMPLOYMENT_RATE	Youth unemployment rate-% of active population aged 15-24 (3 year change in p.p)	World Bank
LOANS_TO_DEPOSITS_RATIO	Loans to deposits ratio (%)	European Central Bank

Source: European Central Bank, Eurostat, World Bank

These variables are complemented with the interbank interest rate (INTERBANK_RATES), modeled in turn, through a link function, based on the dynamics of government bond yields (GOVERNMENT_BOND_YIELD), the monetary policy interest rate (CENTRAL_BANK_POLICY_RATE) and other exogenous factors (*the second panel data regression model, with 400 observations*).[1](Table 2)

Table 2: Description of indicators - second part

Variables	Specification	Data source
The dependent variable		
INTERBANK_RATES	Interbank Rates for the Euro Area (%)	European Central Bank, Federal Reserve
The independent variable		
GOVERNMENT_BOND_YIELD	Long-term government bond yield (%)	Eurostat
CENTRAL_BANK_POLICY_RATE	Central bank policy rates (euro area) (%)	Bank for International Settlements, International Monetary Fund

Source: Bank for International Settlements, European Central Bank, Eurostat, Federal Reserve, International Monetary Fund

1 Starting with 2005, but some data are missing due to their distortion, during the pandemic crisis.

The data were taken at the European level from official websites, such as: Bank for International Settlements (BIS), European Central Bank (ECB), Eurostat (EU), Federal Reserve (FD), International Monetary Fund (IMF), World Bank (WB).

The description of the regression equation, by using EViews 8 on panel data, can be summarized as follows (for both estimates):

$$y_{it} = \alpha + X'_{it}\beta + \mu_i + \vartheta_{it}, \quad i=1,....,N;\ t=1,...,T \ ^{2},$$

The econometric application can estimate two types of models: the fixed effect model or the random effect model. In order to select the best model, we applied the Hausman test, whose hypotheses (Baltagi, 2008) are: a) null hypothesis (H_0): the random effect model is appropriate; b) alternative hypothesis (H_1): the fixed effect model is appropriate. Therefore, if the test probability (p-value) registers a statistically significant value, we will use the fixed effect model, otherwise the random effect model is appropriate.

In order to obtain a valid model, on which decisions can be based, we analysed only the statistically significant coefficients, taking into account a significance threshold of 1%, 5%, and, respectively, 10% and the stationary ones, being expressed in percentages[3](Baltagi, 2008).

4. ESTIMATION RESULTS AND DISCUSSIONS

Results are based on descriptive characteristics (natural logs) of the exogenous variables for the explanatory model of the non-performing loan rate respectively: economic growth, youth unemployment rate and loan-to-deposit ratio (Table 3). We add to these the interbank interest rate, modeled in turn, through a link function, based on the dynamics of government bond yields, the monetary policy interest rate and other exogenous factors.

2 Where: i = cross-sectional size of the sample, t = time (time series size, α, β = coefficients of the equation, X_{it}= observation of exogenous variables, u_{it} = individual specific unobservable effect and ϑ_{it}= residue (remainder disturbance).

3 Probabilities for Fisher tests are computed using an asymptotic Chi.

Table 3: Descriptive statistics - first part

	GDP_GROWTH	YOUTH_ UNEMPLOYMENT_ RATE	LOANS_TO_ DEPOSITS_RATIO
Mean	0.020732	-0.001120	1.261367
Median	0.022734	-0.009000	1.149715
Maximum	0.251625	0.296000	3.257310
Minimum	-0.148142	-0.196000	0.592471
Std. Dev.	0.036441	0.082173	0.509747
Skewness	-0.103144	0.760608	1.681422
Kurtosis	9.644254	4.253177	6.024941
Jarque-Bera	642.5769	56.48784	297.5077
Probability	0.000000	0.000000	0.000000
Sum	7.235416	-0.391000	440.2171
Sum Sq. Dev.	0.462137	2.349863	90.42513
Observations	349	349	349

Source: Author's calculations, using EViews

In order to capture the statistical significance of the regression equation, we eliminated the indicators with strong correlations. Therefore, we identified the linear correlation coefficient for the financial indicators used, highlighting the presence or absence of linear dependence between the variables of the regression model, the direction of the dependence and the intensity (Table 4).

Table 4: Correlations matrix - first part

	GDP_GROWTH	YOUTH_ UNEMPLOYMENT_ RATE	LOANS_TO_ DEPOSITS_RATIO
GDP_GROWTH	1		
YOUTH_ UNEMPLOYMENT_ RATE	-0.4730	1	
LOANS_TO_ DEPOSITS_RATIO	-0.1814	0.2007	1

Source: Author's calculations, using EViews

The *F-statistic test*, as well as the probability associated with it, is another important element that helps explain the model. Thus, the probability does not exceed the 5% significance level and thus we say, with a 95% probability, that

the model is valid. In other words, there is at least one independent variable that can explain the variation of the dependent variable. With the help of this test, it is verified that the regression model is correctly specified.

The results of the estimates are captured in Table 5.

Table 5: The regression equation - first part

Dependent Variable: BANK_NONPERFORMING_LOANS
Method: Panel Least Squares
Cross-sections
Total panel (unbalanced) observations: 349

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP_GROWTH	-0.274249	0.128761	-2.129908	0.0339
YOUTH_UNEMPLOYMENT_RATE	0.195736	0.057321	3.414740	0.0007
LOANS_TO_DEPOSITS_RATIO	-0.028092	0.008278	-3.393377	0.0008
C	0.104516	0.011775	8.876243	0.0000
R-squared	0.089155	Mean dependent var	0.063177	
Adjusted R-squared	0.081234	S.D. dependent var	0.080052	
S.E. of regression	0.076732	Akaike info criterion	-2.285602	
Sum squared resid	2.031288	Schwarz criterion	-2.241418	
Log likelihood	402.8376	Hannan-Quinn criter.	-2.268013	
F-statistic	11.25633	Durbin-Watson stat	0.129727	
Prob(F-statistic)	0.000000			

Source: Author's calculations, using EViews

Economic growth and the loan-to-deposit ratio have an opposite effect on the non-performing loans dynamics, a fact that is also reflected in the economic reality, in that the well-being of the economy, expressed through economic growth, can also be reflected by a reduction in the non-performing loans rate. On the other hand, a high rate of unemployment among young people can determine the reduction of the ability to repay bank loans and, at the same time, the banking crises appearance, through an increase in the non-performing loans volume. Therefore, there is a direct relationship between debtors, who become insolvent, as a result of the increase in the unemployment rate, and the banks bankruptcy, which fail to adequately manage bank assets and liabilities.

We add to these results the interbank interest rate, which is modeled through a link function, based on exogenous factors, as the government bond yields and the monetary policy interest rate, whose characteristics are found in Table 6.

Table 6: Descriptive statistics - second part

	GOVERNMENT_ BOND_YIELD	CENTRAL_BANK_ POLICY_RATE
Mean	0.035130	0.052010
Median	0.034733	0.010000
Maximum	0.224983	5.770000
Minimum	-0.002525	-0.007292
Std. Dev.	0.025068	0.401893
Skewness	1.922291	12.09623
Kurtosis	12.59526	153.6466
Jarque-Bera	1780.831	387994.5
Probability	0.000000	0.000000
Sum	14.05185	20.80403
Sum Sq. Dev.	0.250729	64.44554
Observations	400	400

Source: Author's calculations, using EViews

In order to obtain valid results, we applied the correlation matrix (Table 7), taking into account the confidence interval (-0.5; 0.5):

Table 7: Correlations matrix - second part

	GOVERNMENT _BOND_YIELD	CENTRAL_BANK _POLICY_RATE
GOVERNMENT _BOND_YIELD	1	0.0759
CENTRAL_BANK _POLICY_RATE	0.0759	1

Source: Author's calculations, using EViews

The Table 7 shows that the values are found in the range, and that these are not strongly correlated in such a way that the steps can be continued.

Table 8: Hausman test

Correlated Random Effects - Hausman Test

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.128453	2	0.9378

Source: Author's calculations, using EViews

Next, we used the Hausman test to select the appropriate model (Table 8). According to the Hausman test, the random-effects model is suitable for estimating the equation. Due to the probability value, which is statistically significant (p-value > 0.05), we accept the null hypothesis and reject the alternative hypothesis; thus, we can state that the appropriate model for estimation is the random-effects model.

Table 9: Multivariate regression - second part

Dependent Variable: INTERBANK_RATES

Cross-sections

Total panel (unbalanced) observations: 400

Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GOVERNMENT_BOND_YIELD	0.380177	0.039841	9.542346	0.0000
CENTRAL_BANK_POLICY_RATE	0.008227	0.002452	3.355202	0.0009
C	0.003283	0.00234	1.402787	0.1615
	Effects Specification			
Cross-section random			0.008626	0.1996
Idiosyncratic random			0.017274	0.8004
	Weighted Statistics			
R-squared	0.21151	Mean dependent var		0.007899
Adjusted R-squared	0.207538	S.D. dependent var		0.019375
S.E. of regression	0.017233	Sum squared resid		0.117899
F-statistic	53.24694	Durbin-Watson stat		0.561109
Prob(F-statistic)	0			
	Unweighted Statistics			
R-squared	0.235617	Mean dependent var		0.017057
Sum squared resid	0.144817	Durbin-Watson stat		0.473531

Source: Author's calculations, using EViews

The estimation results (Table 9) of the interbank interest rate dynamics, based on exogenous variables as government bond yields and the monetary policy interest rate capture the reaction of bank profitability and, implicitly, capital adequacy to the increase in government bond yields.

Both the increase in the monetary policy rate and the yield of government securities show a change, in the same sense, on the interbank interest rate. This fact can have repercussions in both directions. On the one hand, a debt-financed economy can lead to the triggering of banking crises. On the other hand, adequate management in ensuring the balance between bank liabilities and assets offsets its burden.

In conclusion, the existence of a consistent amount of sovereign bonds in the bank balance sheet can mean the development of an ample channel for propagating fiscal-budgetary vulnerabilities at the banking stability level and, subsequently, through financial intermediation, at the real economy level.

B. Methodology and estimates for quantifying impact scenarios and finding solutions to compress the interaction between sovereign risk and banking instability

Starting from a quantifying model for the banking crises likelihood and an explanatory model for the sovereign risk premium trend based on the estimates, made available by the European Banking Authority, regarding the residential real estate prices indicator, respectively the GDP deviation, we quantified the impact of some extreme but plausible scenarios, taking into account the interaction model of economic growth, sovereign risk and the banking crisis likelihood. In this sense, the dependent variable reactions to an unexpected shock are reproduced at the explanatory variables level, starting from the two scenarios: basic and adverse.

The methodology used assumes the existence of two macro-financial scenarios: basic, which contains the narrative part, and adverse, which captures the severity of the phenomenon. The research relevance lies in the potential solutions analysis, starting from the vulnerabilities diagnoses presented by the macro and microprudential indicators, at the European Union level. One scenario captures the negative reaction of bank profitability and, implicitly, capital adequacy to the increase in government bond yields, similar to the stress test exercise coordinated by the European Banking Authority.

Therefore, the methodological framework assumes, based on the macroprudential and microprudential assessment tools, built on econometric bases, using multivariate regressions and autoregressive vectors, the creation of two scenarios (basic and adverse) on annual panel data for 28 countries in the European Union, starting with the year 2005, with a number of 448 observations recorded, with the help of ANOVA, respectively EViews 8. The data source refers to official websites, such as: World Bank, International Monetary Fund, European Central Bank, Federal Reserve and Bank for International Settlements.

In order to obtain the data robustness, significant indicators were selected, whose standard error is relatively small and insignificant, or whose t-statistic value falls within the confidence interval, all indicators being *stationary* in level (expressed in percentages). The optimal number of lags is checked, as being equal with 2, according to the table below (Table 10):

Table 10: Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: PD CDS GDP
Exogenous variables: C

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-281.036	NA	0.000662	1.19343	1.219682	1.203753
1	-73.1074	412.3632	0.000287	0.357594	0.462605*	0.398886
2	-55.9086	33.89175*	0.000277*	0.323145*	0.506914	0.395406*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Author's calculations, using EViews

After estimating the indicators, by using autoregressive vector model - VAR, in the *baseline scenario,* the first results can be seen in Table 11.

Table 11: Estimation results with VAR model equation - baseline scenario

Vector Autoregression Estimates
Standard errors in ( ) & t-statistics in [ ]

	PD	CDS	GDP
PD(-1)	0.675343	0.404726	0.016179
	-0.04447	-0.20619	-0.00584
	[15.1851]	[1.96289]	[2.77093]
PD(-2)	0.001291	-0.21805	**-0.02458**
	-0.04407	-0.20431	**-0.00579**
	[0.02930]	[-1.06727]	**[-4.24901]**
CDS(-1)	-0.00638	0.179546	**-0.00806**
	-0.00984	-0.04561	**-0.00129**
	[-0.64837]	[3.93626]	**[-6.23866]**
CDS(-2)	-0.01078	-0.01211	-0.00144
	-0.01018	-0.0472	-0.00134
	[-1.05898]	[-0.25652]	[-1.07562]
GDP(-1)	0.5842	2.830979	**0.333263**
	-0.34186	-1.58493	**-0.04488**
	[1.70888]	[1.78619]	**[7.42529]**
GDP(-2)	-0.88585	2.097438	-0.08443
	-0.35839	-1.66157	-0.04705
	[-2.47173]	[1.26232]	[-1.79442]
C	0.127869	0.095457	**0.021048**
	-0.02244	-0.10402	**-0.00295**
	[5.69938]	[0.91772]	**[7.14571]**
R-squared	0.460791	0.066239	0.236963
Adj. R-squared	0.453893	0.054293	0.227201
Sum sq. resids	42.09772	904.8473	0.725611
S.E. equation	0.299601	1.388997	0.039334
F-statistic	66.7989	5.544936	24.27487
Log likelihood	-98.1638	-828.294	868.2911
Akaike AIC	0.441865	3.509637	-3.61887
Schwarz SC	0.503121	3.570893	-3.55761
Mean dependent	0.412446	0.328471	0.018692
S.D. dependent	0.405419	1.428311	0.044744
Determinant resid covariance (dof adj.)		0.000265	
Determinant resid covariance		0.000254	
Log likelihood		-55.9086	
Akaike information criterion		0.323145	
Schwarz criterion		0.506914	

Source: Author's calculations, using EViews

In the *adverse scenario*, the estimations are shown in Table 12.

Table 12: Estimation results with VAR model equation - adverse scenario

Vector Autoregression Estimates
Standard errors in ( ) & t-statistics in [ ]

	PD	CDS	GDP
PD(-1)	0.647419	0.476935	**0.361668**
	-0.04453	-0.20898	**-0.0866**
	[14.5393]	[2.28222]	**[4.17649]**
PD(-2)	-0.03082	-0.25813	0.101014
	-0.04417	-0.2073	-0.0859
	[-0.69775]	[-1.24525]	[1.17596]
CDS(-1)	-0.01027	0.191933	-0.00065
	-0.00971	-0.04556	-0.01888
	[-1.05826]	[4.21258]	[-0.03457]
CDS(-2)	-0.01622	-0.03931	0.016628
	-0.00968	-0.04543	-0.01882
	[-1.67591]	[-0.86543]	[0.88337]
GDP(-1)	0.069488	0.111894	**0.363255**
	-0.02698	-0.12661	**-0.05247**
	[2.57566]	[0.88374]	**[6.92361]**
GDP(-2)	0.014746	0.020487	-0.47578
	-0.04049	-0.19002	-0.07874
	[0.36420]	[0.10782]	[-6.04247]
C	0.167141	0.187615	**-0.37075**
	-0.02421	-0.11364	**-0.04709**
	[6.90261]	[1.65097]	**[-7.87335]**
R-squared	0.462444	0.058513	0.201699
Adj. R-squared	0.455567	0.046468	0.191486
Sum sq. resids	41.7659	919.8959	157.9551
S.E. equation	0.298418	1.400499	0.580337
F-statistic	67.24443	4.857991	19.74964
Log likelihood	-96.2804	-832.219	-412.875
Akaike AIC	0.433951	3.526132	1.764182
Schwarz SC	0.495207	3.587388	1.825438
Mean dependent	0.413487	0.308193	-0.19556
S.D. dependent	0.404438	1.434218	0.645412
Determinant resid covariance (dof adj.)		0.0572	
Determinant resid covariance		0.054714	
Log likelihood		-1334.7	
Akaike information criterion		5.696224	
Schwarz criterion		5.879993	

Source: Author's calculations, using EViews

After refining the model, the main conclusions are drawn regarding the GDP index dynamics in relation to the chosen variables.

5. ESTIMATED RESULTS AND DISCUSSIONS

Within the model for quantifying the banking stability dependence on sovereign risk, the residential real estate prices impact on the banking crisis likelihood shows a positive effect, which, quantified on the two scenarios, results in similar values.

In the base scenario (Figure 1), residential real estate prices remain at a high level, registering positive values, which is why the probability of a banking crisis maintains a positive trend.

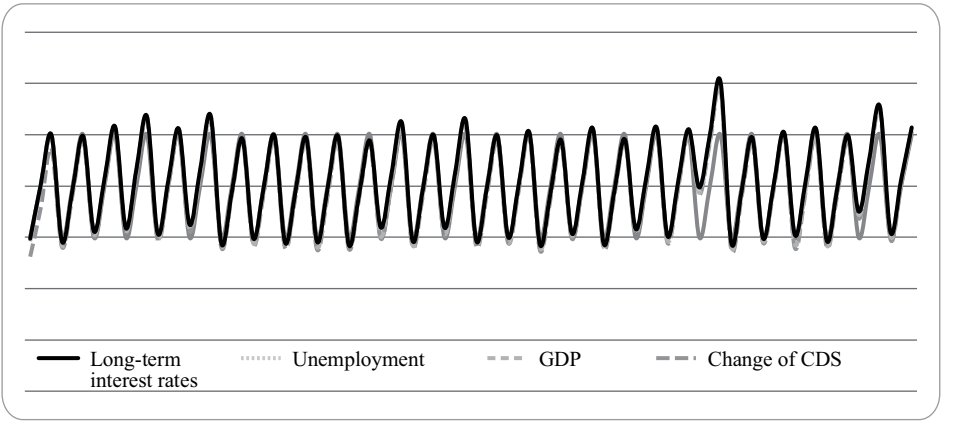

Figure 1: Macroeconomic indicators dynamics - Baseline scenario
Source: Author's calculations, using Anova and EViews

On the other hand, the adverse scenario (Figure 2) assumes negative values for residential real estate prices, which generates relatively lower values in the event of a banking crisis. Paradoxically, negative values suggest an unfavorable framework, but, in correlation with positive coefficients, determine a decrease in the banking crises likelihood, in the short term. It is important to mention that the attempt to identify an adequate mechanism for determining the probability of default, especially with the help of empirical evaluations, faces various difficulties, such as: unpredictable developments, data from extreme phenomena (for example: the pandemic crisis), continuous attempts at macroeconomic stabilisation, difficult for emerging countries, due to the lack of interconnection etc.

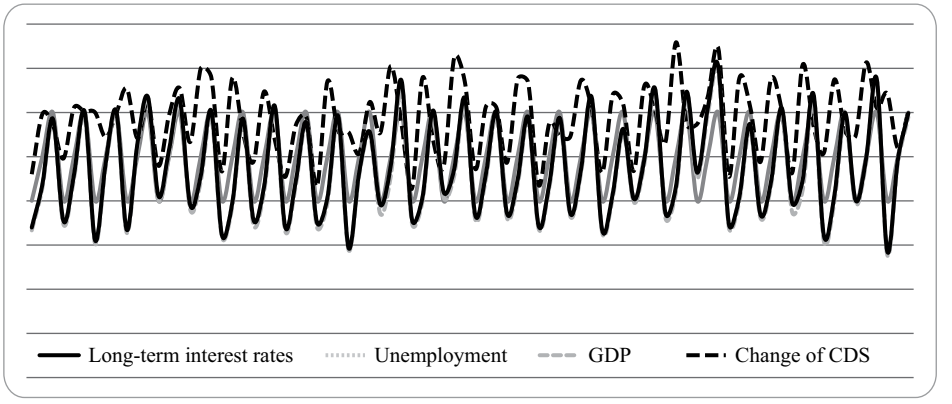

Figure 2: Macroeconomic indicators dynamics - Adverse scenario
Source: Author's calculations, using Anova and EViews

The dynamics of sovereign risk is highlighted, both through the dependence on banking stability and through the influence of GDP dynamics, but also its deviation. Compared to the base scenario, the adverse scenario registers negative values, quantified on the basis of a direct relationship in the same sense, and develops an apparently favorable framework. However, it is necessary to take into account several vulnerabilities. They refer to the contraction accentuation of the global economy and, implicitly, a decrease in the population confidence, followed by a decrease in GDP and the registration of an unemployment upward rate. Thus, a downward trend could generate reduced corporate earnings, combined with a reevaluation of participants' expectations of the market, causing a revaluation of asset prices and, implicitly, a decrease in the house price index.

The banking crises imposed the need to capture, in the most refined form, the banking system vulnerabilities. Early warning indicators help in capturing signals that predict, in due time, the probability of a banking crisis. In addition to these, the sovereign risk, captured by CDS 5Y, proved to have a major impact on the probability of default, influencing, in a negative sense, economic growth.

In the baseline scenario, the results indicate, in the first phase, a negative impact of the banking crisis likelihood on the economic growth, following the harmful effects, felt with a delay, propagated by the banking instability. An evolution in the opposite direction also appears between the sovereign risk premium and the gross domestic product, a fact that has its explanation in the high costs of public debt. On the other hand, there is an inertia effect in the GDP dynamics, its past evolutions having a positive effect on the present evolutions. This fact also has its counterpart in economic reality, as the effects of changes in the gross domestic product in an economy appear over time.

GDP = 0.021048 - 0.02458*PD(-2) - 0.00806*CDS(-1) + 0.333263*GDP(-1)

In the adverse scenario, the same inertia appears in the GDP dynamics, the effects remaining with one lag delay. On the other hand, in the opposite scenario compared to the basic scenario, there is a relationship, of the same sign, between the banking crisis likelihood and economic growth. Moreover, an additional argument refers to the rapid recovery of the economy, after the onset of the pandemic crisis, including armed conflicts, which surprised economies much better prepared, in terms of financial health indicators, than in the period before the global financial crisis.

GDP = -0.37075 + 0.361668*PD(-1) + 0.363255*GDP(-1)

Generally, across all scenarios, the magnitude of the coefficients and their inverse effects may indicate a slowdown in economic growth, while increases in risk premiums challenge debt sustainability in both the public and private sectors in the EU, further highlighting the link between sovereign risk and the probability of banking instability.

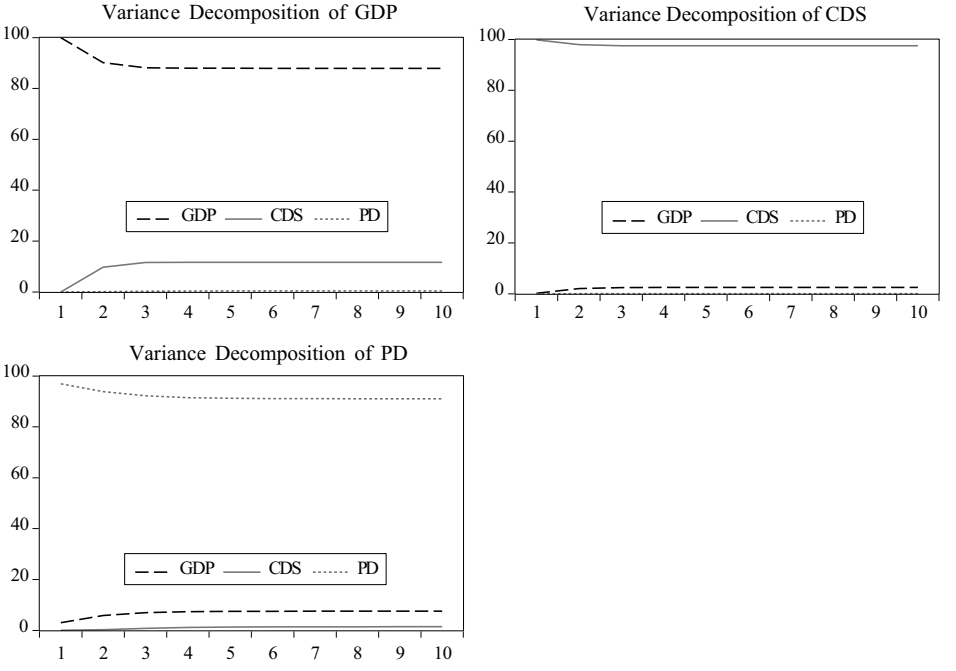

Figure 3: Variance Decomposition - Baseline Scenario
Source: Author's calculations, using EViews

Next, the variance decomposition (Figure 3) captures the relative importance of external shocks in explaining the dependent variable trend. In the base scenario, CDS dynamics explain about 15% of the GDP variation, and in the adverse scenario, the dependent variable can be explained by the PD variation, the effect being visible, starting with the 2nd year, while about 90% of its own changes are found in GDP dynamics.

The similarity of results across the two scenarios can be explained by the relatively short forecast period compared with the historical data period, as well as by data limitations or distortions caused by the pandemic.

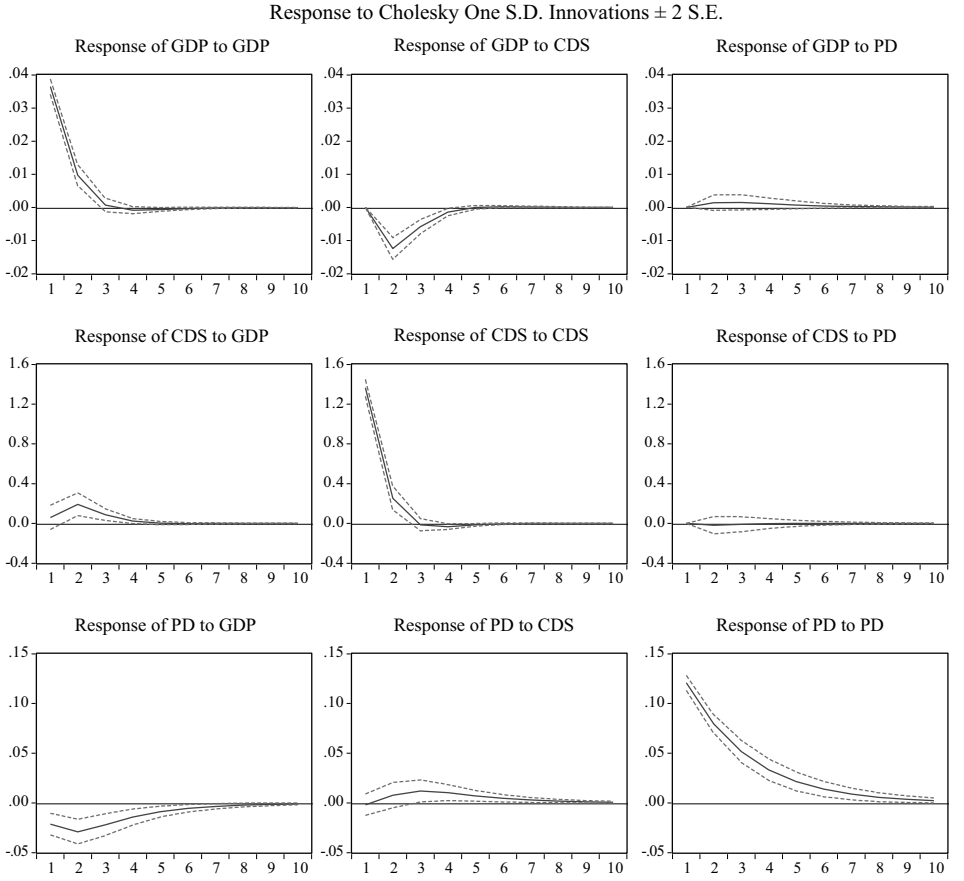

Figure 4: Impulse-response functions - Baseline scenario
Source: Author's calculations, using EViews

Moreover, we followed the dependent variable reaction to an unexpected shock at the explanatory variables level, using the impulse-response function (Figure 4). In baseline scenario, it is observed that in the case of applying a negative shock to the CDS, GDP will register the most significant reaction in the first 1-2 years, while the influence of PD is the least in the 3–5-year interval.

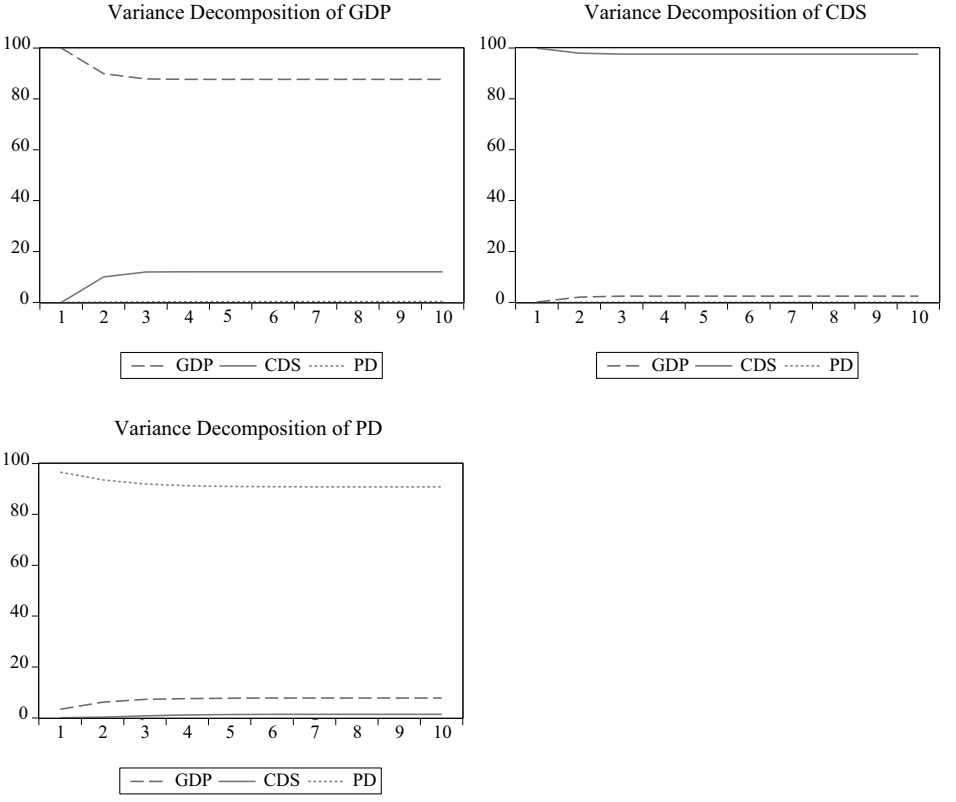

Figure 5: Variance Decomposition - Adverse Scenario
Source: Author's calculations, using EViews

In the adverse scenario, the relationship between the probability of banking crisis and the economic growth is accentuated, therefore, the increase in the banking crisis likelihood shows an effect of diminishing the economic growth, significant from a statistical point of view, after approximately 1 year, reaching a peak after 2 years, after which the shock effect starts to dilute. After 4-6 periods it becomes asymptotically towards 0 (Figure 5).

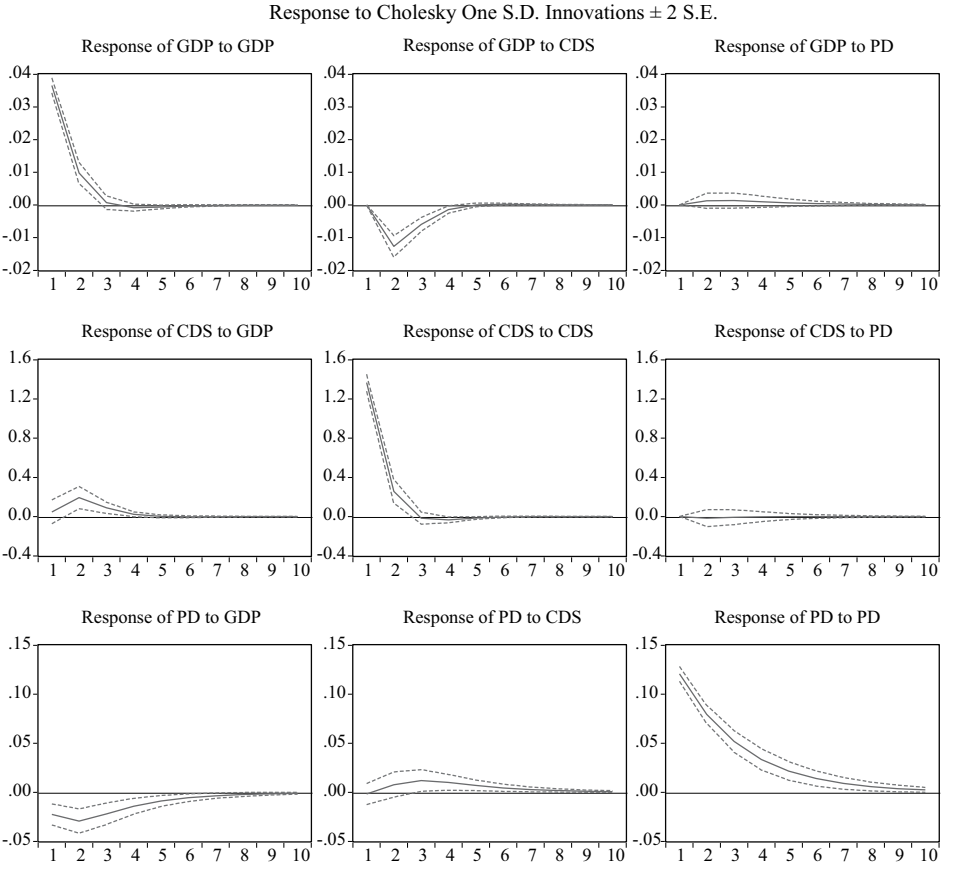

Figure 6: Impulse-response functions - Adverse scenario
Source: Author's calculations, using EViews

However, the most pronounced influence on the GDP variable is presented by the CDS dynamics (Figure 6). The increase of the risk premium causes a change, in the opposite direction, of the economic growth indicator, reaching a maximum after 2 years, at which time the shock effect on GDP begins to dilute, and after 5-6 periods it becomes asymptotically towards 0. The strong influence between these CDS and GDP variables reinforces the idea mentioned above, further emphasising the connection between sovereign risk and banking instability, a visible effect also in adjacent macroeconomic indicators case, such as: long-term rates, unemployment etc., for the next period, respectively until 2025.

The adverse scenario is severe, starting from the declining macroeconomic dynamics, following the severe recession induced by the pandemic crisis and armed conflicts.

6. CONCLUSIONS

The banking sector is closely interconnected with the sovereign, with effects propagating in both directions and significant consequences for the real economy. To mitigate the interaction between sovereign risk and the probability of banking instability, measures are being considered to reduce the state's reliance on bank financing and the banks' reliance on the stability and yields of sovereign bonds.

The attractiveness of government securities investments leads credit institutions to invest in these financial instruments, especially from the perspective of the trinomial profitability - liquidity – the cost of capital.

However, heightened sovereign risk can lead to a decline in the value of banks' asset portfolios and, through the bank solvency channel, may result in a reduction in credit availability for firms, households, and other economic agents.

This part of the research results underlines the idea according to which a significant tendency towards the growth of the portfolio of government bonds can lead to an effect of credit eviction for the private sector, having negative consequences on the potential growth in the economy.

Moreover, the governmental burden reduction by the credit institutions appears as a necessity, considering the insolvency and liquidity unfavorable level, described in the bank balance sheet.

It is also observed that vulnerable credit institutions tend to increase their share of government bonds in total banking assets, as yields increase.

In this sense, the monetary authorities are trying to maintain balance on the market by restoring the risk weights for the public administration exposures, or even by changing the requirements to limit large exposures, with an emphasis on dosage and cadence, in order to avoid procyclicality and, implicitly, macroeconomic instability.

To reduce the unfavorable impact on the credit solvency of institutions, decreasing their sovereign exposures can be a plausible solution, by revising the liquidity requirements.

However, this solution would not be possible without the additional capital necessary to accommodate the losses from the periods of public debt crises, provided in advance by the vulnerable banks. On the contrary, the buffers lack can damage private sector lending and, implicitly, amplify the imbalance of public finances, affecting the real economy.

On the other hand, the dynamics of investors' behavior should not be influenced in any way, regardless of the fact that the risk level depends on a bond price.

Consequently, facilitating the request for additional capital for systemic risk, as a fundamental element in the macroprudential policy scope, may constitute another element that could contribute to mitigating the unfavorable impact of sovereign risk on the credit institutions liquidity and solvency.

Regarding the main vulnerabilities that threaten the financial sector stability, it is, by far, the pandemic crisis and armed conflicts, which affect the proper development of the economy branches. The longer the duration of the crisis, the more attention is needed on the non-performing loans dynamics and, implicitly, the provisions establishment. The losses recognition, at an early stage, is beneficial for maintaining the balance sheets transparency and, also, the adequate support of the non-financial sectors lending.

However, regarding the banking sector, the pandemic and armed conflicts have shown that the economy was much better prepared than prior to the global financial crisis, as evidenced by prudential indicators remaining within moderate-to-low risk ranges, in line with European Banking Authority standards (NPL rate, provision coverage, capital adequacy ratio).

Moreover, maintaining balance and financial stability, at the European Union member states level, represents one of the main objectives of international financial institutions in the sense of reducing the tensions caused by the close connection between the sovereign and the banking sector stability.

Although the eurozone states are trying to adjust the dependence between banks and sovereign risk, the political decision-makers are trying different methods, also related to the prudential field, which will affect the economies of all the countries belonging to the European Union.

In this sense, reforms were also taken into account, regarding different categories of risk exposures, placed in a credit institution, as well as the revision of liquidity requirements in order to reduce sovereign exposures from the banks (ECB, 2023).

Moreover, the fundamental causes of systemic risk, due to the association of sovereign risk and banking instability, are taken into account, such as: public finances situation. As a result, the restructuring of an adequate fiscal-budgetary policy can represent one of the potential solutions. In other words, as government liabilities are reduced, the risk of investing in government bonds can be reduced, as well as the financial resource cost in the economy.

Another preventive measure to mitigate sovereign risk is the implementation of macroprudential policies, which may require capital buffers to address systemic risk.

Consequently, recent experience such as the collapse of Silicon Valley Bank, one of the most important American financial institutions, has proven, once again, that government bonds are quite risky and that regulations on capital requirements for bank exposures to sovereign risk need to be revised in order to reduce the connection between sovereign risk and banking instability.

As future research directions, the paper aims to analyse a wider range of indicators to reduce possible limitations of research on econometric model statistics. Moreover, the database can also be extended to countries outside the European Union, in particular, those of the United States, in order to make comparisons and derive some solutions for ensuring and maintaining the well-being of economies.

The potential severity assessment of vulnerabilities associated with the substantial connection between sovereign risk and banking instability was made possible by re-running quantitative analysis mechanisms developed based on scenarios similar in profile to those applied in the European stress test exercise. The results contribute to improving policy recommendations by formulating measures to mitigate their severity.

The main results, concerning both the assessment of banking soundness and the use of the analytical framework to formulate proposals aimed at mitigating the interaction between sovereign risk and the probability of banking stress, based on multifactorial forecast scenarios under adverse but plausible conditions, underscore the scientific contribution. These findings complement those provided by the European Banking Authority and offer valuable insights for both monetary policy decision-makers and academic researchers.

Conflict of interests

The author declares there is no conflict of interest.

REFERENCES

Ardakani, O.M., Kishor, N.K., & Song, S. (2018). Re-evaluating the effectiveness of inflation targeting. *Journal of Economic Dynamics and Control 90*, 76–97

Balima, W. H., Combes, J.-L., & Minea, A. (2017). Sovereign debt risk in emerging market economies: does inflation targeting adoption make any difference? *Journal of International Money and Finance, 70*, 360–377

Baltagi, B. H. (2008). *Econometric Analysis of Panel Data. Fourth edition*. John Wiley & Sons.

Beutel, J., & List, S., & von Schweinitz, G. (2018). An evaluation of early warning models for systemic banking crises: Does machine learning improve predictions? *Discussion Papers, No 48/2018, Deutsche Bundesbank*. https://www.econstor.eu/bitstream/10419/190949/1/1045533718.pdf

Bank for International Settlements. (n.d.). https://www.bis.org/statistics/dataportal/index.htm?m=205

European Banking Authority. (n.d.). https://www.eba.europa.eu

European Central Bank. (2023). *Financial Stability Review*. https://www.ecb.europa.eu/

European Systemic Risk Board. (n.d.). https://www.esrb.europa.eu/

European Union. (n.d.). https://european-union.europa.eu/index_en

Eurostat. (n.d.). https://ec.europa.eu/eurostat

Fache Rousová, L., & Giuzio, M. (2019). Insurers' investment strategies: pro- or countercyclical?, *Working Paper Series, No 2299, ECB, July.* https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2299~1d060f6979.en.pdf

Federal Reserve. (n.d.). https://www.federalreserve.gov/data.htm

Fouejieu, A. (2017). Inflation targeting and financial stability in emerging markets. *Economic Modelling*, *60*, 51–70.

Garcia, R., Lorenzani D., Monteiro, D., Perticari, F., Vasicek, B., & Vogel, L. (2021). Financial Spillover and Contagion Risks in the Euro Area in 2007-2019. *Economic and Financial Affairs, European Commission, Working Paper No 137, ISSN 2443-8022.* https://economy-finance.ec.europa.eu/system/files/2021-01/dp137_en.pdf

Holopainen, M., & Sarlin P. (2017). Toward Robust Early-Warning Models: A Horse Race, Ensembles and Model Uncertainty. *Quantitative Finance*, *17*(12), 1-31.

International Monetary Fund. (n.d.). https://www.imf.org/external/index.htm

Koijen, R. et al. (2021). Inspecting the mechanism of quantitative easing in the euro area. *Journal of Financial Economics, 140*, 1-20.

Longaric, P. et al. (2023). Sovereign bond markets and financial stability: examining the risk to absorption capacity, *European Central Bank, Financial Stability Review, November 2023.* https://www.ecb.europa.eu/press/financial-stability-publications/fsr/html/ecb.fsr202311~bfe9d7c565.en.html

National Bank of Romania. (2023). *Financial Stability Review*, December 2023. https://www.bnr.ro/Home.aspx

Ortmans, A., & Tripier, F. (2020). *COVID-Induced Sovereign Risk in the Euro Area: When Did the ECB Stop the Contagion? Working Papers No 2020-11.* October CEPII research center. http://www.cepii.fr/PDF_PUB/wp/2020/wp2020-11.pdf

Wijayanti, Rani and Rachmanira, Sagita (2020). Early Warning System for Government Debt Crisis in Developing Countries. *Journal of Central Banking Theory and Practice*, *Special Issue*,12-103

World Bank. (n.d.). https://www.worldbank.org/

БАНКАРСКА НЕСТАБИЛНОСТ И ПОСЉЕДИЦЕ У КОНТЕКСТУ СУВЕРЕНОГ РИЗИКА – ЕВРОПСКЕ ЕКОНОМИЈЕ

1 Адрина Ајонела Страчинару, Универзитет економских студија у Букурешту, Катедра за новац и банкарство, Румунија

САЖЕТАК

Банкарска нестабилност, као посљедица појаве сувереног ризика, током времена је изазвала потребу за детаљном дијагнозом од стране доносилаца одлука у монетарним властима, представљајући тему трајне релевантности и сложености у оквиру економских политика. Главни проблем односи се на постојање веома блиске, зависне везе између вјероватноће банкарске нестабилности и сувереног ризика. Ригорозност овог питања захтијева дубинску анализу, због чега овај рад има за циљ да обухвати аспекте микро и макропруденцијалног карактера, засноване на панел скупу података за земље Европске уније, почев од 2005. године. У том контексту, истраживање идентификује, на основу постављених циљева, главне рањивости макроекономске стабилности кроз микроанализу ликвидности и солвентности кредитних институција, али и алате макропруденцијалне процјене, користећи као методе вишеструке регресије и моделе ауторегресивних вектора, уз допуну једнофакторским и вишефакторским сценаријима отпорности на екстремне, али могуће догађаје. Још један циљ је да се изврши дијагноза уз примјену аналитичког оквира који омогућава процјену осјетљивости банкарских перформанси на динамику приноса државних обвезница, кроз призму тржишног и кредитног ризика. Значај истраживања и добијени резултати односе се на уочавање негативне реакције профитабилности банака и, конкретно, адекватности капитала на повећање приноса државних обвезница. С друге стране, оригиналност истраживања огледа се у процјенама које доприносе формирању скупа опција на нивоу мјешавине економских политика, као и у приједлозима превентивних мјера за ублажавање системских ризика изазваних интеракцијом између сувереног ризика и вјероватноће банкарске нестабилности.

Кључне ријечи: *банкарска нестабилност, спровођење стрес теста, финансијски шокови, ненаплативи кредити (или проблематични кредити), сценарији, суверени ризик.*