Institute of Insurance Economics

University of St.Gallen

# 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**

# Background and Motivation

## 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

# Background and Motivation

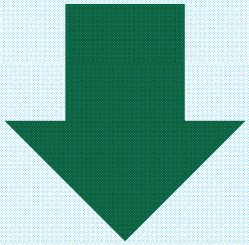
## The problem of non-risk-based contributions

- 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

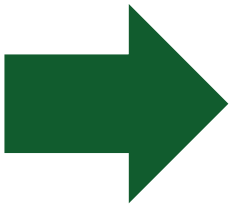


- The introduction of guaranty systems in a competitive market as well as the calculation of fund contribution need to be challenged
- Alternative solutions how to handle with the bankruptcy of an insurance company need to be found

# Background and Motivation

## Own research basis in the context of guaranty systems

- Under What Conditions is an Insurance Guaranty Fund Beneficial for Policyholders? (Rymaszewski, Schmeiser, and Wagner, forthcoming in: The Journal of Risk and Insurance)
- The Impact of Introducing Insurance Guaranty Schemes on Pricing and Capital Structures (Schmeiser and Wagner, 2010, Working Paper under review)
- Insurance Guaranty Funds and Their Relation to Solvency Regulation (Rymaszewski and Schmeiser, 2011, book chapter in: The Future Insurance Regulation and Supervision)



- A Proposal for a Capital Market-Based Guaranty Scheme for the Financial Industry (Schmeiser et al., 2011, Working Paper)

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# Literature Review

- Various overviews of existing financial guaranty systems in the insurance and banking industry

  (Oxera, 2007; Schmeiser and Wagner, 2010; Feldhaus and Kazenski, 1998; Demirgüc-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)

# Literature Review

- 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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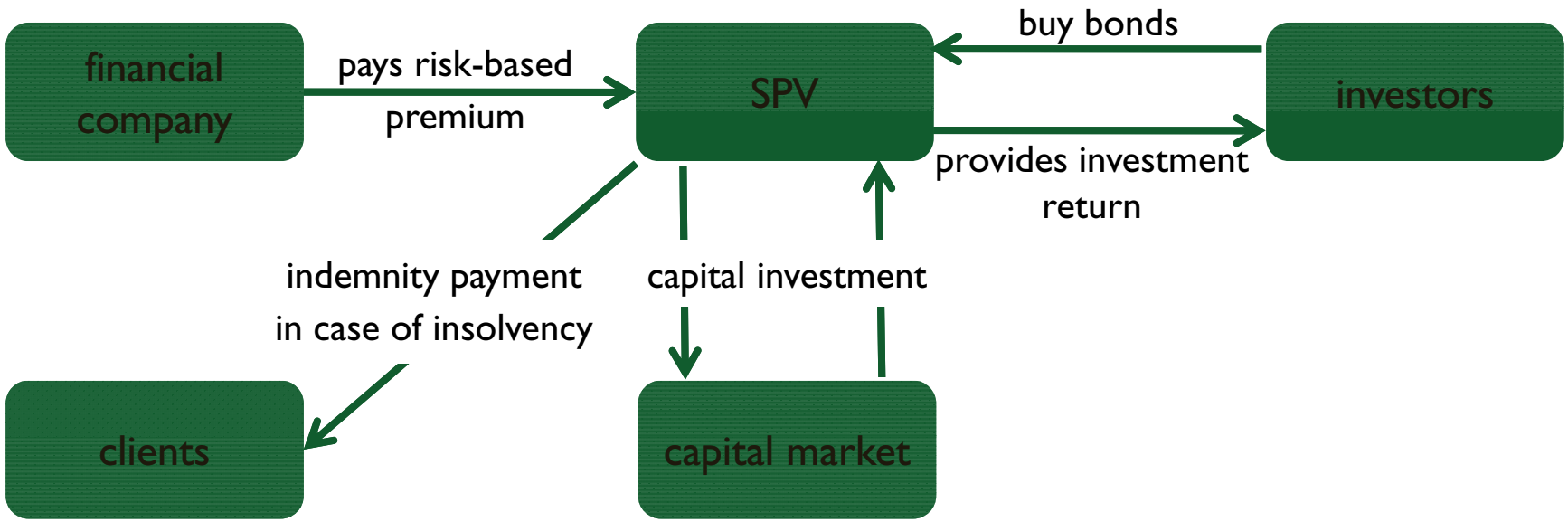
# Proposal of a Capital Market-based Guaranty Scheme

## 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



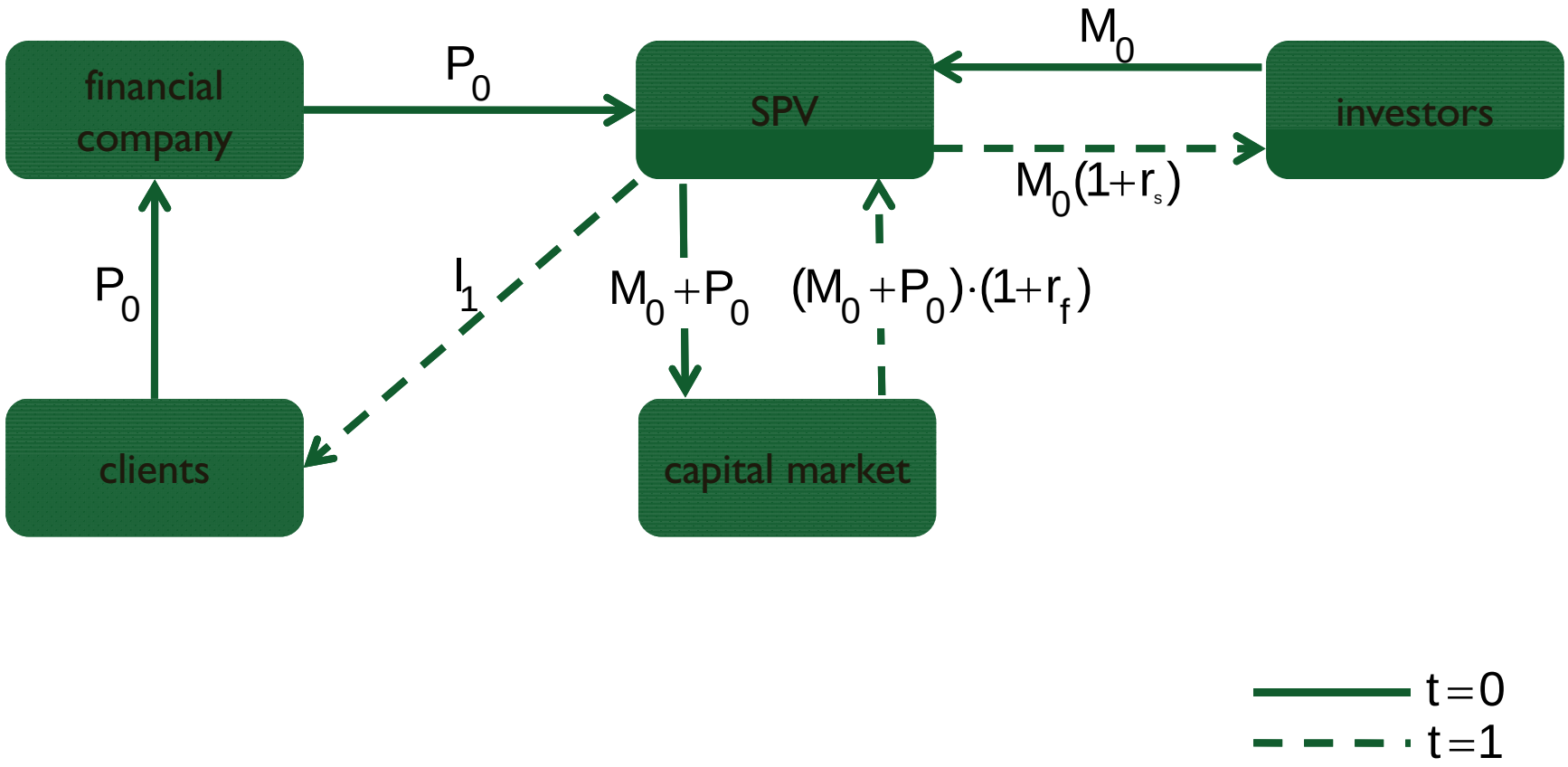
# Proposal of a Capital Market-based Guaranty Scheme

## 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



# 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: $S_1^{(\beta)} = (M_0 + P_0)(1 + r_{\text{f}}) \geq 0$
- Investors' return: $r_{\text{s}} = \frac{(M_0+P_0)(1+r_{\text{f}})-I_1}{M_0} - 1$

| | |
|---|---|
| $M_0^{(\text{ext})}$, $M_0^{(\text{int})}$ | amount of total principal purchased by external and internal investors |
| $\alpha$ | percentage of total principal purchased by external investors |
| $A_1$, $L_1$ | assets and liabilities in $t = 1$ |
| $S_1^{(\beta)}$ | coverage cap |
| $P_0$ | premium payment |

# Proposal of a Capital Market-based Guaranty Scheme

## Stakeholders' positions

- Clients

$$
\begin{aligned}
W_0^{(c)} &= -P_0 + \mathrm{PV}\left[I_1\right] \\
&= -P_0 + \mathrm{PV}\left[\min\left(S_1^{(\beta)}, S_1\right)\right] \\
&= -\underbrace{P_0}_{\text{premium}} + \underbrace{\mathrm{PV}\left[S_1\right]}_{\text{PV of claims}} \underbrace{-\mathrm{PV}\left[\max\left(S_1 - S_1^{(\beta)}, 0\right)\right]}_{\text{PV of DPO}}
\end{aligned}
$$

- Investors

$$
\begin{aligned}
W_0^{(i)} &= \alpha\left(-M_0 + \mathrm{PV}\left[\underbrace{\left(P_0 + M_0\right)\left(1 + r_{\mathrm{f}}\right)}_{S_1^{(\beta)}} - I_1\right]\right) \\
&= \alpha\left(-M_0 + \mathrm{PV}\left[S_1^{(\beta)}\right] + \mathrm{PV}\left[\max\left(S_1 - S_1^{(\beta)}, 0\right)\right] - \mathrm{PV}\left[S_1\right]\right)
\end{aligned}
$$

# Proposal of a Capital Market-based Guaranty Scheme

## Valuation of Stakeholders' positions

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

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

  - and the principal

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

# Proposal of a Capital Market-based Guaranty Scheme

## 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

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

- with

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

# 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

$$\begin{aligned}&\mathrm{PV}\left[\max\left(S_1 - S_1^{(\beta)}, 0\right)\right] = \mathrm{PV}\left[\max\left((L_1 - A_1)^+ - S_1^{(\beta)}, 0\right)\right] \\ &= \mathrm{PV}\left[\max\left(L_1 - A_1 - S_1^{(\beta)}, 0\right)\right]\end{aligned}$$

- and, subsequently, be solved

$$\begin{aligned}&\mathrm{PV}\left[\max\left(L_1 - A_1 - S_1^{(\beta)}, 0\right)\right] = \mathrm{PV}\left[\max\left((1-\beta)L_1 - A_1, 0\right)\right] \\ &= (1-\beta)L_0 N\left(d_1^{(b)}\right) - A_0 N\left(d_2^{(b)}\right)\end{aligned}$$

$$d_1^{(b)} = \frac{\ln\left(\frac{(1-\beta)L_0}{A_0}\right) + \frac{\hat{\sigma}^2}{2}}{\hat{\sigma}}, \quad d_2^{(b)} = d_1^{(b)} - \hat{\sigma}$$

# Proposal of a Capital Market-based Guaranty Scheme

## 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

$$\begin{aligned} M_0 &= \mathrm{PV}\left[S_1^{(\beta)}\right] - \mathrm{PV}\left[S_1\right] + \mathrm{PV}\left[\max\left(S_1 - S_1^{(\beta)}, 0\right)\right] \\ &= \mathrm{PV}\left[\beta L_1\right] - P_0 \\ &= \beta L_0 - P_0 \end{aligned}$$

# Proposal of a Capital Market-based Guaranty Scheme

## Possible Premium-Principal-Combinations (values in mn currency units)

| $\beta$ | $\mathrm{PV}[S_1]$ | $\mathrm{PV}[(S_1 - S_1^{(\beta)})^+]$ | $\mathrm{PV}[S_1^{(\beta)}]$ | $M_0$ | $P_0$ | $P_0/L_0$ |
|---|---|---|---|---|---|---|
| $\sigma_A = 0.05$ | | | | | | |
| 0.00 | 0.00 | 0.000690 | 0 | 0.000 | 0.000 | 0.000% |
| 0.05 | 0.00 | 0.000028 | 4 | 3.999 | 0.001 | 0.001% |
| 0.10 | 0.00 | 0.000001 | 8 | 7.999 | 0.001 | 0.001% |
| 0.15 | 0.00 | 0.000000 | 12 | 11.999 | 0.001 | 0.001% |
| 0.20 | 0.00 | 0.000000 | 16 | 15.999 | 0.001 | 0.001% |
| 0.25 | 0.00 | 0.000000 | 20 | 19.999 | 0.001 | 0.001% |
| 0.30 | 0.00 | 0.000000 | 24 | 23.999 | 0.001 | 0.001% |
| 0.40 | 0.00 | 0.000000 | 32 | 31.999 | 0.001 | 0.001% |
| 0.50 | 0.00 | 0.000000 | 40 | 39.999 | 0.001 | 0.001% |
| $\sigma_A = 0.10$ | | | | | | |
| 0.00 | 0.07 | 0.065332 | 0 | 0.000 | 0.000 | 0.000% |
| 0.05 | 0.07 | 0.015557 | 4 | 3.950 | 0.050 | 0.062% |
| 0.10 | 0.07 | 0.002772 | 8 | 7.937 | 0.063 | 0.078% |
| 0.15 | 0.07 | 0.000351 | 12 | 11.935 | 0.065 | 0.081% |
| 0.20 | 0.07 | 0.000030 | 16 | 15.935 | 0.065 | 0.082% |
| 0.25 | 0.07 | 0.000002 | 20 | 19.935 | 0.065 | 0.082% |
| 0.30 | 0.07 | 0.000000 | 24 | 23.935 | 0.065 | 0.082% |
| 0.40 | 0.07 | 0.000000 | 32 | 31.935 | 0.065 | 0.082% |
| 0.50 | 0.07 | 0.000000 | 40 | 39.935 | 0.065 | 0.082% |

$A_0$=100

$L_0$=80

$\sigma_L$=0.05

$\rho_{A,L}$=0.1

$r_f$=0.02

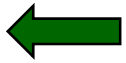
# Proposal of a Capital Market-based Guaranty Scheme

## 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

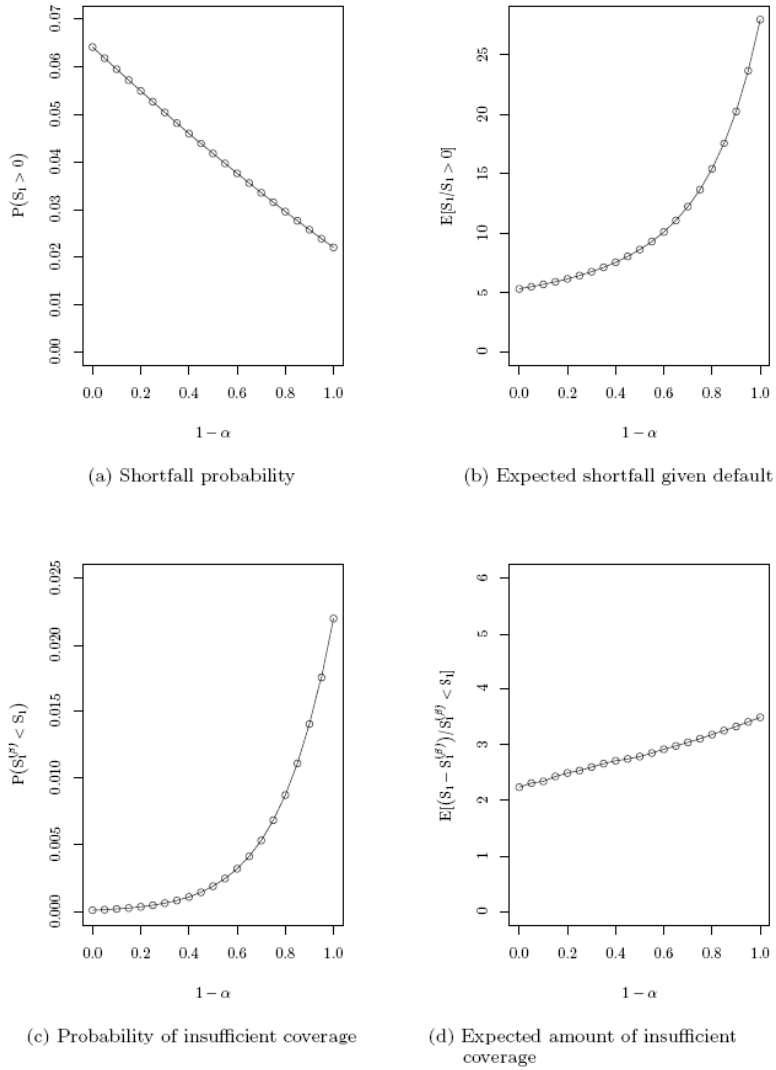
| Parameter | Denotation | Value |
|---|---|---|
| Initial assets | $A_0$ | 100 |
| Asset drift | $\mu_A$ | 0.05 |
| Volatility of assets | $\sigma_A$ | 0.15 |
| Initial liabilities | $L_0$ | 80 |
| Liability drift | $\mu_L$ | 0.03 |
| Volatility of liabilities | $\sigma_L$ | 0.05 |
| Correlation between assets and liabilities | $\rho_{A,L}$ | 0.1 |
| Risk-free rate of interest | $r_f$ | 0.02 |
| Coverage parameter | $\beta$ | 0.3 |
| Percentage purchased by external investors | $\alpha$ | [0;1] |



Numerical example

# Proposal of a Capital Market-based Guaranty Scheme

## Case 1




(a) Shortfall probability

(b) Expected shortfall given default

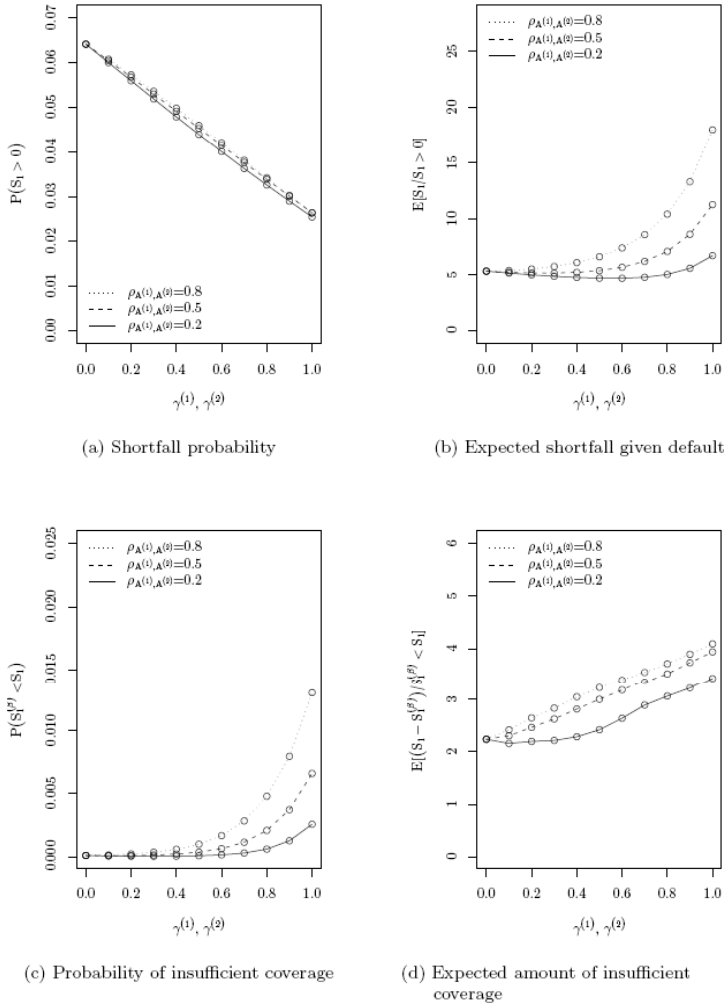
(c) Probability of insufficient coverage

(d) Expected amount of insufficient coverage

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 $E[S_1 \mid S_1 > 0]$. Panel (c) displays the probability that the guaranty vehicle cannot cover all losses $P(S_1^{(\beta)} < S_1)$ and panel (d) the expected amount of insufficient coverage $E[(S_1 - S_1^{(\beta)}) \mid S_1^{(\beta)} < S_1]$.

# Proposal of a Capital Market-based Guaranty Scheme

## Case 2




(a) Shortfall probability

(b) Expected shortfall given default

(c) Probability of insufficient coverage

(d) Expected amount of insufficient coverage

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 $E[S_1 \mid S_1 > 0]$. Panel (c) displays the probability that the guaranty vehicle cannot cover all losses $P(S_1^{(\beta)} < S_1)$ and panel (d) the expected amount of insufficient coverage $E[(S_1 - S_1^{(\beta)}) \mid S_1^{(\beta)} < S_1]$.

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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 and Challenges

## 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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## Discussion

# Thank you for your attention


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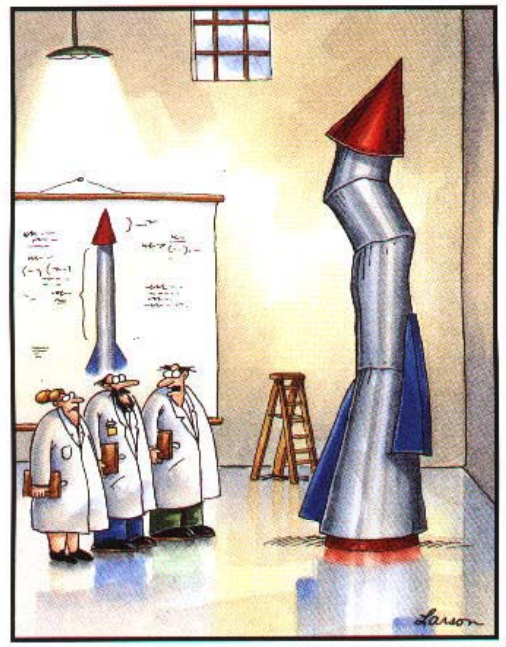

"It's time we face reality, my friends. ...
We're not exactly rocket scientists."

# References


- Bernet, B. and S. Walter, 2009. Design, Structure and Implementation of a Modern Deposit Insurance Scheme. SUERF Studies.
- Cariboni, J., K. Vanden Branden, F. Campolongo, and M. De Cesare, 2008. Deposit protection in the EU: State of play and future prospects. Journal of Banking Regulation, 9(2):82–101.
- Cummins, J., 1988. Risk-Based Premiums for Insurance Guaranty Funds. Journal of Finance, 43(4):823–839.
- Demirgüc-Kunt, A., E. Kane, and L. Laeven, 2008. Determinants of Deposit-Insurance Adoption and Design. Journal of Financial Intermediation, 17(3):407–438.
- Duan, J.-C. and M.-T. Yu, 2005. Fair Insurance Guaranty Premia in the Presence of Risk-Based Capital Regulations, Stochastic Interest Rate and Catastrophe Risk. Journal of Banking and Finance, 29(10):2435–2454.
- Duffie, D., R. Jarrow, A. Purnanandam, and W. Yang, 2003. Market pricing of deposit insurance. Journal of Financial Services Research, 24(2):93–119.
- European Commission JRC, 2008. Risk-based Contributions in EU Deposit Guarantee Schemes: Current Practices.
- European Commission JRC, 2009. Possible Models for Risk-Based Contributions to EU Deposit Guarantee Schemes.
- Feldhaus, W. and P. Kazenski, 1998. Risk-Based Guaranty Fund Assessments. Journal of Insurance Regulation, 17(1):42–63.
- Frolov, M., 2004. Deposit Insurance and Its Design: A Literature Review. Keio University Market Quality Research Project Discussion Paper Series DP2004-004.
- International Association of Deposit Insurers, 2009. Funding of Deposit Insurance Systems. Guidance Paper.
- Madan, D. and H. Unal, 2008. Pricing Reinsurance Contracts on FDIC Losses. Financial Markets, Institutions and Instruments, 17(3):225–247.
- Oxera, 2007. Insurance Guarantee Schemes in the EU: Comparative Analysis of Existing Schemes, Analysis of Problems and Evaluation of Options.
- Pennacchi, G., 2009. Deposit Insurance. Working Paper.
- Plaut, S., 1991. Reinsurance and Securitization of Deposit Insurance; A Workable Proposal for Risk-Based Pricing. Research Program in Finance Working Papers.
- Schmeiser, H. and J. Wagner, 2010. The Impact of Introducing Insurance Guaranty Schemes on Pricing and Capital Structures. Working Papers on Risk Management and Insurance (IVW-HSG), No. 80.
- Sheehan, K. P., 2003. Catastrophe Securities and the Market Sharing of Deposit Insurance Risk. FDIC Banking Review, (1997):1–16.