Financial Risk Management of Pension Schemes – An Economic Capital Approach

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Background

- Recent history and developments:
  - Enron, Equitable Life, Financial crisis of 2007.
  - Basel 2, 3 and Solvency 2.
- Increased scrutiny of occupational pension schemes:
  - Ageing population.
  - Lower expected real investment returns.
  - Unstable financial markets.
- Regulatory differences:
  - Banks, insurers – FSA : Pension funds – The Pensions Regulator.
  - No formal capital requirements for pension funds.
  - Pension funds subject to funding and not solvency standards.
- Need for an effective unifying framework to monitor and manage risk across the entire financial services sector.

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Pensions Change

- UK DB pension schemes:
  - based broadly on years of service, an accrual rate and final salary;
  - in their rudimentary form date back to late 16th century;
  - predominant occupational pension schemes until 1980s;
  - prove their value to employees.
- UK DC pension schemes:
  - based on contributions paid and investment returns earned;
  - have become more favoured since 1980s;
  - due to the rapid growth of the financial markets;
  - and also being more flexible and easily transferable.
- Regulatory developments for DB pension schemes:
  - First attempt at financial regulation – MFR (Pensions Act 1995).
  - Introduction of PPF in Pensions Act 2004.
  - European Commission Green Paper (2010) on future of pensions.
  - European Commission Call for Advice (2011) aims for introduction of risk-based Solvency 2 type regime.

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Decline of UK Defined Benefit (DB) Pension Schemes

Table: Distribution of UK DB pension schemes by status. (Source: The Purple Book (2006–2010))

Scheme status	2006	2007	2008	2009	2010
Open	43%	36%	31%	27%	18%
Closed to new members	44%	45%	50%	52%	58%
Closed to future accruals	12%	16%	17%	19%	21%
Winding Up	1%	2%	2%	2%	2%

Decline of UK Defined Benefit (DB) Pension Schemes

Table: UK DB pension schemes funding statistics. (Source: The Purple Book (2006–2010))

	2006	2007	2008	2009	2010
Total assets (£billion)	818.2	853.0	857.0	780.4	926.2
Total liabilities (£billion)	887.5	914.1	955.4	1109.5	1074.4
Funding level	92.2%	93.3%	89.7%	70.3%	86.2%

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Economic Capital of a Life Insurance Annuity Firm

Definition

Economic capital

- . . . is the amount of capital, or excess assets, required
- . . . to ensure that the market value
- . . . balance sheet of the firm remains solvent,
- . . . over a specified time horizon,
- . . . with a prescribed (high) probability.

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The Stochastic Model – Economic Variables

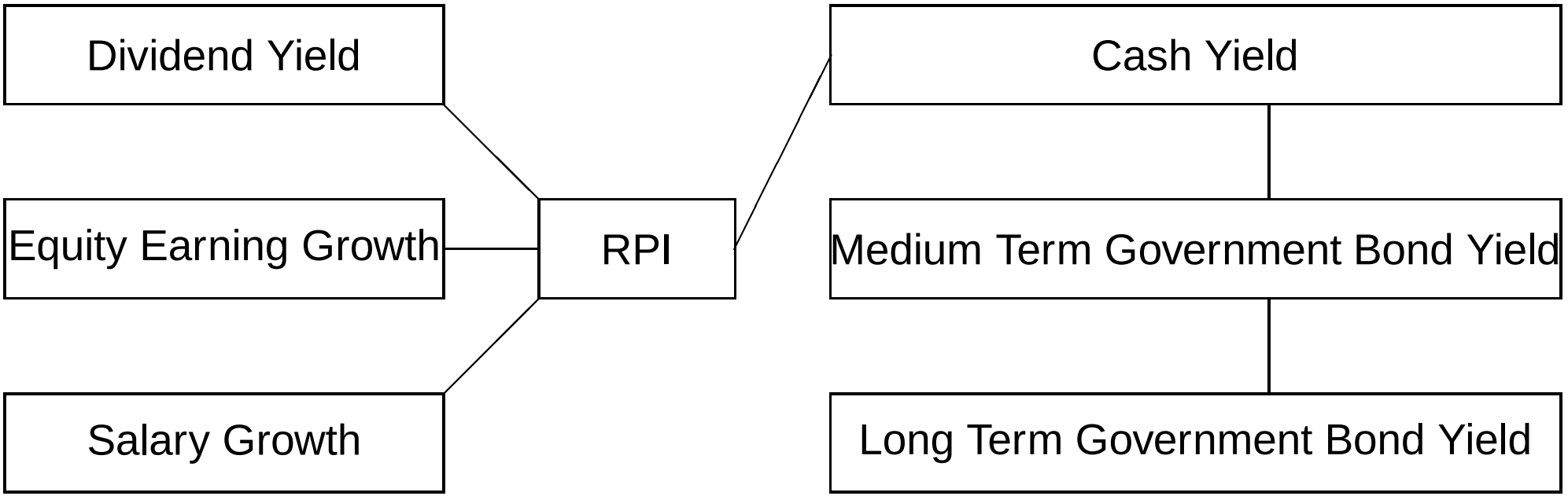


Figure: Graphical model of the economic variables.

Model calibrated using historical data from 1900–2000 (source: Dimson, Marsh & Staunton (2002)).

The Stochastic Model – Demographic Variables

Mortality studies in the UK have extensively documented the

- cohort,
- age-related and
- period-related

improvement effects for both males and females.

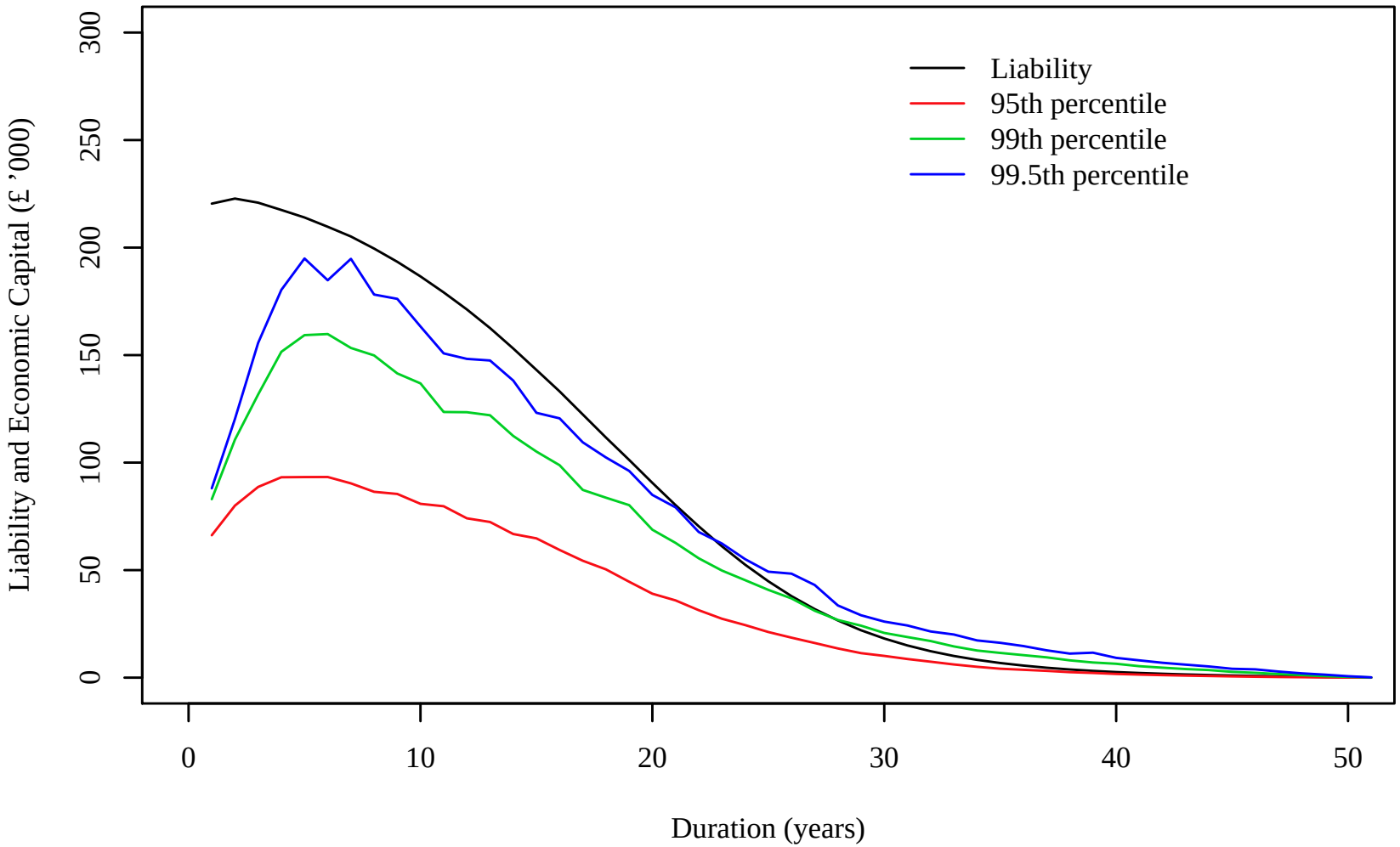
Our approach to mortality modelling:

- Start with the base mortality tables PMA92Base and PFA92Base.
- Project base tables forward to 2008 using middle cohort improvement factors.
- Future projections involve introducing stochastic uncertainty around the central mortality projection using the approach of Sweeting (2008).

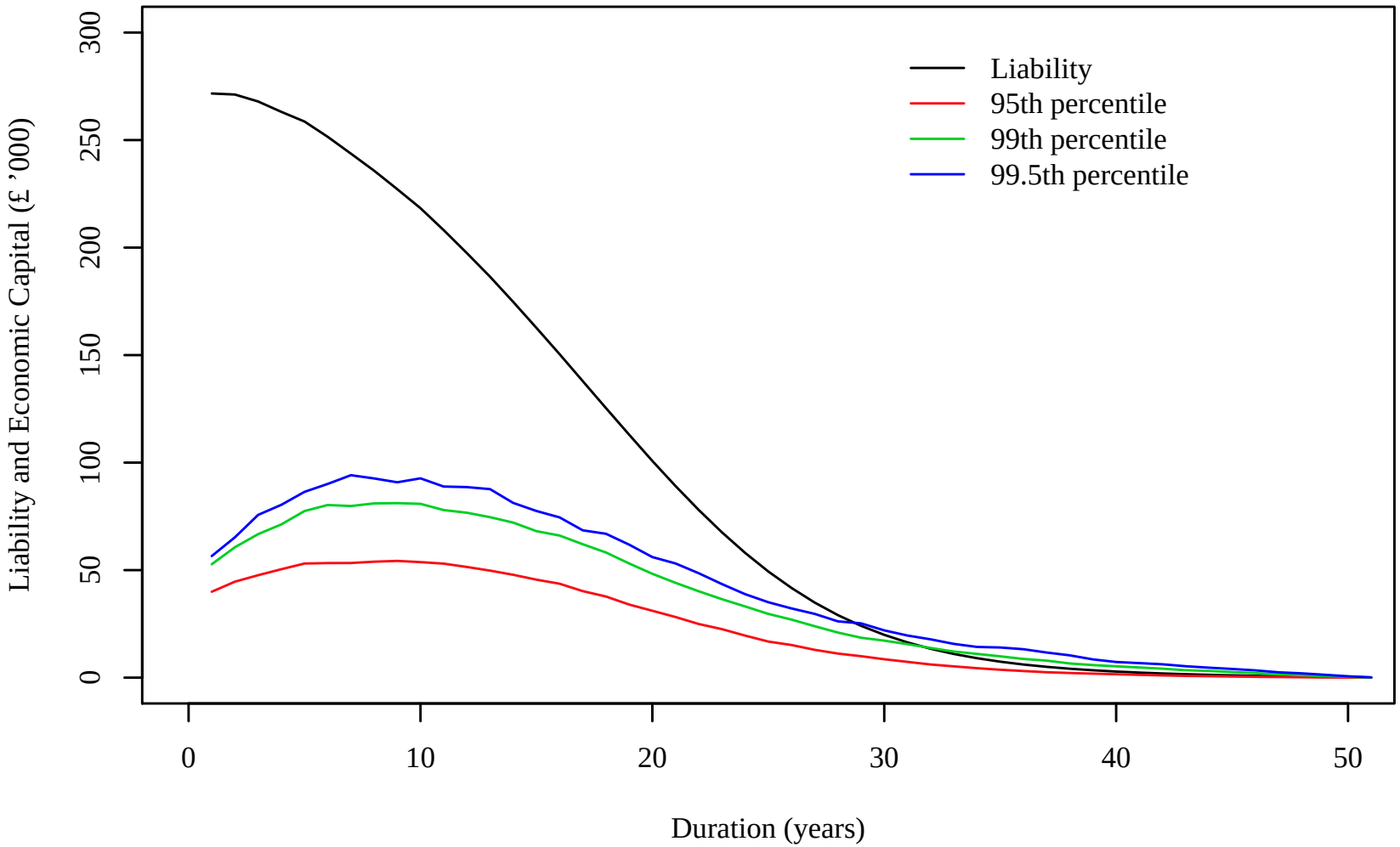
Life Insurance Annuity Example – Assumptions

- Annual pension of £17,329.
- Joint life last survivor annuity.
- At inception both lives aged 70.
- Investment options: Equities + Government Bonds.

Annuity Example – 90% Equity + 10% Bonds



Annuity Example – 100% Bonds



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1. Introduction
2. Economic Capital of a Life Insurance Annuity Firm
3. Economic Capital of Universities Superannuation Scheme
   - Definition of Economic Capital – Revisited
   - Universities Superannuation Scheme (USS)
   - Membership Statistics
   - Model Points
   - Model Points vs Valuation Report (2008)
   - Results
4. Conclusion

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Economic Capital of a DB Pension Scheme

Definition

Economic capital

- . . . is the excess of assets, valued on a market value basis
- . . . over best estimate liabilities in respect of accrued benefits
- . . . required to ensure that assets exceeds liabilities
- . . . on all future valuation dates over a specified time horizon
- . . . with a prescribed (high) probability.

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Universities Superannuation Scheme (USS)

- Retirement age is 62 for both males and females.
- Benefits at retirement:

$$\begin{aligned} \text{Annual pension} &= \frac{1}{80} \times \text{Pensionable service} \times \text{Pensionable salary}; \\ \text{Lump sum payment} &= 3 \times \text{Annual pension}. \end{aligned}$$

- Annual pension is increased in line with RPI.
- Contribution rate: 16% employer + 6.35% employees.
- Investment: 90% real + 10% fixed.

Membership Statistics

Table: Membership statistics of USS, all UK DB pension schemes and all UK open DB pension schemes.

Membership status	USS	All UK DB schemes (millions)	All UK open DB schemes (millions)
Active members	130,450	2.74	1.56
Deferred members	76,104	5.23	1.99
Pensioners	40,945	4.43	1.92
Dependants	8,951	–	–
Total	256,450	12.40	5.48

Model Points

Active members

Age	Number of members	Past service	Annual salary Male	Annual salary Female
30	35,257	5	£24,685	£23,069
40	35,257	9	£35,225	£30,912
50	35,257	13	£43,700	£37,515
60	24,680	17	£49,405	£43,366

Deferred members

Age	Number of members	Average deferred pension
44	76,104	£2,044

Pensioners

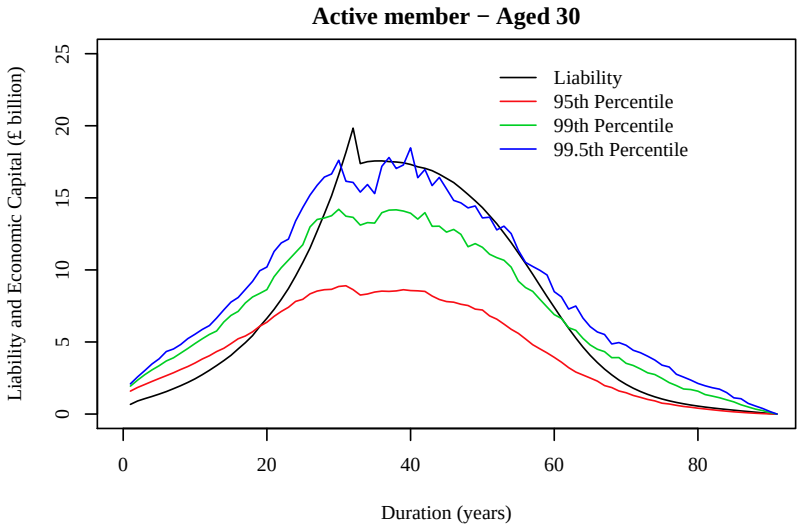
Age	Number of members	Average annual pension
70	40,945	£17,329

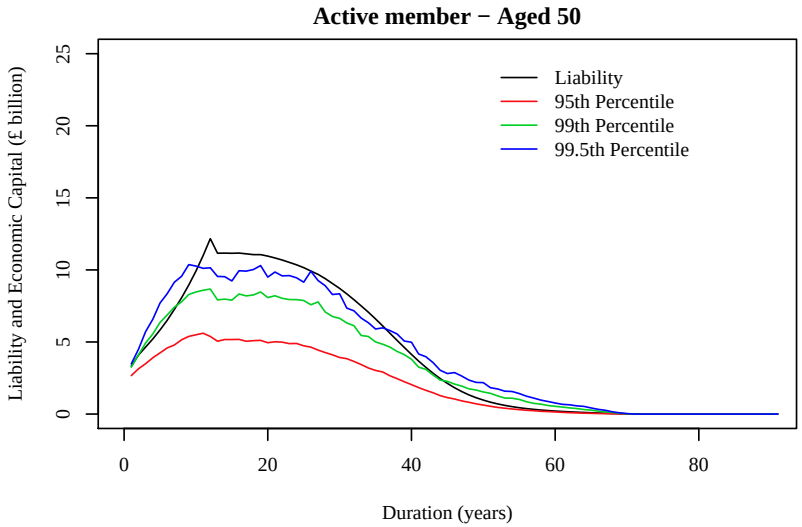
Model Points vs Valuation Report (2008)

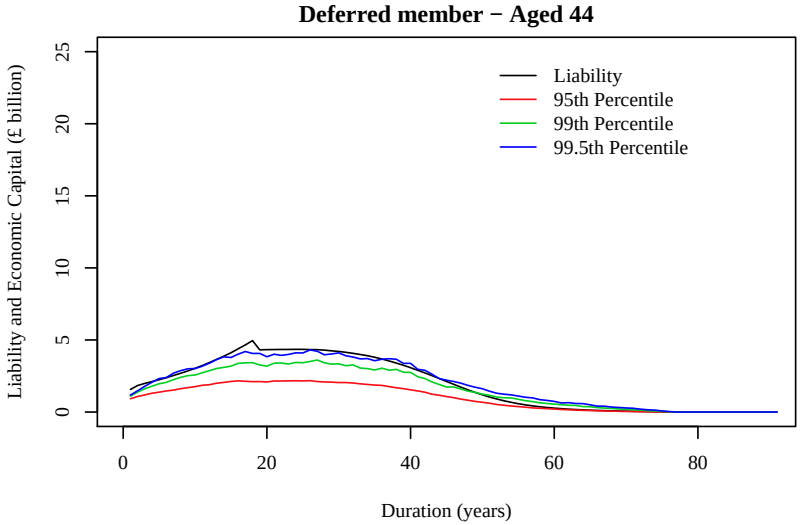
Table: Comparison of accrued benefit liabilities.

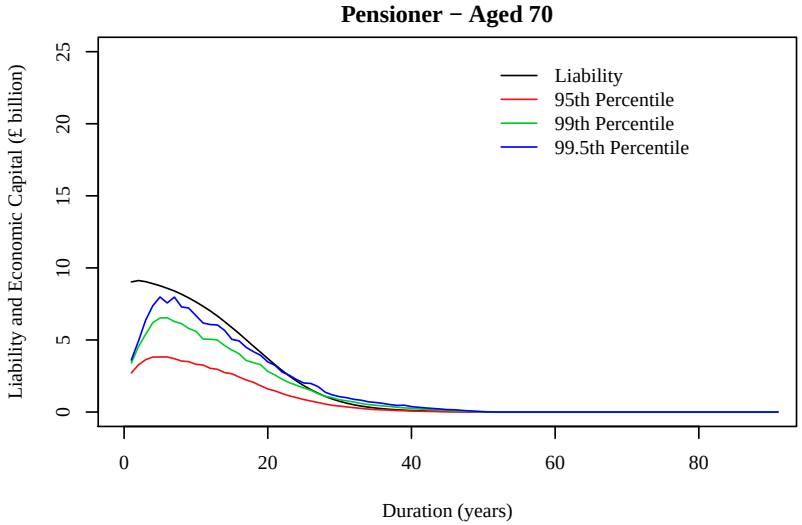
	Model points	USS 2008
Active members	£15,159.1m	£14,774.6m
Deferred members	£2,312.5m	£2,229.3m
Pensioners	£11,064.8m	£11,131.4m
Total	£28,536.4m	£28,135.3m

Base Case – Model Points

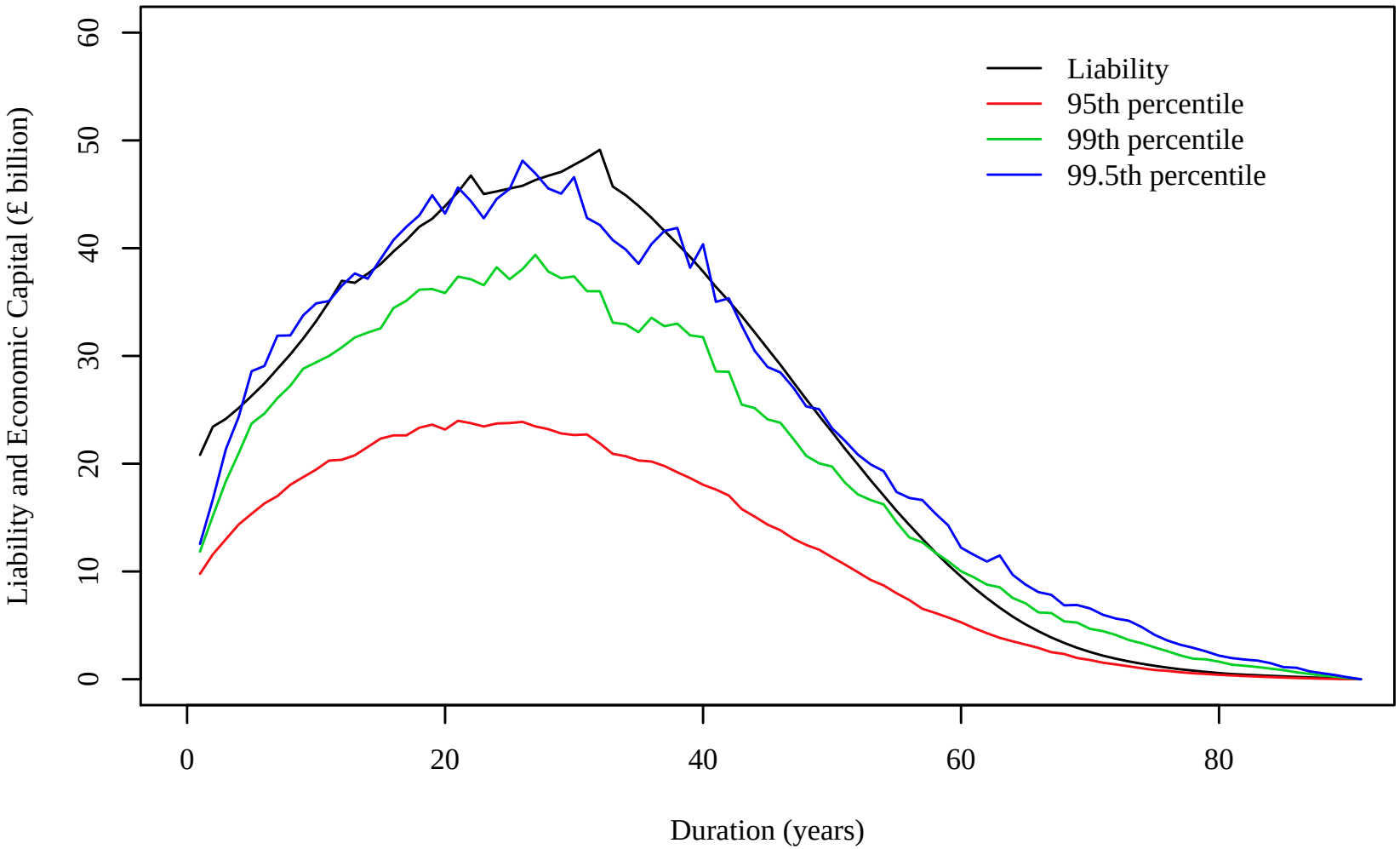




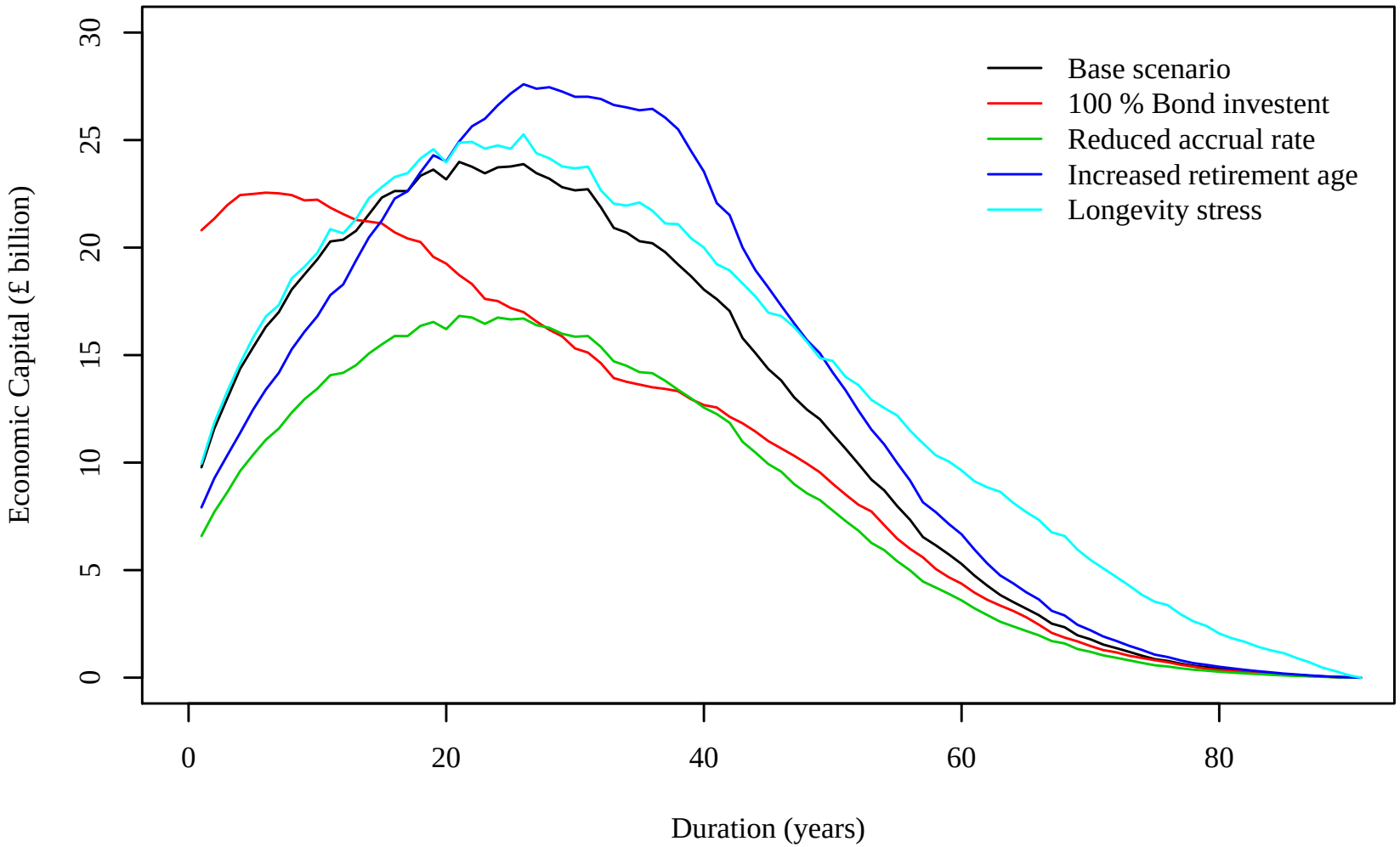




Base Case – Full Scheme



Sensitivity Analysis – EC at 95th Percentile Levels

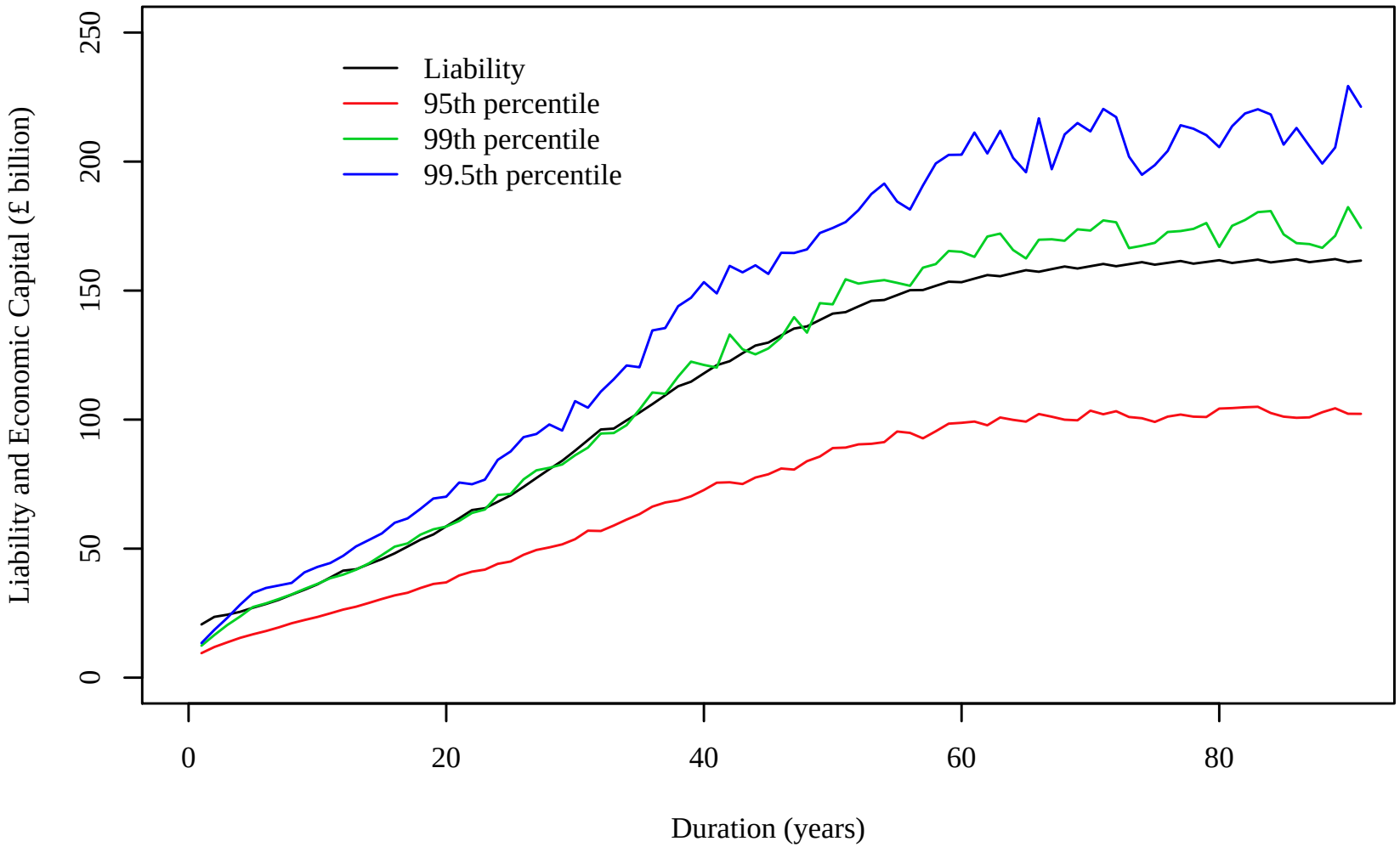


Results Summary

Table: Ratio of USS scheme assets at 2008 actuarial valuation (£28,842.6m) to the sum of scheme best estimate liabilities and economic capital at time zero.

	Economic capital percentile levels		
Scenario	95th	99th	99.5th
Base	94%	88%	86%
100% investment in bonds	58%	52%	50%
Accrual rate reduced to 1/120th	119%	112%	110%
Retirement age increased to 70	112%	104%	102%
Longevity stress	94%	88%	85%

Open Scheme


Liability
95th percentile
99th percentile
99.5th percentile
Liability and Economic Capital (£ billion)
0
50
100
150
200
250
0
20
40
60
80
Duration (years)

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Summary

- Regulatory change is a driver for improvements all round.
- Economic capital is 60% of best estimate liability at the 99.5th percentile level for the base scenario.
- It shows the extent of risk inherent in guaranteeing long-term benefits while backing liabilities with volatile assets.
- Setting capital aside to match economic capital will be challenging, so de-risking DB pension schemes is more likely.
- A risk-sensitive economic capital approach can provide better clarity to help manage DB schemes in a transparent manner.

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