The SYMBOL model

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The SYMBOL model: origins

- In 2005 the JRC was asked to support DG MARKT (now DG FISMA) in the revision of the **Directive on Deposit Guarantee Schemes (DGS)**
- Key issue to be investigated: **target size of DGS funds**
- First goal: to provide an **estimate of the DGS loss** distribution

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Modelling Deposit Insurance Scheme Losses in a Basel 2 Framework

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literature on deposit insurance by proposing a ss distribution of a Deposit Insurance Scheme ory framework. In particular, we generate the Basel 2 theoretical approach and focus on the y capital (tail risk). We also refine our approach mic risks: the correlation between banks' assets ation of our model to 2007 data for a sample of he Italian deposit insurance system covers up to ere, it emerges that the introduction of bank could lead to the collapse of the entire Italian banking system. Our analysis points out that the existing Italian deposit insurance system can be assessed as adequate only in normal times and not in bad market conditions with substantial contagion between banks. Overall, we argue that policy makers should explicitly consider the following when estimating DIS loss distributions: first, the regulatory framework within which banks operate such as (Basel 2) capital requirements; and, second, potential sources of systemic risk such as the correlation between banks' assets and the risk of interbank contagion.

The opinions presented here are exclusively those of the authors and do not in any way represent those of the European Commission.

De Lisa et al. (2011), Journal of Financial Services Research

The JRC, in cooperation with experts from DG MARKT and the academia, developed the **SYstemic Model of Banking Originated Losses**

SYMBOL estimates the **distribution of economic losses and liquidity shortfalls** occurring in the banking sector, possibly also taking into account contagion effects

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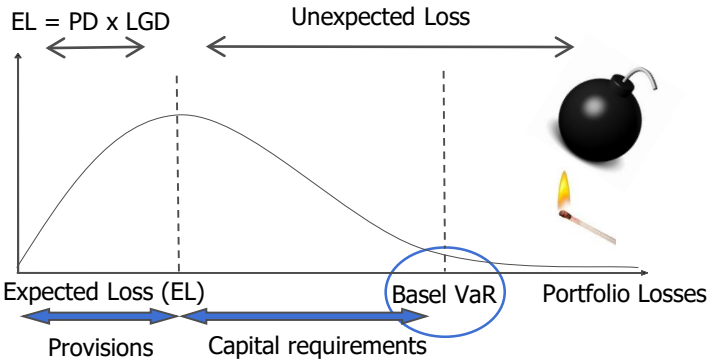
The model (i)

SYMBOL is a micro simulation portfolio model. It is based on bank level data and able to generate crisis scenarios where banks fail, depending on their level of capital and risk weighted assets, as well as on the severity of the negative shock.

- SYMBOL makes use of **BASEL II/III framework** and banks' balance sheet data to simulate banking losses at individual bank level and derive the overall loss hitting the banking system (country level, EU, large groups).
- Allows **comparing different counter-factual scenarios** with alternative regulatory or risk set-ups:
  - Different balance sheet structures
  - Different financial safety net set-ups
  - Alternative/stressed risk weights for asset classes (e.g. impact on financial stability of increased risk associated to high-carbon assets).

The model (ii): main idea

How to estimate the average Default Probability (PD) of a bank portfolio?



The Basel Accord imposes that each bank satisfies **minimum regulatory capital requirements** against the risks the bank may face.

This capital provides **a buffer against unexpected losses** at a specific level of statistical confidence fixed at 99.9%

Capital requirements based on the Basel formula are a function of the PD of the bank's portfolio

MCR = f(PD)

The average default probability of the bank's portfolio (PD) is an estimate of the riskiness of the portfolio of the bank

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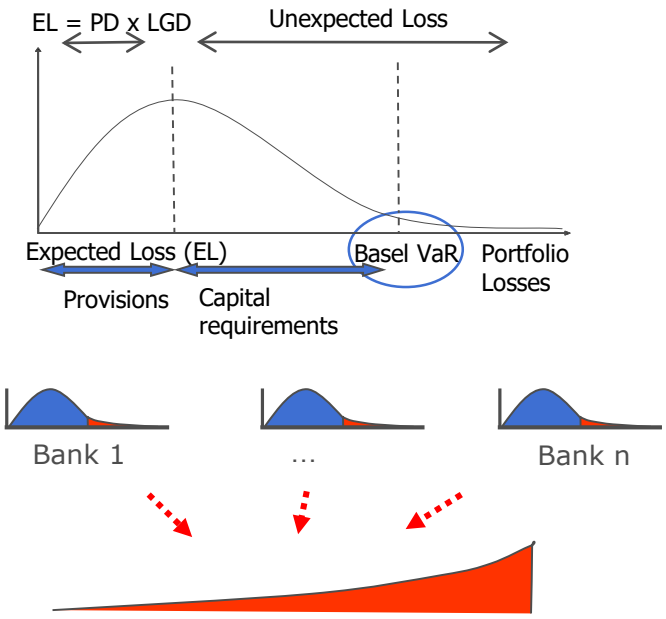
The model (iii): from bank to system losses



Loss distribution of the banking system

- With all parameters known or estimated, we can use the **Basel II/III FIRB formula as the exact shape of the loss distribution** for each bank *j* and use it to simulate samples of gross losses (*h = 1, …, H*) by extracting random numbers representing the intensity of the shocks.

- In each set of extractions *h* the numbers are correlated, to represent the exposure of all banks to common economic shocks **(common factor)**

- After millions of simulations, this data can be used to estimate aggregate distributions of losses.

Methodological steps

1. Balance sheet inputs from Bankscope for banks in EU MSs : *Total assets, RWA, Capital*

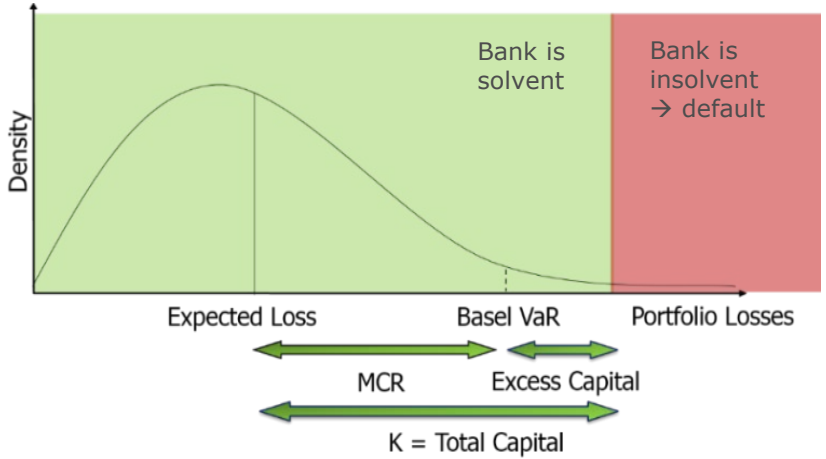
2. Estimate the probability of default

3. Generate a sample of correlated bank losses (via Monte Carlo simulation) using Basel formula and a correlation to a common factor.

4. A bank defaults if simulated losses exceed its total capital: Losses > Capital

5. Compute the unexpected losses of each bank in each simulation run

6. Derive the distribution of losses in a banking system (SYMBOL can assess the effect individual and cumulative effect of the safety net tools)



N. of Simulations: set to obtain 100,000 scenarios with at least 1 bank default

Include safety-net tools to reduce losses: capital, bail-in, resolution funds
Hyp: (1) safety net blocks contagion
(2) at the end of the intervention capital level is at least at 8% of RWA

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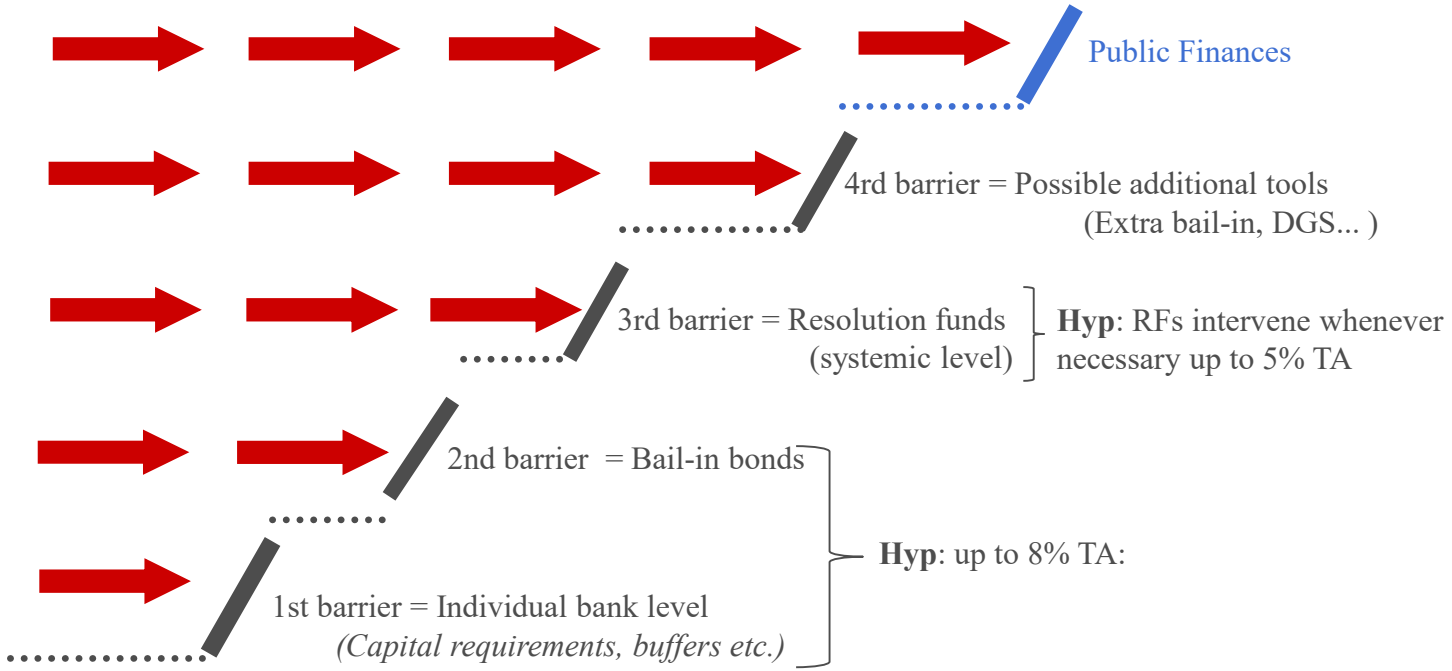
The safety net tools: order of intervention



Inputs

Unconsolidated Orbis Bankfocus data for ~3000 EU banks (more than 70% of total EU assets)

Table A6.1: Descriptive statistics of samples used for SYMBOL simulations

	Nr. of banks	Total assets, bn €	Capital, bn €	RWA, bn €	Cov. Dep, bn €	Gross Losses (GL), bn €	Provisions imputed by EBA Provision/ GL ratio	NPL imputed by robust regression (via Provisions)	RWA/Total assets	Capital/ RWA	NPL/Total assets	NPL / Capital
BE	18	610	37	198	177	296	5	9	32.41%	18.90%	1.49%	24.39%
BG	13	34	4	20	19	21	2	4	56.65%	20.10%	11.20%	98.36%
CY* [1]	6	59	5	32	18	51	10	25	53.35%	15.66%	42.22%	505.18%
CZ	15	165	14	76	67	101	3	4	45.94%	18.00%	2.40%	29.03%
DK	66	651	51	251	105	380	10	17	38.59%	20.26%	2.59%	33.15%
DE	813	4,238	253	1,494	1,022	1,705	20	41	35.25%	16.96%	0.97%	16.23%
EE*	2	10	1	7	4	6	0	0	69.05%	22.62%	1.15%	7.37%
IE*	16	279	35	190	69	129	12	20	68.17%	18.56%	7.13%	56.39%
ES	24	1,596	141.5	1,044	391	805	43	77	65.39%	13.55%	4.83%	54.54%
FR	149	6,660	313	2,004	1,084	1,837	33	58	30.09%	15.62%	0.87%	18.58%
HR	23	51	6	32	19	36	4	6	61.81%	20.11%	11.76%	94.59%
IT	360	2,235	198	1,018	523	1,281	128	261	45.56%	19.45%	11.66%	131.63%
LV	16	28	3	14	8	12	1	1	49.65%	21.69%	4.06%	37.73%
LT*	6	20	2	10	11	13	0	1	49.14%	22.77%	3.65%	32.63%
LU	33	383	22	121	18	110	1	1	31.53%	18.48%	0.35%	6.09%
HU	14	41	4	21	11	14	1	2	51.37%	20.66%	5.22%	49.21%
MT*	7	18	1	9	8	9	0	1	48.31%	13.29%	3.84%	59.84%
NL	17	1,615	112	667	241	676	7	13	41.31%	16.73%	0.80%	11.61%
AT*	53	150	11	73	44	85	3	6	48.33%	15.28%	4.25%	57.49%
PL	26	222	22	143	98	153	7	10	64.40%	15.40%	4.68%	47.22%
PT	90	207	14	126	86	133	15	13	60.79%	11.45%	6.40%	92.02%
RO	15	52	5	27	20	32	4	5	51.19%	18.59%	10.10%	106.15%
SI	12	30	3	17	15	20	2	5	57.28%	19.88%	16.42%	144.24%
SK	10	55	5	30	22	38	1	2	55.20%	15.94%	3.76%	42.78%
FI	15	354	15	61	44	95	1	2	17.15%	23.96%	0.56%	13.73%
SE	72	618	41	169	138	276	1	3	27.34%	24.37%	0.41%	6.17%
UK	76	6,030	376	2,059	1,157	2,440	26	59	34.15%	18.26%	0.97%	15.59%
EU	1972	26.705	1.728	10.089	5.495	10.960	390	733	37.78%	17.13%	2.74%	42.41%

- Capital and risk weighted assets might be corrected to better reflect the real economic concept of RWA and capital. (Quantitative Impact Study EBA or COVID-related measures);
- Robust imputation for missing data and quality check;
- Sample coverage ratio is rescaled using ECB data aggregate per MS. (Results for countries with low sample ratio are deemed to be highly uncertain)

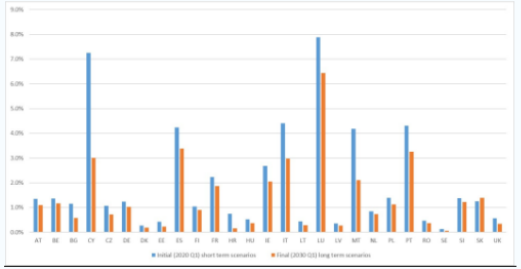
Results: Debt Sustainability Monitor 2019

Table 2: **Excess losses plus recapitalization needs (10.5% RWAs): impact under the baseline and a scenario featuring new regulation settings, (in % of GDP)**

EU28		
Short term scenario	Baseline (current prudential assessment)	0.35%
	Assuming revised prudential assessment (part of stress scenario)	**2.23%**
Long term scenario	Baseline (current prudential assessment)	0.25%
	Assuming revised prudential assessment (part of stress scenario)	**1.69%**

Source: Commission services.

Graph 2: **Excess losses plus recapitalization needs (10.5% RWAs): additional impact in scenario featuring new regulation settings compared to baseline, (in pps of GDP)**



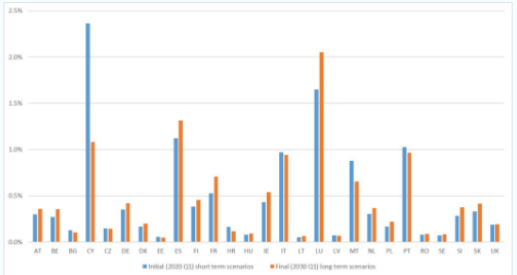
Source: Commission services.

Table 3: **Excess losses plus recapitalization needs (10.5% RWAs): impact under the baseline and a scenario featuring a more severe crisis, (in % of GDP)**

EU28		
Short term scenario	Baseline crisis severity: 99.95% event	0.35%
	Stressed crisis severity: at 99.99% event	**0.81%**
Long term scenario	Baseline crisis severity: 99.95% event	0.25%
	Stressed crisis severity: at 99.99% event	**0.78%**

Source: Commission services.

Graph 3: **Excess losses plus recapitalization needs (10.5% RWAs): additional impact in scenario featuring a more severe crisis compared to baseline, (in pps of GDP)**



Source: Commission services.

Source: Debt Sustainability Monitor 2019 Institutional Paper 120. January 2020. Brussels.

SYMBOL contribution to policy discussions

- Review of the crisis management and deposit insurance framework 2019 - 2022
- ECFIN DSA/DSM/FSR 2011 - 2021
- EDIS proposal 2016 - 2021
- COVID-19: the stabilizing impact of EU bond issuance on the banking system 2021
- The Sovereign-Bank Nexus in the Euro Area: Financial and Real Channels 2020
- Fundamental Review of the Trading Book 2016
- ERFRA (Economic Review of the Financial Regulation Agenda) 2014
- Structural Separation Directive Proposal (IA) 2014
- Bank recovery and resolution (BRRD) 2012 – 2013
- Financial Transaction Tax Proposal 2011
- Capital Requirement Directive Proposal (IA) 2011

Thank you

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