Evaluation of European Deposit Insurance Scheme Funding Based on Risk Analysis

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IFABS 2021 Virtual Conference

15/09/2021
Context of our work:

- 2014. Directive on Deposit Guarantee schemes (DGSD)
- 2015. EBA proposal for the establishment of European Deposit Insurance Scheme (EDIS)
  - <2020: Reinsurance stage. Contribution based on national banking system
  - 2020-2024: Coinsurance stage. Contribution based on Banking Union (BU)
  - >2024: Mutualized stage. Contribution based on BU
- 2020. COVID-19. EBA impact study:
  - + banking risk, + volatility in financial markets - asset quality
Mutualized stage:

- **EDIS:**
  - Only deposit insurance in Eurozone. Replace national schemes
  - Absorb all liquidity needs and losses

- **Problems:**
  - Cross-border subsidies
  - Moral hazard
  - Risk-taking behavior

- **Solution:**
  - Risk-sharing methodology for contributions
Data sources:
- Orbis Bank Focus database
- European deposit guarantee systems data

Sample:
- Year: 2018
- Eurozone banks: 806
- Covered deposits: €4.9 trillions, 81% in the Eurozone
Table 1. Representativeness of sample

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Covered deposit population (bn €)</th>
<th>Covered deposit population (%)</th>
<th>Total Covered deposit sample (bn €)</th>
<th>Representativeness of de sample (%)</th>
<th>Number of Banks in the sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria (AT)</td>
<td>219</td>
<td>3.6</td>
<td>179</td>
<td>82</td>
<td>45</td>
</tr>
<tr>
<td>Belgium (BE)</td>
<td>293</td>
<td>4.8</td>
<td>275</td>
<td>94</td>
<td>13</td>
</tr>
<tr>
<td>Cyprus (CY)</td>
<td>26</td>
<td>0.4</td>
<td>26</td>
<td>99</td>
<td>18</td>
</tr>
<tr>
<td>Germany (DE)</td>
<td>1815</td>
<td>30.0</td>
<td>1053</td>
<td>58</td>
<td>138</td>
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<tr>
<td>Estonia (EE)</td>
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<td>8</td>
<td>87</td>
<td>7</td>
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<tr>
<td>Spain (ES)</td>
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<td>719</td>
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<td>Finland (FI)</td>
<td>129</td>
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<td>125</td>
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<td>138</td>
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<tr>
<td>France (FR)</td>
<td>1168</td>
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<td>1028</td>
<td>88</td>
<td>82</td>
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<tr>
<td>Greece (GR)</td>
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<td>1.7</td>
<td>96</td>
<td>92</td>
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<td>Ireland (IE)</td>
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<td>Italy (IT)</td>
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<td>601</td>
<td>86</td>
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<td>Lithuania (LT)</td>
<td>14</td>
<td>0.2</td>
<td>13</td>
<td>91</td>
<td>5</td>
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<tr>
<td>Luxembourg (LU)</td>
<td>32</td>
<td>0.5</td>
<td>17</td>
<td>54</td>
<td>17</td>
</tr>
<tr>
<td>Latvia (LV)</td>
<td>8</td>
<td>0.1</td>
<td>8</td>
<td>95</td>
<td>10</td>
</tr>
<tr>
<td>Malta (MT)</td>
<td>12</td>
<td>0.2</td>
<td>10</td>
<td>86</td>
<td>6</td>
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<tr>
<td>Netherland (NL)</td>
<td>499</td>
<td>8.2</td>
<td>494</td>
<td>99</td>
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<td>108</td>
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<td>70</td>
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<tr>
<td>Slovenia (SI)</td>
<td>19</td>
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<td>16</td>
<td>85</td>
<td>9</td>
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<tr>
<td>Slovakia (SK)</td>
<td>32</td>
<td>0.5</td>
<td>30</td>
<td>93</td>
<td>8</td>
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<tr>
<td>Total</td>
<td>6,056</td>
<td>100.0</td>
<td>4,913</td>
<td>81</td>
<td>806</td>
</tr>
</tbody>
</table>

Source: Own work
We used SYMBOL microsimulation model (De´Lisa´2011)

SYMBOL’s methodological phases:

- Step 1. Estimation of the implied obligor probability of default ($IOPD_i$)
- Step 2. Simulation of correlated losses
- Step 3. Determination of bank failure
- Step 4. EDIS loss distribution
We analyse contagion risk using three correlations structures:

- $\Sigma_1$: 1; 0.5; 0
- $\Sigma_2$: 1; 0.5; 0.5
- $\Sigma_3$: 1; 0.6; 0.3

We evaluated model risk using different decomposition methods and calculations procedures.

We run several numbers of simulations:

- 100,000
- 500,000
- 1,000,000
- We use two risk measures:
  - VaR
  - ES
- and several confidence levels:
  - 99%
  - 99.5%
  - 99.9%
  - 99.95%
  - 100%
- We conduct a sensitivity analysis of risk portfolio:
  - x2
  - x5
<table>
<thead>
<tr>
<th>Percentile (%)</th>
<th>( \Sigma_1 )</th>
<th>( \Sigma_2 )</th>
<th>( \Sigma_3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Sigma_1 )</td>
<td>( \Sigma_2 )</td>
<td>( \Sigma_3 )</td>
<td></td>
</tr>
<tr>
<td>Defaults</td>
<td>11,124</td>
<td>10,806</td>
<td>11,214</td>
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<tr>
<td>Mean (bn €)</td>
<td>0.78</td>
<td>0.79</td>
<td>0.73</td>
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<td>St. Dev. (bn €)</td>
<td>3.89</td>
<td>3.78</td>
<td>3.41</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.16</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>28.22</td>
<td>28.20</td>
<td>26.24</td>
</tr>
<tr>
<td>TFCL (%)</td>
<td>99.97</td>
<td>99.97</td>
<td>99.97</td>
</tr>
<tr>
<td>Percentile (%)</td>
<td>VaR (bn €)</td>
<td>ES (bn €)</td>
<td>FN (%)</td>
</tr>
<tr>
<td>99.00</td>
<td>0.00</td>
<td>7.81</td>
<td>0.00</td>
</tr>
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<td>99.50</td>
<td>0.00</td>
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<tr>
<td>99.90</td>
<td>0.97</td>
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<td>99.96</td>
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Source: Own work
### Table 3. IOPDx2 sensitivity analysis

<table>
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<tr>
<th>Percentile (%)</th>
<th>$\Sigma_1$</th>
<th>$\Sigma_2$</th>
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<td>Defaults</td>
<td>48,939</td>
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<td>49,029</td>
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<td>Mean (bn €)</td>
<td>0.88</td>
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<td>St. Dev. (bn €)</td>
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<td>Skewness</td>
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<td>0.07</td>
<td>0.08</td>
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<td>Kurtosis</td>
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<td>TFCL (%)</td>
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<td>99.89</td>
<td>99.89</td>
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<table>
<thead>
<tr>
<th>Percentile (%)</th>
<th>VaR (bn €)</th>
<th>ES (bn €)</th>
<th>FN (%)</th>
<th>VaR (bn €)</th>
<th>ES (bn €)</th>
<th>FN (%)</th>
<th>VaR (bn €)</th>
<th>ES (bn €)</th>
<th>FN (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>99.00</td>
<td>0.00</td>
<td>39.16</td>
<td>0.00</td>
<td>0.00</td>
<td>37.89</td>
<td>0.00</td>
<td>0.00</td>
<td>39.63</td>
<td>0.00</td>
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<td>79.15</td>
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<td>1.09</td>
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<td>49.27</td>
<td>373.27</td>
<td>1.00</td>
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<td>163.01</td>
<td>660.47</td>
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<td>394.91</td>
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<td>597.85</td>
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<td>2,499.98</td>
<td>50.89</td>
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<td>2,751.52</td>
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<td>3,316.35</td>
<td>3,316.35</td>
<td>67.50</td>
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</tbody>
</table>

Source: Own work
### Table 4. IOPDx5 sensitivity analysis

<table>
<thead>
<tr>
<th>Percentile (%)</th>
<th>$\Sigma_1$</th>
<th>$\Sigma_2$</th>
<th>$\Sigma_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VaR (bn €)</td>
<td>ES (bn €)</td>
<td>FN (%)</td>
</tr>
<tr>
<td>99.00</td>
<td>13.90</td>
<td>242.45</td>
<td>0.28</td>
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<td>99.50</td>
<td>67.68</td>
<td>451.94</td>
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<td>99.90</td>
<td>708.09</td>
<td>1,290.55</td>
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<td>1,245.28</td>
<td>1,622.61</td>
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<td>3,881.91</td>
<td>3,881.91</td>
<td>79.02</td>
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</table>

Source: Own work
Figure 1. EDIS loss distribution.

Source: Own work
EBA developed a guidelines on methods for calculating risk-adjusted contribution for national DIS (EBA, 2015)

Member states develop their own calculation methods using established guidelines

EBA conducts periodic reviews.

In the last it conclude that no changes are necessary

Methods to calculate contributions:

- Bucket method
- Sliding scale methods:
  - Linear
  - Exponential
Risk-adjusted contribution for i-th bank \((C_i)\) is given for following equation:

\[
C_i = CR \cdot ARW_i \cdot CD_i \cdot \mu
\]  

(1)

where:

- **CR**: contribution rate
- **ARW\(_i\)**: aggregate risk weight for \(i\)-th bank
- **CD\(_i\)**: covered deposits for \(i\)-th bank
- **\(\mu\)**: adjustment coefficient
ARW is determined in the following steps:

1. Definition of risk indicators (IR)
2. Transformation of indicator values into an individual risk score (IRS)
3. Calculation of the aggregate risk score (ARS)
4. Determination of the aggregate risk weight (ARW)
## Table 5. Risk indicators

<table>
<thead>
<tr>
<th>Category</th>
<th>Indicator</th>
<th>Notation</th>
<th>Description</th>
<th>Expected sign on bank risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital</td>
<td>Leverage ratio</td>
<td>C1</td>
<td>Tier 1 capital/Total assets</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>Capital coverage ratio</td>
<td>C2</td>
<td>Actual own funds/Required own funds</td>
<td>Negative</td>
</tr>
<tr>
<td>Liquidity and Funding</td>
<td>Liquidity ratio</td>
<td>L1</td>
<td>Liquid assets/Total assets</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>Loans-to-deposits ratio</td>
<td>L2</td>
<td>Loans/Deposit</td>
<td>Positive</td>
</tr>
<tr>
<td>Asset quality</td>
<td>Non-performing loans ratio</td>
<td>AQ1</td>
<td>NPL/Total loans and debt instruments</td>
<td>Positive</td>
</tr>
<tr>
<td>Business model and management</td>
<td>Risk weighted assets (RWA) to total assets ratio</td>
<td>B1</td>
<td>RWA/Total assets</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Return on assets</td>
<td>B2</td>
<td>Net Income/Total assets</td>
<td>Negative</td>
</tr>
<tr>
<td>Potential losses for the DGS</td>
<td>Unencumbered assets/ covered deposits</td>
<td>P1</td>
<td>Liquid assets/Covered deposits</td>
<td>Negative</td>
</tr>
</tbody>
</table>

Source: *Own work*
Table 6. Effect of risk-adjusted contributions in EDIS by country

<table>
<thead>
<tr>
<th>Country</th>
<th>Bucket method</th>
<th>Sliding scale method (linear)</th>
<th>Sliding scale method (exponential)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ARW (%)</td>
<td>C^{EDIS} (%)</td>
<td>RC^{EDIS/DGS} (%)</td>
</tr>
<tr>
<td>AT</td>
<td>106.5</td>
<td>0.676</td>
<td>-15.48</td>
</tr>
<tr>
<td>BE</td>
<td>114.7</td>
<td>0.728</td>
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</tr>
<tr>
<td>CY</td>
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<td>DE</td>
<td>122.1</td>
<td>0.775</td>
<td>-3.14</td>
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<tr>
<td>EE</td>
<td>57.3</td>
<td>0.364</td>
<td>-54.50</td>
</tr>
<tr>
<td>ES</td>
<td>146.3</td>
<td>0.929</td>
<td>16.07</td>
</tr>
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<td>FI</td>
<td>81.8</td>
<td>0.520</td>
<td>-35.05</td>
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<tr>
<td>FR</td>
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<td>0.855</td>
<td>6.90</td>
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<td>GR</td>
<td>138.4</td>
<td>0.879</td>
<td>9.88</td>
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<td>IE</td>
<td>123.1</td>
<td>0.782</td>
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<td>IT</td>
<td>144.0</td>
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<td>84.6</td>
<td>0.537</td>
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<td>75.4</td>
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<td>SI</td>
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<td>0.813</td>
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<tr>
<td>SK</td>
<td>123.6</td>
<td>0.785</td>
<td>-1.88</td>
</tr>
</tbody>
</table>

Source: Own work
Consolidation of the BU:
- have enabled greater resilience of banks
- COVID-19 pandemic could trigger a severe scenario
- Development of EDIS

We present a quantitative analysis of EDIS financing:
- Soundness of deposit insurance
- Clarify disciplinary problems

We use SYMBOL model to simulate EDIS loss distribution:
- phenomenon is rare but with very high severity
- distribution is skewed and has a very thick tail

Losses depend on:
- Correlations
- Risk of credit portfolios
- Cost of insurance varies from the European Deposit Insurance Scheme to national ones
- EDIS:
  - Degree of risk aversion/level of solvency
  - Equitable risk measures/improve risk management
  - Cross-border subsidies
Thank you for your attention

This work has been financed by I Plan Propio De Investigación, Transferencia y Divulgación Cientifica, Universidad de Málaga, Campus de Excelencia Internacional Andalucía Tech