Asset-Liability Management
in today's insurance world

Presentation to the Turkish Actuarial Society

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Agenda

- **ALM – some definitions and interpretations**
- **Turkish annuities**
  - **ALM considerations**
  - **Dynamic ALM**
  - **Excel example**
  - **Longevity Risk**
- **ALM – further considerations**
  - **Solvency II**
  - **Gamma and theta matching**
- **Appendices**

Why is ALM important?

- Insurance companies may aim to maximise shareholder value and maintain solvency
- Value and solvency can be measured by balance sheet available capital (assets minus liabilities) and required (solvency) capital
- So even though actuaries often tend to be very liability-focussed, both sides of the balance sheet (assets and liabilities) are important
- Their interaction also needs to be taken account of carefully

ALM – Asset-Liability What?

- ALM can be defined as:

- Asset-Liability Matching
- Asset-Liability Management
- Asset-Liability Modelling

- There are some differences between the three definitions
  … but sometimes they are used interchangeably

Asset-Liability Matching (1) – basic interpretation

- A simple way to define a “match” between assets and liabilities is the relationship:
  PV (expected asset flows) = PV (expected liability flows)

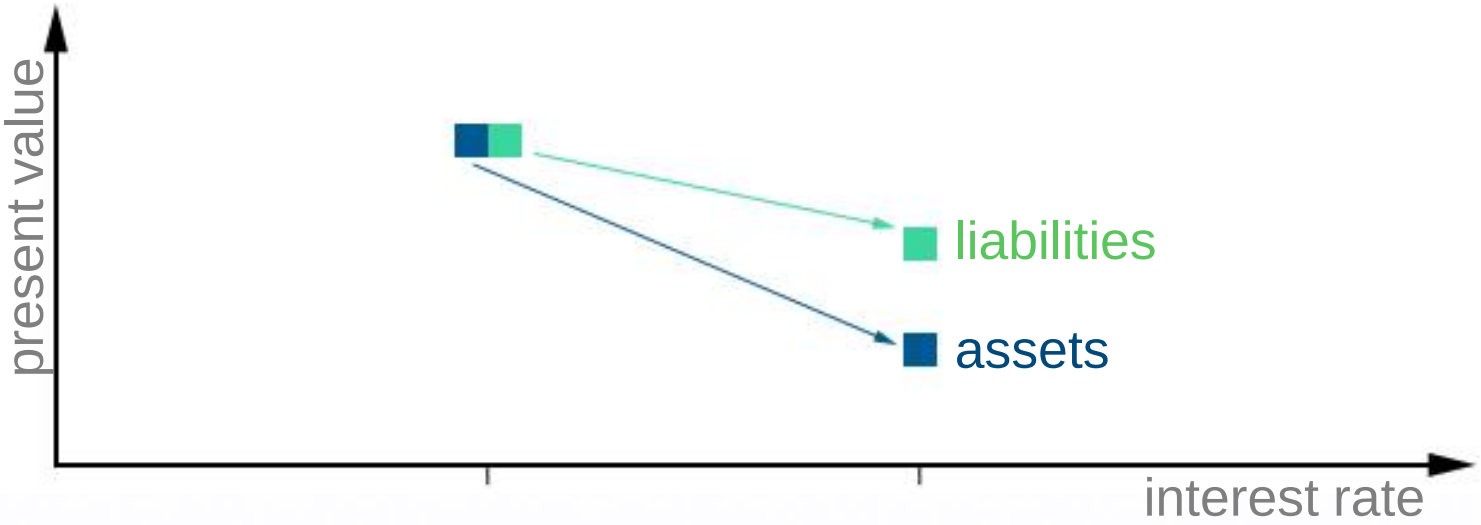
- But this definition has several disadvantages, including that the company is not necessarily protected against:

a. interest rate (and therefore discount rate) changes

b. cash-flow shortfalls (or excess cash needing reinvestment) at certain time points

c. actual liability (or potentially asset) flows being different from the expected ones

Asset-Liability Matching (2) – interest rate changes



- Mitigation (1): “Duration (Delta) matching”
- Invest so that:

(a) PV (expected asset flows) = PV (expected liability flows)

(b) Change in PV (expected asset flows) =

Change in PV (expected liability flows)

- (b) holds for small (and parallel) changes in the interest rates

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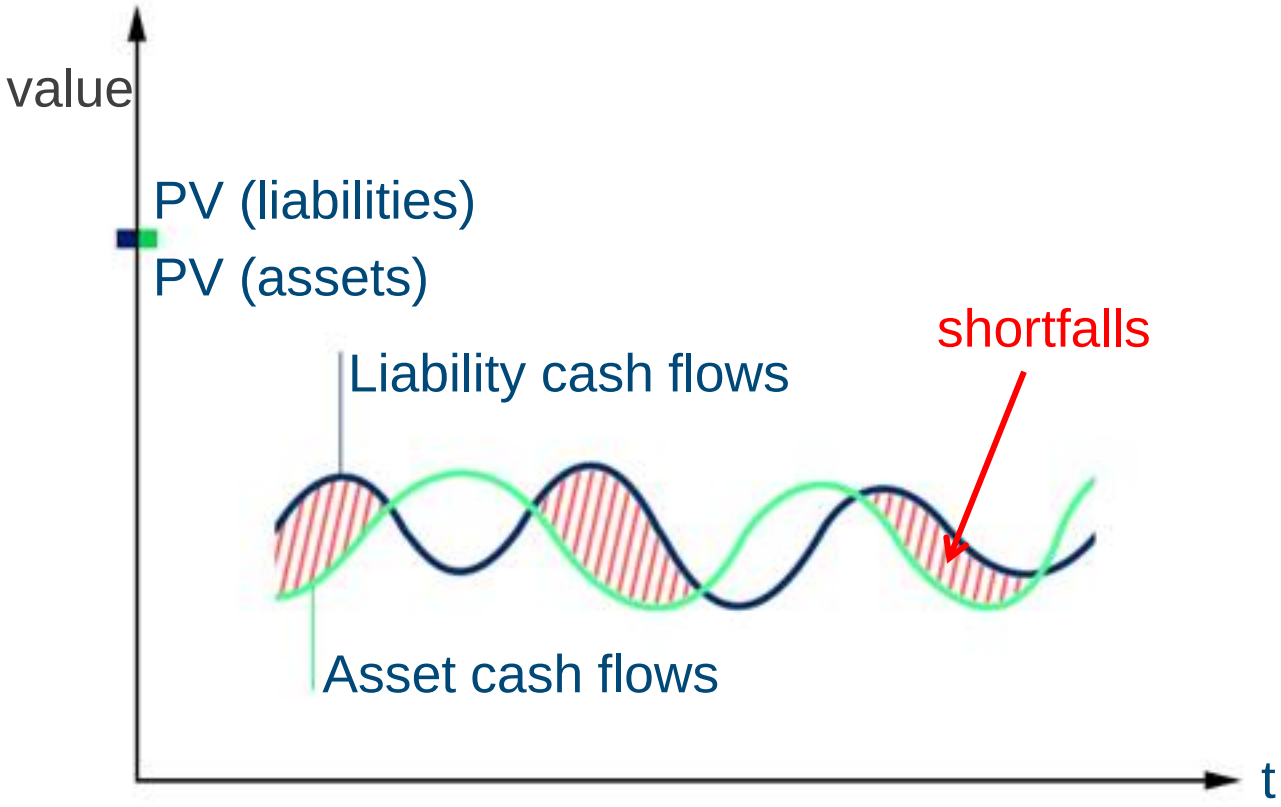
Asset-Liability Matching (3) – shortfalls



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Asset-Liability Matching (3) – shortfalls

- Mitigation (2): “Dedication”
- Invest so that:

(a) PV (expected asset flows) = PV (expected liability flows)

(b) Asset expected flow *(t)* = Liability expected flow *(t)* for all *t*

- Cash-flow matching is much stronger than duration matching
- Can be very difficult and restrictive in practice

Asset-Liability Management (1) - definition

According to the Society of Actuaries (US) ALM is about:

- coordinating decisions on assets and liabilities
- an ongoing process aiming to achieve a company's financial objectives subject to its risk tolerances
- the sound management of the finances of any company that invests to meet certain financial needs

* Society of Actuaries; Professional Actuarial Specialty Guide; Asset-Liability Management

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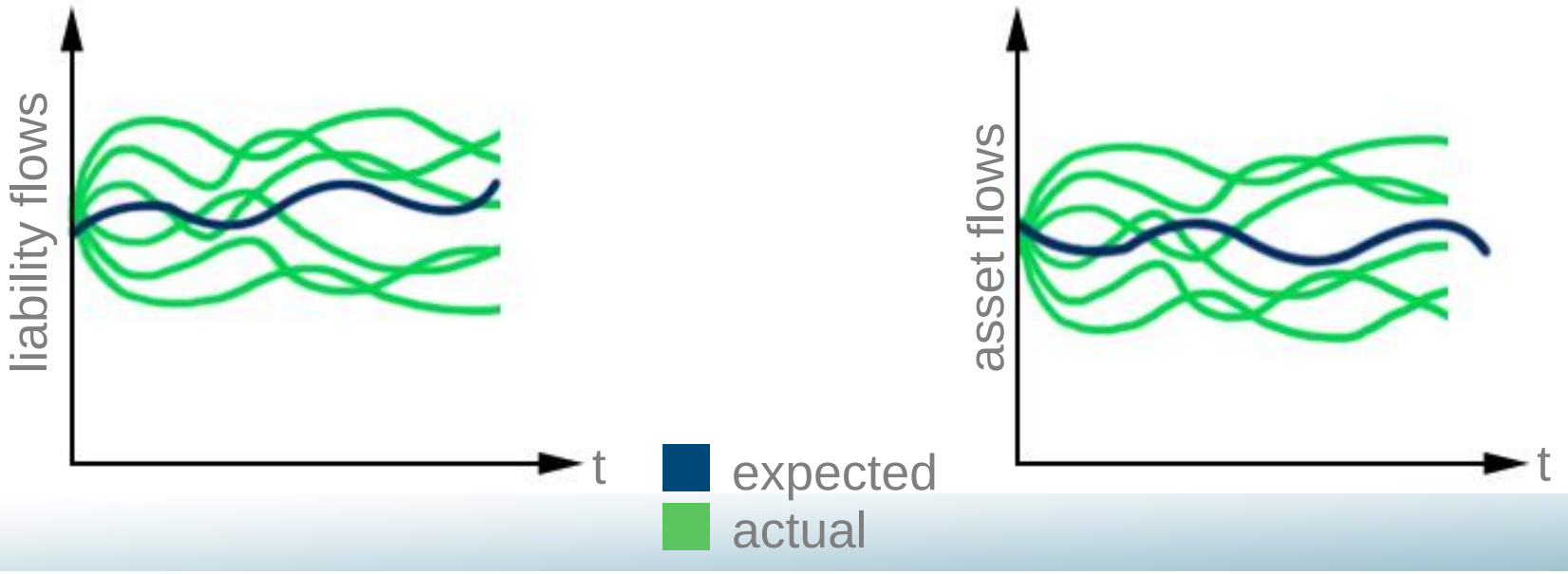
Asset-Liability Management (2) – actual vs expected

- Both “duration-matching” and “dedication” are quite optimistic in that they assume that:

… actual liability and asset cash flows are going to follow the “expected“ path, i.e. that our assumptions about the future (other than interest-rate) experience will prove absolutely correct

- But reality can follow alternative paths:



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Asset-Liability Management (3)

Reasons for deviation include:

- mortality / longevity / disability rates
- investment returns (other than interest rates covered above)
- lapse (including dynamic lapse) rates; other policyholder options
- profit-sharing mechanisms
- premiums
- defaults of assets

Asset-Liability Management (4) – considerations

Need to:

- take into account **net** cash flows (e.g. there are inflows due to future premium income that offsets liability outflows)
- monitor experience, compare actual vs expected and adjust the position and/or the assumptions accordingly
- consider different (economic) scenarios
- maintain some liquidity to meet unexpected liability outgo (e.g. excess lapses)…

  …the realisation of capital gains or losses could be sub-optimal
- consider implicit guarantees provided on future premiums

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  - ALM considerations
    - Dynamic ALM
    - Excel example
    - Longevity Risk
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    - Solvency II
    - Gamma and theta matching
- Appendices

Turkish annuities – ALM considerations (1)

- Annuity liability cashflows are long-term (10-30 years, or more), TRY denominated, fixed, guaranteed (technical interest rate), with profit sharing
- Ideally match with assets of same nature, duration and currency

➢ Could use TRY government bonds

… but maturity up to 10 years => duration and reinvestment risk

➢ Could use TRY corporate bonds (assuming longer durations)

… capture illiquidity premium… but default risk

➢ Could use OTC instruments to swap short for long

… check availability and cost

- Longevity, and surrender option, increase uncertainty of flows

Turkish annuities - ALM considerations (2)

Risk of high interest rates (coupled with longevity risk)

- Current level of Turkish interest rates high compared to technical interest rate (0.5% - 2%) => Likely that investment profits will be generated in early years
- Coincides with period of greater reserves
- Significant extra annuity streams from profit sharing likely to emerge in early years

  …even greater if interest rates go up further
- This could lead to significant losses if longevity improvement stronger than expected

Turkish annuities - ALM considerations (3)

Risk of low interest rates

- Technical interest rate serves as interest rate guarantee for the policyholder
- Even if the actual return is lower than the technical interest rate, there can be no reduction in annuity payments => cost is borne by insurer
- May not be likely in the short term but interest rates can reduce significantly over time => reinvestment risk
- Consider long term nature of annuities compared with length of available bonds (remember Equitable Life* collapse)

* Equitable Life, a once large UK insurer, had written large volumes of annuity contracts guaranteeing high future annuity conversion rates at times of high interest rates. The company closed to new business in 2000 once actual interest rates had reduced significantly (making these guarantees extremely onerous).

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Turkish annuities - ALM considerations (4)

Surrender rates and economic factors

- The market value of assets (backing liabilities) may be greater or less than the surrender value
- There could be liquidity constraints and a loss may arise if assets must be realised at times of reduced market values

- If inflation/interest rates were to rise in future:

- asset values will fall … and surrenders may increase (as people look to move savings to higher rate offers) … can create feedback loop as profit sharing falls

- Conversely lower interest rates may drive lower surrenders

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Dynamic Asset-Liability Modelling (1)

- In the past actuarial projection models were:
  - Liability only
  - Based on a single “deterministic” economic scenario
  - Investment returns projected separately
- Now models can be:
  - *Dynamic*: assets and liabilities talk to each other and each affects the other
  - *Stochastic*: large number of future economic scenarios
- …. particularly where there are policyholder options and guarantees
- ….. which create *asymmetries* and hence *Time Value of Options and Guarantees (TVOG)*

Dynamic Asset-Liability Modelling (2)

- Examples of options include:
- Surrender value options
- Annuity conversion options

- Examples of guarantees include:
- Guaranteed interest rates + profit sharing (particularly relevant in Turkey)
- Guaranteed maturity values

Dynamic Asset-Liability Modelling (3)

- Dynamic ALM models incorporate assumptions on ALM strategies (and other management actions), e.g. which assets to buy and sell
- They can be used to test different ALM strategies
- They may also include policyholder reactions (e.g. dynamic lapses)

➢ Impact on key metrics, such as capital requirements

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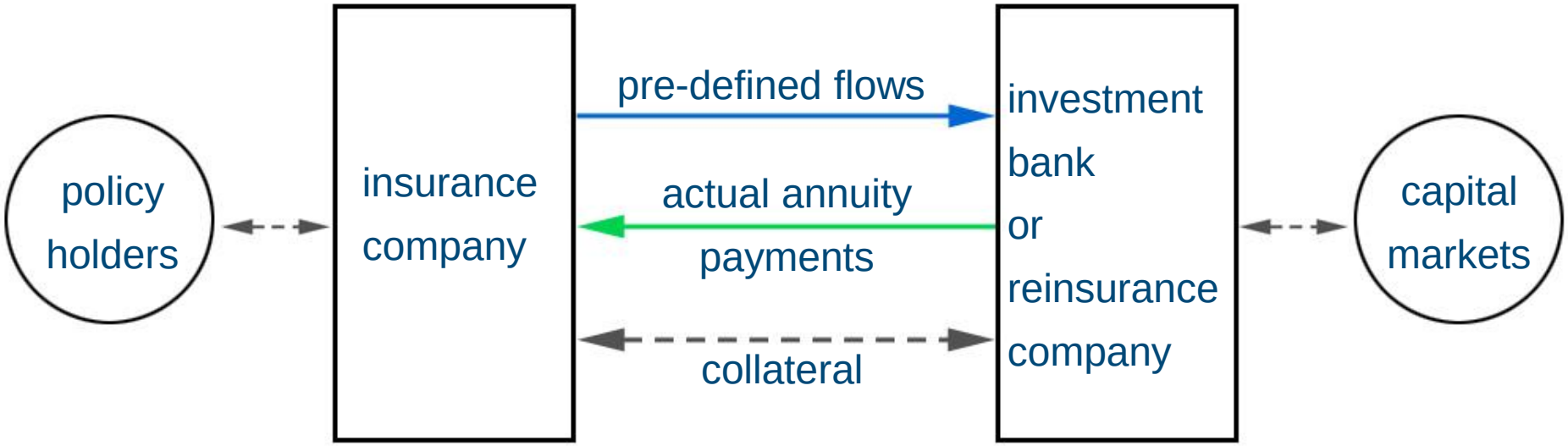
Dealing with longevity risk – longevity swaps (1)



* Based on the “Longevity Risk” book edited by Emma McWilliam

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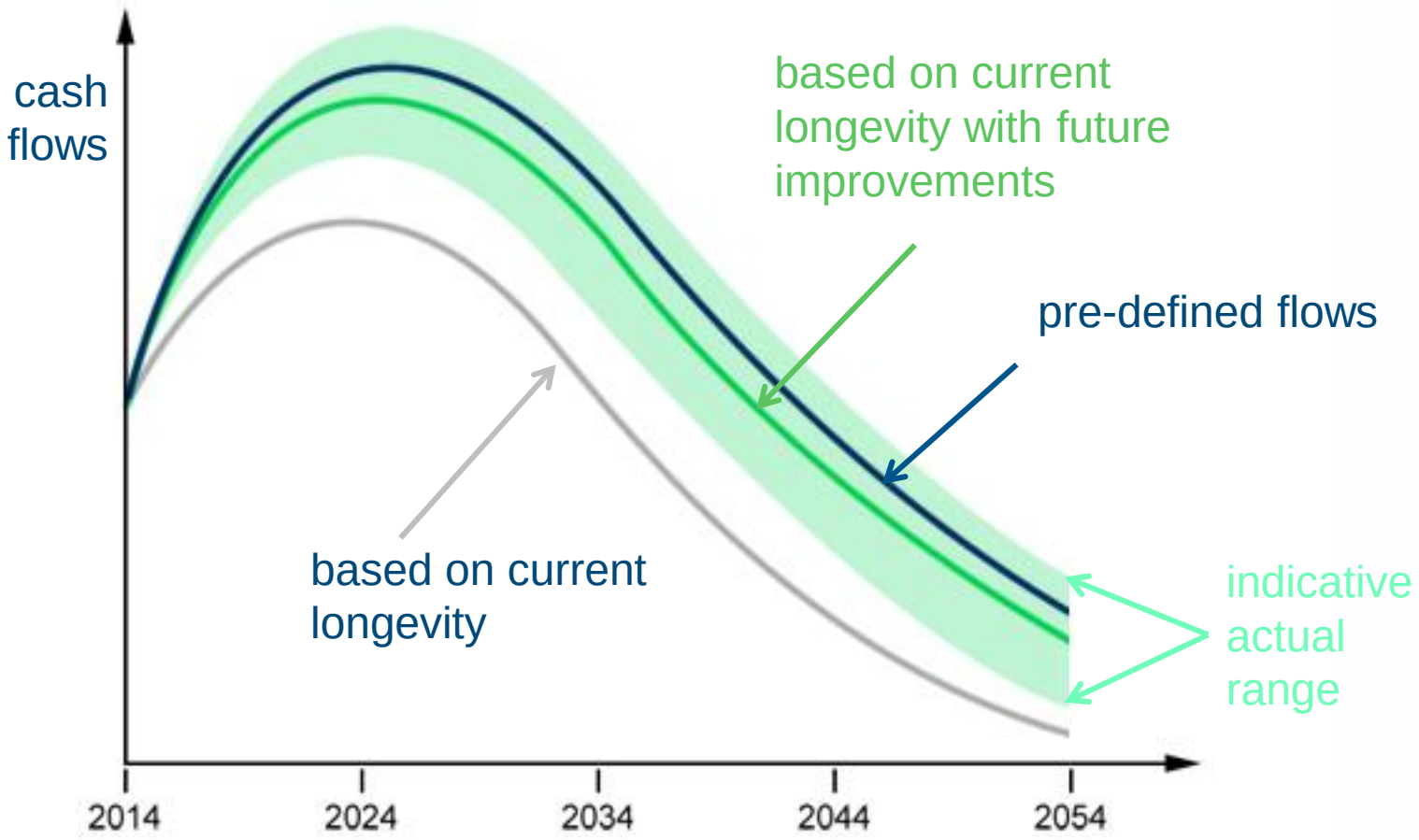
Dealing with longevity risk – longevity swaps (2)



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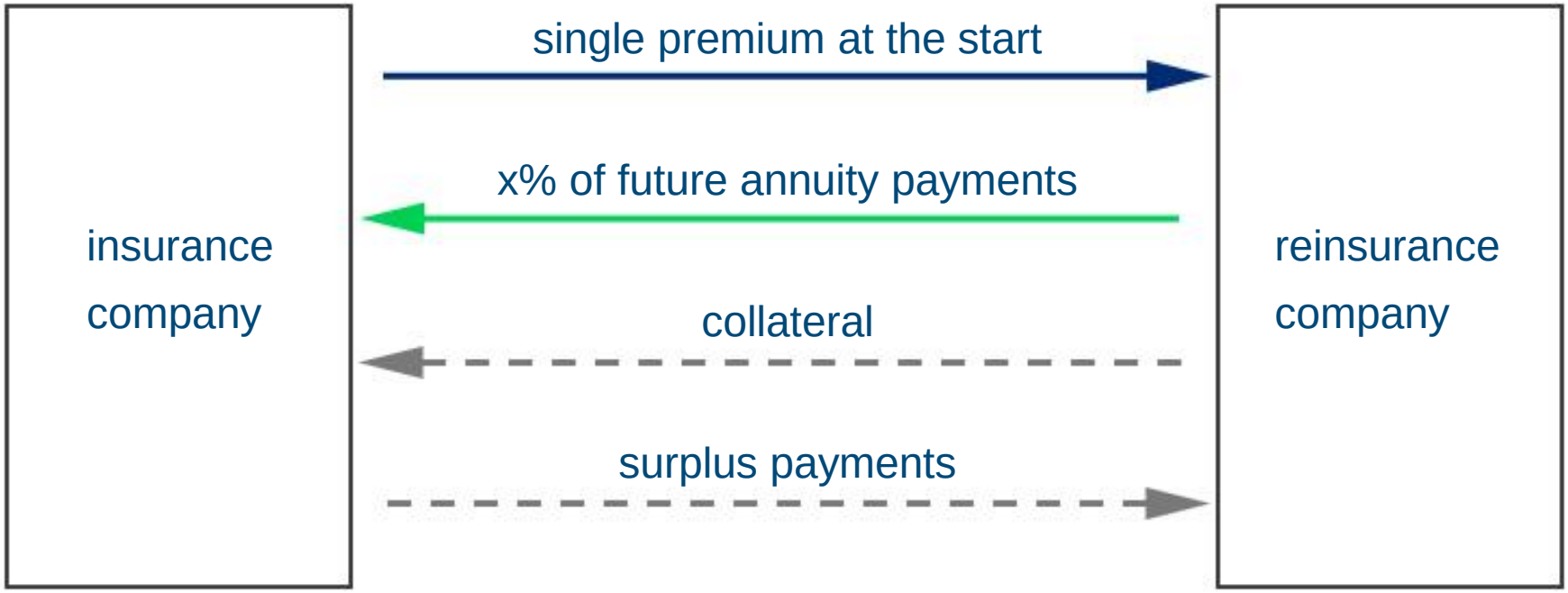
Dealing with longevity risk – annuity reinsurance (1)



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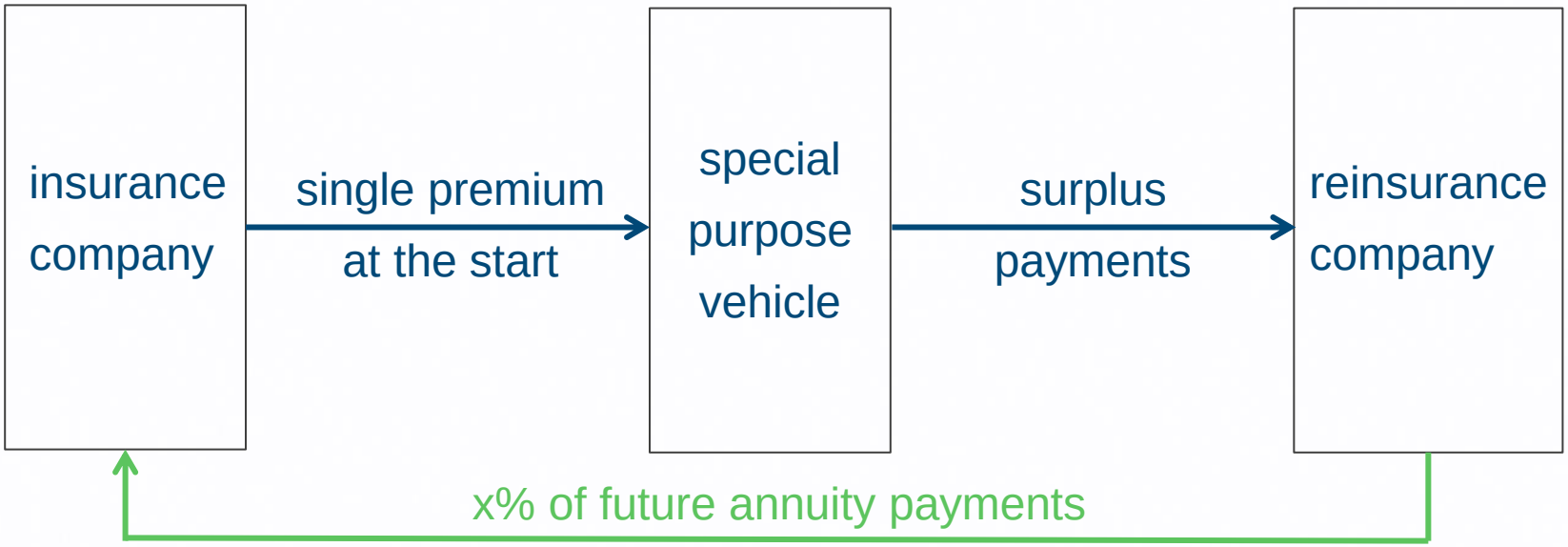
Dealing with longevity risk – annuity reinsurance (2)



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ALM and Solvency II (1)

- Older/traditional solvency regimes
  - ALM seen as specialised, and usually unrewarded
- Solvency II embraces the central role of ALM for insurers
- Solvency II balance sheet
  - Economic valuation of assets and liabilities
    - Hedging recognised
    - Matching adjustment for annuities
  - Dynamic, stochastic ALM model encouraged
- Solvency II capital requirement
  - Risk-based capital approach means effective ALM will imply lower SCR

ALM and Solvency II (2)

- Proper ALM now recognised as having a key role in all areas of company management
  - Risk management
  - Governance
  - Product development
  - Business planning
- This can change the way companies run their business
  - E.g. dynamic/stochastic ALM model now central to key analyses and reporting
    - Product development, innovation
      - Guarantees, options
    - Embedded value
    - FLAOR/ORSA projections

ALM and Solvency II (3)

- Example: Product development
- Innovation in savings products:
  - Unit-linked
    - Policyholder chooses how to invest premium (funds)
  - With guarantees
    - Policyholder chooses what guarantees are to apply
      - Surrender, maturity amounts
      - Withdrawals
      - Annuity conversion
  - Each combination (fund/guarantee) has an associated cost
      - Charged as annual management charge (e.g. 50bps)
- Product is predicated on effective ALM (dynamic hedging)
- Wide experience of this product in the US (“Variable Annuities”)

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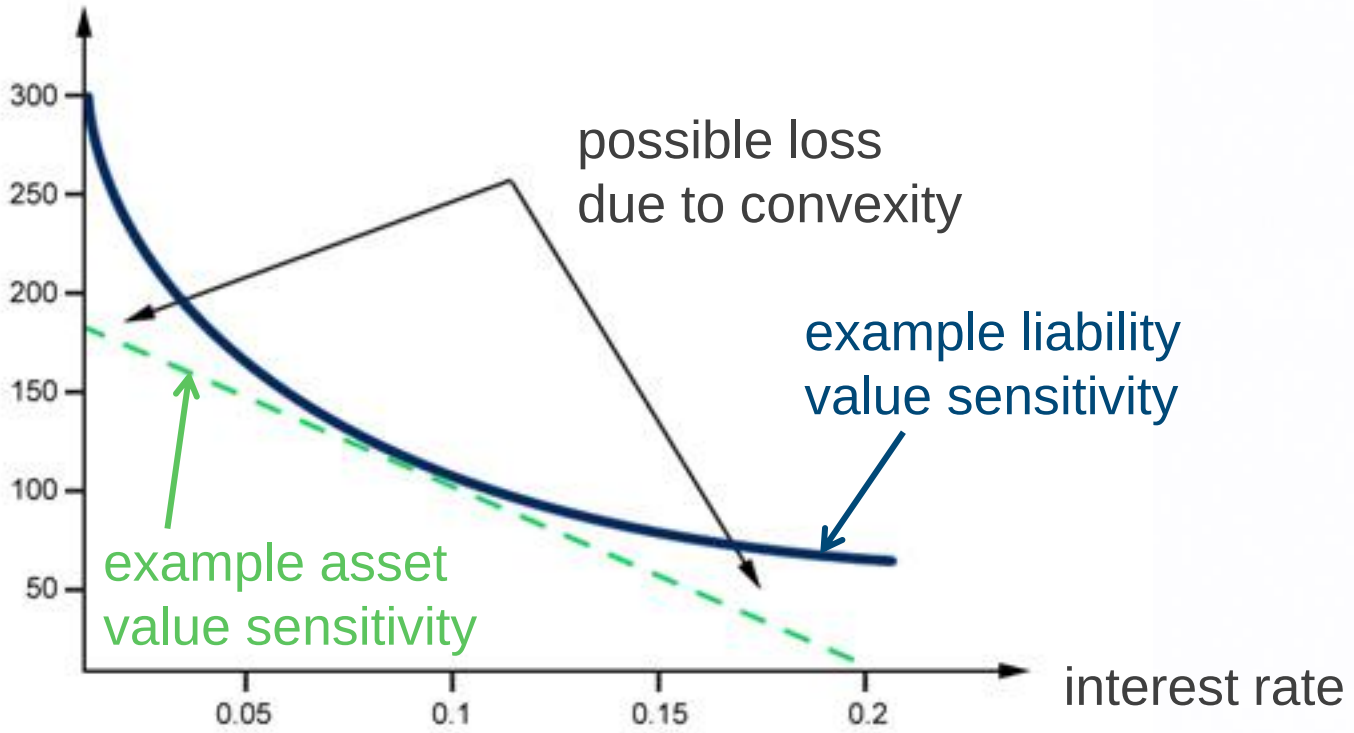
Duration matching – the problem

- The problem with duration matching is that it does not work well:

- for large shifts of the yield curve (1)



- for non-uniform changes of the yield curve (2)

- as time passes (3)

* Based on the “Fixed Income Securities” notes, London Business School, Süleyman Başak

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Duration & convexity matching

- Mitigation (1 & 2): “Duration (Delta) and convexity (Gamma) matching”
- Invest so that:

(1) PV (expected asset flows) = PV (expected liability flows)

(2) Change* in PV (expected asset flows) =
Change* in PV (expected liability flows)

(3) Change* in Change* in PV (expected asset flows) =
Change* in Change* in PV (expected liability flows)

* Changes of the PV of Assets and Liabilities due to changes in **interest rates**

Duration, convexity and theta matching

- Value of liabilities (and assets) not only exposed to interest rate changes
- Also exposed to (amongst other things) the passage of time
- Mitigation 3a: In theory, match theta, too, (where theta reflects the derivative of liability (and asset) value to the passage of time)
- Invest so that all previous equations are held **PLUS:**

✓Change in PV (expected asset flows) =

Change in PV (expected liability flows)

.... where the change in PV now relates to the time passage

Mitigation 3b: In practice, rebalance often (but also consider trading costs)

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Key facts

- Founded in Seattle, USA in 1947
- Today among the world's largest independent actuarial and consulting firms
- 55 offices worldwide covering markets in Europe, North America, Latin America, Asia Pacific, Middle East
- More than 2,600 employees worldwide

- Consulting practices in Life Insurance & Financial Services, Property & Casualty, Healthcare, Pensions & Investments
- Serves the full spectrum of business, financial, government and non-profit organisations
- Owned and managed by approximately 400 principals

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PROFESSIONAL DESIGNATIONS

- Fellow, Institute of Actuaries, UK

EDUCATION

- MA, Mathematics, University of Cambridge
- In 1992, Jeremy received the prize for achieving the highest mark in the life assurance specialist examination of the UK Institute of Actuaries.

PRESENTATIONS AND PUBLICATIONS

- Jeremy speaks regularly at actuarial meetings and has co-authored a number of actuarial papers, including “Dynamic Policyholder Behaviour” and “Dynamic Management Actions”.

CURRENT RESPONSIBILITY

- Jeremy is a principal and consulting actuary with the Milan office of Milliman. He joined Milliman in 2000.

EXPERIENCE

- Jeremy specialises in a wide range of international life insurance work.
- He has helped companies to develop their MCEV/EEV methodology and carries our regular MCEV reviews.
- He has advised on and developed actuarial models for numerous companies in many countries. Models have included ALM/stochastic capabilities and covered MCEV/EEV applications, statutory reporting, Economic Capital / Solvency II, US GAAP and ALM applications.
- Jeremy has carried out various Solvency II assignments, and currently advises on methodology for all three Pillars for a major multinational.
- He has been involved in a number of M&A projects and restructurings.
- Before joining Milliman he worked for 11 years in the UK and European operations of Aviva.

AFFILIATIONS

- Jeremy is a member of the Life Policyholder Behaviour in Extreme Conditions working party for the UK Actuarial Profession.

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- Fellow, Institute of Actuaries, UK
- MDFC, Master Financial Management and Control, IE Business School, Madrid, Spain

EDUCATION

- BSc Mathematics and Computer Science, University of Birmingham, UK

CURRENT RESPONSIBILITY

- Dominic is a principal and consulting actuary with the Milan office of Milliman.

EXPERIENCE

- Dominic has 20 years' industry experience as a consulting actuary.
- Dominic started his career in 1991 with Watson Wyatt and worked in the WW international practice based near London, UK.
- He then moved to the Watson Wyatt Madrid office in 1996, and has been based in Southern Europe ever since.
- Dominic qualified as a Fellow of the UK Institute of Actuaries in 1997.
- Dominic joined Morgan Consulting in early 2003. He joined Milliman when Morgan Consulting was acquired by Milliman in 2004.
- In addition to actuarial training he has a financial management MBA.
- Dominic has performed a wide range of actuarial consulting projects for clients across Continental Europe.
- He has significant experience in the areas of Solvency II, mergers and acquisitions, financial reporting, valuations, and actuarial modelling.
- Dominic has written and presented a number of actuarial papers.

Dominic is fluent in English, Spanish, and Italian.

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- MiF, Masters in Finance, London Business School, UK

EDUCATION

- BSc (Hons) in Mathematics, Thessaloniki, Greece

CURRENT RESPONSIBILITY

Thanos is a Senior Consultant in the Düsseldorf office of Milliman.

EXPERIENCE

The companies Thanos has worked for prior to joining Milliman in Düsseldorf include Credit Suisse, the Royal London Group and Ernst & Young in London, Edinburgh and Athens.

Thanos has 13 years of combined actuarial experience and specialises in a wide range of international (Germany, UK, Greece, Turkey) financial work.

His projects include:

- Advice on Solvency II
- Mergers & Acquisitions
- Deterministic and stochastic modelling
- Longevity derivatives structuring
- MCEV reviews

Thanos is fluent in English, German and Greek.

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Appendix B – Reliances and limitations

- This presentation has been prepared for illustrative purposes only. The numbers shown and the underlying models are not necessarily intended to be illustrative of a real-life situation.
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Thank you.

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