

II. When it rains, does it still pour? Quantifying contingent fiscal liabilities risks stemming from EU banks in times of severe stress

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Abstract: This chapter presents a methodology to assess the potential impact of banks' losses on EU public finances using the Systemic Model of Banking Originated Losses (SYMBOL), a micro simulation model developed by the European Commission's Joint Research Centre (JRC) and Directorate General Financial Stability, Financial Services and Capital Markets Union (DG FISMA). In the context of the Commission's debt sustainability analysis, SYMBOL can provide a complementary analysis of government contingent liabilities risks stemming from the banking sector. By inferring the probability of EU banks' losses in the event of a major banking crisis, the model estimates the potential residual costs for public finances after all layers of the legal safety net of the EU regulatory framework have been deployed (i.e., capital, bail-in and resolution funds). The analysis also illustrates how financial vulnerabilities could affect public debt developments in times of severe stress in the EA and the EU. Overall, the results point to a significant resilience and, in case resolution is ultimately needed, to enough buffers in the banking sector across the EU and the EA as a whole, in case of future large shocks. Relatedly, (implicit) contingent liabilities' risks for the public sector are generally contained, with limited residual costs for public finances. This analysis notably reflects the financial reforms initiated in the aftermath of the 2008 global financial crisis. Despite this, there could be differences across countries.

II.1. Introduction

Government contingent liabilities are defined as a potential financial obligation for the general government that depends on the possible occurrence of future events. These contingent liabilities are not included in the general government debt (i.e., Maastricht debt) since it concerns only possible future and not actual liabilities. It is only in the case of the realisation of uncertain future events that the government takes the loan on its books. These liabilities can be either embedded into explicit contracts like loan guarantees or be implicit unwritten obligations for instance to cover bank losses and recapitalisation needs to safeguard financial stability. Both types of contingent liabilities, if called, will eventually feed general government's deficit and/or debt. The high recourse to off-budget measures like contingent liabilities during the 2008 global financial crisis (GFC) and more recently during the COVID-19 pandemic has shown the important role contingent liabilities play for policy, given the large government support, including State guaranteed loans, during these crisis episodes. Estimating and understanding their size is particularly relevant as a high level of contingencies may indicate a significant level of fiscal risks for the general government. While severe crises, such as the GFC and the COVID-19 crisis, are exceptional events, and episodes of materialisation of CLs are not so frequent, ⁽²⁶⁾ it remains that their potential impact on public finances and other economic fundamentals can be large, often resulting in sizeable surges in general government debt. In this context, to get a more comprehensive assessment of fiscal risks, banking stress scenarios have proven to be useful.

With the benefit of some insights from the latest crises over the last 15 years notably the GFC and the COVID-19 crisis, this chapter assesses government contingent liabilities' risks linked to the banking sector, and explores how the public debt dynamic could be affected by a severe banking crisis in the EU/EA. The rest of the chapter is organised as follows: Section II.2 summarises the EU current financial regulatory framework, Section II.3 describes the methodology used to estimate government contingent liabilities' risks linked to the banking sector, based on the SYMBOL model, Section II.4 shows model results based on recent data, Section II.5 provides a quantification of the projected impact of the realisation of such contingent liabilities on the public debt dynamic at euro area level. Section II.6 concludes.

⁽²⁵⁾ This chapter represents the authors' views and not necessarily those of the European Commission.

⁽²⁶⁾ Bova, E, M Ruiz-Arranz, F Toscani, and H E Ture (2016), "The Fiscal Costs of Contingent Liabilities: A New Dataset", IMF Working Paper WP/16/14.

II.2. The EU current financial regulatory framework

The 2008 Global Financial Crisis (GFC), unfolded in the EU amid a fragmented landscape of co-existing national banking supervisory and regulatory frameworks. The EA had no common financial backstops for sovereigns nor banks, and no harmonised resolution framework for distressed banks. Banking supervision was characterised by a limited exchange of information at the EU level with no binding effect. Such situation exposed some Member States to adverse banks-sovereign feedback loops.

In the aftermath of the GFC, and in parallel with the Basel III reform⁽²⁷⁾ on the global level, a comprehensive reform of the European banking regulatory framework and supervisory architecture has been implemented to make the European financial system more resilient. The aim was primarily to ensure the consistent application of the regulatory banking framework across the EU and to enhance banks' loss absorbing capacity (with the creation of the Single Rulebook, the Single Supervisory Mechanism and the implementation of the Basel standards).⁽²⁸⁾ To this end, in 2012, European Union co-legislators decided to set up a Banking Union (BU) as one of its flagship reforms following the financial system crisis and euro area sovereign debt crisis. The creation of the BU is a structural reform of first order importance in the EU, as it fundamentally alters the regulatory, supervisory, and recovery and resolution frameworks in the geographical area comprised of its participating Member States. The aim of the BU is to place the banking sector on a sounder footing, to break the sovereign-bank nexus and to increase the resilience of the Economic and Monetary Union to adverse shocks, by facilitating private risk-sharing across borders, while at the same time reducing the need for public risk-sharing. The BU creates a common supervision mechanism and a common resolution mechanism, which allow for deeper financial integration underpinned by a stable financial system, where taxpayers are not required to bail out banks in distress. It aims to reinforce financial stability both within the Member States participating in the BU, within the geographical area comprised of its participating Member States, and in the European Union as a whole.

The BU is firmly anchored on the Single Rulebook, which provides a single set of harmonised prudential rules applicable in all EU Member States. The Single Rulebook defines the common regulatory framework for prudential supervision and bank recovery and resolution for all EU banks. The ECB is the common supervisor and directly supervises the 115 significant credit institutions, including all EU Global Systemically Important Banks (G-SIBs) and also on a solo basis their credit institution subsidiaries within the BU. The Single Resolution Board (SRB) is responsible for common resolution actions based on a common legal framework (Single Resolution Mechanism Regulation (SRMR) and the Bank Recovery and Resolution Directive (BRRD)). The Single Resolution Fund (SRF) is at the disposal of the Single Resolution Board (SRB) for use in resolution actions and a common public backstop from the European Stability Mechanism (ESM) was agreed in 2022. The BU spans a single market, which is buttressed by a single currency, the Eurosystem's common monetary policy, and the central judicial oversight by the Court of Justice of the EU. Evidence from the literature supports the conclusion that benefits of the financial reforms in response to the GFC were greatly beneficial.⁽²⁹⁾

In April 2023, the Commission adopted a proposal to adjust and further strengthen the existing EU bank Crisis Management and Deposit Insurance (CMDI) framework and increase the resolution authorities' ability to organise an orderly market exit for failing banks of any size and business model, including

⁽²⁷⁾ Basel III introduced a number of key reforms of international standards for the banking sector, including a strengthening of capital requirements and liquidity metrics and the curbing of the banks' leverage ratio.

⁽²⁸⁾ A single rulebook was introduced in 2009 to lay down capital requirements for banks, provide better protection to EU depositors, and regulate the prevention and management of bank failures. The Banking Union was also created with three pillars: (i) the Single Supervisory Mechanism (SSM), (ii) the Single Resolution Mechanism (SRM) and (iii) the European Deposit Guarantee Scheme (EDIS), which is currently under discussion (European Commission, 2014c).

⁽²⁹⁾ See, for instance, Galliani, C. and S. Zedda (2014), "Will the Bail-in Break the Vicious Circle Between Banks and their Sovereign?", *Computational Economics* Vol. 43 No. 4, pp. 597-614., Benczur P., Cannas G., Cariboni J., Di Girolamo F. E., Maccaferri S. and Petracco Giudici M. (2017) "Evaluating the effectiveness of the new EU bank regulatory framework: A farewell to bail-out?" *Journal of Financial Stability*, 2017, vol. 33, issue C, 207-223, and F. Fiordalisi, F. Minnucci, D.A. Previati, O. Ricci, "Bail-in regulation and stock market reaction", *Econ. Letters*, Elsevier, Volume 186 (2020), Article 108801.

smaller banks.⁽³⁰⁾ This proposal aims at providing resolution authorities with more effective tools and more available resolution funding using industry-funded safety nets enabling better outcomes of resolution processes while still shielding depositors from bank crises by, for example, transferring them from an ailing bank to a healthy one. Such use of safety nets complements the banks' internal loss absorption capacity (LAC), which remains the first line of defence. However, some risks for public finances stemming from the banking sector may still persist, awaiting the completion of the BU with the establishment of EDIS, and calling for a close monitoring of the fiscal risks arising outside the realm of public finances.⁽³¹⁾

II.3. Quantifying government implicit contingent liabilities' risks from the banking sector in the EU: the approach

II.3.1. Methodology

To assess to which extent vulnerability from the financial side of the economy can affect public finances in the EU, banking stress test scenarios are performed based on the Systemic Model of Banking Originated Losses (SYMBOL). SYMBOL is a micro simulation model that was first developed during the aftermath of the GFC by the European Commission's Joint Research Centre (JRC) and Directorate General Financial Stability, Financial Services and Capital Markets Union (DG FISMA).⁽³²⁾ This model has been routinely used in the context of the Commission Debt Sustainability Analysis. In practice, by exploiting the information from EU banks' balance sheets and accounting for the existing legal safety nets (*i.e.*, capital, bail-in, resolution funds), the model allows to simulate – in the event of a systemic banking crisis - the *size* of residual banking losses and recapitalisation needs that may need to be absorbed by the public sector. It also estimates at country level, the *probability* that public finances are significantly hit by such losses and recapitalisation needs. In the context of the Commission's debt sustainability analysis (DSA), those simulated (residual) banks' losses and recapitalisation needs, represent general government's implicit contingent liabilities.

In addition, using a microsimulation model like SYMBOL to run a debt projection stress test provides the important advantage of allowing incorporating features of the national banking systems, while remaining within a unified conceptual framework across EU Member States. In particular, the stress scenario takes into account the distribution of the size (total assets), the asset quality (risk-weighted assets or RWA), and the capitalization (regulatory and total capital) of each Member State's banking sector. As discussed below (in sub-section 4), these elements can lead to important cross-country differences in terms of simulated losses and recapitalisation needs pointing to heterogeneous level of fiscal risks stemming from the banking sector.

SYMBOL also allows distinguishing between excess losses and recapitalisation needs (before and after the safety nets).⁽³³⁾ This provides differentiated impacts of these two types of funding needs on national public finances. Bank losses in excess of capital, usually covered by capital injections (subsidies) in the banking sector, are considered to affect public deficit and debt. As for recapitalisation needs, they are assumed be recouped (and thus "reintegrating" public finances at a later stage) as government receives

⁽³⁰⁾ The SYMBOL results presented in this section do not take into account in the safety net cascade the Common Backstop to the SRF recently added to the existing arsenal.

⁽³¹⁾ See, for instance (i) ECB (2020), 'Liquidity in resolution: estimating possible liquidity gaps for specific banks in resolution and in a systemic crisis. Occasional Paper Series No 250 / November 2020, and (ii) BIS (2020) Bank failure management in the European banking union: What's wrong and how to fix it. Occasional Paper No 15, July 2020.

⁽³²⁾ Since its original version (see De Lisa R., Zedda S., Vallascas F., Campolongo F., Marchesi M. (2011), 'Modelling Deposit Insurance Scheme Losses in a Basel II Framework', Journal of Financial Services Research, Volume:40:3, 123-141.), the SYMBOL model has been further developed in numerous ways, taking into account developments in the regulatory framework and improving its methodology. See for instance, Benczur P., Berti K., Cariboni J., Di Girolamo F., Langedijk S., Pagano A., Petracco Giudici M. (2015), 'Banking Stress Scenarios for Public Debt Projections', European Commission Directorate-General for Economic and Financial Affairs, Economic Papers no. 548, Brussels; and Bellia, M., Di Girolamo, F., Orlandi, F., Pagano, A., Pamies, S. and Petracco Giudici, M. (forthcoming 2023), Assessing risks for public finances stemming from banks in volatile times, European Commission Discussion Paper.

⁽³³⁾ Under all scenarios, the required level of recapitalisation is set at 10.5% of RWA for each bank. This represents the minimum level of capital and capital conservation buffer set by the Capital Requirement Directive IV (CRDIV). The extra capital buffers built for Global Systemically Important Institutions (G-SIIs) are also to be recapitalised.

shares in the bank in exchange. Consequently, recapitalisation needs affect only gross debt (through the stock-flow adjustment). Specifically, following Benczur et al (2015) and the 2022 Debt Sustainability Monitor, the approach used for the SYMBOL stress tests can be broadly described as follows: ⁽³⁴⁾

First, the scenarios are calibrated to reproduce the severity of the 2008-2012 crisis, *i.e.*, a severe and systemic banking crisis. ⁽³⁵⁾

Second, the scenarios consider the latest available data on banking balance sheets and account for the quality of banking assets in the short-term. Over the longer-term, non-performing loans (NPLs) are assumed to be reduced to negligible levels.

Third, the scenarios take into account, in addition to banks' resources, safety nets for bank recovery and resolution (DGS, resolution funds – RF and bail-in) to partly cover banks' losses and recapitalisation needs. ⁽³⁶⁾

Fourth, banks' excess losses (*i.e.*, losses in excess of the available total capital of a bank) and recapitalisation needs (*i.e.*, funds necessary to restore the bank's minimum level of capitalisation) that cannot be covered by legal safety net are assumed to fall on national public finances.

Fifth, the safety nets are assumed to prevent the onset of any further contagion effects. ⁽³⁷⁾

Finally, in the main scenario, non-significant banks are assumed to be liquidated in case of residual losses and recapitalisation needs, while significant banks might be recapitalised or liquidated. ⁽³⁸⁾

We report results for two alternative scenarios, namely:

Reference stress test scenario: In this scenario, the simulations are run without the modelling for '*fire sales*' mechanism. The losses due to NPLs (as per balance sheet) are calculated by using a constant recovery rate (RR). ⁽³⁹⁾

Severe stress test scenario: This scenario includes a '*fire sales*' mechanism, involving a correlation among assets and underpinning the asset value. NPL losses are modelled by linking the level of recovery rates to the size of the common shock. Hence, the higher the correlation, more important are the losses (see Box II.1 on SYMBOL). This reflects the markets' pressure to clean up balance sheets during a financial crisis, and to what extent the dynamics are correlated across countries.

⁽³⁴⁾ It is worth stressing that in this exercise, to estimate the banking loss and recapitalisation needs that each Member States would be expected to face in case of a future major financial crisis, the focus is on the extreme realisations of the common factor (including recapitalisation needs) obtained from SYMBOL. See for more information the European Commission 2022 Debt Sustainability Monitor.

⁽³⁵⁾ Bank losses and recapitalisation needs triggered by the last crisis are proxied by state aid data, in particular the total recapitalisation and asset relief provided to banks over 2008-12 (around 615 bn euro), see European Commission (2014), State Aid Scoreboard 2014, and Benczur et al (2015) *op.cit.*

⁽³⁶⁾ The safety net cascade does not include the Common Backstop to the SRF recently added to the banking crisis management arsenal. Moreover, it should be borne in mind that the focus of the SYMBOL model being the banking sector, it assumes that the banks' losses and recapitalisation needs (partly) disappear once the safety nets are applied. In practice, these losses and recapitalisation needs are transferred to other sectors (e.g., domestic insurance, pension funds or households, or foreign sector) that hold bail-inable bonds and related contingent liabilities.

⁽³⁷⁾ In the SYMBOL model, potential contagion across banks through bail-in is disregarded due to scarce data. Moreover, the model assumes that contagion across global systemically important banks (GSIBs) due to the bail in has been already addressed by the EU banking reform package, where crossholdings of total loss-absorbing capacity (TLAC) instruments are to be deducted between G-SIBs.

⁽³⁸⁾ In line with the 2022 Debt Sustainability Monitor, this assumption is consistent with the fact that entities under direct ECB supervision do not go automatically into resolution, as the SRB decides on a case-by-case basis the resolution of the bank. In practice, most of the SRB's banks (82% of the total number of SRB banks accounting for 97% of total exposure at risk) are earmarked for resolution. In contrast, liquidation is foreseen for 18% of the banks, which account for 3% of total exposure at risk, mostly made up of public development banks and smaller banks with a specific business model. This assumption is thus more favourable to resolution funds than the standard assumptions were either that only significant institutions go into resolution, or that all banks go into resolution, as a share of the significant banks (20%) is now supposed to go into liquidation.

⁽³⁹⁾ Based on the period considered with data affected by the COVID-19 pandemic, the stressed economic condition is assumed to roll back banks condition to the pre-pandemic situation by adjusting the data sample to account for the effects of the support COVID-19 related measures.

Box II.1: The SYMBOL modelling framework for assessing public finances risks

This Box presents the main feature of the systemic model of banking-originated losses (SYMBOL), a micro simulation model developed jointly by the European Commission’s JRC and DG FISMA to simulate banking crises and estimate the distribution of banking sector losses at country level, accounting for all the cushioning layers of the legal safety net available to absorb shocks (capital, bail-in, resolution funds). SYMBOL can use to assess how losses originating in banks’ balance sheets potentially affect public finances due to government interventions to recapitalise banks. As input, it considers a rich dataset covering unconsolidated balance sheet data of banks in EU Member states. See for more information, the European Commission 2022 Debt Sustainability Monitor. Assessing risks for public finances with SYMBOL involves the following steps:

1. Simulating banks’ losses

Starting from the estimated average probability of default of the asset portfolio of each bank, SYMBOL generates realisations for each individual bank’s credit losses using the Basel Foundation Internal Rating Based (FIRB) loss distribution function. More formally, the output of the model is a matrix of losses, $L_{n,i}$:

$$L_{n,i} = LGD \cdot N \left[\sqrt{\frac{1}{1-R_i}} N^{-1}(IOPD_i) + \sqrt{\frac{R_i}{1-R_i}} N^{-1}(\alpha_{n,i}) \right]$$

where n denotes a simulation run, i indicates the bank, LGD is the Loss Given Default, $IOPD_i$ is the average implied obligors’ probability of default, R_i is the coefficient of correlation among different obligators of Bank_{*i*}, and N is the normal distribution function, $N^{-1}(\alpha_{n,i})$ are correlated normal random shocks with correlation ρ .

The correlation structure among the simulated shocks across different financial institutions assumes that the different banks are hit in the national system, due to their common exposure to a common factor, i.e. the business cycle. That correlation is reinforced by including a ‘fire sales mechanism’, which intensity is linked to size of the common shock underpinning the degree of asset correlation and eventually the asset value. This reflects that during a major crisis, many banks will be jointly engaged in asset selling activity to keep their liquidity positions, resulting in an overall deterioration of the asset values in all banks, that in turn would generate further losses and liquidity needs. Specifically, the correlated normal random shocks $\alpha_{n,i}$ includes a bank-specific element and a common factor across financial institutions, as follows:

$$N^{-1}(\alpha_{n,i}) = l \times Z_n + \sqrt{1-l^2} \times W_{n,i}$$

2. Determining banks’ insolvency event and obtaining the aggregated distribution of losses

Based on the matrix of correlated losses, the failure of a bank is determined by comparing the size of simulated losses L_i and the regulatory capital available to absorb the shocks. A bank_{*i*} is assumed insolvent and has excess losses $ExL_{n,i}$, when simulated losses ($L_{n,i}$) exhaust the sum of expected losses (EL_i) and total actual capital K_i , as follows:

$$\begin{aligned} \text{Failure} &\equiv L_{n,i} - EL_{n,i} - K_i > 0 \\ ExL_{n,i} &= \max(L_{n,i} - EL_{n,i} - K_i + 8\% \cdot RWA_i, 0) \end{aligned}$$

In line with the Basel rules, recapitalization needs (i.e. funds necessary to restore the bank’s minimum level of capitalisation) up to 10.5% of risk weighted assets (RWA) are also factored in the losses in excess of capital. Aggregate losses and recapitalisation needs are obtained by summing the losses in excess of capital plus recapitalization needs of all distressed banks at country level (both failed and undercapitalised banks) in each simulation j .

(Continued on the next page)

Box (continued)

3. Accounting for asset quality and non-performing loans

SYMBOL takes into account how current stocks of non-performing loans (NPLs) would contribute to losses in national banking systems. Namely, it assumed that non-collateralised NPLs would turn into loan losses for a Member States in case of systemic banking event, while the collateralised NPL are redeemable subject to a recovery rate. This mechanism generates extra losses, which might materialize even for banks not yet failed, and are added to those coming from the SYMBOL simulations before the intervention of any safety net tools. Specifically, for each bank_i and each country_j potential loans losses from NPLs are as follows:

$$NPLLosses_i = (1 - CollShares_i) \times NPL_i + Collshares_i \times NPL_i \times (1 - RR_i) - Provisions_i$$

where *RR* is the recovery rate, *Collshares* represents the proportion of total loans covered by collateral. *Provisions* and *NPL* are respectively, the amount of provisions and gross non-performing loans declared by banks in their balance sheet.

4. Estimating banks' losses hitting public finances

When estimating the impact of potential bank losses on public finances, SYMBOL implement the loss allocation cascade according to the legislation currently into force with tools (e.g. own funds, bail-in of eligible liabilities and Resolution Fund interventions), intervening to partly cover banks' excess losses and recapitalisation needs before the involvement of general government.

II.3.2. Input dataset

The main data source on banks' financial statements is Orbis Bank Focus. ⁽⁴⁰⁾ The sample covers roughly 75% of all EU banking assets. The sample ratio changes per each Member States ranging from 27.5% in Ireland to higher than 100% in Estonia. This variability calls for a cautious reading of the results, notably for countries with a low coverage ratio (*i.e.*, low share of total assets) and small number of banks as any change in the data could have large effects on results. For the reference year 2021, unconsolidated data for commercial, saving and cooperatives banks are included. ⁽⁴¹⁾ The data provided by Orbis Bank Focus occasionally lack information on specific variables for some banks in the sample (*e.g.*, capital, Risk Weighted Assets (RWA), provisions, NPLs). In those cases, complementary data sources are used, and statistical methodologies are used to impute missing data. ⁽⁴²⁾

⁽⁴⁰⁾ Orbis a commercial database of the private company Bureau van Dijk (part of Moody's analytics).

⁽⁴¹⁾ The caveats about the data series used for the analysis is discussed in the Commission 2022 Debt Sustainability and in Bellia et al. (forthcoming 2023), *op. cit.*

⁽⁴²⁾ Capital is imputed via a robust regression by using common equity, while RWA are approximated using the total regulatory capital ratio (at bank or country level). Missing values for provisions have been estimated by country aggregates coming from the EBA dashboard (<https://www.eba.europa.eu/risk-analysis-and-data/risk-dashboard>), while missing values for NPLs have been imputed by applying a robust regression using provisions as explanatory variable. Recovery rates (country aggregates) are taken from the World Bank (2020 Doing Business report 2020). See the 2022 Debt Sustainability Monitor for further details.

Box II.2: Data adjustments for SYMBOL

This box presents adjustments to the input data for SYMBOL-based simulations to address specificities in the aftermath of the COVID-19 crisis, whose economic and financial affect the data sample use for the analysis. The government COVID-19-related measures had a significant impact on a set of key banking indicators. In order to consider this, data adjustments were made as regards the information related to risk weighted assets (RWA), loans under public guarantees and loans under (expired) moratoria. See for more information, the European Commission 2022 Debt Sustainability Monitor.

1. Regulatory measures and representativeness of the actual risk weighted assets

Balance sheet data for Q4 2021 show that the riskiness of bank's portfolios declined in 2020. To account for a potential bias on the reported RWAs, a correction to the RWA coefficients were applied, ensuring that, in the short term, riskiness of banks is in line with the adverse scenario depicted by EBA (EBA stress test released on 30 July 2021).

2. Public guarantees scheme

Loans guaranteed schemes by the government bear a zero-risk weight in the banks' balance sheets, while losses on such loans would directly affect public finances. However, in response to the pandemic, most Member States introduced programmes providing public guarantees to loans. The heightened risks associated to such loans has been taken into account in the simulation of losses, via an adjustment of the banks' RWAs, relying on EBA aggregated data on new loans under guarantee as of Q4 2021.

3. Loans under moratoria and NPLs

NPLs, on average, have continued to decline in the almost all Member States since 2019. Part of this decline is due to the regulatory measures introduced in response to the pandemic, such as the allowed flexibility about the classification of debtors in the event of moratoria. These measures, including the ones related to capital and liquidity relief, were only been lifted on February 2022. Hence, to address the potential under-reporting of NPLs due to moratoria, which still might affect the banks' balance sheets in 2021, the SYMBOL simulations considered 'Stage 2' loans (i.e. loans where credit risk has increased significantly, though they are not yet registered as NPLs) to adjust the NPL stock.

II.4. Quantifying government implicit contingent liabilities' risks from the banking sector in the EU: the simulation results

This Sub-section illustrates the impact of potential banks' losses on public finances in times of crisis.

Table II.1: **Government implicit contingent liabilities from banks' excess losses and recapitalisation needs, after the safety net cascade, based on the current situation (% of GDP 2021)**

	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT
Reference stress scenario	0.1%	0.1%	0.1%	0.3%	0.1%	0.0%	0.2%	0.6%	0.6%	0.4%	0.1%	0.5%	0.5%	0.0%	0.0%
Severe stress scenario	0.8%	0.3%	0.3%	0.8%	0.4%	0.2%	1.2%	2.3%	2.2%	1.5%	0.3%	1.8%	3.5%	0.2%	0.2%
	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	EU	EA	5 EA MS_Agg
Reference stress scenario	2.0%	0.1%	0.2%	0.2%	0.2%	0.5%	0.4%	0.1%	0.1%	0.7%	0.1%	0.1%	0.3%	0.3%	0.6%
Severe stress scenario	8.1%	0.4%	0.9%	1.0%	1.1%	1.9%	2.1%	0.3%	0.7%	1.7%	0.5%	0.1%	1.2%	1.2%	2.5%

Note: '5 EA MS_Agg' refers to a set of 5 EA Member States (Cyprus, Greece, Spain, Luxembourg and Portugal) with significant financial vulnerabilities according to the model results.

Source: Debt Sustainable Monitor (2022), European Commission.

Overall expected impacts are limited thanks to the safety nets. Based on the current situation ⁽⁴³⁾ assuming a duly application of the legal safety nets, SYMBOL results point to limited (implicit) contingent liabilities risks coming from the banking sector for governments.

Table II.2: **Leftover financial needs after safety nets (% of GDP 2021),**
based on the current situation –
Severe stress test scenario

	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT
Excess loss	0.3%	0.3%	0.1%	0.2%	0.7%	0.1%	0.3%	3.8%	0.7%	0.9%	0.1%	1.0%	2.2%	0.1%	0.1%
Excess losses plus recap	1.7%	0.5%	0.6%	1.0%	1.6%	0.3%	1.5%	4.4%	3.8%	4.9%	0.5%	3.6%	7.5%	0.3%	0.4%
Excess losses plus recap after bail in	1.0%	0.5%	0.5%	1.0%	0.5%	0.3%	1.5%	3.4%	2.8%	1.9%	0.5%	2.4%	5.3%	0.3%	0.2%
Excess losses plus recap after RFs	0.8%	0.3%	0.3%	0.8%	0.4%	0.2%	1.2%	2.3%	2.2%	1.5%	0.3%	1.8%	3.5%	0.2%	0.2%
	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	EU	EA	5 EA MS_Agg
Excess loss	1.5%	0.1%	0.7%	0.3%	1.2%	0.5%	0.7%	0.1%	0.2%	0.4%	0.2%	0.1%			
Excess losses plus recap	14.5%	0.5%	1.4%	1.7%	2.4%	2.1%	3.6%	0.3%	1.0%	2.3%	1.0%	0.4%	2.6%	2.9%	4.4%
Excess losses plus recap after bail in	10.8%	0.5%	1.1%	1.2%	1.5%	2.1%	2.9%	0.3%	1.0%	2.1%	0.6%	0.1%	1.5%	1.6%	3.3%
Excess losses plus recap after RFs	8.1%	0.4%	0.9%	1.0%	1.1%	1.9%	2.1%	0.3%	0.7%	1.7%	0.5%	0.1%	1.2%	1.2%	2.5%

'5 EA MS_agg' refers to a set of 5 EA Member States (Cyprus, Greece, Spain, Luxembourg and Portugal) with significant vulnerabilities according to the model results.

Source: Debt sustainable Monitor (2022), European Commission

Risks are limited overall, with few exceptions in case of more adverse conditions. SYMBOL provides additional contingent liability risk measure by reporting the *theoretical* probability that public finances are significantly (*i.e.*, by at least 3% of GDP) affected by a systemic banking crisis, as shown in Table II.3.

Table II.3: **Theoretical probabilities of public finances being hit by more than 3% of GDP,**
based on the current situation

	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV
Reference stress scenario	0.02%	0.01%	0.01%	0.19%	0.01%	0.00%	0.06%	0.11%	0.15%	0.06%	0.00%	0.06%	0.15%	0.00%
Severe stress scenario	0.38%	0.09%	0.14%	0.55%	0.12%	0.02%	0.65%	1.50%	1.28%	0.65%	0.09%	0.79%	2.50%	0.02%
	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	
Reference stress scenario	0.01%	1.45%	0.02%	0.04%	0.08%	0.01%	0.02%	0.07%	0.00%	0.00%	0.04%	0.03%	0.03%	
Severe stress scenario	0.03%	5.62%	0.12%	0.46%	0.59%	0.43%	0.80%	1.18%	0.02%	0.21%	0.71%	0.29%	0.07%	

Note: Green: low risk (probability lower than 0.50%), Yellow: medium risk (probability between 0.50% and 1%),

Red: high risk (probability higher than 1%).

Source: Debt Sustainable Monitor (2022), European Commission.

SYMBOL-based estimates point to overall *low* theoretical probabilities of having contingent liabilities of significant size (*i.e.*, higher than 3% of GDP) hitting public finances in the event of a severe crisis (Table II.3). As already noted earlier, these probabilities are affected by the magnitude of existing contingent liabilities but also by other factors such as the degree of concentration of the banking sector in each Member States. These estimates show that the risk of a significant impact on public finances in case of a major banking crisis is limited (*i.e.*, less than 1%) for all Member States but Luxembourg. Yet, under the more extreme (stressed) scenario, five Member States (*i.e.*, Cyprus, Spain, Greece, Luxembourg and Portugal) show a significant risk for their public finances to be hit by losses of (at least) 3% of GDP.

II.5. Projecting the impact of a banking crisis on debt dynamics in times of severe stress

Banking stress-test scenario modelling is useful to monitor the potential adverse impact on public finances due to the materialisation of contingent liabilities in case of a major banking crisis. Indeed, one of the lessons learnt from the GFC is that economic policy surveillance needs to adopt a holistic approach, ensuring that interconnections between the different strands of the economy - private and public sectors

⁽⁴³⁾ The 'current situation' refers to the 'short-term' results - occurring in one-year time - (as reported in the 2022 Debt Sustainability report) assuming constant bank balance sheets (end of 2021) in line with the current situation where there is a full implementation of the EU financial Regulation, including the treatment of non-performing loans as explained in Box II.2.

as well as financial and the real sectors- are properly monitored, in view of identifying risks early on and support the design of timely corrective actions.

In order to assess potential debt sustainability risks due to the banking sector, the SYMBOL results of the previous section are used in the context of the European Commission's Debt Sustainability Analysis (DSA) risk framework to derive public debt projections. ⁽⁴⁴⁾ The results are shown for the EA as a whole and for an aggregate of the potentially most affected EA Member States – according to SYMBOL. ⁽⁴⁵⁾

SYMBOL's ability to allow for a breakdown between bank's losses and recapitalisation needs is also relevant for the design of stress-test debt projections to illustrate the impact of a banking crisis. It allows distinguishing between the impact on the government budgetary balance and on public debt (through stock-flow adjustments). This distinction is particularly relevant since financial assets bought by the government to support the banking sector tend to be sold at a later stage, meaning that the part of the increase in the debt-to-GDP ratio related to the coverage of bank recapitalisation needs is recouped (partly or fully) at a later stage. As a result, the stress-test debt projections reflect the fact that banks losses are assumed to have a permanent impact on public finances, while recapitalisation needs have only a transitory effect.

II.5.1. Debt projection results under a banking stress test scenario: the approach

Following Benczur et al (2015), the banking stress-test on public debt projections based on SYMBOL assumes the following elements:

A severe banking crisis unfolds in the first projection year (currently 2024 – *i.e.*, one year beyond the Commission autumn 2022 forecast horizon, consistently with the 2022 Debt Sustainability Monitor).

The SYMBOL-based estimated country-specific bank losses in excess of bank capital are assumed to lead to a reduction in the projected government budgetary balance in the year of the banking shock (due to subsidies to the banking sector). The estimations used are those corresponding to the most adverse SYMBOL scenario ("severe stress scenario").

The SYMBOL-based estimated country-specific bank's recapitalisation needs are assumed to lead to an increase in the gross public debt via the stock-flow adjustments in the year of the banking shock (due to the acquisition of banks' financial assets).

The public funding used for banks' recapitalisations is assumed to be gradually recovered in full (through the sale by the government of the acquired financial assets), within five years following the year of the banking shock, thus leading to a reduction in the gross public debt all else being equal (through a decrease in the projected stock-flow adjustments) over those years. ⁽⁴⁶⁾

A banking crisis also affect GDP growth, (relative to the baseline). ⁽⁴⁷⁾ As a novelty in SYMBOL compared with Benczur et al (2015) and the 2022 Debt Sustainability Monitor, the debt projections also account for the impact that a banking crisis has on the economic activity. ⁽⁴⁸⁾ Concretely, in the debt

⁽⁴⁴⁾ The approach follows the one introduced Benczur et al (2015) *op.cit.* and used the 2022 Debt Sustainability Report (and in Bellia et al (2023) *op.cit.*). The potentially more affected countries are those identified by SYMBOL (highlighted in red in Table II.3).

⁽⁴⁵⁾ The Member States that compose the aggregate of the potentially most affected EA Member States – according to are Greece, Portugal, Cyprus, Spain and Luxembourg. The selection of the countries was made *a priori* based on Table II.3 on the SYMBOL theoretical probabilities of public finances being hit by more than 3% of GDP, in the event of a severe crisis.

⁽⁴⁶⁾ The rationale of the full recovery of bank recapitalisations come from the fact SYMBOL simulations split banking recapitalisation needs into two parts: (i) a part that is not recoverable as it covers true capital shortfalls to the extent that the value of assets is below the value of liabilities, and (ii) a part that reflects a capital injection to increase the banks' capital to a (regulatory) minimum level to cover operations. The full recovery assumption applies to this latter part of the bank recapitalisation.

⁽⁴⁷⁾ It is assumed a persistent impact (higher in the case of the stressed scenario with no safety nets) on the budget balance corresponding to the bank losses (as the recapitalisation needs are assumed to be recouped). All else being equal, the long-term impact on debt depends on the sign of the interest-growth rate differential, thus, largely driven by the GDP effect in our simulations.

⁽⁴⁸⁾ A banking crisis also affect inflation and interest rates; however, the latter considerations are beyond the scope of this paper, yet accounting for it would imply a more adverse debt dynamic. Hence, the results need to be understood all else being equal.

projection, at the onset of a banking crisis, it is assumed an immediate and permanent loss of the GDP level of (i) 2 pps. in absence of safety nets, and (ii) 0.8 pp. in case of a duly application of the current legislation. Such a calibration of the GDP impact is in line evidence provided by the relevant literature. ⁽⁴⁹⁾

The path of the debt ratio obtained for the banking crisis stress-test scenario is plotted alongside the path obtained under the baseline to highlight the potential impact of a banking contingent liability shock. Public debt projections under the stress-test scenario are derived using the Commission’s standard debt projection model, from which a debt-to-GDP ratio path over a 10-year projection horizon is derived as follows:

$$d_t = \alpha^n d_{t-1} \frac{1 + i_t}{1 + g_t} + \alpha^f d_{t-1} \frac{1 + i_t}{1 + g_t} \frac{e_t}{e_{t-1}} - b_t + c_t + f_t$$

where d_t is the debt-to-GDP ratio in year t , α^n is the share of public debt denominated in national currency, α^f is the share of public debt denominated in foreign currency, i_t is the nominal implicit interest rate on government debt in year t , g_t is the nominal GDP growth rate in year t , e_t is the nominal exchange rate in year t , b_t is the general government primary balance over GDP in year t , c_t is the change in age-related costs over GDP in year t relative to the base year, and f_t is the stock-flow adjustment over GDP in year t .

Debt projections are based on the European Commission's forecasts up to the 2-year forecast horizon, *i.e.*, 2022 autumn forecast. Beyond that, we use GDP growth projections agreed with the Economic Policy Committee (EPC) – Output Gap Working Group (OGWG). For inflation (GDP deflator) and the real long-term interest rate, we use the long-run convergence assumptions agreed with the EPC. Baseline projections are based on a "no-fiscal policy change" assumption, *i.e.*, the general government structural primary balance (SPB) is assumed to be only modified - beyond the last forecast year (*i.e.*, T+2 corresponding to the end of projections) – by projected ageing costs, as from the latest (2021) Ageing Report. The cyclical component of the general government balance is calculated using standard (country-specific) semi-elasticities over the period until the output gap closes.

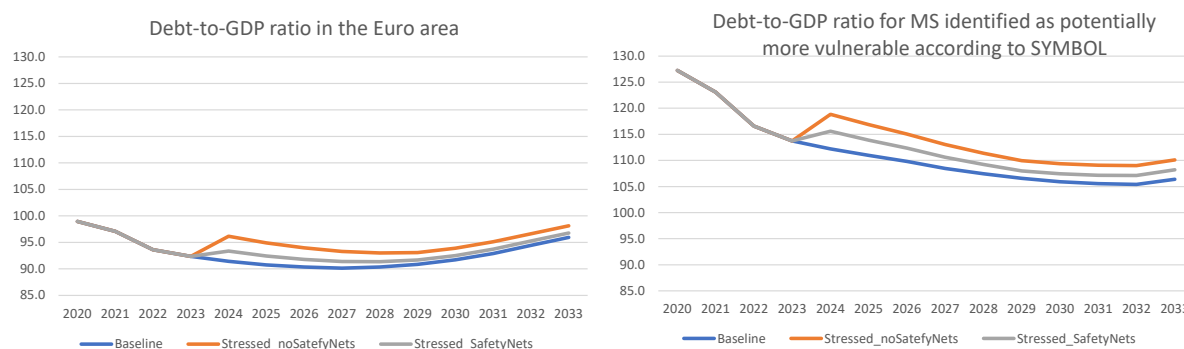
II.5.2. Debt projection results under a banking stress test scenario: the results

Graph II.1, left-hand side shows the debt dynamics for the EA as whole in the event of a major banking crisis, alongside the baseline debt projections. The baseline shows how a gradual debt reduction followed by an increase in the debt ratio from the middle of the horizon onwards, driven by raising ageing costs and less favourable financing conditions. By design, the impact (*i.e.*, related to the baseline) of the banking shock is strongest in 2024, which is the year of the banking crisis in the simulations. That year public finances are hit by banks’ losses plus the full extent of the recapitalisation needs. Thereafter, recapitalisation needs are gradually recouped (*i.e.*, within five years), as the government sells its participation to the banks’ capital. In this scenario, the impact of a banking crisis on the debt-to-GDP level in the EA as whole would amount to about 2 pps. at the onset of the banking crisis (grey line in Graph II.1) assuming a duly application of the current legislation. This effect is limited by the existence of safety nets. Otherwise, the impact would be more than doubled, amounting to 5 pps. (*i.e.*, orange line in

⁽⁴⁹⁾ For instance, See Breuss, F., W. Roeger and J. in’t Veld (2015), “The Stabilizing Properties of a European Banking Union in Case of Financial Shocks in the Euro Area”, European Economy, Economic Paper No 550; (http://ec.europa.eu/economy_finance/publications/economic_paper/2015/pdf/ecp550_en.pdf). They report impacts of a banking crisis using QUEST-based simulations aiming at replicating the GFC event while accounting for available safety-nets for euro-area Member States. The latter framework is fully in line with the SYMBOL setup and thus provides a key reference for calibrating our GDP impact channel. Breuss et al (2015) illustrate the beneficial impact of regulatory reforms enacted beyond 2008, providing useful evidence on the magnitude of banking crisis channels in the EU, suggesting that a euro area Member States experiencing a banking crisis would post a -2 pps. and 0.8pp permanent GDP loss in case of a duly application of the current legislation and if absence of safety nets respectively. In the same vein, see Jorda, O, M Schularick and A Taylor (2011): “When credit bites back: leverage, business cycles and crises”, Federal Reserve Bank of San Francisco, Working Papers, no 2011-27. They also referred to 2 pps. GDP adverse impact in the context of their study based on a large sample including 5 global financial crises over the time span of 140 years and across 14 countries. It should be, nevertheless, noted that we assume a permanent shock of 2% on the GDP level based on the literature however the literature suggests that the magnitude of the shock on GDP will be higher in the short term.

Graph II.1, left-hand side). After the first year, the impact on the debt projections would decrease as governments progressively resale the financial assets acquired to meet the banks' recapitalisation needs. Over the medium term, the remaining effect relates to banks *excess losses* and permanent adverse GDP impact. Hence, by 2032, the EA debt-to-GDP level would be 1 pp. and 2 pps. higher than in the baseline in case of safety nets intervention and in absence safety nets respectively. ⁽⁵⁰⁾

Graph II.1: **Public debt projections**
- Severe stress test scenario for bank-related contingent liability risks



Note: The group of EA Member States identified as potentially more vulnerable by SYMBOL includes Cyprus, Greece, Spain, Luxembourg, and Portugal.

Source: European Commission.

Turning to the aggregate of potentially most affected EA Member States – according to SYMBOL, the baseline shows a gradual debt reduction with the debt dynamic only starting to reverse at the end of the horizon onwards. ⁽⁵¹⁾ The results show a higher impact (*i.e.*, related to the baseline) of the crisis on the debt ratio and the role play by the safety nets, compared with the EA as whole (Graph II.1, left-hand side). In absence of safety nets (*i.e.*, orange line in Graph II.1, right-hand side), (*i.e.*, in 2024) the impact of a severe banking crisis on the aggregated debt-to-GDP level would reach about 7 pps. at the onset of the banking crisis (versus about 5 pps for the EA as whole). In case of a due application of the current regulation (*i.e.*, grey line in Graph II.1, right-hand side), the impact would be reduced to about 3 pps. (versus about 2 pps in for the EA as whole). Over time, the impact on the debt projections would decrease as governments progressively resale the financial assets acquired to meet the banks' recapitalisation needs. Over the medium term, the remaining effect relates to banks excess losses and permanent adverse GDP impact. Hence, by 2032 the aggregated debt-to-GDP ratio would be higher compared with the baseline by about 2 pps. and 4 pps. in case of safety nets intervention and in absence of safety nets respectively. Given the strongly declining trend of debt in these countries, such a shock would not durably alter the debt dynamic.

II.6. Conclusions

The assessment of general governments' contingent liability risks stemming from the banking sector is an important element complementing the European Commission debt sustainability analysis framework. The

⁽⁵⁰⁾ As regards the results a number of caveats should be borne in mind: First, these results are obtained within a framework assuming no further contagion effects - thanks to the safety nets, and no feedback loops on sovereign rates, hitting back banks' balance sheets. Moreover, the adopted approach assumes a permanent impact on the GDP level at the onset of the crisis meaning that the budget balance is deteriorated via direct banking losses. Hence, the fact that the budget balance would be affected due to the shock on GDP level would probably further amplify the ultimate impact on debt. Finally, the focus of the SYMBOL model being the banking sector, it also assumes that the banks' losses and recapitalisation needs (partly) disappear once the safety nets are applied. In practice, these losses and recapitalisation needs are transferred to other sectors (*i.e.*, domestic insurance, pension funds or households, or foreign sector) that hold bail-inable bonds and related contingent liabilities. See for instance, Cariboni J., Fontana A., Langedijk S., Maccaferri S., Pagano A., Petracco Giudici M., Rancan M. and Schich S. (2016), 'Reducing and sharing the burden of bank failures', OECD Journal: Financial Market Trends, volume 2015/2. Overall, considering the aforementioned elements could have increase tge risks for the public finances.

⁽⁵¹⁾ The difference in terms of debt reduction between sample with the EA as a whole and the one with the 5 selected EA Member States can be explained by the specific features of country groups, with, for instance, differences in underlying primary balance assumptions, rise in ageing costs dynamics as well as macro-financial conditions.

key role played by the banking sector during the global financial crisis and lately during the COVID-19 crisis has illustrated this fact and pointed at the need to properly monitor the channels via which the banking sector may affect public finances in a context of crisis.

The present section discusses the potential impact of banks' losses on EU public finances using the Systemic Model of Banking Originated Losses (SYMBOL), which is a microsimulation model applied to analyse risks for public finances stemming from the banking sector during a period of financial stress. In the context of the Commission's debt sustainability analysis, SYMBOL provides interesting features that make it well suited for supporting the design of stress test debt scenarios and the assessment of related impacts on debt-to-GDP paths amid a banking crisis by (i) distinguishing between simulated bank losses (with a deficit and debt impact) and bank recapitalisation needs (with a debt impact), (ii) using bank-level data and accounts for national banking systems differences, and (iii) taking into account the current layers of the legal safety nets (like Bail-in and the Resolution Funds).

Overall, for the EA as whole, the results indicate that, based on the current situation, involving a duly application of the current regulation, no further contagion effects, nor feedback loops on sovereign rates and banking balance sheets, the (implicit) contingent liabilities risks that could stem from a systemic banking crisis are limited. This is thanks to the legal safety nets, in line with the reform agenda that was set into motion in the aftermath of the 2008 global financial crisis over a decade ago. Under the *Reference stress scenario*, in case of full phasing-in of the banking regulation, the expected budgetary impact of a banking crisis would be negligible for most Member States with combined excess losses and recapitalisation needs not exceeding 1% of the GDP. Under the more adverse scenario (involving a 'fire-sale' mechanism), the potential losses and recapitalisation needs are projected to be more significant, reaching up to 2-3% of GDP in a number of Member States, and even beyond (up to 8% of GDP) in one case, while the safety nets are fully in place. Using the SYMBOL results to assess potential debt sustainability risks due to the banking sector in the context of the European Commission's Debt Sustainability Analysis (DSA) risk framework, also confirm the key role of the safety nets.

The impact of a severe banking crisis on the debt-to-GDP level at the onset of the banking crisis (*i.e.*, in 2024) is projected to reach for the EA as whole about 2 pps and 5 pps. in case of a due application of the current legislation and without the safety nets being in place respectively. Focussing on a selected number of EA Member States that are more affected according to the model, the results show a more significant projected impact of a severe crisis on the aggregated debt ratio, at the onset of the banking crisis, reaching about 7 pps and 3 pps, in absence of safety nets and once the safety nets are fully in place, respectively. Over the medium term (*i.e.*, by 2032), the overall impact would be lower, reaching about 2 pps and 4 pps (against about 1 pp and 2 pps for the EA as whole) in case of a due application of the regulation and in absence of safety nets, respectively.

Finally, it is worth stressing that severe banking crises are exceptional events, and the materialisation of government contingent (implicit) liabilities is not frequent. Yet, although the overall extent of the estimated risks for public finances (and the debt ratio in particular) appear limited for the EA as whole - having taken in due consideration the SYMBOL model's caveats - the magnitude of the potential impact nevertheless calls for a continuous monitoring, as the impact is expected to be higher for a few Member States that the model identifies as more affected, which tend to be characterised by already high debt ratios and/or very large banking sectors relative to the rest of the economy, both known as aggravating factors in event of crisis.