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## Recent Innovations in Longevity Risk Management; A New Generation of Tools Emerges

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### Agenda



1. The Mortality/Longevity Landscape
2. The investor's perspective
3. A move towards standardisation in the longevity market
4. Capital Market Solutions – A Template
5. DB-AEGON Case Study

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Section 1

The landscape

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The Landscape



Mortality Risk Holders

US INSURERS

'Regulation Triple X'

ATM Mortality Risk: €8tn  
OTM Mortality Risk  
(Annual Increase): €8bn

Risk profile

– 1y to whole of life

– Generally ATM

Longevity Risk Holders

Pension Funds

UK Pensions Act 2004  
FRS 17 2005

ATM Longevity Risk: Size - €1.1tn  
in the UK alone!

European Insurance Companies

Solvency II

ATM Longevity Risk: Size - €200bn in the UK

Risk profile

– 10-20y to whole of life

– Generally ATM

Source: Top 10 US insurers statutory filing 2010, Milliman White Paper on Life ILS market, LLMA conference presentation - November 2010, OECD Pensions at a Glance 2011 and 'AXA: Longevity Risk 2010', presentation to analysts

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## The Risk Transfer Market in Longevity



### Hedgers



### Investors



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## The need for alternative routes to longevity risk management



### Existing Issues

#### Need for capacity

- Limited Reinsurance Capacity, especially for large transactions
- £10-20bn estimated capacity\*
- £12bn of new annuity premiums a year in the UK<sup>o</sup>
- ~£200 bn of existing UK reserves in 2009<sup>+</sup>
- ~£1 trillion of outstanding occupational Defined Benefit Pension Liabilities

#### A solution for deferred risk...

- Capital markets hedge could be only cost efficient option for deferred business

### Emerging Influences

#### Increase in required capital for annuities under Solvency II

- Extent of increase depends on existing capital regime

#### A push towards standardization in the longevity market

- Increasing availability of standard derivatives and indices, e.g. LLMA

#### Bulk Annuities business is growing

- £30bn in the UK since 2006<sup>o o</sup>, various estimates for growth....

<sup>o o</sup> Starting with a non risk-based capital regime and for annuities in payment

<sup>o o</sup> Lane Clark Peacock – Pension Buyouts 2011

\* Prudent value for Compulsory Purchase Annuities, gross of reinsurance, by Millman consultants from FSA returns – 'Longevity Risk' by Emma McWilliam;  
<sup>o</sup> Financial Times;

<sup>o o</sup> Deutsche Bank Estimate for non risk-based capital insurers

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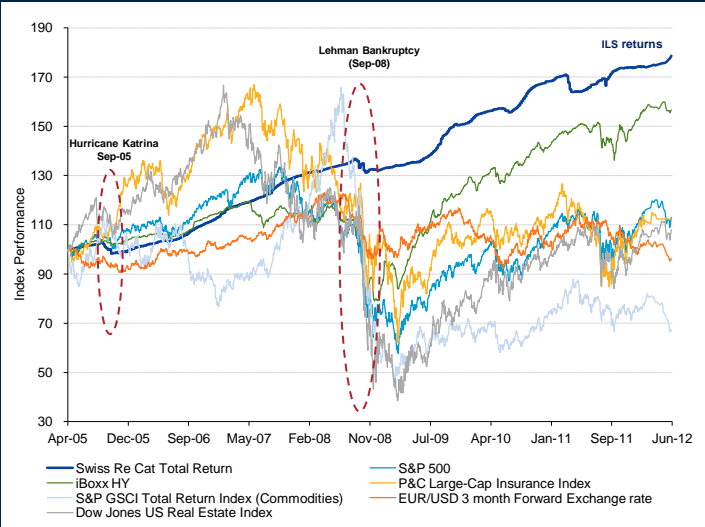


Section 2

The Investor's perspective

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Why Longevity as an Asset class?  
The ILS Market has performed well

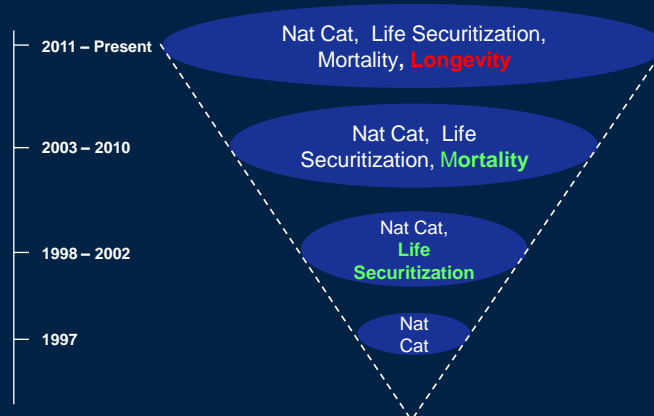


Notes:  
1. All indices are scaled to 100 as of April 1, 2005  
2. Swiss Re TR Cat Bond Performance Index tracks the total return for all outstanding US\$ denominated cat bonds, as available on Bloomberg  
3. The iBoxx HY US\$ TR Index contains the 50 most liquid sub-investment grade US\$ denominated bonds issued by corporate issuers  
4. P&C Large-Cap Insurance Index is custom composite of USD stock prices of ACE, Allianz, Chubb, Munich Re, Swiss Re, Travelers and Zurich; index constituents are equally-weighted  
Source: Deutsche Bank, Bloomberg

## Longevity is evolving as an ILS investment....



- There are some key differences between existing ILS investments versus insurance risk from longevity
- Longevity risk is long-dated and linked to trends in mortality improvements



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### Section 3

A move towards standardisation in the Longevity Market

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## Longevity Indices...



- A key feature of ILS market that is helping longevity to become an 'asset class' in its own right is the development of 'longevity indices'
- Number of attempts at launching indices have been made.
- The longest enduring have been those launched by institutions: e.g. Deutsche Borse (2005)
- LLMA launched indices for Holland, E&W, Germany, US in March 2012
- Indices really reference mortality rates, rather than being 'indices' as such

Reference Regions are expanding...		
	LLMA Life & Longevity Markets Association	DEUTSCHE BÖRSE MARKET DATA
UK	✓	✓
Germany	✓	✓
US	✓	✓
Netherlands	✓	✓
France	✗	✗
Spain	✗	✗
Japan	✗	✗

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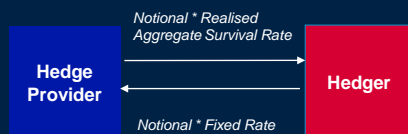
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## 'Standard' Longevity Derivatives S-Forwards and Q-Forwards

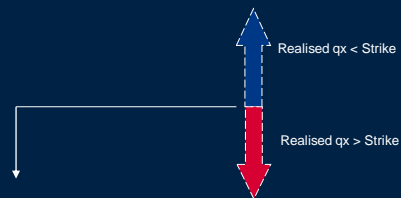


- Swaps linked to the survival rates or mortality rates of a given population or pools

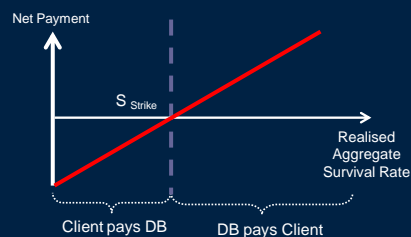
### S-Forward: Trade Structure



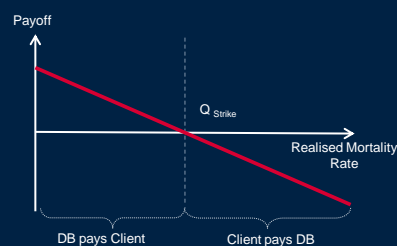
### Q-Forward: Payment Sensitivities



### S-Forward: Payoff to Client



### S-Forward: Payoff to Client



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## Section 4

### Capital Markets Solutions – A Template

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## Features of a 'Capital Markets' Longevity Hedge



The challenge is to match investors needs with hedgers needs

Investors prefer:

- Loss Limiting
- Shorter dated than traditional reinsurance (10-20 years) via commutation mechanism
- Linked to population mortality Indices (ONS, CBS, Statistisches Bundesamt)
- Inflation escalation is excluded
- Transacted as a Derivative under ISDA or (re)insurance contract

**=> Difficult to place annuity/pensions risk with investors;**

**but works if risks is appropriately structured**

## Challenges



- The major challenge is around quantifying the amounts by which the hedge can depart from the portfolio
- To do that need to identify the causes which are:

### -Population basis

- Improvements basis: General population vs annuitant population
- Sampling basis – Smaller pools have noisier mortality experience
- Methods to quantify: Li and Hardy (2011), Coughlan et al (2011)

### -Term basis

- Protection payoff covers the full liabilities
- Can be quantified via simulations

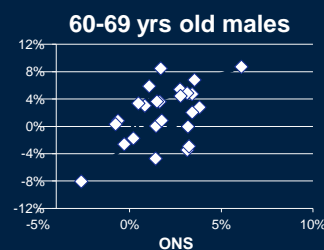
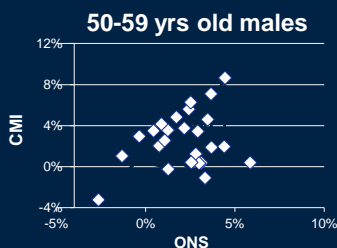
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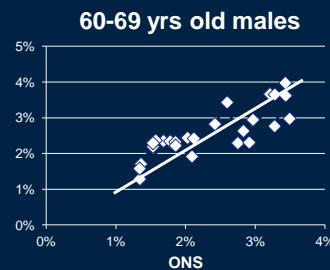
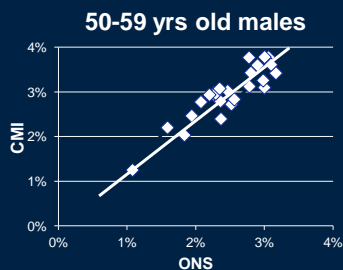
## Basis Risk Case Study: ONS vs CMI



- YoY Improvements: **30-60%** correlation



- Rolling 10 yr Improvements: **70-90%** correlation



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Source: Continuous Mortality Investigation and UK ONS

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## Section 6

### The AEGON-DB Case Study

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## Introduction to the Transaction



- In January 2012, Deutsche Bank and AEGON completed the largest longevity risk management transaction to date.
- The deal transferred longevity risk from €12bn of AEGON's €30bn of Dutch reserves.
- As well as being the largest index transaction to date, the transaction achieved a number of other important milestones:
  - The first trade to reference **population mortality** in Continental Europe (Holland)
  - The first trade to be targeted specifically to **capital markets investors**

## Transaction Key Features



### Population Mortality Reference

- The AEGON transaction references mortality of the Dutch Population as deduced from data by the Dutch National Office for Statistics. The portfolio hedged consists of a series of model points which are representative, in demographic breakdown and annuity amount, of the client's underlying portfolio.

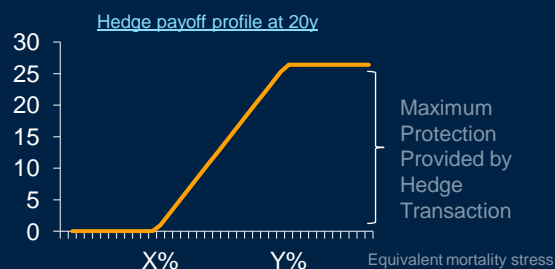
### Cashflows and Term

- The hedge terminates in 20 years time. Deal flows are as shown, but floating payments are capped and floored.
- A commutation mechanism determines the payment at maturity – the mechanism is designed to provide longevity protection for liability cashflows occurring beyond the 20y maturity point.

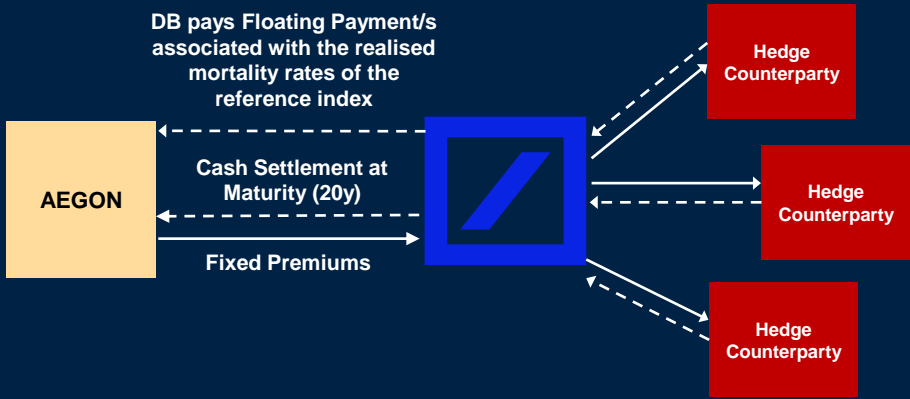
## Transaction Key Features...continued



- **Capped and Floored transaction:** swap payments to AEGON are capped and floored at different equivalent levels of mortality stresses. An example of the structure of the cap and floor is shown here using the payment at maturity (the commutation payment) as an example
- **Legal Structure:** The legal structure of the transaction was as a derivative documented under the ISDA framework.



# Transaction Cash Flows



*Thank you*

*Questions?*

