Investment Implications of Changing Longevity Assumptions

Objectives

Part 1 (Dan Mikulskis)

- Introduce different views on human longevity development;
- Be familiar with some of the commonly used mortality assumptions;
- Understand the development in mortality assumptions over the last decade.

Part 2 (Muqiu Liu)

- Quantify the impact of changing mortality assumptions on a scheme's Pension Risk Management Framework ("PRMF");
- Understand the impact of changing mortality assumptions on investment strategy;
- Understand the sensitivity of key pension risk management parameters to changes in long term mortality improvement.

Part 3 (Dan Mikulskis)

- Understand the common results of including longevity risk in ALM;
- Draw out the scenarios in which the overall risk reduction of a longevity hedge is most significant;
- Outline role of investment consultant in advising on longevity risk.

How long are we going to live?

Biomedical Development Aubrey de Grey
"The first 1,000-year-old is probably only ~ 10 years younger than the first 150-year-old"

Genetic and Non-genetic Changes Vaupel et al. (1998)
There is no natural upper limit to the length of human life.
Non-genetic changes and discovery of genes and other survival attributes affecting longevity, will lead to even longer lives.

Environmental issues Loladze (2005)
Decreased food-derived health benefits associated with higher levels of atmospheric carbon dioxide.

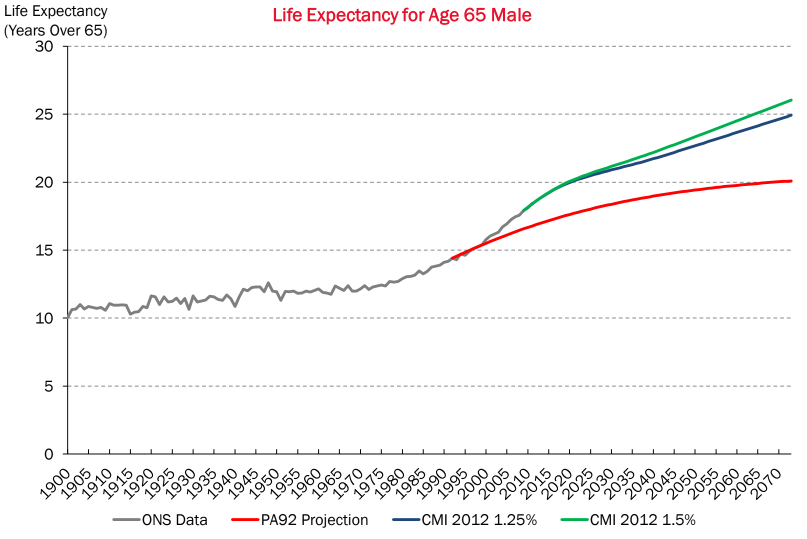
Obesity Olshansky et al. (2005)
From our analysis of the effect of obesity on longevity, we conclude that the steady rise in life expectancy during the past two centuries may soon come to an end.

How long are we going to live?

"Prediction is difficult, especially around the future."

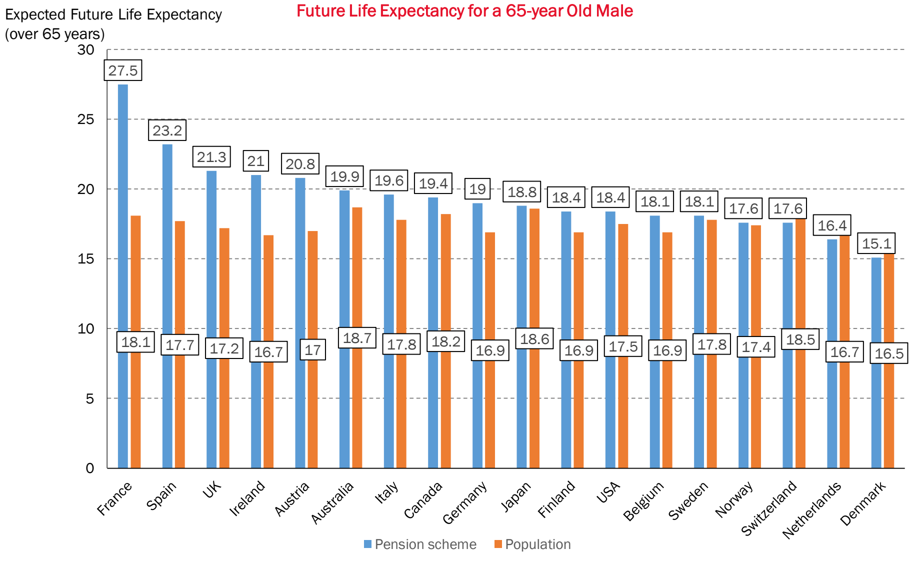
- Niels Bohr, Danish Physicist (1885-1962)

How long are we going to live?



Source: ONS, Redington, CMI

What do actuaries think?



Source: Second international comparative study of mortality tables for pension fund retirees - Cass Business School & Institute of Actuaries (2011)

Who lives longer?

Scheme A	22.8		
90% S1	Medium Cohort	1%	
Scheme B	22.6		
Scheme Specific	CMI 2011	1.25%	
Scheme C	22.0		
S1	CMI 2009	1%	
Scheme D	23.7		
S1_L	CMI 2009	1.25%	
Scheme E	23.3		
Scheme Specific	CMI 2010	1%	
Scheme F	24.4		
S1_L	CMI 2009	1.5%	

Source: Individual scheme annual report & accounts for 2012 (publicly available)

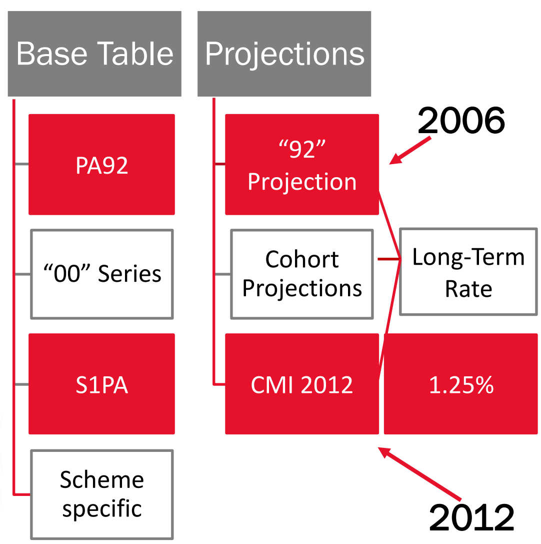
Mortality tables

The Pensions Regulator

- *Trustees need to own the assumptions on mortality.*
- *There are two separate decisions for trustees on mortality assumptions:*
  - *the baseline table for the current rates of mortality; and*
  - *the allowance for future improvements.*
- *Trustees should adopt the terminology recommended by the CMI to aid transparency and understanding.*

— The Pensions Regulator, February 2008

Consultation document: Good practice when choosing assumptions for defined benefit pension schemes with a special focus on mortality



Source: LCP Accounting for Pensions 2007, KPMG Pensions Accounting Survey 2013

Background

	Sample Pension Scheme
Liability PV	£1 billion under self-sufficiency basis (LIBOR + 50bps)
Longevity Assumption	PA92 base table with "92" series projection
Funding Level	80% Funding on self-sufficiency basis
Contribution	£10 million p.a. over the 10 year funding period

Objective	Performance Indicators	Performance	Status
Funding Objective	Expected Return (ER) > Required Return (RR)	RR: Libor +1.80% ER: Libor +1.80% Difference: 0.00%	
Risk Budget	VaR < 10% of liabilities	9.80%	
Hedging Strategy	Funding ratio (SS basis)	80%	
	Nominal Hedge Ratio (SS basis)	80%	
	Inflation Hedge Ratio (SS basis)	80%	
Collateral	Total available eligible collateral	160,000,000	
	Potential collateral call after VaR95 event	75,000,000	

Impact of changing mortality assumption

Objective	Performance Indicators	Longevity (PA92)	Status	Longevity (S1PA CMI2012 1.25%)	Status
Funding Objective	Expected Return (ER) > Required Return (RR)	RR: Libor +1.80% ER: Libor +1.80% Difference: 0.00%		RR: Libor +2.65% ER: Libor +1.80% Difference: 0.85%	
Risk Budget	VaR < 10% of liabilities	9.80%		11.4%	
Hedging Strategy	Funding ratio (SS basis)	80%		75%	
	Nominal Hedge Ratio (SS basis)	80%		71%	
	Inflation Hedge Ratio (SS basis)	80%		71%	
Collateral	Total available eligible collateral	160,000,000		160,000,000	?
	Potential collateral call under a VaR95 event	75,000,000		75,000,000	

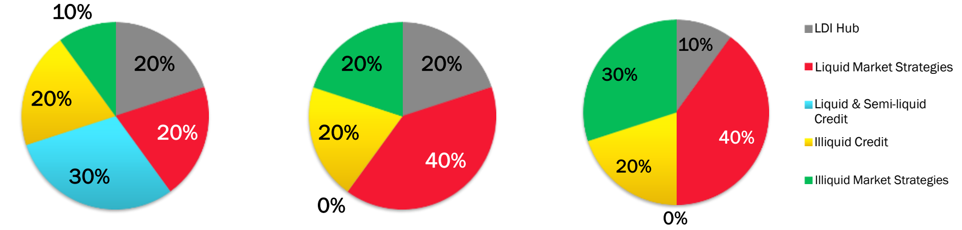
Investment implications of changing mortality assumption

Mortality Assumptions	Liability PV (£Millions)	Required Return (bps p.a. Above LIBOR)	Required Contribution (£ Millions p.a.)	Hedge Ratio
PA92 "92" series	1,000	180	10	80%
S1PA CMI2012 0%	1,003	187	10.3	81%
S1PA CMI2012 1%	1,058	251	15.5	73%
S1PA CMI2012 1.25%	1,072	265	16.9	71%
S1PA CMI2012 1.5%	1,088	285	18.4	69%
S1PA CMI2012 1.75%	1,103	302	19.9	67%

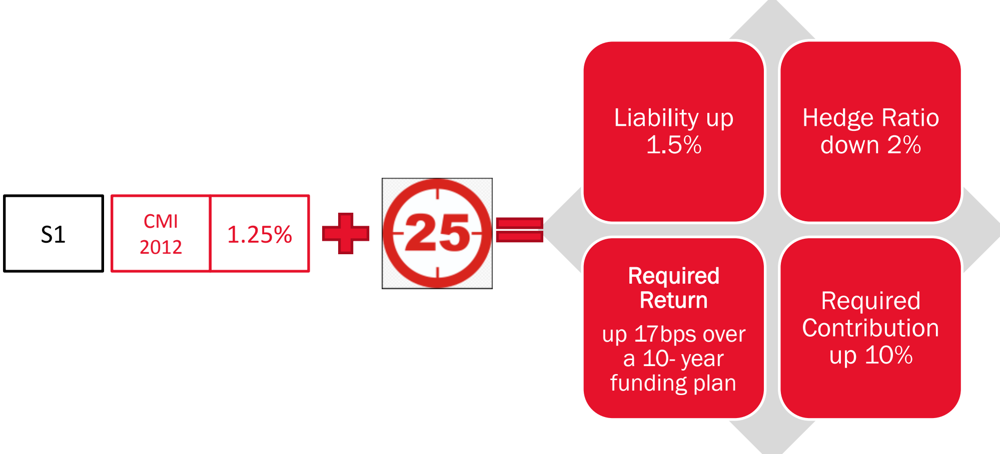
Initial Portfolio – ER 180bps

Re-Risked Portfolio - ER 235bps

Further-Risked Portfolio - ER 265bps



Impact of Changing Mortality Assumption



The challenges of including longevity in ALM output

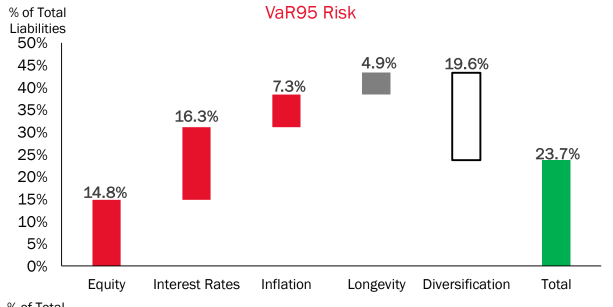
There are a number of clear limitations with dealing with longevity risk alongside asset & liability market based risks in a standard ALM framework

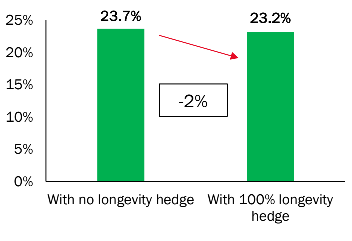
It doesn't feel like a market risk:

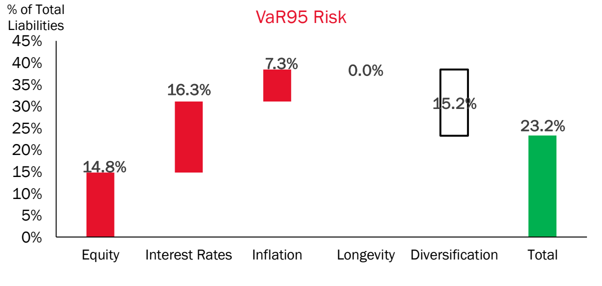
- If you only observe and realise it every 3 years
- If it only moves in one direction
- When the market for transactions is so limited
- Assuming low or zero correlations with other risks in the scheme leaves the "unsatisfying" results from an ALM perspective that most of the longevity risk for most schemes will be "diversified away"

The challenges of including longevity in ALM output – simplified illustration

Sample UK Scheme	
Equity allocation	60%
Hedge Ratio	40%
Funding Level Gilts Flat	75%
Inflation linkage of liabilities	75%



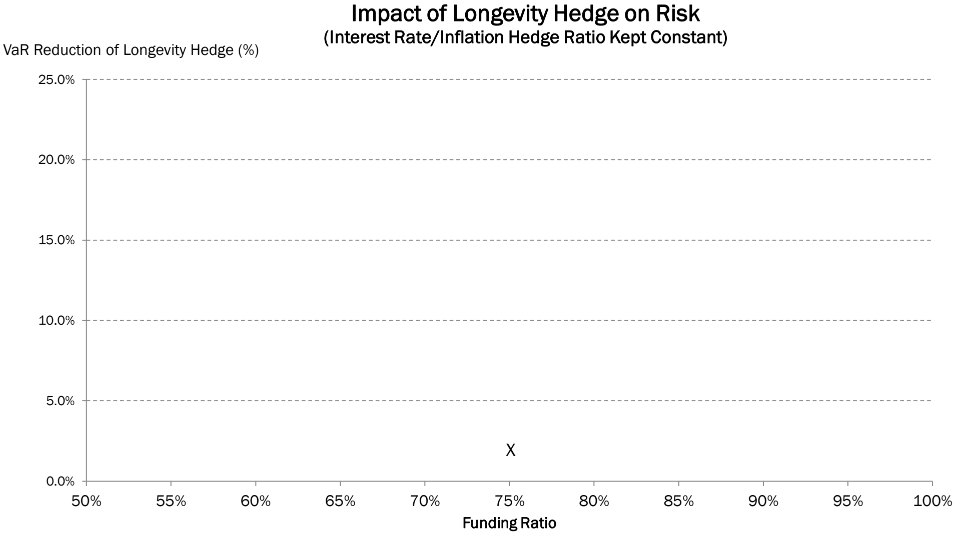




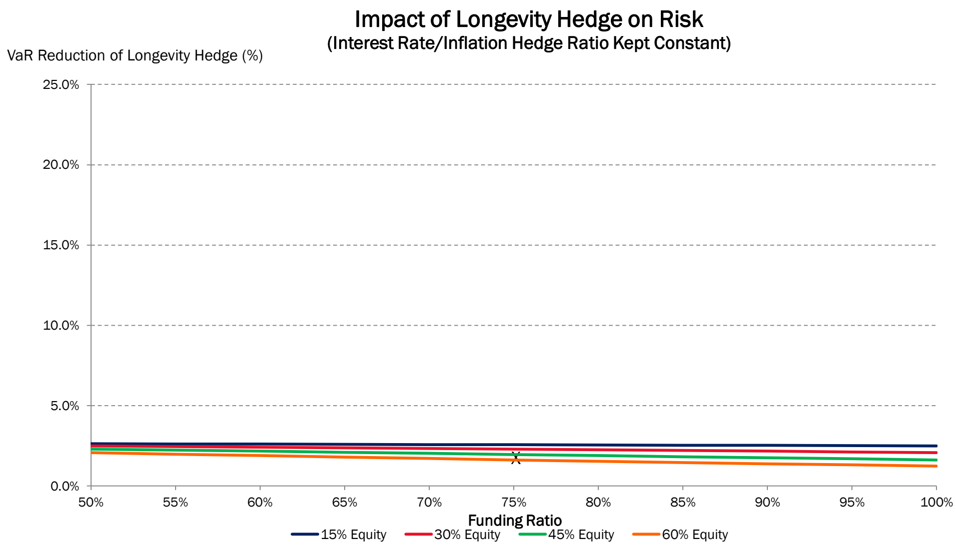
When would a longevity hedge have the greatest impact on overall risk?

- Higher funding level?
- Higher hedge ratio?
- Lower equity allocation?

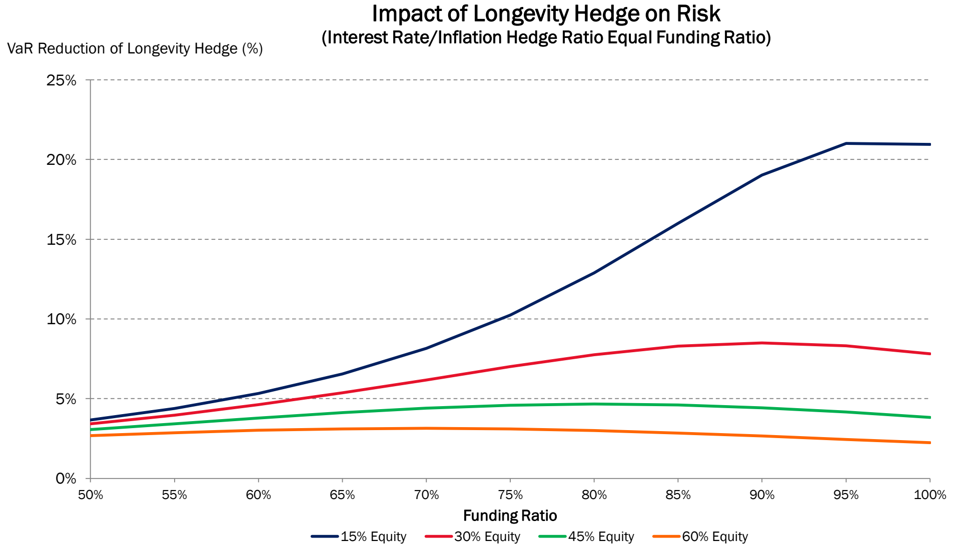
When would a longevity hedge have the greatest impact on overall risk?



When would a longevity hedge have the greatest impact on overall risk?



When would a longevity hedge have the greatest impact on overall risk?



When would a longevity hedge have the greatest impact on overall risk?

- Funding level >80%
- Hedge ratio = Funding ratio
- Equity allocation < 30%

Longevity Transactions – The Role of an Investment Consultant

Pre Trade

- Assess current market tradable levels and appetite of providers
- Provide illustrations of overall scheme risk reduction of longevity hedges, alongside other risks
- Advise on required changes to current (& future target) investment strategy to produce a longevity "reserve"

Trade Execution

- Detailed price discovery
- Granular risk analysis – individual member data
- Comparison of possible hedging structures
- Address second order issues (Inflation hedge, LPI, collateral management, CSAs)
- Role of LDI manager

Post Trade

- Monitor performance alongside hedging strategy
- Market update on hedging other tranches
- Possibility of buy-in/buy-out

Conclusions – what have we covered today?

- Views on future longevity vary, our role as investment consultants is to draw out actionable investment strategy implications
- The longevity changes over the last decade made apparently sound investment strategies insufficient, requiring further contributions or changes in strategy (other things held equal)
- There are two distinct investment strategy approaches to longevity risk within pension schemes:
    1. Hedging
    2. Reserving
- With each approach, it is important to understand where the scheme's assumptions for both current and future longevity improvements are
- Assessing longevity risk alongside other financial risks is not easy or ideal, but can be done
- Models vary, but most assume low or zero correlations with financial variables. This will suggest that taking out longevity risk will result in material overall risk reduction when the following conditions apply:
    1. Hedge Ratio = Funding Ratio
    2. Funding Ratio > 80%
    3. Equity allocation < 30%

13-15 Mallow Street London EC1Y 8RD Telephone : +44 (0) 20 7250 3331 www.redington.co.uk

Contacts & Further Reading

Dan Mikulskis
Co-Head of ALM & Investment Strategy
Direct Line: 0203 326 7129
Dan.Mikulskis@redington.co.uk

Muqiu Liu
Vice President
Direct Line: 0203 326 7109
Muqiu.Liu@redington.co.uk

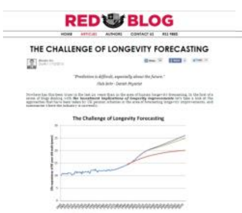
Wenyu Bai
Vice President
Direct Line: 0203 326 7120
Wenyu.Bai@redington.co.uk

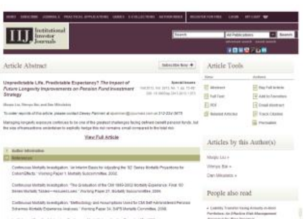
Gurjit Dehl
Vice President
Direct Line: 0203 326 7102
Gurjit.Dehl@redington.co.uk

About Redington

Redington is an independent investment consultancy with a mission to design, develop and deliver the best investment strategies for its client to reach their funding goals with the minimum level of risk. We combine the best of actuarial analysis with the practicality of a capital markets approach, which delivers clients clear, actionable advice. Our clients trust us with over £270 billion of assets, and we advise ten of the 25 biggest pension funds in the UK.

Further Reading





http://blog.redington.co.uk

Scholarly article: Liu, Bai, Mikulskis : Unpredictable Life, Predictable Expectancy? The Impact of Future Longevity Improvements on Pension Fund Investment Strategy – Institutional Investor Journals Fall 2013 p73-78. Available at: *http://www.iijournals.com/doi/abs/10.3905/sp.2013.2013.1.073#sthash%2Eo6KyK93n%2EzX1qaMVo%2Edpbs*

13-15 Mallow Street London EC1Y 8RD Telephone : +44 (0) 20 7250 3331 www.redington.co.uk

Disclaimer