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**

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

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

\[ \text{MCR} = f(\text{PD}) \]

The average default probability of the bank’s portfolio (PD) is an estimate of the riskiness of the portfolio of the bank.
The model (iii): from bank to system losses

- 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)

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

N. of Simulations: set to obtain 100,000 scenarios with at least 1 bank default
The safety net tools: order of intervention

1st barrier = Individual bank level
(Capital requirements, buffers etc.)

2nd barrier = Bail-in bonds

3rd barrier = Resolution funds
(systemic level)

Hyp: RFs intervene whenever necessary up to 5% TA

4th barrier = Possible additional tools
(Extra bail-in, DGS...)

Hyp: up to 8% TA:

Public Finances
Inputs

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

• 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)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>EU28</th>
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</thead>
<tbody>
<tr>
<td>Short term scenario</td>
<td></td>
</tr>
<tr>
<td>Baseline (current regulatory)</td>
<td>0.15%</td>
</tr>
<tr>
<td>Assuming revised regulatory</td>
<td>2.22%</td>
</tr>
<tr>
<td>Long term scenario</td>
<td></td>
</tr>
<tr>
<td>Baseline (current regulatory)</td>
<td>0.22%</td>
</tr>
<tr>
<td>Assuming revised regulatory</td>
<td>1.49%</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Scenario</th>
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<tbody>
<tr>
<td>Short term scenario</td>
<td></td>
</tr>
<tr>
<td>Baseline crisis severity: 99.95% event</td>
<td>0.35%</td>
</tr>
<tr>
<td>Stress test crisis severity: 99.95% event</td>
<td>0.81%</td>
</tr>
<tr>
<td>Long term scenario</td>
<td></td>
</tr>
<tr>
<td>Baseline crisis severity: 99.95% event</td>
<td>0.23%</td>
</tr>
<tr>
<td>Stress test crisis severity: 99.95% event</td>
<td>0.78%</td>
</tr>
</tbody>
</table>

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.
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