Risk Management for Guaranteed Life Bonds

Presented by
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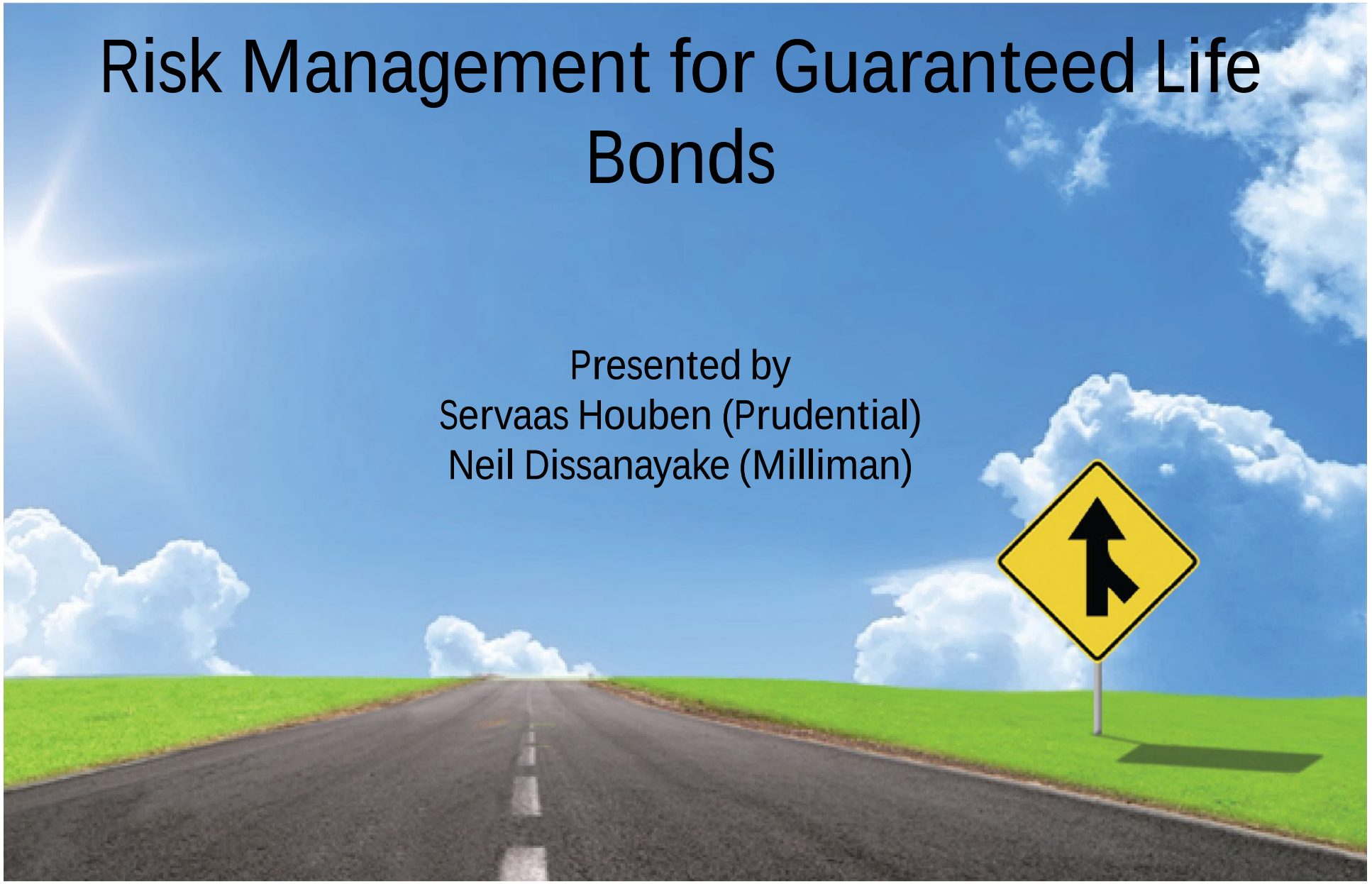

Agenda

- Current regulatory and capital framework
- Guaranteed life bonds product details and product example
- Market risk management
- Case study

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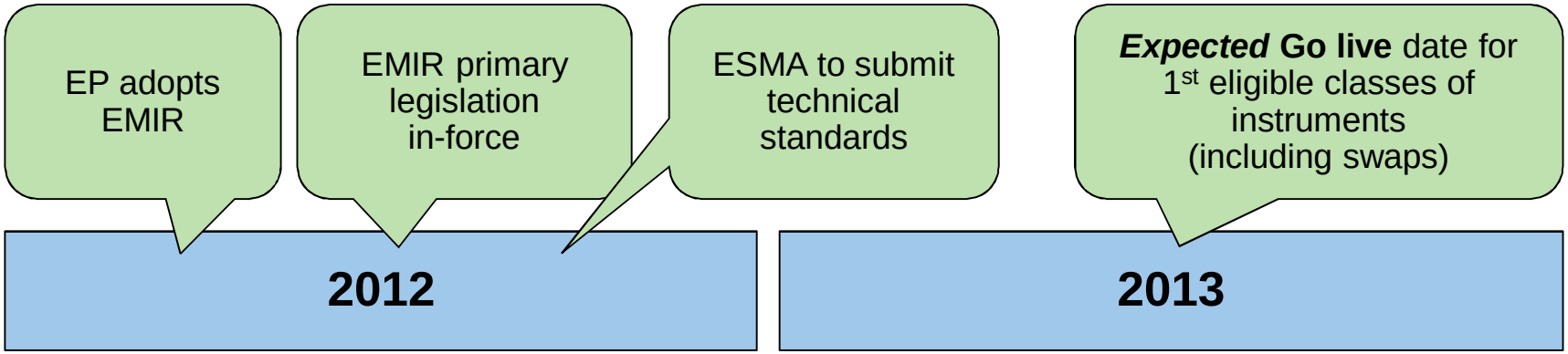
EMIR & Central Clearing

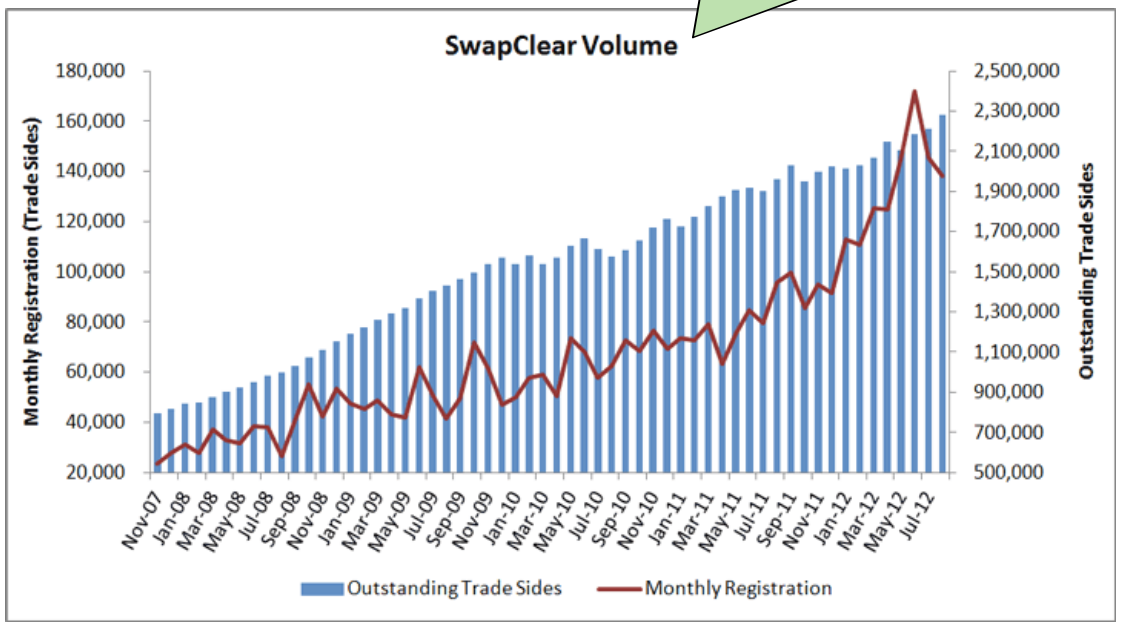
- Mandatory clearing of all qualifying OTC derivatives at a CCP
  - *CCP = Central Counterparty*
- Risk mitigation standards for non-centrally cleared derivatives
- Exemptions:
  - *Small non-financial firms, below defined thresholds*
  - *Pension schemes (for 3-years temporarily)*
  - *Foreign exchange (?) (may depend on MIFID2 classification)*
- Reporting of all derivative transactions to trade repositories
- CCPs to be regulated on a consistent basis across EU members
- CCPs subject to capital requirements and transparency



EMIR Implications

- Costs for end user?
  - implementation
  - margining
  - CCP costs
  - reporting
- Will we see reduced…
  - hedging?
  - liquidity?
  - price differentiation?
  - counterparty risk?
- OIS-curve discounting
  - Net Receive Fixed
    - → gain from existing positions

The move to a cleared interest rate swap market has started already.

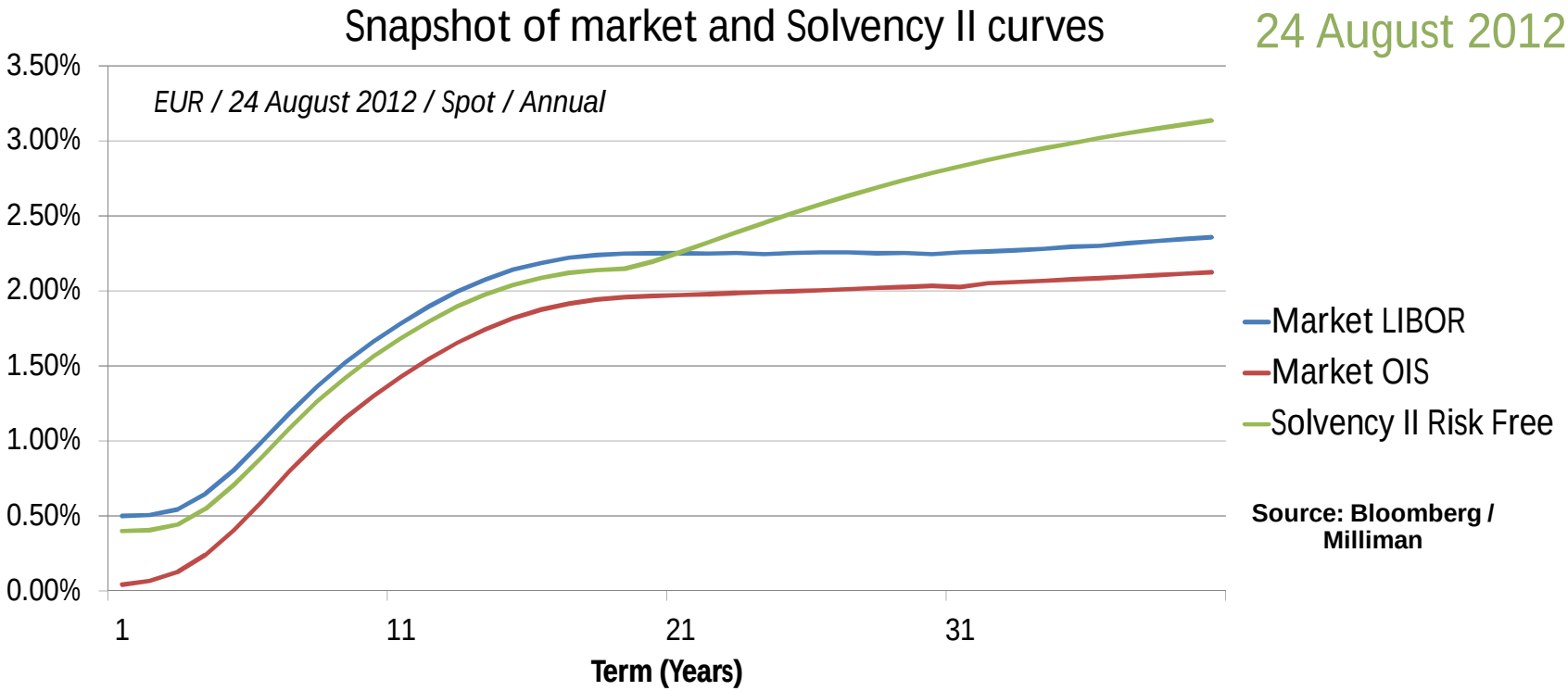


Source: LCH Clearnet

Risk Free Curves

EUR

24 August 2012



Source: Bloomberg / Milliman

Risk Management → Hedging uses assets quoted on OIS

Pricing (Guarantees) → Funding for hedging based on OIS

Provisioning → Solvency II based on LIBOR & UFR

- One-off surplus (based on current market environment)
- Hedging efficiency and provisioning risk due to LIBOR-OIS basis

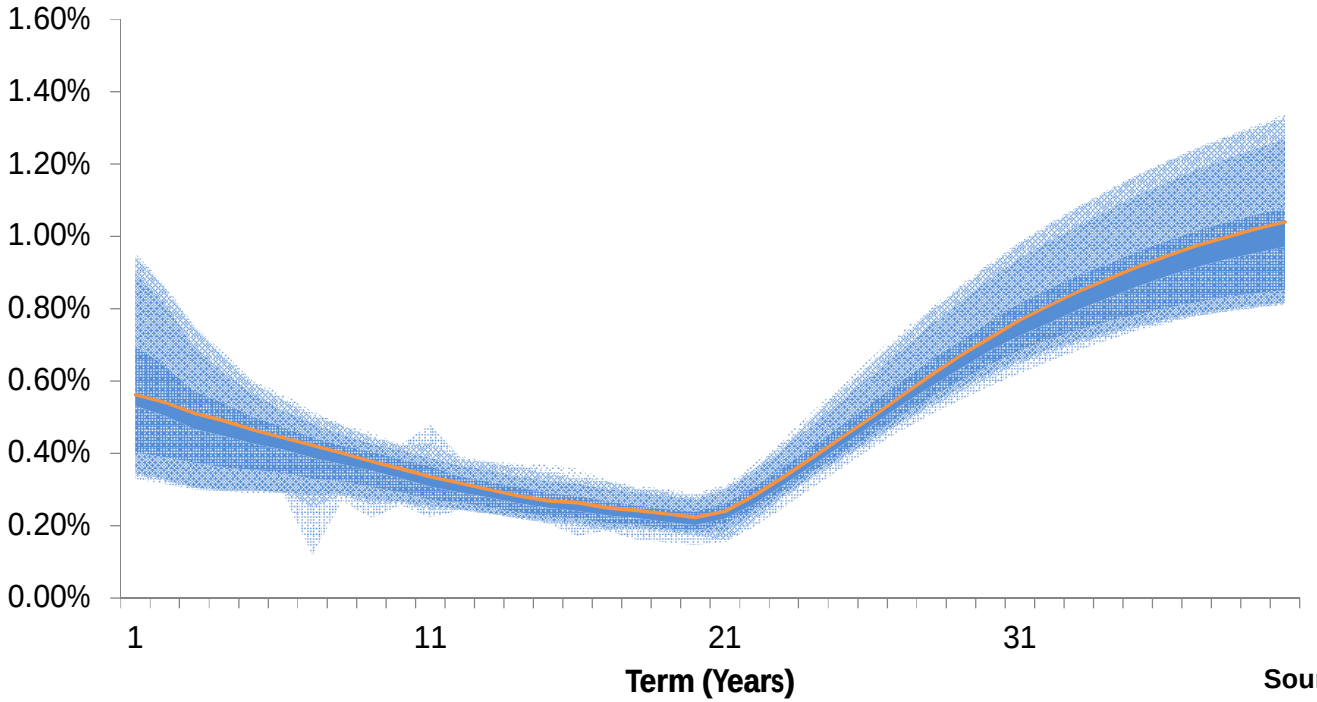
Solvency II-OIS Spread

EUR

from 2 Jan 2012

Analysis of daily data points

Term	1-year	20-year	30-year
0.5% percentile	34 bps	17 bps	61 bps
Median	56 bps	22 bps	72 bps
99.5% percentile	95 bps	29 bps	93 bps



Source: Bloomberg / Milliman

Capital & Risk Management

Solvency II

- Significant difference between market and Solvency II for discounting long-term fixed cash-flows
- Currently → Surplus.
  - But… this depends on UFR relative to prevailing market conditions
- SCR Capital Charge for this basis and risk of reversal?

Risk Management

- Added complexity and potential inefficiency in current hedge strategies.
- Are there solutions?
  - LIBOR-vs-OIS basis hedge-able via swap
  - Active markets currently for EUR (liquid to c20 years) plus GBP and USD
- Full Solvency II-OIS more challenging

Regulatory and Capital Framework

Regulations	Capital
• Solvency I • Reserve 4% of unit funds • Focus risk measurement • Different regimes in Europe • Solvency II • Standard formula • Instantaneous stresses • Balancing during stress not allowed • Favours equity hedges • Internal model • Uncertainty based regulations • Use test	• Value at risk • Instantaneous shock • Risk reduction due to underlying limited • Benefit from hedged assets in force • Conditional Tail Expectation • Tail Value at risk, average of worst • Considers entire extreme of policy • Risk reduction due to future trading • Hedge effectiveness test • Highly computationally intensive • Model approval process inevitably subjective • Hedge effectiveness allowed for in practice

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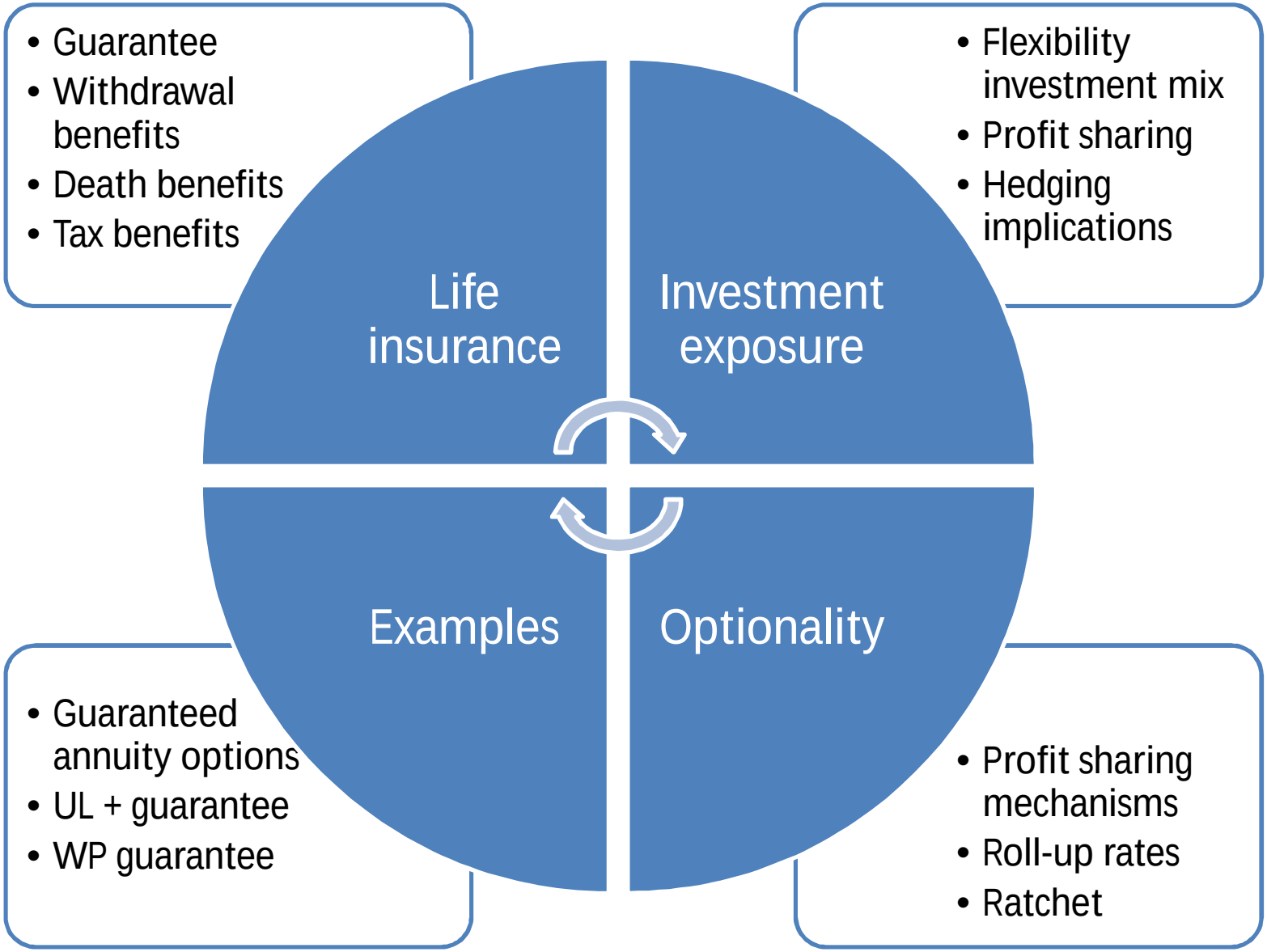
Product Details



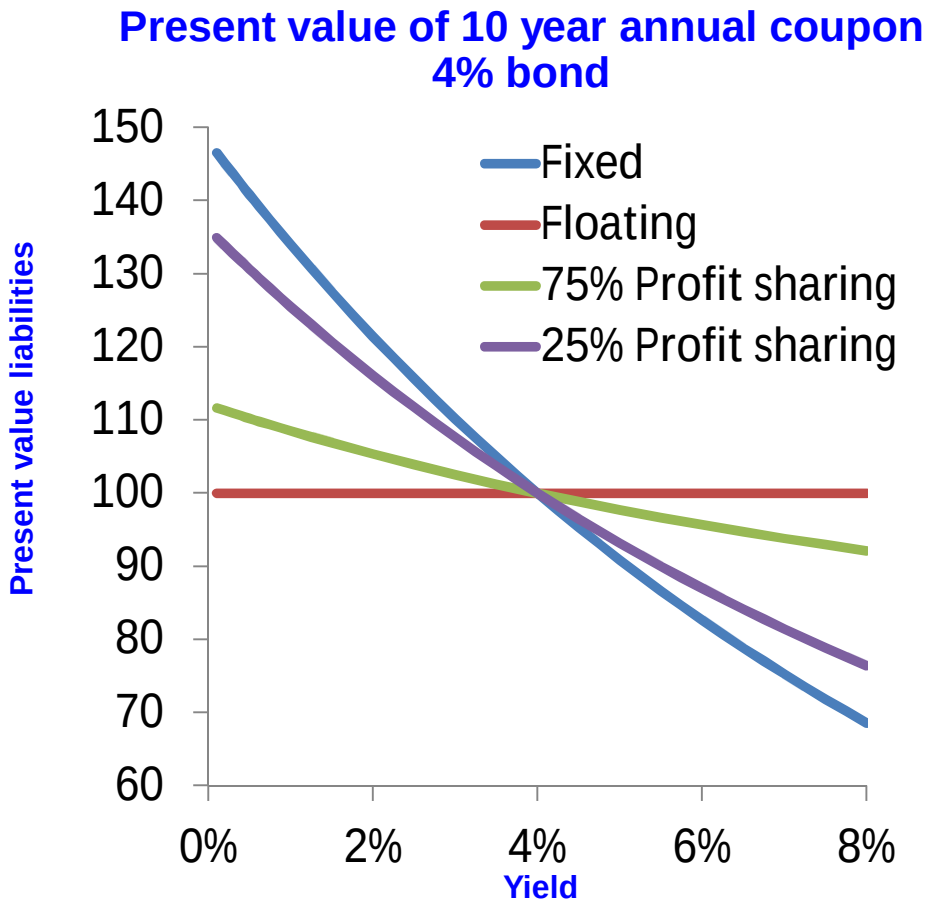
Examples Dutch Products

Features	• Bonuses non discretionary:
	  ◦ Formula based
	  ◦ Bonuses based on contractual agreements
	  ◦ Board responsible for setting realistic contract rates at start date
	• Valuation challenges:
	  ◦ Bonuses path dependent
	  ◦ Computer computation power required
	• No ring fencing arrangements as in UK

Immediate annuities	• Lump sum at t = 0, payments over time • Most competitive product (cross selling bank products)
Company profit sharing	• Annuity guaranteed payment as under immediate annuities, *plus* • Company profit sharing when return exceeds annuity guarantee
Excess interest, company profit	• Max return (Company profit sharing, government bond return x year period)
Interest rate discount	• When company return is expected to be higher than guaranteed return, policyholder discount given at start of the policy.

Present value fixed and floating bond

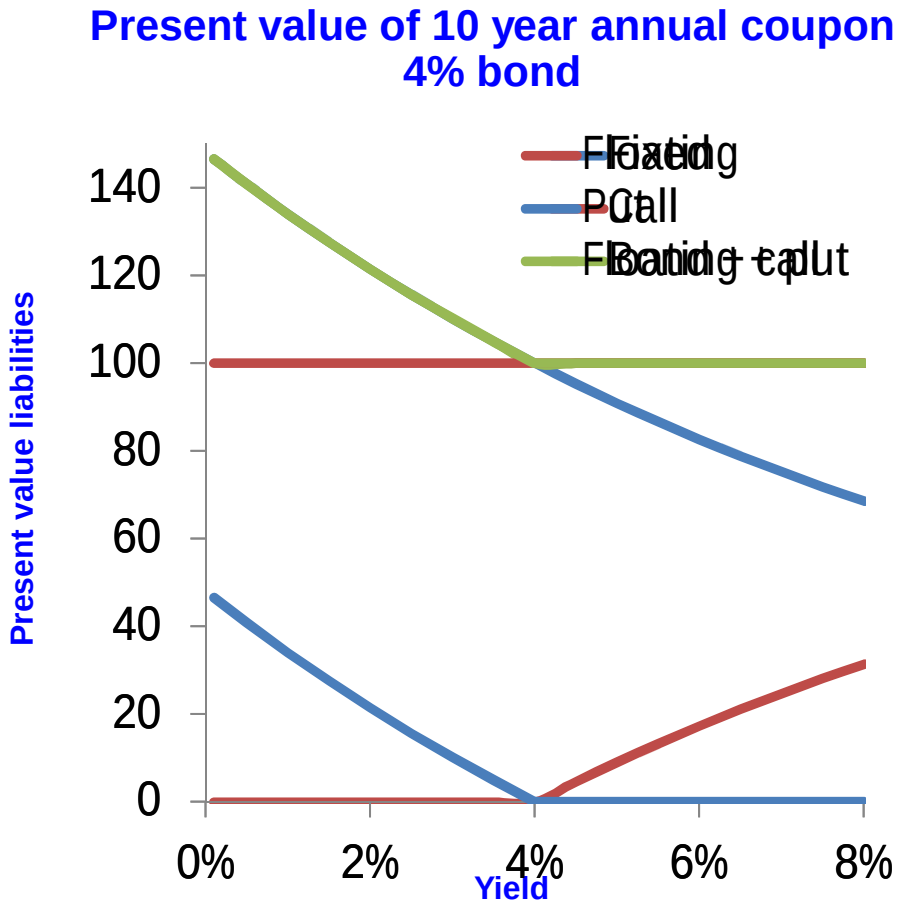
- Fixed bond: fixed coupon payments and principal payment at maturity. Present value function of current interest rates (0% profit sharing).
- Floating bond: variable payments depending on interest rate. Present value constant (100% profit sharing).
- Profit sharing is within these extremes.



GLB as combination of fixed bond+call or floating bond+put

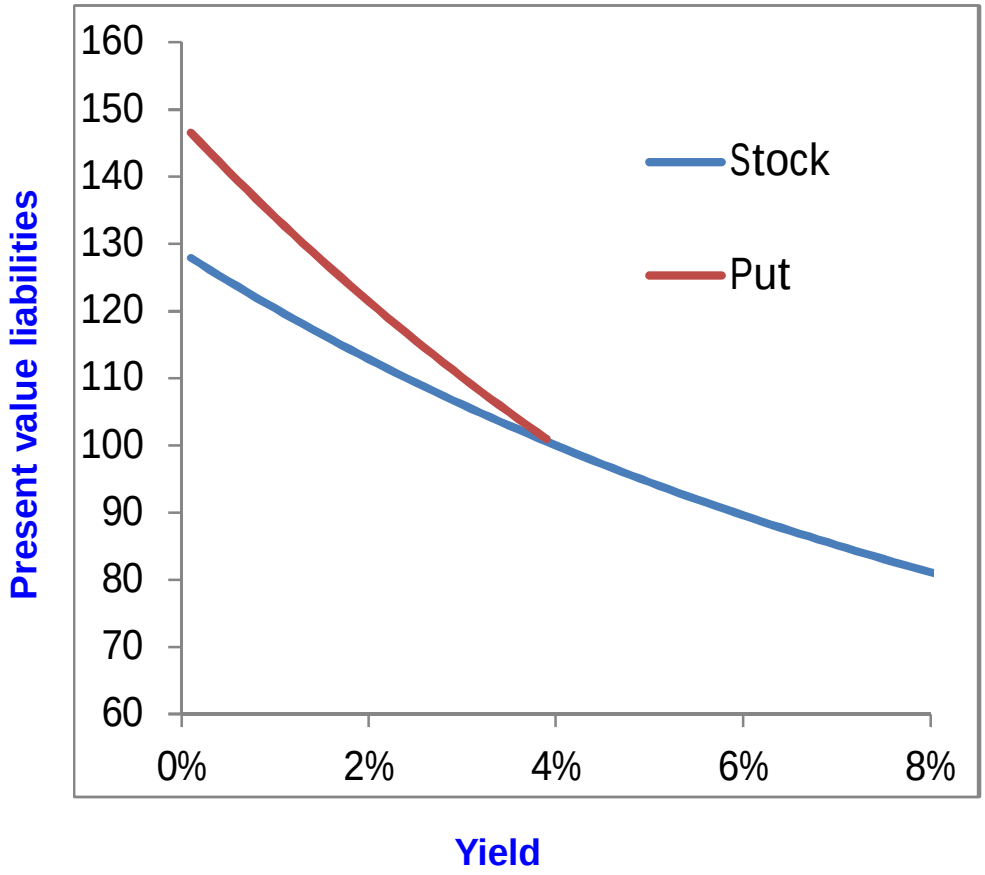
- Interest call option with strike value 4%:
  - Payout option when yield above 4% guarantee
  - Payout option (yield) = Max(100 – value fixed bond (yield), 0)
- Interest put option with strike value of 4%:
  - Payout when yield below 4% guarantee
  - Payout option (yield) =

  Value fixed (yield) – value floating

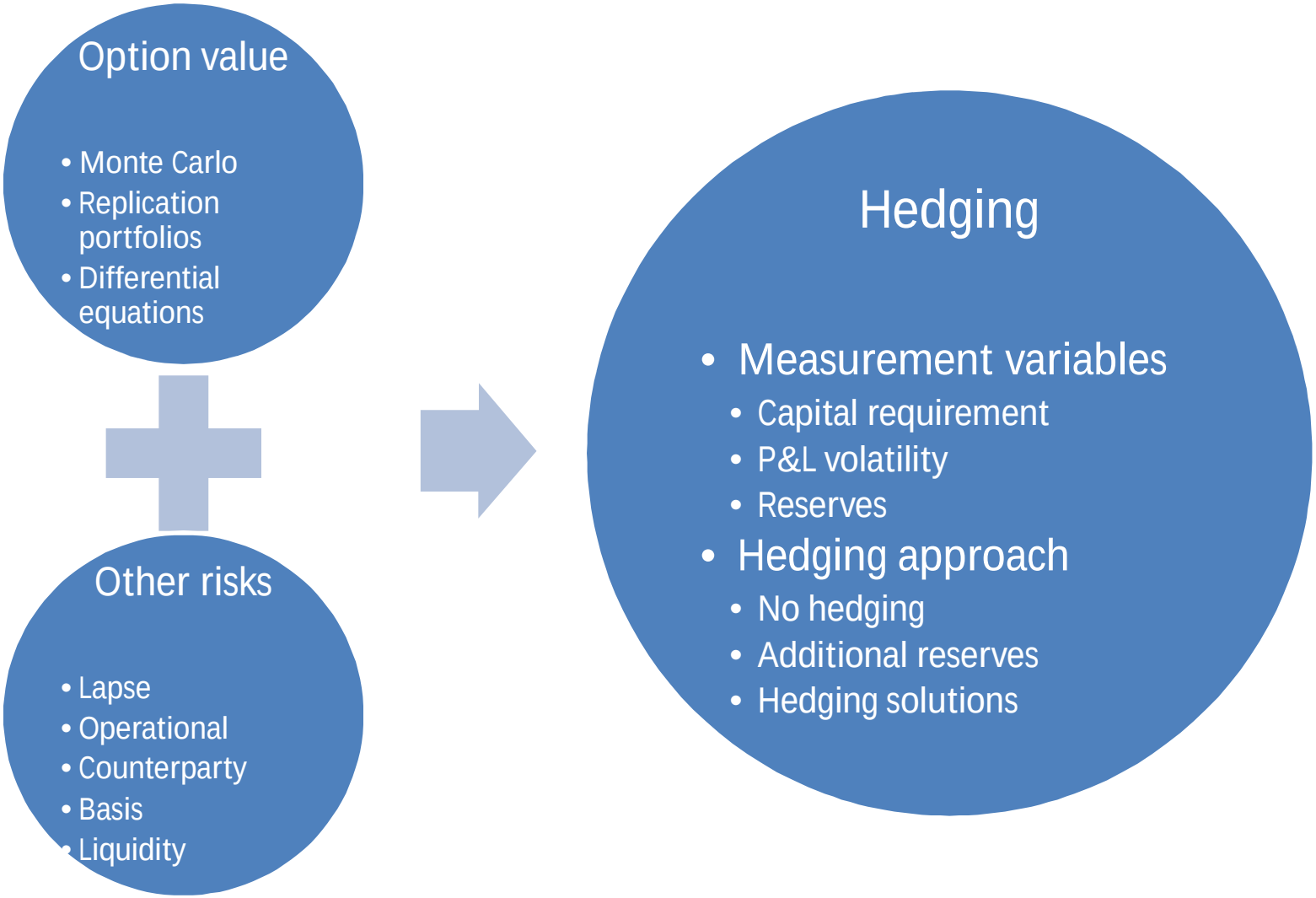


Company profit sharing – overall payoff

- Example:
  - Time horizon 10 years
  - Payment of 100 at time 0
  - Guarantee 4%
  - Profit to policyholder 40% above guarantee
  - No life insurance, or (other) operational risks
- Fixed bond + call:
  - bond (4% guarantee)
  - call (profit sharing for return above 4% guarantee)
- Floating bond + put:
  - Stock (x% profit sharing)
  - Put (guarantee of 4% return)



Hedging Process



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Market Risk Management (using hedging techniques)

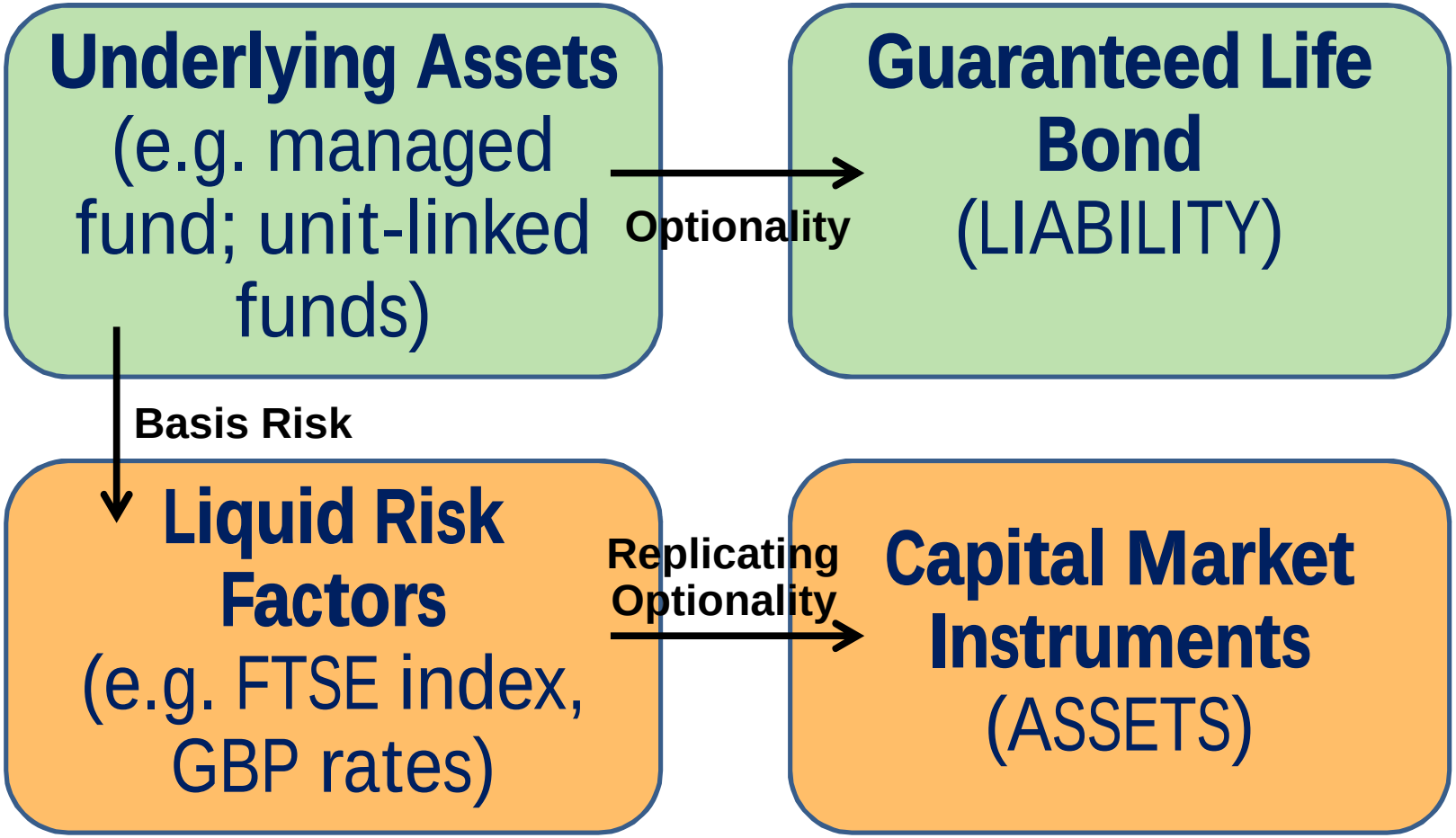
Delta (& Gamma)
(Risk from underlying fund value)

Rho
(Risk from interest rates)

Vega
(Risk from realised and assumed volatility)

Effectiveness of Hedging

Hedge Mapping

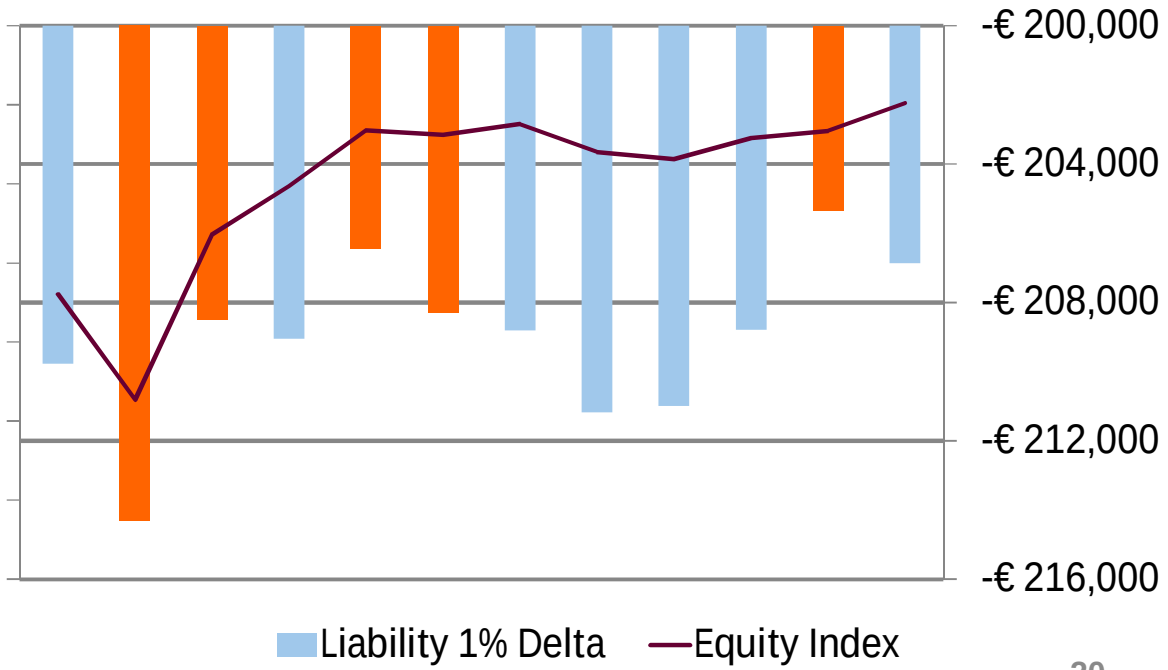


Delta Hedging

Delta Hedging

- **Hedge instruments:** Futures, forwards, total return swaps, ETFs, delta 1, short-selling stocks, reverse repo + sale
- Re-balancing creates convexity to match liability (→ gamma risk)
- Expected cost from 'buying-high / selling-low' funded by hedge premiums
- Key is balancing the trade-off between:
  - Liquidity / spread
  - Roll cost
  - Threshold
  - Rebalancing freq.
  - Hedge Basis

Source: Bloomberg / Milliman

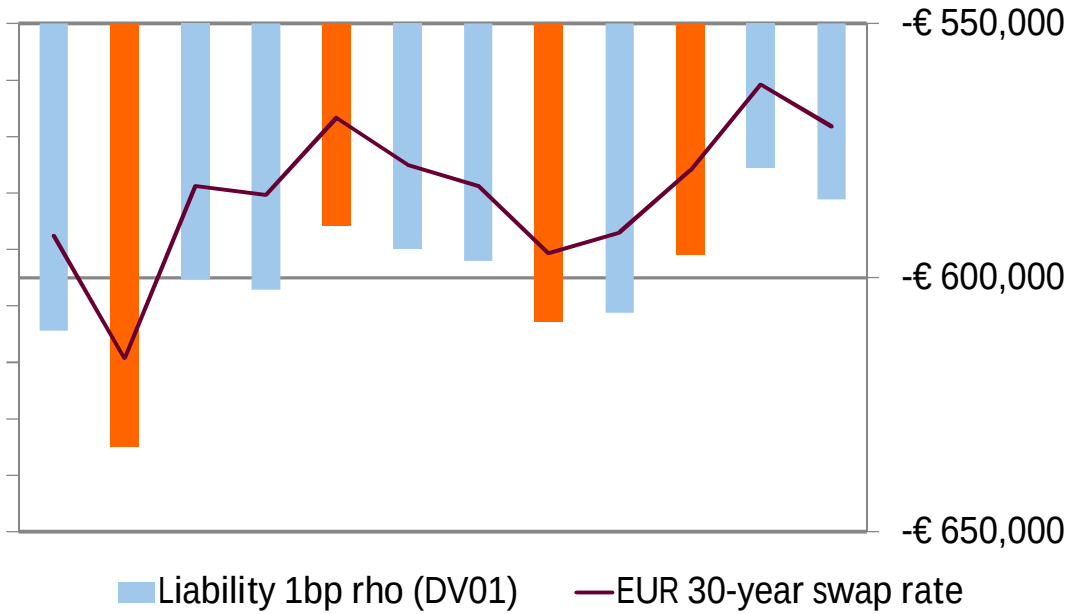


Rho Hedging

Rho Hedging

- **Hedge instruments:** OTC interest rate swaps, cleared interest rate swaps, swaptions
- Similarly re-balancing creates convexity (→ gamma risk)
- **Key issues:**
  - Term structure risk vs liquidity / spread
  - Roll vs unwind
  - Valuation issues
    - CVA-pricing
    - OIS vs LIBOR

Source: Bloomberg / Milliman



Vega Hedging

Vega Hedging

- Risk characteristics:
  - Re-balancing strategy cost (buy-high / sell-low) higher than priced for in pricing and provisioning assumptions
  - Changes in mark-to-market of liability on balance sheet due to changes in market assumed volatility
- **Hedge instruments:** ETOs, OTC index options, variance swaps, swaptions
- **Key issues:**
  - Long-term risk vs Short-term liquidity
  - Implied Vol (and broker-dealer premium) vs Realised Vol (and uncertain gamma risk)
  - Counterparty risk
  - Skew (ATM vs ITM or OTM)

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Hedge Effectiveness (Case Study)

- Aggregation of **actual** European performance data
- Analysis Period = 1 June to 1 September 2011
- Mixture of minimum withdrawal, accumulation and death guarantees
- Mixture of single and regular premium business
- Normalised to un-hedged loss of EUR 100 million for the period

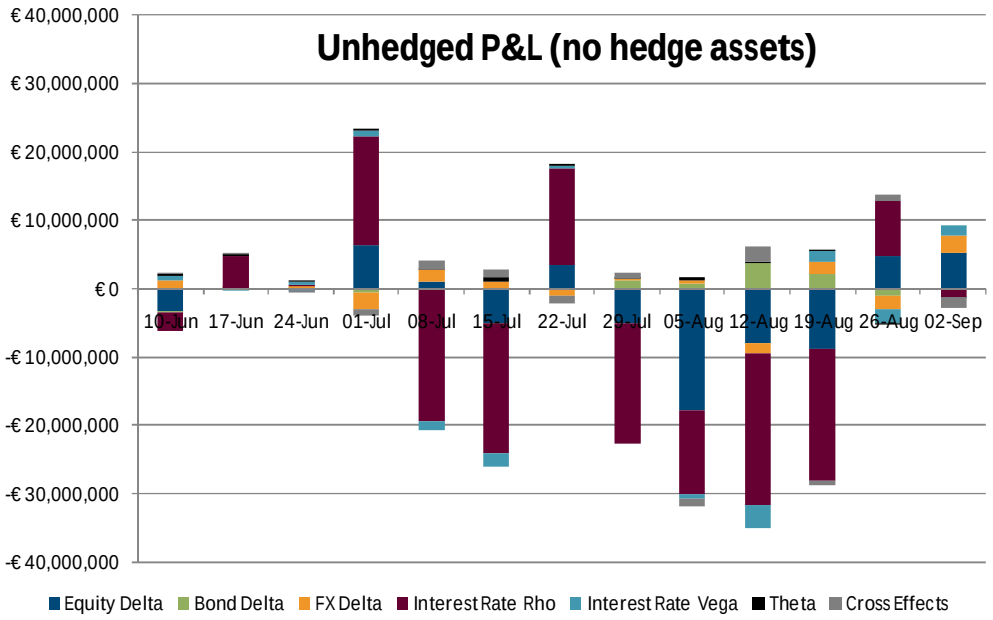
Hedge Effectiveness

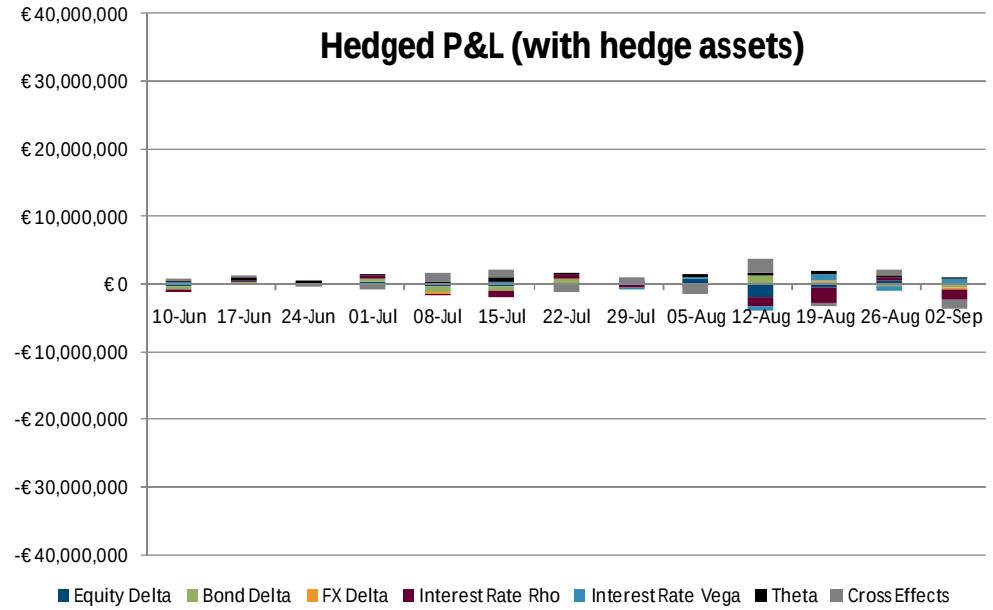
	LIABILITY	ASSETS	P&L	
Market Risk - Hedged				
Equity Delta	€ 27,311,224	€ 25,622,682	-€ 1,688,542	94%
Bond Delta	-€ 5,841,967	-€ 5,925,252	-€ 83,286	101%
FX Delta	-€ 2,409,184	-€ 2,286,173	€ 123,011	95%
IR Rho	€ 71,538,920	€ 66,098,359	-€ 5,440,561	92%
IR Vega	€ 3,763,508	€ 4,614,651	€ 851,143	123%
				93%
Market Risk - Unhedged				
Equity Vega	€ 697,434		-€ 697,434	
Cross	-€ 615,171	€ 878,452	€ 1,493,623	
Theta (net premiums)	-€ 2,586,752	€ 1,037,040	€ 3,623,792	
TC / Interest	-€ 98,343	-€ 856,713	-€ 758,370	
Net P&L (exc. Basis Risk)	**€ 91,759,670**	**€ 89,183,045**	**-€ 2,576,624**	***97%***
Fund Mapping Basis	€ 8,240,331		-€ 8,240,331	
Net Capital Markets P&L	**€ 100,000,000**	**€ 89,183,045**	**-€ 10,816,955**	***89%***

Source: Milliman

Hedge Effectiveness

- Time Series of Weekly P&L Impacts
- Impacts Graphed:
  - Equity Delta
  - Bond Delta
  - FX Delta
  - Rho
  - IR Vega
  - Cross Effects & Theta
- Graphs on same scale
- Clear Reduction in Volatility





Source: Milliman

Summary

- Broad range of products with embedded long-term guarantees and significant market risk exposure
- Regulatory change via EMIR and Solvency II and uncertainty over implementation of some of these rules is making hedging more challenging
- However, hedging on a dynamic basis is still a powerful method to mitigate market risk for long-term guaranteed life bonds

References

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- ESMA press release on EMIR, http://www.esma.europa.eu/system/files/2012-403_0.pdf

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