

# Using Derivatives To Manage Pillar 2 Capital In Life Assurance Companies

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## Agenda

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  - RPI swap overlay for index-linked annuities in payment



Banking Risk Models And Their  
Similarities With Pillar 2 Risk Models  
For Life Assurance Companies

## Introduction

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- Basel 2 for banks is expected in 2007 and coincides with Solvency 2
  
- Both objectives are based around 3 pillars:
  - Pillar 1 - Minimum capital requirements (credit, market, insurance and operational risk)
  - Pillar 2 - Supervisory review (regulation by the FSA)
  - Pillar 3 - Market discipline (disclosure by banks/insurers to the market)
  
- The aim is to introduce a more risk-sensitive capital framework and to incentivise the implementation of good risk management practices

## Pillar 1 – Banks

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 Complexity

Approach	Standardised Approach	Internal Ratings Based (IRB)	
		Foundation	Advanced
<b>Retail</b>		Exposure At Default (EAD), Loss Given Default (LGD) and Probability of Default (PD) calculated from historical data using all data available  Min 5 years data required  Min 10% LGD for mortgages	
Mortgages	35%		
Qualifying Revolving	75%		
Other	75%		
<b>Corporate</b>		LGD and EAD supplied. PD from historical data – min 5 years data required – all available data used  45% LGD for senior claims, 75% LGD for subordinate claims, 2.5 years effective maturity M	EAD, LGD and PD calculated from historical data, using all data available  Min 5 years data for PD, 7 years for EAD and LGD
AAA to AA-	20%		
A+ to A-	50%		
BBB+ to BB-	100%		
Below BB-	150%		
Unrated	100%		

- For banks choosing Internal Ratings Based (IRB), two approaches exist when examining assets on the balance sheet – *Foundation* and *Advanced IRB*
- *Foundation IRB* allows banks with less historical data to use market averages, benefiting from potentially lower capital charges
- *Advanced IRB* most benefits banks with high quality receivables – good historical data showing low losses and may allow extremely low capital charges especially prime RMBS

## Pillar 2 – Banks

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- Strict guidelines must be met under Pillar 2 (Supervisory review) before an internal ratings based approach can be adopted, i.e. where the bank uses its own estimates for PD, LGD and EAD rather than using factors set by the regulator
- Examples of areas to be assessed by the FSA are:
  - Integrity of grading processes
  - Integrity of estimation techniques for PD, LGD and EAD
  - Data history and quality to support estimates used
  - Suitable IT systems to store and analyse data
  - Processes in place / data history for certain minimum time periods
  - The “use” test
- There is an expectation that an internal economic capital model will also be used and that its results will be disclosed
- The more sophisticated banks will be able to take advantage of reduced capital requirements and therefore be more competitive

## Pillar 2 – Life Assurance Companies

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- The favoured approach for Pillar 2 by the FSA is currently 1 year VaR models, with a probability of ruin = 0.5%
- Pillar 2 impact may be most significant as it will expose the economic impact of ALM mismatches
- Many of these risks would not be significant in a deterministic model; however these models will no longer be acceptable for Pillar 2

Asset Risk	Impact
Credit	Credit duration likely to be instrumental in deciding allocations (as per Realistic Peak under Pillar 1)
Interest Rate	Interest rate risk to continue to be key risk under Pillar 2
Currency	Mismatched currency risk likely to be more penal on a stochastic basis Particularly mismatched GAO hedges to be more penal as volatility becomes important
Property	Reduced holdings against fixed liabilities as basis risk between property/inflation/interest rates highlighted
Equity Risk	Equity volatility (particularly long term) likely to become very penal in with-profits funds
Inflation	Inflation risk (particularly LPI) likely to be more penal under Pillar 2
Reinvestment	Reinvestment risk will become highlighted, particularly noticeable in index-linked portfolios

## Pillar 2 – Issues

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- **Significant data requirements:** Need accurate quantitative information on all risks brought together in a common framework
- **No right answer:** Certain assumptions can make a big difference to the absolute figure – relative figures may be more reliable
- **Difficult to quantify and integrate all risks:** Prone to challenge by businesses on issues where there is little available data
- **Danger of incorrect incentives:** Inappropriate assumptions (e.g. choice of confidence level for allocation) could lead to too much or too little emphasis on a particular line of business

### Points to Note

- Essential to get the data right
- Should calibrate the cost of risk to market prices as far as possible
- Useful management tool but need to understand the limitations
- Use different confidence levels for different purposes (e.g. 98% for internal allocation, 99.9% for comparison with regulatory capital, 99.97% at the Group level)





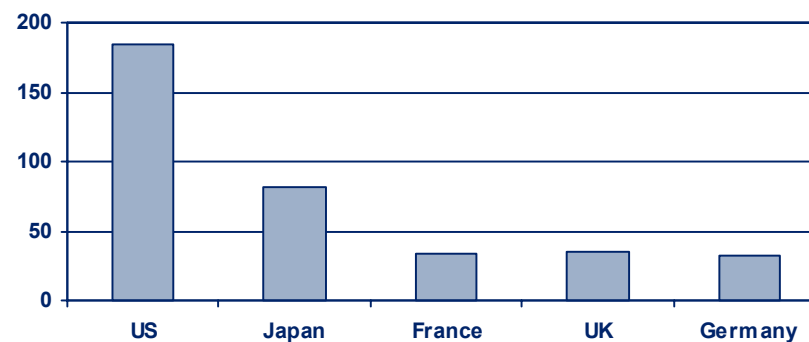
Availability Of Derivatives In The  
Market To Match Risks Faced By  
Life Assurance Companies

## Derivatives As A Global Risk Management Tool

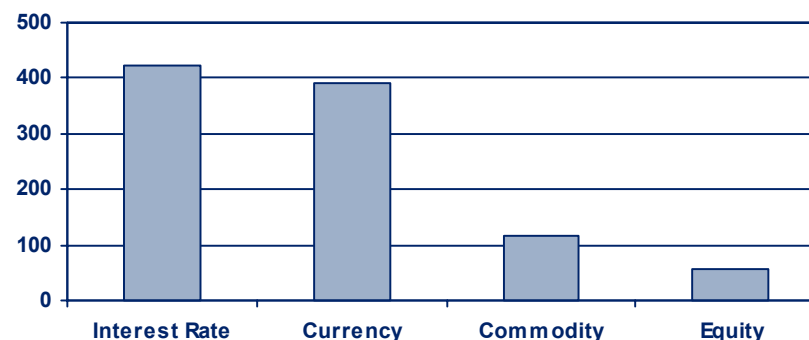
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- ISDA is the global trade association for privately traded derivatives and provide the basis for documentation and standards for OTC derivatives
- According to ISDA (International Swaps and Derivatives Association), 92% of the world's largest companies use derivatives
- US companies are far greater users than other territories where derivatives are viewed as an integral risk management tool
- Banks are leading users of derivatives to manage risk and techniques have been refined over the last decade
- In the UK, all banks use derivatives to manage their balance sheet risk; however insurers are not universal users yet

Number Of The World's Top 500 Companies Using Derivatives By Country

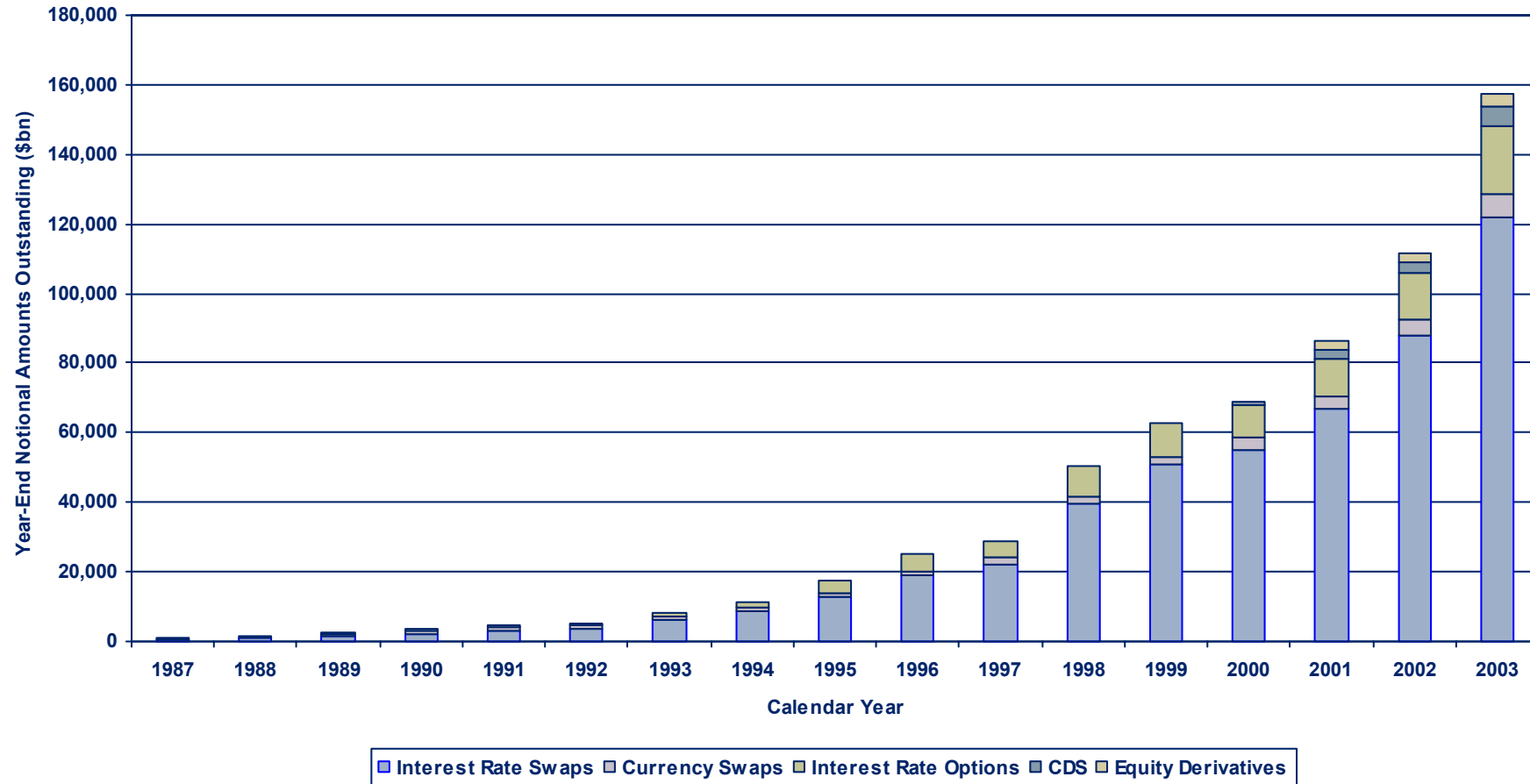


Number Of The World's Top 500 Companies Using Derivatives By Type Of Risk



# Derivatives – International Market Growth

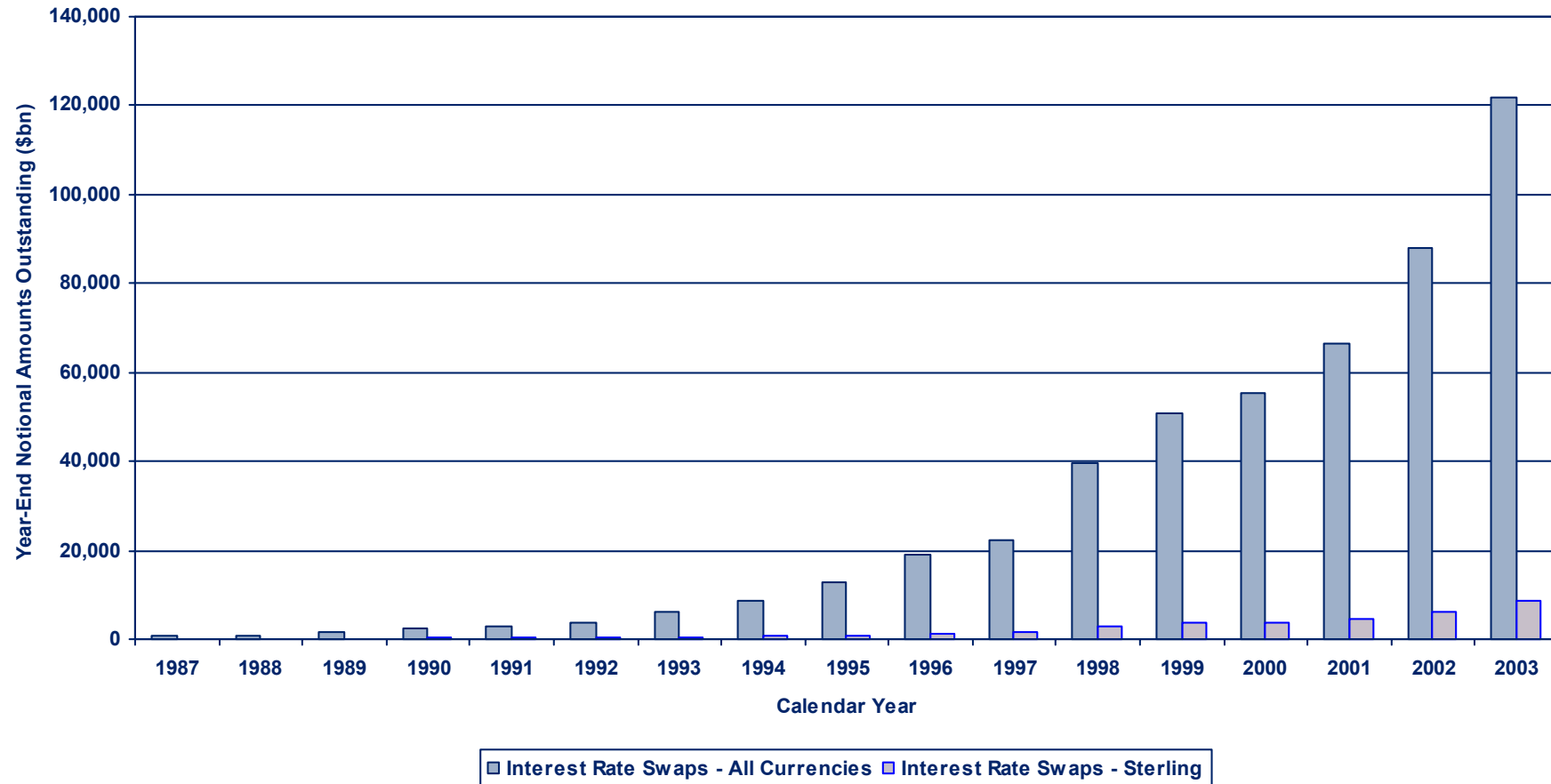
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Sources: International Swaps and Derivatives Association (ISDA) and Bank for International Settlements (BIS)

# Interest Rate Swaps – International Versus Sterling Market Growth

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Sources: International Swaps and Derivatives Association (ISDA) and Bank for International Settlements (BIS)

## The Role Of Derivatives For UK Life Assurance Companies

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- The range and liquidity of instruments available is very wide and deep and there are many applications for life assurance companies
  
- Derivatives can feature as part of the solution for many of the following issues:
  - Product development
  - Hedging liabilities in a fair value / ICA environment
  - Increased emphasis on banking style risk management
  - Yield enhancement
  
- The range of derivative instruments include:
  - Interest rate swaps and options
  - Credit default swaps
  - Collateralised Debt Obligations (CDO's) and Collateralised Loan Obligations (CLO's)
  - Equity swaps and options
  - Property swaps
  - Hybrid interest rate/equity swaps



Case Study:  
Equity-Linked Swaptions For GAO's

## Alternative Strategies For GAO's Linked To Equity Backed Funds

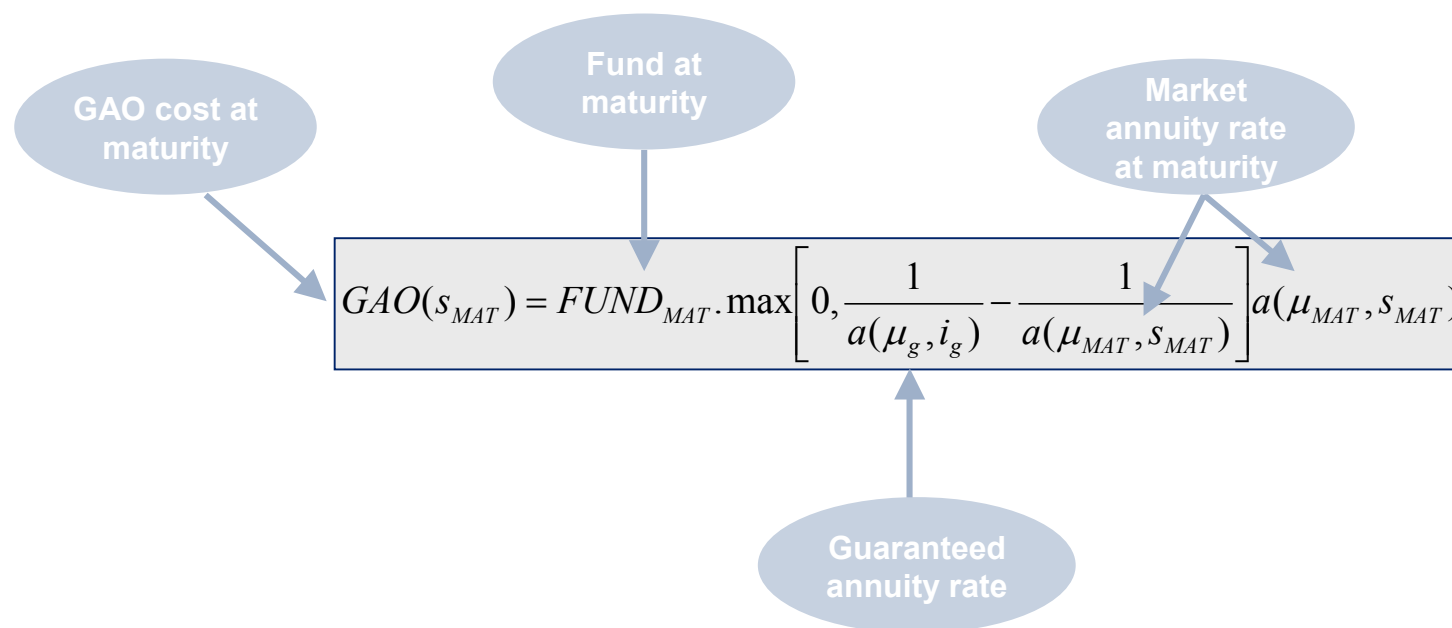
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- Pillar 2 requirements for UK insurance companies are likely to have an impact on the effectiveness of any GAO hedges
  
- We have built a model of the GAO risk and simulated examples of the Pillar 2 capital position under a 1-year VaR model (the FSA preferred Pillar 2 method) using:
  - No hedges
  - Vanilla GBP swaptions
  - FTSE-linked swaptions
  
- The results show the FTSE-linked hedge to be the most capital efficient to varying degrees depending on GAO strike and vesting period; the FTSE-linked hedge being most effective for the longest vesting period and the highest GAO strike price

## GAO Liabilities For Equity Backed Funds

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- For unit-linked funds and traditional with-profits, the size of the GAO liability is proportional to the value of the accumulated fund at policy maturity:



- The GAO cost approximately resembles a receiver swaption with nominal size scaling with the accumulated fund and with the strike price determined by the guaranteed annuity rate



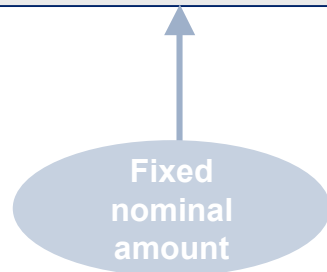
## Overview Of Standard Market Hedges

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**(1) Receiver Swaption hedge**

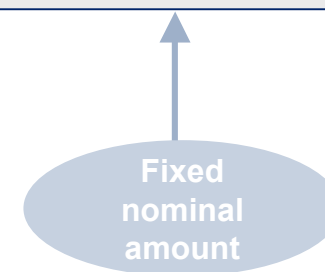
- Insurer buys a strip of receiver swaptions
- Cash payoff:

$$P_{SWAPTION}(s_{MAT}) = N_0^{SWAPTION} \cdot \max[0, K - s_{MAT}] a_{20}(s_{MAT})$$

**(2) CMS Floor hedge**

- Insurer buys a CMS floor
- Cash payoff:

$$P_{CMS}(s_{MAT}) = N_0^{CMS} \cdot \max[0, K - s_{MAT}]$$

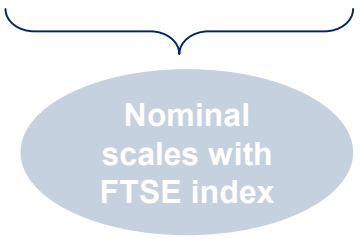


## Alternative Hedge – Swaptions With Payouts Linked To FTSE

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- For unit-linked funds and traditional with-profits, the size of the GAO liability is proportional to the value of the accumulated fund at policy maturity
  - Therefore the payoff from the hedge should be proportional to the fund value
  - Assuming the fund is all invested in UK equities the appropriate derivative hedge is a FTSE-linked receivers swaption
  - Cash payoff:

$$P_{FTSE-SWAPTION}(s_{MAT}) = N_0^{FTSE} \left[ \frac{FTSE_{MAT}}{FTSE_0} \right] \cdot \max[0, K - s_{MAT}] a_{20}(s_{MAT})$$

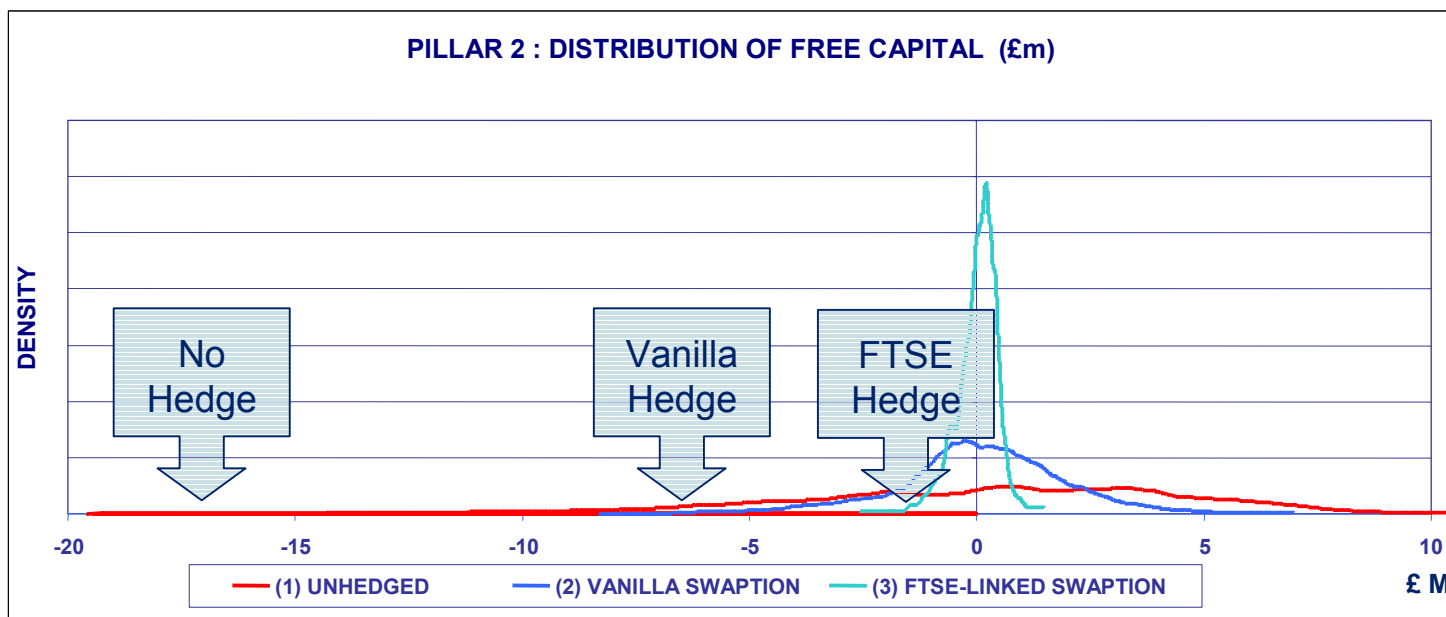


Nominal  
scales with  
FTSE index

# Pillar 2 Model – Example Output

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Vesting @ 10Y, GAO strike = 5%



## Statistics

	MIN	MAX	MEAN	SDEV
UNHEDGED	(19.61)	11.62	0.00	4.68
VANILLA	(11.54)	6.99	0.00	2.06
FTSE	(2.56)	1.48	0.00	0.48

## Percentiles

	0.5%	1.0%	2.5%	5.0%	10.0%
UNHEDGED	(16.42)	(13.85)	(11.08)	(8.36)	(5.95)
VANILLA	(7.00)	(6.40)	(4.82)	(3.69)	(2.52)
FTSE	(1.86)	(1.51)	(1.16)	(0.87)	(0.61)

## Pillar 2 Model - Summary Of Results

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**Vesting Term = 5Y****Expressed As % Of Initial Fund**

GAO strike	Swaption strike	Unhedged	Vanilla hedge	FTSE hedge
4%	5%	8.1%	1.8%	1.6%
5%	5%	13.2%	4.9%	1.0%
6%	5%	17.3%	7.0%	1.8%

**Vesting Term = 10Y**

GAO strike	Swaption strike	Unhedged	Vanilla hedge	FTSE hedge
4%	5%	11.0%	3.3%	1.8%
5%	5%	16.4%	7.0%	1.9%
6%	5%	20.7%	9.3%	2.9%

**Vesting Term = 15Y**

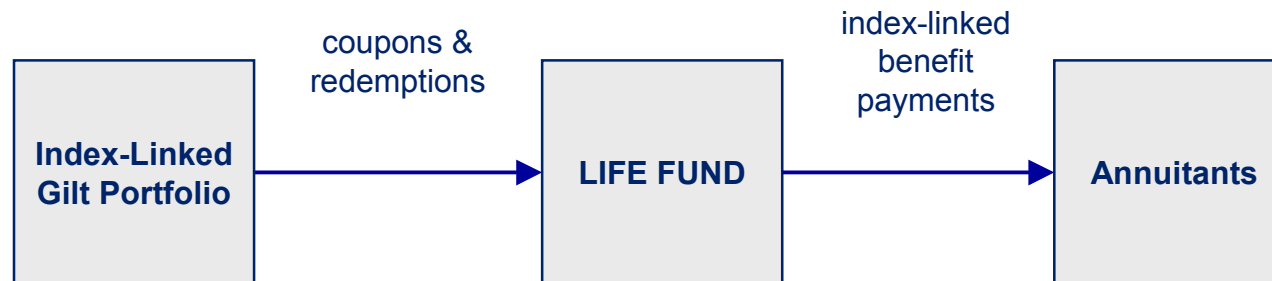
GAO strike	Swaption strike	Unhedged	Vanilla hedge	FTSE hedge
4%	5%	12.4%	6.0%	2.8%
5%	5%	20.1%	11.3%	3.7%
6%	5%	25.9%	15.8%	5.6%



Case Study:  
RPI Swap Overlay For Index-Linked  
Annuities In Payment

## Conventional Strategy [1] : Funding Annuities With Index-Linked Gilts

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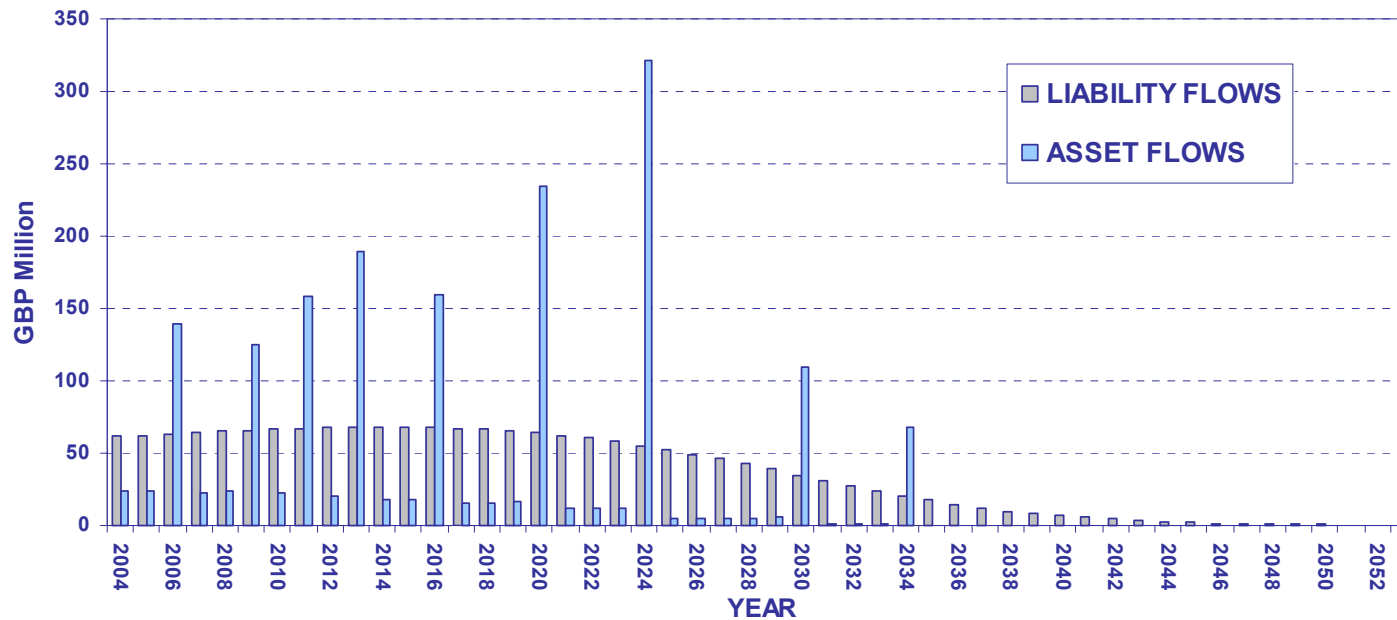


- The current strategy of many life offices to fund index-linked annuities is to select a portfolio of index-linked gilts on the basis of:
  - Matching duration of assets to mathematical reserves
  - Good spread of maturities to improve convexity
  - Market value of assets = mathematical reserve
- The portfolio RBS analysed consisted of £1.0bn of index-linked gilts
- These backed the statutory valuation annual cashflows (excluding expenses) for the index-linked annuity liabilities (based on cashflows for valuation 31/03/04)

# Conventional Strategy [1] : Matching Annuities With Index-Linked Gilts

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Index-Linked Annuity Outgo vs ILG Cashflows (Market-Implied Inflation)



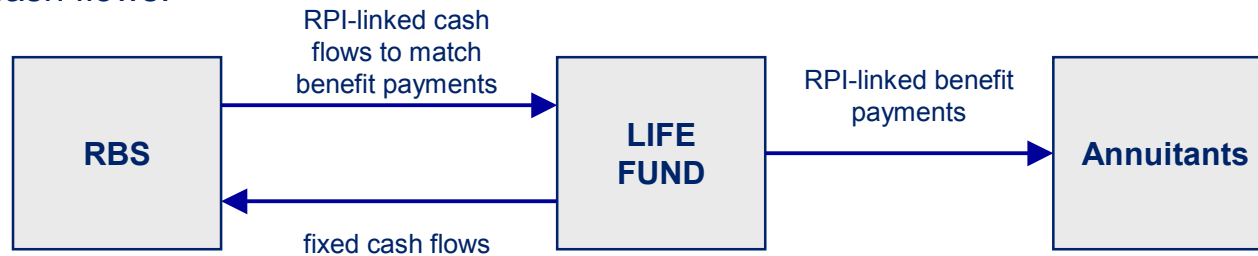
■ Portfolio statistics:

	PVBP (Inflation)	Duration	Convexity
<b>Liabilities</b>	£968k	10.8	185
<b>Assets</b>	£1,004k	10.6	164

# Alternative Strategy [2] : RPI Swap Overlay, Cashflow Matching To 35Y

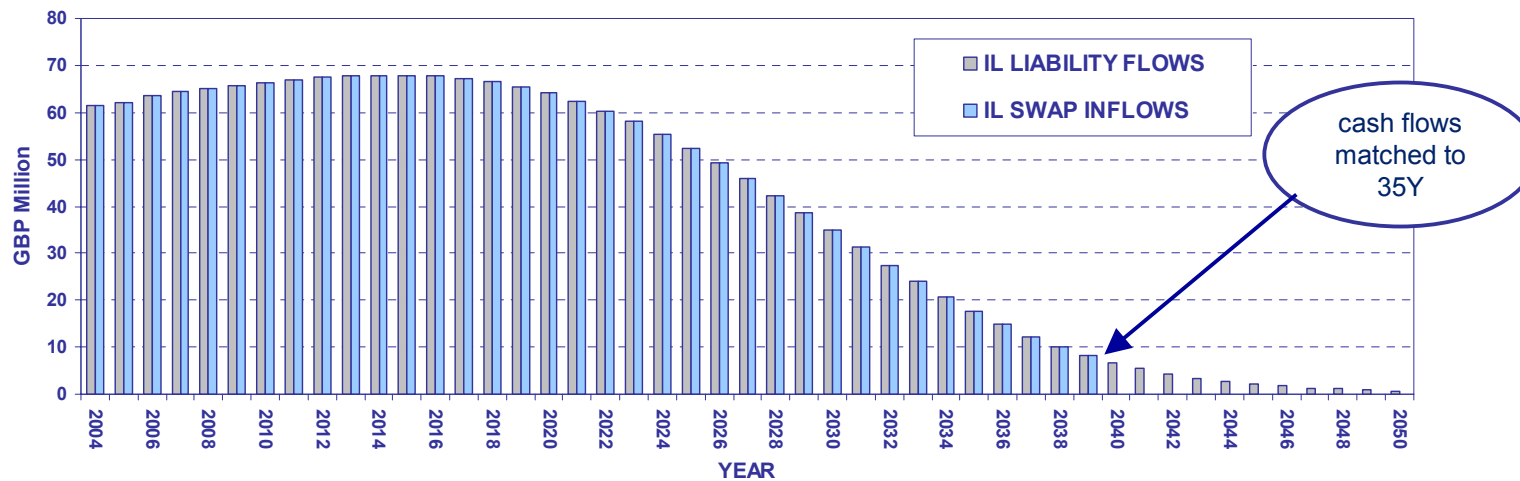
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■ RPI swap cash flows:



■ Asset and liability cash flows:

Index-Linked Annuity Outgo vs RPI-Linked Swap Inflow

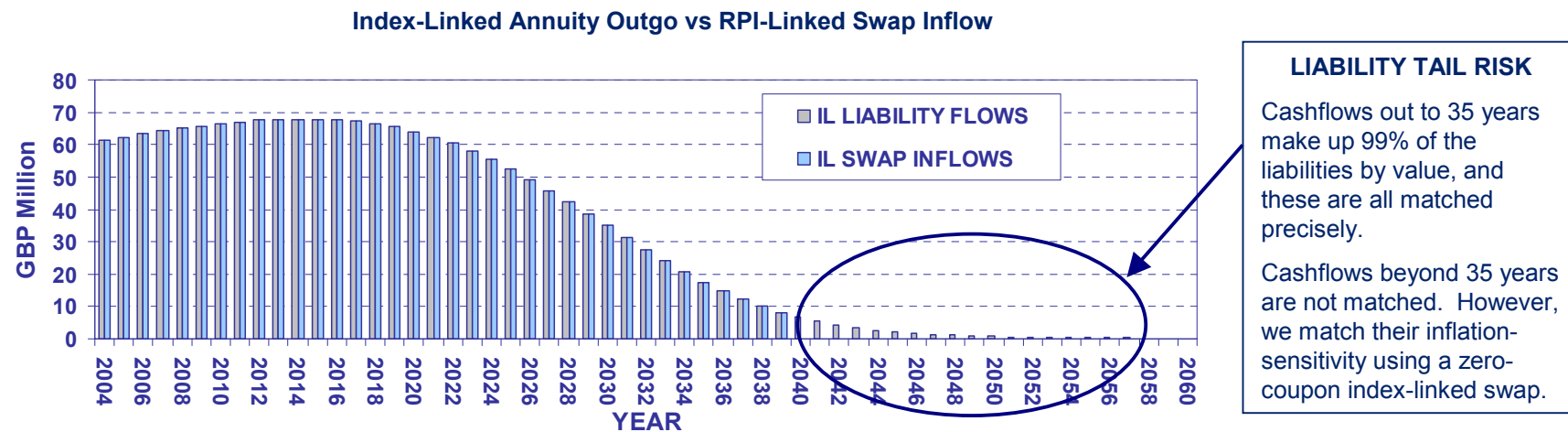




## Alternative Strategy [2] : RPI Swap Overlay, Dealing With Liability Tail

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- The liability cash flows beyond 35Y need to be dealt with:

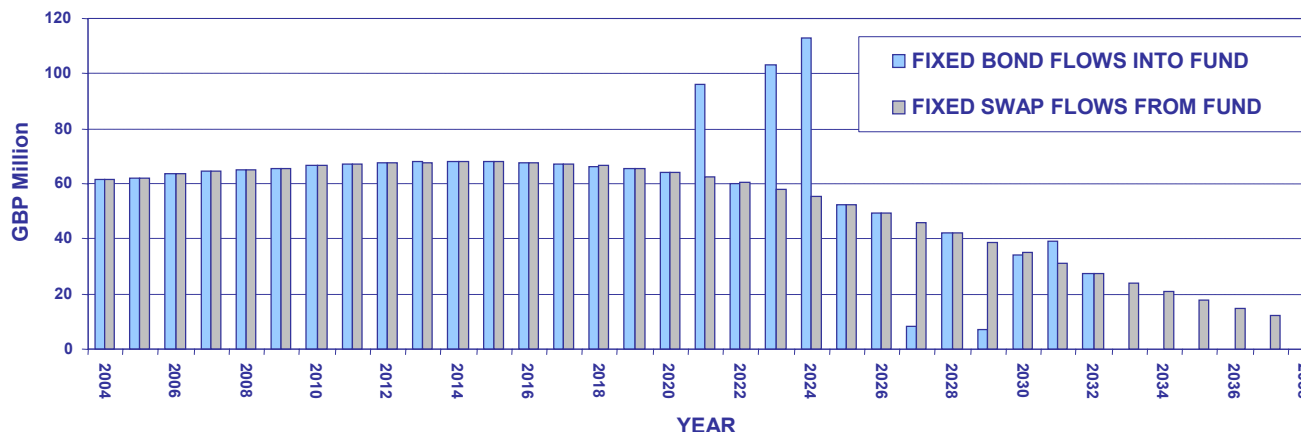


- The inflation-sensitivity of the “tail” cash flows (beyond 35Y) for a 0.01% increase in the future average inflation rate is an increase of the present value of these cashflows by £26,000
- This inflation sensitivity is matched by a **zero-coupon inflation swap**, under which the insurer receives the swap nominal indexed with inflation, and the insurer pays the swap nominal indexed at some fixed rate with a 30-year maturity, and (un-indexed) swap nominal of £16.0m

# Alternative Strategy [2] :Covering The Swap With A Bond Portfolio

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### Fixed Swap Flows From Fund vs. Fixed Bond Flows Into Fund



	PV	Duration	Convexity
Fixed Swap "Liabilities"	£967m (PV at gilts)	11.0	187
Fixed Assets (Bonds)	£875m (MV)	10.6	168

Mismatch in duration

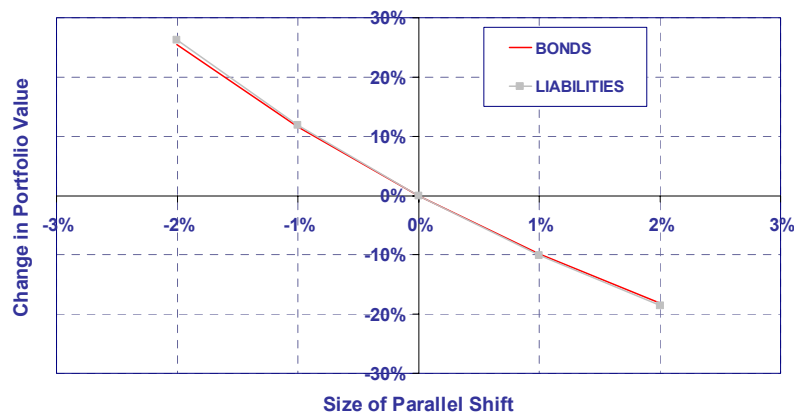
Corporate Bond Portfolio	
No. of bonds	76
Selection Criteria	Broad Investment Grade
IRR	6.03%
Spread over gilts (duration weighted)	109 bp
Long-run average historical annualised default loss rate	16 bp

## Alternative Strategy [2] : Duration Matching Using Interest Rate Swaps

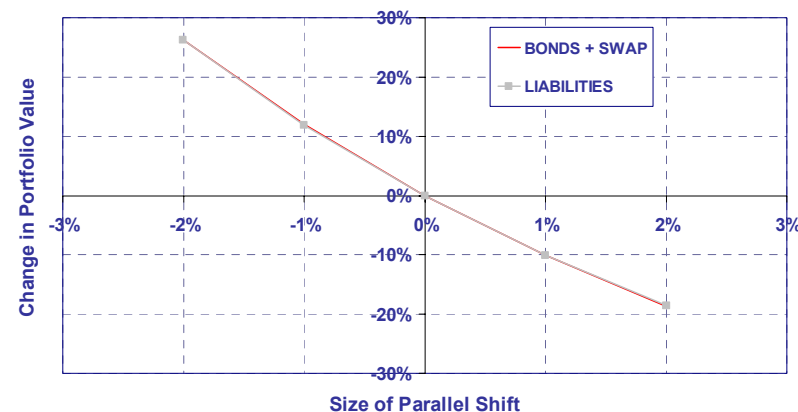
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- The interest rate sensitivity of the bond portfolio can be increased using swaps to match the duration of the “fixed” annuity liabilities
- This is achieved using generic interest rate swaps where the life office receives fixed under a 30-year swap with a nominal of £88.4m

Portfolio Sensitivity : Change In Portfolio Value  
[ Corp Bonds + Inflation Swaps Only ]



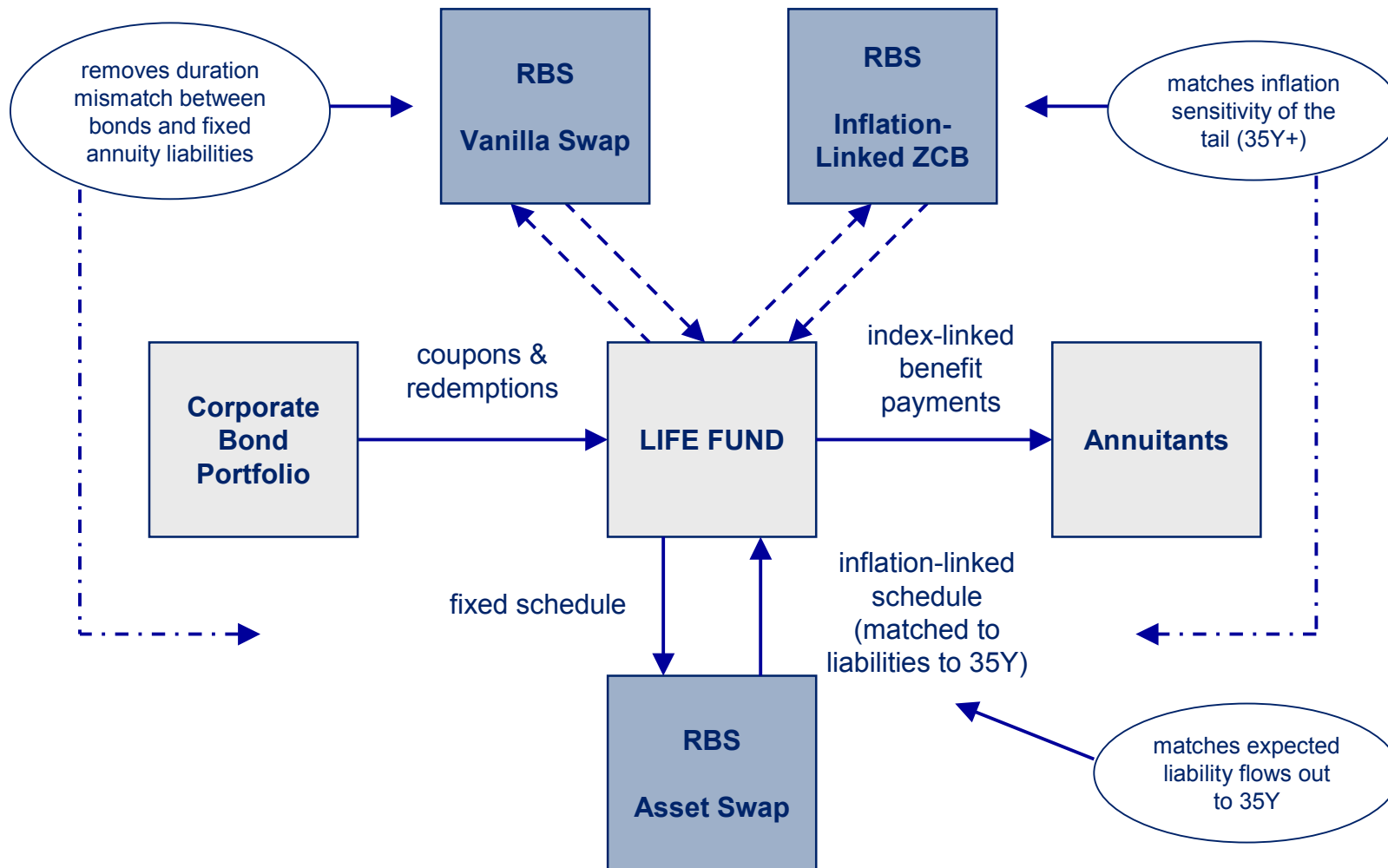
Portfolio Sensitivity : Change In Portfolio Value  
[ Corp Bonds + Inflation Swaps + Vanilla IRS ]



- The graphs above illustrate the improvement in the matching of asset and liability sensitivities of the annuity portfolio before and after the swap (based on parallel yield curve shifts only)

# Alternative Strategy [2] : The Overall Position

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## Pillar 1 – Reserve And Capital Requirements

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	Index-Linked Gilt Portfolio	Bond Portfolio + Swaps + Reinvested Cash
<b>Backing Assets (Market Value)</b>	<b>£1,000.0m</b>	<b>£1,000.0m</b>
Portfolio real IRR	1.92%	3.02%
Long-run average annualised default rate	0.00%	0.26%
Long-run average loss given default (LGD) rate	0.00%	60%
Prudent margin for credit	0.00%	0.24% <sup>(1)</sup>
Risk-adjusted real yield	1.92%	2.78%
Discount rate	1.87%	2.71%
<b>Mathematical Reserves</b>	<b>£1,000.0m</b>	<b>£913.9m</b>
RCR (Parallel shift in yields by 20% x annualised 15-year gilt yield)	£0.3m	£0.1m
LTICR	£40.0m	£36.6m
<b>ECR</b>	<b>£40.3m</b>	<b>£36.7m</b>
<b>Reserves + ECR</b>	<b>£1,040.3m</b>	<b>£950.6m</b>

**Pillar I net release of £89m (8.9% Fund)**

(1) Determined using: (Long-run default rate) \* (LGD rate) \* (150%), where the 50% loading is for prudence

## Pillar 2 – Results

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	Index-Linked Gilt Portfolio	Bond Portfolio + Swaps + Reinvested Cash
<b>Backing Assets (Market Value)</b>	<b>£1,000.0m</b>	<b>£1,000.0m</b>
Projected Assets (average)	£996.2m	£964.7m
Projected Reserve (average)	£957.2m	£868.9m <sup>(1)</sup>
Projected Net Assets (average)	£39.0m	£95.8m <sup>(1)</sup>
Projected Net Assets (0.5 <sup>th</sup> percentile)	£38.8m	£91.0m <sup>(1)</sup>
Projected Credit Losses (0.5 <sup>th</sup> percentile)	-	£32.0m
Projected Capital Required at t = 1Y	(£38.8m)	(£59.0m)
<b>Projected Capital Required at t = 0Y</b>	<b>(£36.9m)</b>	<b>(£56.3m)</b>
<b>Asset/liability cash flow shortfall in year 1</b>	<b>£37.3m</b>	<b>(£0.0m)</b>
<b>Additional Capital Requirement</b>	<b>£0.4m</b>	<b>(£56.3m)</b>

**Pillar 2 net release of £57m (5.7% Fund)**

- The additional capital is effectively the asset shortfall plus expected 99.5<sup>th</sup> percentile credit losses

(1) Discount rate for liabilities has same credit risk haircut as Pillar 1 but excludes the margin for prudence

## Pillar 1 And Pillar 2 – Summary And Analysis

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- Capital requirements expressed as a percentage of the current annuity fund:

	Index-Linked Gilt Portfolio	Bond Portfolio + Swaps	Capital Released
<b>Pillar 1</b>	104.0%	95.1%	<b>8.9%</b>
<b>Pillar 2</b>	100.0%	94.3%	<b>5.7%</b>

- The two asset portfolios are well-matched, and so the above differences are principally due to credit risk
- The results suggest the Pillar 1 credit risk haircut assumption is weaker than that corresponding to the 99.5<sup>th</sup> percentile
- The bond portfolio is on average “A-/A3” investment grade and so forecast credit losses are relatively low



## Q&A Session



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