



**The Actuarial Profession**

making financial sense of the future

## Variable annuities – a global perspective

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17 September 2010

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# Agenda

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## Variable annuities

The US, Asia and Europe – three different stories

VAs are risky

Risk management for VAs

Impact of the 2008/9 crisis

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# Variable annuities (VAs) are life-insurance products with investment guarantees

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- They combine the advantages of traditional life-insurance products
  - long-term savings with a high degree of security and guaranteed benefits
- with the advantages of unit-linked products
  - upside potential
- They have
  - rich and transparent benefits,
  - can be linked to actively managed funds
  - have typically personal tax benefits, and
  - are sheltered from the policyholder's creditors.
- But: VAs generate high risks

# Unit linked products with guarantees can serve as an alternative to traditional products

## Unit linked with guarantee

- Transparent explainable guarantees
- Explicit charges
- Individually owned investment fund
- Backed by a tractable hedging programme



## Traditional Products

- Mechanism of policyholder profit participation not transparent
- Implicit charges
- Collectively owned investment fund
- Management of guarantees is difficult to understand from an external perspective

***Transparency to customers and shareholders***

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# There are four major types of VA-guarantees

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- **Guaranteed Minimum Death Benefits (GMDBs)**
  - guarantee in case of death. The death benefit will be the asset value of the contract or, if higher, the guarantee
- **Guaranteed Minimum Accumulation Benefits (GMABs)**
  - which offer guarantee at maturity
- **Guaranteed Minimum Income Benefits (GMIBs)**
  - which offer a guaranteed annuity income
- **Guaranteed Minimum Withdrawal Benefits (GMWBs)**
  - which allow the policyholder to withdraw a certain amount of assets at certain dates and to receive minimum payments
- **Roll-ups, resets and ratchets**

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# Drivers of demand

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- a growing number of individuals are reaching retirement age
- there is a growing pool of retirement assets and roll-over assets;
- only life insurers can offer lifetime guarantees
  - banks and mutual funds cannot provide such guarantees

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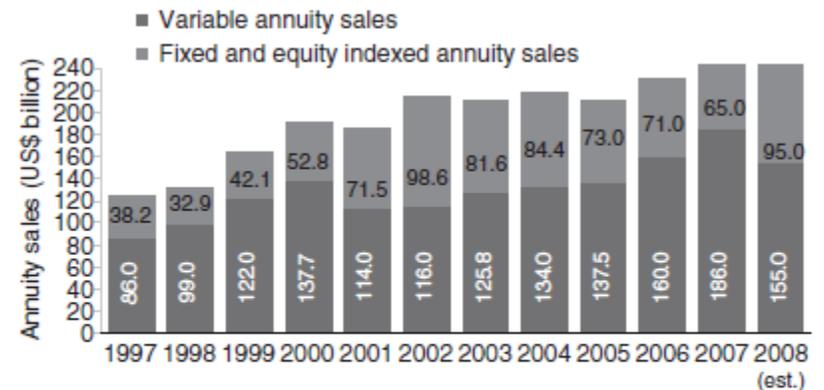
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# Slow start but tremendous growth in the US

- Initial launch in 1952 by TIAA-CREF
- Only in the mid 1990s the equity market boom drove up VA sales significantly
- By 2000 annual VA sales reached a peak of US\$138 billion
- US\$155 billion in 2008
- For 2009, VA sales were expected to drop further to approximately US\$130 billion

Figure 2.1 US annuity gross sales

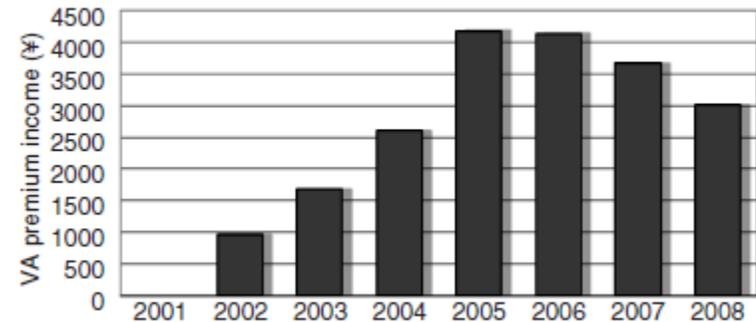


VA sales declined by 17% in 2008 from US\$186 billion to US\$155 billion.  
Source: Variable sales data from Towers Perrin VALUE Survey includes all non-pension VA premiums (first-year and renewal, separate account and fixed account). Fixed sales from LIMRA data includes deferred and immediate annuities, equity-indexed annuities and market value adjusted annuities (excludes structured settlements) and Towers Perrin estimates.

# A success story – VAs in Japan

- The success story for VAs in Asia began in Japan
  - driven by bancassurance
- Success factors
  - Strong savings culture
  - conservative investors
  - bad experience with pure equity investments
  - distributors earn commission income
  - bank's own mutual funds are basis for VAs

Figure 3.1 Development of VA production in Japan



¥1 billion = US\$11 million. Source: Life Insurance Association of Japan.

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# VAs in Europe did not take off yet, but are available by now

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- Introduction of TwinStar in Germany by Axa
- Closely followed by product launches by Aegon, Royal London and Lincoln
  - initially international insurance groups dominated the market
  - due to imported capabilities, infrastructure and experience
- In 2007 Axa expanded into Spain, Italy, France, Belgium and Portugal
- Allianz, Aegon and ING play catch up with Axa and are aggressively adding markets
- Local insurers now start to create their own VA-products
  - R+V, Ergo, Swiss Life

# GMWBs play an important role in Europe

**Table 4.1** VAs in Europe

Market	Company	Product	Type
Belgium	Allianz	Invest4Life	GMWB
Belgium	ING	LifeLong Income	GMWB
Belgium	MetLife	CitiVA	GMWB
France	AEGON/ La Mondiale	Terre d'avenir	GMWB, DB
France	Allianz	Invest4Life	GMWB
France	AXA	Capital Ressource	GMWB
Germany	Allianz	Invest4Life	GMWB
Germany	AXA	Twinstar	GMIB
Germany	Canada Life	Garantie Investment Rente	GMWB
Germany	ERGO	Global Top Return	GMAB, IB
Germany	Friends Provident	FriendsPlanPrivate	GMAB
Germany	R+V	Premium-Rente Garant	GMWB
Germany	Swiss Life	Swiss Life Champion	GMAB
Hungary	ING	Europerspektiva	GMAB
Italy	Allianz	Invest4Life	GMWB
Italy	AXA	Accumulator	GMWB, AB
Italy	Generali	Risparmio	GMWB, AB
Luxembourg	Old Mutual	Beacon Navigator	GMIB, DB, WB

September 1, 2009, data, based on the author's independent research.  
Sources: company websites; Société Générale Monitor; Milliman; business press.

**Table 4.1** VAs in Europe (cont.)

Market	Company	Product	Type
Netherlands	ING	RVS Guarantee Perspective	GMAB, DB
Netherlands	SNS Reaal	Principal Protection 3	GMAB
Poland	ING	Europerspektiva	GMAB, DB
Poland	MetLife	Citi VA Orchidea	GMWB
Portugal	AXA	Accumulator	GMAB
Spain	AXA	Accumulator Futuro	GMAB, DB, WB
Spain	ING	Generacion F unico	GMAB
Spain	MetLife	Citi VA (Avida)	GMWB
Switzerland	AXA	Twinstar	GMAB
Switzerland	Baloise	RentaSafe	GMWB
Switzerland	Generali	Investment PlanPlus	GMAB
Switzerland	Swiss Life	Champion	GMIB
UK	AEGON	5 for life	GMWB
UK	AIG	Living Time 75	GMWB, AB, DB
UK	Hartford	Platinum	GMWB, IB
UK	Hartford	SafetyNet	GMDB
UK	MetLife	Trustee Investment Plan	GMWB
UK	MetLife	MetLife Guaranteed Bond	GMWB
UK	Prudential	Pru Flexible Retirement	GMAB

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# There are shortfall and pricing risks for VAs

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- **Shortfall risk**
  - the risk that, due to insufficient asset performance of the underlying assets or adverse development of insurance risk, the assets are not sufficient to cover the guarantees
- **Pricing risk**
  - the risk that the price of the guarantees is inadequate
  - The main pricing risk is model risk, caused by inadequate pricing models including inadequate calibration.

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# Dynamic hedging does not remove all risks

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- long-term volatility risk
- interest-rate risk
- gamma risk
- foreign exchange risk
- basis risk
- dividend risk
- funds choice risk
- other policyholder behaviour risk
- liquidity risk
- counterparty credit risk
- key-person risk
- other operational risks
- correlation risks
- bond credit-spread risk
- pricing credit-spread risk
- liquidity for collateral risk
- transaction cost risk
- cost of capital risk
- cost of risk management risk
- opaqueness premium risk

**These risks are typically not eliminated but only transformed**

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# The valuation of VAs is by no means easy

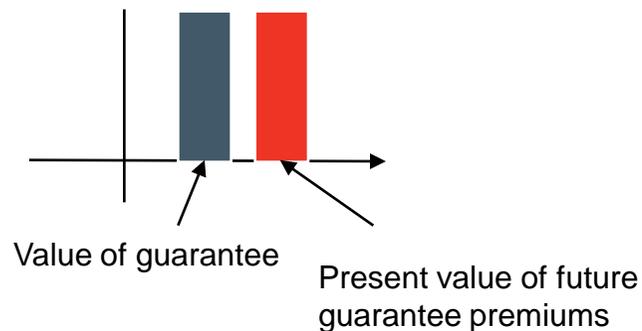
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- valuation of the underlying unit-linked contract
  - typically deterministic, using a certainty-equivalent approach
- valuation of the embedded options, reflecting the guarantees
  - typically using risk-neutral valuation
  - as the embedded options are in most cases path-dependent a stochastic simulation approach has to be applied
    - requiring an economic scenario generator
    - with an adequate calibration and representation of risk factors
    - implicit assumptions of the pricing model are easily overlooked and may lead to unrecognised risks

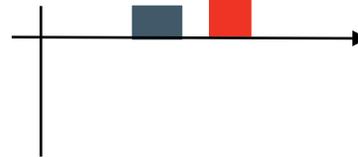
All these approaches interpolate, and to a great extent, extrapolate, the value of a VA guarantee from observed prices of instruments traded in a liquid market

# Policyholder behaviour needs to be considered in pricing and hedging

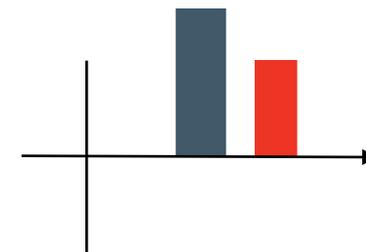
- The company charges guarantee premiums spread over the life-time of the policy and plans a certain income from these
- The value of the guarantee for the client however fluctuates with the markets
  - and may decrease to 0
  - as well as increase dramatically



Situation at start



Out of the money lapsation:  
why should the policyholder  
continue?



In the money  
persistency: why should  
the policyholder lapse?

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# There are different ways to manage risks from VA products

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Hedging	<ul style="list-style-type: none"><li>■ Effectively required for large companies</li><li>■ Mix of dynamic hedging and static hedging optimal</li></ul>
Investment Bank Solutions & Reinsurance	<ul style="list-style-type: none"><li>■ OTC derivatives</li><li>■ Reinsurance again available</li><li>■ Counterparty risk</li></ul>

# Product design is the most important risk management tool

- What guarantees should I offer and what options are available to structure the charges for the guarantees?
- Which underlying funds should be made available and do these allow to control **basis risk** and **long term volatility risk**?
- What product features can be used to manage **policyholder behaviour risk** and what are the reasonable assumptions for policyholder behaviour?
- What is the basis for the surrender value? What is the implication of regulation on surrender values?



## Design features

- Features that can help manage risks (e.g. basis risk, long term volatility risk and policyholder behaviour risk) and/or increase the competitiveness of the product:
  - Type and level of guarantee and charging structure for guarantee
  - Surrender values and surrender charges
  - Choice of underlying investment portfolios
  - Tax, legal and regulatory requirements

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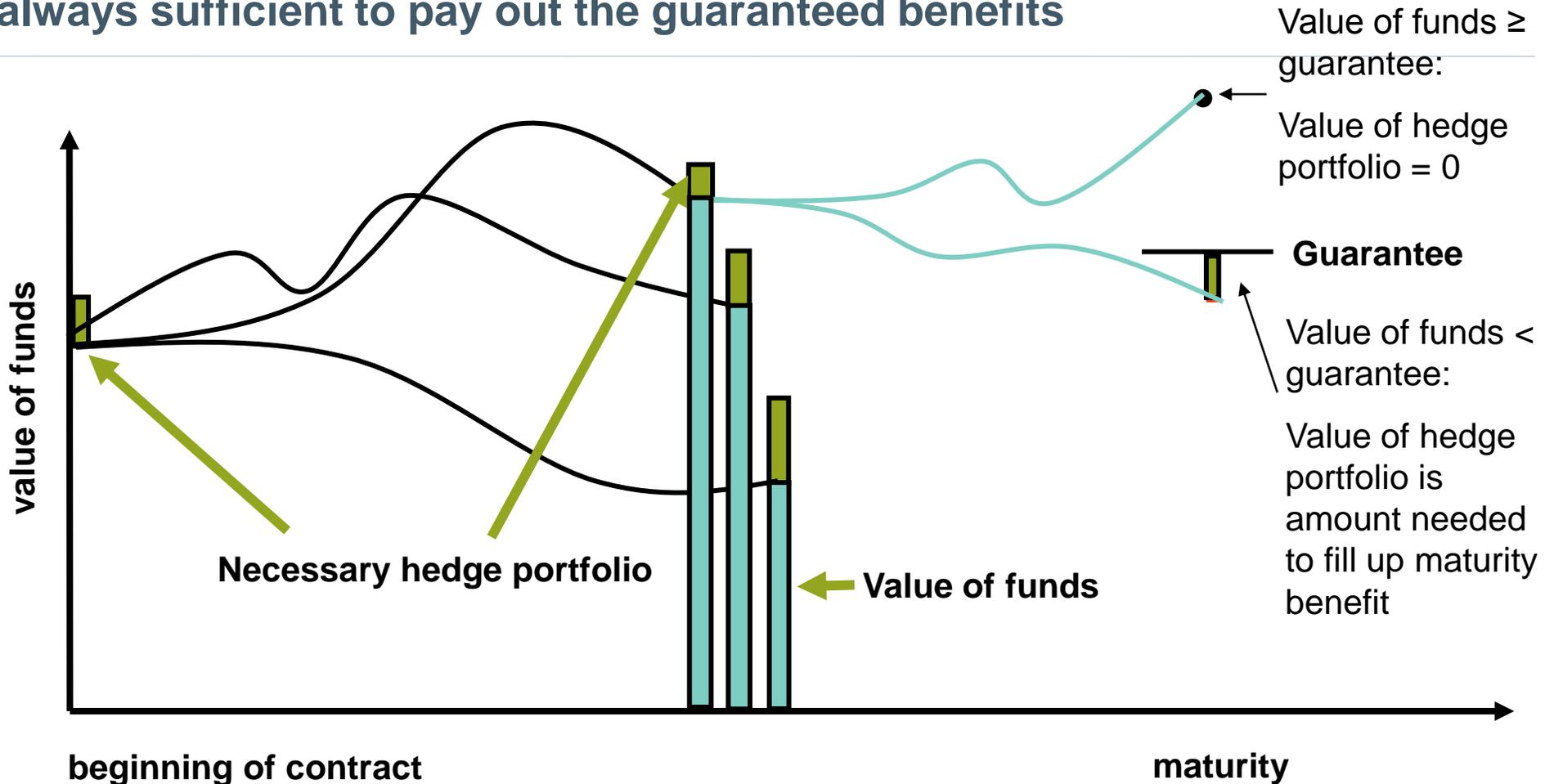
# Typically, following risks should be mitigated by product design

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Basis risk	funds selection / creation
Long term volatility risk	pricing, asset reallocation, funds creation, vol swaps
Policyholder behaviour risk	pricing, surrender values, structure of benefits

as of 2007

# Dynamic hedging ensures that the hedge portfolio is always sufficient to pay out the guaranteed benefits



Dynamic Hedging is a continuous process

Dynamic hedging works on a portfolio level

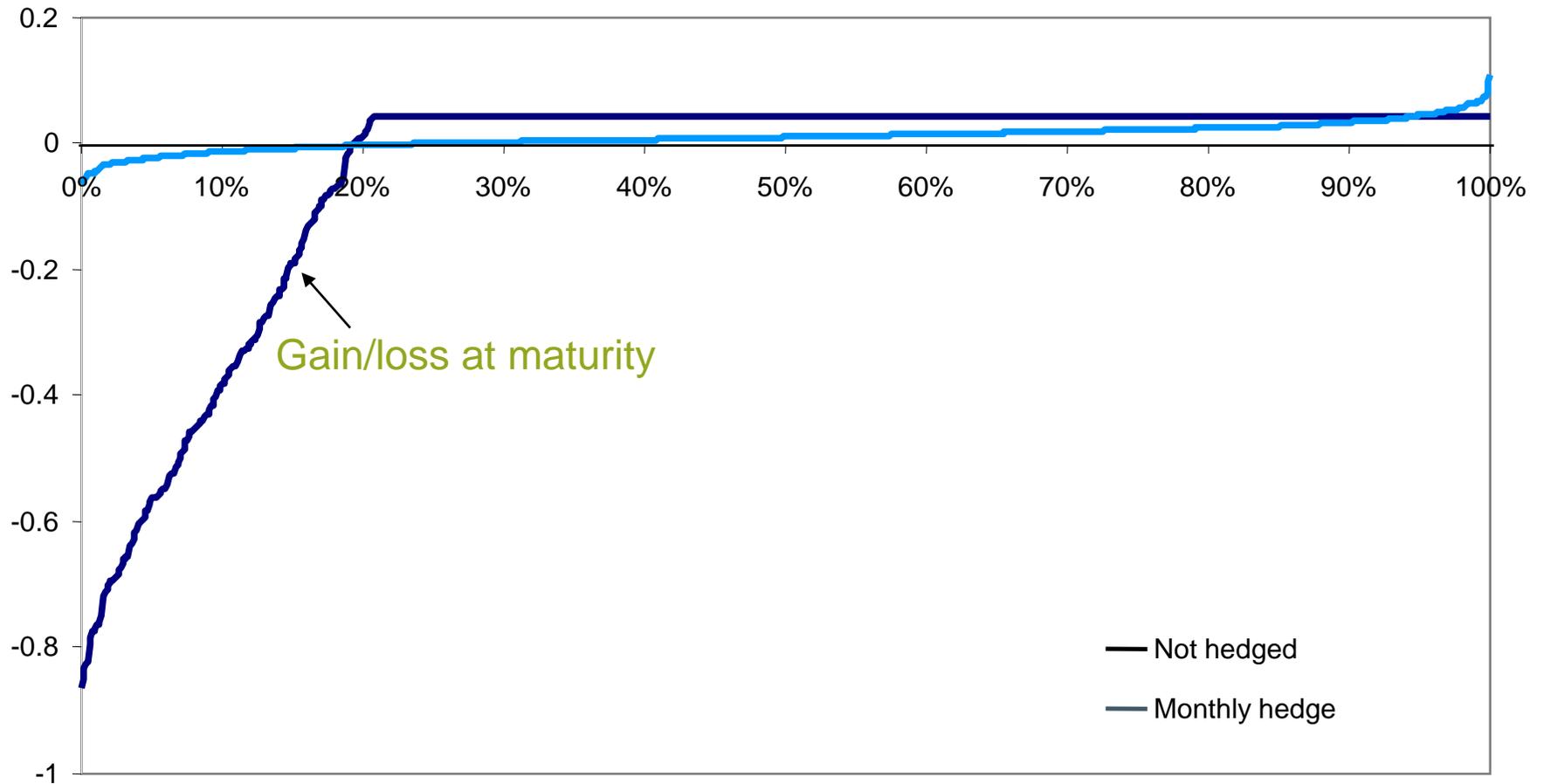
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# Proper risk reporting is a must when hedging

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- **Quantifying risk exposure**
  - **but be aware of the fact that a mark-to-model means that you take an implicit view**
  - **net greeks, but also**
  - **scenario-analysis, i.e. „what can go wrong“**
- **Historical hedge effectiveness analysis**
- **Explain hedge slippages**

# The dynamic hedging effect



Most adverse scenario

All possible scenarios

Best possible scenario

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# Did Hedging Work?

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- fourth quarter of 2008
  - sharp hike in implied volatility → significantly increased the cost of hedging
  - lower interest rates → higher cost of future guarantees
- VA writers incurred high losses:
  - Basis risk introduced by managed funds
  - Too rich benefits (especially too high ratchet frequencies)
  - Inconsistent hedging models
    - Valuation assumptions different from financial reporting assumptions
- But losses would have been far higher without hedging
  - Hedging saved 40 billion USD

**Hedging worked - but only if applied properly**

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# Not all is lost...

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- The Hartford lost 90% of market capitalisation
- Axa stopped Twin Star in Germany
- Simplification of products – less rich features
- Passive underlying funds
- Volatility controlled funds
- Re-emergence of (I)CPPI
- Soft guarantees – indexed to floating or average
- Still strong interest – not much alternatives in low interest environments

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# Main risks coming home...

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Basis risk

Only benchmark indices hedged  
95% correlation is not enough

Long term volatility risk

Volatility spike unhedged

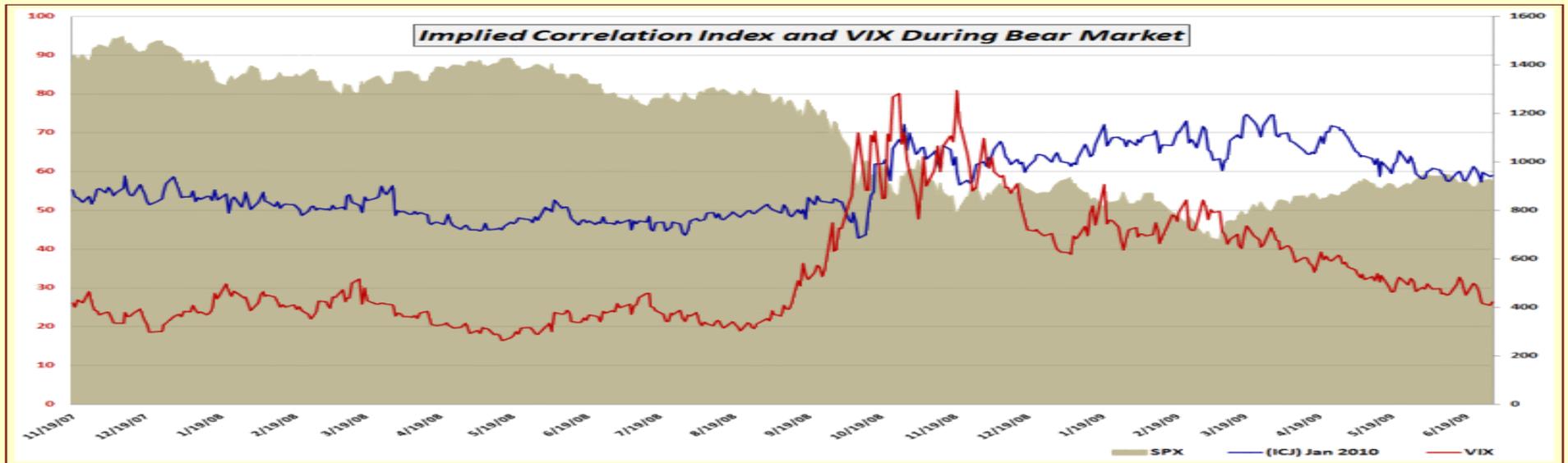
Policyholder behaviour risk

Mass lapses

Plus Hedging weaknesses

as of 2009

# Volatility and correlation increased, driving up hedging costs



[source: CBOE]

FIGURE 1: EXPECTED HEDGE COST (IN BPS OF GUARANTEED WITHDRAWAL BASE - SEE INDEX METHODOLOGY FOR DETAILS)



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