Long-term guarantees

An Overview

Prof. Dr. Hato Schmeiser
Structure input presentation

• Introduction to long-term guarantees

• Costumers’ willingness to pay for investment guarantees

• PLI: Where to set the minimum interest rate guarantee?

• Quick Summary
Introduction

• Focus on long-term guarantees
  - «The» USP of life insurance products
  - Other options (like surrender or paid-up option) influence the value and the management of long-term guarantees

• Forms
  - Point-to-point guarantees with a minimum interest rate guarantee; cf. unit-linked products
  - Year-by-year basis (cliquet-style); cf. PLI (participating life insurance contracts)
  - Lookback guarantees; cf. unit-linked products

• Valuation and risk management
  - Value of the guarantee (put option) needs to be paid by the customer in order to finance risk management measures (like equity capital etc.) which ensure that the guarantee can be fulfilled
Value of long-term guarantees

- **Value of long-term guarantees is very sensitive to model assumptions**
  - Hence, the provider faces a **substantial model risk**
  - Example for the valuation of a point-to-point guarantee in the B/S-context

1. **T = 20 years; money-back-guarantee, riskless rate of return = 3 %, volatility = 10 %**
   Value of the option: 1.4 % of the upfront premium

2. **Like case 1, but riskless rate of return = 1 %**
   Value of the option: 8.6 % of the upfront premium

3. **Like case 2, but volatility = 20 %**
   Value of the option: 23.1 % of the upfront premium
Value of long-term guarantees

• **Even more complex in insurance practice**
  - Model assumptions (underlying process with jumps to reflect the possibility market crashes)
  - Mortality risk
  - Parameters are time-varying
  - The riskless rate of return is rather a stochastic figure
  - Policyholder behavior

• **Long-term guarantees are currently very expensive**
  - Low interest rate environment / high volatility of the underlying

• **Alternatives (tbd)**
  - Partial transfer of investment risk to policyholders / the society in general
  - Securitization of the guarantee via specific investment strategy
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Customers’ point of view

• «The customer demands long-term guarantees»
  - But: Is he or she willing to pay the fair price?
  - What do we know about the customers’ willingness to pay in respect to long-term investment guarantees
  - .... I think not really much!

• An example from the Swiss market
  - Focus: Saving's part of an unit-linked life insurance contract
  - Point-to-point guarantee
  - N = 375, online questionnaire
  - Source: Gatzert, Huber and Schmeiser, Geneva Papers on Risk and Insurance 2011
  - Some limitations
Customers’ point of view

<table>
<thead>
<tr>
<th></th>
<th>OPT model</th>
<th>All participants (n=360)</th>
<th>Participants with WTP &gt; 0</th>
<th>Participants with WTP≥OPT model</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>p-value</td>
<td>Median</td>
<td>Std</td>
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<tr>
<td><strong>Medium-risk fund</strong></td>
<td></td>
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<tr>
<td>Default probability</td>
<td>7%</td>
<td>20%</td>
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<tr>
<td>G I</td>
<td>298</td>
<td>219</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G II</td>
<td>1,003</td>
<td>516</td>
<td></td>
<td></td>
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<tr>
<td><strong>High-risk fund</strong></td>
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<tr>
<td>Default probability</td>
<td>14%</td>
<td>36%</td>
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<tr>
<td>G I</td>
<td>1,117</td>
<td>401</td>
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<tr>
<td>G II</td>
<td>2,057</td>
<td>788</td>
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<td><strong>Medium-risk fund,</strong></td>
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<tr>
<td><strong>Premium 50,000</strong></td>
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<tr>
<td>G I</td>
<td>1,491</td>
<td>1,045</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G II</td>
<td>5,015</td>
<td>2,344</td>
<td></td>
<td></td>
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<tr>
<td><strong>Medium-risk fund,</strong></td>
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<td></td>
<td></td>
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<tr>
<td><strong>Contract term 20 years</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>G I</td>
<td>204</td>
<td>206</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G II</td>
<td>1,363</td>
<td>603</td>
<td></td>
<td></td>
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</tbody>
</table>

Notes: GI = money-back guarantee; GII = 2% guaranteed interest rate on premium; default probability = probability that the maturity fund value falls below the single up-front premium; medium-risk fund = 50% bonds and 50% stocks; high-risk fund = 100% stocks; p-value for two-sided t-test (with respect to the guarantee costs according to option pricing theory (OPT) model with data from Table 1); N = number of respondents with WTP > 0, respectively, with WTP≥OPT.
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January 1, 2012: maximum interest rate guarantee drops to 1.75% (Germany)

April 2012: Zurich reduces interest rate guarantee to 1% in Switzerland

February 2013: Allianz plans new product with temporary guarantee in Germany

February 2013: Zurich plans to drop interest rate guarantee in Germany

March 2013: Ergo plans to develop product with 0% interest rate guarantee
Long-term guarantees in life insurance contracts

- **Focus: participating life insurance contracts**
  - Minimum interest rate guarantee based on the savings provided on a *year-by-year basis* (cliquet-style) for the whole contract duration
  - Participation in the annual return of the insurance company’s asset portfolio
  - Both elements are regulated by the insurance supervisory authorities

- **Long-term interest rate guarantees are becoming more and more difficult to manage**
  - Long contract durations
  - (Higher) equity capital requirements under new solvency regulations (Solvency II, SST)
  - Current capital market situation with low-return investment opportunities

- **Are higher guaranteed rates better for the policyholder?**
  - Switzerland: from 1.75% to 1.50%; Germany: from 2.25% (2011) to 1.75% (2012)
Research question: at what level should the regulator set the maximum value of the interest rate guarantee when taking into account policyholder utility?

Considered characteristics

**Insurance company**
- Equity capital $E_0$
- Asset allocation: share $\gamma$ invested risk-free
- Solvency II: safety level / ruin probability $\varepsilon$

**Policyholder**
- Iso-elastic utility function (CRRA)
- Constant relative risk-aversion: parameter $\rho$

**Contract**
- Risk-adequate premium / price: $P_0$ (i.e., adequate returns on $E_0$; market model assures financing for the industry)
- Contact length $T$
- Minimum interest rate guarantee $g$
- Participation $\alpha$
Structure of the analysis

1. Implications for insurance companies
   - Defines level of equity capital $E_0$
   - Simultaneously defines asset allocation $\gamma$

2. Implications for policyholders
   - Defines policyholder payoff $L_T$ and individual utility $U$

3. Definition of the optimal interest rate guarantee by the regulator

4. (Robustness analysis of the results)
Implications for the asset allocation of insurers

Assumptions (A) – (D)

Level of equity capital ($E_0$)

and simultaneously

Asset allocation ($\gamma$)

$NPV = 0$

$R_T = \epsilon = 0.5\%$

$r_f = 3.00\%$

$g = 1.75\%$

($E_0 = 0.11$, $\gamma = 0.89$)
No room for risky investments when $r_f \to g$

$r_f - g \to 0$

Asset allocation $\gamma \to 100\%$

No room for risky but also promising investments $\Rightarrow$ In practice, enforced asset allocation only superficially safe, since not diversified (Euro crisis!)

- Minimum interest rate guarantee virtually worthless
- Investment possibly unfavorable compared to direct investment
- Asset portfolio without opportunities for participation in insurer’s surplus
Policyholder utility depends on the difference of the rates $r_f$ and $g$

<table>
<thead>
<tr>
<th>Interest (in %)</th>
<th>Insurer</th>
<th>Characteristics of $L_T$</th>
<th>CE of payoff $L_T$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$r_f$</td>
<td>$g$</td>
<td>$E_0^{eq}$</td>
<td>$\gamma^{eq}$</td>
</tr>
<tr>
<td>3.0</td>
<td>1.5</td>
<td>0.12</td>
<td>0.87</td>
</tr>
<tr>
<td>3.0</td>
<td>1.0</td>
<td>0.14</td>
<td>0.84</td>
</tr>
<tr>
<td>3.0</td>
<td>0.5</td>
<td>0.16</td>
<td>0.82</td>
</tr>
<tr>
<td>3.0</td>
<td>-0.5</td>
<td>0.21</td>
<td>0.76</td>
</tr>
<tr>
<td>3.0</td>
<td>-1.0</td>
<td>0.23</td>
<td>0.74</td>
</tr>
<tr>
<td>3.0</td>
<td>-1.5</td>
<td>0.25</td>
<td>0.71</td>
</tr>
<tr>
<td>3.0</td>
<td>-10.0</td>
<td>0.47</td>
<td>0.36</td>
</tr>
</tbody>
</table>

Maximum utility depends on actual risk-aversion – overall, lower interest rate guarantees (compared to $r_f$) offer the higher utility.
Implications for the definition of the interest rate guarantee

- Assumptions (A) and (B) – regulator’s values of the interest rate guarantee and minimum participation adopted by insurers – meeting solvency requirements (C) and assumption of competitive market / offering of fair premiums (D)

- Generally customer utility is higher when the guaranteed interest rate is clearly below the risk-free interest rate (by two percent in the considered examples)
  - Given the current market situation a nominal capital conservation guarantee (0%-interest) is reasonable under the model assumptions used

- Under current regulations only lower interest rate guarantee allow for more risky investments (cf. current high demand for government bonds with good credit-standing)
  - Opportunities for customers through policyholder participation
  - Limitation of customers’ risks due to minimum interest rate guarantee

Less may be more
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Possible aspects to discuss

- How can long term guarantee products be funded in a low interest rate environment?
- What are the legal considerations around long-term guarantees?
- What demand exists for long-term guarantee products?
- Are there creative ways of offering long-term guarantee products?
- How important are long-term guarantee products for society?
Contact

Prof. Dr. Hato Schmeiser
E-Mail  hato.schmeiser@unisg.ch
Telefon +41 71 224 36 50

Institute of Insurance Economics
University of St. Gallen
Tannenstrasse 19
CH-9000 St. Gallen
http://www.ivw.unisg.ch