MCEV: Risk Assessment & Prudential Regulation

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Introduction

- **Life insurers find guarantees harder to earn**
  - *BaFin* warns against low interest rate pressure
- **Agency conflict**
  - Gambling for resurrection
  - Absence of sophisticated claimholders
  - Remuneration like asset manager
- **Prudential Regulation**
  - Effectiveness in controlling risk taking incentive
  - Solvency II initiative
- **Industry move towards market-consistent valuation**

Outline

- **Motivation & Literature**
- **Optionality & Solvency in Analytical Model**
  - Valuation
  - Solvency
- **Market Consistent Embedded Value**
  - Model Building Blocks
  - Asset Allocation, Rates Environment
- **Systemic Risk**
- **Conclusion**

This Paper

- **Paper builds on rationale for prudential regulation to tackle agency problems and compares effectiveness of regulatory regimes**
- **Results suggest:**
  - Owner's call option value increases with risk
  - Solvency II incentivizes risk reduction
  - In a realistic multi-period setting
    - Value of future operations reduces incentive for risk shifting
    - Low yields threaten solvency, calling for a regime that rewards protection of existing asset portfolio
    - Restoring solvency can be optimal for owners

Related Literature

- **Corporate Finance**
  - Determination of debt value (Merton, 1974) and Leland (1994) in optimal firm value context
  - Asset substitution (Jensen et al, 1976) and representation hypothesis of Tirole et al (1994)
- **Insurance**
  - Plantin & Rochet (2007): rationale for regulation
  - Brennan & Schwartz (1976, 1979) and Briys & de Varenne (1994, 1997): fair valuation
  - Wüthrich, Furrer & Bühlmann (2007) in general setup

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Setup of Generic Life Insurer

- **Balance sheet**

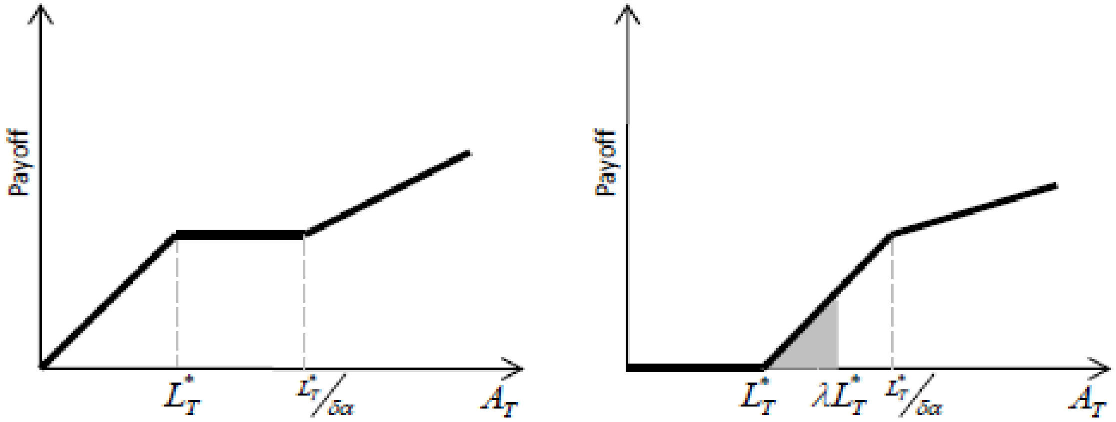
Table 1: Balance sheet of a generic life insurer

Assets		Liabilities & Equity	
Assets	A_0	Liabilities	$L_0 = \alpha A_0$
		Equity	$E_0 = (1-\alpha)A_0$
Total	A_0	Total	A_0

- **Guarantee as minimum payout:** $L_T^* = \alpha A_0 e^{r^* T}$
- **Profit participation as portion of profits allocated to policyholders:** $C_T = [\delta \alpha A_T - L_T^*]$
- **Total payoff:** $L_T(A_T) = [\delta \alpha A_T - L_T^*]^+ + L_T^* - [L_T^* - A_T]^+$

Stakeholder Payoffs

- **Payoff profiles**



(a) Policyholder payoff (b) Equity holder payoff

- **Profit participation & guarantees alter pay profiles**
- **But overall payoff structure still favors asset substitution**

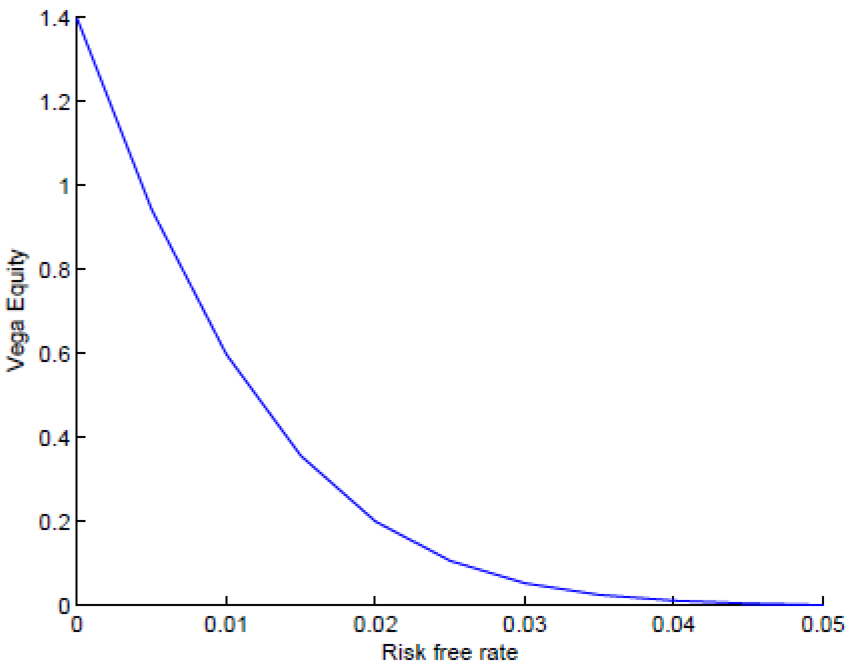
The Agency Conflict

- **Asset Substitution**

Table 2: Impact of Asset Pool Volatility on Fair Equity Value

σ	Fair Equity Value at $t = 0$
0.00%	5
1.00%	5.000
2.00%	5.003
3.00%	5.052
4.00%	5.180
5.00%	5.358

- **Gambling for Resurrection**



VaR and Solvency Regulation

- **Insolvency condition $L_T > A_T$ rewritten**

$$L_0(1+g(\tilde{r})) > A_0(1+\tilde{r})$$

or in terms of the period's net earnings

$$A_0\tilde{r} - L_0 g(\tilde{r}) < -E_0$$

- **Probability of insolvency**

$$\mathrm{Prob}\,(X < -E_0) = \beta$$

- **Regulator requires minimum capital to limit probability of insolvency to $\beta_{\max}$**
- **Solvency Ratio** $\lambda = \dfrac{\text{Available Capital}}{\text{Required Capital}}$

Solvency Regulation

- **Solvency I**
  - Solvency ratio determined by regulatory constant and size of insurance reserves: $\lambda = \frac{E_0}{\vartheta L_0}$
  - No consideration of distributions of risks
- **Solvency II**
  - Various risk sources modeled and combined based on constant correlation assumption and $X \sim N(\mu_X, \sigma_X)$
  - Required capital is a function of the VaR $\lambda = \frac{E_0}{F(X|\beta_{\max})}$
- **Economic VaR**
  - Replace Normal dist of X by empirical distribution

Capital Requirements: Application

- **MCR in different market environments**

Table 3: Solvency Regimes and Regulatory Capital in Analytical Model

		Solvency I		Solvency II		Economic VaR		
μ	σ	E_{MCR}	λ	E_{MCR}	λ	E_{MCR}	λ	$\text{Corr}(A_T, L_T)$
1.00%	2.00%	3.80	131.58%	5.93	84.35%	5.00	100.00%	35.07%
2.25%	2.00%	3.80	131.58%	4.61	108.39%	4.58	109.21%	16.65%
5.00%	2.00%	3.80	131.58%	1.94	258.14%	1.86	268.80%	2.71%
2.25%	0.00%	3.80	131.58%	0.00	NaN	0.00	NaN	-100.00%
2.25%	1.00%	3.80	131.58%	2.27	219.84%	2.26	221.04%	0.00%
2.25%	2.00%	3.80	131.58%	4.61	108.39%	4.58	109.21%	16.65%
2.25%	3.00%	3.80	131.58%	6.70	74.59%	5.00	100.00%	37.94%

- **Asset substitution problem remains under Solvency I which Solvency II can overcome**

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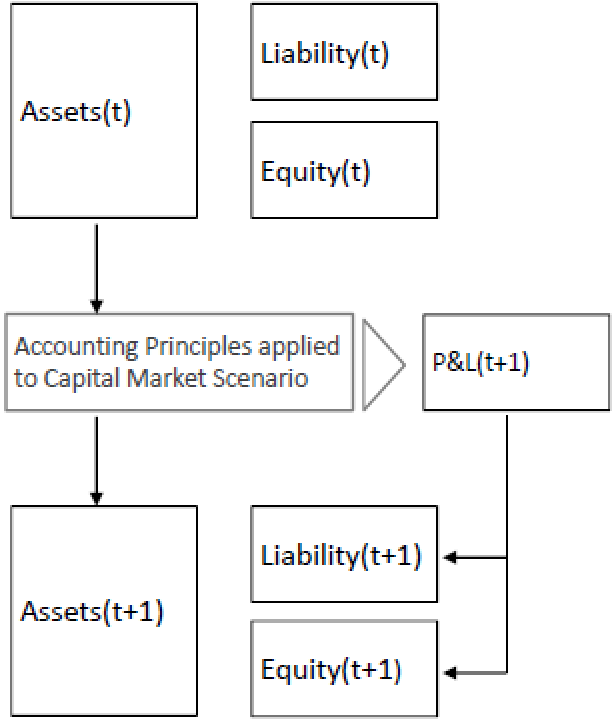
Realistic Model: Setup

- **Continuation value of operations reduces incentive for risk shifting**

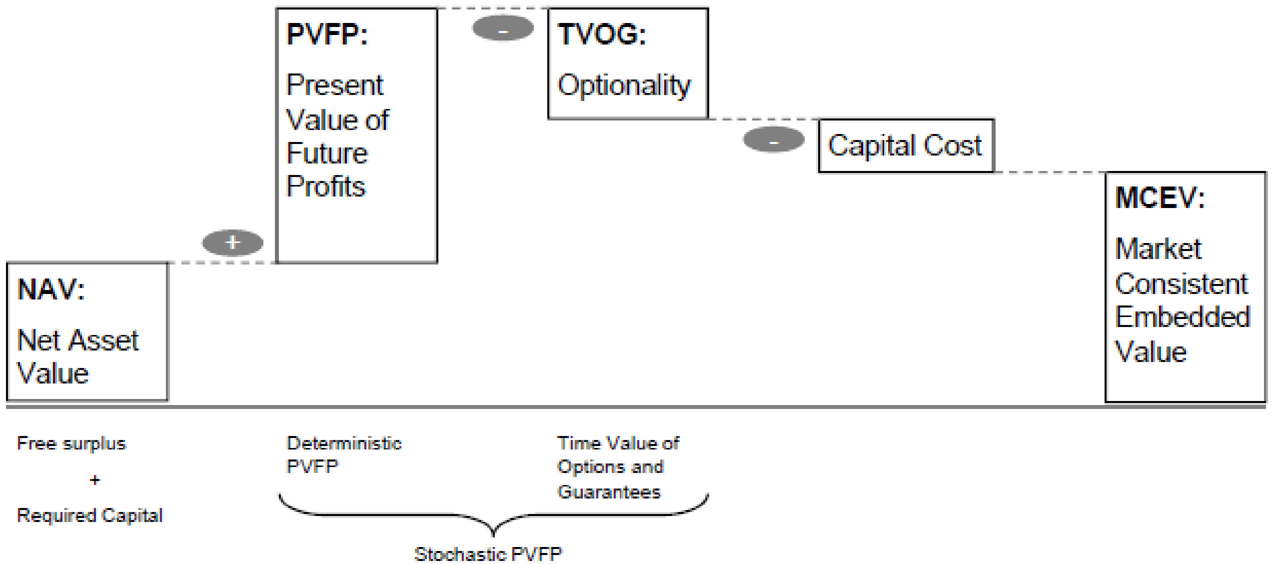
$$E_{\text{Fair}} = G(\text{Profits}_t) + E\left[\sum_{k=t+1}^{\infty} G(\text{Profits}_k)\right]$$

- **Sharing rules generally more complex**
  - Accounting and regulatory principles determine payoffs
  - Averaging discounted (risk neutral) CFs gives the fair value of insurance assets & liabilities



MCEV

- The *Market-Consistent Embedded Value* (MCEV) is the net-asset value of the market-consistent balance sheet.
- Definition according to CFO-Forum

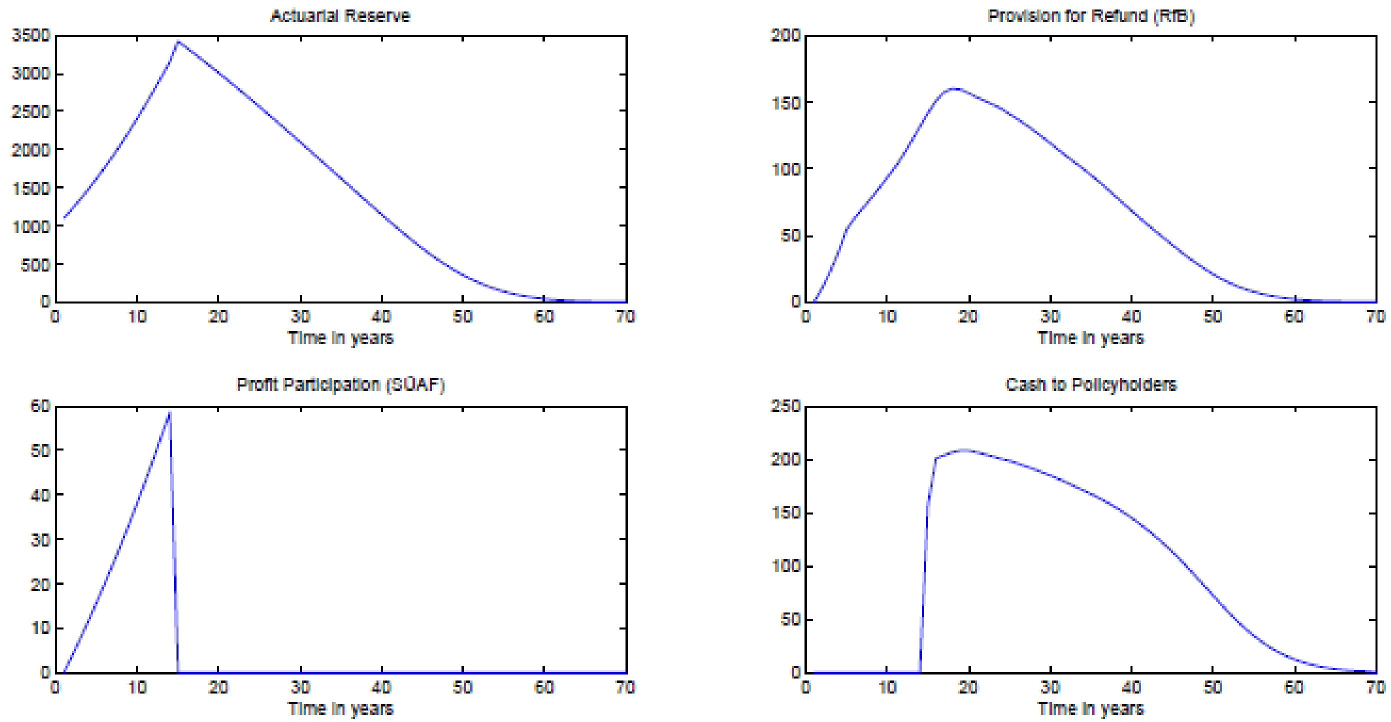


Model Building Blocks

- **German life insurance environment**
- **Simulation requires elaboration on**
  – Sharing rules (e.g. *RfB*, *SÜAF*, …)
  – Lapses (e.g. fee structure, …)
  – Solvency regime (Solvency I vs. Solvency II)
  – Capital market scenario generator (e.g. term structure model)
  – Mortality tables (e.g. DAV 2004 R)

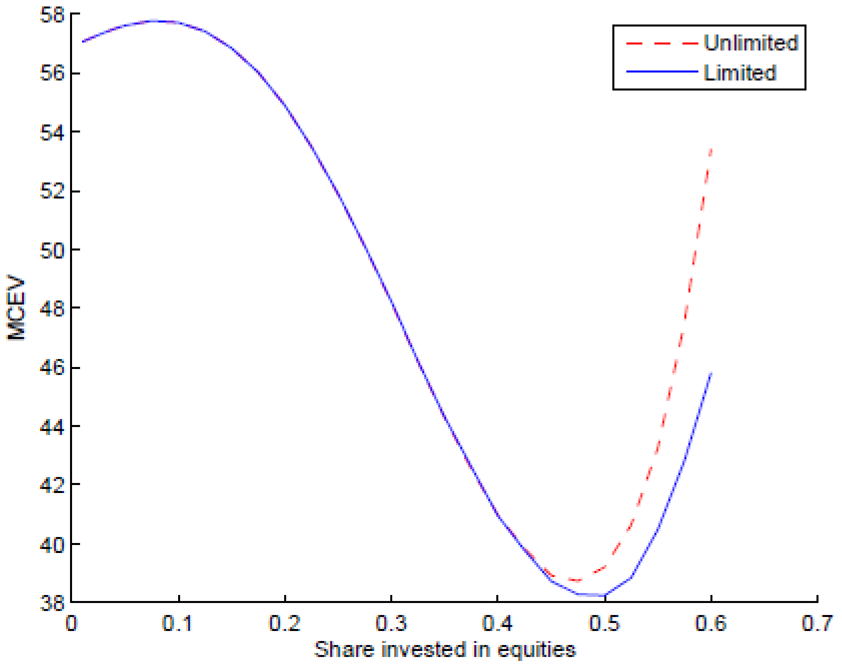
Typical Model Output

- **Representative contract with annuity payout**



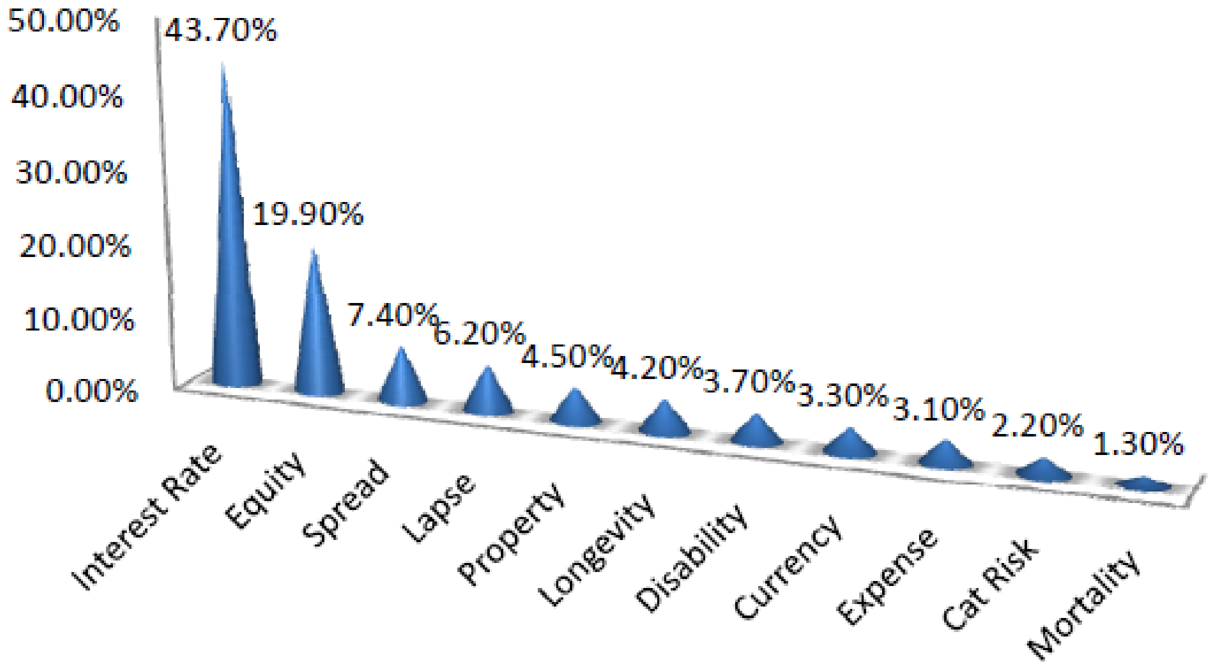
Asset Allocation

- **Equity investments impact value**
- **Optimal allocation about 10%**
- **Multi-period setup: no incentive for asset substitution**
  – Volatility effect only dominates for pro-hibitively large fractions => But owner benefits from avoiding insolvency in these cases



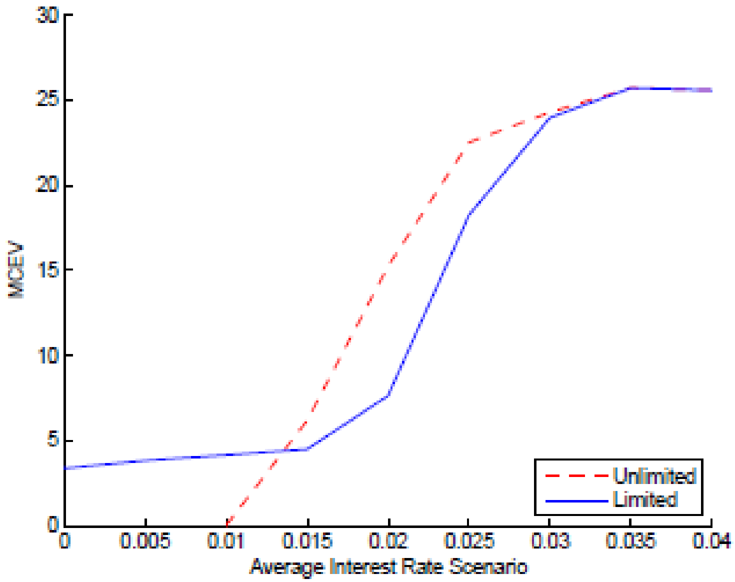
Risk Decomposition

- **Risk sources of a generic (German) life insurer based on CEIOPS and *BaFin* publications**



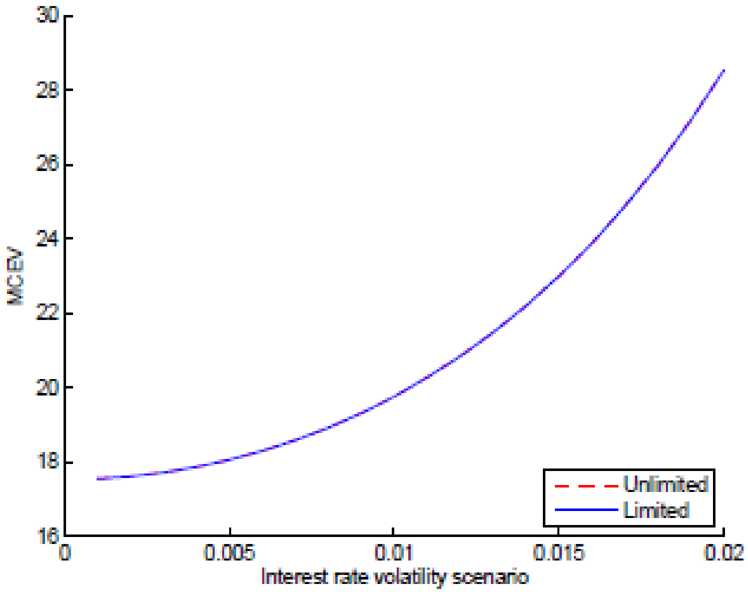
Interest Rate Environment

- **Average Rate**



  – Incentive to restore solvency

- **Rates Volatility**



  – Standard option pricing effect dominates

Value-based Management & Incentive Alignment

- **Normal environment**

Assets	Liabilities and Equity
Market consistent asset value	Market value of liabilities
	MCEV

- **Stressed scenario**

Assets	Liabilities and Equity
Market consistent asset value	Market value of liabilities
	MCEV

- **Economic Capital**

MCEV

MCEV

Economic capital:

- Difference between market-consistent net-asset values under normal and stressed scenarios
- Depicts sensitivity of capital to various risks

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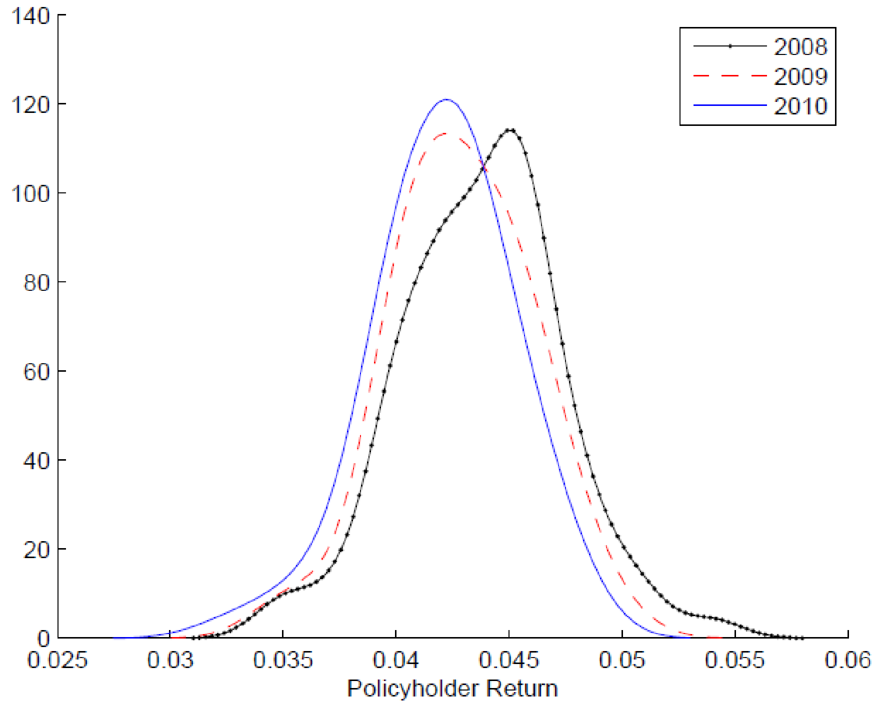
Systemic Risk

- Solvency risk can cause guarantees to be worthless when most needed
- Inability of insurers to earn minimum guarantee?
- Credited returns still significantly above average guarantee of ca. 3.5%



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Concluding Remarks

- **The paper investigates the agency conflict between policyholders and firm owners under different solvency regimes**
  - Solvency II overcomes asset substitution problem as long as management regards equity capital as expensive
- **MCEV model**
  - Impact of asset allocation and market environments on equity performance is analyzed
  - Continuation value reduces the agency problem
  - Volatility effect on owner’s call is *positive*

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