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Replicating Portfolios in life insurance business: Use and limitations

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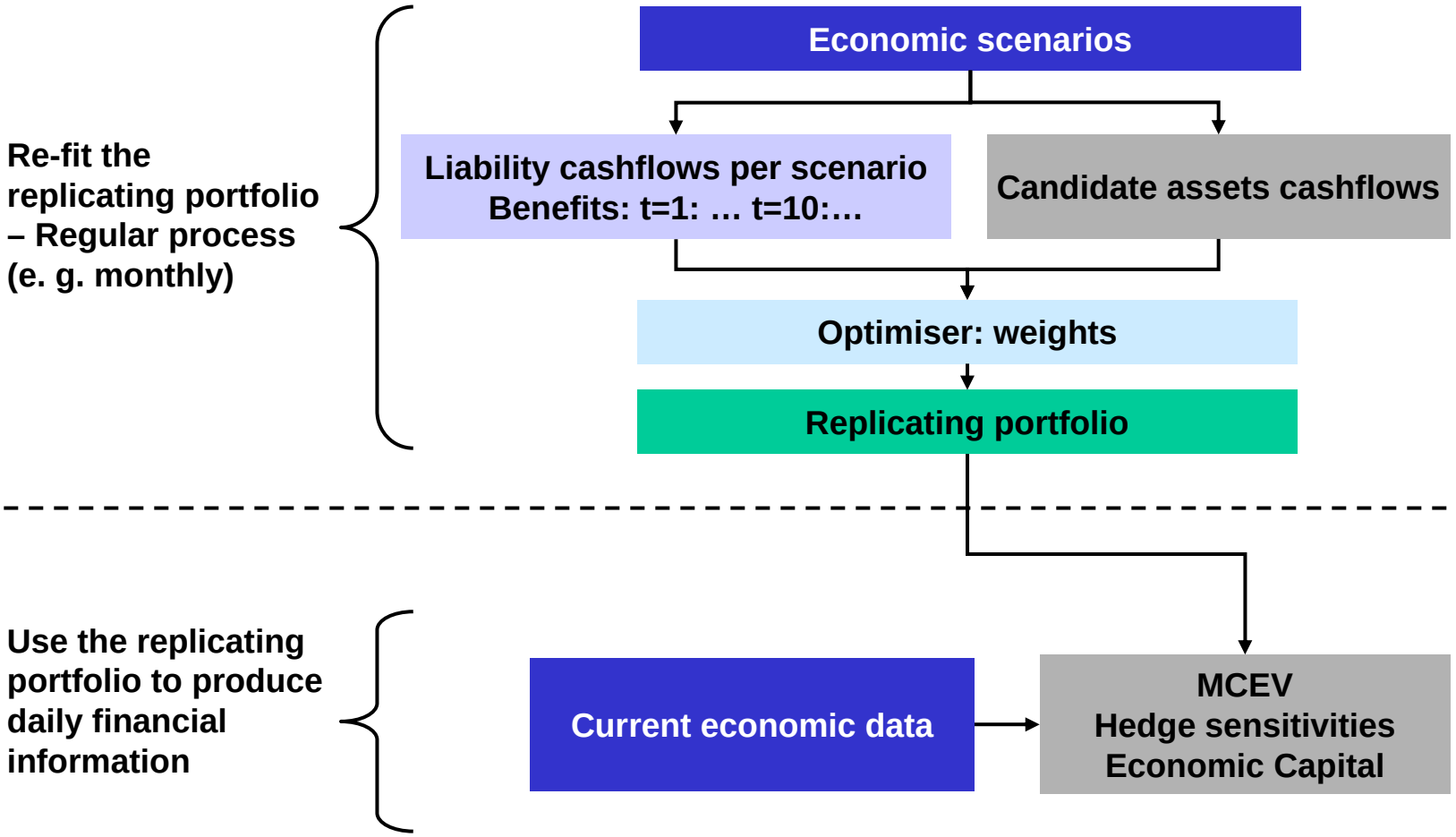
DAV
DEUTSCHE AKTUARVEREINIGUNG e.V.

Today's investigation:

- The robustness of Replicating Portfolios
  - How should Replicating Portfolios (RPs) be designed to be adequate for future application, i.e. to give reasonable results under changed capital market conditions?
  - Is the correlation coefficient a reliable indicator for the goodness of a Replicating Portfolio?

RPs and where they come from:



You never know what you're gonna get:

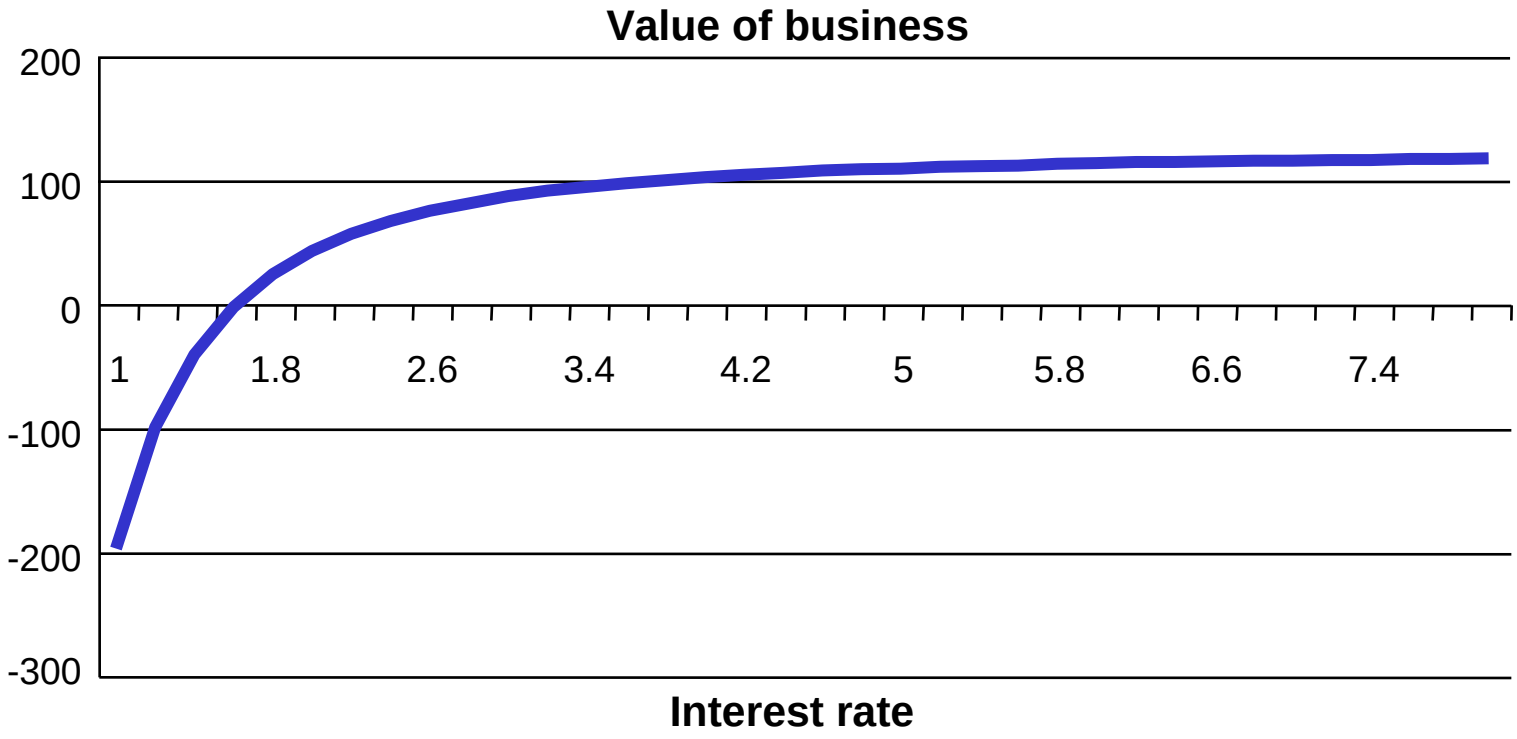
- Replicating Portfolio shall help you to calculate "business values" (e.g. MCEV)
  - in the future
  - under unknown future capital market conditions
  - instead of running the whole business model
- Therefore: The Replicating Portfolio does not need to be "optimal" today – but robust enough for tomorrow!

Try to “span the space”:

- Take several scenario sets as basis for the calibration of a Replicating Portfolio
  - real world, risk neutral
  - shifts in interest, equities, volatilities
- Nevertheless: You have to do more!
  - The trouble can be named: It’s the randomness of the **shape of the interest rate curve**

A simple example:

- The “value of business” is a concave function of interest rates at t = 1:

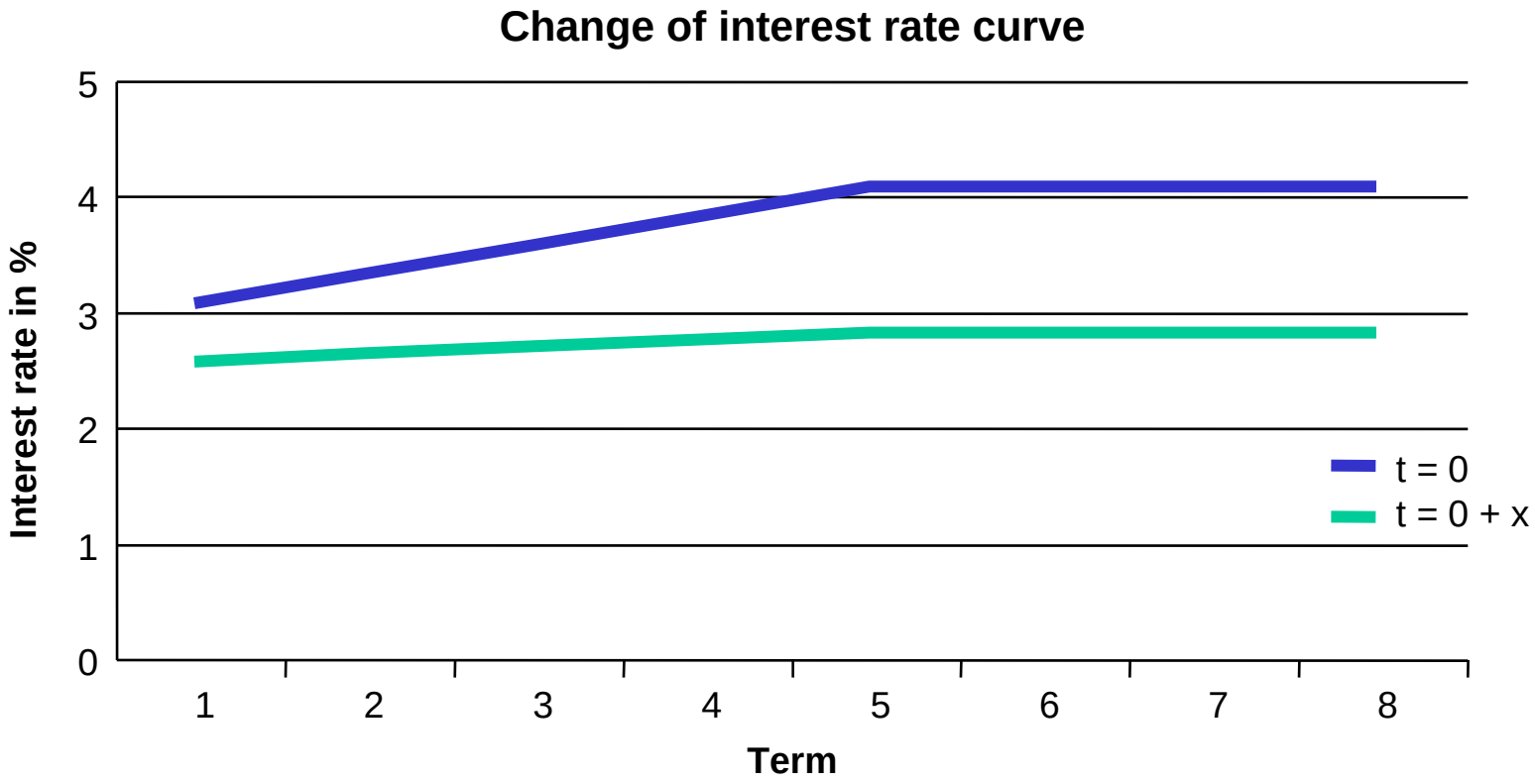


A simple example:

- Candidate assets are
  - Cash
  - 2- and 6-year zero coupon bond
  - Receiver and Payer Swaptions with
    - term = 1 year
    - tenor = 5 years
    - strike = 4%
- Optimisation is done by “least squares”

A simple example:

- As an example – a flattened shape at t = 0 + x with x = 1 month (e.g.)
- with minor changes of volatility at t = 0 + x



Results:

The "value of business" is:

t = 0	86,1
t = 0 + x	**34,6**

Three different Replicating Portfolios have been calculated for Monte-Carlo simulations at t = 0 + x:

Shift	Shift + Vola	Shift + Vola + Shape
– 20,3	**– 3,2**	**34,3**

Resumee:

- Span the whole space!
  - Include many different scenario sets
  - “Generate” scenario sets with significantly different shapes of interest rate curve
  - Include also deterministic scenario sets
- Don’t trust the correlation coefficient!
  - In our example, the best replicating portfolio was always worst in the sense of the correlation coefficient….

Presenter's contact details

Thorsten Wagner
Senior Manager
Financial Risk Management

KPMG AG
Barbarossaplatz 1a
50674 Köln

Tel. +49 221 2073 5380
Fax +49 1802 11991 1271

thorstenwagner@kpmg.com