



Joint Colloquium of the IACA, PBSS and IAAHS Sections
of the International Actuarial Association
Westin Copley Place Hotel, Boston, U.S.A. – 4-7 May 2008

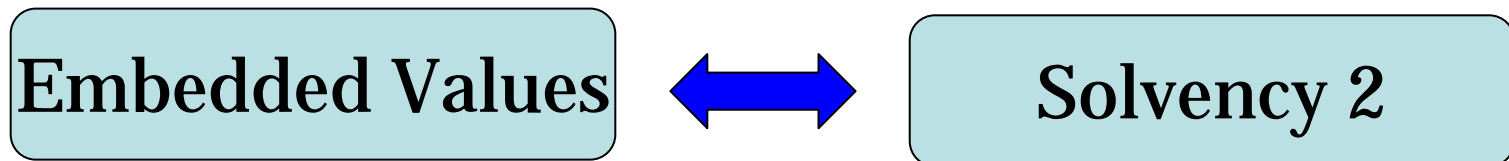
Solvency 2 – Internal Models Embedded Values and Solvency Capital Requirements – close relatives?

Tobias Ebel (DKV, German Health Insurance)



Motivation

- Background: Many European insurers use actuarial „stochastic“ projection software to compute the Embedded Value of their business.
- Obvious idea: Use these models as internal models for Solvency 2.
- One aim of this talk: Contrast conceptual and mathematical differences between



Agenda

- **Why calculate Embedded Values for German Health Insurance?**
- **Differences between Embedded Value and Solvency 2 models**
 - mathematical differences
 - conceptual differences
- **Philosophical and practical remarks about Solvency 2**
 - Modeling financial vs. underwriting risk
 - Nested projections
 - Price tags on liabilities
 - Double protection for the policy-holder
- **Two more buzz-words**
 - Replicating portfolio: A way to reconcile different accounting rules?
 - Risk-based capital via Embedded Value: A proxy for the SCR?

German private health insurance – rights and obligations of the two parties

	Insurer	Policyholder
Contract	cannot terminate, thus calculates as in life with a so-called ageing reserve	no surrender value (until now, this'll change in 2009)
Medical inflation	can adjust premiums when extrapolated claims deviate more than 5-10%	can change to tariff with lower premium
Participation	can retain policyholder share in a tax-free reserve for two years before allocating individually (usually cash-back or premium deductions)	gets at least 80% of total profit – with 90% of investment profits guaranteed!
Tariff calculation	“has” to add a security margin of at least 5% on both net premiums and expenses	independent trustee checks all calculation parameters
Guarantees	can update all calculation assumptions with every premium adjustment (→ small longevity and interest rate risk compared to life!)	Does not get reserve filled up by insurer – has to pay higher premiums

Why calculate Embedded Values for German Health Insurance?

- Because the contracts are basically
 - with-profits life annuities
 - starting immediately
 - with payments increasing as the annuitant gets older.
- Features less usual for life insurance are
 - the lack of long-term guarantees and
 - “automatic” new business arising from medical inflation.

Agenda

- Why calculate Embedded Values for German Health Insurance?
- Differences between Embedded Value and Solvency 2 models
 - mathematical differences
 - conceptual differences
- Philosophical and practical remarks about Solvency 2
 - Modeling financial vs. underwriting risk
 - Nested projections
 - Price tags on liabilities
 - Double protection for the policy-holder
- Two more buzz-words
 - Replicating portfolio: A way to reconcile different accounting rules?
 - Risk-based capital via Embedded Value: A proxy for the SCR?

Mathematical Differences between Embedded Value and Solvency 2 models

	Embedded Value (EV)	Solvency 2 (SCR)
Quantity of interest	cash flows CF_t from and to shareholder (e.g. dividends and capital injections)	drop in net asset value $\Delta NAV = NAV_0 - NAV_1$
Time horizon	large number N of years	1 year
Probability measure	risk-neutral (martingale) measure Q <small>(at least for market-consistent Embedded Values)</small>	realistic measure P
Stochastic evaluation	expectation E^Q	$(1-\alpha)$ -quantile, $\alpha=0,5\%$ (a.k.a. as value at risk VaR)
Discounting	yes, with so-called deflators φ_t	no

A quick look at formulae

To put it plainly,

$$EV = E^Q \left(\sum_{t=1}^N \varphi_t CF_t \right)$$

(present value of future shareholder cash-flows)

whereas

$$SCR = \inf \{x \mid P(\Delta NAV \geq x) \leq \alpha\}$$

(1 in 200 damage to equity).

Conceptual Differences between Embedded Value and Solvency 2 models

	Embedded Value	Solvency 2
Target audience	financial analysts	regulators
Paramount goal	provide information	protect policyholders
Modeling focus	average case (entire distribution counts)	extreme events (only tails count)
Role of insurance risk	<ul style="list-style-type: none"> • less important • considered non-systematic, hence diversifiable • allowed for by simple spread over risk-free rate 	<ul style="list-style-type: none"> • vital (obviously!) • difficult as only source of information is history (as of now) • scarcity of forward-looking info discussed on next slide
Accounting rules	<ul style="list-style-type: none"> • whichever are in force • in many cases local GAAP • important for participation 	<ul style="list-style-type: none"> • so-called solvency balance sheet • ideally all-economic valuation • might converge with IFRS
Solvency rules	whichever are in force (Solvency 1)	none (otherwise concept would be circular!)

Agenda

- Why calculate Embedded Values for German Health Insurance?
- Differences between Embedded Value and Solvency 2 models
 - mathematical differences
 - conceptual differences
- Philosophical and practical remarks about Solvency 2
 - Modeling financial vs. underwriting risk
 - Nested projections
 - Price tags on liabilities
 - Double protection for the policy-holder
- Two more buzz-words
 - Replicating portfolio: A way to reconcile different accounting rules?
 - Risk-based capital via Embedded Value: A proxy for the SCR?

Modeling financial vs. insurance risk (Philosophical remark 1)

- For financial risk, there are two sources of information
 - past experience (statistics)
 - market prices of derivatives that imply anticipated volatilities
- For insurance risk, as of today, there are only statistics.
- Solvency 2 however, claims to reward the insurer if she
 - anticipates risks
 - pro-actively manages them
 - does away with “old-school all-retrospective mentality”.
- But: Apart from a few extrapolations, statistics can only look backward by their very nature! Forward-looking information about insurance events is extremely scarce.
- Therefore: Keep expectations modest!

Simulation nesting – projections within projections (A practical remark)

- There are two ways where it may become necessary to do nested simulations:
 - Computing Embedded Values, you want to know when to release shareholder capital but this depends on future SCRs.
 - Computing SCRs, you may have chosen to value liabilities via stochastic projections.
- These issues will need to be solved pragmatically now (and by quantum computers later!)

Price tags on insurance liabilities (Philosophical remark 2)

- Although not officially intended, the solvency capital requirements – especially those computed via the standard formula – might serve as price tags on insurance liabilities.
- The similarity with the *Black-Scholes* price tag on options is striking: If market participants are given a “price formula” by some authority – regulating or scientific –, there is a high chance they’ll accept it as the “right” price.
- Therefore: expect more trading of insurance liabilities.

Yet another difference: Levels of prudence

Solvency 2 tries to offer *double protection* for policyholders:

- A safety margin is added onto the best-estimate reserve.
Idea: If the insurer became insolvent, another insurer would demand the reserve plus this margin to run-off the business.
- Then, the solvency capital requirement protects the policyholder against the former scenario.

This is typical for the two different mentalities behind Embedded Values and Solvency 2.

Agenda

- Why calculate Embedded Values for German Health Insurance?
- Differences between Embedded Value and Solvency 2 models
 - mathematical differences
 - conceptual differences
- Philosophical and practical remarks about Solvency 2
 - Modeling financial vs. underwriting risk
 - Nested projections
 - Price tags on liabilities
 - Double protection for the policy-holder
- Two more buzz-words
 - Replicating portfolio: A way to reconcile different accounting rules?
 - Risk-based capital via Embedded Value: A proxy for the SCR?

Replicating portfolios (1)

Idea:

1. Replace insurance liabilities by a portfolio of (idealized) capital assets with “identical” cash-flows (and hope this choice doesn’t depend on accounting rules).
2. Then, apply accounting/valuation rules to this asset portfolio.

Challenge:

1. Either “approximate” those ideal assets (zero coupon bonds, medical inflation linkers, etc.) by assets that are actually traded – and allow for the mismatch.
2. Or directly derive a convincing price for them, especially if you can’t find traded assets with similar characteristics.

Replicating portfolios (2)

Remarks on this approach:

1. Valuation of assets is more *intuitive* than valuation of cash-flows.
2. The same portfolio may be used under different accounting regimes.
3. To be honest, you're not solving the problem, you're just reformulating it in a more accessible way.
4. You might end up mixing accounting regimes:
 - First, you create a local GAAP policyholder participation asset.
 - Then, you value this asset according to IFRS.
 - A bit weird at first sight but perfectly fine.

Risk-based capital via Embedded Values

- Suppose you calculate an (internal) risk-based capital as the 1 in 200 drop in Embedded Value, i.e.

$$RBC = \inf \{x | P(\Delta EV \geq x) \leq \alpha\}$$

with $\Delta EV = EV_0 - EV_1$ as before.

- Suppose further, you can solve all nesting problems.
- Can you make sure that $RBC \geq SCR$?
- Provided the business is profitable at all, you would expect $EV_t \geq NAV_t$ but “the bigger the quantity the bigger the drop” may be wrong → open question.