A Proposal for a Capital Market-based Guaranty Scheme for the Financial Industry

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Overview

1. Background and Motivation
2. Literature Review
3. Proposal of a Capital Market-based Guaranty Scheme
4. Advantages and Challenges
5. Discussion
Solvency regulation and guaranty systems

– The recent financial market crisis and the resulting insolvency costs have revealed the need for a reconsideration of regulatory designs, in particular with regard to solvency measurement

– Aim of solvency regulation and supervision is to reduce financial companies’ default probabilities to a predefined small, yet still positive level
  → The question is what happens if a financial company goes bankrupt

– Possible response: Introduction of an insurance guaranty fund (deposit insurance) financed by all insurance companies (banks)
  → This approach forces the internalization of the industry’s insolvency costs

– However, due to the inhomogeneity of companies’ risk, the calculation of risk-based premiums and a clear definition of a guaranty fund’s pay-outs is crucial
The problem of non-risk-based contributions

- Really risk-based contributions to guaranty funds are only possible in arbitrage-free markets due to the problem of allocating (unsystematic) diversification effects.
- As a consequence, wealth transfers between different financial companies cannot be avoided.
- However, non-risk-based premiums create adverse incentives depending on premium size and payment mechanisms.
- A transfer of guaranty systems to the capital market might be a potential solution with regard to this problem.
Background and Motivation

The problem of non-risk-based contributions

− Before a financial guaranty system is introduced, potential adverse incentives should be analyzed

− The riskiness of a financial company should influence its required contribution to the guaranty funds

− The introduction of guaranty systems in a competitive market as well as the calculation of fund contribution need to be challenged

− Alternative solutions how to handle with the bankruptcy of an insurance company need to be found
Own research basis in the context of guaranty systems


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Various overviews of existing financial guaranty systems in the insurance and banking industry
(Oxera, 2007; Schmeiser and Wagner, 2010; Feldhaus and Kazenski, 1998; Demirgüç-Kunt et al., 2008; Cariboni et al., 2008; Frolov, 2004)

Current state of practice and research regarding risk-based contributions is more advanced for deposit insurance
(European Commission JRC, 2008; Oxera, 2007; European Commission JRC, 2009; Bernet and Walter, 2009; Duffie et al., 2003; Cummins, 1988; Duan and Yu, 2005)
- Some brief discussions on market-based financing solutions can be found (Bernet and Walter, 2009; International Association of Deposit Insurers, 2009; Sheehan, 2003; Pennacchi, 2009)

- No proposals or models regarding a market-based funding of deposit insurance or insurance guaranty funds exist (for reinsurance solutions see Sheehan, 2003; Plaut, 1991; Madan and Unal, 2008)
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Proposal of a Capital Market-based Guaranty Scheme

Approach

- Introduction of a capital market-based financial guaranty system as alternative to current deposit insurance systems and insurance guaranty funds

- Transfer of guaranty system to capital market with a similar structure like insurance-linked securities or cat bonds

- Establishment of one special purpose vehicle (guaranty vehicle) per company
Proposal of a Capital Market-based Guaranty Scheme

**Basic setting**

- **financial company**: pays risk-based premium
- **SPV**: provides investment return
- **investors**: buy bonds
- **clients**: indemnity payment in case of insolvency
- **capital market**: capital investment
Proposal of a Capital Market-based Guaranty Scheme

Key aspects

− System that aims at protecting clients / paying off clients in case of default rather than at preventing default (cf. current discussion on CoCos)

− No systematic wealth transfer between clients of different companies

− Ability to cover shortfalls of major financial companies
Proposal of a Capital Market-based Guaranty Scheme

Cash flows

- **financial company**
  - $P_0$ to **SPV**
- **SPV**
  - $I_1$ to **clients**
  - $M_0 + P_0$ and $(M_0 + P_0)(1 + r_f)$ to **capital market**
  - $M_0(1 + r_s)$ to **investors**

- **clients**
  - $P_0$ to **financial company**

- **capital market**
  - $M_0 + P_0$ and $(M_0 + P_0)(1 + r_f)$ to **SPV**

- **investors**
  - $M_0(1 + r_s)$ to **SPV**

- **Symbols:**
  - $P_0$: Initial investment
  - $I_1$: Interest
  - $M_0$: Market value
  - $r_s$: Risk-free rate
  - $r_f$: Financial guaranty rate

- **Time Points:**
  - $t=0$
  - $t=1$
Proposal of a Capital Market-based Guaranty Scheme

Characterization of Guaranty Bonds

− Principal: \( M_0 = M_0^{\text{ext}} + M_0^{\text{int}} \)
  \[ M_0^{\text{ext}} = \alpha M_0, \quad M_0^{\text{int}} = (1 - \alpha) M_0 \]

− Claims: \( S_1 = (L_1 - A_1)^+ \)

− Indemnity payment: \( I_1 = \min\left( S_1^{(\beta)}, S_1 \right) \)

− Coverage cap: \( S_1^{(\beta)} = (M_0 + P_0)(1 + r_f) \geq 0 \)

− Investors' return: \( r_S = \frac{(M_0 + P_0)(1 + r_f) - I_1}{M_0} - 1 \)

\[ \begin{array}{|c|c|}
\hline
M_0^{\text{ext}}, M_0^{\text{int}} & \text{amount of total principal purchased by external and internal investors} \\
\alpha & \text{percentage of total principal purchased by external investors} \\
A_1, L_1 & \text{assets and liabilities in } \tau = 1 \\
S_1^{(\beta)} & \text{coverage cap} \\
P_0 & \text{premium payment} \\
\hline
\end{array} \]
Proposal of a Capital Market-based Guaranty Scheme

Stakeholders' positions

- Clients

\[ W_0^{(c)} = -P_0 + \text{PV}[l_1] \]
\[ = -P_0 + \text{PV} \left[ \min \left( S_1^{(\beta)}, S_1 \right) \right] \]
\[ = -P_0 + \text{PV} \left[ S_1 \right] - \text{PV} \left[ \max \left( S_1 - S_1^{(\beta)}, 0 \right) \right] \]

- Investors

\[ W_0^{(i)} = \alpha \left( -M_0 + \text{PV} \left[ \left( P_0 + M_0 \right) \left( 1 + r_f \right) - l_1 \right] \right) \]
\[ = \alpha \left( -M_0 + \text{PV} \left[ S_1^{(\beta)} \right] + \text{PV} \left[ \max \left( S_1 - S_1^{(\beta)}, 0 \right) \right] - \text{PV} \left[ S_1 \right] \right) \]
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Valuation of Stakeholders' positions

- The condition $W_0^{(c)} = W_0^{(i)} = W_0^{(f)} = 0$ yields

  - the premium

  $$P_0 = PV[I_1] = \underbrace{PV[S_1]}_{(a)} - \underbrace{PV\left[\max\left(S_1 - S_1^{(\beta)}, 0\right)\right]}_{(b)}$$

  - and the principal

  $$M_0 = PV\left[S_1^{(\beta)}\right] + \underbrace{PV\left[\max\left(S_1 - S_1^{(\beta)}, 0\right)\right]}_{(b)} - \underbrace{PV[S_1]}_{(a)}$$
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Valuation of Stakeholders' positions

- To solve (a), we assume
  - a geometric Brownian motion of assets and liabilities
  - no purchase of guaranty bonds by the financial company ($\alpha = 1$)

- Then

$$PV[S_1] = E^Q \left[ \exp(-r_f)(L_1 - A_1)^+ \right] = L_0 N \left( d_1^{(a)} \right) - A_0 N \left( d_2^{(a)} \right)$$

- with

$$d_1^{(a)} = \frac{\ln \left( \frac{L_0}{A_0} \right) + \hat{\sigma}^2}{\hat{\sigma}} , \quad d_2^{(a)} = d_1^{(a)} - \hat{\sigma} , \quad \hat{\sigma}^2 = \sigma_L^2 + \sigma_A^2 - 2\rho_{A,L} \sigma_L \sigma_A$$
Proposal of a Capital Market-based Guaranty Scheme

Valuation of Players' positions

- To solve (b), we
  - recall that $S_1^{(\beta)} \geq 0$
  - and set the coverage cap according to $S_1^{(\beta)} = \beta L_1$

- Then, (b) can be rewritten as
  
  $PV \left[ \max \left( S_1 - S_1^{(\beta)}, 0 \right) \right] = PV \left[ \max \left( (L_1 - A_1)^+ - S_1^{(\beta)}, 0 \right) \right]$
  
  $= PV \left[ \max \left( L_1 - A_1 - S_1^{(\beta)}, 0 \right) \right]$

- and, subsequently, be solved
  
  $PV \left[ \max \left( L_1 - A_1 - S_1^{(\beta)}, 0 \right) \right] = PV \left[ \max \left( (1 - \beta)L_1 - A_1, 0 \right) \right]$
  
  $= (1 - \beta)L_0 N \left( d_1^{(b)} \right) - A_0 N \left( d_2^{(b)} \right)$

\[ d_1^{(b)} = \frac{\ln \left( \frac{(1-\beta)L_0}{A_0} \right)}{\hat{\sigma}} + \frac{\hat{\sigma}^2}{2}, \quad d_2^{(b)} = d_1^{(b)} - \hat{\sigma} \]
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Valuation of Players' positions

- Thus, the premium can be expressed as

\[ P_0 = L_0 \left( N \left( d_1^{(a)} \right) - (1 - \beta) N \left( d_1^{(b)} \right) \right) + A_0 \left( N \left( d_2^{(b)} \right) - N \left( d_2^{(a)} \right) \right) \]

- And the principal

\[
M_0 = \text{PV} \left[ S_1^{(\beta)} \right] - \text{PV} [S_1] + \text{PV} \left[ \max \left( S_1 - S_1^{(\beta)}, 0 \right) \right] \\
= \text{PV} [\beta L_1] - P_0 \\
= \beta L_0 - P_0
\]
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Possible Premium-Principal-Combinations (values in mn currency units)

<table>
<thead>
<tr>
<th>$\beta$</th>
<th>$\text{PV}[S_1]$</th>
<th>$\text{PV}[\left(S_1 - S_1^{(\beta)}\right)^+]$</th>
<th>$\text{PV}[S_1^{(\beta)}]$</th>
<th>$M_0$</th>
<th>$P_0$</th>
<th>$P_0/L_0$</th>
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<tr>
<td>$\sigma_A = 0.05$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
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<td>0.10</td>
<td>0.00</td>
<td>0.000001</td>
<td>8</td>
<td>7.999</td>
<td>0.001</td>
<td>0.001%</td>
</tr>
<tr>
<td>0.15</td>
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<td>0.000000</td>
<td>12</td>
<td>11.999</td>
<td>0.001</td>
<td>0.001%</td>
</tr>
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<td>16</td>
<td>15.999</td>
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<td>0.001%</td>
</tr>
<tr>
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<td>19.999</td>
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<td>0.001%</td>
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<tr>
<td>0.30</td>
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<td>0.000000</td>
<td>24</td>
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<td>0.001%</td>
</tr>
<tr>
<td>0.40</td>
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<td>32</td>
<td>31.999</td>
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<td>0.001%</td>
</tr>
<tr>
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<td>0.000000</td>
<td>40</td>
<td>39.999</td>
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<td>0.001%</td>
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<tr>
<td>$\sigma_A = 0.10$</td>
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<td>11.935</td>
<td>0.065</td>
<td>0.081%</td>
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<td>0.07</td>
<td>0.000030</td>
<td>16</td>
<td>15.935</td>
<td>0.065</td>
<td>0.082%</td>
</tr>
<tr>
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<td>19.935</td>
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<td>0.082%</td>
</tr>
<tr>
<td>0.30</td>
<td>0.07</td>
<td>0.000000</td>
<td>24</td>
<td>23.935</td>
<td>0.065</td>
<td>0.082%</td>
</tr>
<tr>
<td>0.40</td>
<td>0.07</td>
<td>0.000000</td>
<td>32</td>
<td>31.935</td>
<td>0.065</td>
<td>0.082%</td>
</tr>
<tr>
<td>0.50</td>
<td>0.07</td>
<td>0.000000</td>
<td>40</td>
<td>39.935</td>
<td>0.065</td>
<td>0.082%</td>
</tr>
</tbody>
</table>

$A_0 = 100$
$L_0 = 80$
$\sigma_L = 0.05$
$\rho_{A,L} = 0.1$
$r_f = 0.02$
Proposal of a Capital Market-based Guaranty Scheme

Financial Company Invests in SPV

1. The financial company purchases guaranty bonds of its own guaranty vehicle

2. The financial company purchases guaranty bonds of another financial company whereas both companies' assets have a certain positive correlation

### Numerical example

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Denotation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial assets</td>
<td>$A_0$</td>
<td>100</td>
</tr>
<tr>
<td>Asset drift</td>
<td>$\mu_A$</td>
<td>0.05</td>
</tr>
<tr>
<td>Volatility of assets</td>
<td>$\sigma_A$</td>
<td>0.15</td>
</tr>
<tr>
<td>Initial liabilities</td>
<td>$L_0$</td>
<td>80</td>
</tr>
<tr>
<td>Liability drift</td>
<td>$\mu_L$</td>
<td>0.03</td>
</tr>
<tr>
<td>Volatility of liabilities</td>
<td>$\sigma_L$</td>
<td>0.05</td>
</tr>
<tr>
<td>Correlation between assets and liabilities</td>
<td>$\rho_{A,L}$</td>
<td>0.1</td>
</tr>
<tr>
<td>Risk-free rate of interest</td>
<td>$r_1$</td>
<td>0.02</td>
</tr>
<tr>
<td>Coverage parameter</td>
<td>$\beta$</td>
<td>0.3</td>
</tr>
<tr>
<td>Percentage purchased by external investors</td>
<td>$\alpha$ [0:1]</td>
<td></td>
</tr>
</tbody>
</table>
Case 1

Figure 5: Effects on shortfall measures when the financial company purchases the fraction \((1-\alpha)\) of its own guaranty bonds. Panel (a) shows the shortfall probability \(P(S_1 > 0)\) and panel (b) the expected shortfall given default \(E[S_1 | S_1 > 0]\). Panel (c) displays the probability that the guaranty vehicle cannot cover all losses \(P(S_1^{(0)} < S_1)\) and panel (d) the expected amount of insufficient coverage \(E[(S_1 - S_1^{(0)}) | S_1^{(0)} < S_1]\).
Figure 7: Effects on shortfall measures of financial company 1 (or 2) if financial company 1 purchases fraction $\gamma^{(1)}$ of company 2’s financial guaranty bonds and financial company 2 purchases fraction $\gamma^{(2)}$ of company 1’s financial guaranty bonds, with $\gamma^{(1)} = \gamma^{(2)}$. Panel (a) shows the shortfall probability $P(S_1 > 0)$ and panel (b) the expected shortfall given default $E[S_1 | S_1 > 0]$. Panel (c) displays the probability that the guaranty vehicle cannot cover all losses $P(S^{(1)}_1 < S_1)$ and panel (d) the expected amount of insufficient coverage $E[(S_1 - S^{(1)}_1) | S^{(1)}_1 < S_1]$. 

Case 2
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Advantages and Challenges

Challenges

- By investing in its own or a foreign guaranty vehicle, a financial company can lever out the purpose of the guaranty system
  - Clear investment limits needed in supervisory law

- Would transactions costs make the system too expensive?
  - Credit-linked note instead of SPV
  - Credit market is already well-established

- Are there enough investors willing to invest in such a product?
  - Possibility to raise capital through a stepwise increase of the principal starting from zero
Advantages and Challenges

Challenges

- How to deal with the volatility of annual premiums?
  
  ➔ As long as bankruptcy is declared on time, the capital market-based guaranty system can secure clients’ claims
  ➔ Other risk management measures can be taken to reduce the spread required

- Can the capital market provide enough risk-free capital?
  
  ➔ Current insurance guaranty and deposit insurance systems have a similar fund volume which is currently invested in the capital market
Advantages

- Access to high amount of capital
  → Ability to even cover shortfalls of major financial companies
  → Possible protection of all potential clients, from privates to large companies

- Risk-adequate premiums

- No cross-subsidization effects
  → client just receive payments from their guaranty vehicle
  → No incentives to close contracts with worst performing financial company
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Thank you for your attention
References