Actuarial Frontiers –
State of the Art Actuarial Practice

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8TH GLOBAL CONFERENCE OF ACTUARIES

A journey

FROM:

Calculating Liabilities

Interactive Assets & Liabilities

Understanding Capital Markets

Stochastic Modelling

Economic Capital Economic Value

TO:

Managing

Risk

Capital ⟷ Value

The starting point: calculating liabilities

Analysing history
- Demographics
- Economics
- Experience

Developing assumptions
- Demographics
- Economics
- Experience

Building projection models
- Cash flows
- Reserves
- Capital

Life Insurance – General Insurance – Pension Funds

Step 1: Understanding other parts of the enterprise

The actuary in a corner

Theoretical assumptions
- Expenses
- Investment
- Experience

Integration of asset and liability management

Realistic assumptions
- Dynamic investment strategies
- Hedging

Step 2: Understanding capital markets

As markets develop and mature, actuaries have an increasing need to understand capital market theory

Life?   **True today**

General?   **True for some today**

Pensions?   **Signs that this will come soon**
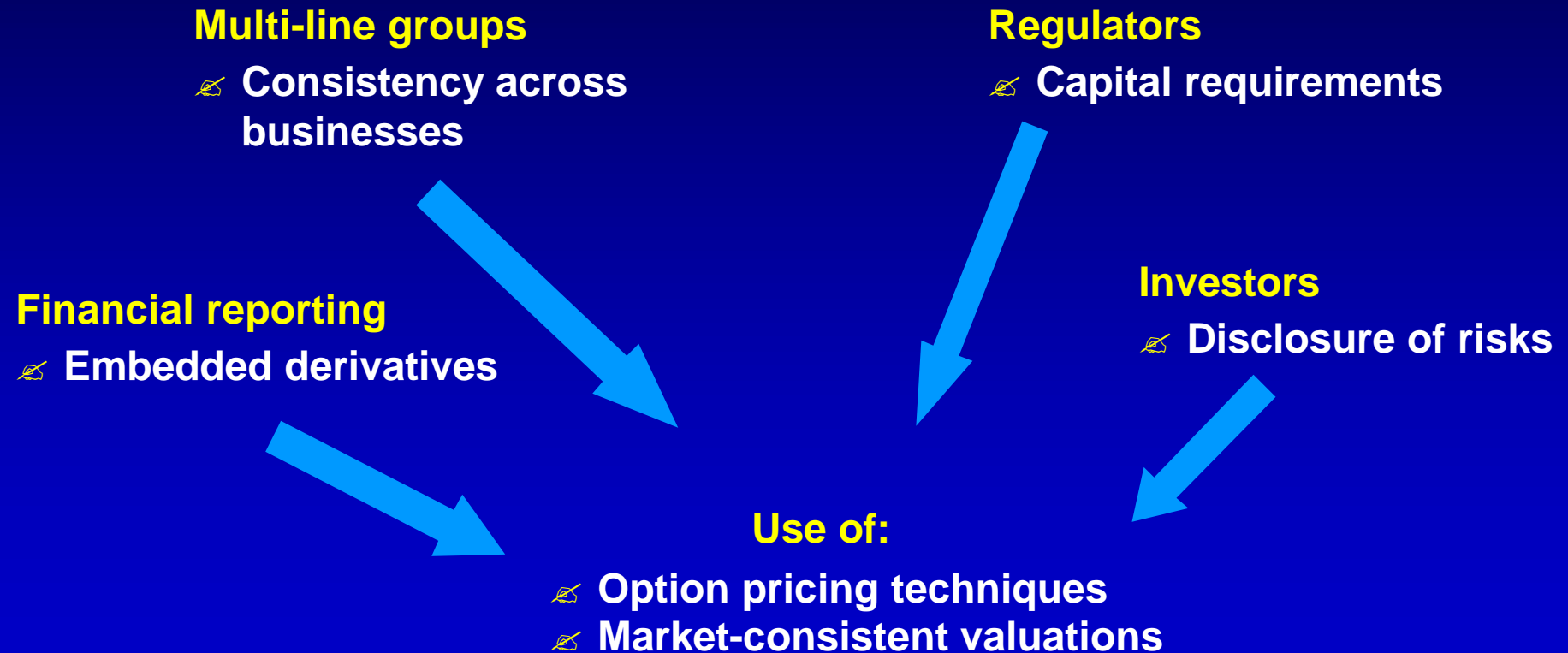
Step 2: Understanding capital markets

Life Insurance: a natural progression

- ? Early companies are mutuals or quasi mutuals
  - ? Capital is borrowed from other policyholders

- ? If policyholder capital is plentiful, competition drives guarantees higher

- ? An economic downturn wipes out the free capital

- ? Following failures, regulators require more sophisticated techniques and more capital to cover guarantees and asset/liability mismatches

Step 2: Understanding capital markets

Life Insurance: **A number of factors are forcing actuaries to adopt market-consistent valuation techniques**

Multi-line groups
- Consistency across businesses

Regulators
- Capital requirements

Financial reporting
- Embedded derivatives

Investors
- Disclosure of risks

Use of:
- Option pricing techniques
- Market-consistent valuations

Step 2: Understanding capital markets

General Insurance:

Financing risk

- ? **Alternative Risk Transfer**

- ? **Securitisation**

Allocating capital

- ? **Securing credit ratings**

- ? **Stochastic modelling**

Step 2: Understanding capital markets

Pension funds

- As pension funds mature, guaranteed liabilities become more important
  - When funds decline or close to new members they need to match or sell guaranteed liabilities

- When failures occur, regulators increase capital requirements
  - Governments will not bail out funds for ever

- Financial reporting will harmonise across pension funds and life assurance companies

New approaches will be needed for valuing guarantees and asset liability mismatches

Step 3: Moving to a world of probabilities

Traditional actuarial techniques have limitations!

Example: How solvent is a fund with a guaranteed liability of $1,000 in 10 years?

Initial assets = $500

Traditional technique:

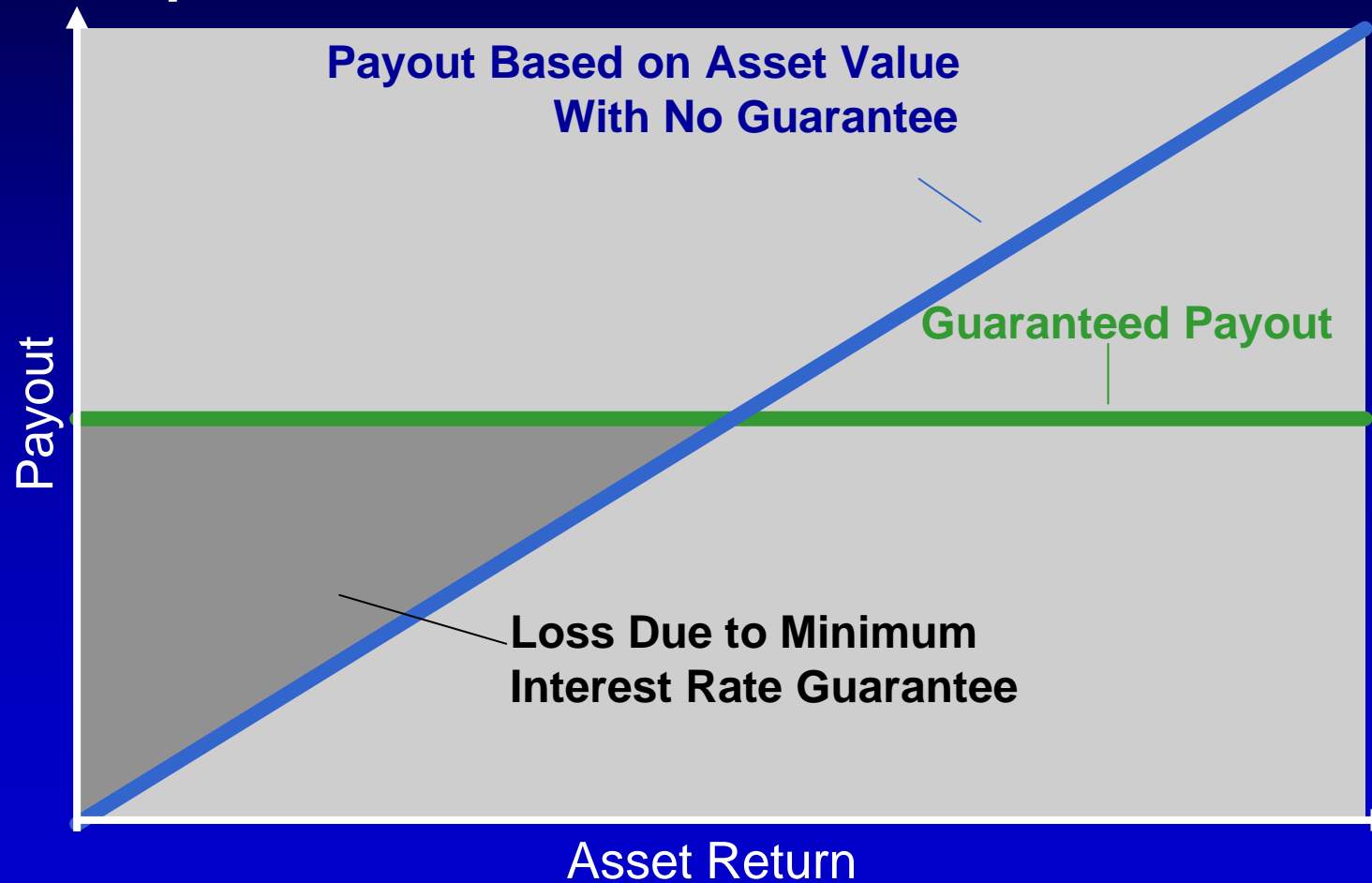- Analyse history
- Develop assumptions
- Build projection models

Step 3: Moving to a world of probabilities

The traditional technique gives different answers depending on the asset mix assumed

Asset Value

1000

750

500

Bonds 4.5%   Equities - 8%

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Traditional actuarial techniques do not cope well with options

Payout Based on Asset Value With No Guarantee

Guaranteed Payout

Loss Due to Minimum Interest Rate Guarantee

Payout

Asset Return

Step 3: Stochastic modelling

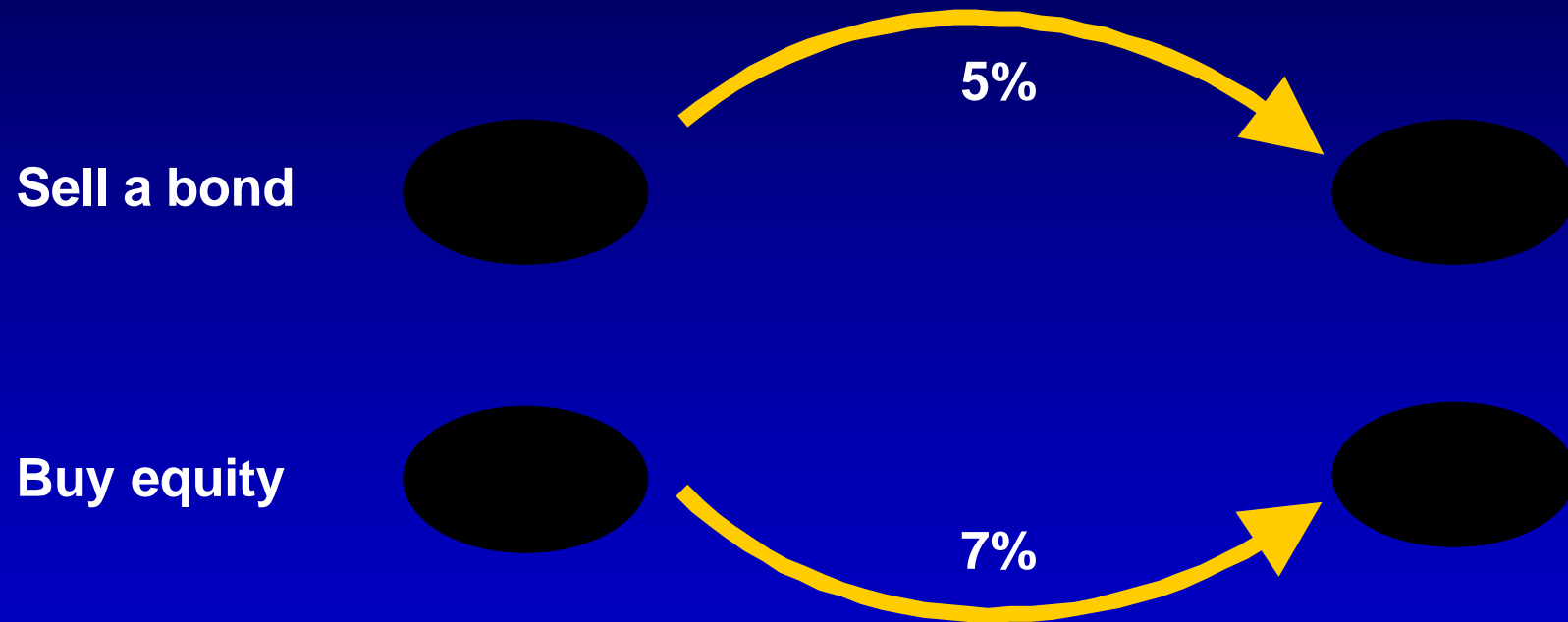Stochastic modelling allows us to explore outcomes across the full range of financial and other scenarios
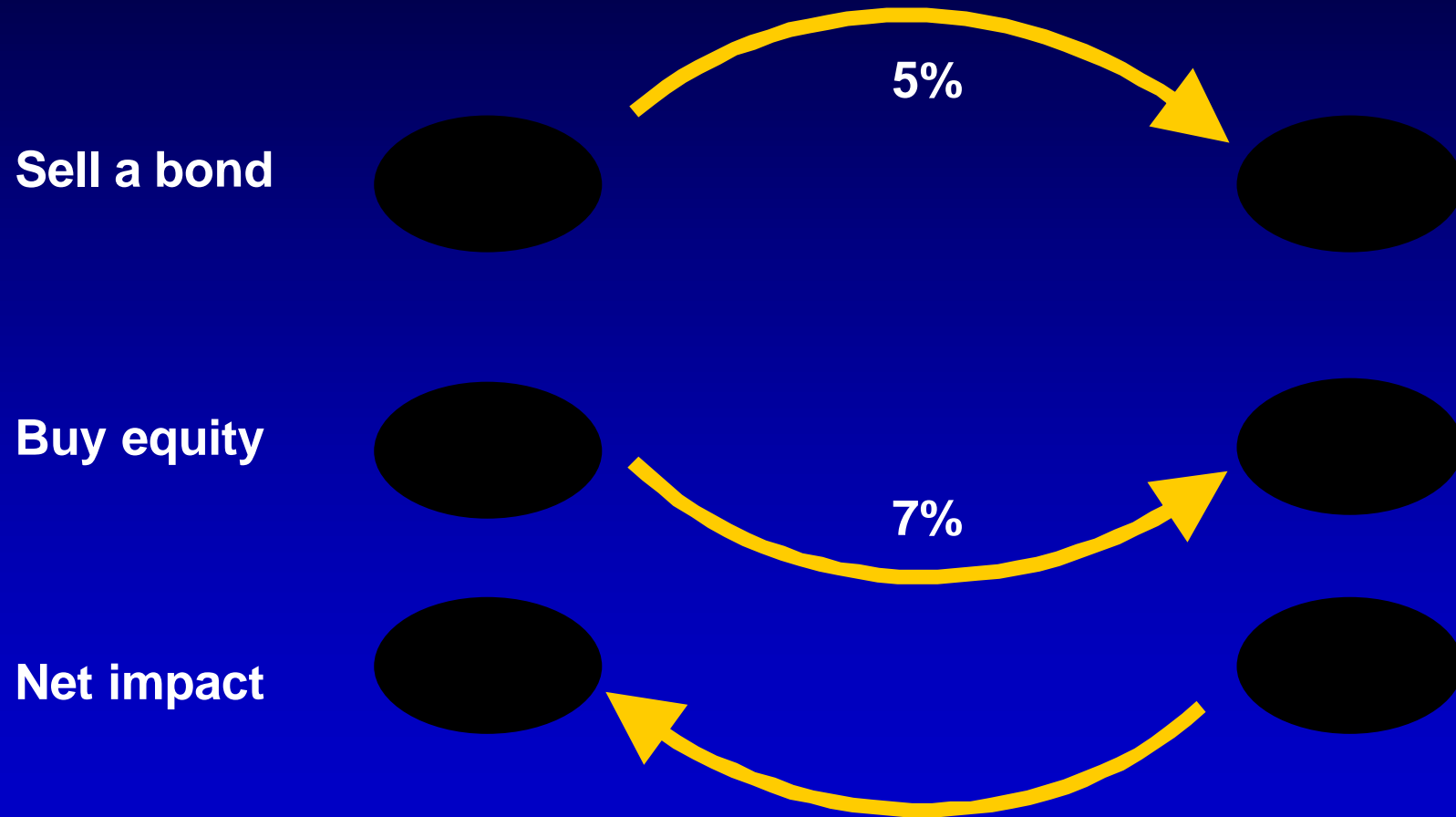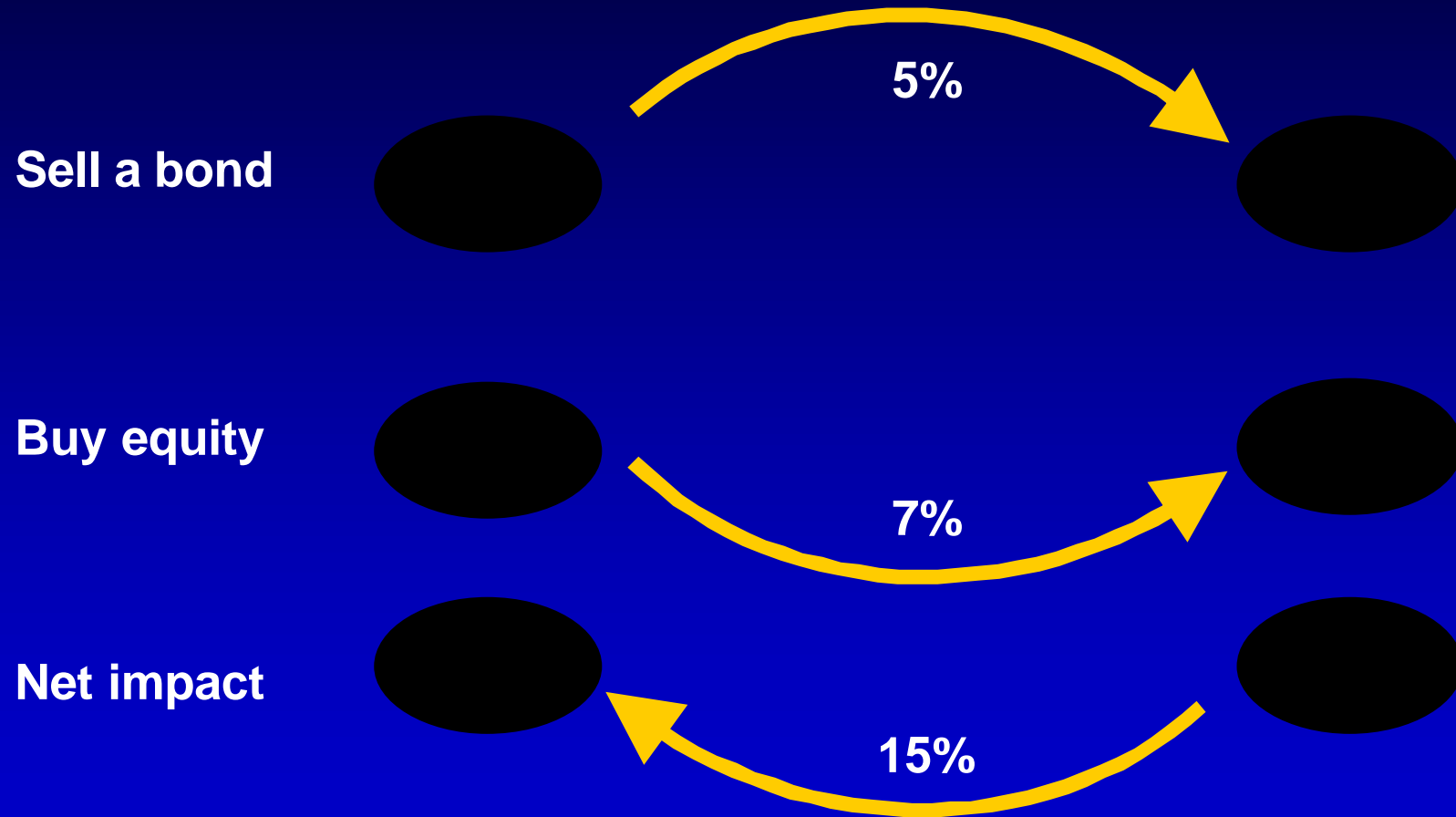
Economic Scenario Generator

- ✍ **Inflation**
- ✍ **Interest Rates**
- ✍ **Credit Costs**
- ✍ **Currency Exchange**
- ✍ **GDP**

Asset Behaviour Model

Liability model

Insurance risk distributions

Projected Financials

Projected cash flows in multiple scenarios

Step 4: Economic capital

PV Surplus

Median return

2%

Capital required

Distribution of scenarios

98%

Security Factor

50%

100%
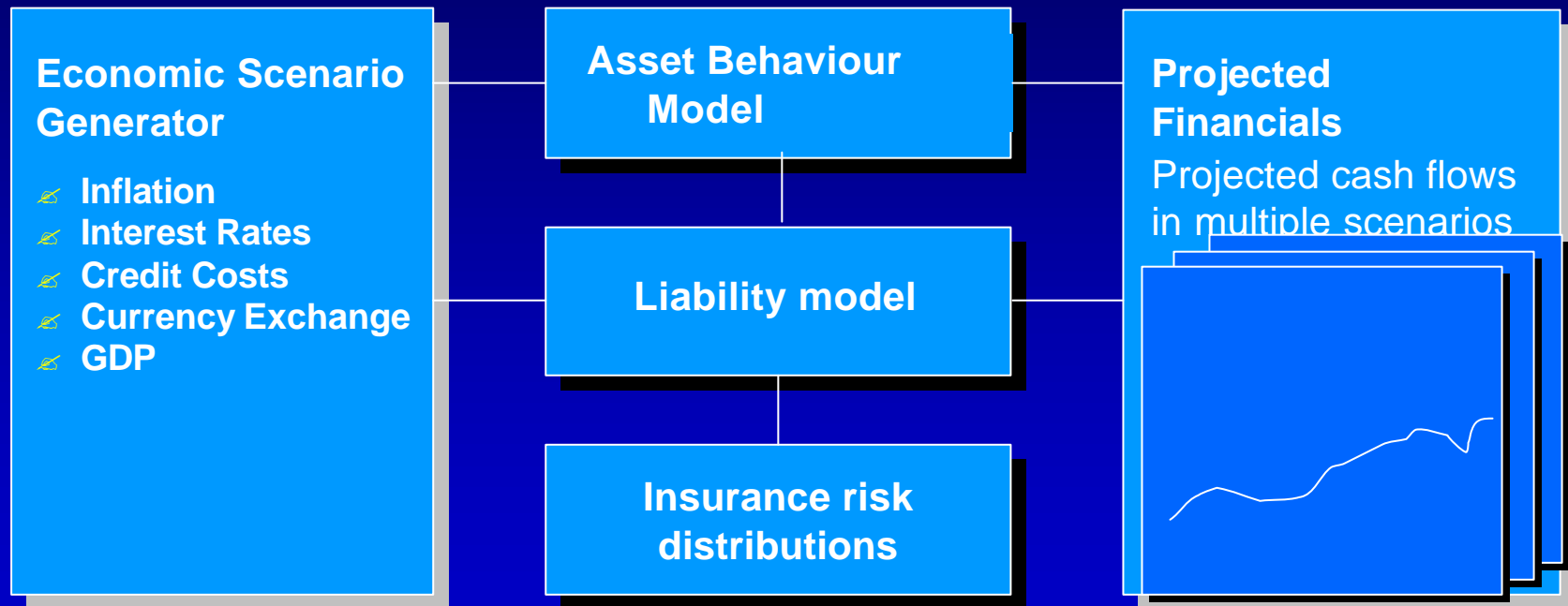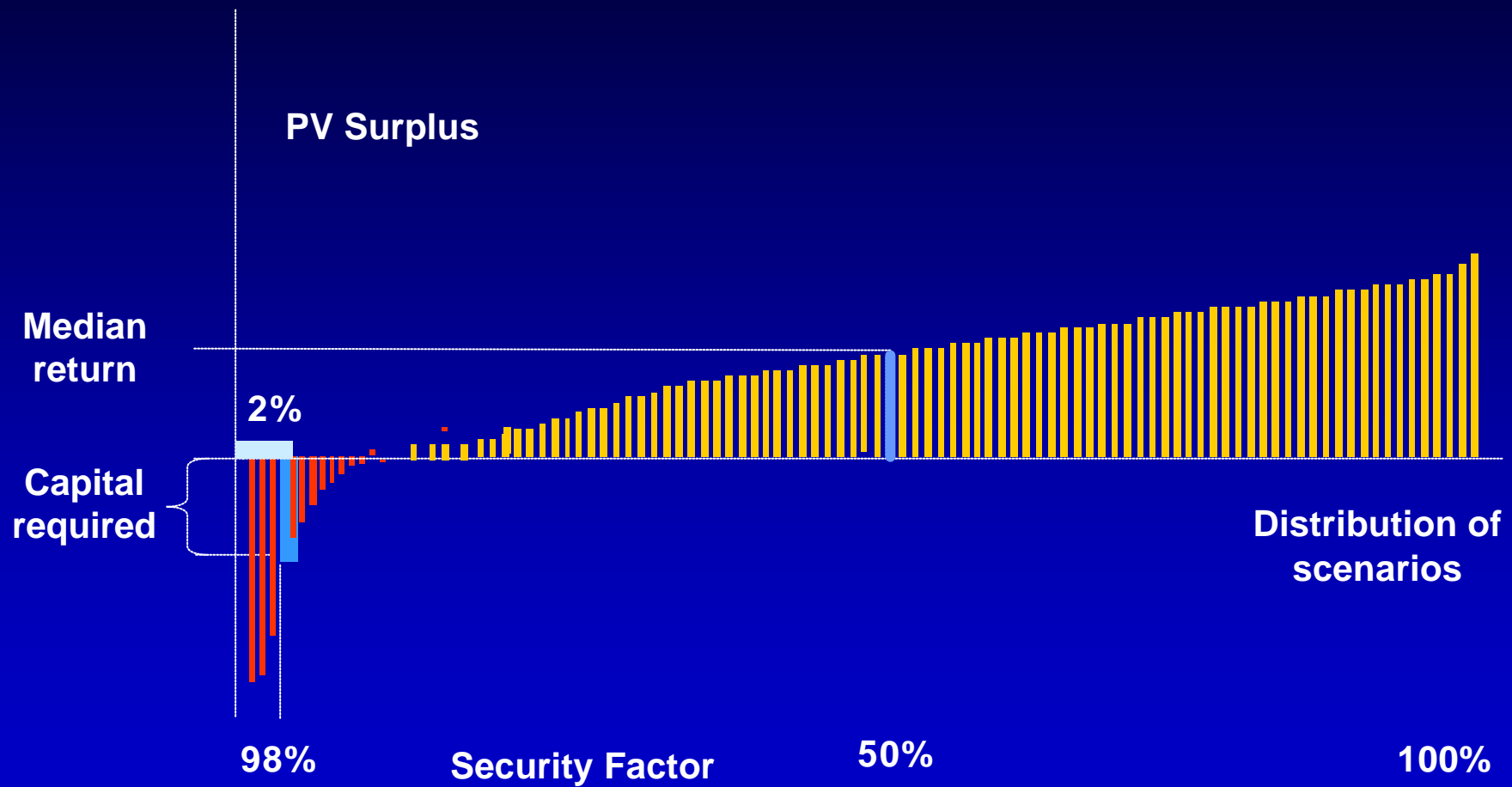
Step 4: Economic value

Issue: what projection yields and discount rates do we use?

5%

Sell a bond

Buy equity

7%

Step 4: Economic value

Sell a bond

5%

Buy equity

7%

Net impact

Step 4: Economic value

Sell a bond

5%

Buy equity

7%

Net impact

15%

Step 4: Economic value

Excluding asset risk premia also gives us the answer

Sell a bond

Buy equity

Net impact

5%

5%

5%
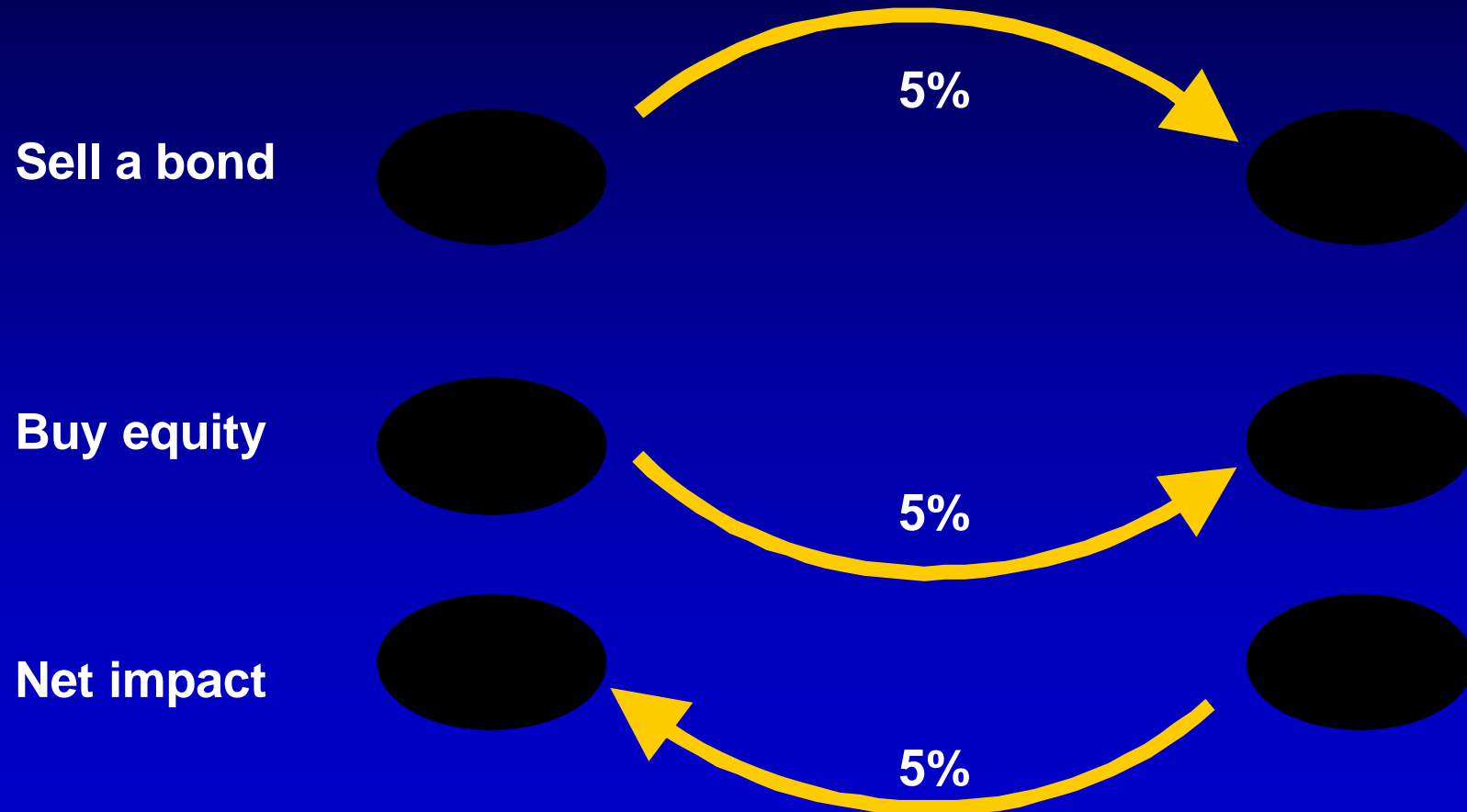
Step 4: Economic value

Real world

Risk-neutral world

Project assets and liabilities at expected yield.

→ Adjust asset yields →

Project assets and liabilities at risk free rate.

Risk-adjusted values

← No change ←

Discount results at risk-free rate to get net present value
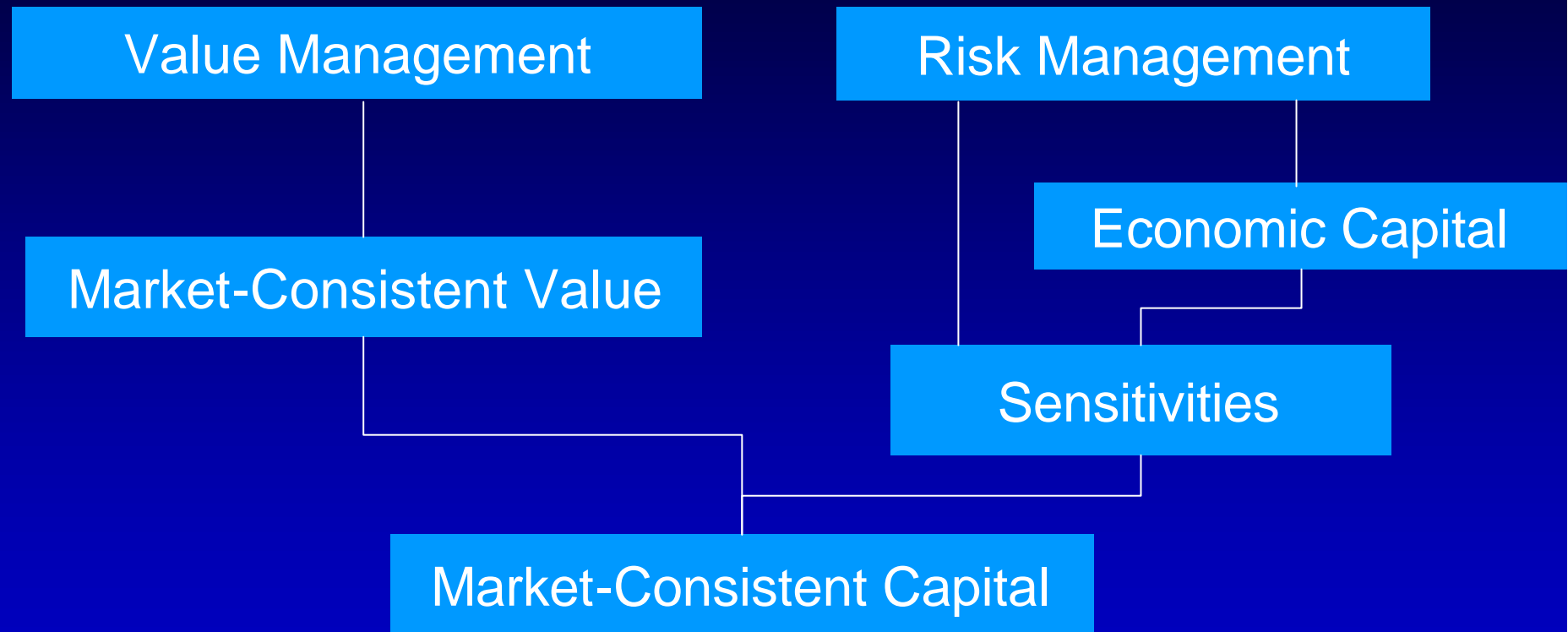
Step 4: Economic value

To calculate a market-consistent value:

- ? Project cash flows based on stochastic risk-neutral scenarios,

- ? Discount results at risk-free rates
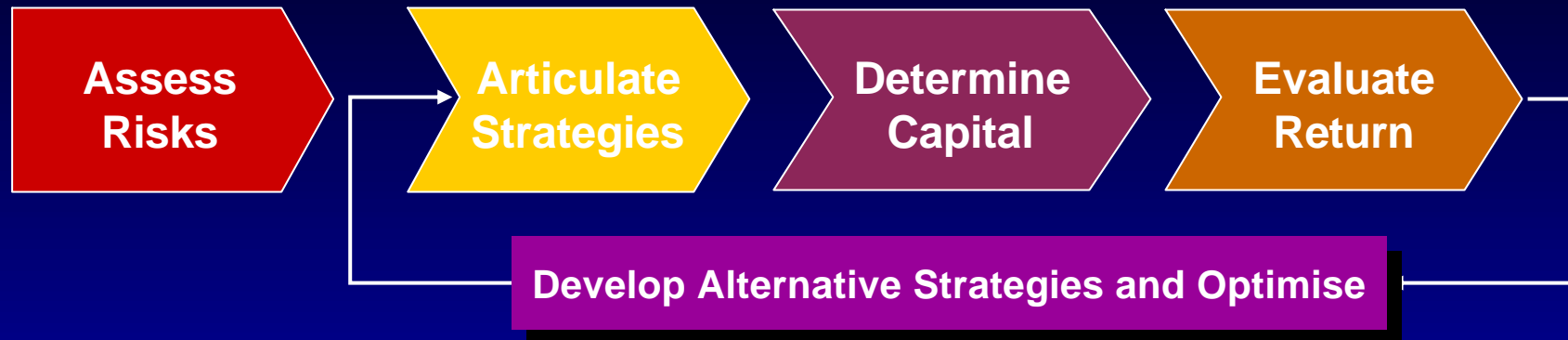
- ? Average the discounted values

This technique:

- ? Can accurately allow for options and guarantees;

- ? Allows modelling of customer and corporate behaviour

Value Management

Risk Management

Market-Consistent Value

Economic Capital

Sensitivities

Market-Consistent Capital

The same tools can be used to measure and manage value and risk

Step 5: Managing risk, capital and value

Assess Risks → **Articulate Strategies** → **Determine Capital** → **Evaluate Return**

Develop Alternative Strategies and Optimise

- Identify risk factors
- Prioritise risk factors
- Model risk factors as necessary

- Overlay business and risk management strategies
- Link results to financial measures
- Develop results distribution for each strategy

For each strategy:
- Establish economic capital
- Allocate capital to business segment

For each strategy:
- Determine expected rate of return
- Determine riskiness of return
- Compare to capital market alternatives

- Iterate until optimal

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Communication is the biggest challenge

Life Product Pricing Example

1970's Actuary:

I've calculated the premium rates using commutation functions
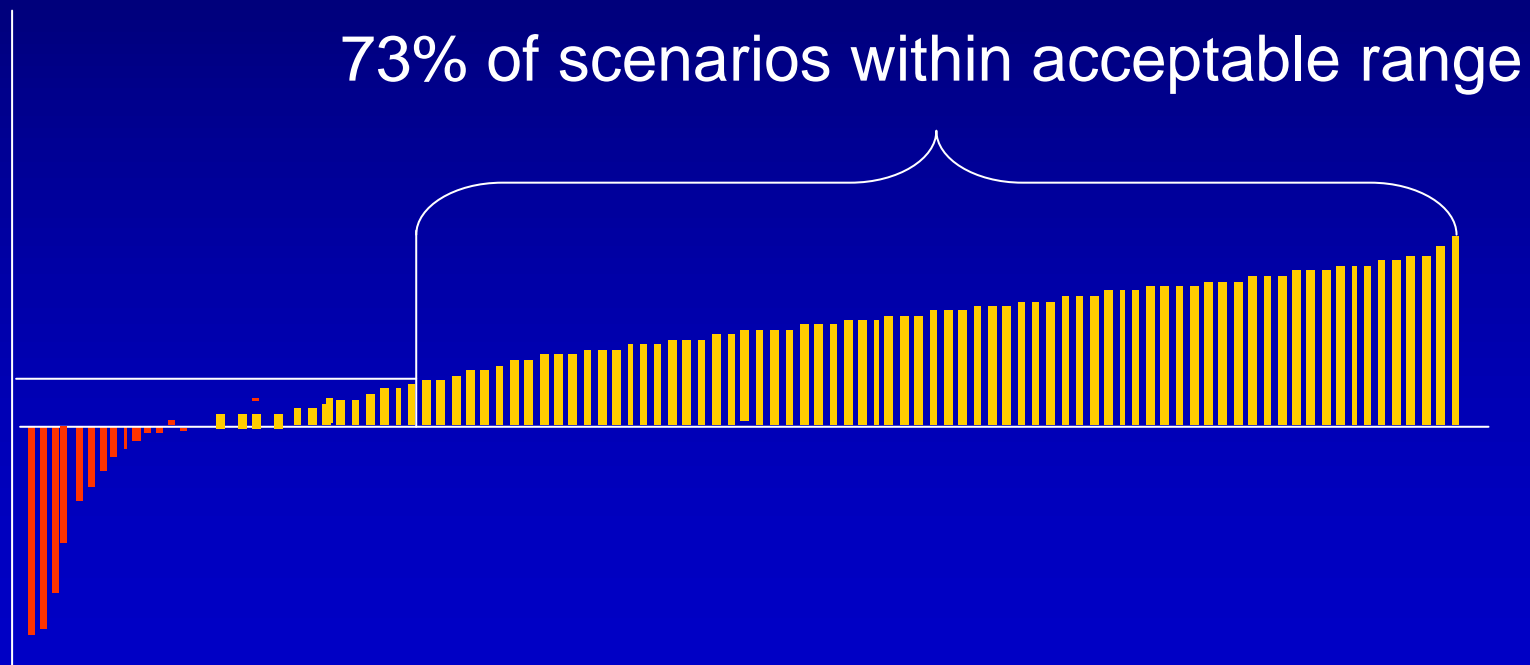
1980's Actuary:

I've profit tested the premium rates and they meet our return on capital hurdle of 15%

1990's Actuary:

The premium rates meet our targets and the sensitivity tests show that there is some downside risk.
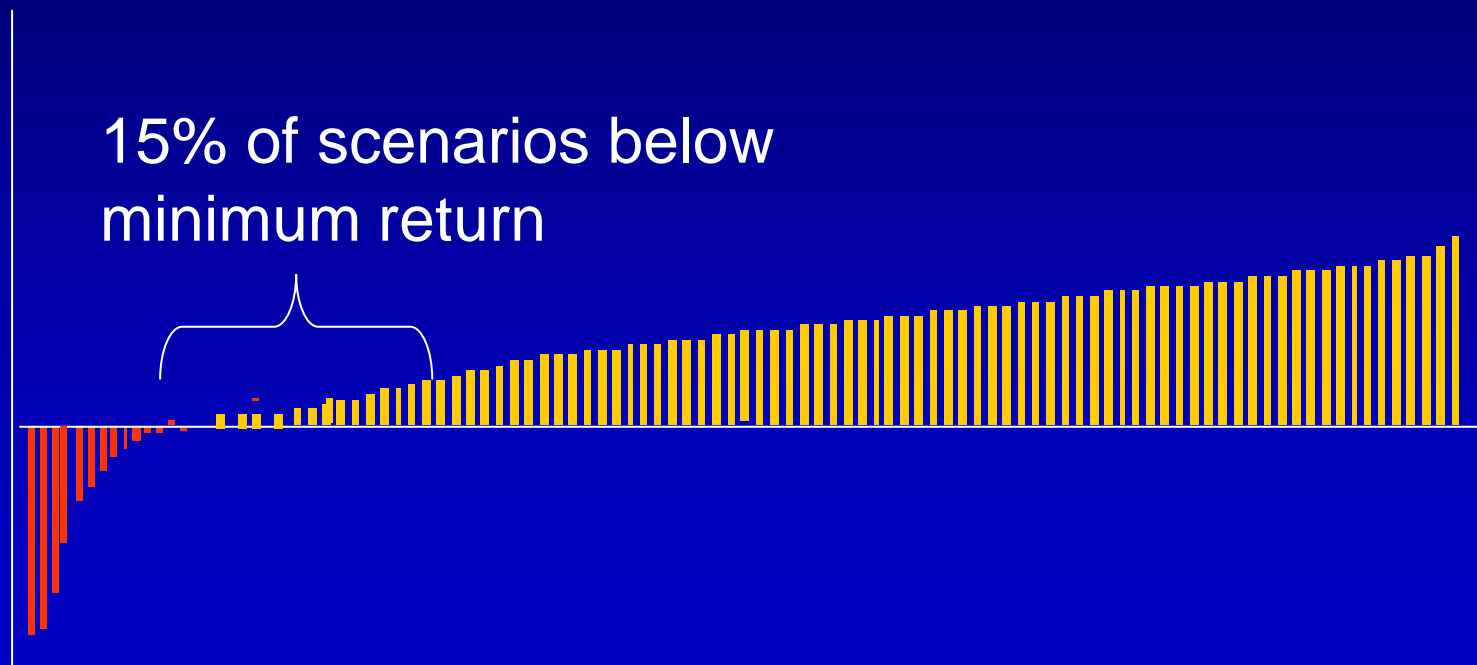
Communication is the biggest challenge
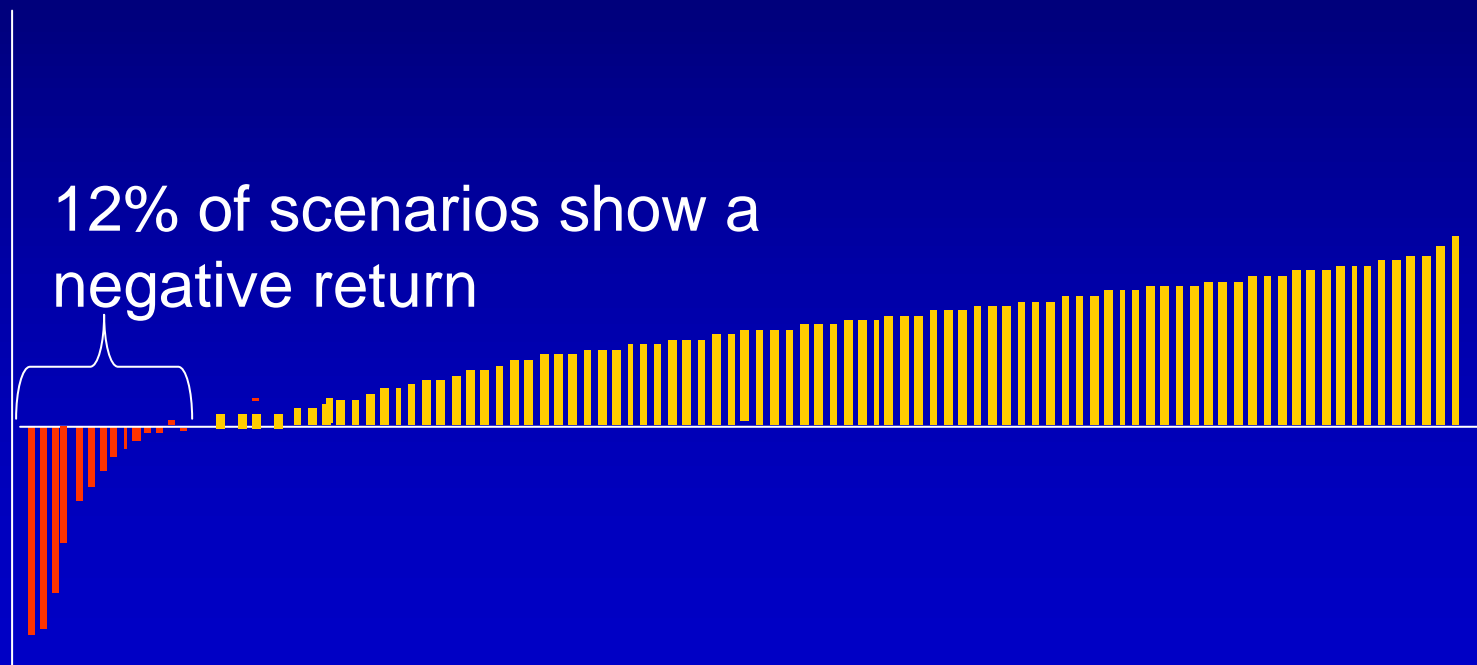
2000's Actuary:

73% of scenarios within acceptable range

2000's Actuary:

15% of scenarios below
minimum return

Communication is the biggest challenge
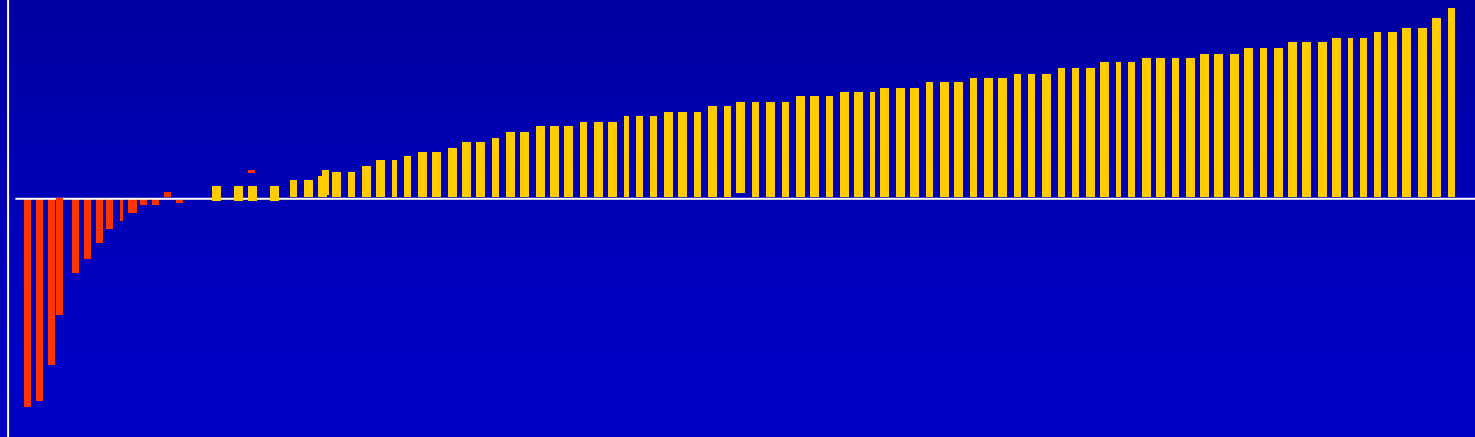
2000's Actuary:

12% of scenarios show a
negative return

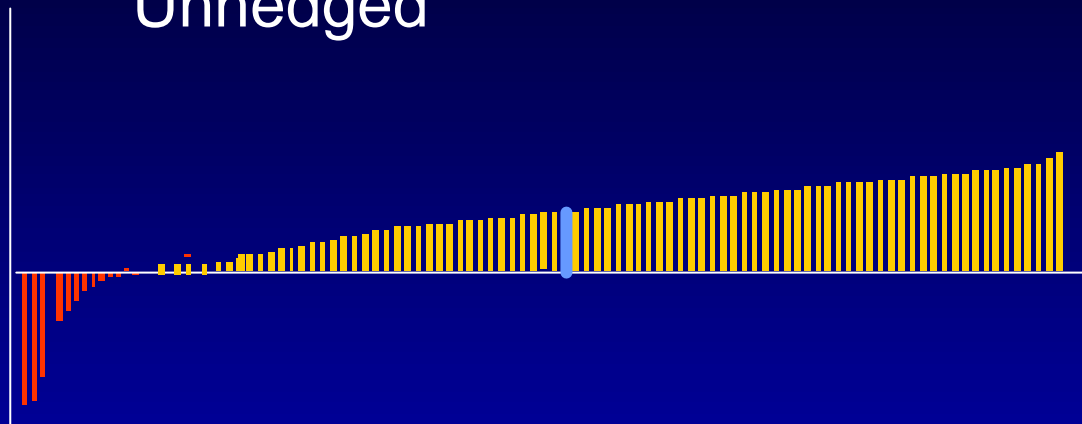# Communication is the biggest challenge

2000's Actuary:

Overall market-consistent value is acceptable at 4% of premium. However, downside risk is outside our tolerance
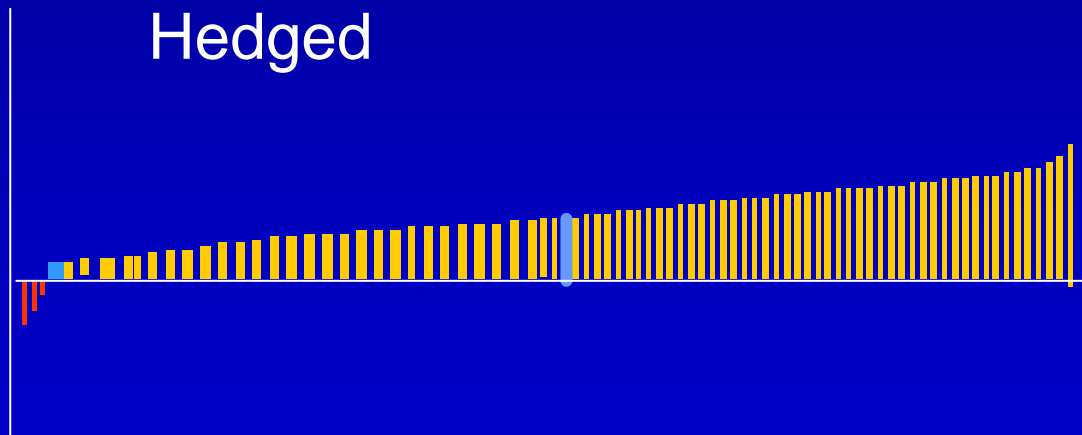
Communication is the biggest challenge

The hedging programme reduces the downside risk to acceptable levels while maintaining profitability at 3.8% of premium

Unhedged

Hedged

Is the journey over?

- ? These techniques are new and still developing

- ? However, they are quickly becoming mainstream:
    - ? Solvency II in Europe is expected to use them for determining capital for Life and P/C insurers
    - ? Already in use in UK for Life reserving and recommended for Life and P/C capital determination
    - ? Many multinational insurers use them

- ? International Accounting Standards will use them for Life liabilities

Actuaries are going to be busy!