Under Which Conditions is an Insurance Guaranty Fund Beneficial for Policyholders?

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Customer protection through securing institutions' liquidity

- Current financial crisis and insolvency costs reveal the necessity for a reconsideration of regulation design and solvency measurement.
  → *Development of the European Solvency II, e.g. CEIOPS (2009).*
- Aim of solvency regulation and supervision is to reduce insurers' default probability to a predefined small, yet still positive level.
  → *Further questions arise with regard to an insurance company default and coverage of associated insolvency costs.*
  → *Apparently no system in-place for controlled run-off.*
- Possible response: Guaranty fund (entirely) financed by all companies.
  → *Forces internalization of the entire industry's insolvency costs.*
- However, since inhomogeneity of companies' risk, calculation of risk-based premiums and definition of fund's pay-outs crucial.
  → *Typically not considered in insurance practice.*

Literature review of selected scientific contributions

- Costs connected with insolvency as main reason for regulation.
  → *E.g. Mayes (2004) (with special focus on the banking sector).*
- Guaranty fund should demand risk-based premium payments to avoid adverse incentives.
  → *See Cummins (1988); Duan and Yu (2005).*
- Risk-subsidy effect: insurers increase market value by raising the volatility of their assets.
  → *See Lee et al. (1997) (empirical significance; but no influence of monitoring effect when charging ex-post risk-inadequate fees).*
- Ex-post charges cannot be organized in a risk-based way because the insolvent company, which may have been the riskiest one, is typically not charged at all.
  → *See Han et al. (1997); Brewer-III et al. (1997); Downs and Sommer (1999); Sommer (1996).*

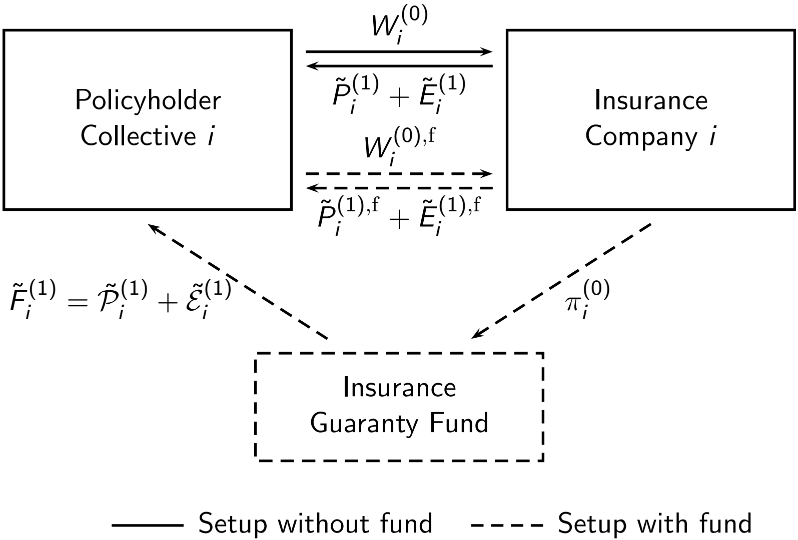
What is the contribution of this work?

- If a contingent claim approach is applied to value the claims of an insurance company's stakeholders, policyholders cannot be made better off by the introduction of a fairly designed guaranty fund.
- In an incomplete market setting, it is shown under which conditions a fund is advantageous for risk-averse policyholders:
  - Possible diversification benefits measured by an increase in the utility of the policyholders.
  - Correlation between the fund's payoff and the insurer's assets as well as the premium level in the fund are important in order to draw benefits.
- Homogeneous companies: If diversification benefits arise, the increase in utility is equally allocated to all participating policyholders.
- Heterogeneous companies: Fund is in general no longer beneficial – at least not to the same extent – for all policyholders.
  $\rightarrow$ *Concept of utility-based premium calculations.*

Model framework

- Set $\mathcal{C} = \{1, \ldots, M\}$ of M mutual companies.
  → *Oneness of policyholders and owners.*
- Analysis in a one-period model.
- Hypotheses:
  - Identical investment strategies of companies and fund.
  - Guaranty scheme funded solely by companies
  - No (additional) transaction costs due to the fund.
- In the arbitrage-free setting of the contingent claims approach, the pooling of insurance claims in an insurance guaranty fund does not change the wealth situation of either policyholders or shareholders.
  → *Also see Doherty and Garven (1986); Cummins (1988).*
- More precisely, if both stakeholder groups apply the same form of present value calculus and the stakes are priced in a fair way (present value of future cash flow equals the initial contribution), there will be no advantage from an insurance guaranty fund.

Summary of cash flows and stakeholder positions



Summary of notations

- $W_i^{(0)}, W_i^{(0),\mathrm{f}}$ = aggregated premium paid by the policyholders without/with fund at $t = 0$.
- $\tilde{P}_i^{(1)}, \tilde{P}_i^{(1),\mathrm{f}}$ = insureds' position without/with fund at $t = 1$.
- $\tilde{E}_i^{(1)}, \tilde{E}_i^{(1),\mathrm{f}}$ = owners' stake without/with fund at $t = 1$.
- $\pi_i^{(0)}$ = premium charged by the fund at $t = 0$.
- $\tilde{\mathcal{P}}_i^{(1)}$ = claims against the fund at $t = 1$.
- $\tilde{\mathcal{E}}_i^{(1)}$ = equity stake in the fund at $t = 1$.

Aggregated policyholders' position at time $t = 0$

- Without guaranty fund

$$\begin{aligned} W_i^{(0)} &= P_i^{(0)} + E_i^{(0)} \\ &= \mathrm{PV}[\min(\tilde{A}_i^{(1)}, \tilde{S}_i^{(1)})] + \mathrm{PV}[\max(\tilde{A}_i^{(1)} - \tilde{S}_i^{(1)}, 0)] = \mathrm{PV}[\tilde{A}_i^{(1)}] \end{aligned}$$

$\rightarrow \max(\tilde{S}_i^{(1)} - \tilde{A}_i^{(1)}, 0)$ *stands for the insolvency put option.*

- With guaranty fund

$$\begin{aligned} W_i^{(0)} = W_i^{(0),\mathrm{f}} &= P_i^{(0),\mathrm{f}} + E_i^{(0),\mathrm{f}} + \mathcal{P}_i^{(0)} + \mathcal{E}_i^{(0)} \\ &= \mathrm{PV}[\min(\tilde{A}_i^{(1),\star}, \tilde{S}_i^{(1)})] + \mathrm{PV}[\max(\tilde{A}_i^{(1),\star} - \tilde{S}_i^{(1)}, 0)] + \mathrm{PV}[\tilde{F}_i^{(1)}] \end{aligned}$$

where $A_i^{(0),\star} = \mathrm{PV}[\tilde{A}_i^{(1),\star}] = \mathrm{PV}[\tilde{A}_i^{(1)}] - \mathrm{PV}[\tilde{\pi}_i^{(1)}] = A_i^{(0)} - \pi_i^{(0)}$.

- If $\mathrm{PV}[\tilde{F}_i^{(1)}] = \pi_i^{(0)}$, the present value of the policyholders' claims with respect to the fund equals the initial contribution.
  $\rightarrow$ *This is fulfilled in an arbitrage-free market; otherwise systematic wealth transfers between different insurers would take place.*

Utility of policyholders' wealth positions at time $t = 1$

- Without guaranty fund

$$\phi_i^{(1)} = \langle \tilde{W}_i^{(1)} \rangle - \frac{a_i}{2} \mathrm{var}(\tilde{W}_i^{(1)}) = \langle \tilde{A}_i^{(1)} \rangle - \frac{a_i}{2} \mathrm{var}(\tilde{A}_i^{(1)}),$$

where a_i defines the risk aversion parameter.

- With guaranty fund

$$\begin{aligned} \phi_i^{(1),\mathrm{f}} &= \langle \tilde{W}_i^{(1),\mathrm{f}} \rangle - \frac{a_i}{2} \mathrm{var}(\tilde{W}_i^{(1),\mathrm{f}}) \\ &= \langle \tilde{A}_i^{(1),\star} + \tilde{F}_i^{(1)} \rangle - \frac{a_i}{2} \mathrm{var}(\tilde{A}_i^{(1),\star} + \tilde{F}_i^{(1)}) \\ &= \langle \tilde{A}_i^{(1)} - \tilde{\pi}_i^{(1)} + \tilde{F}_i^{(1)} \rangle - \frac{a_i}{2} \mathrm{var}(\tilde{A}_i^{(1)} - \tilde{\pi}_i^{(1)} + \tilde{F}_i^{(1)}). \end{aligned}$$

- Absolute change in utility due to the introduction of the guaranty fund

$$\begin{aligned} \Delta_{\mathrm{a}} \phi_i^{(1)} &= \phi_i^{(1),\mathrm{f}} - \phi_i^{(1)} \\ &= \langle \tilde{F}_i^{(1)} - \tilde{\pi}_i^{(1)} \rangle - \frac{a_i}{2} \left[\mathrm{var}(\tilde{F}_i^{(1)} - \tilde{\pi}_i^{(1)}) + 2\mathrm{cov}(\tilde{A}_i^{(1)}, \tilde{F}_i^{(1)} - \tilde{\pi}_i^{(1)}) \right]. \end{aligned}$$

Minimum requirement: Self-supporting guaranty fund

- Cash flow $\tilde{F}_i^{(1)}$ dependent on
  - the number of companies M,
  - their asset and claim distributions,
  - the correlation structures between assets and claims,
  - the premiums charged and their stochastic distribution at time $t = 1$.
- Minimal requirement: the fund has to be self-supporting

$$\sum_{i \in \mathcal{C}} \langle \tilde{F}_i^{(1)} \rangle = \sum_{i \in \mathcal{C}} \langle \tilde{\pi}_i^{(1)} \rangle.$$

  $\rightarrow$ *No external agent (e.g., taxpayer) has to cover a part of the default risk through (contingent) payments to the fund.*

- Self-supporting requirement implies that the derivation of an adequate structure for the payoff scheme is strongly determined.
  $\rightarrow$ *However, in general, various schemes can be derived, thereby implying different incentives for the market participants.*

Risk-neutral investors

- Assumption: policyholder collective of company j does not adjust for risk while making its financial decisions.
  → *Indifference between both setups, without or with the guaranty fund, i.e.* $\phi_j^{(1)} = \phi_j^{(1),\mathrm{f}}$.
- Implication:
$$\Delta_{\mathrm{a}}\phi_j^{(1)} = \phi_j^{(1),\mathrm{f}} - \phi_j^{(1)} \overset{!}{=} 0.$$
- Since $a_j = 0$:
$$\Delta_{\mathrm{a}}\phi_j^{(1)} = \langle \tilde{F}_j^{(1)} - \tilde{\pi}_j^{(1)} \rangle \overset{!}{=} 0 \quad \Leftrightarrow \quad \langle \tilde{F}_j^{(1)} \rangle = \langle \tilde{\pi}_j^{(1)} \rangle.$$
- Condition $\phi_j^{(1)} = \phi_j^{(1),\mathrm{f}}$ is fulfilled if and only if $\langle \tilde{F}_j^{(1)} \rangle = \langle \tilde{\pi}_j^{(1)} \rangle$.
- Since the guaranty fund is supposed to be self-supporting, the latter condition is always accounted for on an aggregated level.
  → *If all investors are risk-neutral, there is no possibility to achieve a utility-based Pareto enhancement by introducing a guaranty fund.*

Risk-averse policyholders, $a_i > 0$, $\forall i \in \mathcal{C}$

- Pooling of claims in a fund is beneficial if

$$\begin{aligned}
\Delta_{\mathrm{a}}\phi_i^{(1)} > 0 \quad &\Leftrightarrow \quad \langle \tilde{F}_i^{(1)} - \tilde{\pi}_i^{(1)} \rangle - \frac{a_i}{2}\left[\mathrm{var}(\tilde{F}_i^{(1)} - \tilde{\pi}_i^{(1)}) + 2\mathrm{cov}(\tilde{A}_i^{(1)}, \tilde{F}_i^{(1)} - \tilde{\pi}_i^{(1)})\right] > 0 \\
&\Leftrightarrow \quad \langle \tilde{F}_i^{(1)} - \tilde{\pi}_i^{(1)} \rangle - \frac{a_i}{2}\Big[\mathrm{var}(\tilde{F}_i^{(1)}) + \mathrm{var}(\tilde{\pi}_i^{(1)}) - 2\mathrm{cov}(\tilde{F}_i^{(1)}, \tilde{\pi}_i^{(1)}) \\
&\qquad\qquad + 2\mathrm{cov}(\tilde{A}_i^{(1)}, \tilde{F}_i^{(1)}) - 2\mathrm{cov}(\tilde{A}_i^{(1)}, \tilde{\pi}_i^{(1)})\Big] > 0 \\
&\Leftrightarrow \quad \langle \tilde{F}_i^{(1)} - \tilde{\pi}_i^{(1)} \rangle + a_i\Big[\mathrm{cov}(\tilde{A}_i^{(1)}, \tilde{\pi}_i^{(1)}) + \mathrm{cov}(\tilde{F}_i^{(1)}, \tilde{\pi}_i^{(1)}) - \mathrm{cov}(\tilde{F}_i^{(1)}, \tilde{A}_i^{(1)}) \\
&\qquad\qquad - \frac{1}{2}\mathrm{var}(\tilde{F}_i^{(1)}) - \frac{1}{2}\mathrm{var}(\tilde{\pi}_i^{(1)})\Big] > 0.
\end{aligned}$$

- Investigation of the inequality:
  - Value $\langle \tilde{F}_i^{(1)} - \tilde{\pi}_i^{(1)} \rangle = \langle \tilde{F}_i^{(1)} \rangle - \langle \tilde{\pi}_i^{(1)} \rangle$ is dependent on the premiums paid by the companies and the payoff scheme $\tilde{F}_i^{(1)}$.
  - Correlation $\rho(\tilde{A}_i^{(1)}, \tilde{\pi}_i^{(1)}) = 1$, and $\rho(\tilde{F}_i^{(1)}, \tilde{\pi}_i^{(1)}) = \rho(\tilde{F}_i^{(1)}, \tilde{A}_i^{(1)})$, since same asset allocation is assumed.

Risk-averse policyholders II

- Condition cannot be fulfilled whenever both the insurance company and the fund are investing only in risk-free assets.
  $\rightarrow$ *For diversification, a positive asset return volatility is needed.*
- Complex relationship between $\tilde{F}_i^{(1)}$ and the asset $\tilde{\mathbf{A}}^{(1)}$, claim $\tilde{\mathbf{S}}^{(1)}$, and premium distributions $\tilde{\mathbf{\Pi}}^{(1)}$ of all companies.
  $\rightarrow$ *Explicit derivation of necessary conditions for a positive diversification benefit is not practicable without loss of generality.*
- Changes in utility implied by the existing guaranty funds are not, in general, identical for all market players.
  $\rightarrow$ *No guarantee that different policyholder groups profit equally from a utility increase or decrease.*

Risk-averse policyholders III

- $\langle \tilde{F}_i^{(1)} \rangle = \langle \tilde{\pi}_i^{(1)} \rangle$ does not hold in general.
  $\rightarrow$ *Dependence on payoff-structure and asset and claims distributions.*
- Premium principle

$$\text{Premiums } \mathbf{\Pi}^{(0)} = (\pi_i^{(0)})_{i \in \mathcal{C}} \text{ such that } \langle \tilde{F}_i^{(1)} \rangle = \langle \tilde{\pi}_i^{(1)} \rangle, \forall i \in \mathcal{C}.$$

  $\rightarrow$ *Even if all participants have the same* $a_i > 0$*, the effect is different for every insurer.*
- Well-known problem of allocation of diversification effects.
  $\rightarrow$ *Capital allocation dilemma discussed by, e.g., Phillips et al. (1998); Myers and Read (2001); Sherris (2006); Gründl and Schmeiser (2007).*
- Identical change in utility if all companies are homogeneous, i.e. have identical asset and claim distributions, as well as equal correlation structures between assets and claims.

Utility-based premiums in the general case

- Demand premium calculation leading to an equal utility increase for all companies.
  → *Calculation possible, if all can reach the preset utility increase.*
- Premium principle:

$$\text{Premiums } \mathbf{\Pi}^{(0)} = (\pi_i^{(0)})_{i \in \mathcal{C}} \text{ such that } \Delta_{\mathrm{a}} \phi_i^{(1)}(\mathbf{\Pi}^{(0)}) = K, \forall i \in \mathcal{C}.$$

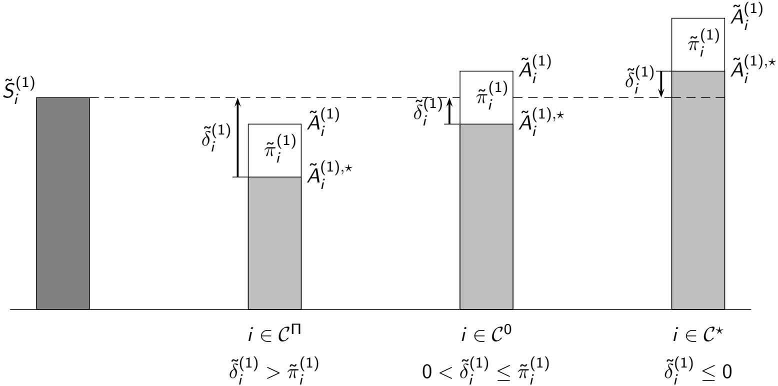
  → *Change in utility considered as function of all premiums charged.*
  → *Depending on K, a set of premium combinations can be found.*
- Other possible principles could use
  - the relative change in utility $\Delta_{\mathrm{r}} \phi_i^{(1)} = \Delta_{\mathrm{a}} \phi_i^{(1)} / |\phi_i^{(1)}|$,
  - the marginal change in utility $\Delta_{\mathrm{a}} \phi_i^{(1)} / \pi_i^{(0)}$, or
  - the ratio $[\Delta_{\mathrm{a}} \phi_i^{(1)} / |\phi_i^{(1)}|] / \pi_i^{(0)}$.

Derivation of an exemplary payoff function I

- Policyholder deficit in the setup with an insurance guaranty fund

$$\tilde{\delta}_i^{(1)} = \tilde{S}_i^{(1)} - \tilde{A}_i^{(1),\star}.$$

- With regard to their respective safety levels, companies are classified:



Derivation of an exemplary payoff function II

- Fund deficit

$$\tilde{\gamma}^{(1)} = \sum_{i=1}^{M} \left(\tilde{S}_i^{(1)} - \tilde{A}_i^{(1),\star} \right)^+ - \sum_{i=1}^{M} \tilde{\pi}_i^{(1)}.$$

- Fund's payoff structure at time $t = 1$ defined by $\tilde{F}_i^{(1)}(\tilde{\mathbf{A}}^{(1)}, \tilde{\mathbf{S}}^{(1)}, \tilde{\mathbf{\Pi}}^{(1)})$:

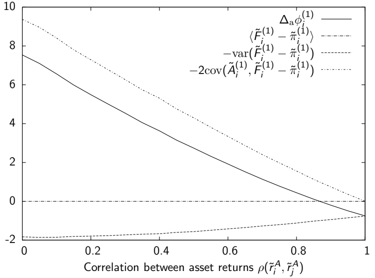
$$\tilde{F}_i^{(1)} = \begin{cases} \tilde{\delta}_i^{(1)} & \text{for } i \in \mathcal{C}^{\Pi} \text{ and if } \tilde{\gamma}^{(1)} \leq 0 \\ \tilde{\kappa}_i^{(1)} & \text{for } i \in \mathcal{C}^{0} \text{ and if } \tilde{\gamma}^{(1)} \leq 0 \\ \frac{\tilde{\pi}_i^{(1)}}{\sum_{j\in\mathcal{C}^\star} \tilde{\pi}_j^{(1)}} \left[\sum_{j\in\mathcal{C}} \tilde{\pi}_j^{(1)} - \sum_{j\in\mathcal{C}^\Pi} \tilde{\delta}_j^{(1)} - \sum_{j\in\mathcal{C}^0} \tilde{\kappa}_j^{(1)} \right] & \text{for } i \in \mathcal{C}^{\star} \text{ and if } \tilde{\gamma}^{(1)} \leq 0 \\ \frac{\tilde{\delta}_i^{(1)}}{\sum_{j\in(\mathcal{C}^\Pi\cup\mathcal{C}^0)} \tilde{\delta}_j^{(1)}} \sum_{j\in\mathcal{C}} \tilde{\pi}_j^{(1)} & \text{for } i \in \mathcal{C}^{\Pi} \cup \mathcal{C}^{0}\text{, if } \tilde{\gamma}^{(1)} > 0 \\ 0 & \text{for } i \in \mathcal{C}^{\star} \text{ and if } \tilde{\gamma}^{(1)} > 0 \end{cases}$$

where, $\tilde{\kappa}_i^{(1)} = \max \left(\tilde{\delta}_i^{(1)}, \frac{\tilde{\pi}_i^{(1)}}{\sum_{j\in\mathcal{C}\setminus\mathcal{C}^\Pi} \tilde{\pi}_j^{(1)}} \left[\sum_{j\in\mathcal{C}} \tilde{\pi}_j^{(1)} - \sum_{j\in\mathcal{C}^\Pi} \tilde{\delta}_j^{(1)} \right] \right).$

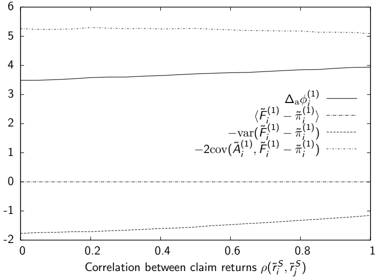
Numerical illustration

- Analysis deployed by means of a Monte Carlo simulation with $N = 1\,000\,000$ iterations.
- Use of presented exemplary payoff scheme.
- Asset and claim returns are modeled as normally distributed variables.
- Assets and claims at time $t = 1$ follow lognormal distributions:
  $A_i^{(1)} = A_i^{(0)} e^{\tilde{r}_i^A}, \qquad \tilde{\pi}_i^{(1)} = \pi_i^{(0)} e^{\tilde{r}_i^A}, \qquad \tilde{S}_i^{(1)} = S_i^{(0)} e^{\tilde{r}_i^S}.$
- "Standard case":
  - $A_i^{(0)} = 60$, $\pi_i^{(0)} = 5$, $S_i^{(0)} = 40$
  - $\langle \tilde{r}_i^A \rangle = 0.15$, $\sigma(\tilde{r}_i^A) = 0.2$; $\langle \tilde{r}_i^S \rangle = 0.1$, $\sigma(\tilde{r}_i^S) = 0.15$
  - $\rho(\tilde{r}_i^A, \tilde{r}_j^A) = 0.4$, $\rho(\tilde{r}_i^S, \tilde{r}_j^S) = 0.3$
  - $a_i = 2$

Diversification benefits in the case of homogeneous companies I



(a) Sensitivity on $\rho(\tilde{r}_i^A, \tilde{r}_j^A)$.



(b) Sensitivity on $\rho(\tilde{r}_i^S, \tilde{r}_j^S)$.

Figure: Sensitivity of the change in utility $\Delta_{\mathrm{a}}\phi_i^{(1)}$ on the correlation between (a) asset returns $\rho(\tilde{r}_i^A, \tilde{r}_j^A)$, and (b) claim returns $\rho(\tilde{r}_i^S, \tilde{r}_j^S)$.

$\rightarrow$ *Less diversification in fund with increasing correlation between assets.*

$\rightarrow$ *Issue, since high asset correlations in capital markets are typically exp.*

Benefits in the case of homogeneous companies II

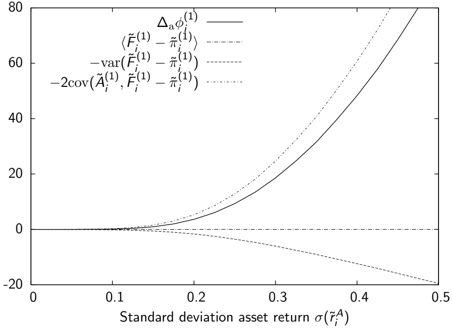
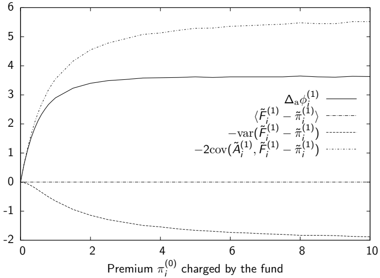


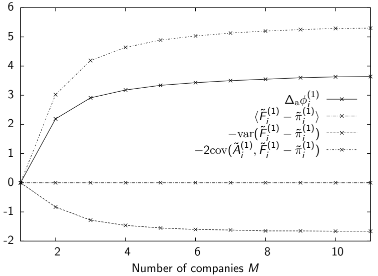
Figure: Sensitivity of the change in utility $\Delta_a \phi_i^{(1)}$ on the standard deviation of asset returns $\sigma(\tilde{r}_i^A)$.

$\rightarrow$ *Slightly negative effect of pooling when assets are invested risk-free.*

Benefits in the case of homogeneous companies III



(a) Sensitivity on $\pi_i^{(0)}$.



(b) Sensitivity on M.

Figure: Sensitivity of the change in utility $\Delta_a \phi_i^{(1)}$ (a) on the premium $\pi_i^{(0)}$ charged by the fund and, (b) the number of companies M.

$\rightarrow$ *No significant benefits can be obtained once the necessary funds for decreasing the default probabilities to a minimum level are collected.*

Benefits in the case of homogeneous companies IV

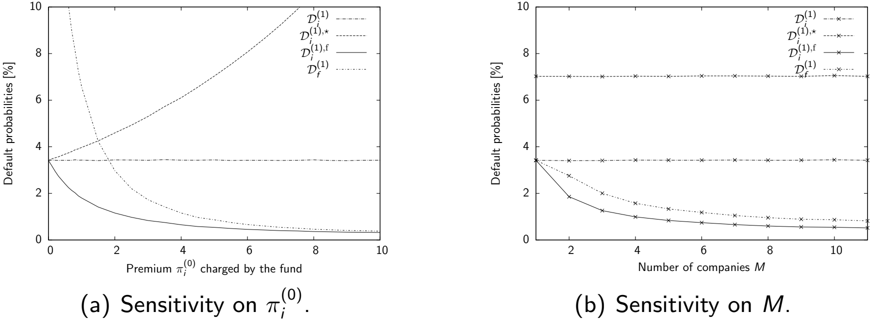


Figure: Sensitivity of the default probabilities on the premium $\pi_i^{(0)}$ charged by the fund and the number M of participating companies.

→ *Default risk for the policyholders reduced to the fund's default risk.*

→ *After the fund premium is charged, the company's default risk increases.*

→ *Limit for risk, and for charged premium, defined by solvency regulation.*

Utility based premiums in the general case I

companies	homogeneous			heterogeneous I			heterogeneous II		
i	$\sigma(\tilde{r}_i^A)$	$\sigma(\tilde{r}_i^S)$	$\pi_i^{(0)}$	$\sigma(\tilde{r}_i^A)$	$\sigma(\tilde{r}_i^S)$	$\pi_i^{(0)}$	$\sigma(\tilde{r}_i^A)$	$\sigma(\tilde{r}_i^S)$	$\pi_i^{(0)}$
1	0.20	0.15	0.49	0.20	0.15	0.45	0.20	0.15	0.51
2	—	—	—	0.16	—	0.22	—	0.11	0.16
3	—	—	—	0.18	—	0.31	—	0.13	0.30
4	—	—	—	0.22	—	0.64	—	0.17	0.69
5	—	—	—	0.24	—	0.82	—	0.19	0.82
$\Delta_r \phi_i^{(1)}$	**1.00 %**			**1.00 %**			**1.00 %**		
$\sum_{i \in \mathcal{C}} \pi_i^{(0)}$	2.45			2.44			2.48		
$\langle \mathbf{\Pi}^{(0)} \rangle$	0.49			0.49			0.50		
$\sigma(\mathbf{\Pi}^{(0)})$	0.00			0.24			0.27		
$\Delta_r \phi_i^{(1)} / \langle(\mathbf{\Pi}^{(0)}\rangle$	2.04 %			2.04 %			2.00 %		

Table: Premiums are calculated along the principle $\Delta_r \phi_i^{(1)}$ fixed to $K = 1.00\%$.

→ *All companies can expect an (equal) increase in utility.*

→ *Relative utility increase per premium similar on aggregate level.*

Utility based premiums in the general case II

companies	heterogeneous III			heterogeneous IV			heterogeneous V		
i	$A_i^{(0)}$	$S_i^{(0)}$	$\pi_i^{(0)}$	$A_i^{(0)}$	$S_i^{(0)}$	$\pi_i^{(0)}$	$A_i^{(0)}$	$S_i^{(0)}$	$\pi_i^{(0)}$
1	60	40	0.50	60	40	0.50	60	40	0.83
2	58	—	0.84	—	38	0.06	30	20	0.95
3	59	—	0.65	—	39	0.27	45	30	0.94
4	61	—	0.33	—	41	0.74	90	60	0.50
5	62	—	0.18	—	42	0.98	120	80	0.12
$\Delta_\mathrm{r}\phi_i^{(1)}$	**1.00 %**			**1.00 %**			**1.00 %**		
$\sum_{i\in\mathcal{C}}\pi_i^{(0)}$	2.50			2.55			3.34		
$\langle\mathbf{\Pi}^{(0)}\rangle$	0.50			0.51			0.67		
$\sigma(\mathbf{\Pi}^{(0)})$	0.26			0.36			0.36		
$\Delta_\mathrm{r}\phi_i^{(1)}/\langle(\mathbf{\Pi}^{(0)}\rangle$	2.01 %			1.96 %			1.49 %		

Table: Premiums are calculated along the principle $\Delta_\mathrm{r}\phi_i^{(1)}$ fixed to $K = 1.00\%$.

Summary

- Within complete markets, the introduction of a guaranty fund cannot improve the position of the policyholders if all stakes are priced fairly.
- In incomplete markets, risk-neutral investors cannot be made better off through the existence of a self-supporting fund.
- If the roll-out of a fund implies transaction costs, its introduction is detrimental to the insureds.
- Case of risk-averse investors in incomplete markets: potential diversification benefits might be achieved by pooling claims.
  $\rightarrow$ *Advantages or disadvantage in terms of utility are only equal for all insurers if they are homogeneous (utility function, risk aversion).*
- Problem of allocating possible diversification benefits similar to the capital allocation problem.
- Concept of a utility-based premium calculation principle to derive charges for a guaranty fund guarantees equal changes in utility among all participants.

Conclusion & Outlook

- In general, wealth or utility transfers between policyholders of different insurers are unavoidable.
- In our setting, insurance guaranty funds may even be systematically unfavorable for all, if, e.g., all insurers invest solely in risk-free assets or in highly correlated assets.
- In our opinion, mentioned aspects can be seen as arguments against the introduction of a fund.
- However positive influence on the agency problems within insurance markets often pointed out.
- Examination of the interactions between both facets of interest.
- Other solutions leading to a controlled run-off of an insurance company should be analyzed in more details in the future.

Further information

- **Reference for this publication**
  P. Rymaszewski, H. Schmeiser, J. Wagner. Under Which Conditions is an Insurance Guaranty Fund Beneficial for Policyholders? *Working Papers on Risk Management and Insurance*, 75, 2010.

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