Mortality Improvement Volatility and Longevity Risk: Implications for the US

Stuart Silverman, FSA, MAAA, CERA

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Agenda

- Reasons for modeling volatility in future mortality rates
- Impact of mortality rate volatility on liability projections
- Longevity exposure in the US
- My view on what needs to happen

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Why reflect mortality rate volatility in our liability projections?

- There has been a lot of analysis relating to various expectations for future mortality improvement rates
- However, this still doesn't get to the issue of uncertainty
- We can develop an expectation, but we do not know for certain that the expectation will be met
  - There is no crystal ball
- We can perform stress tests, and while they may seem tangible, they may actually be arbitrary

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What does the future hold for mortality rates?

- Not sure – but at least let's recognize there is uncertainty
- Some reasons that mortality rates can continue to improve at current or even higher improvement rates are:
  - Continued advancement in medical research and application
    - Could the breakthrough in cancer research be around the corner?
    - Genome testing
  - Lifestyle Awareness
    - Depends on socioeconomic factors
- Some reasons that mortality rates may not improve at current improvement rates or may even deteriorate are:
  - Improvements in heart-related deaths may taper off
    - Obesity epidemic
    - Statin drugs/surgery/reduction in smoking already have improved rates dramatically
  - Bacteria evolving resistance to antibiotics
  - Extreme events – climate change, pandemics, terrorism

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Sources of Mortality Rate Volatility

- Random dates of death (relevant for smaller populations)
- Current mortality table uncertainty
  - Depends on credibility/relevance of experience of the population
- Uncertain pattern in future mortality improvement rates
  - While mortality rates have significantly improved over the last 50 years, they have not improved in a smooth pattern
  - The pattern of improvement is relevant because we are concerned with cash flow patterns, not long-term improvement statistics
- Extreme longevity occurrences
  - A medical breakthrough that shifts the curve
- Catastrophic mortality event
  - E.g., a pandemic

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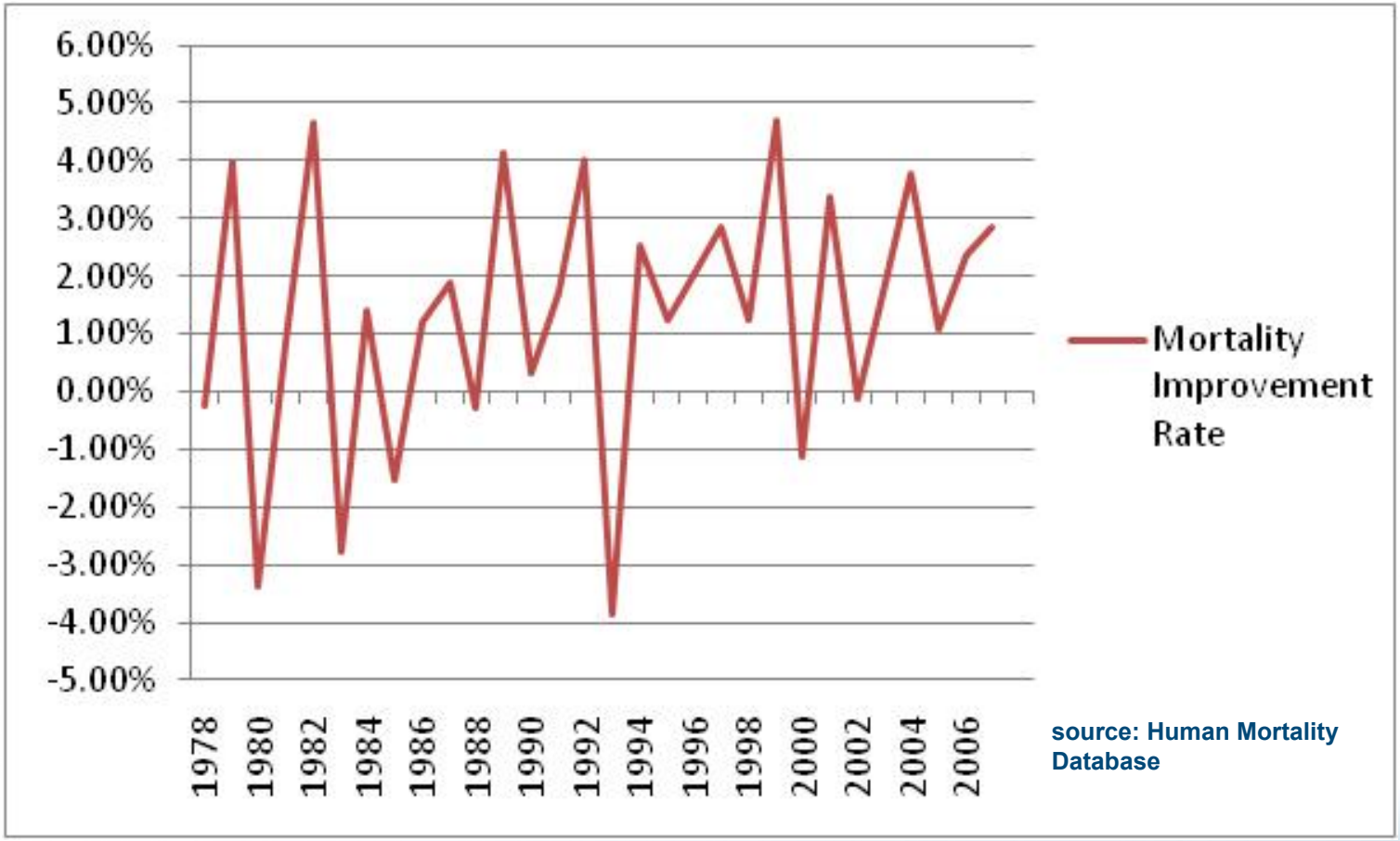
Historical US 80-Year-Old Male General Population Mortality Improvement Rates



source: Human Mortality Database

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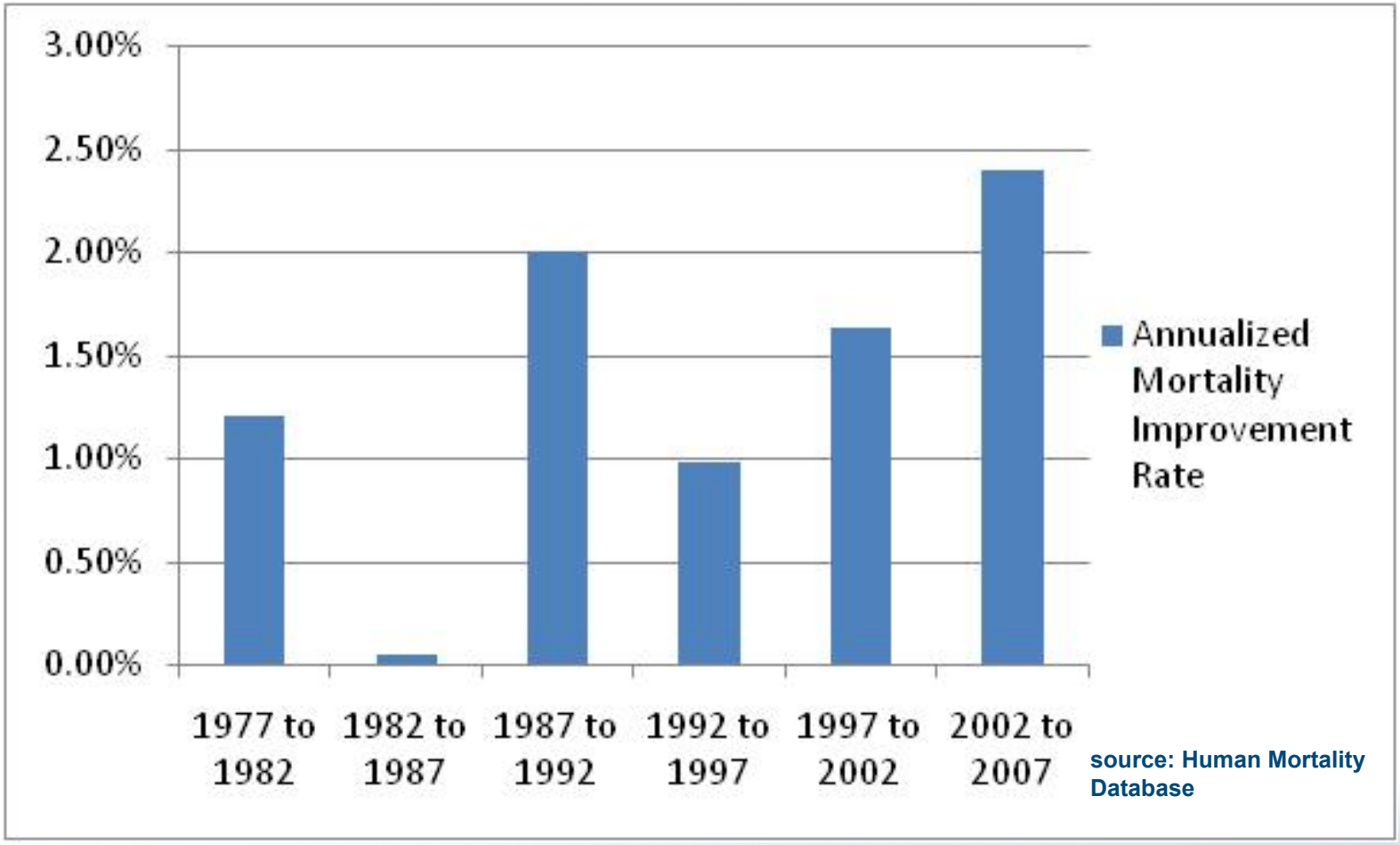
Historical US 80-Year-Old Male General Population Annualized Mortality Improvement Rates



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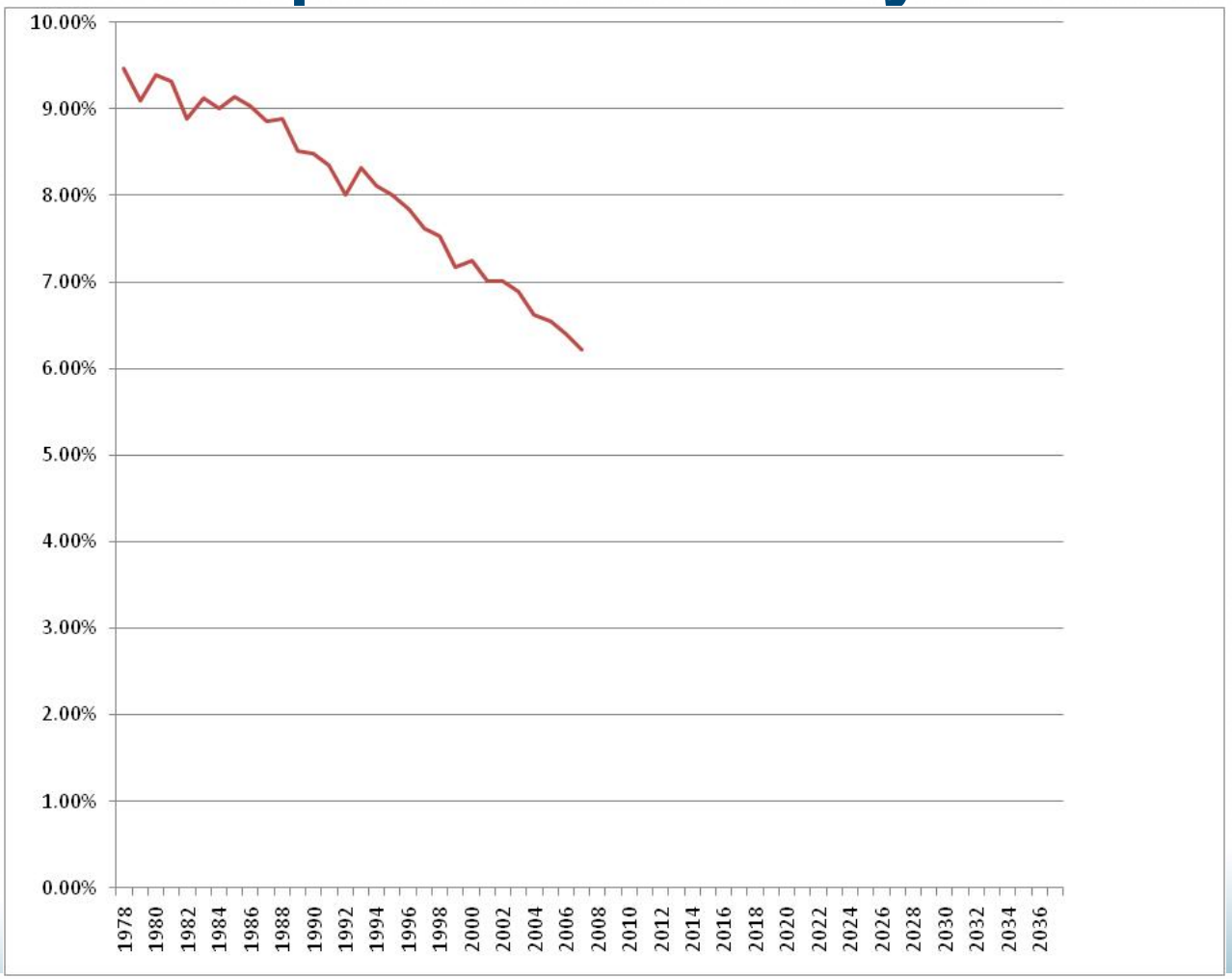
Historical US 80-Year-Old Male General Population Mortality Rates



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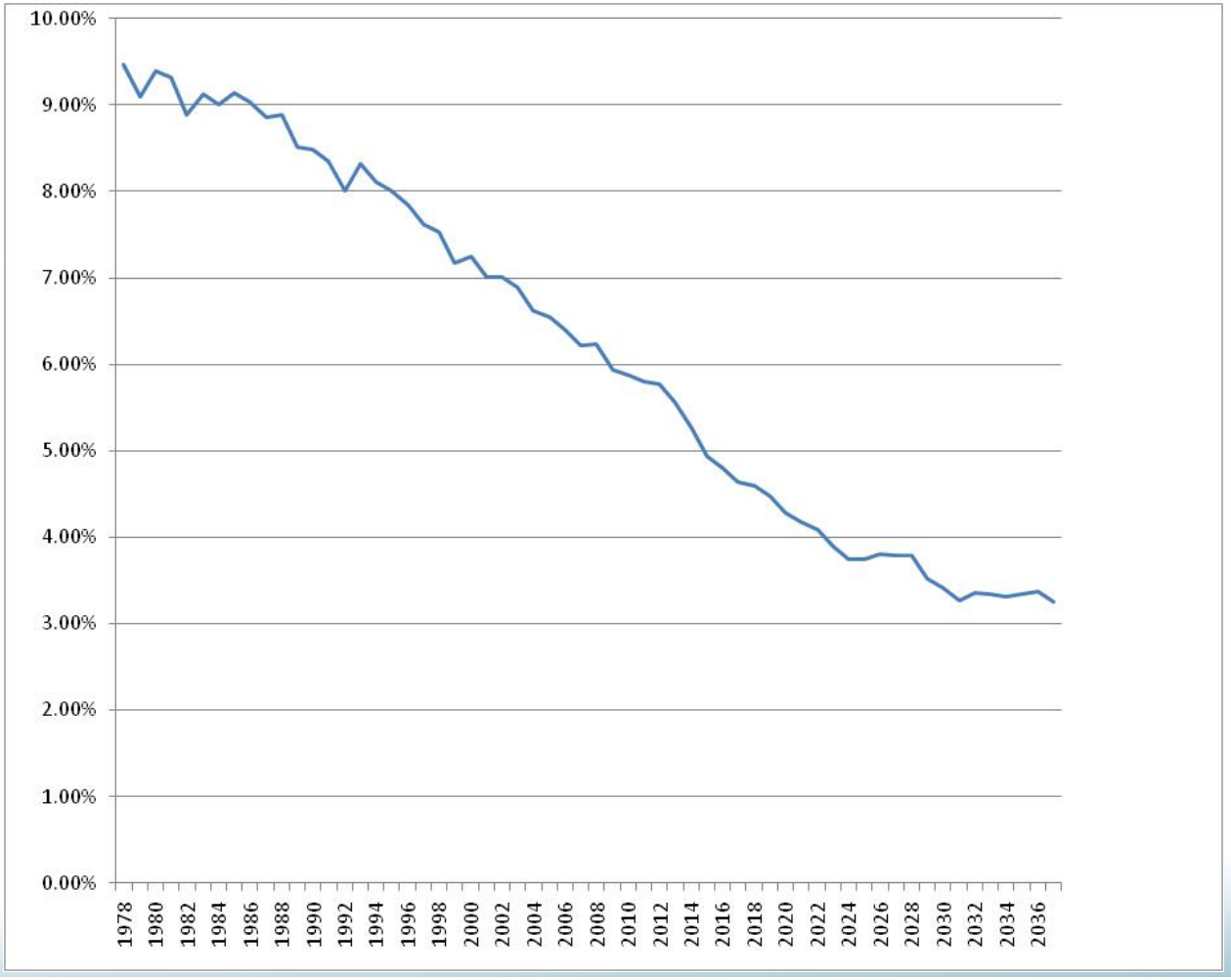
Projected Mortality Rates Based on Historical Averages and Volatility (single scenario #1)



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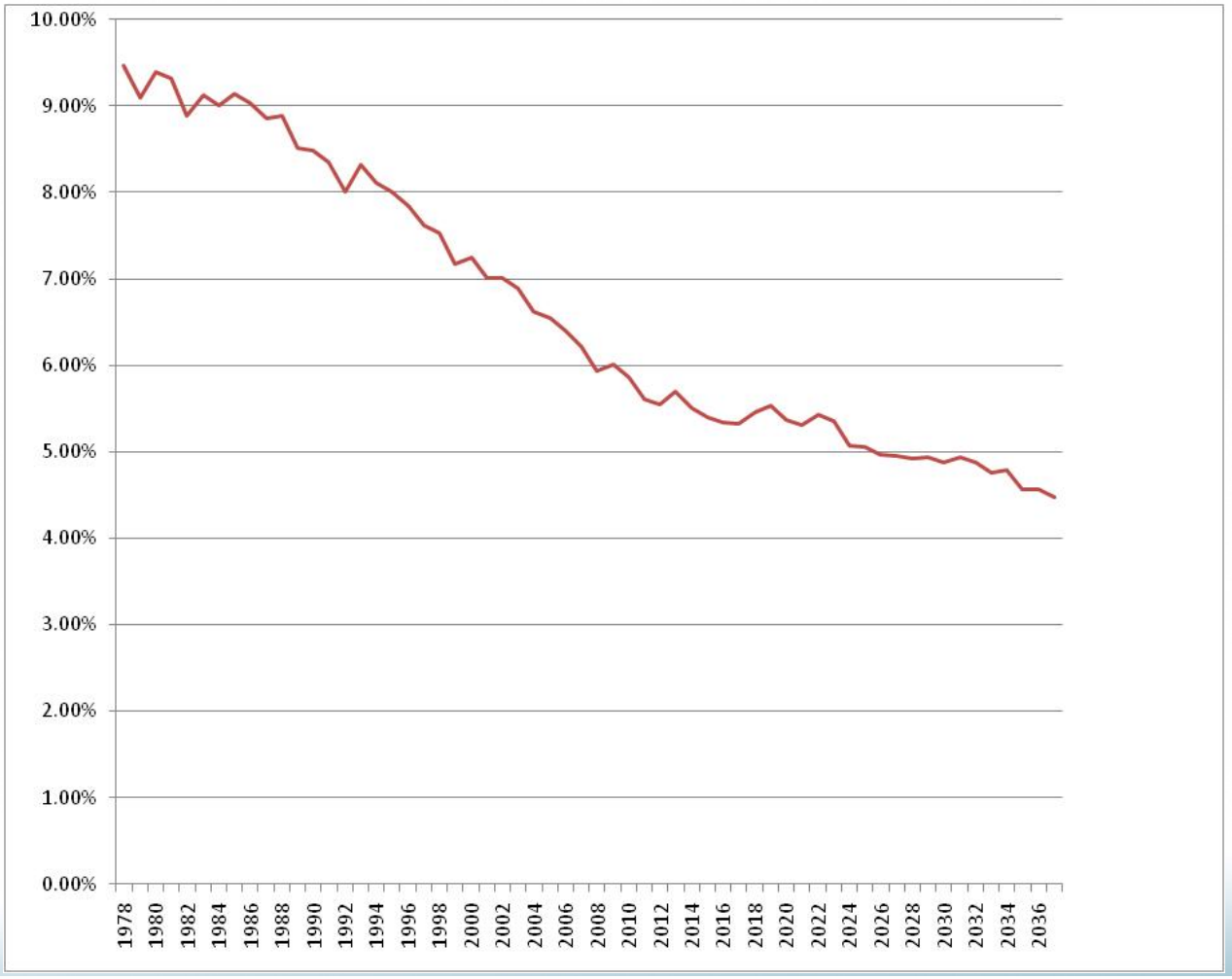
Projected Mortality Rates Based on Historical Averages and Volatility (single scenario #2)



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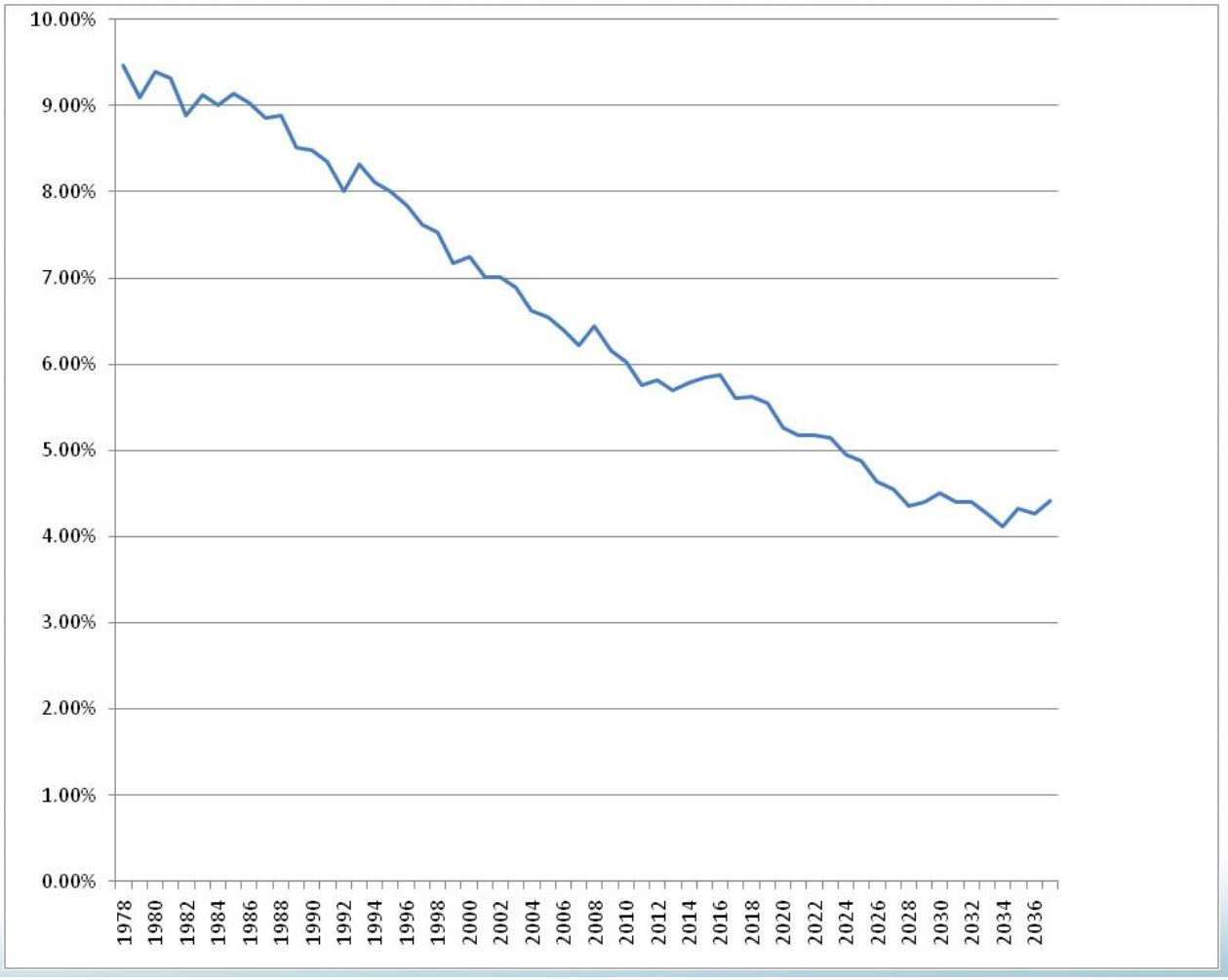
Projected Mortality Rates Based on Historical Averages and Volatility (single scenario #3)



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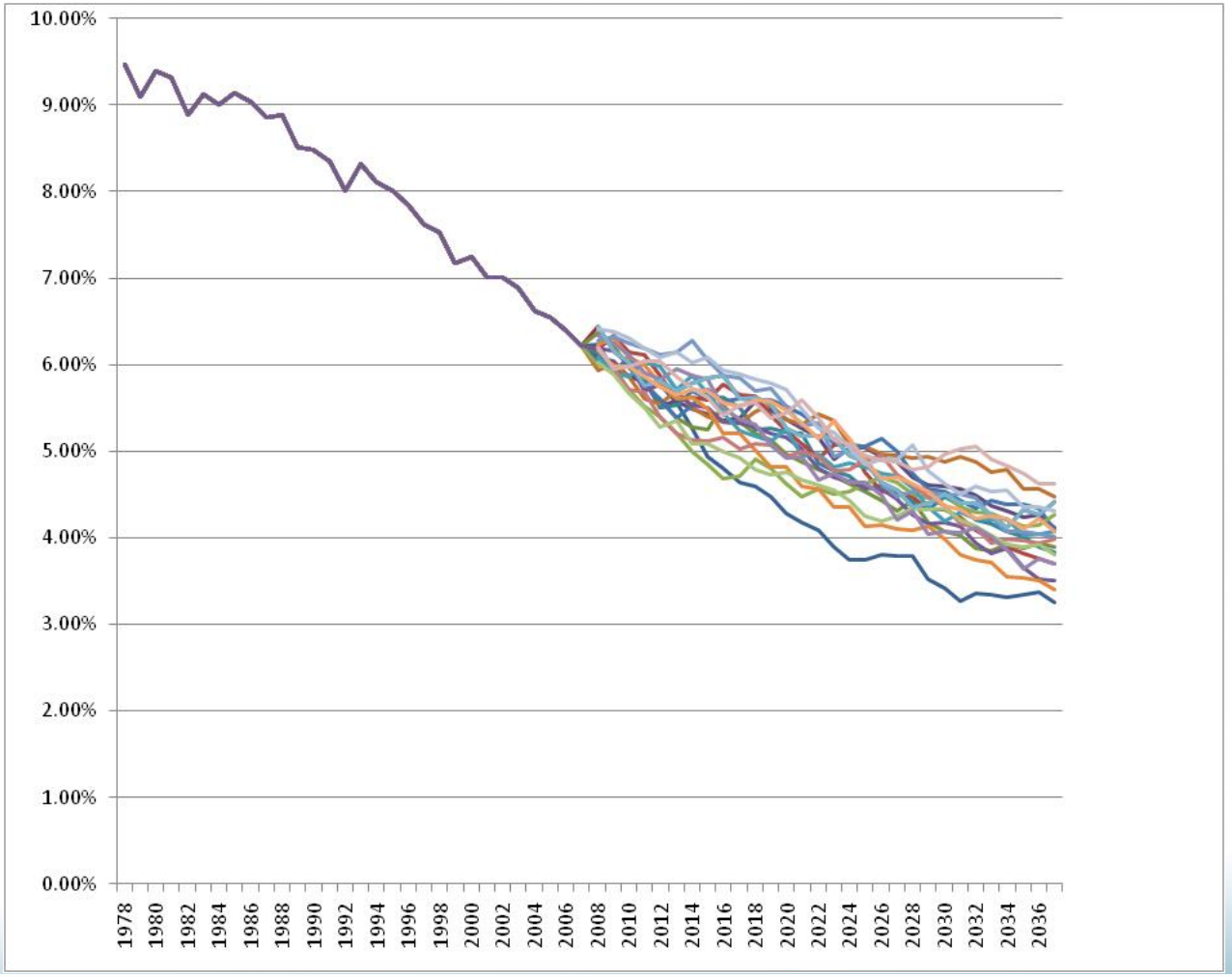
Projected Mortality Rates Based on Historical Averages and Volatility (20 scenarios)



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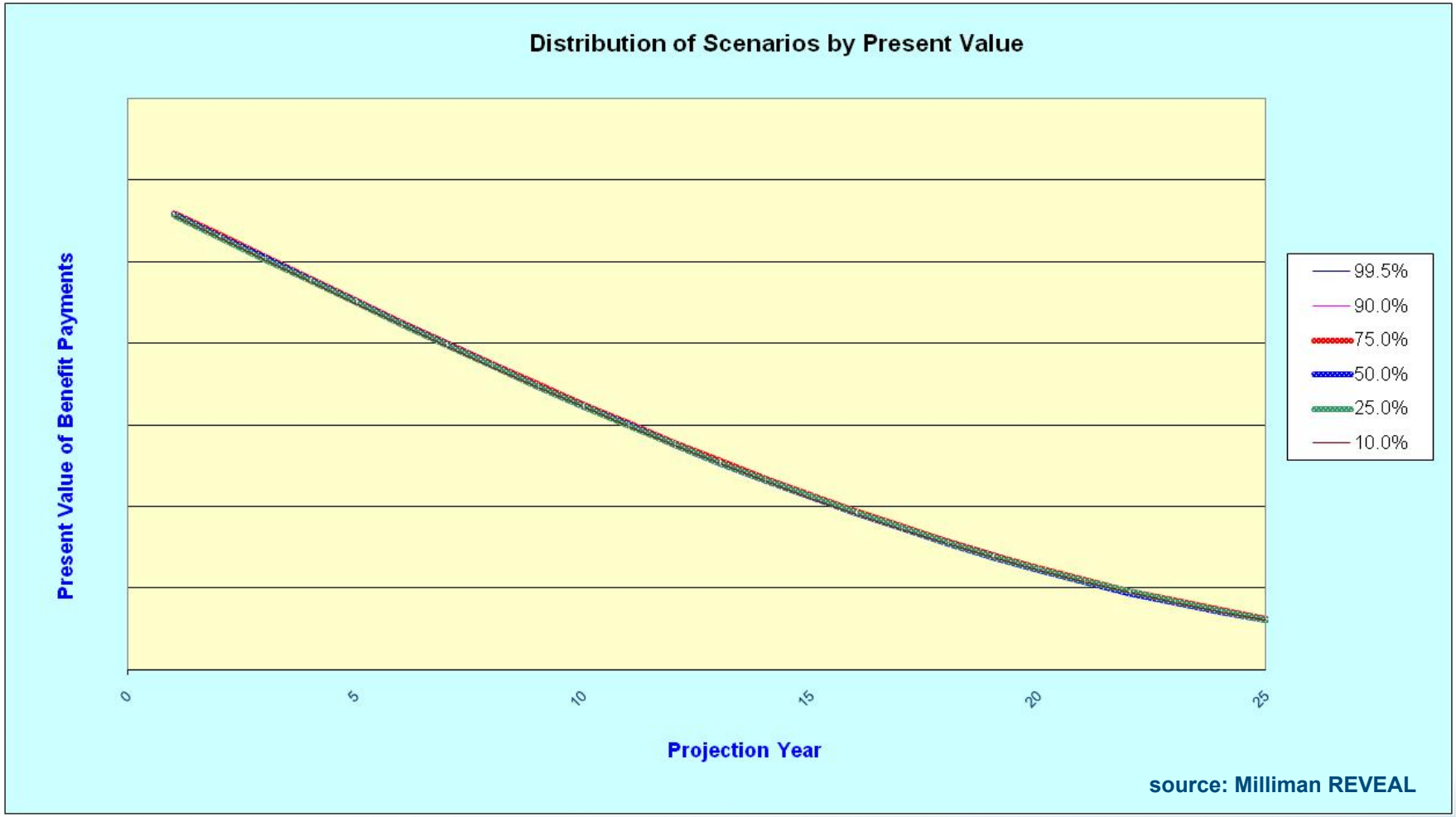
Projected Economic Liabilities of a Closed Block of Annuitants Receiving Benefits Under Static Mortality Assumptions



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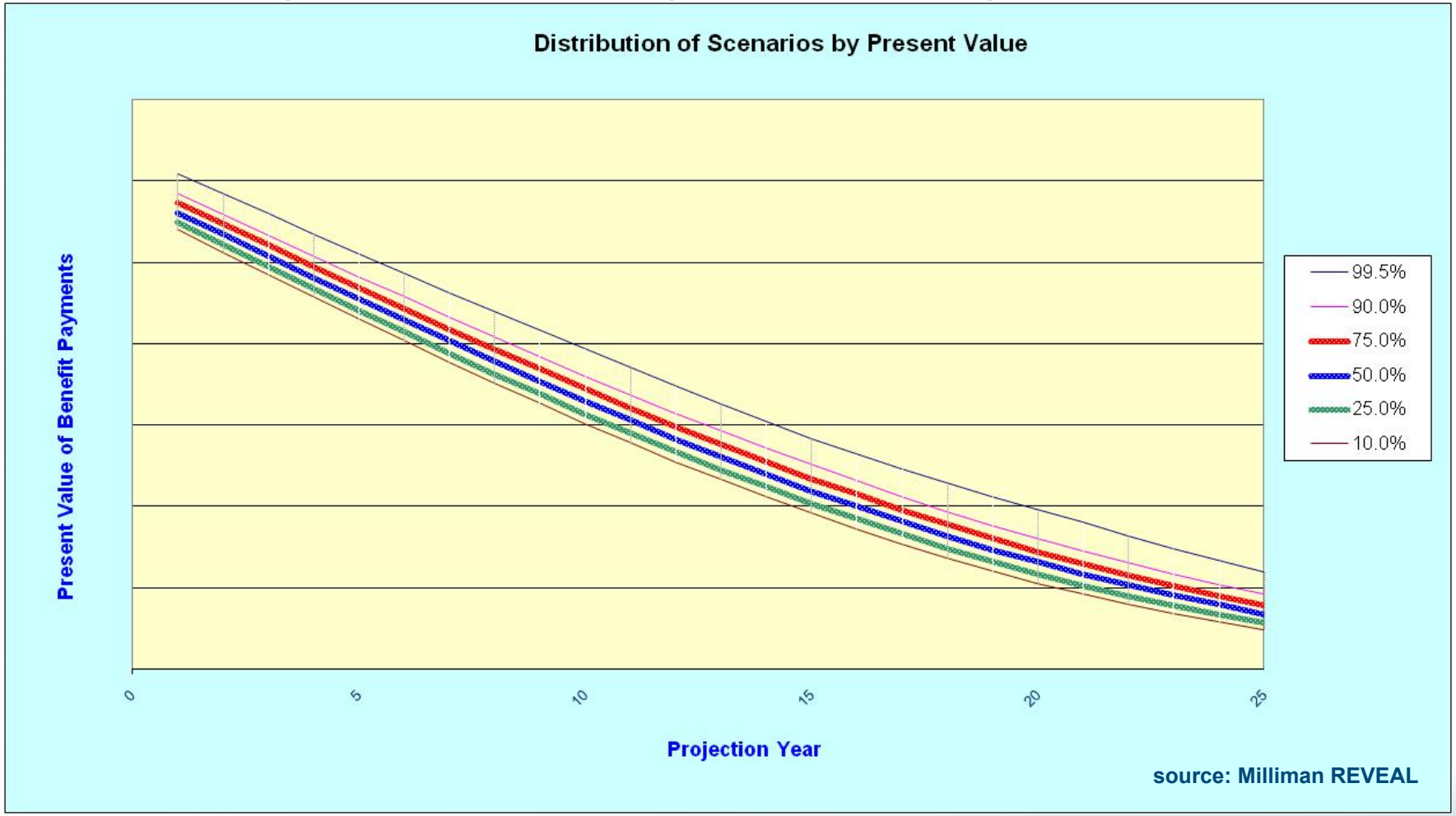

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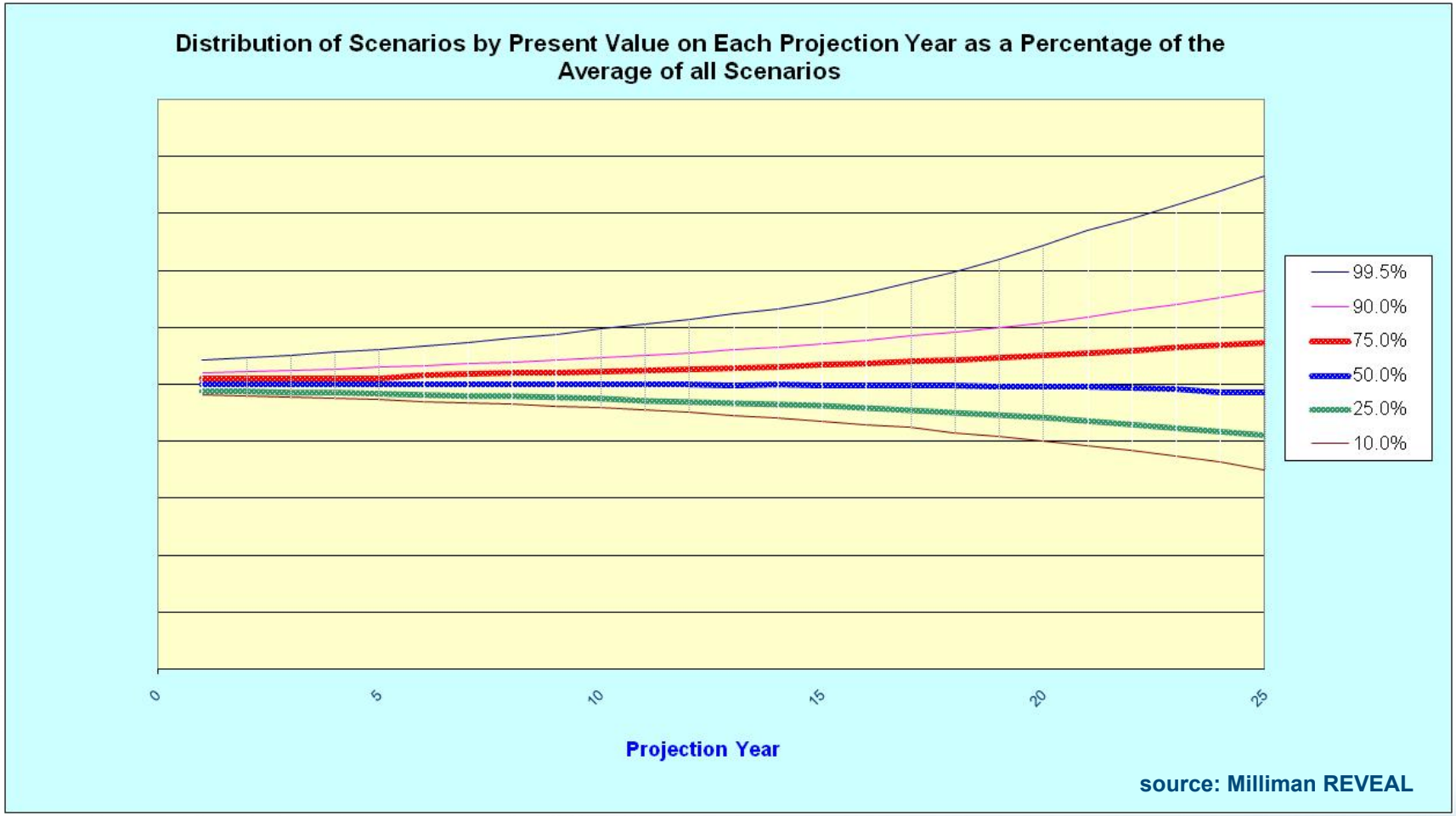
Projected Economic Liabilities Expressed as a Percentage of the Average of all Scenarios



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Cost of Volatility: What is it and why does it matter?

- There is a cost for uncertainty
- Reflecting volatility in the underlying assumptions results in the stochastic average diverging from the deterministic valuation
  - Even when volatility is symmetrical
- More room for individuals to live longer than to die earlier creating an asymmetric cash flow pattern
- Cost of Volatility = stochastic average – deterministic valuation
- Investors should be compensated for this cost
  - For example, insurance companies invest their capital when they issue annuities
- Dependent on volatility assumptions
- Cost of Volatility grows over time

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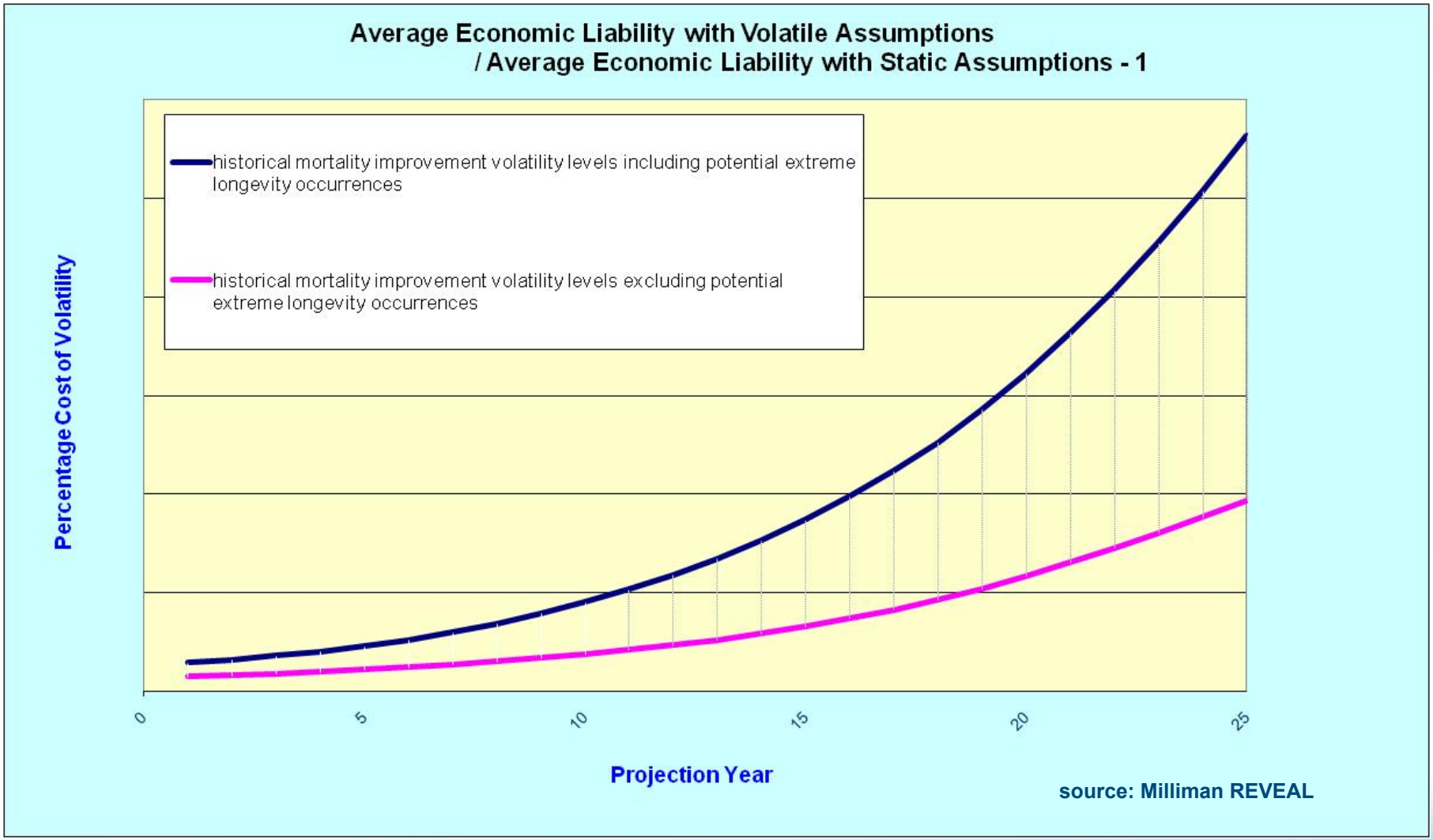
Cost of Volatility Expressed as a Percentage of Expected Liability



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Why is this relevant to the US?

The Longevity Exposure in the US is huge

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Longevity Exposure in the US

- $1.4 trillion in pension liabilities from 100 largest corporate defined benefit pension plans (source: Milliman 100 Pension Funding Index)
- $3.0 trillion in pension liabilities from state pension plans (source: http://www.barclayswealth.com/Images/Municipal-Research-Special-Report-States-Pensions.pdf)
  - Not including federal and municipal pension plans
- $57 billion of assets in group annuity and terminal funding contracts reported from 10 insurance companies (source: LIMRA)
- $13 billion of fixed immediate annuities and structured settlements sales in 2010 (source: LIMRA)

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The Longevity Exposure will grow further

- Baby boomers are just starting to reach retirement
- $8.9 trillion of defined contribution assets (source: ebri.org)
- $2.3 trillion of deferred annuity assets (source: LIMRA)
- Some portion will be converted into payout annuities with longevity risk borne by insurance companies
- Another portion will be borne by individuals
  - And implicitly by the government, to the extent that individuals outlive their financial resources

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Don’t forget about:

- Social Security
- Medicare & Medicaid
- $250 billion in OPEB liabilities (e.g., post retirement medical benefits) from 100 largest corporate defined benefit pension plans (source: Milliman 100 Pension Funding Index)

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Capital Requirement Issues

- Pension plans are not required to hold capital in excess of best estimate liabilities
  - In fact, most plans are underfunded.
  - As of end of 2010, the100 largest corporate defined benefit pension plans had an average funded ratio of 84% and only 7 of the companies had funded ratios >100% (source: Milliman 100 Pension Funding Index)
- Insurance companies reserve and capital requirements are also lacking
  - 10% margin in the Annuity 2000 table may not be conservative
  - No C-2 for longevity risk in RBC formula

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What do we need to do?

- There is too much exposure, we need to spread risk
  - Prudential recently completed a US pension Buy-In transaction
  - Capital Markets ultimately need to be involved
- Recognition of economic based capital requirements
  - Both insurance and pension accounting rules
  - Reflecting current best estimate mortality assumptions and a margin for volatility
- As actuaries, we need to encourage insurance companies/ pension plans to take on/keep this exposure as they can be more successful in managing the risk
  - Otherwise, taxpayers may be overly burdened supporting an extremely large elderly population that have exhausted their financial resources

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Contact Details:

Stuart Silverman, FSA, MAAA, CERA
Principal & Consulting Actuary
(646) 473 - 3108
stuart.silverman@milliman.com

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