The Actuarial Profession
making financial sense of the future

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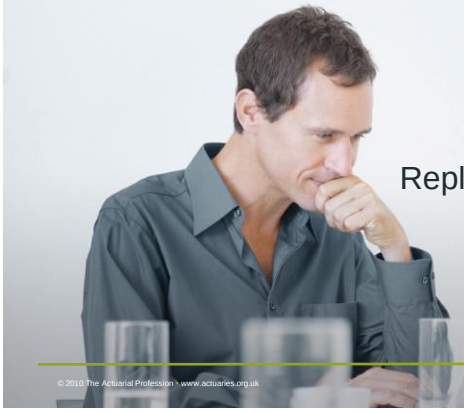


Replicating portfolios for value-added ALM risk management

Metrics used to manage Life Business
Sample of key metrics used

NBV New Business Value

APE Annual Premium Equivalent

NBM New Business Margin

BOP Business Operating Profit

EV Embedded Value

Net Flows

RBC Risk Based Capital

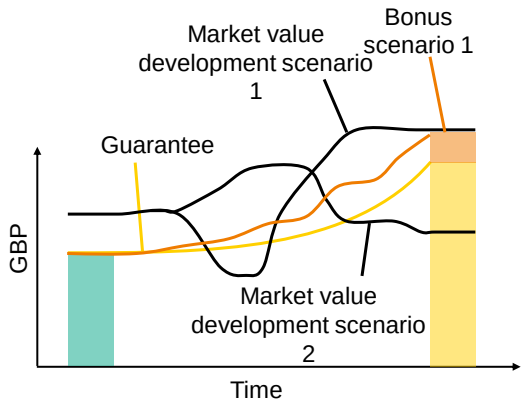
PXS Profit by Source

RBRM Risk Based Return Measure

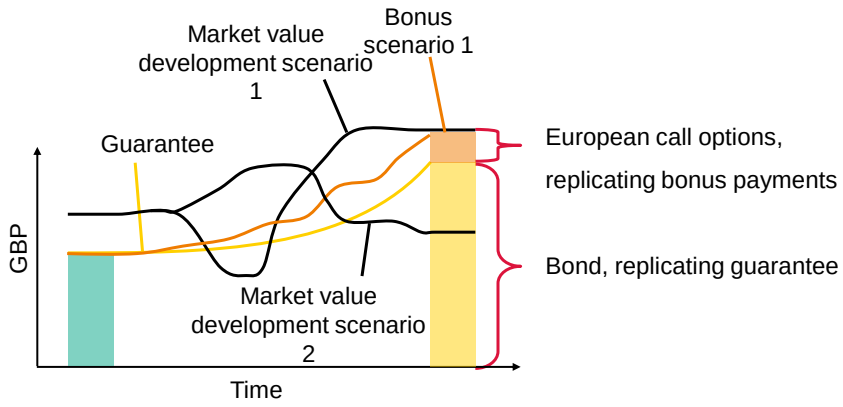
A simplified central representation of liabilities adds value

- Helps quantify and understand market risk:
  - Faster, simpler economic capital calculations to meet Solvency II and Swiss Solvency Test ("SST")
  - Identification of unrewarded risks, non-hedgeable ALM risk
  - Improve quality of management information
- Market risk is typically the largest single risk facing life insurers today

Theory of replication:
Basics of replication (1/2)

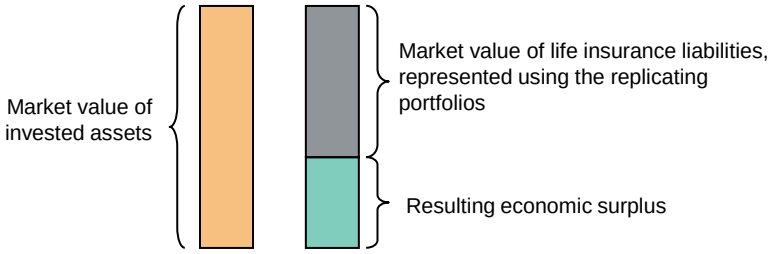


Theory of replication:
Basics of replication (2/2)



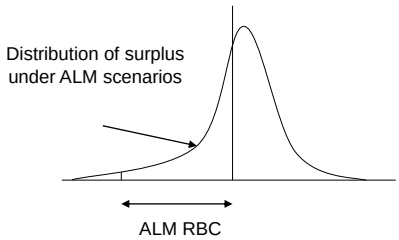
Introduction to replicating portfolios

- Replicating portfolios can help evaluate ALM RBC
  - Taking full account of actual asset holdings and interactions
- Replicating portfolios allow simulation of economic balance sheets under thousands of stochastic scenarios, reflecting multiple risk factors



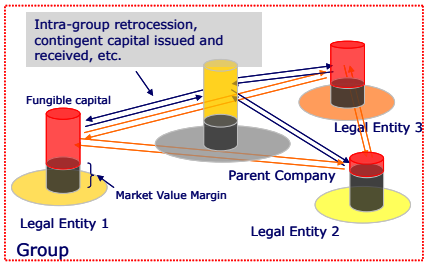
Global companies need group-wide risk management practices

- Risk based regulation increases demands for information about liabilities
- Data needed at both group **and** local level
  - Diversification benefits need careful allocation to give correct capital requirement
- Group level economic capital calculation requires effective aggregation of both liabilities and assets



Replicating Portfolios help model intra-group Capital and Risk Transfer Instruments (CRTIs)

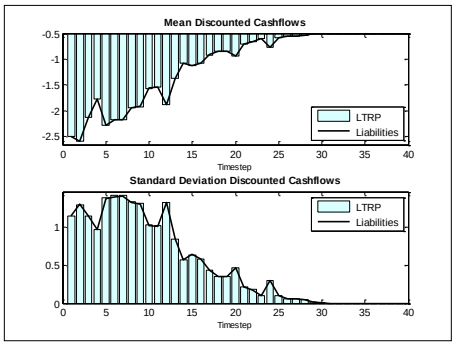
- Zurich Group uses a variety of intra-group transactions
- CRTIs manage risk, capital and liquidity of our balance sheets
- Types of CRTI include
  - Internal reinsurance
  - Internal loans and hybrid loans
  - Guarantees
  - Derivatives
- **Replicating portfolios are fundamental to modelling CRTIs**

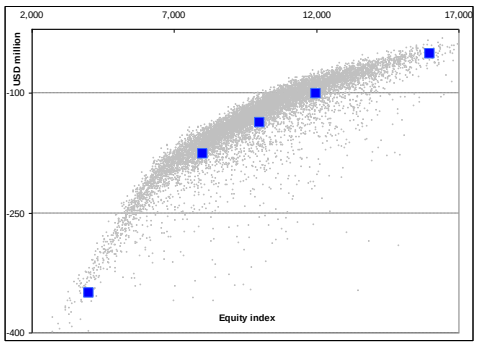


Source: *FINMA*

Replicating portfolios allow transfer and creation of information about liabilities

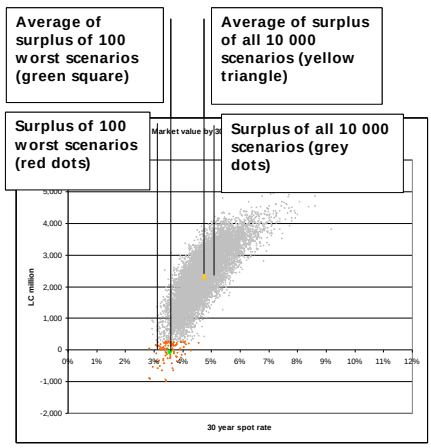
- Valuation, greeks and cash flow patterns can be obtained under any economic assumption





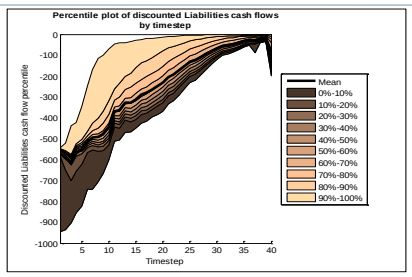
Analysis of ALM Economic Capital gives deeper understanding of drivers of ALM risk

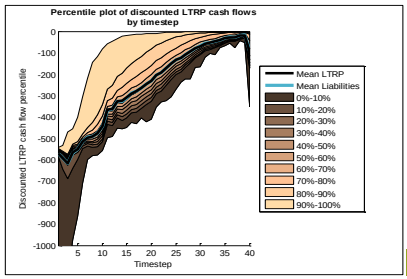
- Analysis of risk drivers under stochastic scenarios has many advantages:
  - Takes full account of Time Value of Options and Guarantees
  - Correlation and diversification effects captured
  - Drivers of ALM RBC can be analyzed
    - Interest rates of different terms, equity market levels or any other economic variables captured in the real-world ALM RBC scenarios



Confidence in quality of replicating portfolios needed for ALM insight to add value

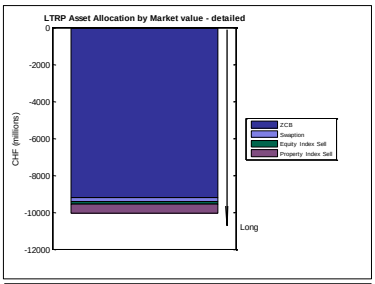
- Ideal replicating portfolio matches the cash flows from the liability it replicates in any economic scenario
- Not always possible in practice so defined acceptance criteria are needed
- A transparent process is critical in building confidence: no “black-boxes”
- Visualising goodness of fit tests is valuable in understanding model output

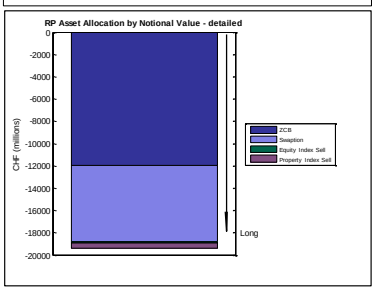




Standardised communication helps share insights beyond replicating portfolio experts

- Standardised, automated reporting essential given high volume of data
- Training users important
- Careful analysis of constituents is useful
  - Reveals nature of risks
  - Demonstrates stability over time
  - Avoiding “over-fitting”
- Thought required before use as a benchmark for investment management



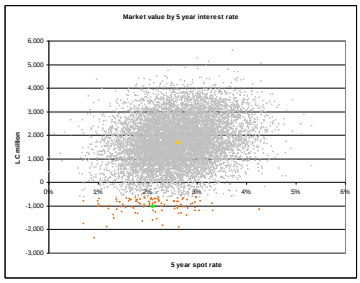


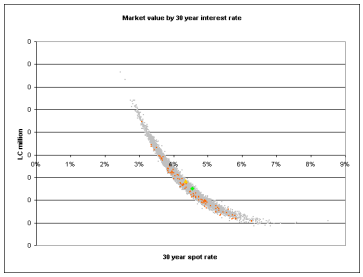
Non hedgeable risks are at the core of the insurance business

- Insurers exist to provide certainty to policyholders by taking on their risks
- Some risks could be hedged. Some risks cannot and have to be supported with capital, requiring additional returns for shareholders
- Shareholders can often gain exposure to hedgeable risks on their own
- **Understanding both hedgeable and non hedgeable (NH) risk is fundamental to superior risk adjusted profits**

Using replicating portfolios to analyse NH risk

- The construction of replicating portfolios from candidate assets makes them ideal for identifying and understanding NH risks
- Can evaluate NH market risks by considering differences between tradable and non-tradable replicating portfolios
- A similar approach could be applied to apportioning required capital





Going forward / discussion

- Replicating portfolios do face challenges:
  - "Circularity" where investments impact liabilities
  - Calibration is complex for complex management actions
  - Models need to work well with scenarios for calibration
  - Non-market risks typically not covered

- Competition includes
  - Curve fitting
  - Nested stochastic projections

Thank you for your attention. Any questions or comments?

Expressions of individual views by members of the Actuarial Profession and its staff are encouraged.

The views expressed in this presentation are those of the presenters.