AFIR LIFE MUNICH 2009

Variable Annuity Risk Management and Hedging Effectiveness

Section Finance de l'AAI
IAA Finance Section
AFIR

Section Vie de l'AAI
IAA Life Section
LIFE

DAV
DEUTSCHE AKTUARVEREINIGUNG e.V.

Contents

1. Overview of Variable Annuity Products
2. Techniques used to manufacture the guarantees and to study effectiveness of Hedging
3. Hedge design considerations
4. Economic Capital under alternative Hedging Strategies
5. Performance of Hedging Programs since the outset of the credit crunch
6. Lessons learned and a look into the future

Section 1
Overview of Variable Annuity Products

VA-Product design

- VA: Unit linked product with Guaranteed Benefits

Characteristic	Comment
Retirement savings	Available for investment purposes
Choice of managed funds	Attractive (similar to unit linked)
Menu of different guarantees	Attractive and differentiable
Offered as optional rider policies	Flexible and Customisable (customer has choice and a feature for sales adviser)
…with commercially attractive charges	Transparent (key to treating customers fairly)
…sufficient to meet the cost of hedging	Profitable and capital efficient

- Any or all of the following benefits are possible:

Benefit	Features
GMDB (Death)	• Guaranteed investment return upon death • Return of premium, roll-up, ratchet, reset, combos
GMAB (Accumulation)	• Guaranteed investment return at future point in time • Various time periods and renewal options available
GMIB (Income)	• Guaranteed annuitisation factors or minimum income levels • Ideal retirement savings / protection product
GMWB (Withdrawal)	• Guaranteed regular withdrawal amounts • Specific term (7% for 20 years) or 5% for life

VA Launches in Europe (August 2009)

MetLife
Multiple UK launches in Dec 2006, May 2007, Jun 2008 & Jan 2009; Poland in 2008
Greece Feb 09, Spain May 09

Canada Life (frischer wind. klare flüsse. feste wurzeln.)
Launched Garantie Investment Rente in March 2009

SwissLife
Launched 'Champion' in Germany in Oct 2008 and Swiss Life Exclusive Invest DWS in Apr 2009

ERGO
Launched GlobalTopReturn in Germany and Luxemburg in 2008 and Vorsorge Invest-Plus (V.I.P.) in 2009

Lincoln Financial Group
Launched i2Live in May 2007;
Acquired by Sun Life Financial

AEGON
GMWB '5-for-life' and pensions product in the UK and similar through La Mondiale in France

The Hartford
First mover in UK 'Gold' and 'Platinum'
Closed to NB 2009

Allianz / **AGF** / **RAS**
Invest4Life launched July 2008 in Germany, France in October 2008 and in Italy in Feb. 2009

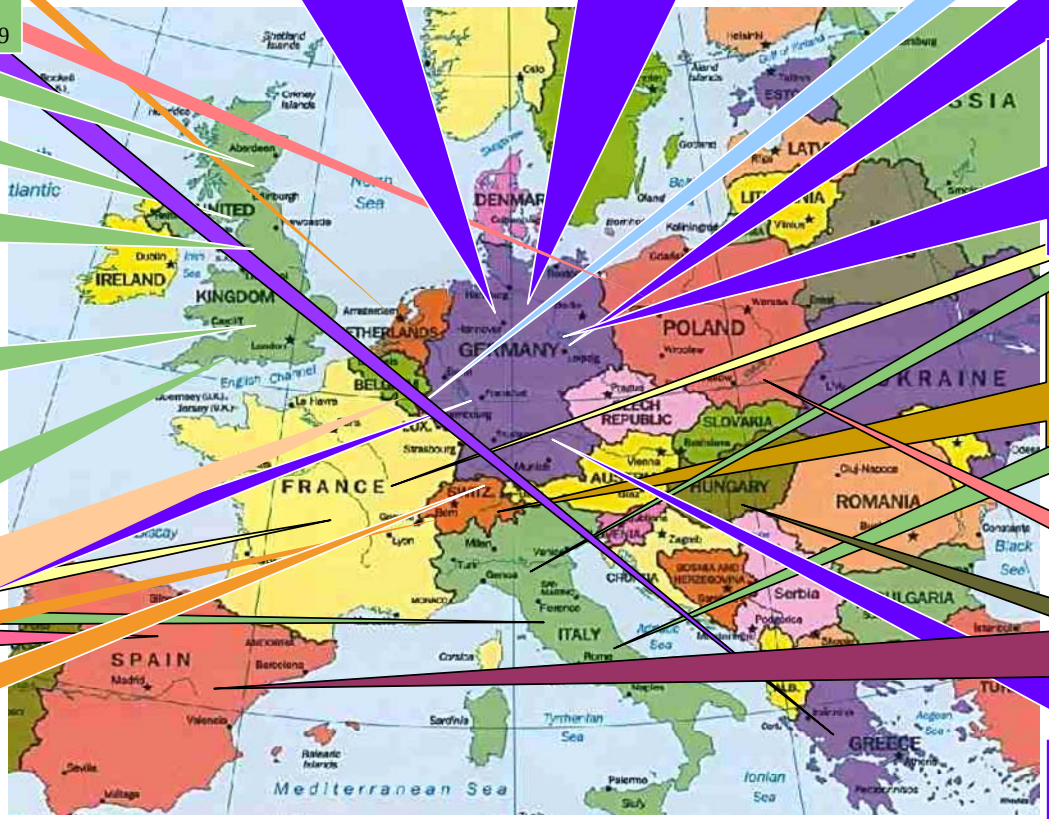
Generali Group
Switzerland for several years and launched in 2008 in Italy

AXA Financial Protection
European roll-out of 'Accelerator' plans in Germany ('Twinstar'), Belgium, France, Spain, Italy, UK Offshore (Isle of Man), Portugal, Switzerland

ING
GMAB products launched in Spain in 2007, Hungary in 2007, Poland and Netherlands in 2008, Belgium in 2009

Bâloise Holding
Launched GMWB 'RentaSafe' in Switzerland in Oct-2008

R+V
PremiumGarantRente launched in Aug 2008



Source: Milliman

There is significantly more non-public activity

European VA Product Launches

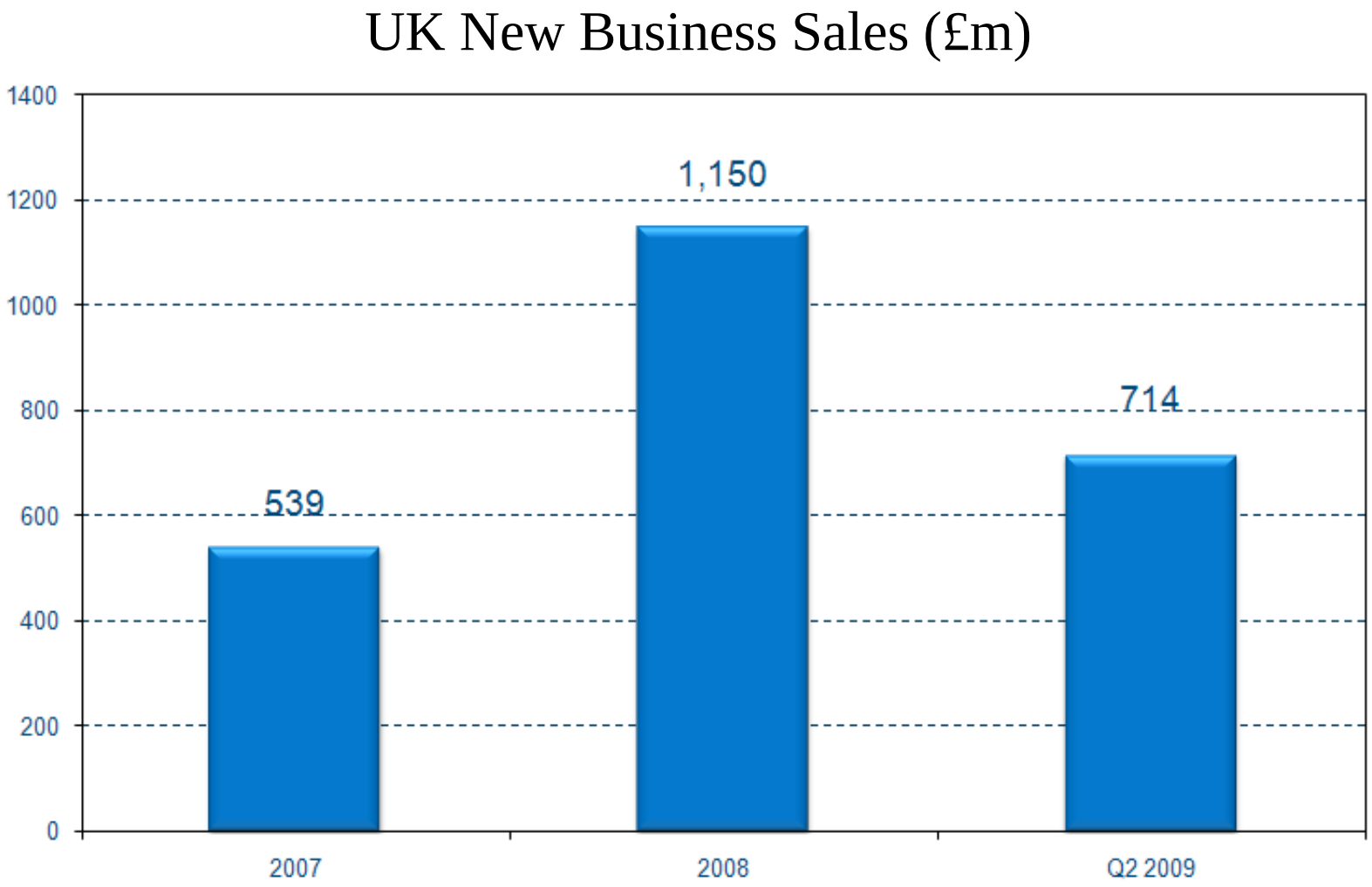
There is significantly more non-public activity

- New product launches continuing apace
- Table includes historic VA product launches, but excludes re-launches due to repricing and/or redesign

Company	Product	Type	Country	Date
Hartford	SafetyNet	WB	UK	Feb-05
4 Products launched in UK and Germany by AXA, AEGON MetLife in 2006				*2006*
10 Products launched in UK, Italy, Spain, Belgium, Hungary, France by AXA, ING, Lincoln, MetLife, Hartford, Generali in 2007				*2007*
ING	Europerspectiva	AB / DB	Poland	Jan-08
AXA	Twinstar	AB	Switzerland	Jan-08
ERGO	Global Top Return	IB / AB	Germany	Feb-08
ING	RVS Guarantee Perspective	AB / DB	Netherlands	Mar-08
AXA	Accumulator	AB	Portugal	Apr-08
Aegon	Income for Life	WB / IB	UK	May-08
MetLife	Retirement Portfolio	WB / AB	UK	Jun-08
Allianz	Invest 4 Life	WB	Germany	Jul-08
R+V	PremiumGarantieRente	IB	Germany	Aug-08
MetLife	Citi VA Orchidea	WB	Poland	Sep-08
Swiss Life	Champion	IB	Germany	Oct-08
Baloise Life	RentaSafe	WB	Switzerland	Oct-08
Allianz	Invest 4 Life	WB	France	Oct-08
AXA	Twinstar	WB	Switzerland	Nov-08
MetLife	Citi VA Investment Bond	WB	UK	Jan-09
Aegon / La Mondiale	Terre d'Avenir	WB / DB	France	Jan-09
MetLife	Citi VA Auvida	WB	Greece	Feb-09
Allianz	Invest 4 Life	WB	Italy	Feb-09
ING	Lifelong Income	WB	Belgium	Feb-09
Canada Life	Garantie Investment Rente	WB	Germany	Mar-09
MetLife	Citi VA (Avida)	WB	Spain	May-09
MetLife	Citi VA	WB	Belgium	May-09
Swiss Life	Exclusive Invest DWS	AB	Germany	Apr-09
ERGO	Vorsorge Invest-Plus (V.I.P.)	AB	Germany	Jun-09
AXA	AXA pensiones privilege	AB / DB	Spain	Jun-09

Source: Milliman

UK VA Statistics



Section 2
Techniques used to manufacture the guarantees and to study effectiveness of Hedging

Techniques to manufacture the guarantees

- Liabilities for Guaranteed Benefits are sensitive to changes of capital market parameters such as interest rate (Rho), volatility (Vega), equity prices (Delta)) and actuarial assumptions such as lapses, mortality

- Investment in hedge derivatives to offset changes in liabilities of the guaranteed benefits due to market movements (“Matching the Greeks”)
  - Dynamic hedging (Delta, Delta-Rho, Delta-Rho-Vega)
  - Static hedging / Semi-static hedging / Structured Derivatives

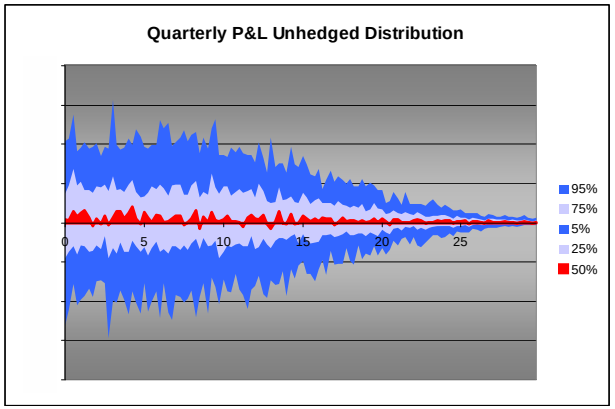
- Actuarial parameters have to be considered in the pricing, and liability valuation with inclusion of suitable risk margins

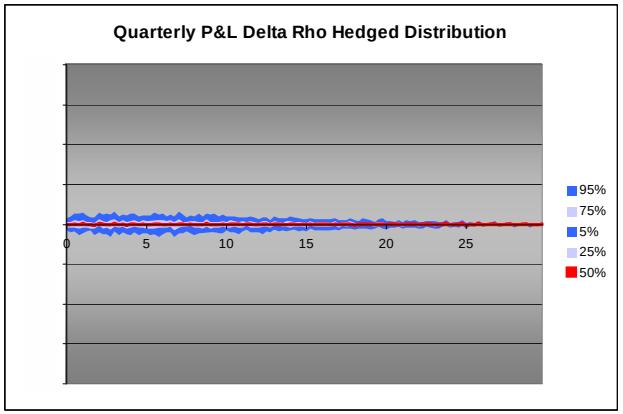
Derivative Hedge Instruments

Instrument	Delta	Rho	Vega	Other
Equity Index Futures	✓			
Currency Futures / Forwards	✓			
Inflation & Credit Swaps	✓	✓		
Interest Rate Swaps / Bond Futures	✓	✓		
Equity Rate Hybrids	✓	✓		Correlation
Interest Rate Swaptions		✓	✓	Gamma
Variance Swaps / Volatility Futures			✓	
Equity Options (ET & OTC)	✓	✓	✓	Gamma

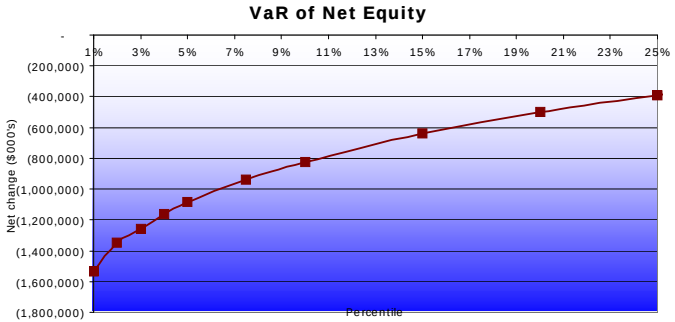
Techniques to study effectiveness of hedging

1. Immediate balance sheet shocks
2. Multiple stress scenario analysis





3. Historic back testing
4. Mock and ongoing live testing



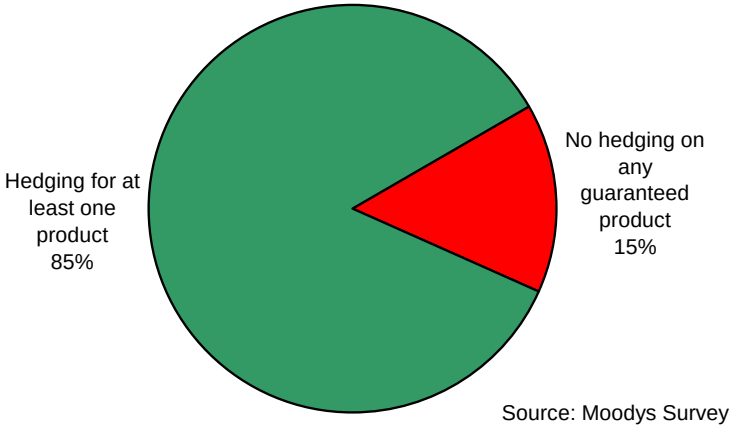
	5 Percentile	1 Percentile	Oct 19, 1987	Sep 11, 2001
Market Movements				
S&P	-0.92%	-0.94%	-20.47%	-4.92%
Russell	-1.06%	-1.37%	-12.53%	-3.86%
Volatility	1.37%	2.46%	8.13%	9.92%
Interest Rates	0.06%	0.11%	0.12%	-0.31%
Change in Assets				
Equity Index Futures	(279,025)	(317,955)	(4,927,339)	(1,281,904)
Interest Rate Future	(469,917)	(791,226)	(868,675)	2,244,078
	(748,942)	**(1,109,181)**	**(5,796,015)**	**962,174**
Change in Liabilities	**333,570**	**423,149**	**7,475,089**	**2,871,818**
Net Change	**(1,082,512)**	**(1,532,330)**	**(13,271,103)**	**(1,909,644)**

Section 3
Hedge design considerations

Hedge design considerations

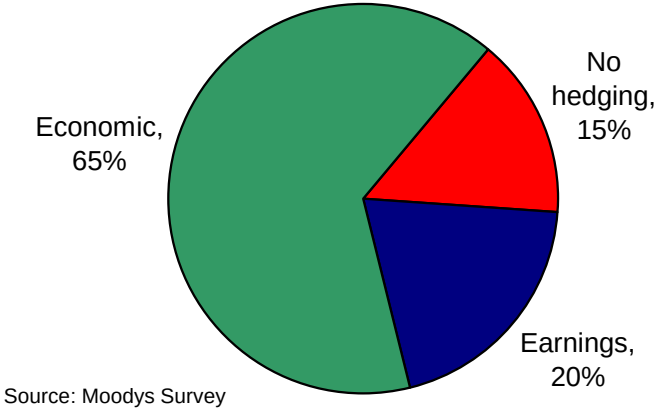
- Appropriate Charges
  - Product transparency & attractiveness
  - Finance the hedging program
  - Risk management is an integral part of product design
- Reduce P&L Volatility
- Reduce Capital at Risk
  - Consider full or partial hedge, based on preferences
- Moody's give ratings credits to those that hedge and negative credits to those that don't

Percentage of the US Industry that Hedges



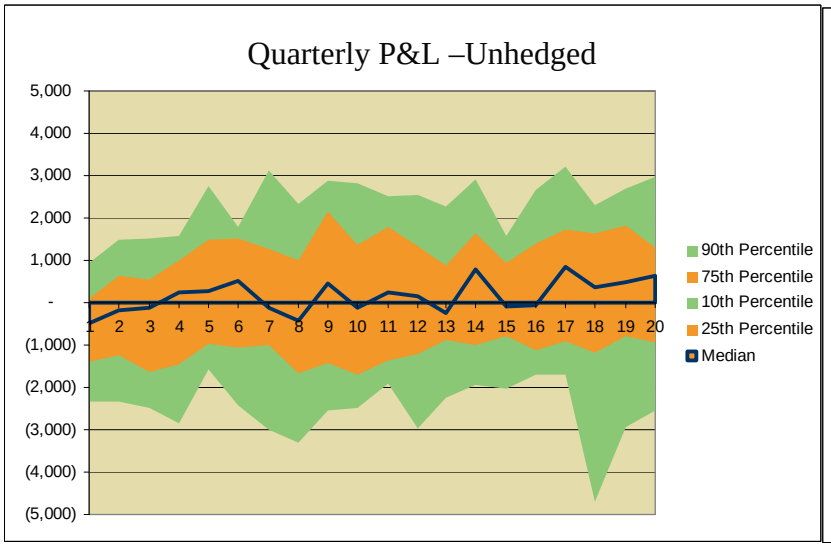
Source: Moodys Survey

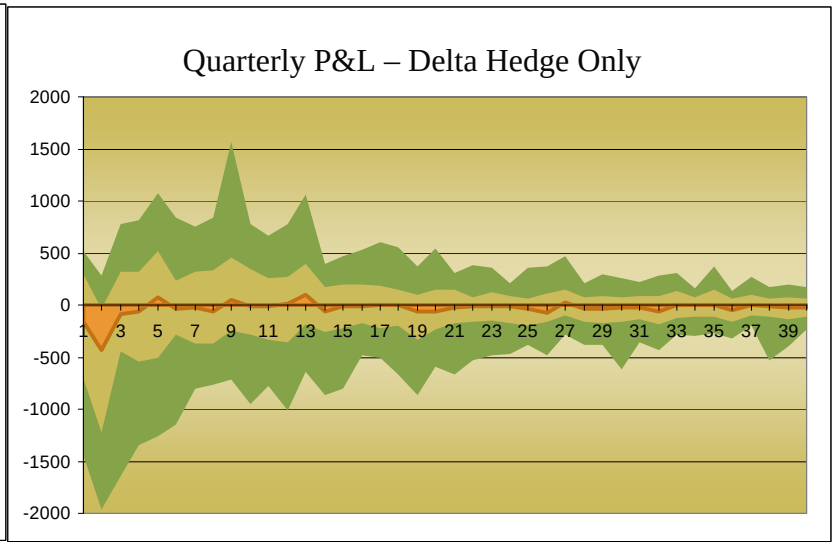
Primary Objectives of the Hedge

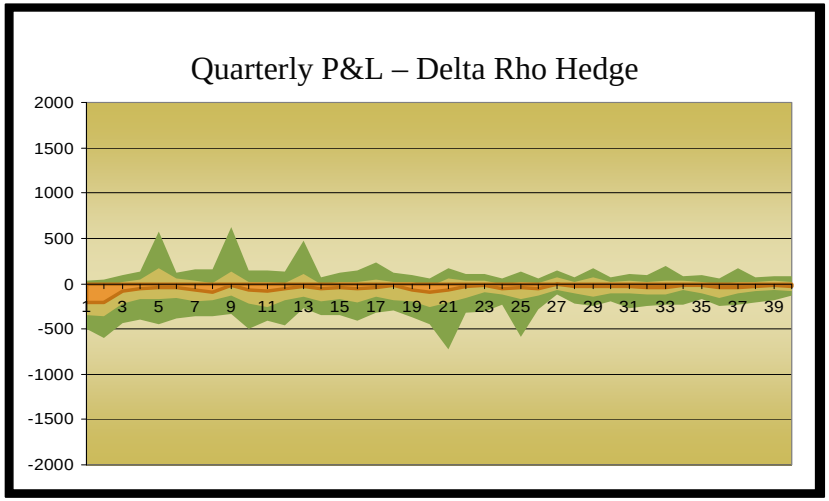


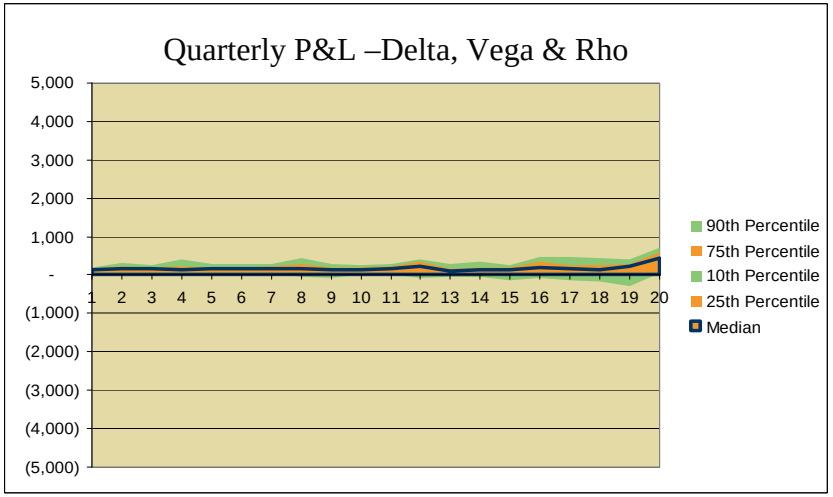
Source: Moodys Survey

Unhedged vs. Hedged

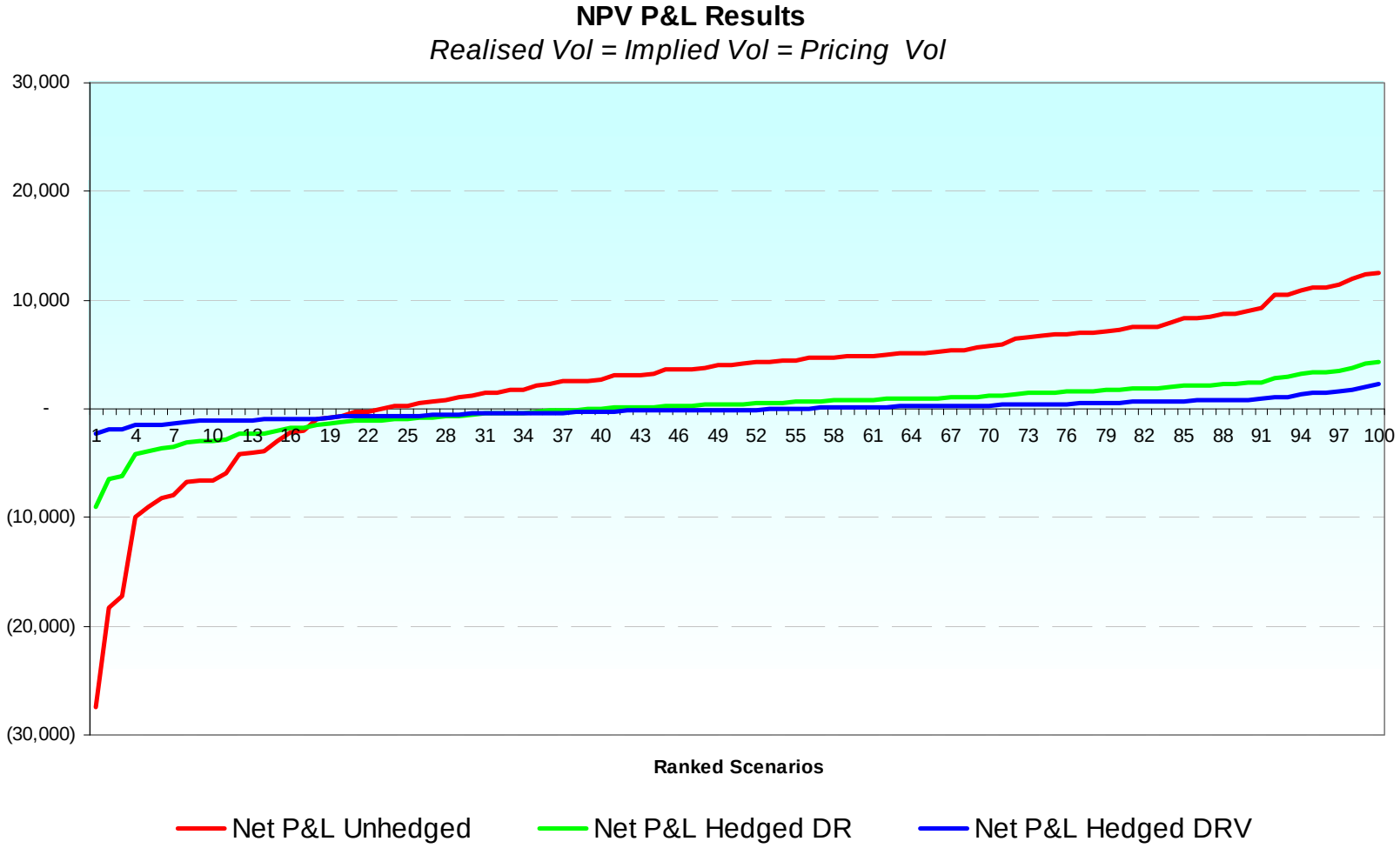








Stochastic Effectiveness Testing

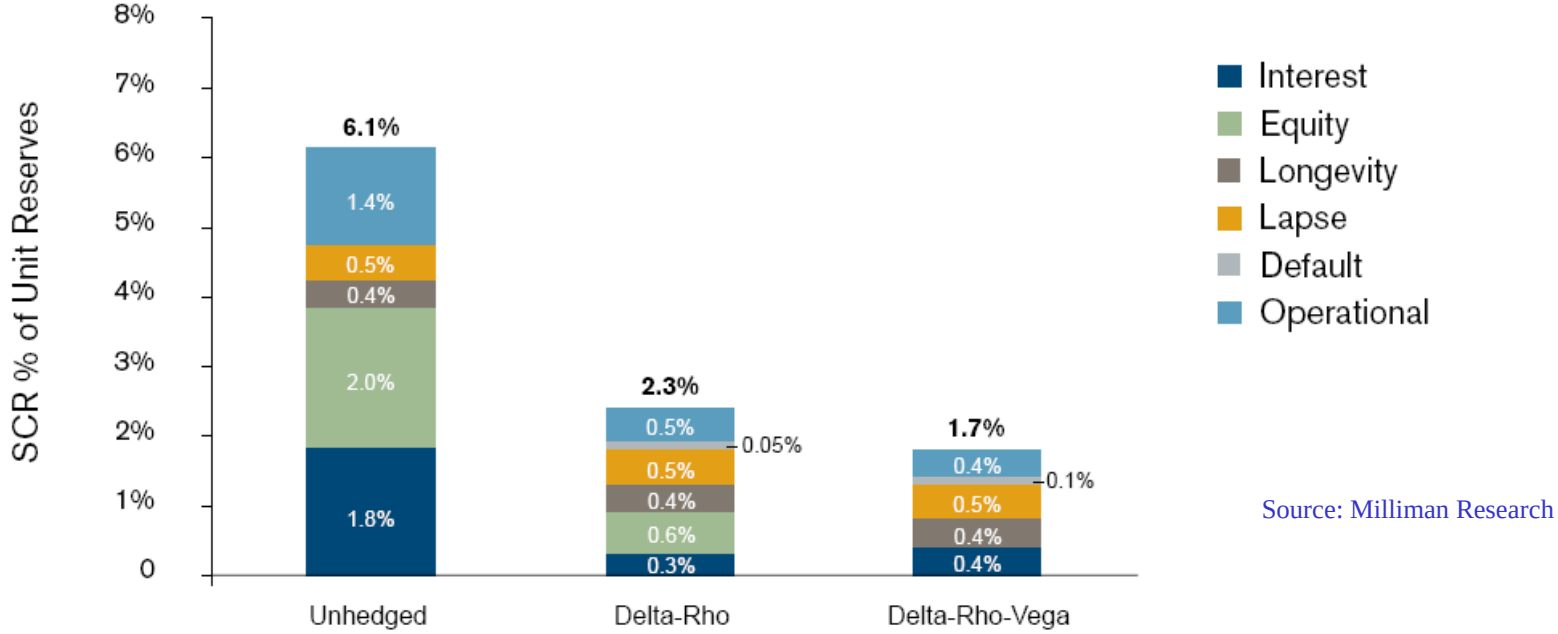


Section 4
Economic Capital under alternative Hedging Strategies

Immediate Stress Tests

	Liability Option Value	Hedge Asset Value	Capital Loss Unhedged	Capital Loss Hedged	Hedge Protection Ratio
Base	20	20			
-20% returns	25.6	25.0	5.6	0.6	89%
-20% returns +5% volatility	30.6	29.8	10.6	0.8	92%
-20% returns +5% volatility -1% rates	33.9	33.0	13.9	0.6	96%

Solvency II Capital Requirement



Source: Milliman Research

Assumptions:

- **GLWB: 4.5% for life; 100 Bps Guarantee fee p.a.; 65-year-old-male**
- **Asset mix: 50% Equity, 50% European Bonds**
- **Calibration done on 1st Feb 2009 (⇨Hedgecosts: 75 bps)**
- **Method follows QIS4 approach**

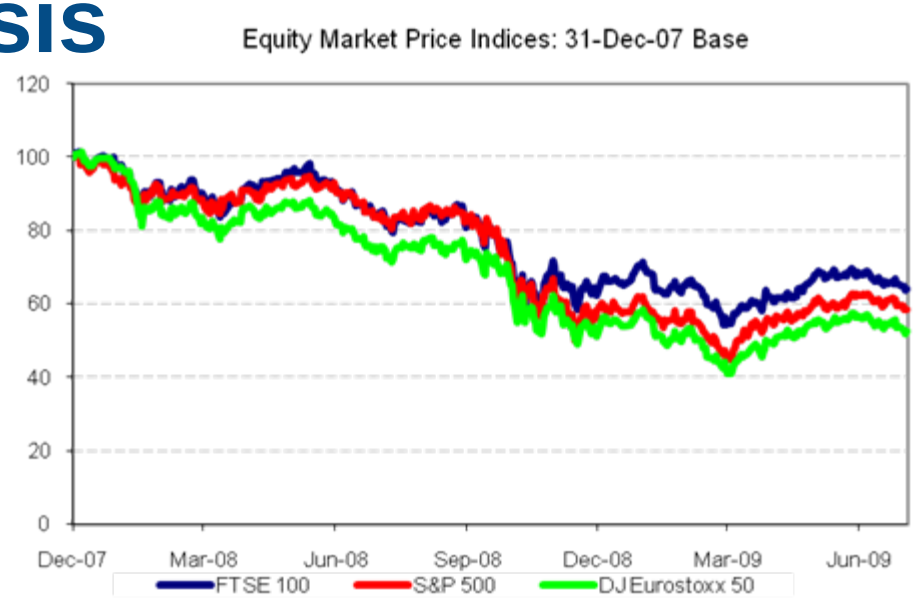
Source: Variable Annuities by Ledlie et al (2008)

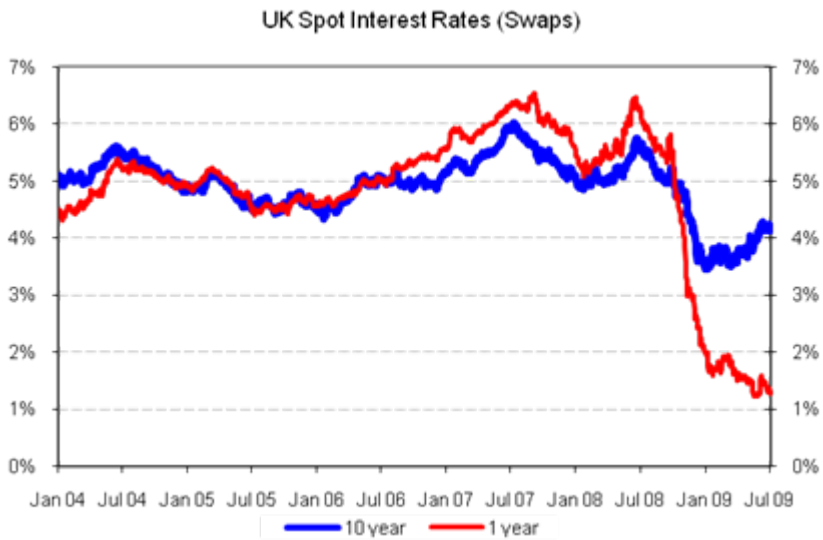
Including volatility stress	Immediate Stress (capital strain/AV)	Cash Flow Projection (PVFP/AV)
Unhedged	5.8 %	12.9 %
DR Hedge	2.9 %	2.5 %
DRV Hedge	0.0%	2.0%

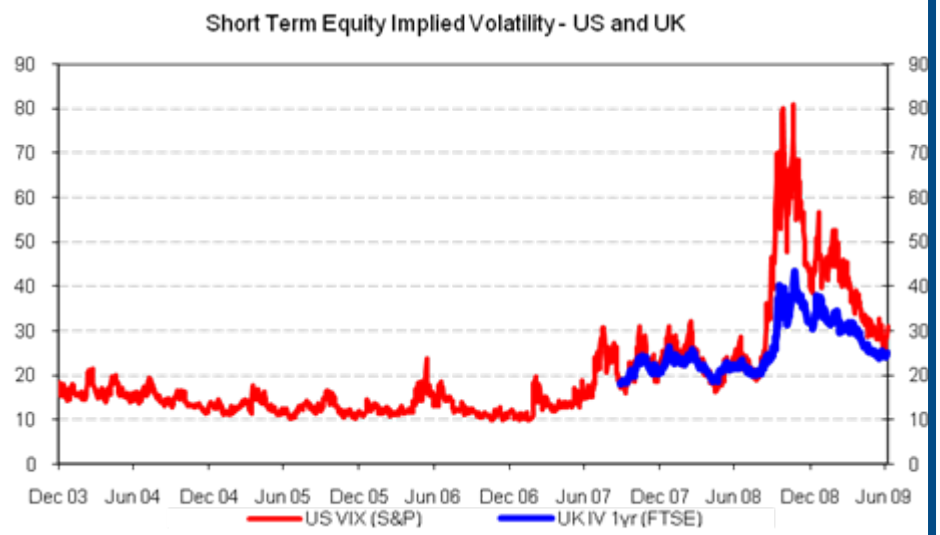
Section 5
Performance of Hedging Programs since the outset of the credit crunch

Global Financial Crisis

- Global decline in equity markets
- Reduction in interest rates
- Increase in equity volatility
- Credit risk failures: Lehman Brothers, Merrill Lynch, Bear Sterns





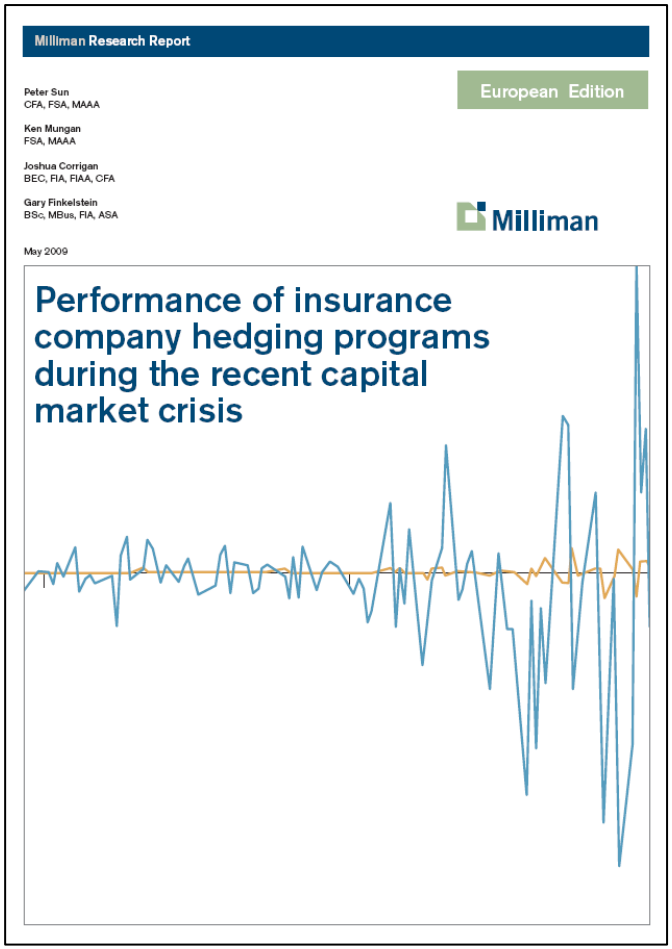


Impact on VA Market

- **Polarisation of the industry**
  - A few have exited, but those with robust risk management and who are experiencing the benefit of sales growth are committed to the product class and developing their manufacturing capability
- **Repricing and product innovation**
- **Demand increasing, product proposition strong as ever**
  - UK volumes exceeded £1.1 Bn in 2008, up 100% from 2007
  - With-profit bond sales up 77% in 2008 from 2007
  - Sales of retail structured products hit a record £9.7Bn in 2008, up 25% from 2007
- **Manufacturing vs reinsurance or wholesale banking**
- **Risk thresholds tightened**
  - Restricted funds
  - More extensive use of hedging with tighter risk rebalancing thresholds
  - 24 trading
  - More blocks of business and greater risk coverage (Greeks and fee revenue)

Milliman Hedge Effectiveness Reports

- May 2008
  - Survey of major US VA writers
  - 88% of respondents experiencing gains or unanticipated losses of less than 10 basis points of account value."
- Nov 2008
  - Survey of major US VA writer hedge programs over the Sep-Oct 08 period
  - US VA hedge programs have been 93% effective in achieving their goals
  - Saved the US VA insurance industry $40 Billion due to hedge gains
- May 2009
  - European VA hedge programs over the Sep-08 to Dec-08 period
  - Have been 94% effective in achieving their goals
- July 2009
  - US VA writers over Nov-08 to Mar-09
  - Programs have been 94% effective in achieving their goals


Milliman Research Report

Peter Sun
CFA, FSA, MAAA

Ken Mungan
FSA, MAAA

Joshua Corrigan
BEC, FIA, FIAA, CFA

Gary Finkelstein
BSc, MBus, FIA, ASA

European Edition

Milliman

May 2009

Performance of insurance company hedging programs during the recent capital market crisis

Use of hedging is increasing

Major Industry Issues

- Fixed annuities and exposure to bonds
- DAC write-downs
- Re-provisioning of guarantees
  - Insurance to investments SOP03-1 to FAS133/157
  - Write business cross-border (FOS/FOE/Reinsure)
  - Impact of Solvency II
- Hedge effectiveness
- Scope and use of hedging
  - Tighter risk rebalancing thresholds
  - 24 trading
  - More blocks of business and greater risk coverage (Greeks and fee revenue)

    ⇨**More hedging not less (not just for VA)**

Section 6
Lessons learned and a look into the future

Lessons Learned

- Vega / Gamma / convexity protection is important to protect mark-to-market balance sheets
- Ability to reprice quickly is important
- Liquidity of main forms of hedge instruments (futures and swaps) held up very well during the crisis
- Liquidity and credit risk of OTC based hedges was problematic
- Control of basis risk is important

The Future

- Product innovation continues
- Product prices will be more sensitive to market conditions
- Focus on core value proposition
- Wealth accumulation and decumulation product opportunities exist, driven by demographics
- Expansion in the use of hedging

Contact Details

Gary Finkelstein

gary.finkelstein@milliman.com

Milliman London
Financial Risk Management
Finsbury Tower 103-105 Bunhill Row
London EC1Y 8LZ

Ph: +44 (0)207 847 1500
Fx: +44 (0)207 847 1501

Heinz Holler

heinz.holler@milliman.com

Milliman GmbH
Maximilianstr. 35a
80539 München

Ph: +49 (0)89 5908 2390
Fx: +49 (0)89 5908 1200

Appendix

Variable Annuity Sales and Assets

Year	Sales ($ billions)	Growth Rate	Assets at 12/31	Growth Rate
2004	$129.9	2.7%	$1,154.6	18.2%
2005	133.2	2.5%	1,192.5	3.3%
2006	157.3	18.1%	1,388.3	16.4%
2007	178.6	13.5%	1,497.2	7.8%
2008	150.9	-15.5%	1,126.8	-24.7%

Source: Morningstar

Japanese VA Market

- 5 major companies announced either withdrawal from VA market or stop of selling certain products
- Some changed product to less risky design
- Some continue selling existing products to gain market share

Company	March-09			VA Business Restructuring
	Rank	Asset (billion $US)	Chg from Mar-08	
Hartford	1	26.2	(10.3)	Withdraw from annuity market (June 1, 2009)
Mitsui Sumitomo MetLife	2	20.1	(2.3)	Stop selling GMAB (April 1, 2009)
Sumitomo Life	3	19.3	0.3	Stop selling single premium GMAB (October 1, 2009)
ING	4	19.3	(1.9)	Withdraw from VA market (August 2009)
Tokio Marine Nichido Financial	5	18.5	(0.8)	Redesign products
Manulife	6	11.4	(0.4)	Redesign products
T&D Financial	7	6.6	0.7	
Mitsui Life	8	5.9	(0.4)	Withdraw from VA market (April 1, 2009)
Dai-ichi Group	9	5.4	2.3	
ALICO Japan (AIG)	10	4.7	(1.6)	
Others		6.5	0.5	
Total		143.9	(13.8)	

(*) Source: Hoken Mainich Shinbun