

Derisking Pension Plans Using Financial Solutions

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Agenda

- Key risks in pension liabilities and derisking solutions
- Longevity swaps
- Examples of longevity swaps
- A case study
- Conclusion

Key risks in pension liabilities and derisking solutions

Key risks in pension liabilities and derisking solutions

■ Inflation risk

- Hedged with inflation swaps, conditional indexation

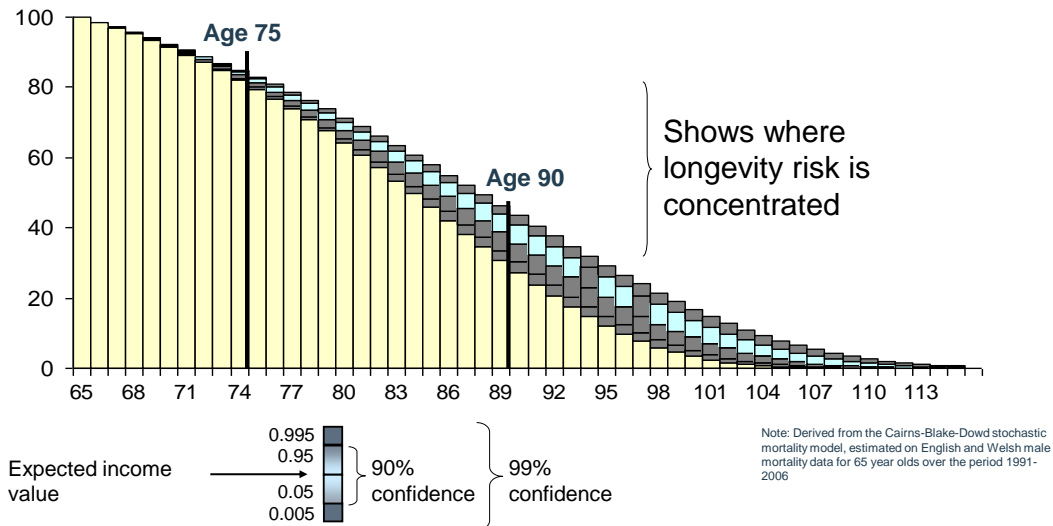
■ Interest rate risk

- Hedged with interest rate or duration swaps

■ Longevity risk

- Ideally, longevity should be hedged before these other risks
- But only now is a new market for longevity hedging developing
- Could become increasingly important if there is:
 - Covenant risk:
 - Danger of sponsor covenant weakening
 - Risk of plan actuary building in excessive improvements in life expectancy

Survivor fan chart – males aged 65



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Types of longevity derisking solutions

■ Buy-ins

- Immediate and deferred annuities

■ Buy-outs

- Pensions in payment with life insurer
- Company needs sufficient assets to pay up-front costs
- Will insurer still be around in 25 years to continue paying the pensioners?

■ Longevity swaps

- Suitable for plans with liabilities > £500m

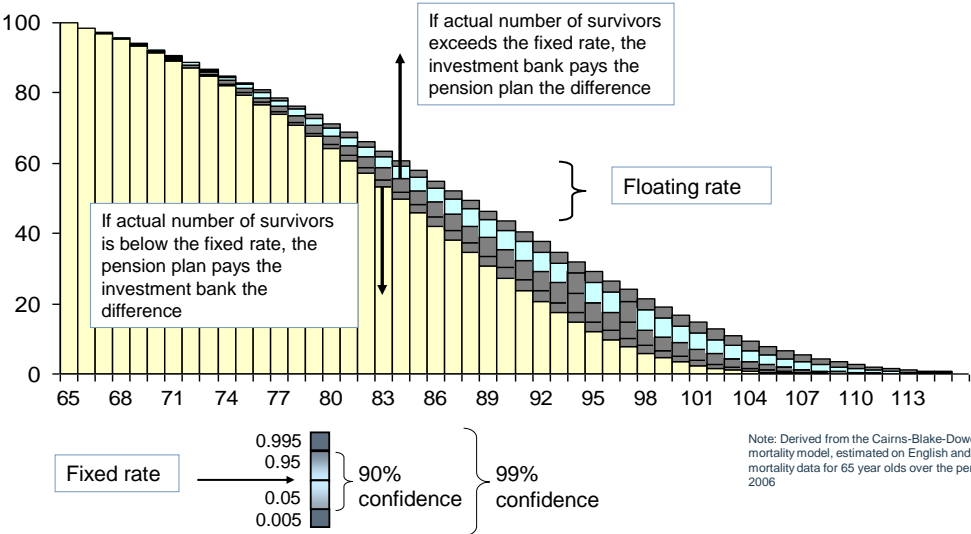
■ DIY (or synthetic) buy-in combines longevity, inflation and interest rate swaps

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Longevity swaps

Longevity swap – males aged 65

Pension plan always ends up paying out a fixed rate and hence locks in future pension payments



Mechanics of longevity swaps

- Pension fund pays fixed leg equal to expected pension payments plus longevity risk premium
- Pension fund receives floating leg from counterparty equal to pension paid to plan member
- Term: fixed (e.g., 20 years) or until last member dies (run-off)
- Future cashflow payments from pensioner liabilities can be estimated more accurately than for deferred or active members, so most extant solutions have dealt only with pensions in payment

Cash flow v value swaps

- **Cash flow swap:**
 - Pension fund pays the fixed leg:
 - Pre-determined set of regular cash flows based on the projected survivorship of the plan members
 - and receives the floating leg:
 - Cash flows equal to current pensions in payment
 - Most common type of swap currently
- **Value swap:**
 - Pension fund pays the fixed leg:
 - Present value of a pre-determined set of regular cash flows at the swap's maturity
 - and receives the the floating leg:
 - Present value of actual cash flows needed to pay pensions
 - Most appropriate for smaller schemes and for hedging active and deferred members' pensions

Insurance v capital markets swaps

- **Insurance based longevity risk transfer (indemnification):**
 - Fixed leg paid as a premium to insurer
 - Illiquid and difficult to unwind
 - More expensive than capital market swaps due to regulatory capital requirements not faced by banks?
- **Capital markets longevity swap:**
 - Fixed leg paid to investment bank
 - Potentially much greater liquidity, since the swap can be traded
 - Must take off for longevity hedging market to succeed, since insurance capacity insufficient on global basis

Index v customized swaps

	<i>Advantages</i>	<i>Disadvantages</i>
Index swaps	<ul style="list-style-type: none">• Cheaper than customized swaps• Lower set-up/operational costs• Shorter maturity, so lower counterparty credit exposure	<ul style="list-style-type: none">• Not a perfect hedge:<ul style="list-style-type: none">○ Basis risk○ Roll risk
Customized swaps	<ul style="list-style-type: none">• Exact hedge, so no residual basis risk• Set-and-forget hedge, requires minimal monitoring	<ul style="list-style-type: none">• More expensive than index hedge• High set-up and operational costs• Poor liquidity• Longer maturity, so larger counterparty credit exposure• Less attractive to investors

Source: Coughlan (2007)

Examples of longevity swaps

Swiss Re – Friends’ Provident longevity swap

- **World’s first publicly announced swap in April 2007**
 - Pure longevity risk transfer
 - But insurance contract not capital market instrument
- **Friends Provident’s £1.7bn book of 78,000 of pension annuity contracts written between July 2001 – December 2006**
 - Retains administration of policies
- **Swiss Re makes payments and assumes longevity risk**
 - In exchange for undisclosed premium

JPMorgan – Canada Life longevity swap

- **World’s first capital market longevity swap in July 2008**
- **Canada Life hedged £500m of its annuity book:**
 - 125,000 lives
 - 40-year swap customized to insurer’s longevity exposure
 - But based on LifeMetrics Index improvements
- **Longevity risk fully transferred to investors:**
 - Hedge funds and ILS funds
- **JPM acts as intermediary and assumes counter-party credit risk**

Nine longevity swaps in 2008-11

Date	Hedger	Type	Size (£m)	Term (yrs)	Format	Intermediary
Jan 2008	Lucida	Ins	N/A	10	Index-based hedge; exposure placed with capital market investors	JPMorgan
July 2008	Canada Life	Ins	500	40	Exposure placed with capital market investors	JPMorgan
Feb 2009	Abbey Life	Ins	1500	Run-off	Reinsurance contract	Deutsche Bank
Mar 2009	Aviva	Ins	475	10	Exposure placed with capital market investors & Partner RE	RBS
June 2009	Babcock	PF	500-750	50	Reinsurance contract with Pac Life Re	Credit Suisse
July 2009	RSA	Ins	1900	Run-off	Reinsurance contract with Rothesay Life; combined with inflation & interest rate swaps	Goldman Sachs
Dec 2009	Berkshire Council	PF	750	Run-off	Reinsurance contract	Swiss Re
Feb 2010	BMW	PF	3000	Run-off	Reinsurance contract	Deutsche Bank, Paternoster
Feb 2011	Pall (UK)	PF	70	10	Index-based hedge; exposure placed with capital market investors	JPMorgan

A case study

In January 2011 Pall (UK) Pension Trustees implemented a different approach to longevity hedging

Professional Pensions

adp Digital Publisher of the Year 2010

News . Defined Benefit

Pall scheme completes world's first longevity hedge for non-retired members

Professional Pensions | 01 Feb 2011 | 09:43

By Jonathan Stapleton

- £70 million hedge
- Deferred members
- Based on a longevity index

FINANCIAL NEWS

It's a longevity hedge ... but not as we know it

Mark Cobley

01 Feb 2011

The Pall longevity hedge is different because:

- Hedges longevity risk of **deferred / non-retired** members only
- **Objective of hedge:** To hedge of the **value** of the liability
- **Maturity of hedge:** 10 years
- **Hedging instrument:**
 - Mortality forward rate derivative or “q-forward”
 - Based on the LifeMetrics Longevity Index
 - Not an exact hedge
- **Flexibility of hedge:**
 - Size of hedge can be adjusted at any time
 - An alternative hedging solution can be implemented at any time

Source: Mercer press release and various publications

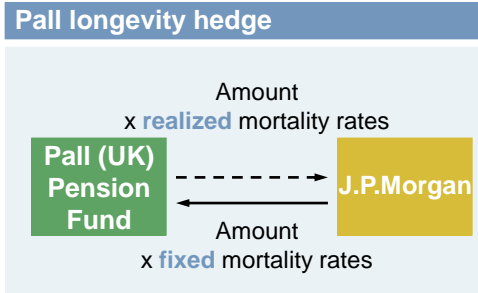
Approach is closely aligned with how other pension risks are managed

Key parties involved in the Pall longevity hedge

- **Mercer:**
 - Consultant to the Trustees
 - Provided advice and due diligence
 - Transaction broker
- **Barlow Lyde & Gilbert LLP**
 - Legal advice to the Trustees
- **Schroders:**
 - Asset manager
 - Execution and management of transaction
- **J.P. Morgan:**
 - Hedge provider
 - Custodian services for collateral

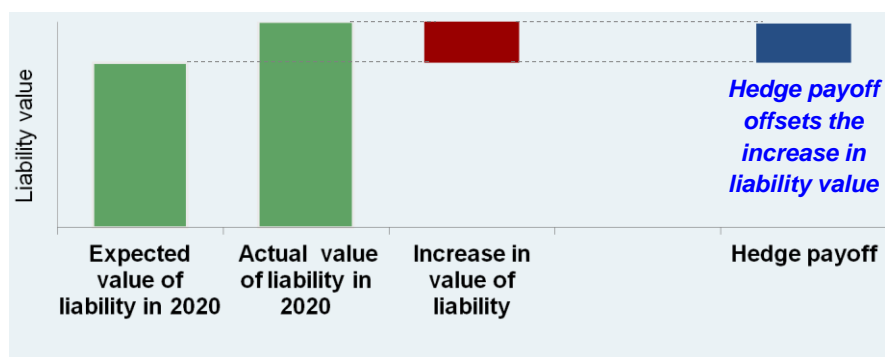
How does the hedge work?

- No upfront payment
- Exchange of payments only at maturity
- The hedge was calibrated to pay an amount that compensates for any increase in the value of the liability
- Collateral is posted as security



The hedge protects the funding level of the pension fund

Liability value and the payoff of the hedge



- If mortality rates in 2020 are lower than expected
 - Longevity will be higher than expected
 - Value of the liability will be larger than expected

Index hedges are well suited to hedge longevity risk of younger, pre-retirement deferred pension members

- Customised (indemnity) hedges generally not available
- Longevity risk prior to retirement is all “valuation” risk
 - No cash flow risk
 - Most risk lies in mortality improvement forecasts
- Longevity exposure of deferreds is not well defined
 - Lump sum commutation options
 - Early retirement options
 - Options to exchange spouse & member benefits (where relevant)
 - ➔ Not efficient or desirable to hedge all the longevity risk

Deferreds have more longevity risk than pensioners

Using index-based longevity hedges requires three kinds of analysis

(A) Basis risk analysis	<ul style="list-style-type: none">■ <u>Pension longevity vs. Index longevity</u><ul style="list-style-type: none">■ Long-term relationships in mortality experience
(B) Calibration of hedging instrument	<ul style="list-style-type: none">■ <u>Optimal hedge ratio</u><ul style="list-style-type: none">■ To maximise effectiveness of the hedge
(C) Hedge effectiveness assessment	<ul style="list-style-type: none">■ <u>How much does the hedge reduce risk?</u>

A systematic framework for these has been developed only recently

Characteristics of the Pall hedge

■ Pension members

- UK males aged 55 – deferred pensioners pre-retirement
- Retirement age 65
- Mortality same as that for UK males with life assurance
 - Higher socio-economic group than national population

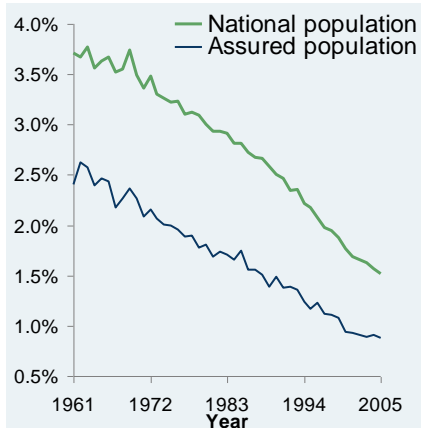
■ Hedge

- Hedge liability **value** over 10-year horizon
- Longevity Index hedge linked to National Population data
 - LifeMetrics England & Wales Male longevity index

Pension member demographics same as UK males who own life assurance: “Assured population”

- Assured population is an affluent subset of the national population
 - Data collected by the CMI
- Assured population has:
 - Lower mortality rates
 - Higher mortality improvements
 - Higher life expectancy
- But very noisy data:
 - Very few lives at high ages
 - Number of lives vary each year
 - Contributors vary

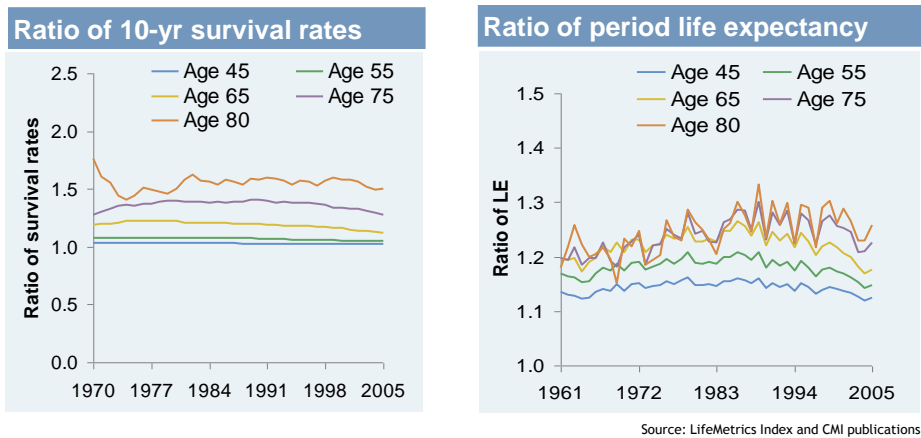
Historical mortality rates age 65



Source: LifeMetrics Index and CMI publications

At face value basis risk relative to national population is “high”

But basis risk analysis reveals common trends and other long-term relationships



- Ratios calculated as Assured population divided by National population
- Use as input into hedge effectiveness analysis

Hedge effectiveness

- Assessment of hedge effectiveness based on historical data 1961-2005
- Use of historical data → model-independent approach

	Correlation* between liability & hedging instrument	Hedge effectiveness (Risk Reduction)
Historical scenarios	0.98	82.4%

Source: Coughlan, Khalaf Allah, Ye, Kumar, Cairns, Blake & Dowd (2010)
 *Correlation of value at the hedging horizon

- This is not a special case
- Similar results obtained for other cases

Conclusion

Conclusion

- **Longevity risk has been treated differently from other risks**
 - Eliminating the risk with exact, customised hedges is not always the best approach
- **A risk management approach can be more appropriate**
 - Similar to the way in which inflation and interest rate risks are managed
- **This presentation has:**
 - Demonstrated that this new approach can be implemented in practice, as evidenced with the Pall longevity index hedge
 - Proposed a practical framework for assessing the effectiveness of longevity hedges
 - Demonstrated that basis risk between an index hedge and a pension fund can be managed

Thank you!

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Capital Markets Solutions Conference**

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Waterloo, Ontario, Canada

<http://www.longevity-risk.org/>



References

- The Pall longevity hedge is described in:
 - Mercer Press Release 1 February 2011:
“World’s first longevity hedge for non-retired pension plan members completed”.
[<http://uk.mercer.com/press-releases/1406520>]
 - Professional Pensions 1 February 2011:
“Pall scheme completes world’s first longevity hedge for non-retired members,”
Jonathan Stapleton. [<http://www.professionalpensions.com/professional-pensions/news/2017540/pall-scheme-completes-world-s-longevity-hedge-retired>]
- The hedge effectiveness framework and example analysis are described in more detail in the following publication:
“Longevity Hedging 101: A Framework for Longevity Basis Risk Analysis and Hedge Effectiveness,” Guy Coughlan, Marwa Khalaf-Allah, Yijing Ye, Sumit Kumar, Andrew Cairns, David Blake & Kevin Dowd (2010).
[pensions-institute.org/workingpapers/wp1013.pdf]

