European Actuarial Academy

an initiative of the 'Deutsche Aktuarvereinigung', the Dutch 'Actuarieel Genootschap', the 'Schweizerische Aktuarvereinigung' and the 'Aktuarvereinigung Österreichs'

Non Traditional Pricing
- Alternative Risks -

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Traditional pricing

Traditional pricing

- Collective risk equalization by using actuarial techniques within the risk collectives; the risk collectives cover liabilities/claims

- Life insurance: Liabilities backed by technical provisions that cover the liabilities; prudent calculation of the used guaranteed interest rates; guaranteed interest rates financed by an intelligent asset mix that follows legal principles of balancing rentability, liquidity and prudency

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- Life insurance: Profit participation for the policyholders as a result of prudent calculation of interest rates; collective participation of the policyholders by bonusses that follow a portfolio interest rate

Non-traditional pricing: Overview

Non-traditional pricing = transfer of insurance risks to the capital market

Main risk exposure in life insurance:

- Mortality risks, longevity risks
- Investment risks
- Interest-rate risks

Main risks in non-life insurance

- CAT-risks

Principal question: Can these risks be hedged by the capital market against the background that the capital maket has another dimension of capacity than the global insurance capacity ?

Life insurance: Non-traditional pricing

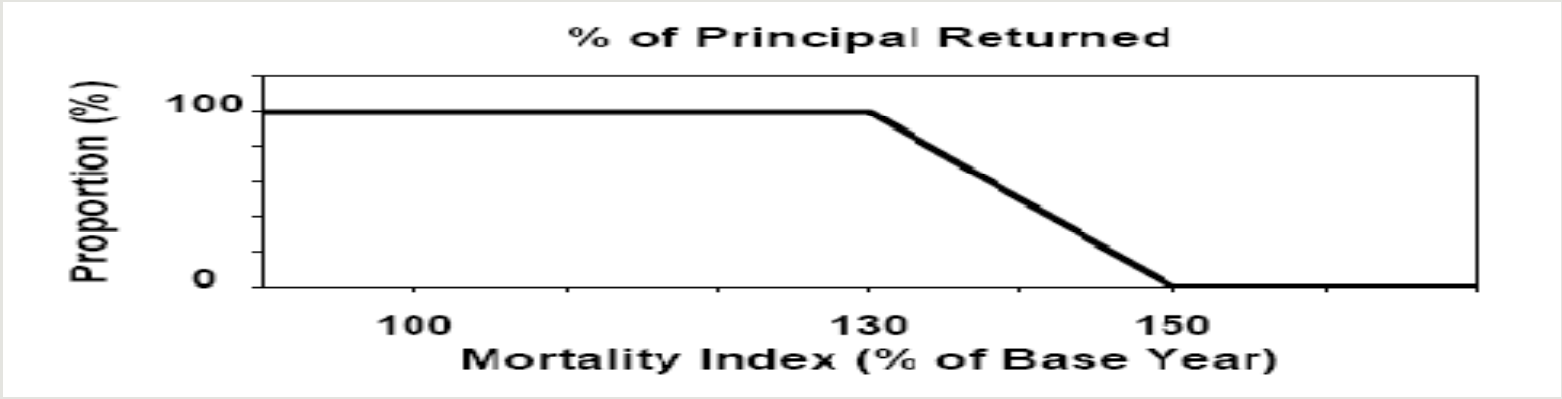
Example: Mortality Bond of Swiss Re, 2003 - 2007

Reference index: Mix of mortality rates in several countries (U.S.A. 70%, U.K. 15%, France 7,5%, Switzerland 2,5%, male 65&, female 35%); index tailored to Swiss Re exposure

Principal: 400 Mio US-Dollar; hedges exposure to Mortality-CAT-risks (severe outbreak of influenca, major terrorist attack,natuaral desaster)

Principal-at-risk: If measured mortality index greater than 130% of reference index; principal exhausted if measured mortality index greater than 150% of reference index

Quarterly coupon: 3 month U.S. Dollar Libor + 135 bps (rather attractive)



Life insurance: Non-traditional pricing

Example: Mortality Bond of Swiss Re, launched 2003

Payment at maturity (T)	$100\% - \sum_t loss_t$	if $\sum_t loss_t < 100\%$
	0%	if $\sum_t loss_t \geq 100\%$
Loss percentage in year t $= loss_t$	0%	if $q_t < 1.3q_0$
	$[(q_t - 1.3q_0)/(0.2q_0)] \times 100\%$	if $1.3q_0 \leq q_t \leq 1.5q_0$
	100%	if $1.5q_0 < q_t$

where:

q_0 = base index

$q_t = \sum_j C_j \sum_i (G^m A_i q^m_{i,j,t} + G^f A_i q^f_{i,j,t})$

Key :

$q^m_{i,j,t}$ = mortality rate (deaths per 100,000) for males in the age group i for country j

$q^f_{i,j,t}$ = mortality rate (deaths per 100,000) for females in the age group i for country j

C_j = weight attached to country j

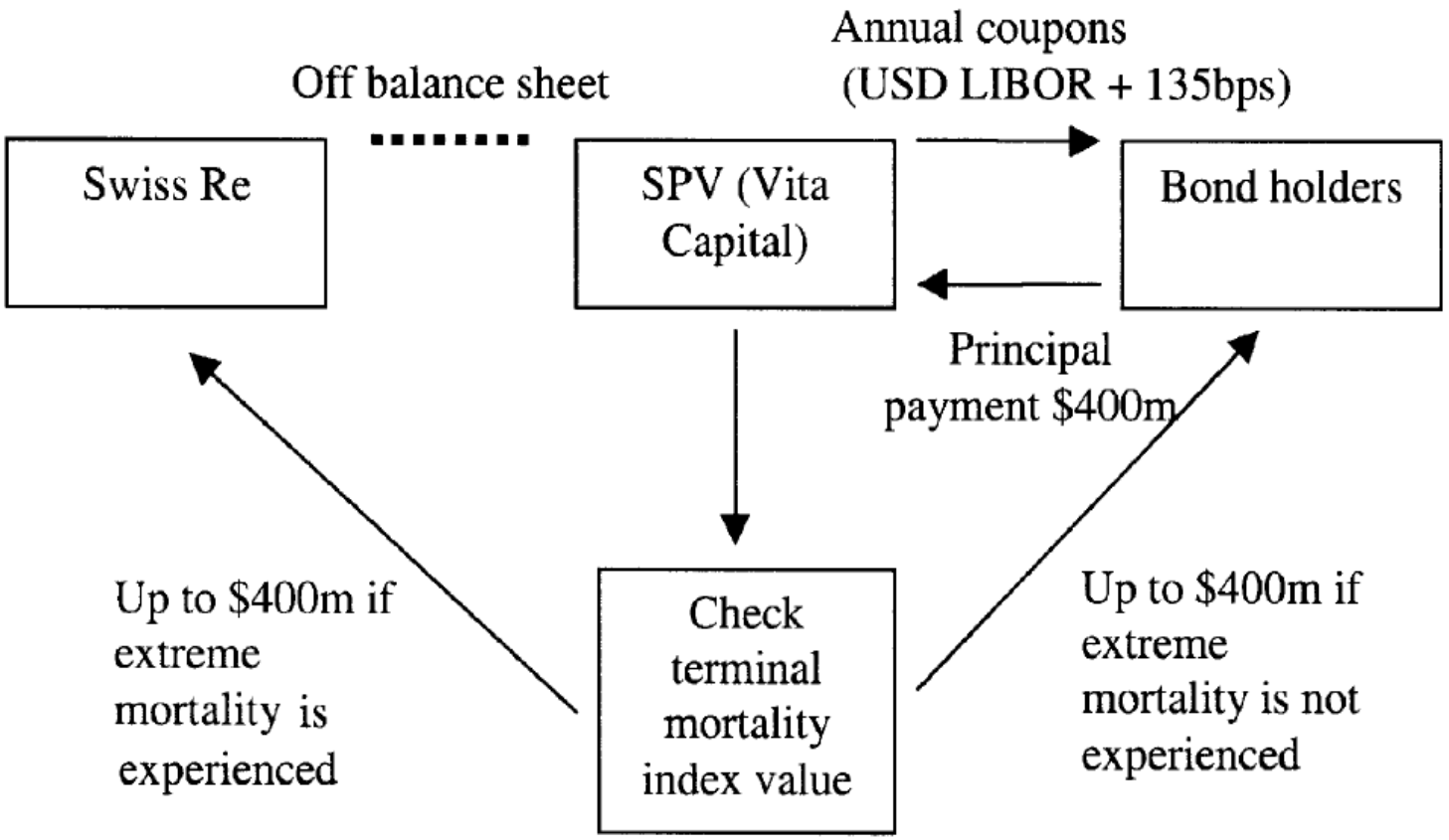
A_i = weight attributed to age group i (same for males and females)

G^m and G^j = gender weights applied to males and females respectively

The following country weights apply:
U.S.A. 70%, U.K. 15%, France 7.5%, Italy 5%, Switzerland 2.5%, male 65%, female 35%.

Life insurance: Non-traditional pricing

The structure of Swiss Re mortality bond



Life insurance: Non-traditional pricing

Example: Variable Annuities

are unit-linked products based on normal funds with additional guarantees based on capital market instruments:

- GMIB = Guaranteed Minimum Income Benefit
- GMAB = Guaranteed Minimum Account Benefit
- GMDB = Guaranteed Minimum Death Benefit
- GMWB = Guaranteed Minimum Withdrawal Benefit

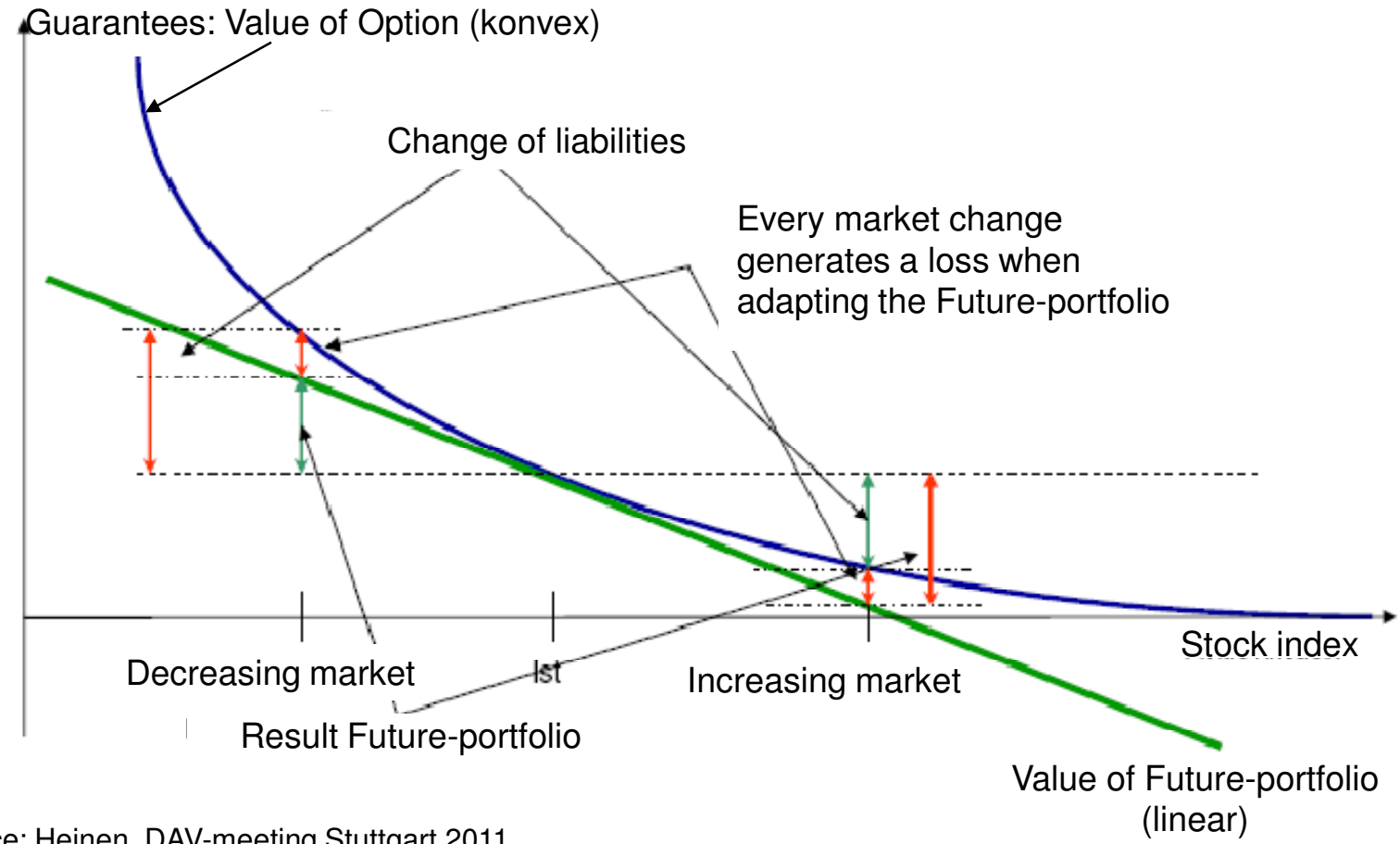
The guarantees are priced by an additional fee of around 15-200 bps plus 0-5% of the regular premiums for the unit-linked policy, depending on the profile of the policy (many variants)

The guarantees are hedged by an hedging portfolio that is appromimating the value of the guarantees.

Life insurance: Non-traditional pricing

Variable Annuities: Hedging the guarantees

- Value of option of future-portfolio dependent on changing markets -



Source: Heinen, DAV-meeting Stuttgart 2011

Life insurance: Non-traditional pricing

Variable Annuities: Hedging the guarantees

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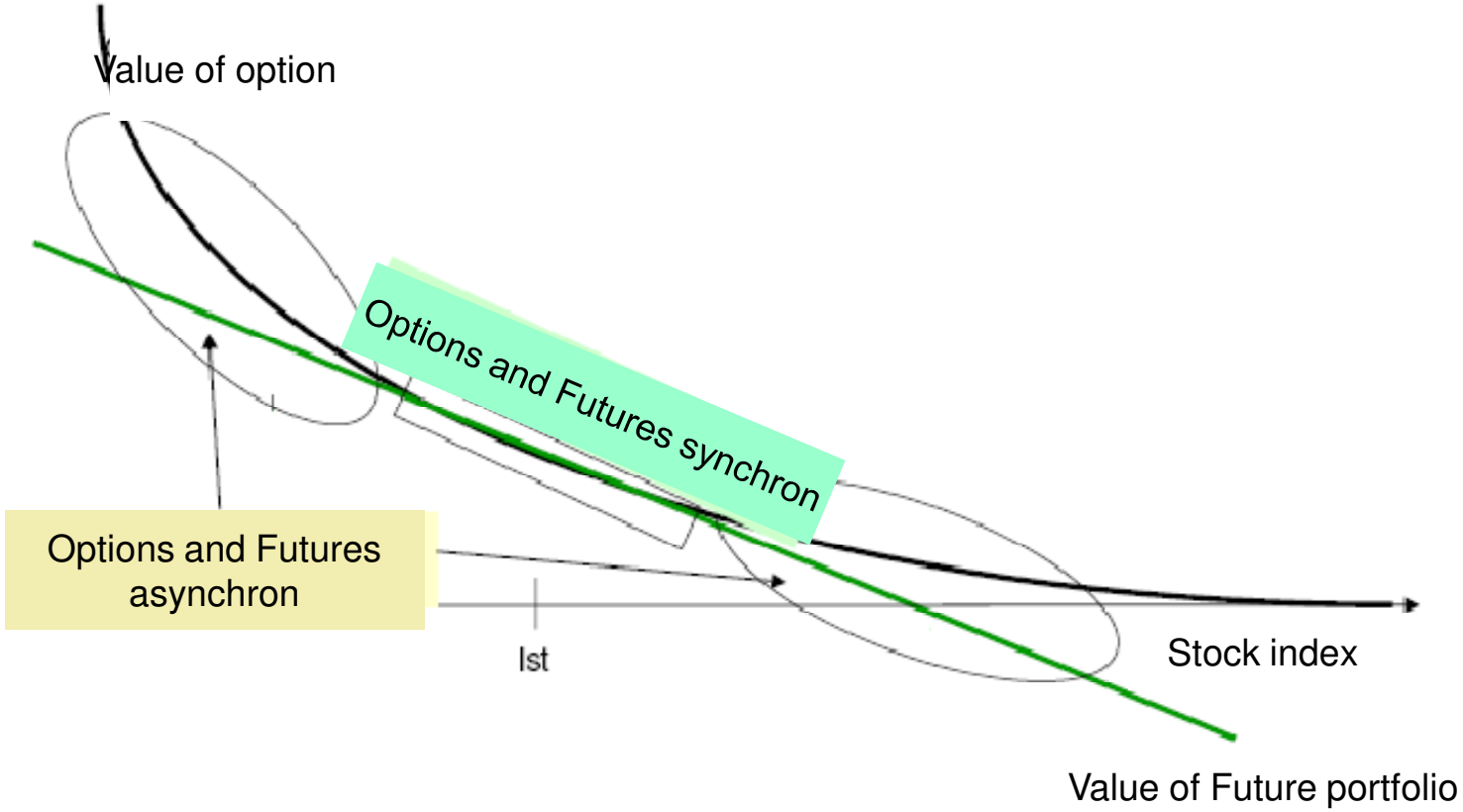

Life insurance: Non-traditional pricing

Variable Annuities: Hedging the guarantees

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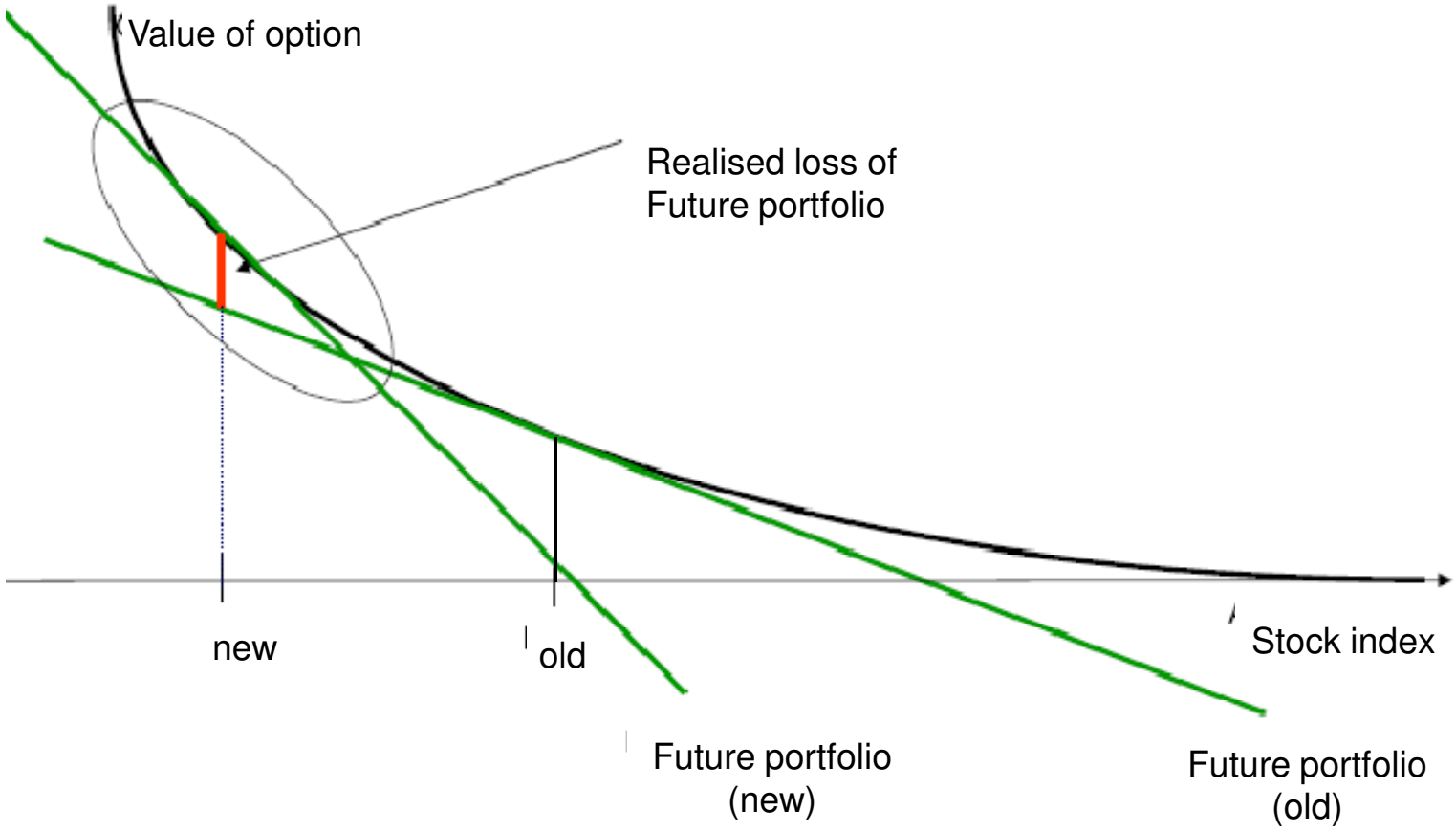
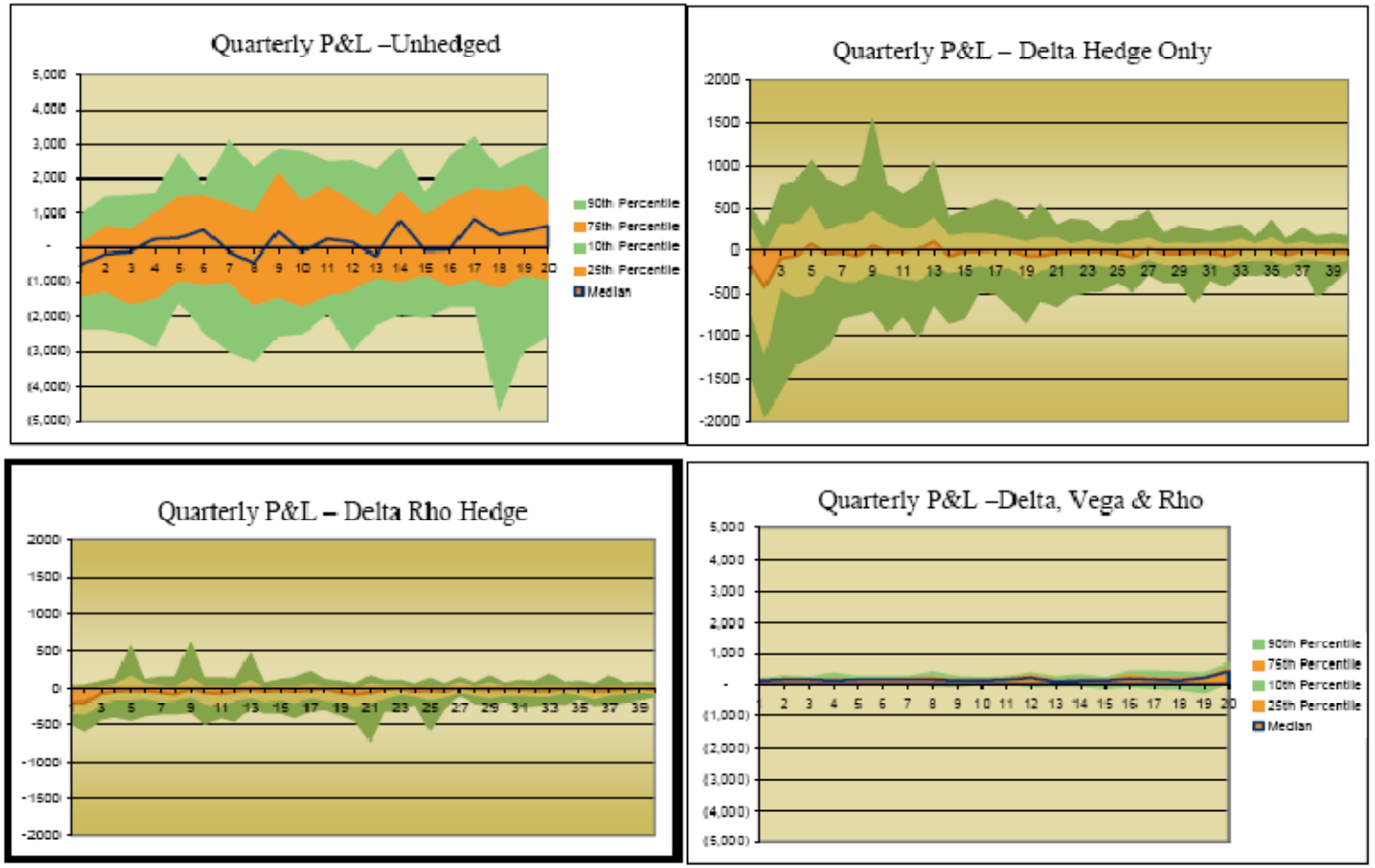


Life insurance: Non-traditional pricing

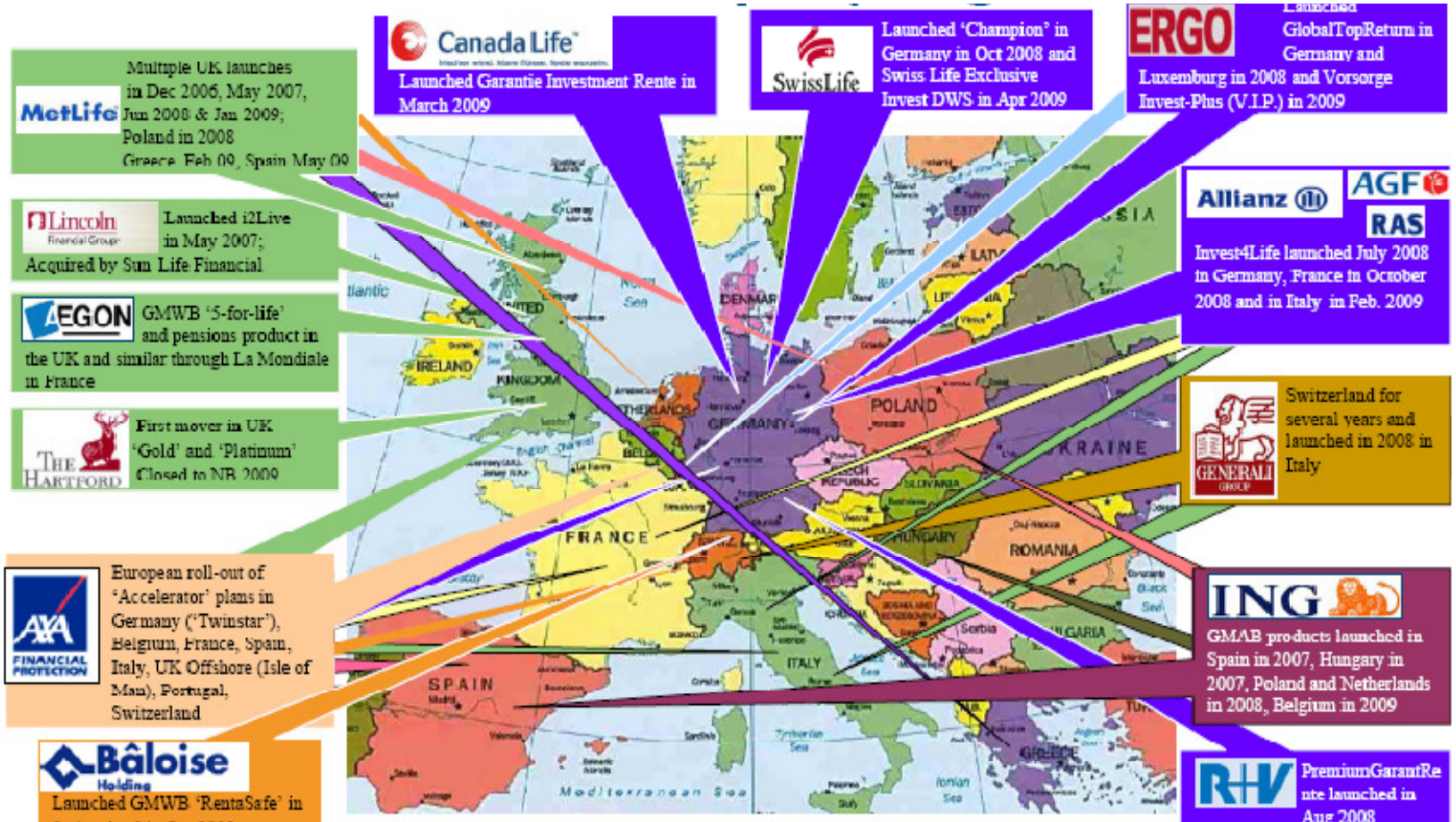
Variable Annuities: Quality of hedging



Source: Finkelstein/Holler, Variable Annuity Risk Managment, AFIR/Life Congress, Munich 2009

Life insurance: Non-traditional pricing

Variable Annuities in Europe (August 2009)

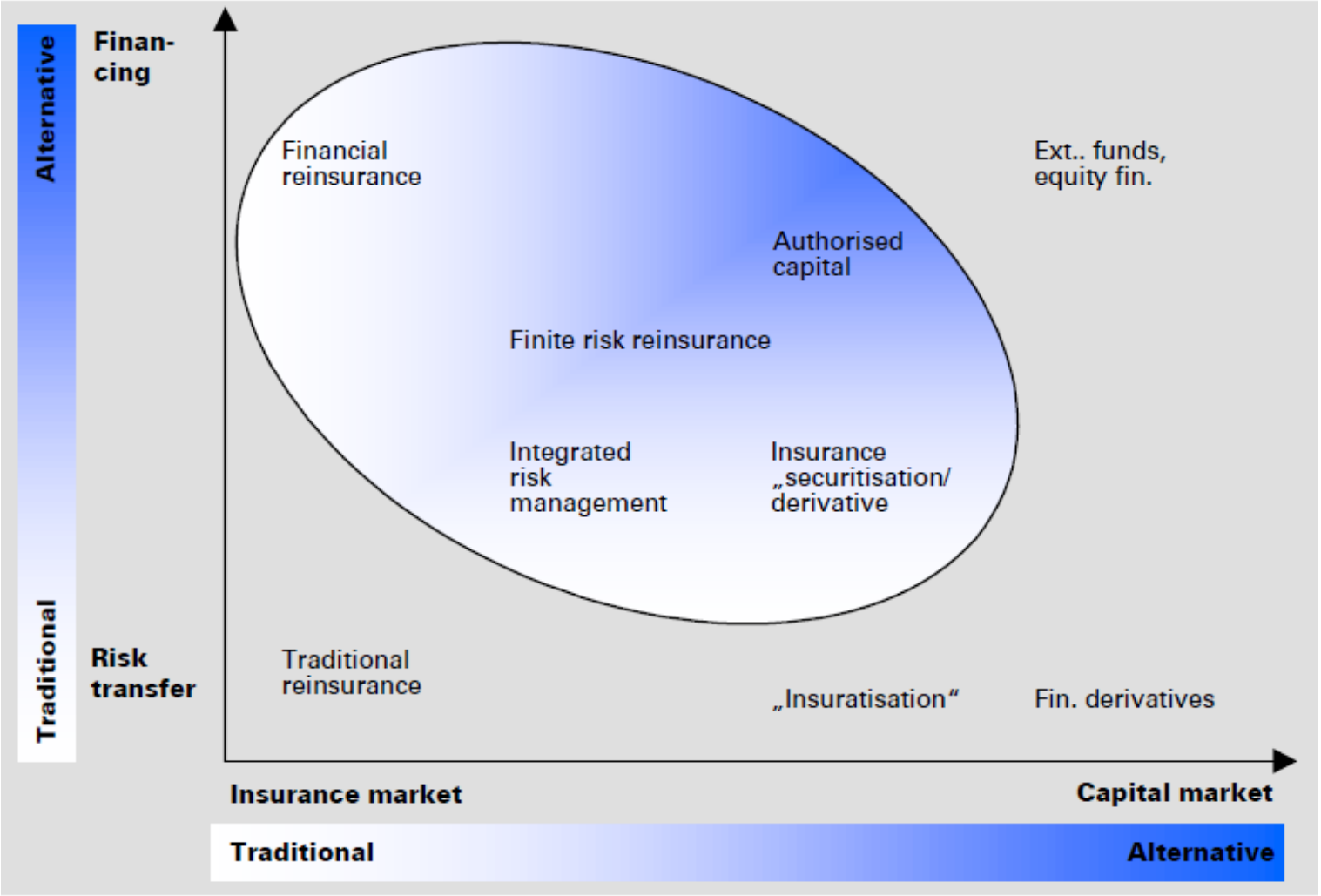


Source: Milliman

There is significantly more non-public activity

Non-life insurance: Non-traditional pricing

Traditional reinsurance versus non-traditional reinsurance



Source: MunichRE

Non-life insurance: Non-traditional pricing

Alternative Risk Transfer (ART)

= New forms of reinsurance by use of the capital market

- Asset Hedge: Claims for payments are hedged by compensation of another claims for payments:
  → Classical reinsurance, derivaties
- Liability-Hedge: Claims for payment are hedged by a corresponding reduction of the liabilities on the liability side of the balance sheet:
  → Insurance Linked Bonds (ILB)
- Leverage Management: Claims for payments are hedged by equity injection
  → Equity Puts

Non-life insurance: Non-traditional pricing

Effects of Alternative Risk Transfer on balance sheet

Source: Schradin, Finanzielle Steuerung der Rückversicherung (1998)

Non-life insurance: Non-traditional pricing

Example: CAT-Risks insured by capital market:

- Insurance linked bonds (ILB)
  - Bonds are issued based on insurance risks
  - Principal-at-risk and/or coupon-at-risk
  - ILB as a liability hedge; risk capital is prefinanced
- Derivatives
  - Derivatives (futures, forwards, swaps); underlying based on insurance risks (triggers)
  - Prominent example: Weather derivatives
  - Derivative as an asset hedge; risk capital is financed at maturity

Non-life insurance: Non-traditional pricing

Insurance Linked Bonds (ILB)

- Fixed-or floating-rate securities with conditional payment (maturity, interest payments, repayment shape and height), is dependent on an insured event (trigger):
  - Principle-protected bonds: unconditional repayment
  - Principle-at-risk bonds: Conditional repayment depends on the insurance event (eg, hurricane, earthquake, exceeding a defined level of damage)
  - Coupon payments unconditional or conditional (coupon-at-risk)
- Initial application in the field of CAT risks, increasingly used in other areas of insurance (Mortality bonds, longevity bonds, motor bonds, etc.)
- The bonds are on the investor side by relative independence from the capital market and are therefore well suited for diversification

Non-life insurance: Non-traditional pricing

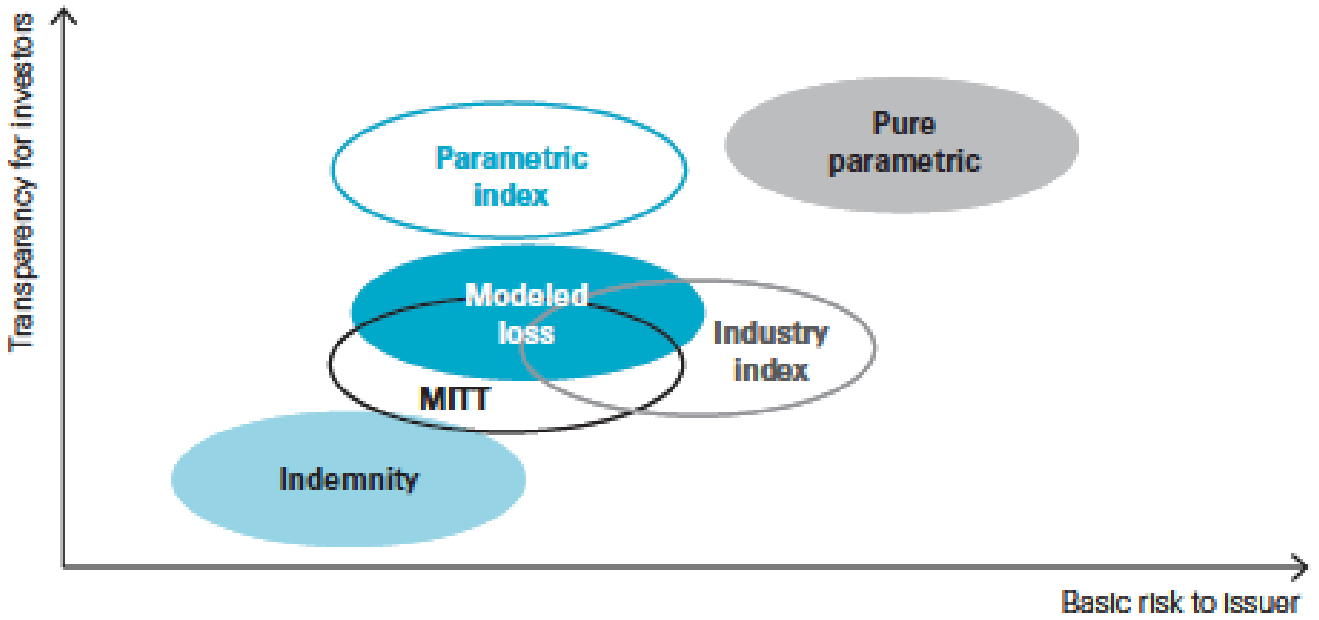
Insurance Linked Bonds (ILB)

Trigger Types

- Indemnity trigger
  - Reaching or exceeding of a certain amount of loss by an insurer
- Industry index
  - Reaching or exceeding of a certain industry-specific level of damage
- Modelled Loss
  - Mathematical models, whose data is based on physical events
- Parametric trigger
  - Dependent on physical parameters (wind speed, scale earthquake, etc.)
- Hybrid trigger
  - Mixture of different types of triggers

Non-life insurance: Non-traditional pricing

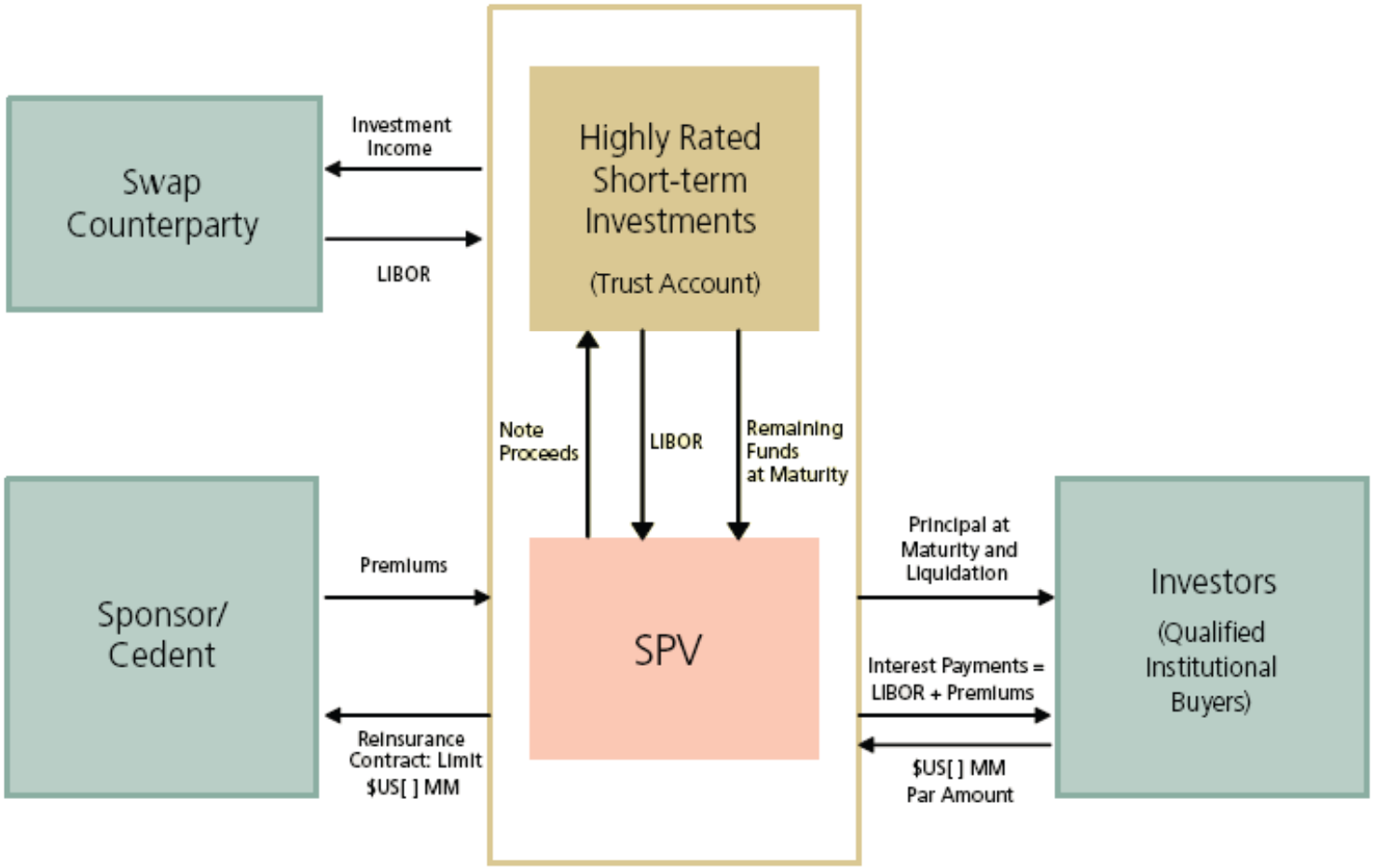
The transparency and basic risk for various types of triggers



Source: Swiss Re Capital Markets

Non-life insurance: Non-traditional pricing

Structure of Insurance Linked Bonds (ILB)



Guy Carpenter, The Catastrophe Bond Market at Year–End 2007, 2008

Non-life insurance: Non-traditional pricing

Derivate

- Insurance-Futures at stock exchange
  → In case of occurrence of damage (underlying) predefined financial compensation

- Insurance-Options at stock exchange
  → Is based on a futures contract

- OTC- Insurance-Derivaties
  → Prominent example: Weather derivatives

- OTC-Insurance-Options

- OTC Insurance-Swaps
  → Regular payments LIBOR + Spread in % against contingent payment

Non-life insurance: Non-traditional pricing

Example 1: Weather Derivative

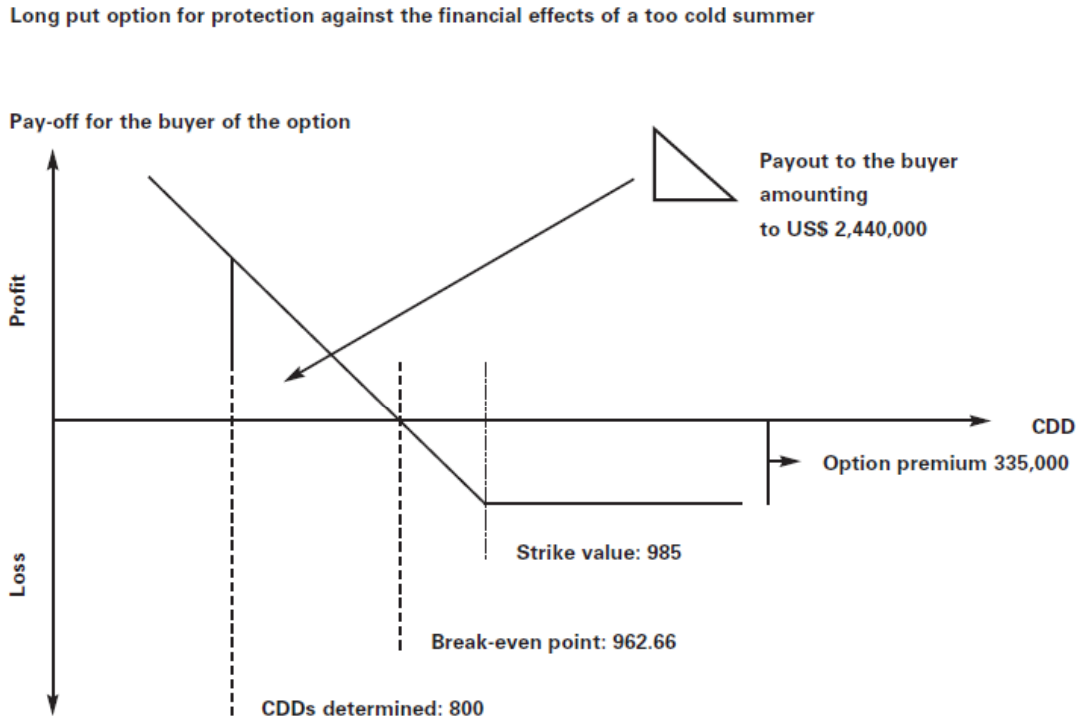
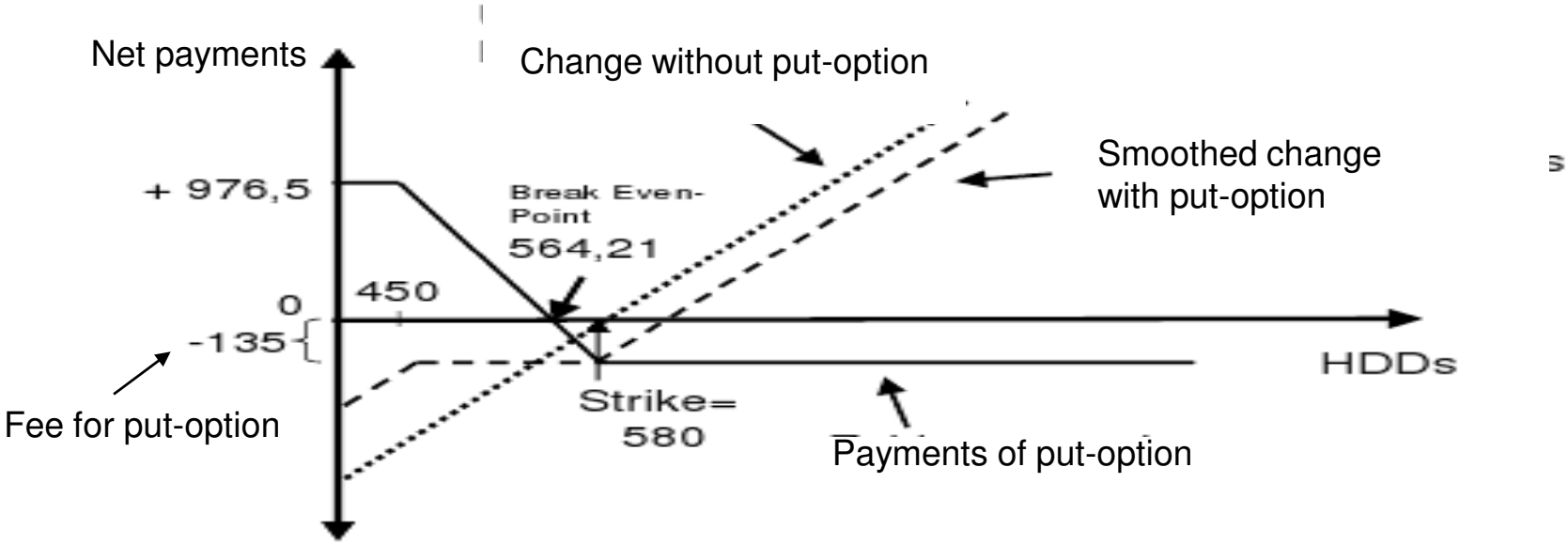


Figure 3: Exemplary pay-off diagram of a long put

Story:This positive result result for the buyer of this option means that he can partly or even fully compensate for the revenue lost due to the weather conditions and, in extreme cases,possibly evenpocket windfall profits

Non-life insurance: Non-traditional pricing

Example 2: Weather derivative



Story (energy provider): Hedging the change of turnover because of weather disasters

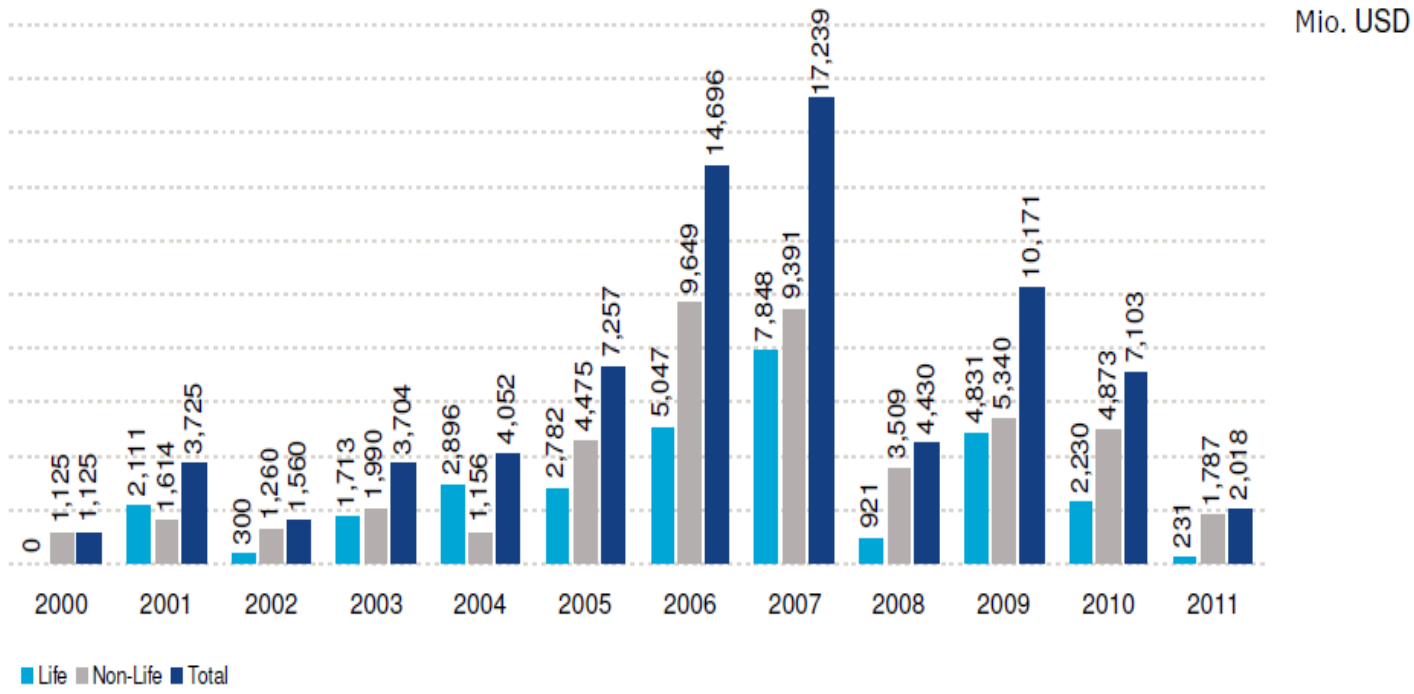
Non-life insurance: Non-traditional pricing

ART – Consequences and problems

- Basis risk
  → Underlying not exactly consistent with the damage
- Moral Hazard and Adverse Selection
  → Possibility of manipulation by asymmetric information
- Credit risk
  → At ILB restricted, limited to derivatives, but possible
- Duration and flexibility
  → Short durations, high flexibility, but IBNR problem
- IBNR
  → Claims payment can be beyond the expiration of contract
- Cost and price issues
  → Depending on market, high transaction costs at ILB
- Volatility of capital market
  → Great importance of the situation in the capital markets
- Regulatory Aspects
  → Recognition as reassurance not always guaranteed

Market situation

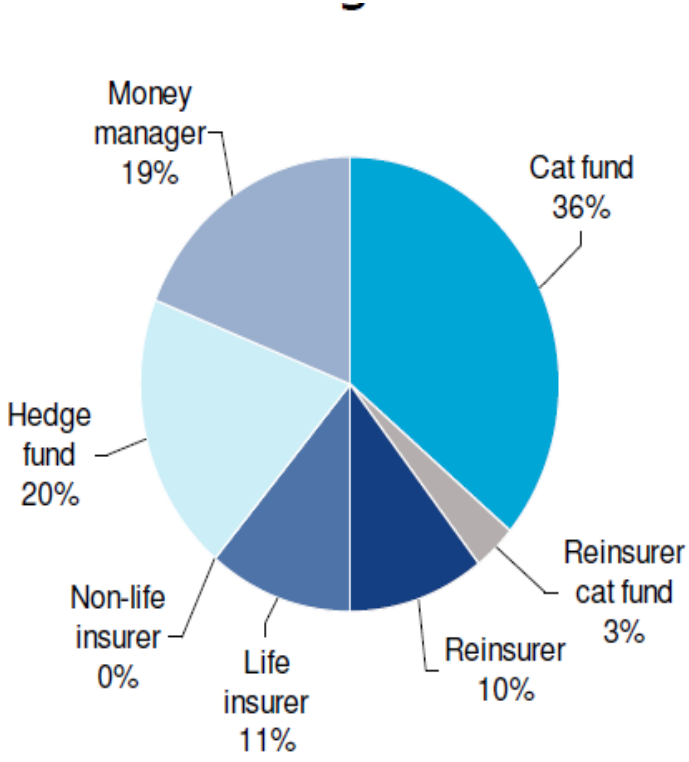
Development of the market volume

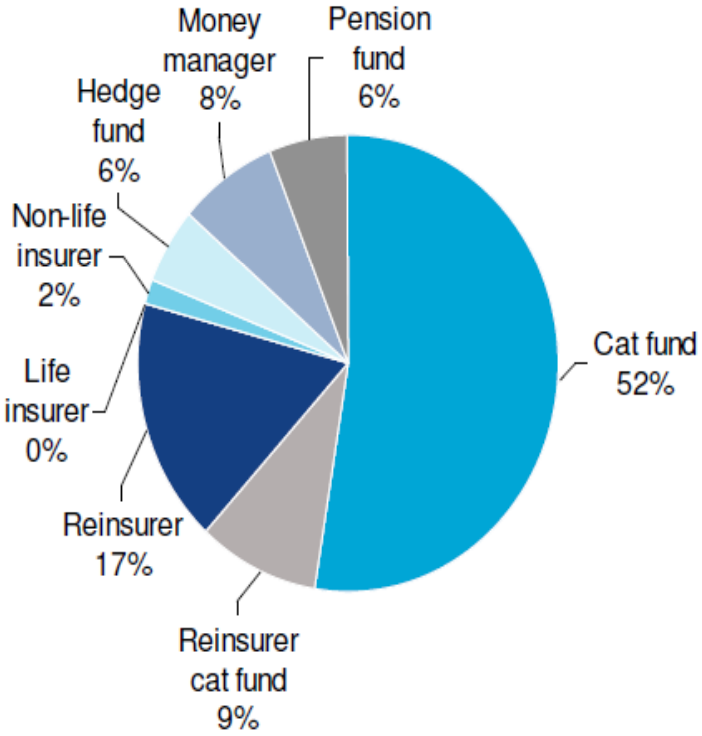


Quelle: Goldman Sachs/Hannover Re Ende Juni 2011

Market situation

Changement of investor behaviour (2004 and 2010)

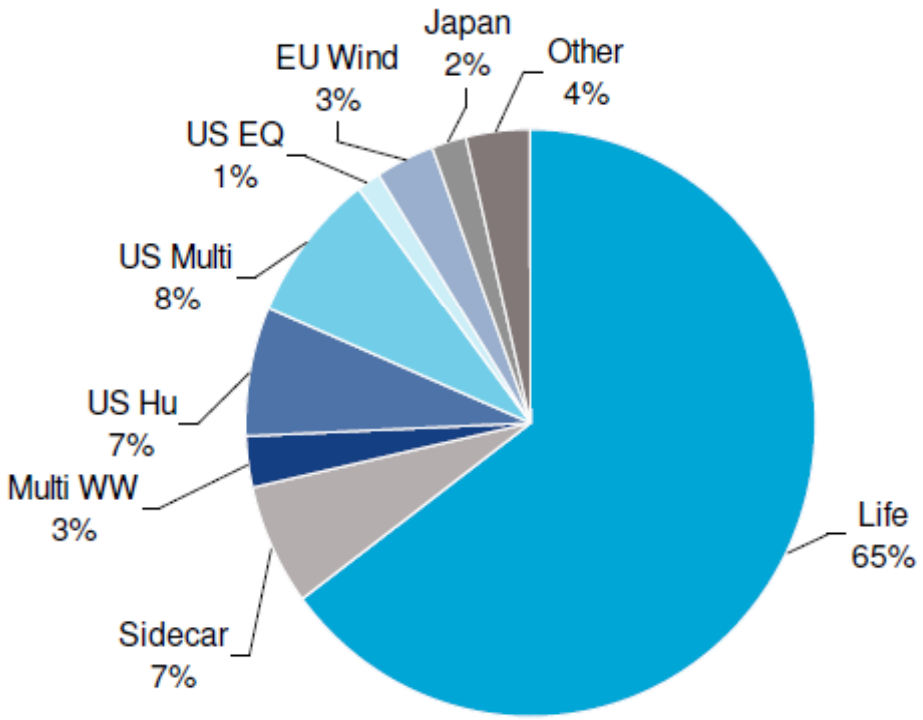




Quelle: Goldman Sachs Ende 2010

Market situation

Market volume 2010: 45,3 Billion USD



Quelle: Goldman Sachs/Hannover Re Ende 2010

Thank you for your attention !

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