Guarantees: Past, Present, Future?

Ralf Korn (TU Kaiserslautern, Fraunhofer ITWM, EI-QFM)

Motivation I:

Nov. 2011: DGVFM/DAV launched the "Topic of the Year 2012"
The Future of the Interest Rate Guarantee in German Life Insurance

Nov. 2012: DGVFM/DAV launched the "Topic of the Year 2013"
Alternative (to) Guarantees

Workshop on "Alternative Guarantees" at TU München, 9.9.2013
(see also **https://aktuar.de/dgvfm/topic_of_the_year/**)

Motivation II:

The current situation (interest rates, Solvency II, ….)

Motivation III:

Work of the group "Altersvorsorgeprodukte" of the ***EI-QFM in Kaiserslautern*** (including members of ERGO, Swiss Life, Canada Life, MLP, Franke und Bornberg, Fraunhofer ITWM, Univ. Ulm, …) that discusses all aspects of guarantee products

Symposium "**Zukunft der Garantien – Garantien der Zukunft**" at EI-QFM in Kaiserslautern on August 22 (information: info@ei-qfm.de)

See: **www.ei-qfm.de**

0. Some preliminary remarks

- **Guarantees are the basis of every insurance deal**
- Guarantees have a **price**
- Guarantees can result in different challenges
  - o Guarantees for a collective („Law of large numbers")
  - o Singular guarantees (Single contracts, reinsurance, …)
  - o ….
- Guarantees cannot be canceled (at least not without an enormous loss in the public image of the corresponding insurer)

But also:

- There is no arbitrage opportunity on the financial market
- Hope for a better future is no basis for a guarantee
- Are there possibilities to reshape (not cancel!!!) given guarantees?

1. *Motivation*: Some aspects/problems of Life Insurance

Aim:
- Save today for the retirement period

Problems:
- Long time lag between premium and pension payments
  - ***Duration matching***
- Uncertainty about the amount of money needed in the future
  - ***Interest rate and inflation risk***
- Uncertainty on the duration of the payment period
  - ***Longevity risk***

$\Rightarrow$

Typical problems in financial mathematics with non-hedgeable risks

Danger for the insured:
Errors will typically be realized when they can no longer be corrected !

1. *Motivation*: Basic forms of pension

Defined Benefit – The insurer takes the risk
- payment (often just a lumo sum),
- insurer invests and finally pays the guaranteed amounts

Defined Contribution – The insured takes the risk
- customer pays,
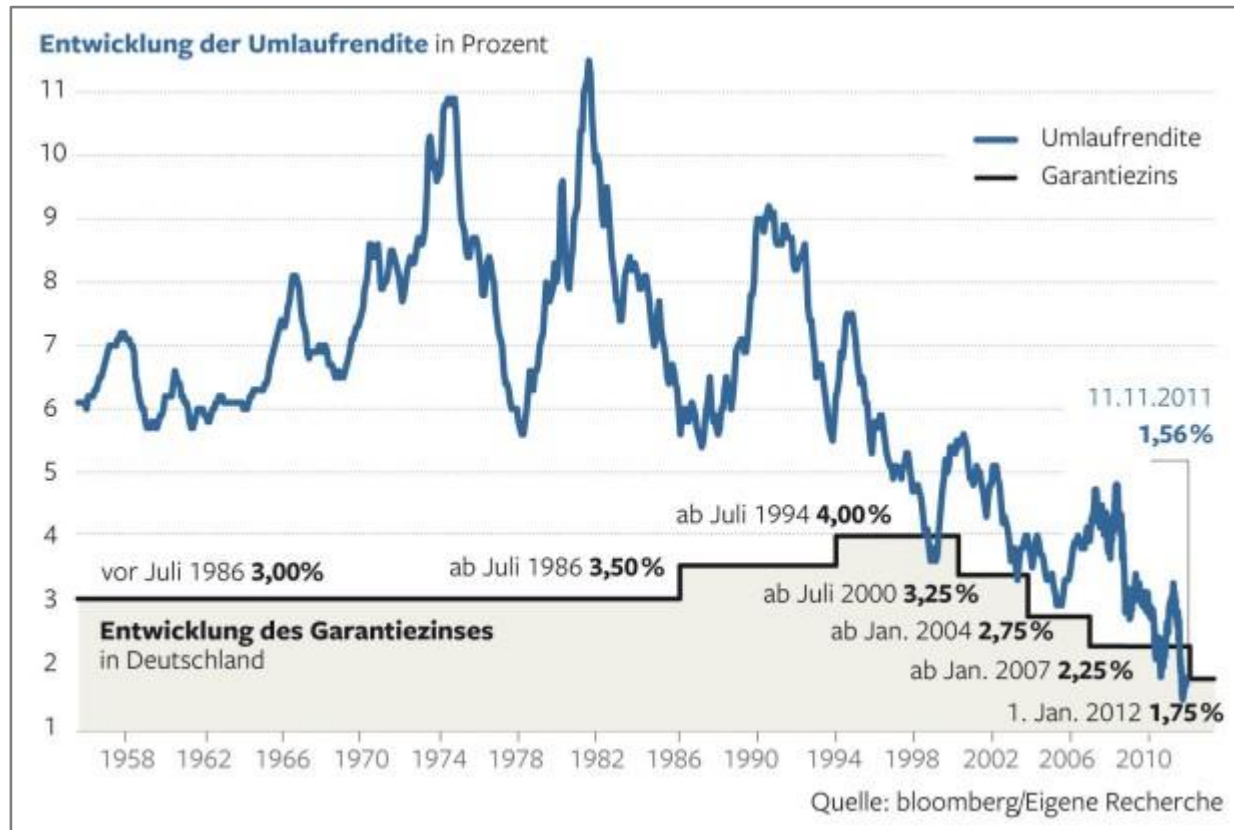- insurer invests, customer gets the result

Best (?) of both worlds – The German system …
- mixture of a Defined-Contribution-System
- and a performance guarantee (free of charge !!!)

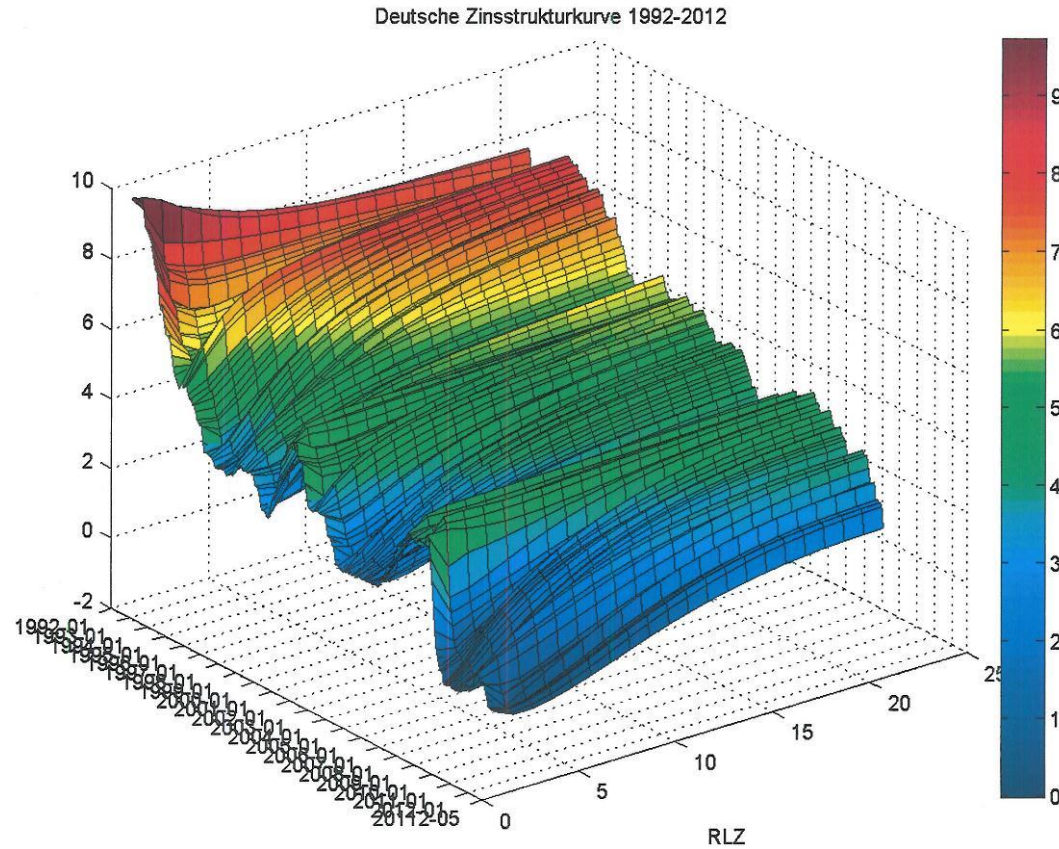⇨ Unique selling property compared to bank products (?)

⇨ *Can that work?*

1. *Motivation*: Average yield ⇔ guarantee rate ("Höchstzinssatz")

(Data: Tom Ewen)

1. *Motivation*: *The historical interest rate date*

Evolution of the German termstructure of interest rate curve in recent years

Deutsche Zinsstrukturkurve 1992-2012

2. Main problems – Practical point of view

- **Longevity risk** => will not be considered today

- **Are older (and more expensive!!!) contracts fully hedged ? =>** will not be considered today **(but might be the biggest problem!)**

- **How long will the interest rate stay low?**

  o Hard to predict

  o Given today's term structure curve: still some time.

  o Model based: be very careful !

  o No good economic forecasting models available !!!

  o .....

2. Main problems – Practical point of view

Valuation of financial products

- **There are no arbitrage opportunities** ("Arbitrage-free markets")

    $\Rightarrow$ A riskless (!) gain above the riskless interest rate is not possible

    $\Rightarrow$ Guarantees have a price:

    - Implicit costs (Reduction in return => CPPI)

    - Explicit costs (Costs for derivatives=> OBPI)

Modelling problems

- There do not yet exist tractable models for the **long term** evolution of stock prices and interest rates

Conceptual problems

- Understanding guarantees?

- How to advertise guarantees?

- Future concepts for guarantees?

2. Main problems – Understand that a classical product is a good product

A very simple example

Initial capital   100 €
Index with rate of return   μ = 5%, volatility σ = 20%   (Black-Scholes model)
Money market account   r = 2%   (constant interest rate)

Alternative 1:
Costs of an option based guarantee (i.e. index fund plus put on the fund) with a

- Lower bound of 101,01 € (i.e. 1% minimum rate of return), full upside potential

=>

Costs of the additional put option: **7,44 €**

Is this just a bad example, can the costs be reduced, … ?

Costs of lower bounds

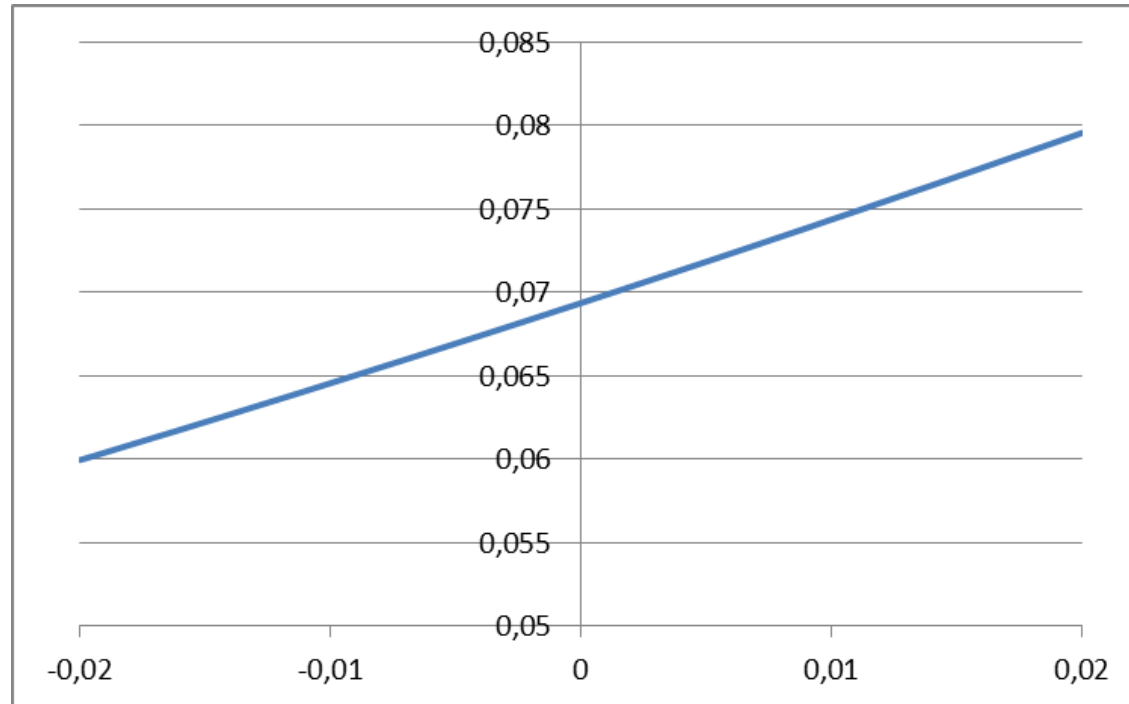**Option based guarantees – some numbers 1**

Figure C1: Costs of an **additional put option** (y-axis) as a function of the guarantee expressed in the equivalent interest rate (x-axis)

Reduced costs via upper bounds
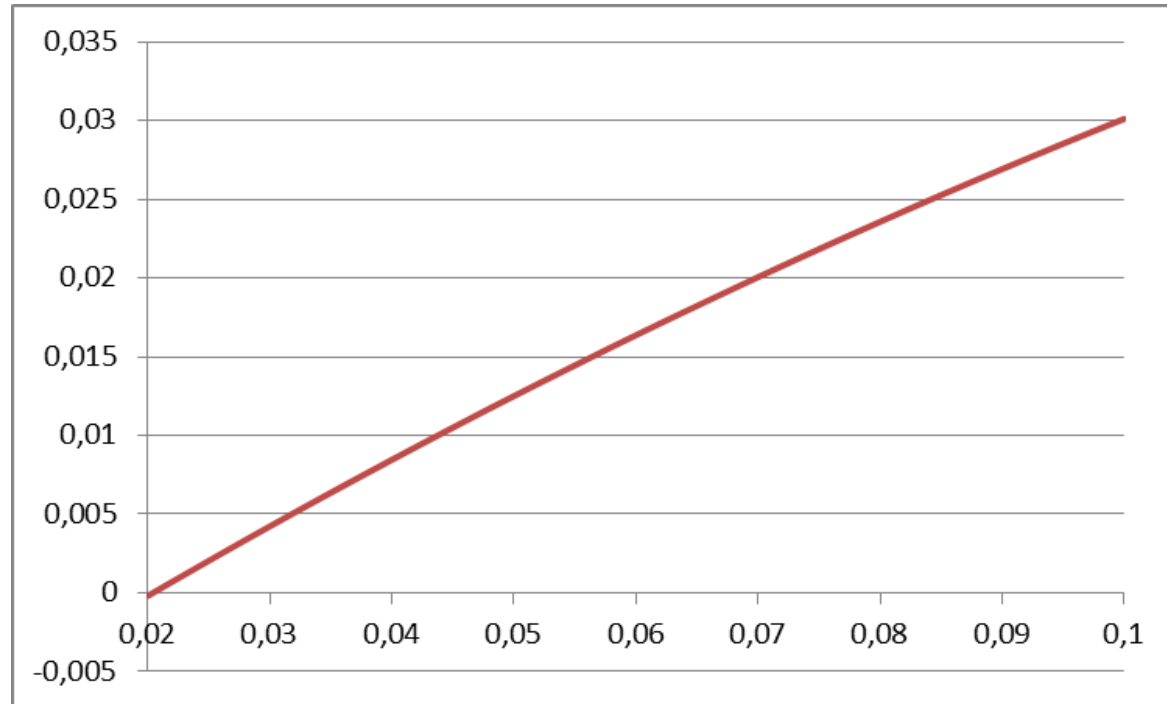**Option based guarantees – some numbers 2**

Figure C2: Costs of a **guarantee of 2%** (y-axis) as a function of the sacrificed guarantee expressed in the equivalent **upper bound for the percentage yield** (x-axis)

Additional mean wealth via reduced guarantees
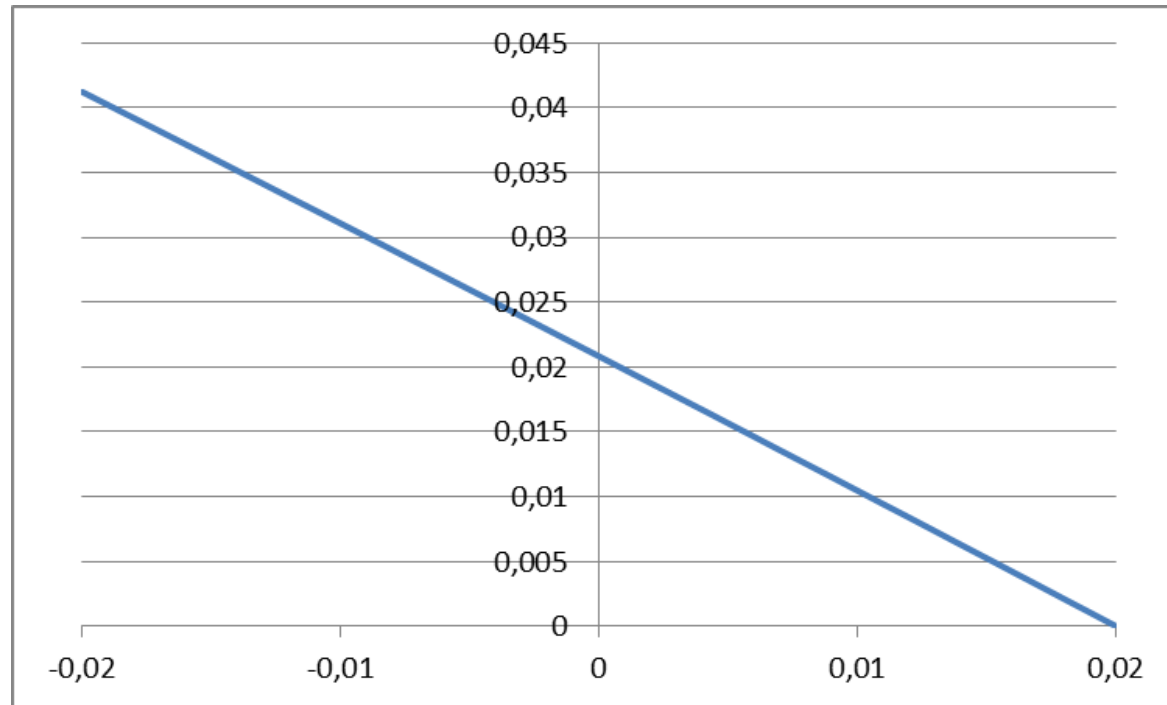**An alternative – some numbers 3**

Figure C3: **Additional mean wealth above the guarantee**(y-axis) as a function of the **guaranteed minimum interest rate** (x-axis)

Lessons learnt

- An interest rate guarantee is hard to beat impressively

- There is not so much room if an interest rate guarantee is very close to the maximal achievable rare

- Simple modifications will not solve current problems

Hence

- It needs a new understanding of the <u>quality of classical products</u> (*No reasons to hide*)

- It needs a radical conceptual change if one wants <u>a new quality</u> of products

- In particular: new kind of guarantees ?!

Note :

So far we only argued in terms of single contracts !!! Where is the collective ???

3. How to deal with the current situation?

- Promise, take the risk and hope => **Not really a strategy** …

- **Improve the reputation** of the classical guarantee and compare the costs/yields of a classical collective product with a single, personalized bank product

- **Alternative guarantees**
  - Variable annuities are a step in the right direction, **because** they are expensive!
  - Paid guarantees vs. guarantees for free

- Personalized CPPIs
  - Similar problems as classical products (hard to generate attractive guarantees at the current situation!)
  - More or less a bank product!

- Temporary fixed guarantees
  - Reasonable, but will they be accepted?

3. How to deal with the current situation?

- **A step in the wrong direction**:

  o Construct a **very complicated product and** try to **explain it in all details** to the customer, such as e.g. complicated cliquet options

  $$(*) \quad P + \max\left\{\min\left\{\sum_{i=1}^{n}\max\left\{\min\left[\alpha_i\frac{S(t_i)-S(t_{i-1})}{S(t_{i-1})},C_i\right],F_i\right\},C\right\},F\right\} \quad \text{paid in T}$$

  o **Suggestion:** Only communicate the important details, otherwise trust will be lost!

4. Aspects for future generations of guarantees - requirements

Some requirements on future generations of guarantees
(my personal view/recommendation):

A. A guarantee should be constructed in such a way that **it is always possible to generate it**

B. A guarantee should be **fair to the whole of the collective**

C. A guarantee in life insurance should make use of the **advantages of the collective**

D. Guarantees should be flexible in the sense that they should be quoted in relative form with respect to an index i.e. as a percentage ("**Compare to the economy and not to numbers**")

4. Aspects for future generations of guarantees – some suggestions

Suggestion 1: **Classical guarantees with a moving benchmark**

"Guaranteed return of x % of the return of an index (such as REX, DAX, ….)"

Advantages:

- Can always be satisfied by construction of the guarantee and leaves room for working with the contributions ("safe" and "potential")
- Attitude towards risk of the customer is mirrored in the choice of the benchmark ("flexible")
- Same local returns for all members in the same risk class of the collective ("fair")

Disadvantages:

- Needs arguments (such as historical simulation or model simulations) to be accepted
- Has to offer a lower guaranteed interest rate than the one offered at the moment
- Great flexibility results in smaller (different) collectives

4. Aspects for future generations of guarantees – some suggestions

"Suggestion" 2: Make use of longevity risk

- No new product, more a suggestion for ingredients of ways to generate guarantees or attractive products

- Life insurers face longevity risk anyway and can maybe eliminate/swap parts of the longevity risk

    o Mortality bonds, mortality derivatives, …

    o Direct investment in the "retirement industry" (medical industry, care centers, ….)

- Main problems so far:

    o reliable modeling necessary

    o deep and liquid markets

Note the innovation:

Investment as a part of **true asset-liability management** !!!

4. Aspects for future generations of guarantees – further aspects

"Suggestion" 3: 100% guarantees or not ?

- Combination of a very basic 100% guarantee (say for 60 % of the paid premia) and a very likely – say – 95% guarantee on the remaining premia plus participation in the surplus

- Note:
  - 100 % guarantees do not exist anyway …
  - Difference in the long term evolution between variance and capital-at-risk of stock investments can be made use of !

"Suggestion" 4: Idea behind universal portfolios (T. Cover (1991))

- Highest possible degree of diversification
- Use a variant for the collective
- Still very vague idea

5. Concluding remarks

I believe in a future for life insurance if

- Life insurers **believe in their own product** ("No lamentations about the low guarantee, about the own wrong investment strategy, ...)
- Future guarantee concepts will be generated **more flexible and easier to fulfill**
- Life insurers **concentrate on their advantages** compared to banks (i.e. the collective, the compentence on hedging mortality, smoothing returns...)
- Politics remains in favour of life insurance by setting/keeping **the appropriate legal/political framework**
- Insurance/financial mathematics considers **relevant scientific problems**:
  - Optimal investment for large investors
  - Long-term interest rate modelling
  - Optimal asset-liability management strategies
  - .....

Thank you for your attention !

korn@mathematik.uni-kl.de