Embedded Value – Quo Vadis?

A XIV. Altenburger Gyula Szimpózium
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GENERALI GRUPPE

AMB GENERALI

Agenda

- **Introduction**
- **Valuation Methods**
- **Market-consistent Embedded Value**
- **Sample**
- **Outlook**

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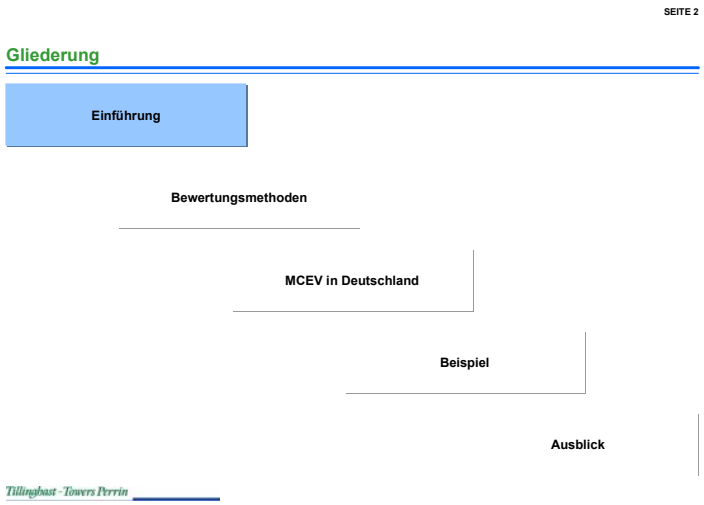


- Motivation for market-consistent valuation
- Introduction into market-consistent valuation methods and applications for traditional life insurance products
- Recognition of burn-through expenses
- Sample for closed formulae (non-stochastic) valuation methods

Food for thought regarding the valuation of options and guarantees for life Insurance products

Introduction

Why market-consistent valuation methods?

- Criticism of traditional Embedded Value methodology

Capitalization of earnings through Asset Liability Mismatch and Credit Spreads

Sample: - Life insurer “borrows” 100 EURO at 5% p.a.
- Investment into equities with expected return of 7% p.a.

Embedded Value Approach

Investment return	7	7	7	7	7
Interest payable	(5)	(5)	(5)	(5)	(5)
Profit	2	2	2	2	2
PVFP(@7%)	8,2				

Market-consistent approach

- No creation of value through mismatch
- If the return on equity is higher than the borrower rate, profits are realised when they occur and are not capitalised

Introduction

Why market-consistent valuation ?

- Criticism of traditional Embedded Value methodology
- Guarantees and options in the focus of financial analysts

Analysts 2001/2002

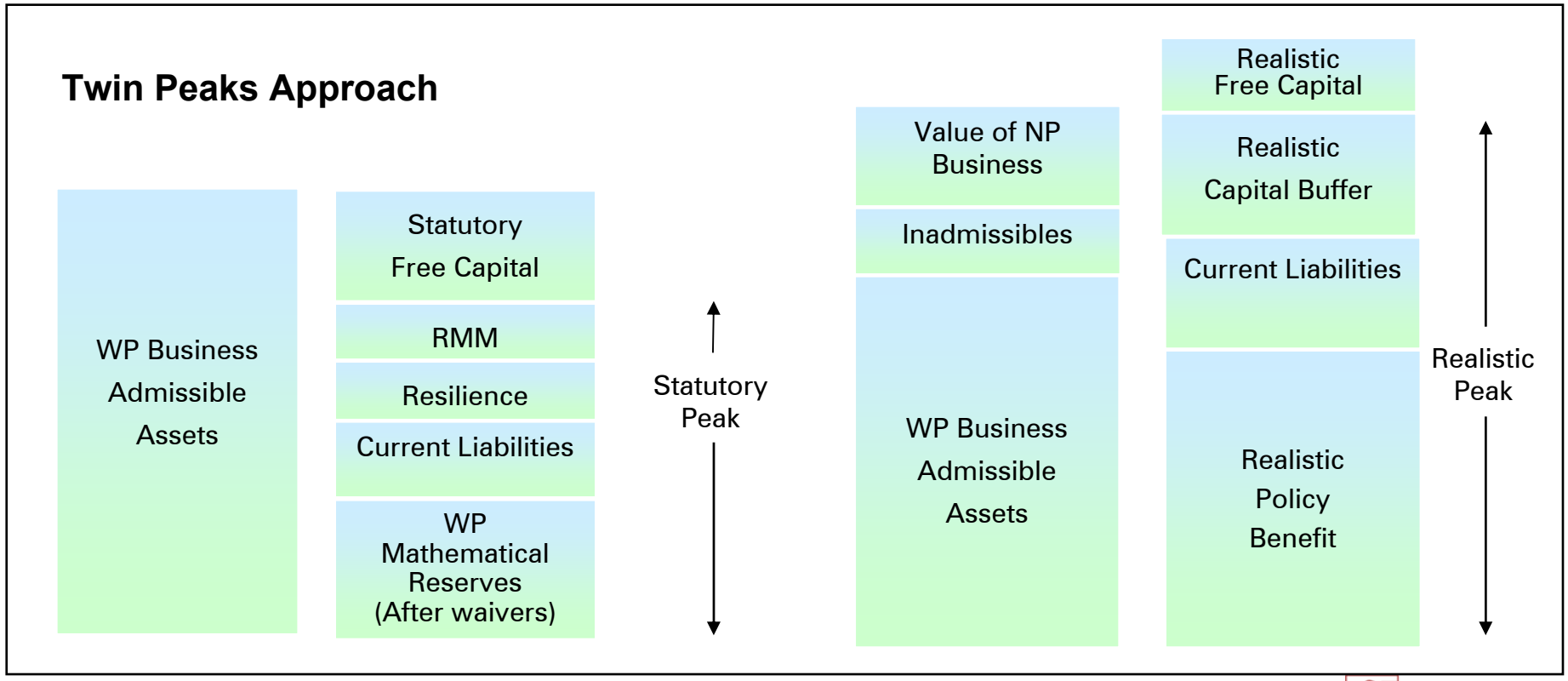
Analysts 2003

- **„Death of Embedded Value is exaggerated. Lack of confidence in the embedded value approach against the backdrop of volatile financial markets is understandable, but misplaced."**
  BEAR STEARNS, May 2003
- **„Traditional EV failed to forewarn investors of the impact on insurers from falling markets via asset/liability mismatch and costly options & guarantees."**
  Citigroup/Smith Barney, Jan. 2004

Introduction

Why market-consistent valuation ?

- Criticism of traditional Embedded Value methodology
- Guarantees and options in the focus of financial analysts
- Development of complex regulatory mechanics, e.g. Twin Peaks approach in the UK and possible application in Fair value accounting methods within the IFRS framework



Introduction

Why market-consistent valuation ?

- Criticism of traditional Embedded Value methodology
- Guarantees and options in the focus of financial analysts
- Development of complex regulatory mechanics, e.g. Twin Peaks approach in the UK and possible application in Fair value accounting methods within the IFRS framework
- Doubts regarding the current business model

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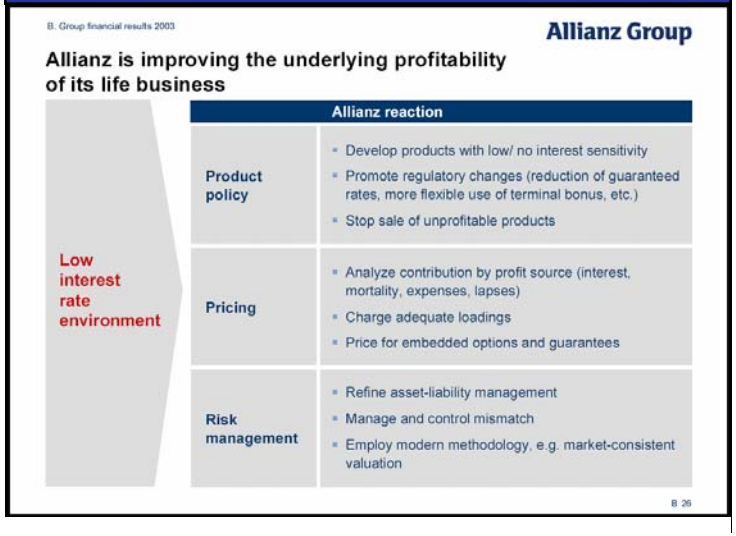

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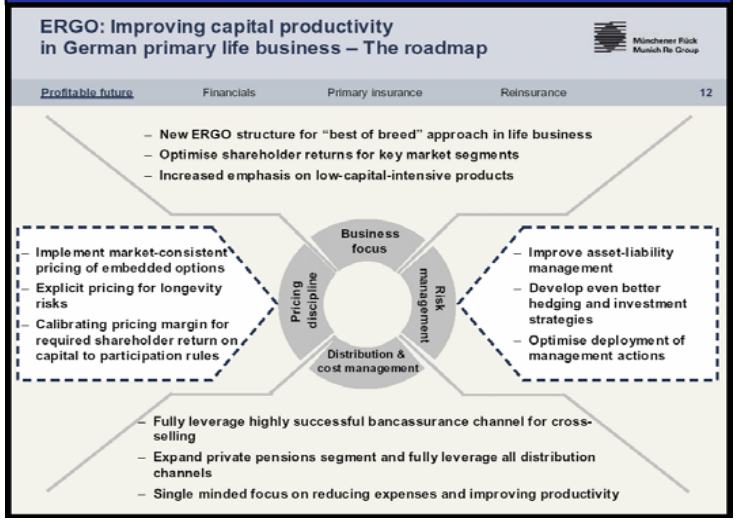

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Valuation Methods

What are market-consistent valuation methods?

Description	Limitations

■ Valuation in line with market theory
  ■ Arbitrage-free assumptions
  ■ Includes valuation of options and guarantees
■ Can be applied in various areas
  ■ Insurance liabilities
  ■ Single products
  ■ In-force portfolios
  ■ Shareholder dividends
	■ Insurance liabilities are not traded at capital markets
	  ■ E.g. Capital markets for long-term options with low strikes are partially not liquid
	  ■ Biometric risks and guarantees are not (yet) traded at capital markets

Market-consistent valuation methods for insurance liabilities aim at their valuation in accordance with modern finance theory

Valuation Methods

There are three theoretical concepts for market-consistent valuation

- Replicating Portfolio Approach
  - Construction of a portfolio that matches the cash flows of the option that is valued independent of the development of capital markets
  - Principle of arbitrage-free environment: Replicating portfolio needs to have the same price as the option
- Risk neutral valuation
  - The price of the option equals the mean value of discounted cash flows using a risk neutral probability measure. Thereby cash flows are discounted using risk-free interest rates.
  - This approach is frequently used in stochastic models whereby the expected return of each asset class equals the risk-free rate
- State price deflators
  - In this approach subjective „real-world“ probabilities and expectations are used. For each path, risk-adjusted discount factors need to be applied, which generally cannot be derived easily
  - These risk-adjusted discount rates are called “state price deflators”

All approaches lead to the same result

Valuation Methods

Calculation methods can be categorised as follows ...

Closed Formulae → Easy options, which costs cannot be influenced by management actions, e.g. lump-sum options for unit-linked annuities or GMDBs

Deterministic Approach → Liabilities without optionality, e.g. Term assurance or unit-linked business

Stochastic Simulations → Options of more complex nature dependent on management actions and policyholder behaviour, e.g. traditional with-profit business

Requirements for capital markets

- **Arbitrage-free**
- **Reproduction of relevant market prices**

Valuation Methods

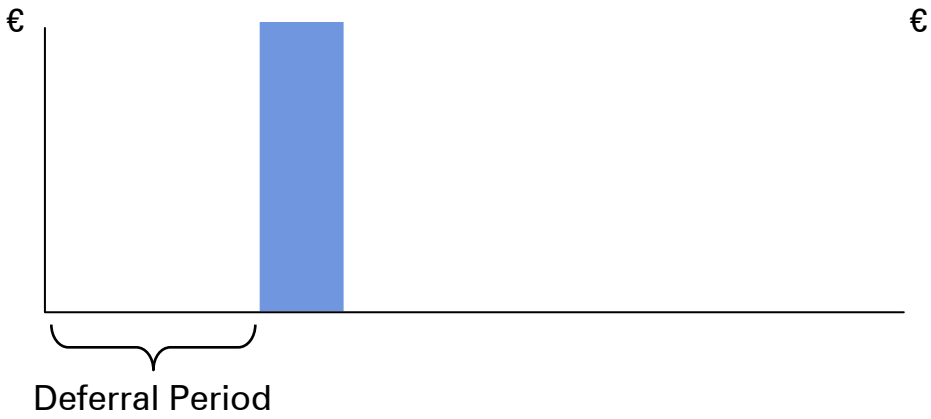
Example: Valuation of guaranteed annuity option

- Situation
  - Non-profit unit-linked annuities
  - Guaranteed annuity conversion factors (i.e. mortality, technical interest rate)
  - Shareholder pays for guarantee because of no explicit loadings for this guarantee
- Risk management
  - Reduction of biometric risk with reinsurance
  - Hedging of interest guarantees on capital markets

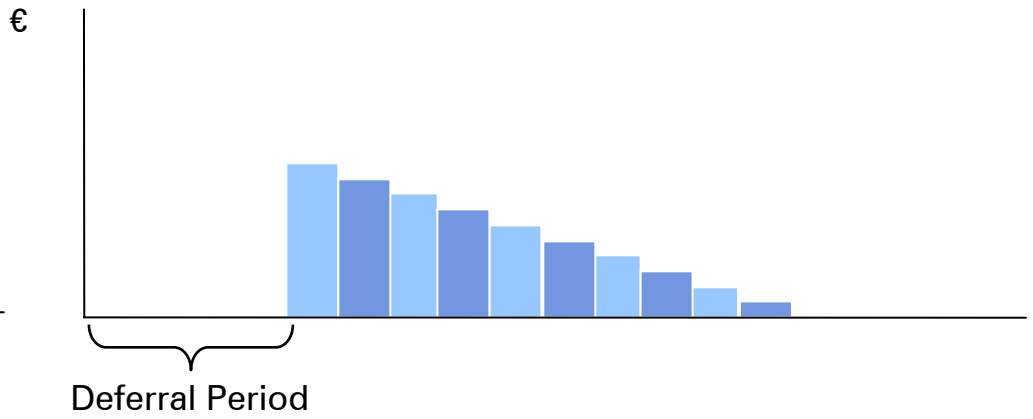
Valuation Methods

What are the policyholders options?

LUMP-SUM PAYMENT



ANNUITY

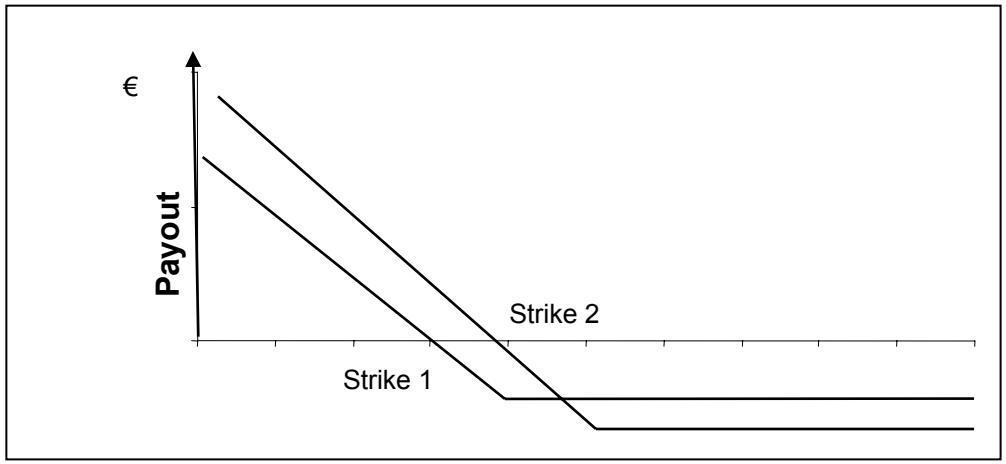


- Policyholder has the option to buy a portfolio of zero bonds for a price that has been fixed at outset, i.e. the valuation of the insurance option requires the valuation of interest rate derivatives
- The value of the guaranteed annuity option equals the sum of the prices of the individual options („Replicating Portfolio“)
- These options are generally not traded in liquid markets → Construction via Receiver Swaptions
- Valuation of Receiver Swaptions via closed formulae (Black) and implicit volatilities

Valuation Methods

Construction of hedging portfolio using receiver swaptions

- The holder of a receiver swaptions has the right to acquire a bond with a fixed term and coupon (Strike) for a fixed price
- Motivation: Protection against fall in interest rates below a given level



- Approach: Cash Flows of expected annuity payments is replicated with coupon bonds
  - Capital at annuity conversion = Present value of coupons and principle payments
  - Coupon = Discount rate = Technical rate = Strike (Swaptions)
- Example:
  - Annuitant age 65; outstanding deferral period 5, 10, 15 years
  - Male, Standard German annuitant mortality table, 4% Technical rate, Capital at annuity conversion = 100.000 €
  - Mortality of 2nd order equals pricing assumptions

Valuation Methods

Valuation of the replicating portfolio

SWAPTION VOLUME (€)

Deferral period \ Swap-Duration	1	5	10	15	20	30	40
5,10,15	3.144	3.373	3.539	3.421	2.894	1.193	239

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SWAPTION PRICES (NORMALISED %)

Deferrak period \ Swap-Duration	1	5	10	15	20	30	40
5	0,21	0,40	0,44	0,39	0,37	0,40	0,46
10	0,12	0,31	0,43	0,48	0,52	0,58	0,68
15	0,07	0,27	0,47	0,6	0,68	0,77	0,89

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COST OF HEDGING PORTFOLIO (€)

Deferral period \ Swap-Duration	1	5	10	15	20	30	40	Σ
5	7	14	15	13	11	5	1	371
10	4	10	15	16	15	7	2	421
15	2	9	17	20	20	9	2	499

Valuation Methods

There are numerous limitations for such an approach

- Which annuitisation capital has to be used?
  - Is the fund performance uncorrelated to interest rates → Accumulation phase and annuitisation can be handeled separately→ Capital at annuitisation equals the rolled-forward amount of capital plus future premiums using the risk-free interest rate
  - Is the fund performance correlated to interest rates (bond funds) : Stochastic projections for both phases become necessary (limited closed formulae can be used)
- How does one derive the price of the swaption?
  - Bloomberg publishes implicit volatilities for strikes „at the money“
  - Because of the „Volatility Smile“ this leads to problems if the difference between strike and forward swap rate is very large
- The constructed replicating portfolio gives an upper limit for the price of the option
  - Life insurer only exercises the options „in the money“
  - Policyholder has an option to a basket of cash flows
- Other
  - Proportion of policyholders exercising the option prudently
  - Flexible anuitisation point
  - Costs for immediate annuities
  - ...

Valuation Methods

Cost of the guaranteed annuity option can vary very much

Example: Costs in EURO for annuitisation capital of EUR 100.000

Deferred period	Garanteed Interest	DAV 94R 4%	DAV 94R 3,25%	DAV 94R 2,75%
	5	371	98	24
	10	421	150	45
	15	499	232	87

- The cost of the option increase with
  - Higher guaranteed interest
  - Longer deferred period
- Policyholder should be charged for these costs
  - E.g. By charging additionally 10 bp p.a. of the investment fund
  - Dependent on term to annuitisation and guaranteed interest

Calculation of costs for option very interesting for product pricing process

Agenda

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Market-consistent Embedded Value

Sample

Outlook

MCEV for European Life Insurance Industry

How can MCEV be calcualted for traditional with-profits business?

Market-consistent ...

- Arbitrage-free economic scenarios
- Calibration to relevant capital market positions

... Embedded Value ...

- Shareholder view, valuation of possible payouts to shareholders
- Valuation without new business
- Questions: Need for capital

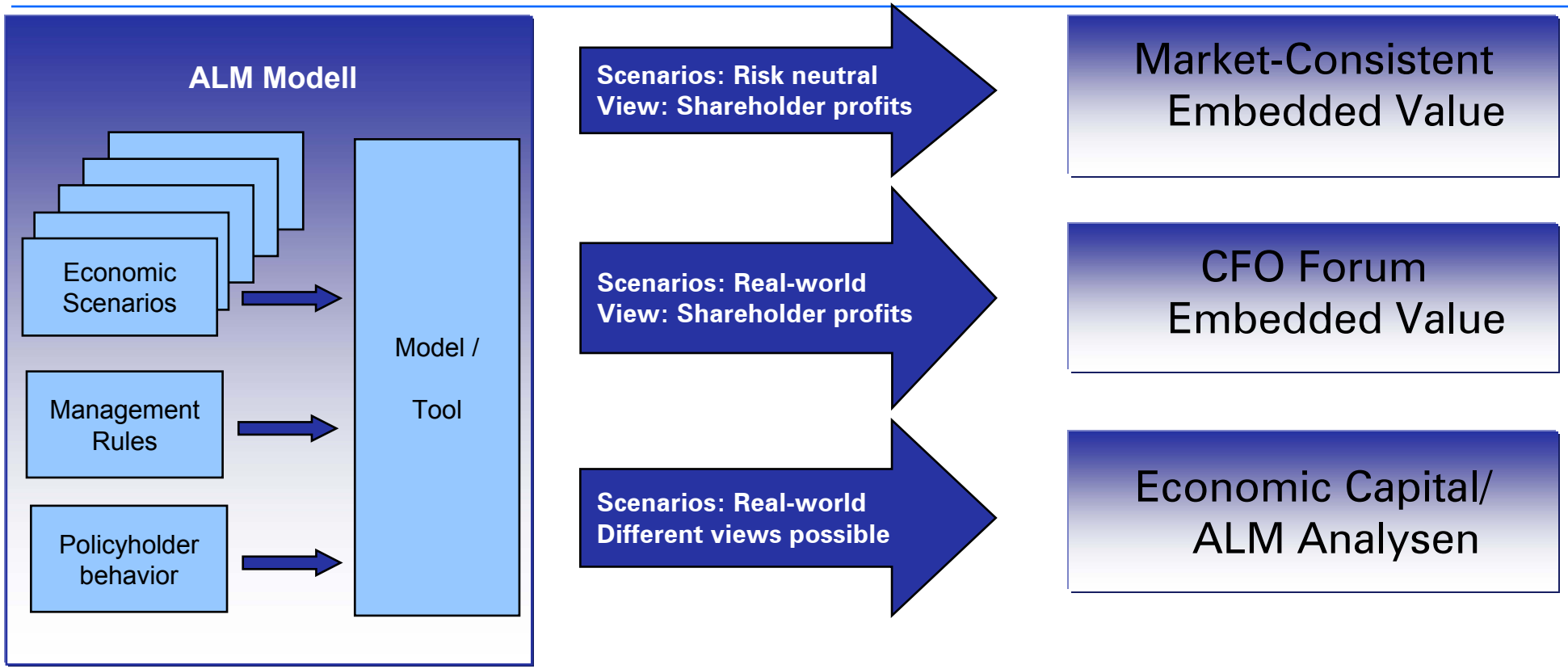
... for European life insurers

- Policyholder profit participation
  - Profits are shared with policyholders using a formulae approach
  - Policyholder bonus can be managed according to strategy
- Smoothing effects
  - Buffers on asset and liability side used for smoothing
  - In reality no actual mark-to-market of options (similar to Asian options)
- Policyholder and management behaviour
  - Empirically there are not always prudent market participants as assumed in financial market theory
    - Policyholders do not exercise options and guaranteed in a prudent way
    - Also, management actions are not always prudent in a financial sense

The high complexity of the business requires stochastic modelling techniques

MCEV for European Life Insurance Industry

ALM models can be used in various contexts



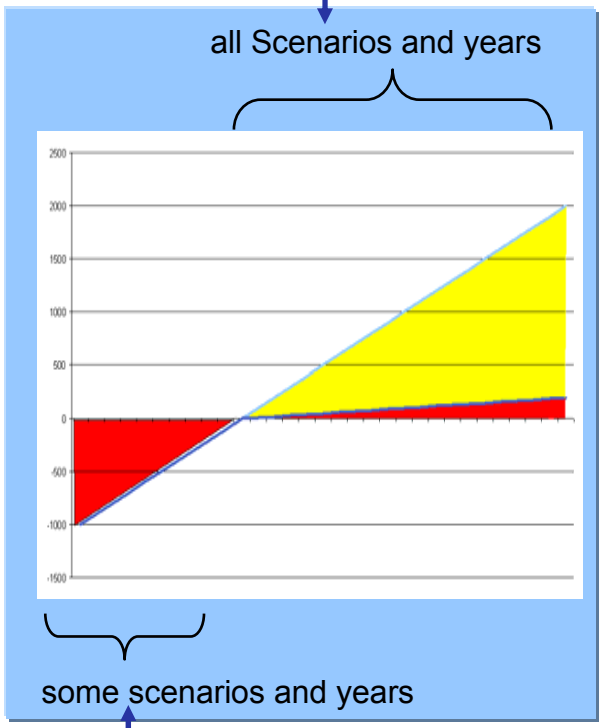
- Existing and functional ALM models are the ideal starting point to calculate MCEV
- MCEV requires arbitrage-free and market-consistent scenarios, while for Economic Capital generally „real-world“ scenarios are required
- Important: Anticipated management and policyholder behaviour can significantly impact the MCEV

MCEV for European Life Insurance Industry

Analysis of results

Case 1	Comment
All scenarios ■ Non-negative surplus ■ Profits split, e.g. 90% / 10% Policyholder / Shareholder ■ No Shortfall / burn-through	■ „Value“ of options / guarantees could be reduced to zero by management ■ Successful risk management

Case 2	Comment
In some scenarios ■ Negative surplus ■ Losses covered by shareholder 100%	■ Equity market crash ■ Long period of low interest rates ■ Results in lower MCEV compared to case 1



MCEV for European Life Insurance Industry

For traditional business, burn through expenses can be estimated as …

Burn-through Costs = **MCEV w/o burn-through** - **MCEV**

Interpretation

- Average potential capital injections from shareholder over all economic scenarios
- Equivalent to insurance premium for catestrophe protection of the life insurer
- Excluded Limited Liability Put Option

Calculation (MCEV w/o burn-through)

- Deterministic
- Can be derived from existing EV models
- Include cost of capital

Essential Parameter (MCEV w/o burn-through)

- Interest vector
- Policyholder behaviour

Calculation (MCEV)

- Stochastic ALM models
- Mean over all risik neutral scenarios

Essential Parameter (MCEV)

- Interest vector
- Volatility (Interest, Equity)
- Management/ Policyholder behaviour

MCEV for European Life Insurance Industry

Capital and Cost of Capital in MCEV

Why capital?

- Regulatory requirements/ Rating agencies
- Risk capital for
  - Asset liability mismatch risk (if unhedged)
  - Insurance risks
  - Operational risks
- Capital has a cost

Why cost of capital?

- Finance therory gives two reasons
  - Agency costs
  - Tax inefficiencies

MCEV for European Life Insurance Industry

MCEV Profit & Loss Account

Value created through insurance management	
■ Experience Variances	xxx
■ Assumption changes	xxx
■ Value of new business written	xxx
Value created through investment management	
■ Investment return on net worth	xxx
■ Investment return on value of in-force	
■ Return on assets backing in-force	xxx
■ Mismatch profit	xxx
Total Value created	**xxx**

MCEV for European Life Insurance Industry

MCEV Sensitivities

Typical sensitivities currently

- Future investment return
- Risk discount rate

MCEV Balance Sheet risks

- Levels of equity markets
- Level and shape of yield curve
- Levels of option prices (implied market volatility)
- Credit risk spreads
- Insurance risks
  - mortality/morbidity
  - lapses
  - expenses, one-off and ongoing
- Management actions

MCEV for European Life Insurance Industry

Traditional vs. market-consistent Embedded Value

	Traditional Embedded Value	Market-Consistent Embedded Value
Guarantees and Options	Inner value	Capital market oriented valuation / market value
Risk discount rate and risk premiums	Capitalised risk premiums	No capitalisation of risk premiums
Cost of capital	Mostly, only solvency capital	Total capital / Economic Capital

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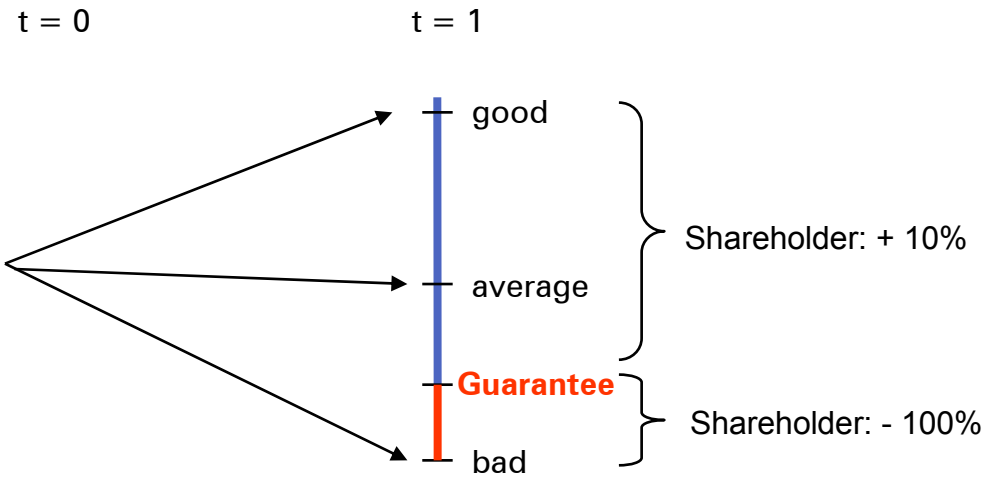
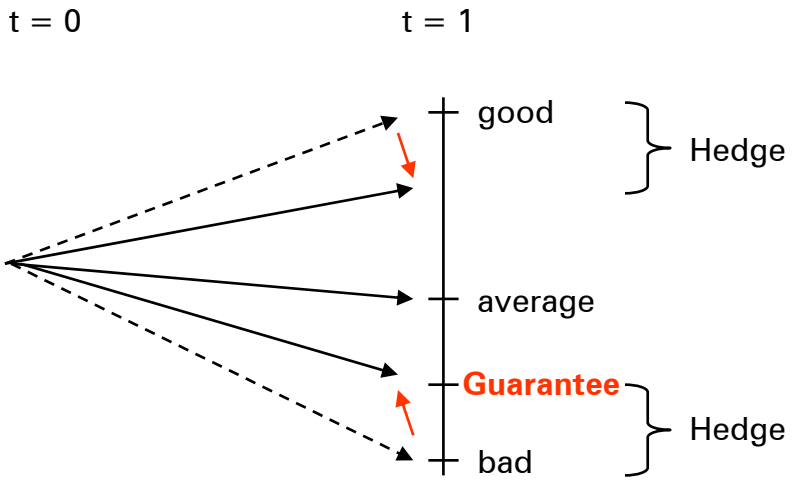
What‘s the effect of a hedge?

Simplified Scenario Analysis





- In bad scenarios a burn-through occurs
- What is the cost of the burn-through?

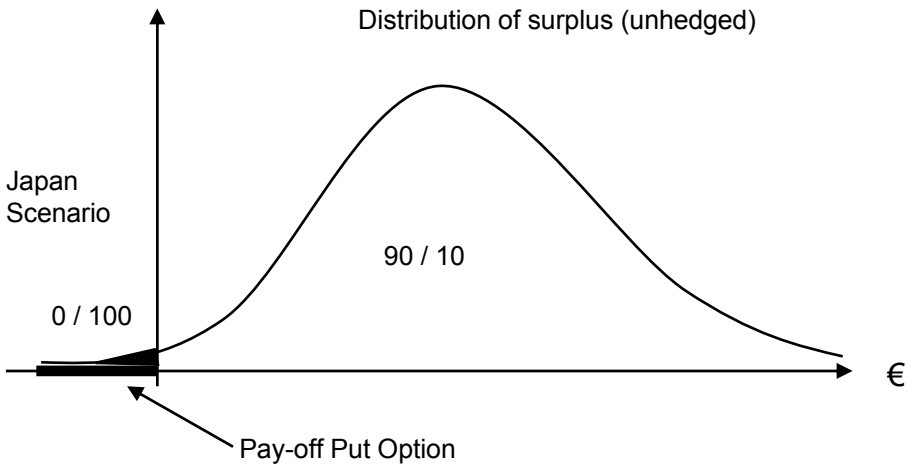
- No burn-through → maximized MCEV
- Effective hedge
  - No downside risk
  - Lower upside potential

ASSET ALLOCATION - UNHEDGED

ASSET ALLOCATION - HEDGED

Example

Japan Scenario: How can the burn-through expenses be estimated?



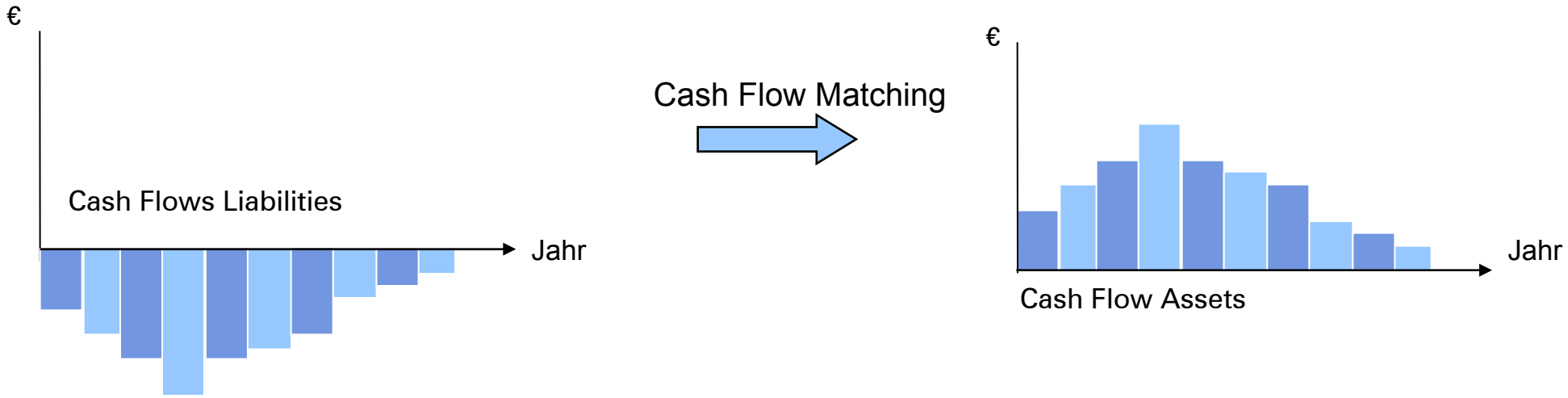
- Burn-Through Costs ≈ risk neutral probability x shortfall
- Alternative: 90% of Hedging expenses (Buy put option) as rough estimate

- Method does not only provide MCEV in the case that the management has not applied a hedge or cannot apply a hedge
- Additionally, a hedging portfolio is created → Buy investing in the hedging portfolio, the burn-through costs can be eliminated and the MCEV is at its maximum
  - Hedging portfolio is financed by the policyholders to a large extent
  - In this simplified scenario it is assumed that only a Japan-Scenario can cause the burn-through, i.e. equity exposure needs to be driven dynamically by adjusting the exposure accordingly

Example

Cashflow Matching does not always help

- If surrenders depend on capital market → Diversification possible
  → deterministic assumptions for calculating future payouts
- Obvious solution to avoid burn-through in Japan-scenario:



- Surrender option could lead to problems in duration or cash flow matching
  - Market value decrease caused by rise in interest rates
  - Prudent policyholder behaviour
- Accounting: Short-term depreciation risk
- Benchmark problem

Example

Receiver Swaptions again build the hedging portfolio

- Advantage of hedge portfolio of options
  - Reinvestment with pre-determined interest and thereby securing the policyholders guaranteed interest
  - Duration of assets can be shorter in comparison to liabilities → low surrender risk
  - Receiver swaptions are simply not exercised when interest rates increase over the strike

Burn-through can be avoided in rising and falling interest rate scenario

- Tasks
  - Determine hedging portfolios
  - Valuation of hedging portfolios

Example

The construction of the hedging portfolio requires advanced modelling techniques

1. Step – Determine reinvestment profile

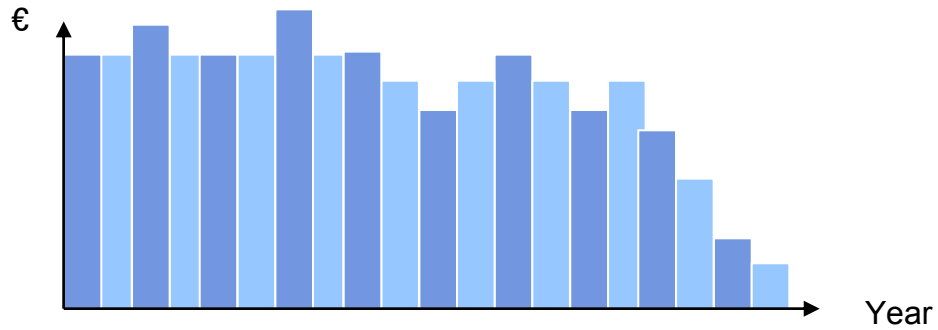
- Cash flows (assets and liabilities)
- Realistic bonus strategy

2. Step - Determine strikes

- Guaranteed interest, but taking into account
  - Expense and risk profits
  - Current portfolio yield
  - Other buffers
- Might be dependent on projection year

3. Step – Valuation of replicating portfolio

- Reinvestment in coupon bonds → swaptions
- Valuation as in previous example lump-sum option



SWAPTION VOLUMEN (€)

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SWAPTION PREISE (NORMIERT %)

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15	0,07	0,27	0,47	0,6	0,68	0,77	0,89

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KOSTEN DES HEDGEPORTFOLIOS (€)

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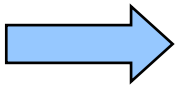
5	7	14	15	13	11	5	1	371
10	4	10	15	16	15	7	2	421
15	2	9	17	20	20	9	2	499

Example

Burn-Through expenses need to be calculated individually for each company

- Number of price factors is significant
  - Interest rate environment/ Implicit volatilities
  - Guaranteed interest
  - Expense and risk profits
  - Proportion of annuity business
  - Structure of asset portfolio
- There are again numerous limitations similar to the one previously stated
- Based on our calculations for a sample in-force portfolio, the costs of a „Japan Hedge“ amount to about 1%-2% of total assets at year-end 2003
  - Very high, if shareholder has to pay alone (burn-through expenses)
  - Traditional Embedded Values currently amount to about 2%-3 % of total assets



Policyholder should participate in costs for hedge

Example

Remarks to the Example

- In order to calculate the MCEV, 90% of the hedging costs are deducted from the deterministic maximum value
  - This approach is based on a rough estimate and only intends to give an indication of the size of the costs for the guaranteed interest in the case that no management actions are taken
  - There are many possible management actions that would reduce the burn-through costs and which could in general on be evaluated using stochastic models
- The overall goal is not only to construct hedging portfolio but also price optimisation
  - Even though the MCEV does not decrease in the case of over hedging, only the lowest possible amount of assets should be tied in this portfolio
    - Policyholders expect certain participation in equity performance
    - Benchmark risk
- For valuation purposes, receiver swaptions are of great use
  - There are liquid markets also for long durations
  - Protection against falling interest rates
  - In practice other alternatives might be necessary (limitations of use of derivatives)

Agenda

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Market-consistent Embedded Value

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Outlook

What can MCEV‘s be used for?

- Not the calculation of MCEV but the valuation of alternative management options is important
- The amount of burn-through costs drives the necessity to take action

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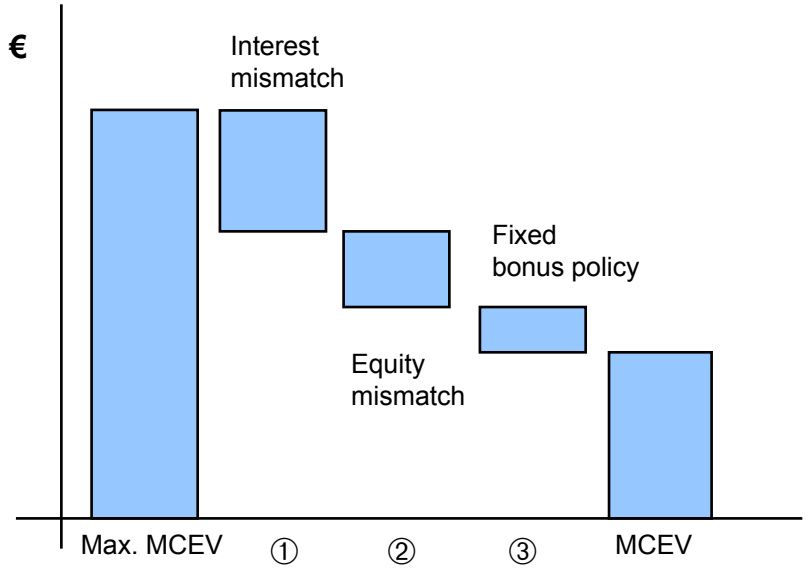
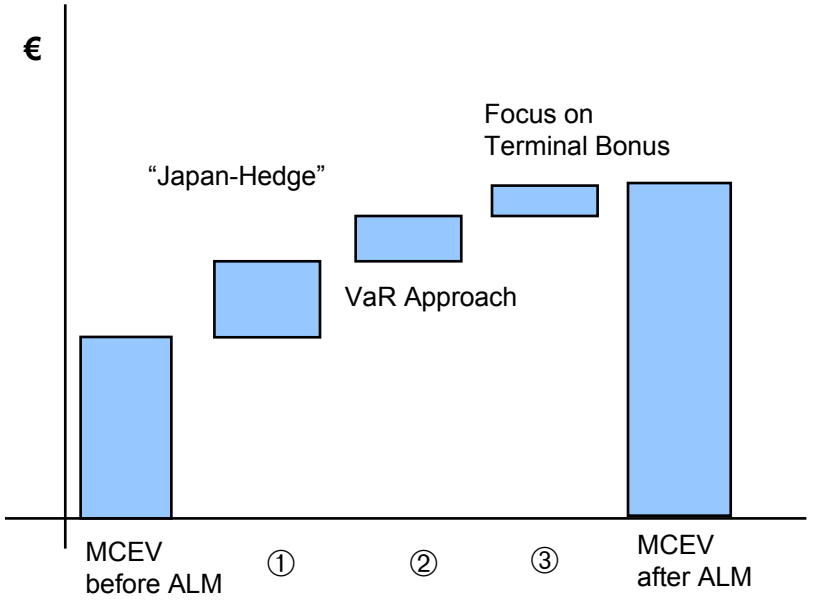
- ALM strategies are compared in a capital market consistent way
- Targets are set for ALM goals



MANAGEMENT ACTION



Maximizing MCEV is an important goal for the company

- **At the same time minimization of Economic Capital is desired**
- **Combination of valuation and risk management**

Outlook

MCEV – Almost The Same – Only Completely Different

citigroup
Smith Barney

See page 166 for Analyst Certification and Important Disclosures

Industry Report

EQUITY
RESEARCH:
EUROPE

Insurance

7 January 2004

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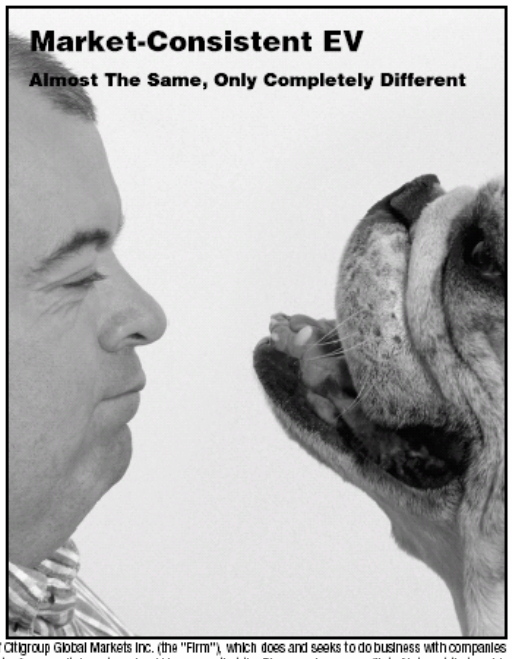
Market-Consistent EV

Almost The Same, Only Completely Different

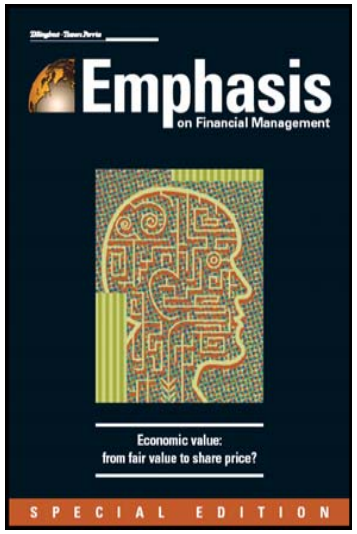


Europe

Outlook

Other publications

Market Consistent Embedded Values
www.tillinghast.com



Economic Value: from fair value to share price?
www.tillinghast.com