

## Hedging case study – interest rate risk in Equitable Life

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Derivatives Seminar, 15 October 2007

### Overview

- Motivation for hedging
- The initial proposal
- Clarification of objectives
- Impact evaluation
- Strategy refinement
- Execution

### Motivation for hedging

Motivation for hedging

- Interest rate exposure on “GIR” business
- Unitised pensions with guaranteed minimum roll up of 3.5% per annum and ability to defer retirement (can retire between ages 50 and 75)
- £5 bn asset share, £0.6 bn cost of guarantee
- ICA impact 6% before diversification (assumes 50% of policyholders defer by 5 years)

Motivation for hedging

## Risk impact

- Capital requirements
- Stakeholder “burnthrough”
- Repayment of subordinated loan
- Stability of working capital

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Initial proposal

## The initial approach

- Portfolio of average rate floors derived “bottom-up”
- Aim to match cost of guarantee cash flows on the GIR business based on the ICA retirement pattern and taking into account existing assets
- Series of scenarios provided to investment bank

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Initial proposal

## Average rate floors

- An average rate floor is an instrument that pays out if the average level of interest rates over a specified period is below the strike level
- Payoff is:  $\text{Notional} \times \max(0, S - L)$ 
  - $S$  = strike
  - $L$  = average LIBOR rate over the period
- Good match but concern over pricing transparency

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Initial proposal

### Average rate floors v swaptions

Rate floors	Swaptions
Closer match(?)	More liquid
Less need for rebalancing(?)	Pricing more transparent
Slightly lower premium	Lower bid-offer

Similar price & ICA impact

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Initial proposal

### Initial proposal

- Initial strategies considered had ICA benefit of 8%

Decisions made:

- Use swaptions rather than average rate floors
- Consider appropriate retirement assumptions further (eg prudent but less conservative than ICA)
- Redesign hedge around this

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### Process to arrive at revised hedge

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graph TD; A[Clarify hedging objectives] --> B[Develop associated key metrics]; B --> C[Test original hedge against these metrics]; C --> D[Amend hedge]; D --> E[Bring proposal to the Board]; E --> C; C -.->|Iterations| D
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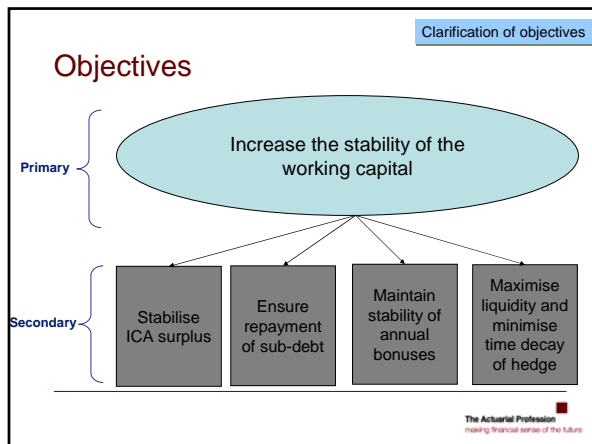
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- Clarification of objectives
- ## Agreeing associated metrics
- Working capital in different scenarios
    - instantaneous
    - over time
  - Range of retirement behaviours
  - All at fund level
  - Plus check secondary objectives
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Clarification of objectives

## Top down versus bottom up analysis

Bottom-up	Top-down
Captures GIR liabilities more precisely, but - retirement behaviour is uncertain, and - asset shares in mix of investments	Captures impact on whole fund Ties back to overall objectives

Bottom-up useful in construction but evaluation focuses on top-down impact

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Clarification of objectives

Impact on short term working capital

Yield curve	Retirement deferral		
	Best-estimate	Increased	Dynamic
Unchanged throughout			
Yield curve parallel shift up + 100 bps			
Yield curve parallel shift down - 100 bps			
Yield curve parallel shift down - 200 bps			
Yield curve steepening of upward slope			
Yield curve steepening of downward slope			
Yield curve inflexion (1)			
Yield curve inflexion (2)			

■ Instantaneous stresses

■ To be calculated pre and post hedge

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Clarification of objectives

Impact on projected working capital

Yield curve	Retirement deferral		
	Best-estimate	Increased	Dynamic
Unchanged throughout			
+ 100bps at t=0, then falls 40 bps pa y1-5			
- 100bps at t=0, then rises 40 bps pa y1-5			
Falls by 20 bps pa y1-5			
Falls by 40 bps pa y1-5			
Rises by 20 bps pa y1-5			

■ Deterministic projection with stochastic realistic balance sheet calculation at the end of year 5

■ To be calculated pre and post hedge

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Impact evaluation

No hedge, instantaneous stresses

Yield curve	Retirement deferral		
	Best-estimate	Increased	Dynamic
Unchanged throughout	0%	-6%	-12%
Yield curve parallel shift up + 100 bps	-2%	2%	-6%
Yield curve parallel shift down - 100 bps	1%	-19%	-22%
Yield curve parallel shift down - 200 bps	0%	-37%	-39%
Yield curve steepening of upward slope	0%	4%	-5%
Yield curve steepening of downward slope	-1%	-18%	-21%
Yield curve inflexion (1)	2%	-6%	-12%
Yield curve inflexion (2)	-1%	-6%	-12%

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## No hedge, 5 year stresses

Yield curve	Retirement deferral		
	Best-estimate	Increased	Dynamic
Unchanged throughout	0%	-8%	-12%
+ 100bps at t=0, then falls 40 bps pa y1-5	0%	-16%	-21%
- 100bps at t=0, then rises 40 bps pa y1-5	-4%	-7%	-10%
Falls by 20 bps pa y1-5	-4%	-27%	-27%
Falls by 40 bps pa y1-5	-11%	-52%	-48%
Rises by 20 bps pa y1-5	2%	4%	-3%

## Hedge impact, instantaneous stresses

Yield curve	Retirement deferral		
	Best-estimate	Increased	Dynamic
<b>No hedge:</b>			
Unchanged throughout	0%	-6%	-12%
Yield curve parallel shift up + 100 bps	-2%	2%	-6%
Yield curve parallel shift down - 100 bps	1%	-19%	-22%
Yield curve parallel shift down - 200 bps	0%	-37%	-39%
Yield curve steepening of upward slope	0%	4%	-5%
Yield curve steepening of downward slope	-1%	-18%	-21%
Yield curve inflexion (1)	2%	-6%	-12%
Yield curve inflexion (2)	-1%	-6%	-12%
<b>With hedge:</b>			
Yield curve parallel shift up + 100 bps	-7%	-2%	-11%
Yield curve parallel shift down - 100 bps	11%	-9%	-12%
Yield curve parallel shift down - 200 bps	29%	-8%	-10%
Yield curve steepening of upward slope	-4%	0%	-9%
Yield curve steepening of downward slope	7%	-10%	-13%
Yield curve inflexion (1)	3%	-4%	-10%
Yield curve inflexion (2)	-2%	-7%	-13%

## Hedge impact, 5 year stresses

Yield curve	Retirement deferral		
	Best-estimate	Increased	Dynamic
<b>No hedge:</b>			
Unchanged throughout	0%	-8%	-12%
+ 100bps at t=0, then falls 40 bps pa y1-5	0%	-16%	-21%
- 100bps at t=0, then rises 40 bps pa y1-5	-4%	-7%	-10%
Falls by 20 bps pa y1-5	-4%	-27%	-27%
Falls by 40 bps pa y1-5	-11%	-52%	-48%
Rises by 20 bps pa y1-5	2%	4%	-3%
<b>With hedge:</b>			
Unchanged throughout	-4%	-12%	-16%
+ 100bps at t=0, then falls 40 bps pa y1-5	7%	-10%	-14%
- 100bps at t=0, then rises 40 bps pa y1-5	-12%	-16%	-18%
Falls by 20 bps pa y1-5	4%	-19%	-19%
Falls by 40 bps pa y1-5	17%	-23%	-20%
Rises by 20 bps pa y1-5	-7%	-5%	-12%

Strategy refinement

Refining the strategy

- Focus on retirement pattern:
  - Dynamic with 50% defer for 5 years
- Exclude 2007 and 2008 costs
- Include a volatility shock
- Improve matching subject to pricing considerations

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Strategy refinement

Revised results for hedge fitting

Yield curve	No hedge
Yield curve parallel shift up + 100 bps	2%
Yield curve parallel shift up + 200 bps	0%
Yield curve parallel shift down - 100 bps	-5%
Yield curve parallel shift down - 200 bps	-14%
Yield curve steepening of upward slope	4%
Yield curve steepening of downward slope	-5%
Yield curve inflexion (1)	1%
Yield curve inflexion (2)	-1%

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Strategy refinement

Revised results for hedge fitting

Yield curve	Change WC
Unchanged throughout	0%
+ 100bps at t=0, then falls 40 bps pa y1-5	-5%
- 100bps at t=0, then rises 40 bps pa y1-5	-1%
Falls by 20 bps pa y1-5	-10%
Falls by 40 bps pa y1-5	-25%
Rises by 20 bps pa y1-5	5%

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## Performance of chosen hedge

Yield curve	No hedge	Hedge
Yield curve parallel shift up + 100 bps	2%	-1%
Yield curve parallel shift up + 200 bps	0%	-5%
Yield curve parallel shift down - 100 bps	-5%	2%
Yield curve parallel shift down - 200 bps	-14%	4%
Yield curve steepening of upward slope	4%	1%
Yield curve steepening of downward slope	-5%	0%
Yield curve inflexion (1)	1%	2%
Yield curve inflexion (2)	-1%	-2%

## Performance of chosen hedge

Yield curve	No hedge	Hedge
Unchanged throughout	0%	-2%
+ 100bps at t=0, then falls 40 bps pa y1-5	-5%	0%
- 100bps at t=0, then rises 40 bps pa y1-5	-1%	-6%
Falls by 20 bps pa y1-5	-10%	-4%
Falls by 40 bps pa y1-5	-25%	-3%
Rises by 20 bps pa y1-5	5%	-1%

## Rationale for chosen hedge

- Close to optimal plain vanilla swaption strategy in terms of instantaneous results and all over 5 year results acceptable (prepared to rebalance annually)
- Reluctant to introduce more "exotic" strategies to match path dependency /rate up exposure
- Satisfactory checks on subsidiary metrics



## Execution

- Finalised ISDA and CSA with counterparty
- Finalised IMA charges with outsourced investment manager
- Potential market impact due to deal size => confidentiality important
- Single transaction rather than tranches
- Price negotiation over a few days

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## Conclusions

- The Board were very hesitant about using derivatives
- The final solution was probably not perfect
- But it met Board's requirements
- Robust process was very valuable...
- ...but significant judgement was still required

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