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Variable Annuities

Society of Actuaries in Ireland Evening Meeting

September 17, 2008

Variable Annuities Working Party

- Presented paper to Faculty and Institute in March 2008
- Working Party members
  - Colin Ledlie
  - Dermot Corry
  - Gary Finkelstein
  - Alan Ritchie
  - Ken Su
  - Colin Wilson
- Colin Ledlie, Dermot and Gary will present here today

Introduction (Section 1)

- Variable Annuity
    - Can be a confusing term
    - Originated in the US
    - We defined it as "any unit-linked or managed fund vehicle which offers optional guarantee benefits as a choice for the customer"
- Similar products available for many years – e.g. Maturity Guarantees Working Party in 1980
- Fagan proposed a form of hedging for these types of guarantees in 1977 but the 1980 Working Party took the view that there would be practical disadvantages to this method
- Advances in hedging techniques have been the key enabler in recent years

Agenda

- Definitions
- Market Context
- Sample Product
- Customer Outcomes
- Risk Management
- Pricing
- Hedging and Market Risk Management
- Reserving and Capital
- Regulatory Issues
- Discussion Points

Definitions (Section 2)

- GMDB – Guarantee on death. May guarantee premium paid or the guarantee may include additional feature
- GMAB – Accumulation benefit. As above with guarantee at surrender/maturity rather than death
- GMIB – Income Benefit. Guarantees a minmum income at annuitisation
- GMWB – Withdrawal Benefit. Guarantees a minimum withdrawal from the fund each year. Fund can still be surrendered so different from a traditional annuity.
- Variations of GMWB have withdrawal benefit payable for life

UK Market Opportunity (Section 3)

- Bridges the gaps left by the decline of with-profits and defined benefit pension schemes

- Traditional annuities give strong guarantees but inflexible and result in fixed interest investment for up to 30 years

- Drawdown (or ARFs in Ireland) allow investment in risky assets but no income protection if market falls

- UK market scale (2006) - £9.6bn annuities, £2.6bn drawdown

- Face some regulatory challenges to product design

US Variable Annuity Sales ($bn)

Source: NAVA, Milliman

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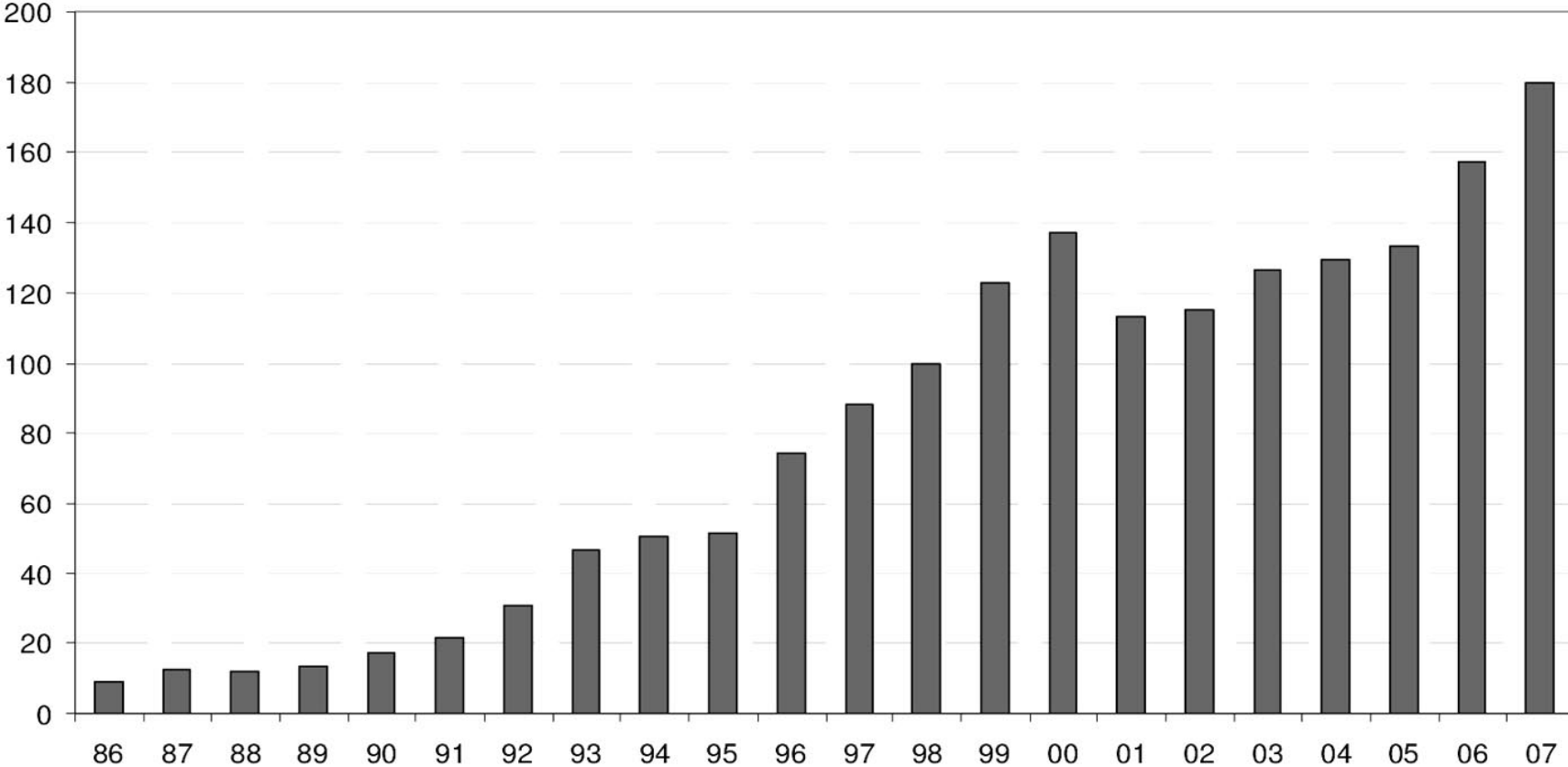
Japanese Net VA Assets
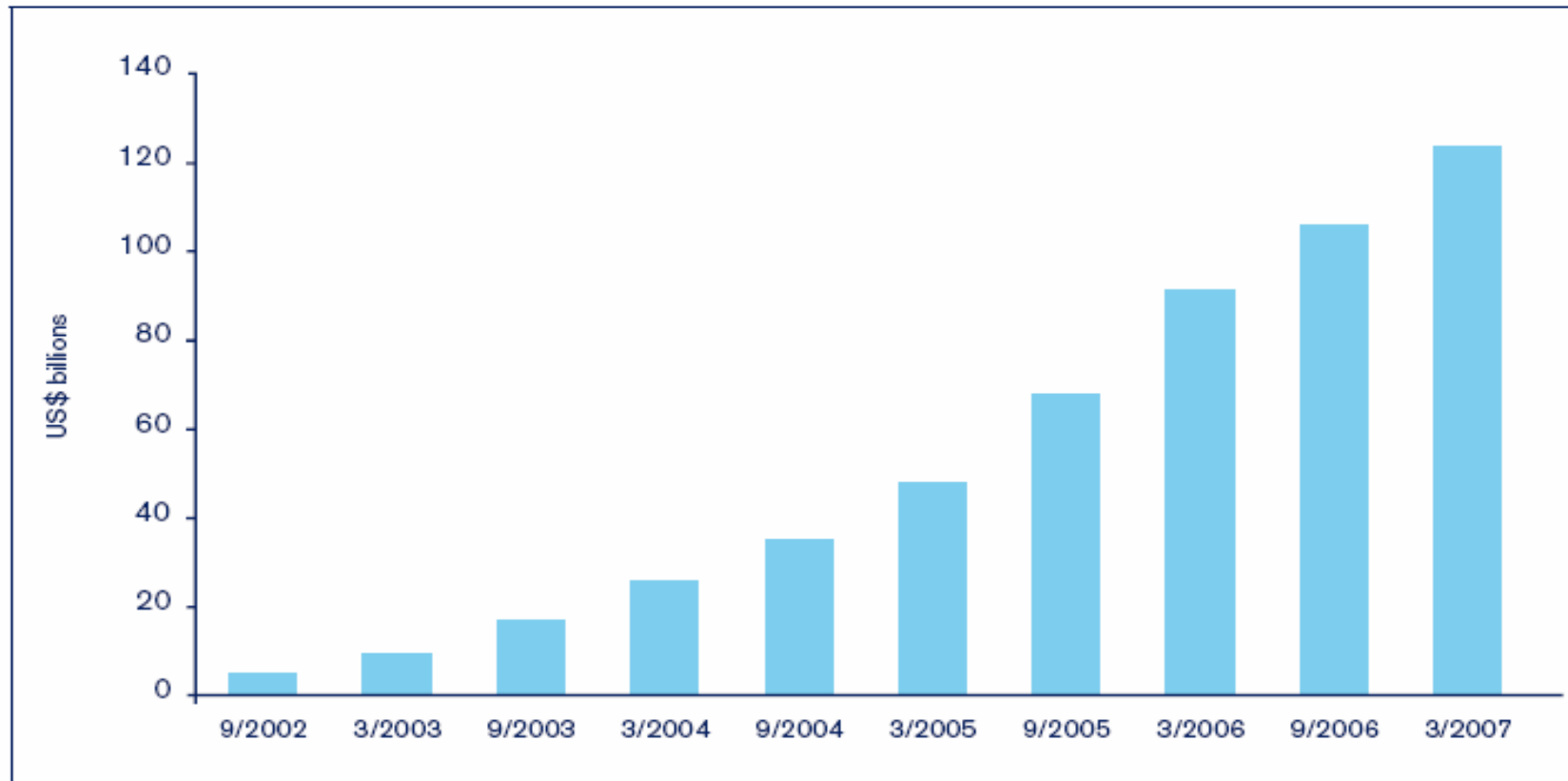
Source: Hoken Mainichi Shimbun.

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European and Asian Developments

- Launches in Korea, Hong Kong, Taiwan etc
- Growing interest in Continental Europe
    - Aegon, Allianz, AXA, ING, Generali, Met Life, Munich Re (Ergo)
    - Others at the planning stage
- UK market
    - Aegon, Hartford, Lincoln, Met Life
    - Standard Life, Prudential and AXA have all announced that they are considering entering the market
- Majority of above based in Ireland but activity also in Luxembourg
- Germany changing regulations to allow VA business to be written by domestic German companies

Sample Product Design (Section 5)

- Guaranteed Minimum Withdrawal Benefit for life

- 5% pa of original premium guaranteed income at age 65 for life

- Annual Step-Up (subject to 15% maximum to age 75)

- 60% Equity Backing Ratio

- Charge for Guarantee 0.75% pa

Customer Outcomes (Section 6)

- Stochastic Analysis of outcomes
- Initially examine two selected scenarios – one bad (38) and one good (81)
- Compare VA with income drawdown
- Then move on to probability distributions of outcomes
- Treating Customers Fairly considerations

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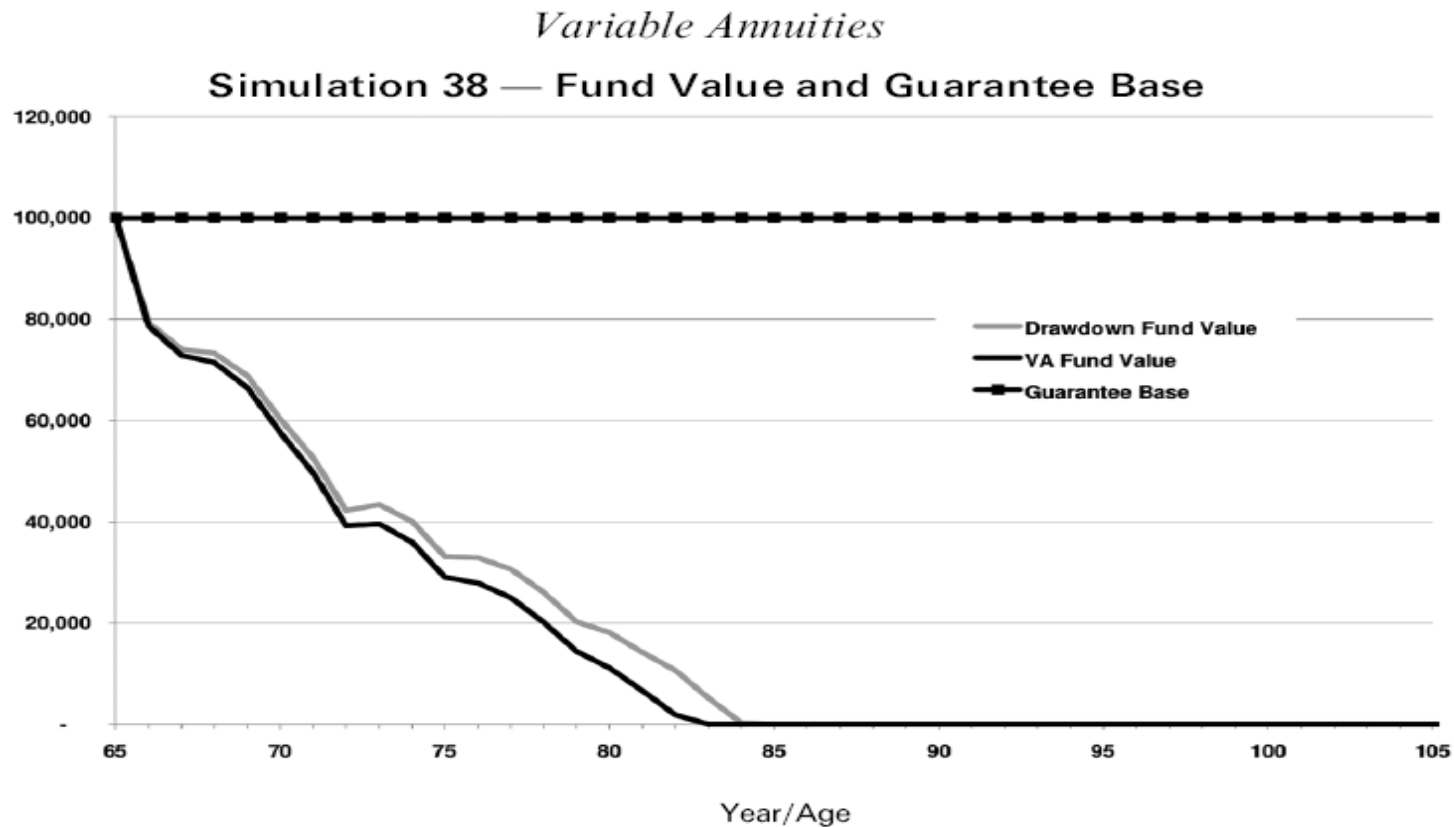# Simulation 38 – Fund Value and Guarantee Base

Figure 6.2.4a. Fund value and guarantee base, Scenario A

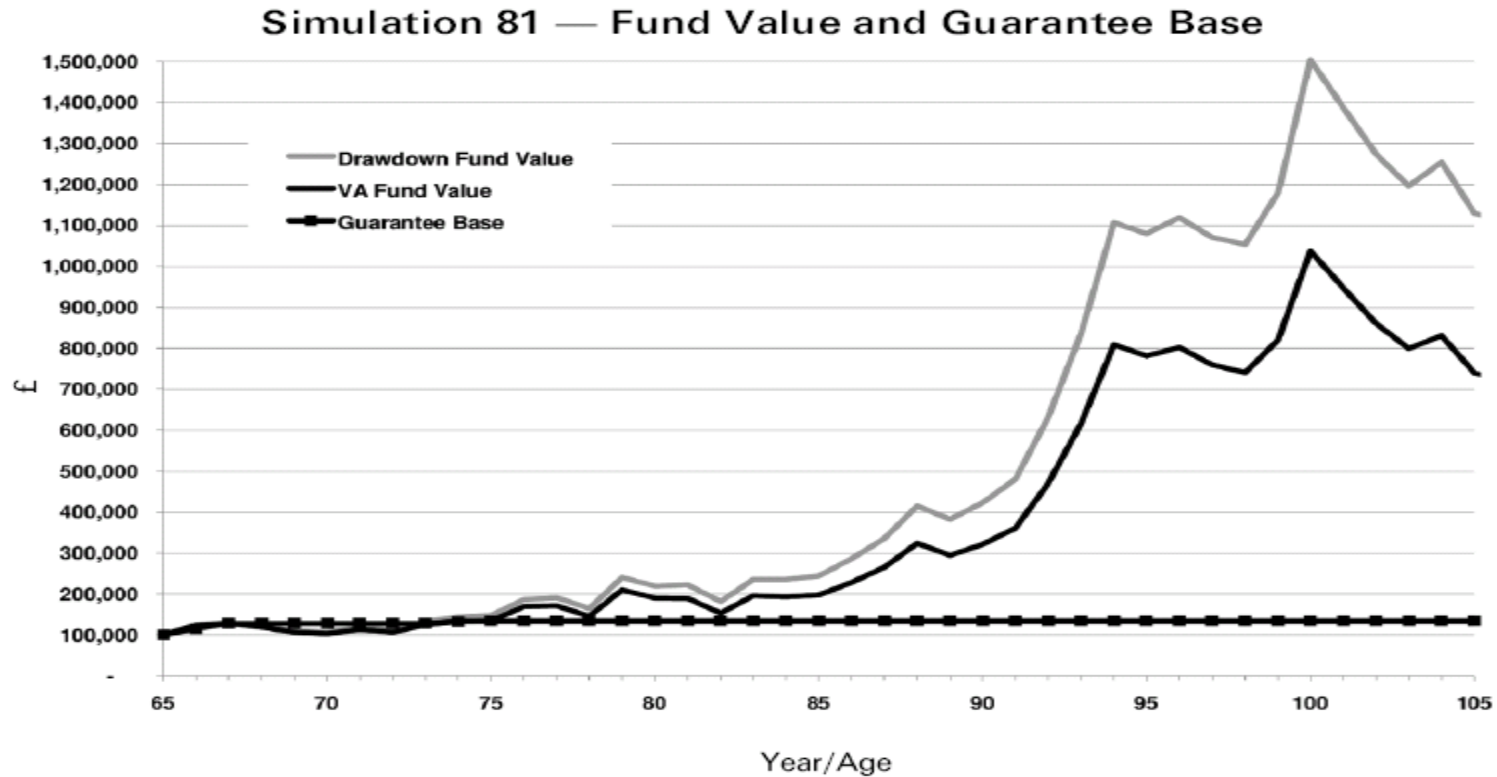# Simulation 81 – Fund Value and Guarantee Base

Figure 6.2.4b.   Fund value and guarantee base, Scenario B

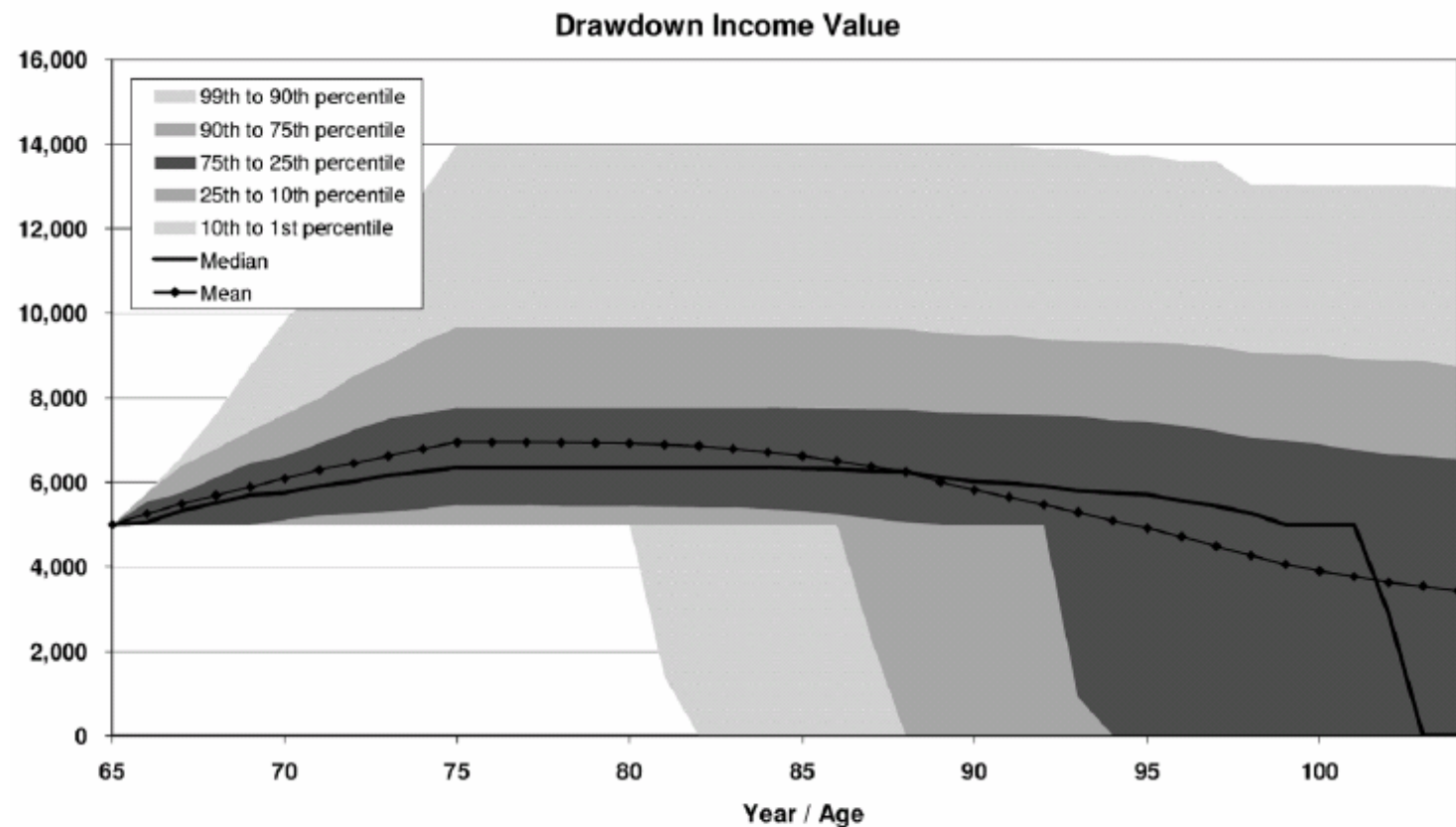# Probability Distribution – Income from Drawdown

Drawdown Income Value

Figure 6.3.3b.   Percentiles of income through time, Drawdown

Probability Distribution – Income from VA

VA Income Value

Legend:
- 99th to 90th percentile
- 90th to 75th percentile
- 75th to 25th percentile
- 25th to 10th percentile
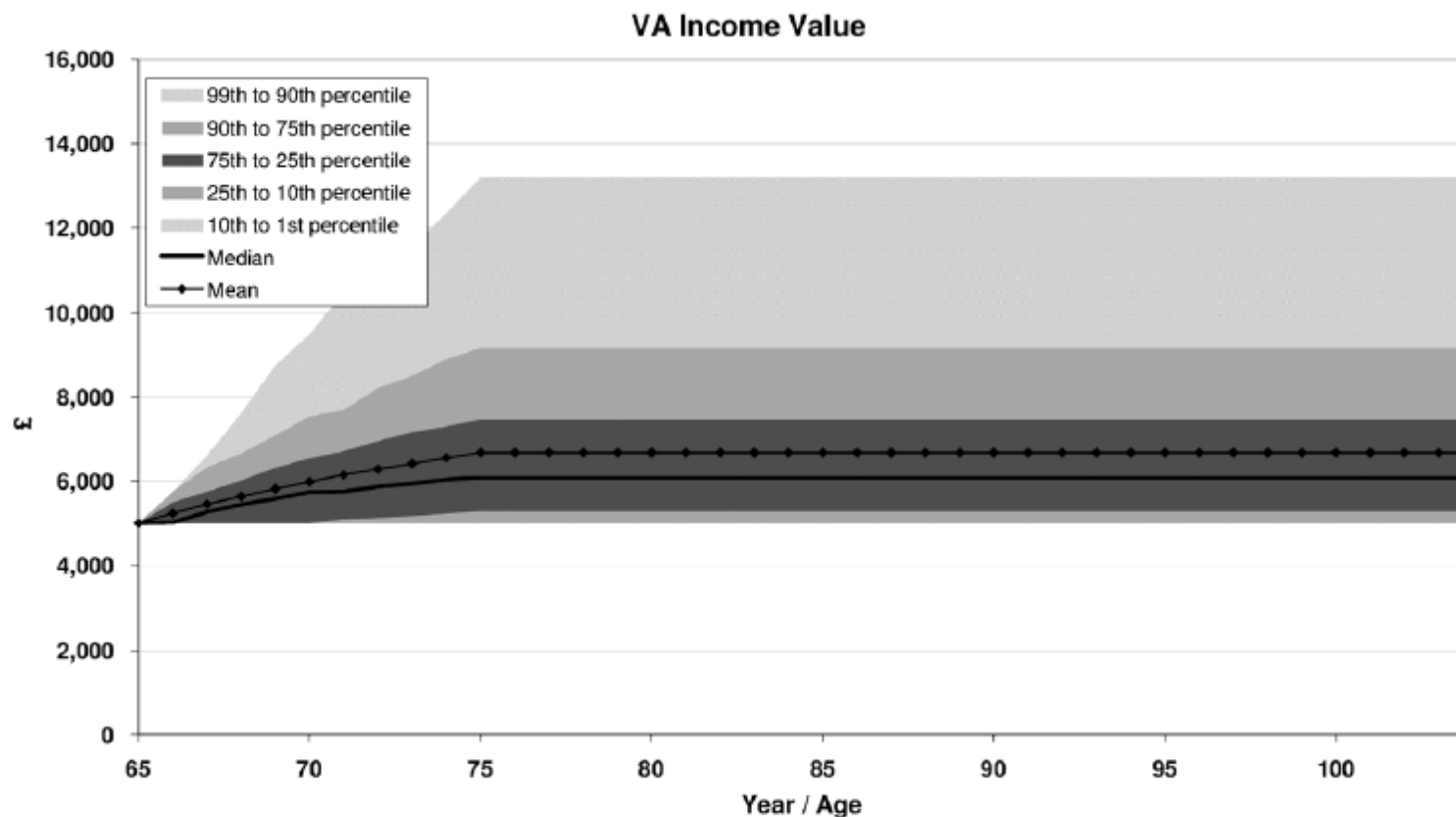- 10th to 1st percentile
- Median
- Mean

Figure 6.3.3a. Percentiles of income through time, Variable Annuity

Treating customers fairly

- Consider how the guarantee operates in a range of scenarios and appropriateness of product

- Information requirements for the distributor to allow them to understand the product

- Review products post sale – continuing to meet needs. Should they notify customer if guarantee is well out of the money?

- Careful consideration of any ability to review charges and/or benefits

Key Market Risks (Section 9)

- Equity asset value movements (referred to as Delta)

- Bond asset value movements (if bonds in portfolio)

- Changes in interest rates (Rho)

- Equity market volatility (Vega)

- Interest Rate volatility

- Correlation between interest rates and equity markets

- Performance of funds compared with underlying indices (basis risk)

- Pricing is normally fixed for a period of time
  - Ideally changes with market conditions

Key Non-Market Risks

- Lapse behaviour (or turning off guarantee)
- Mortality/Longevity
- Funds chosen by the policyholder
- Start of withdrawals
- Amount of withdrawals per annum
- Business mix – ages, genders etc

Pricing (Section 7)

- Key elements for market consistent pricing
  - Economic scenario generator
  - Model to project guarantee income and claim payments
  - Assumptions on key variables
    - Mortality
    - Lapse, including dynamic behaviour if appropriate
    - Election rates
    - Etc.

Pricing of Sample Product in paper

- Market Consistent Cost at 30/06/07 = 0.49 % pa
- Sensitivity
    - 1% absolute fall in interest rates – 0.82 % pa
    - 25% relative increase in equity vol – 0.67 % pa
    - Longevity 80% of central assumptions – 0.60 % pa
    - Defer withdrawals for 3 years – 0.38%
    - Flat withdrawals rather than dynamic – 0.37%

Price to the customer

- Range of factors
  - Economic price
  - Competitive position
  - Perceived value of guarantee to customers
  - Willingness to change price if markets change
  - Hedging strategy
  - Capital and reserving requirements
  - Sensitivity of the price to assumptions

Hedging and Market Risk Management (Section 10)

- "Greeks" commonly used to describe the market risks

- Delta - risk that UL fund falls in value
  - Delta = $\partial V_L / \partial V_A$ (where V_A denotes value of UL fund)

- Gamma – convexity of the liability option
  - Gamma = $\partial \Delta / \partial V_A = \partial^2 V_L / \partial V_A^2$

- Rho – Risk of interest rate change
  - Rho = $\partial V_L / \partial r$ (where r is the interest rate)

- Vega – Volatility of the underlying assets
  - Vega = $\partial V_L / \partial \delta_A$

Hedging Techniques

- Dynamic Hedging
    - Using "Greeks" select assets which will move in the same way as the liability
    - Dynamically adjust hedge assets as value of "Greeks" changes
    - Depends on highly liquid assets with low trading costs
- Static Hedging
    - Use over the counter options
    - Work well for simple guarantees such as GMAB
    - Exotic hedges needed for more complex guarantees
    - Some rebalancing almost certainly required – e.g. demographic variations
    - Can be used as a core with a form of dynamic hedging for the rebalancing

Market Risk Management – Reinsurance

- Growing market in reinsurance
- Risk appetite varies – market, mortality/longevity, lapse, election
- Limited availability of full risk transfer
- Provides alternative for smaller books or new entrants
- Reinsurance company may have minimum size and other limitations

Impact of Hedging - Examples

- We examine the implications of various market stresses on the option value
  - With no hedging and different hedge strategies
- Then look at longer term profit and loss distribution projections
- This gives us some possible input for economic capital

Instantaneous Stresses (Section 10)

Table 10.8.4(a)

#	Equities	Market movement Interest rates	Equity volatility	Swaption volatility	Capital strain (economic value) Unhedged	Delta rho	Delta rho vega
(i)	−5%				−253	−14	−2
(ii)	−25%				−1,959	−762	−286
(iii)		−1%			−1,939	−266	−189
(iv)			+6%		−1,542	−1,542	54
(v)				+3%	−200	−200	−200
(vi)	−25%	−1%	+6%	+3%	−5,767	−2,900	4

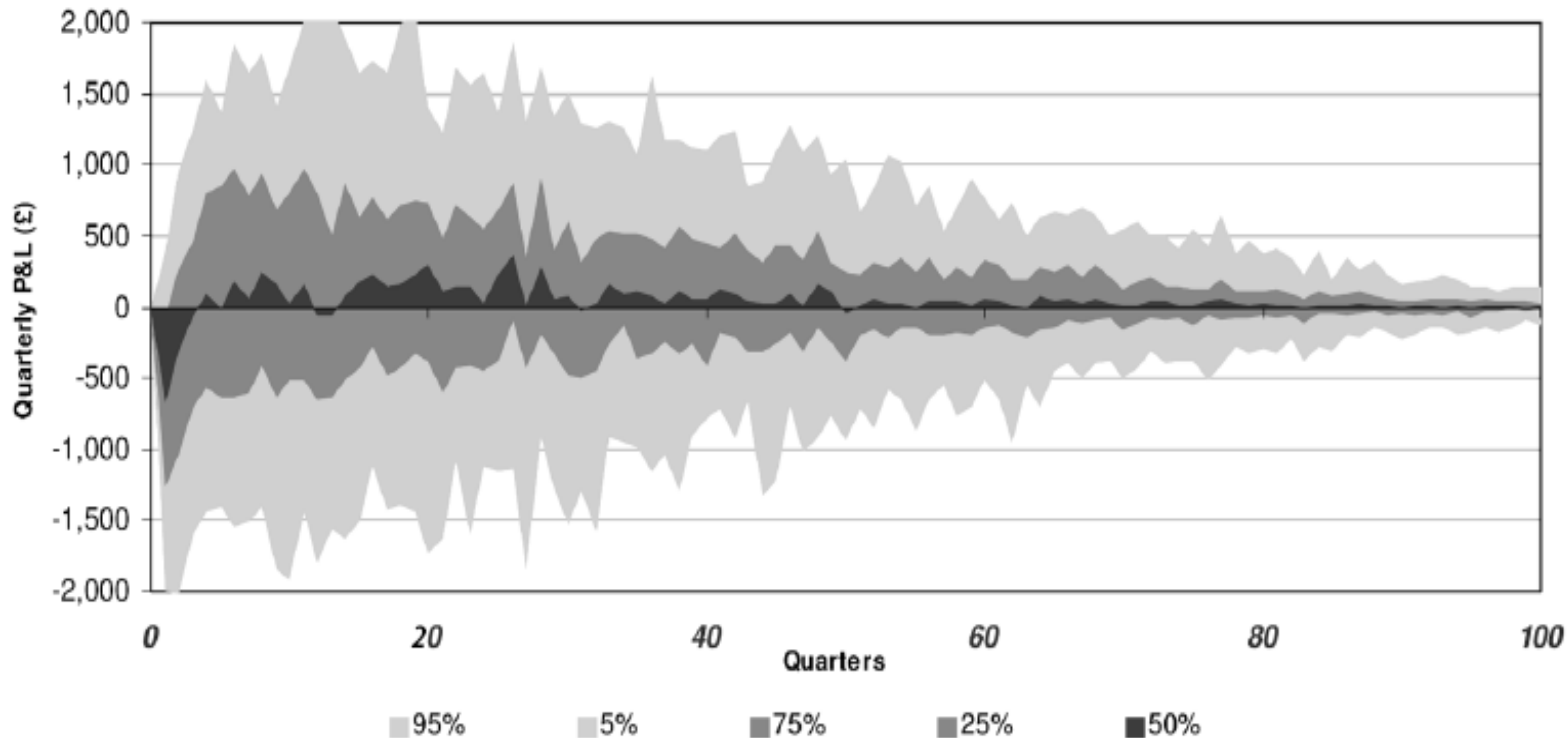# Projection over time – Unhedged

Figure 10.9.5(a).   Unhedged quarterly P&L distribution WB product (£)
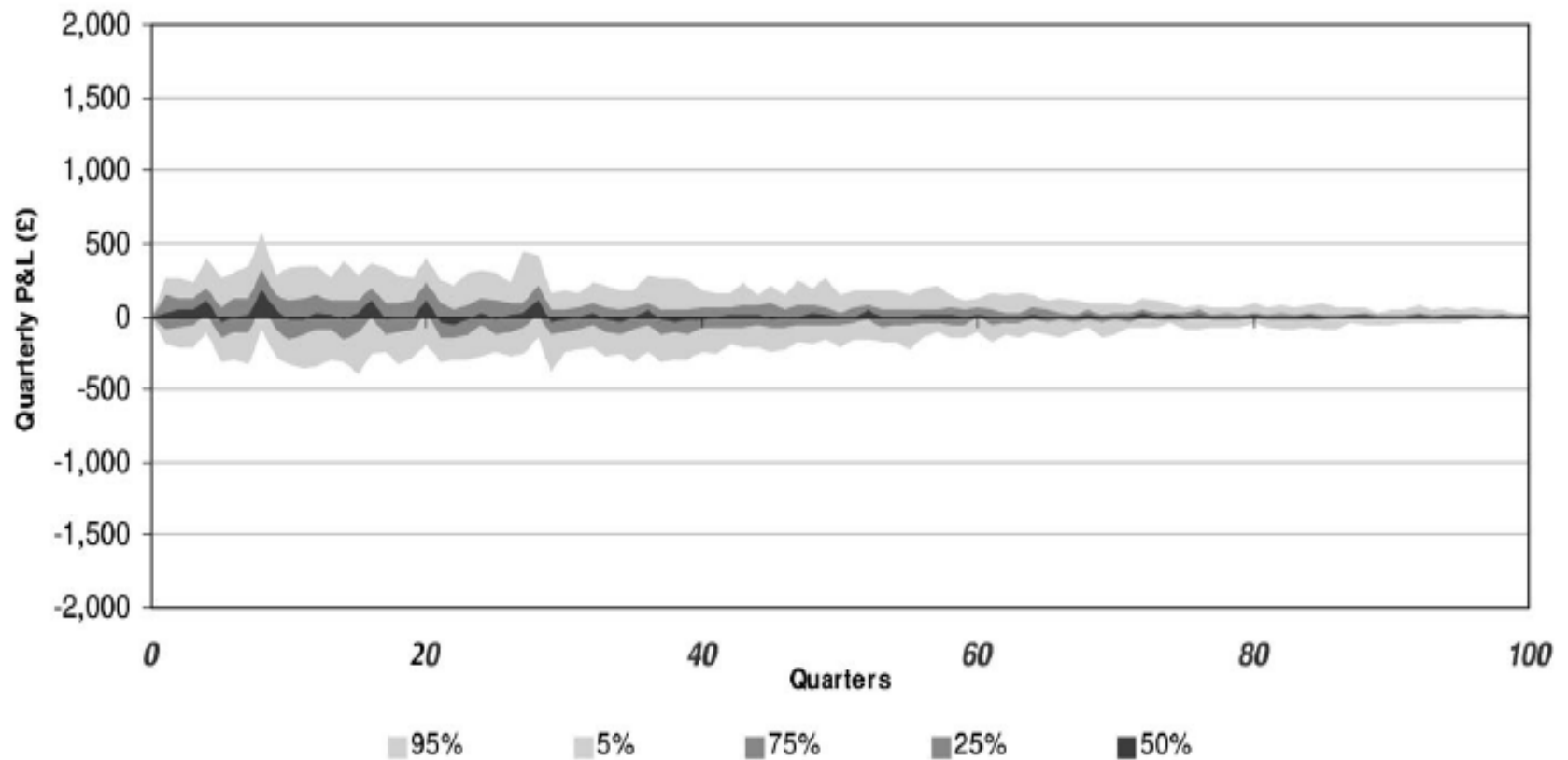
Hedged

Figure 10.9.5(c).   Delta rho vega hedged quarterly P&L distribution
WB product (£)

Measures of Economic Capital at Risk

	Immediate Stress (capital strain/AV)	Cash Flow Projection (PVFP/AV)
Unhedged	5.8 %	12.9 %
Delta-Rho Hedge	2.9 %	2.5 %
Delta-Rho-Vega Hedge	0.0%	2.0%

Reserving and Capital (Section 8)

- Stochastic approach needed to reserving

- Most common approach in Ireland is to use Conditional Tail Expectation (CTE) approach

- CTE approach adapted from the US method

- This involves projecting cashflows over the life of the policy for each scenario calculating reserve

- CTE reserve is average of worst scenarios

- Allowing for hedging involves nested stochastic projections of profits for each scenario

Solvency Margin

- Products carry investment risk => 4% solvency margin
- May be possible to issue base UL product and rider as distinct products => 4% applies to rider only
- Financial Regulator likes to see minimum total capital based on CTE 90
- Solvency II will lead to a change in approach
  - Easier to identify the impact of the different market aspects
- Solvency II does not currently allow adequately for Dynamic Hedging
- However also poor at dealing with basis risk, dynamic lapse, longevity etc

Regulatory Constraints (Section 11)

- HMRC limits on income drawdown (know as GAD limits) complicate market in the UK

- Can limit income payout when markets fall

- Can force higher income when markets rise

- Undesirable and lobbying for change

- Not an issue in Ireland – though 3% ARF minimum withdrawal could cause similar issues

Market Conditions

	30/06/07	07/03/08
FTSE 100	6608	5700
10 Year Equity Implied Volatility	20.0%	27.1%
20 Year Swap Rate	5.49%	4.90%
Swaption Volatility (10 year option on 10 year swaps)	12.0%	11.4%
Cost of Guarantee	**0.49 %**	**0.96%**

Discussion Topics (1)

- Is the authors' optimism regarding the prospects for the product justified ?

- Is there a genuine consumer benefit from these products ?

- Will domestic companies succeed in this market or will companies with established track records elsewhere dominate ?

Discussion Topics (2)

- Will hedging techniques perform as intended in extreme market conditions ?

- What changes to legislation would facilitate better outcomes for the customer (and acceptable outcomes for HMRC) ?

- Are actuaries well equipped to develop and market these products ?