

Life Protection Seminar

A Focus on Pricing & Valuation Strategies in a (Re)Insurance Environment of Increased Risks

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Münchener Rück
Munich Re Group



Agenda

- ❑ Global **Financial Crisis** background
- ❑ Impact of the crisis on **capital**
- ❑ Impact of the crisis on **products/pricing**
- ❑ **Risk Models** - developing and utilizing pricing models in unstable times
- ❑ **ERM** & Financial Crisis
- ❑ **ERC** & Financial Crisis

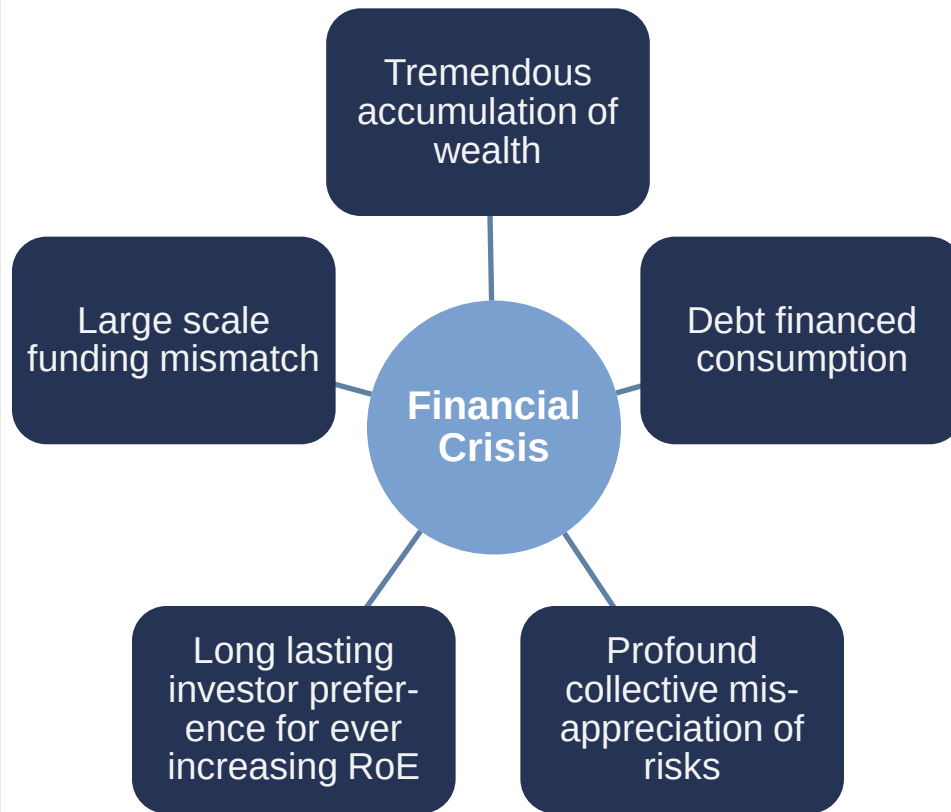
Global Financial Crisis – the causes...

- Last two recessions recorded in history are:
 - July 1990 to March 1991
 - March 2001 to November 2001

- The current recession is said to have started in December 2007
 - Housing Bubble, Subprime Loan Losses
 - Rise in oil and food prices
 - MBS, CDO, CDS
 - Inadequate regulation and oversight
 - Unemployment, Consumer Confidence

Drivers of the GFC

Drivers of financial crisis



Observations

- **Combination** of factors which are individually problematic, but collectively devastating
- Absence of **transparency** on this highly explosive constellation is a thumping collective failure of western economy
- **Banking sector** lost sight of its financial stability in its effort to improve its RoE
- **Risk management systems** unable to unveil the threat
- The **price** the **banking sector** is going to pay for its failures will be stunning
- Financial institutions should acknowledge that **pro-cyclical** regimes to capital management and regulation are not sustainable

Global Financial Crisis – the Perfect Storm

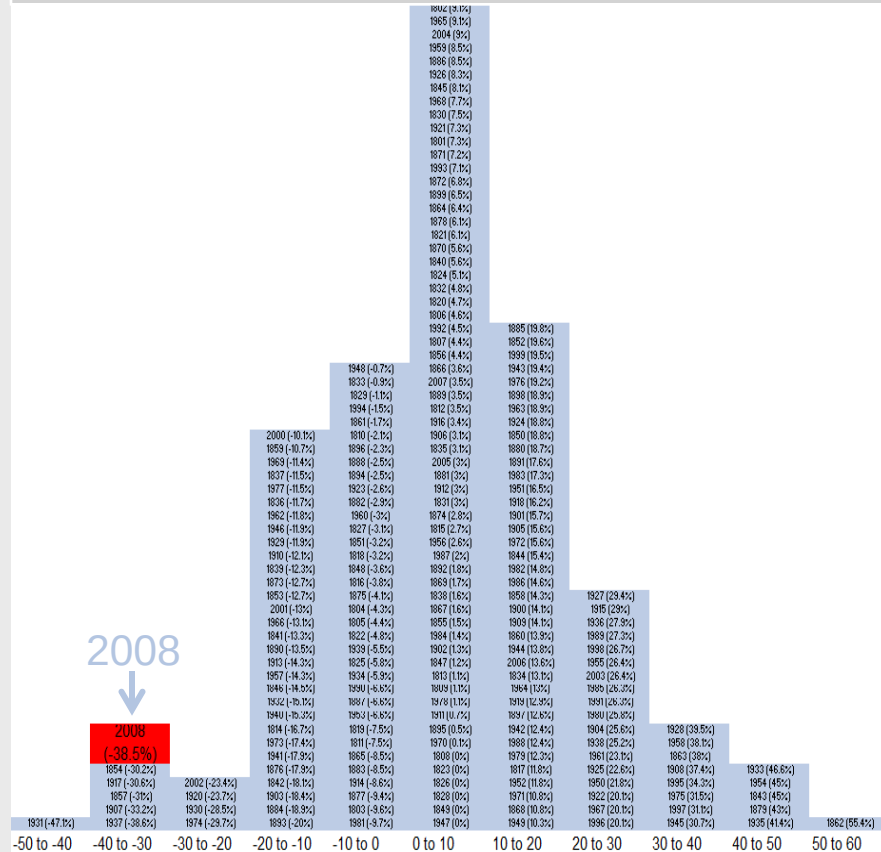
Capital has been depleted...

1. **Stock market** crashed
 - ☐ Asset value dropped
 - ☐ Liability increased (VA)
 - ☐ EV decreased
2. **Corporate bond** spread increased
 - ☐ Asset value dropped
3. **Volatility** increased
 - ☐ VA can no longer be hedged at reasonable cost
 - ☐ Reserve for VA increased
4. **Liquidity** disappeared on most assets
 - ☐ Cash became king
5. Yield on **risk free** assets drops
 - ☐ Statutory reserve increases



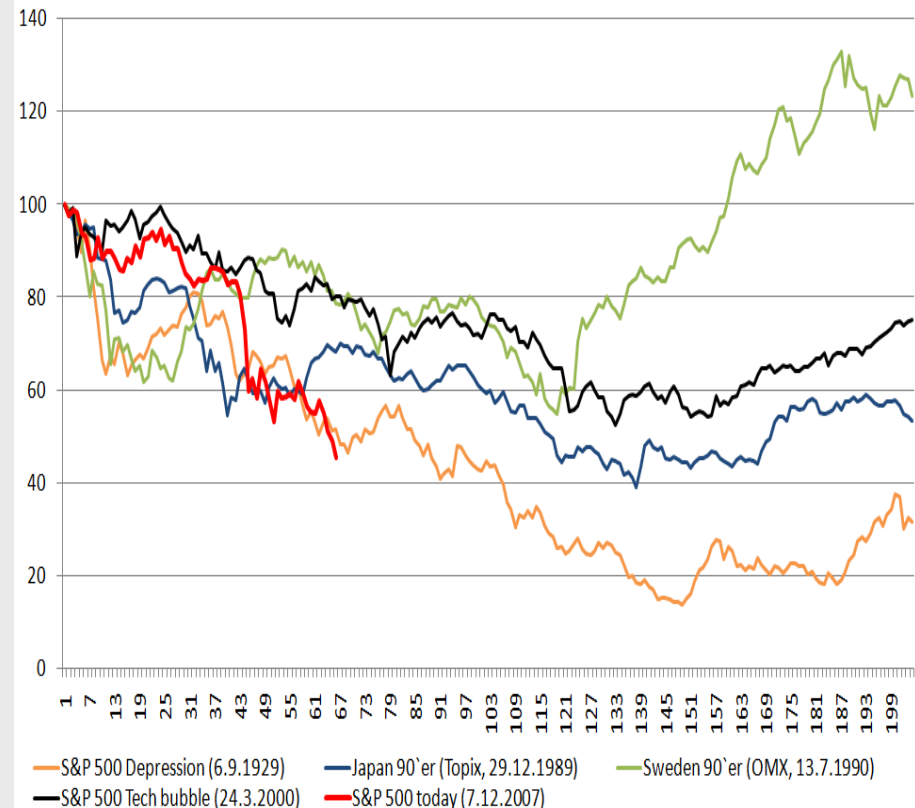
Capital Markets - Year 2008 in an historical context

Historical stock market development (annual development of the US stock market since 1801)



2008 was the third worst year since 1801

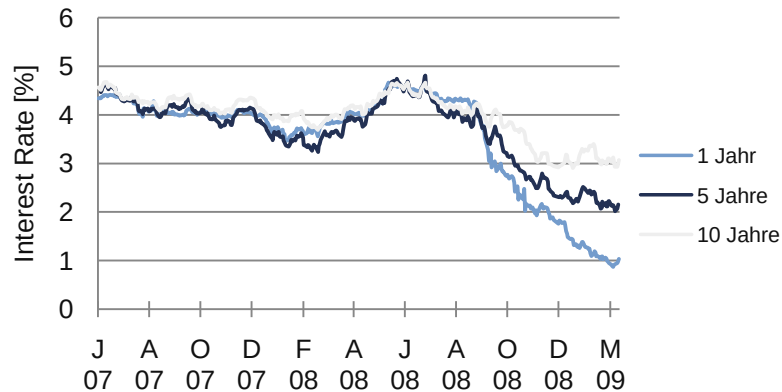
Stock market indices in economic crises (normalized on 100, development in weeks since peak)



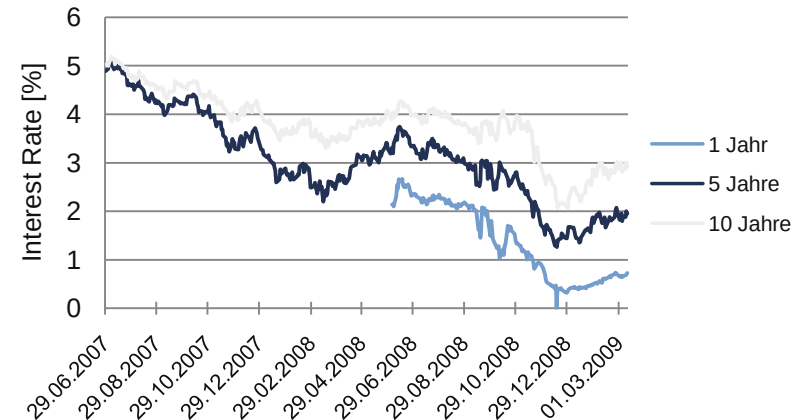
No timely rebound in three out of four cases

Low interest rates, high spreads and high uncertainty

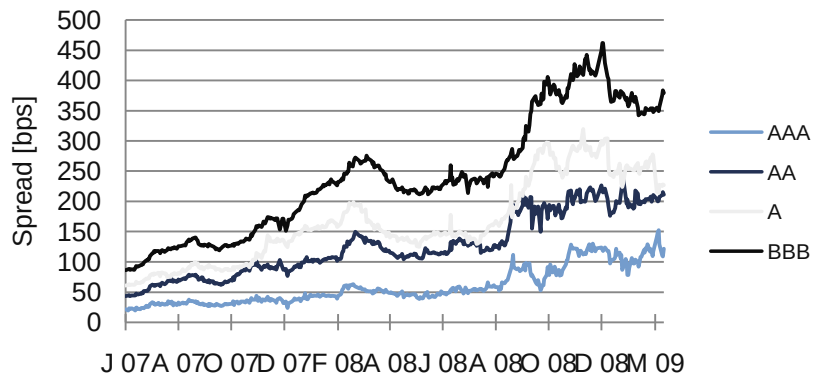
EUR government bond



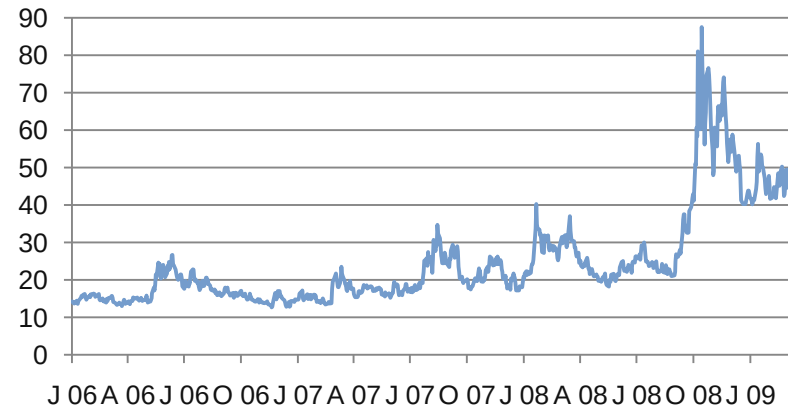
USD government bond



EUR corporate spreads (10 years)



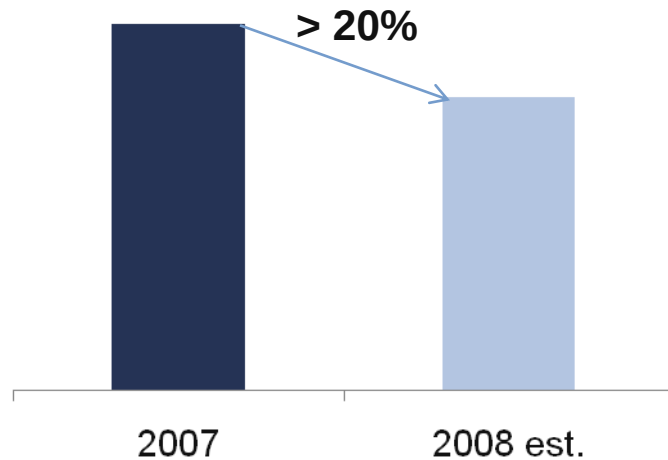
VSTOXX Index



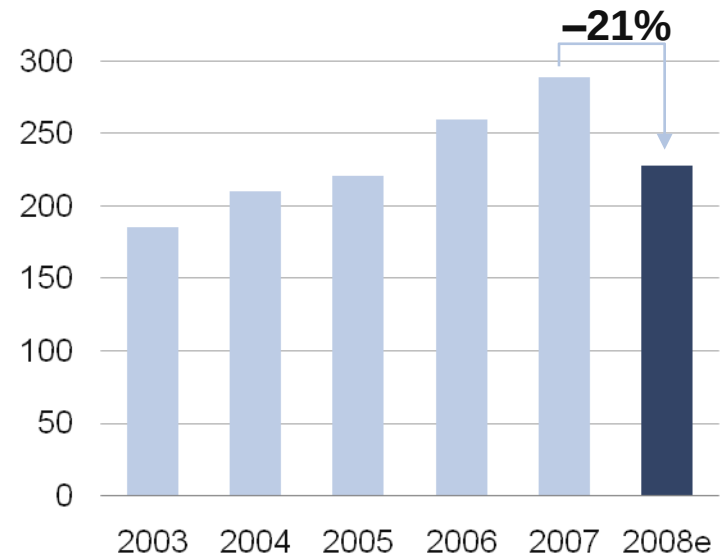
Insurance sector capitalization declined...

Insurance sector capitalization (Accounting view)

Reduction in primary insurers capital¹



Shareholders' equity of reinsurers is declining for the first time in years (year-end² US\$ bn)



Main reasons for worsened capital situation of insurers:

- Realized and unrealized investment losses (responsible for ca. 90% of the capital reduction)
- Hurricanes Ike and Gustav (responsible for around 10% of the decline)

¹ Aon Benfield estimate and Munich Re research, based on a sample of large global insurers w/o AIG

² Munich Re: Data 2003–07 based on financial reports of 35 global reinsurance companies (incl. some primary insurance business); 2008 estimate based on external assessments of the biggest 15 companies as at February 2009; development influenced by exchange rate effects.

...even more so on an economic basis

Comparison of Accounting view and Economic view

Decline of equity typical
for recent disclosures



Main reasons for higher drop
in economic view

- Increased **hedging costs** in an economic view (enormous rise of market volatility) esp. for life insurance business
- Different consideration of **goodwill** and other intangibles
- **Market-consistent** valuation of **liabilities** in an economic balance sheet in a low interest environment

Global Financial Crisis – Consequences

Only beginning to understand the **consequences** of this crisis:

- ☐ Tolerance for risk
- ☐ Opportunity cost of statutory capital is much higher than priced for
- ☐ Would capital be ever cheap again?
- ☐ Viability of certain lines of business or guarantees (VA)
- ☐ Lapse?
- ☐ New regulations?
- ☐ M & A

Unlocking Regulatory Capital in Asia

- ❑ Capital is still available but **expensive**
 - Life Insurers are EV rich but statutory capital poor
 - Many have been forced to raise capital at the worse possible time to meet statutory/S&P requirements
 - Options such as Reinsurance may offer a cheaper source of (regulatory) capital
- ❑ In most solvency regime companies have to meet a Solvency Margin Ratio in excess of a certain level that varies by country:
 - **SMR = Available Capital/Required Capital**
 - **Available Capital (AC): Asset** (typically at market with adjustments) – **Liability** (typically calculated with prescribed basis and method)
 - **Required capital (RC):** calculated with a set of factors that varies with the nature of the underlying risk (often crude)
- ❑ Fin Re typically **increases** the **SMR** by
 - Increasing AC (**increase asset** or **decrease liability**)
 - Decreasing RC (**reinsurance credit** for the risk transferred)
 - Or both

Unlocking Regulatory Capital

How to structure the transaction...

❑ Source of Regulatory Capital

- Excess **statutory reserve** and required capital (over economic)
- **Embedded value** (future profits not recognized in capital)

❑ Unlocking excess **statutory reserve** (source of regulatory arbitrage)

- e.g. High prescribed mortality on WOL, excessive required capital (denominator),
- The greater the excess the better the value to the client
- Need good knowledge of products, local regulatory regime and economic risk capital

❑ Unlocking **EV**

- This is **future profit** –normally not an admissible asset given its uncertain nature
- Transfer the risk (and profit) to the reinsurer in exchange for **upfront payment** (the upfront payment increases AC and is normally an admissible asset)

Impact of GFC on Life Insurers...

- ❑ Low current market interest rates which will lead to low discount rates applicable to liabilities and hence **higher liability values**
- ❑ Higher liability values– further strain on **free assets**
- ❑ Low **asset values**, especially in jurisdictions where assets are marked to market, which (with higher liability values) will lead to significant pressure on emerging earnings, capital positions and solvency
- ❑ Considerable continuing difficulties in the **valuation of illiquid assets**
- ❑ Re-estimation of many **parameters** in Dynamic Financial Analysis models and/or “internal models” used to estimate economic capital requirements
- ❑ To need to review the methodology and assumptions used to calculate **diversification** benefits in portfolios and/or the extent of correlations between risks in different product markets and geographies
- ❑ Is the impact **short term** – versus pricing long term contracts
- ❑ Further challenges using market data to **disaggregate** measures of **credit spreads** from **illiquidity margins** so as to obtain suitable discount rates for liabilities
- ❑ Case for the **liquidity premium**?

Impact of GFC on Life Insurers...

- ❑ Exposed the **cost of guarantees** - Life insurers with significant **capital guarantees** or **minimum interest rate crediting** obligations inherent in their product liabilities will come under intense pressure if their positions are unhedged
- ❑ Companies pricing using **MCEV** – have use lower risk free rates
 - Higher **reserves** – and associated cost of capital
 - Higher **capital costs** – if factors applied to PVFC/reserves
 - **Embedded Values** reported by insurers are likely to drop
- ❑ Potential liquidity demands may **increase surrenders**
- ❑ Low investment returns **increasing premium rates**
- ❑ If **earned rates** lower than assumed in pricing – accumulation of assets with interest will not be adequate to meet benefit payments
- ❑ Reduced **credit ratings** leading to decreasing new business
- ❑ Increased focus on **credit-worthiness** of counterparties, including reinsurers
- ❑ Long term **non-par products** – only profitable if experience is better than pricing assumption
- ❑ **Par products** – what level of dividends to declare

Source: *The Global Financial Crisis – What Next* (IAA 2009)

Impact of GFC on Life/Health Products...

LIMRA November 2008

❑ Poll of **insurance executives** of impact of economy on individual products:

➤ Impact on sales

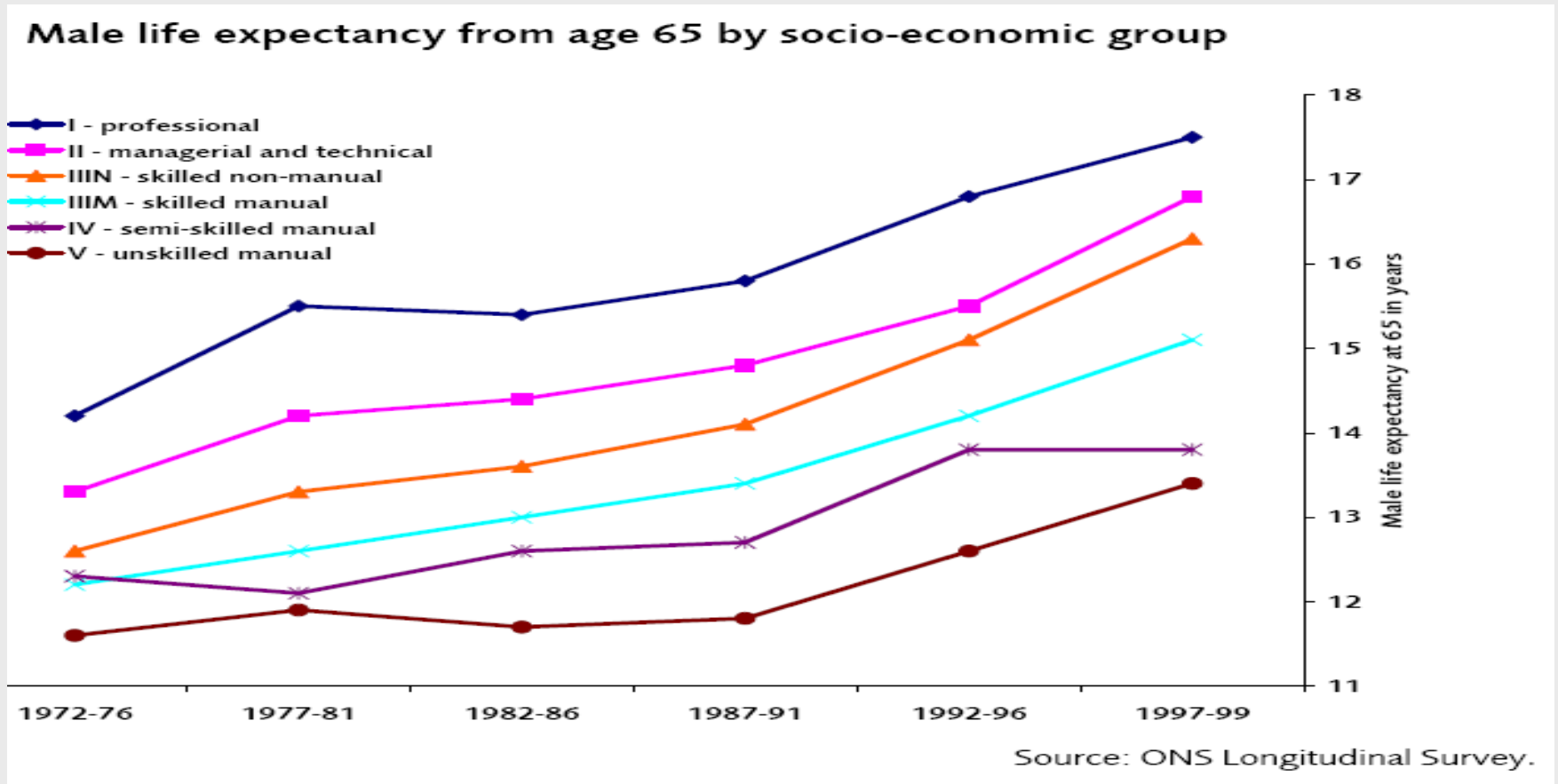
- UL ↓ VUL ↓↓
- Fixed annuities ↑↑↑ Variable annuities ↓↓↓
- LTC ↓↓ DI ↑

❑ Poll of **independent producers**

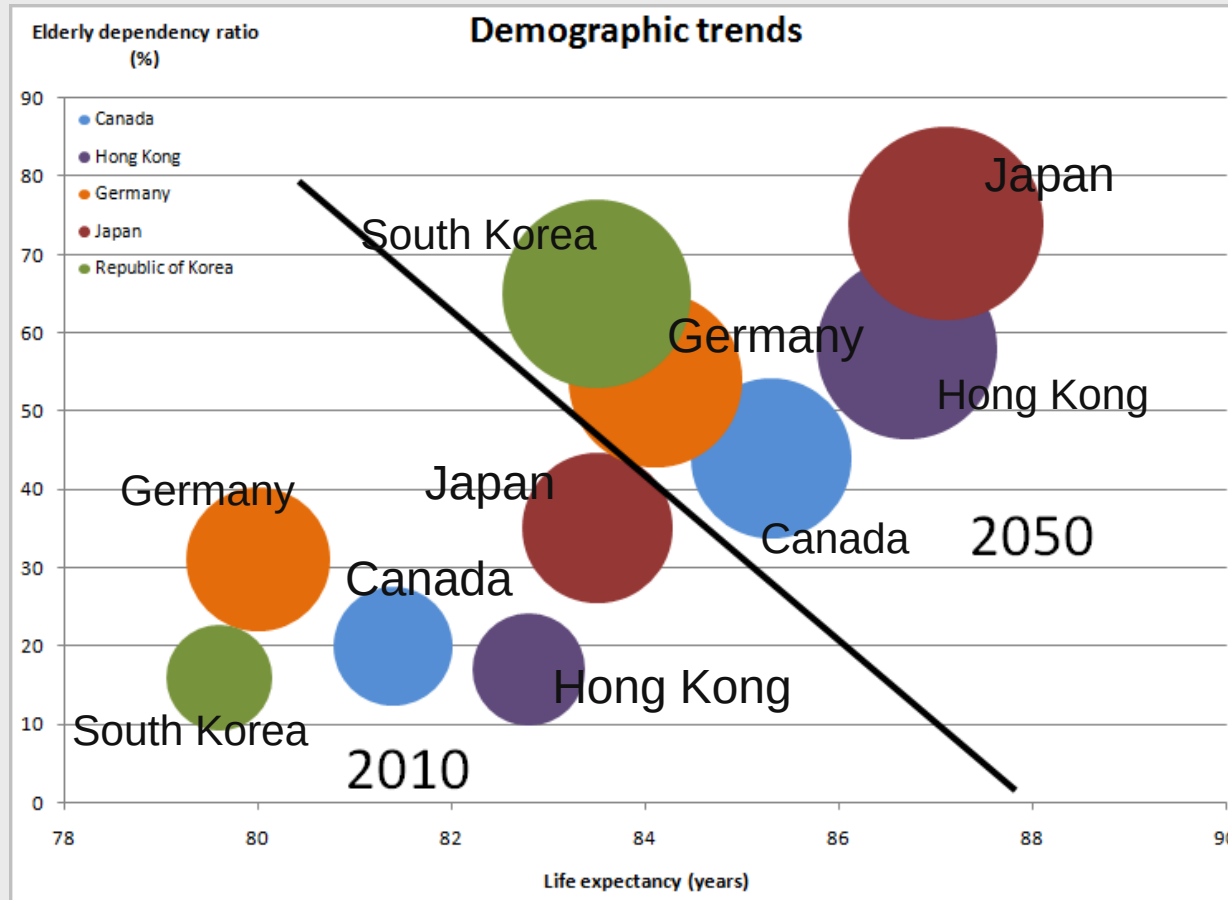
➤ optimistic but confidence shaken (executive compensation, etc)

❑ **Consumers** are worried, uneasy and shaken → return to basic fixed protection products??

Understanding the Drivers of Mortality/Longevity



Demographic trends from 2010 to 2050

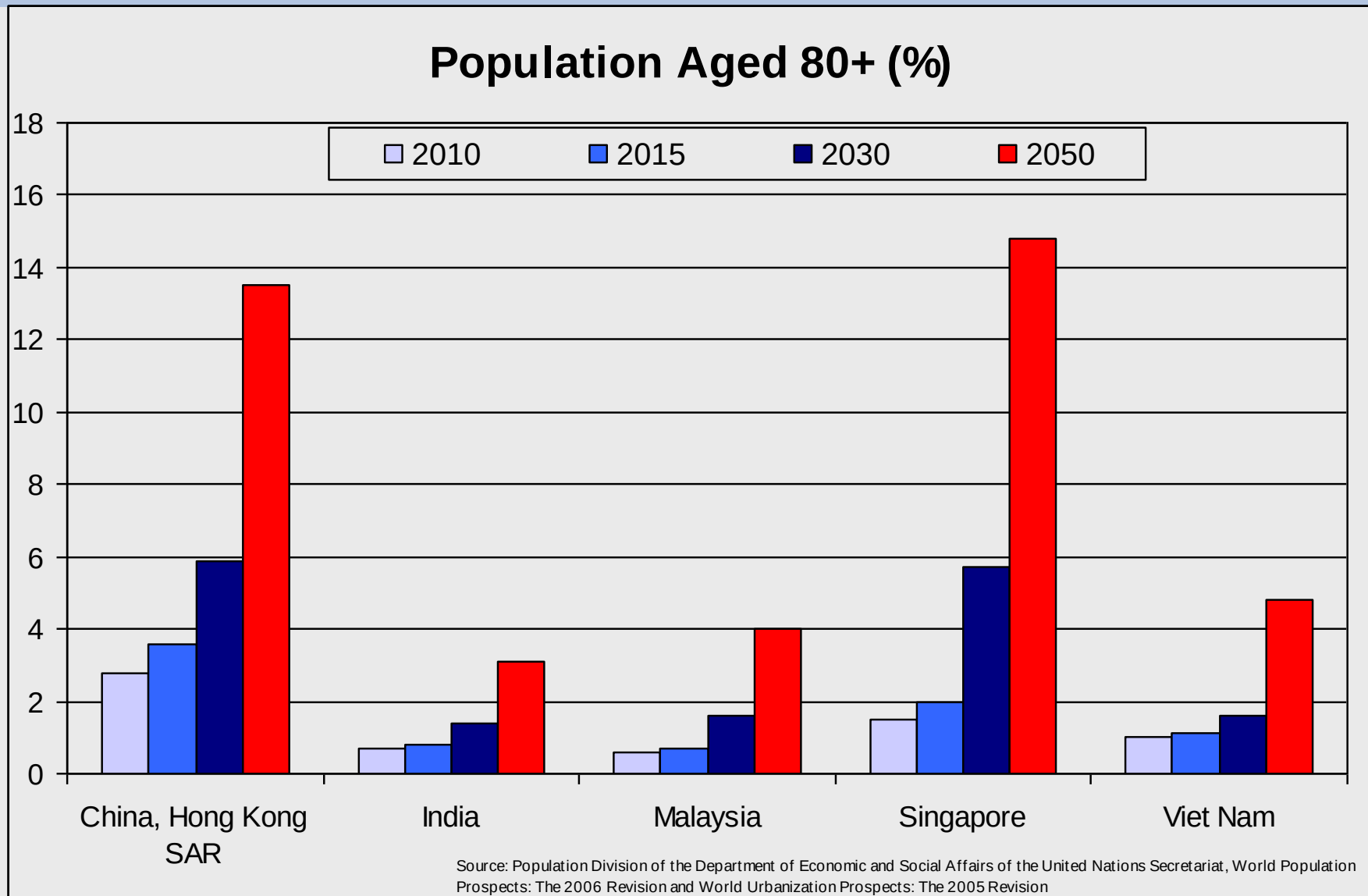


❑ The larger the bubble, the higher the **percentage of the population aged over 65**.

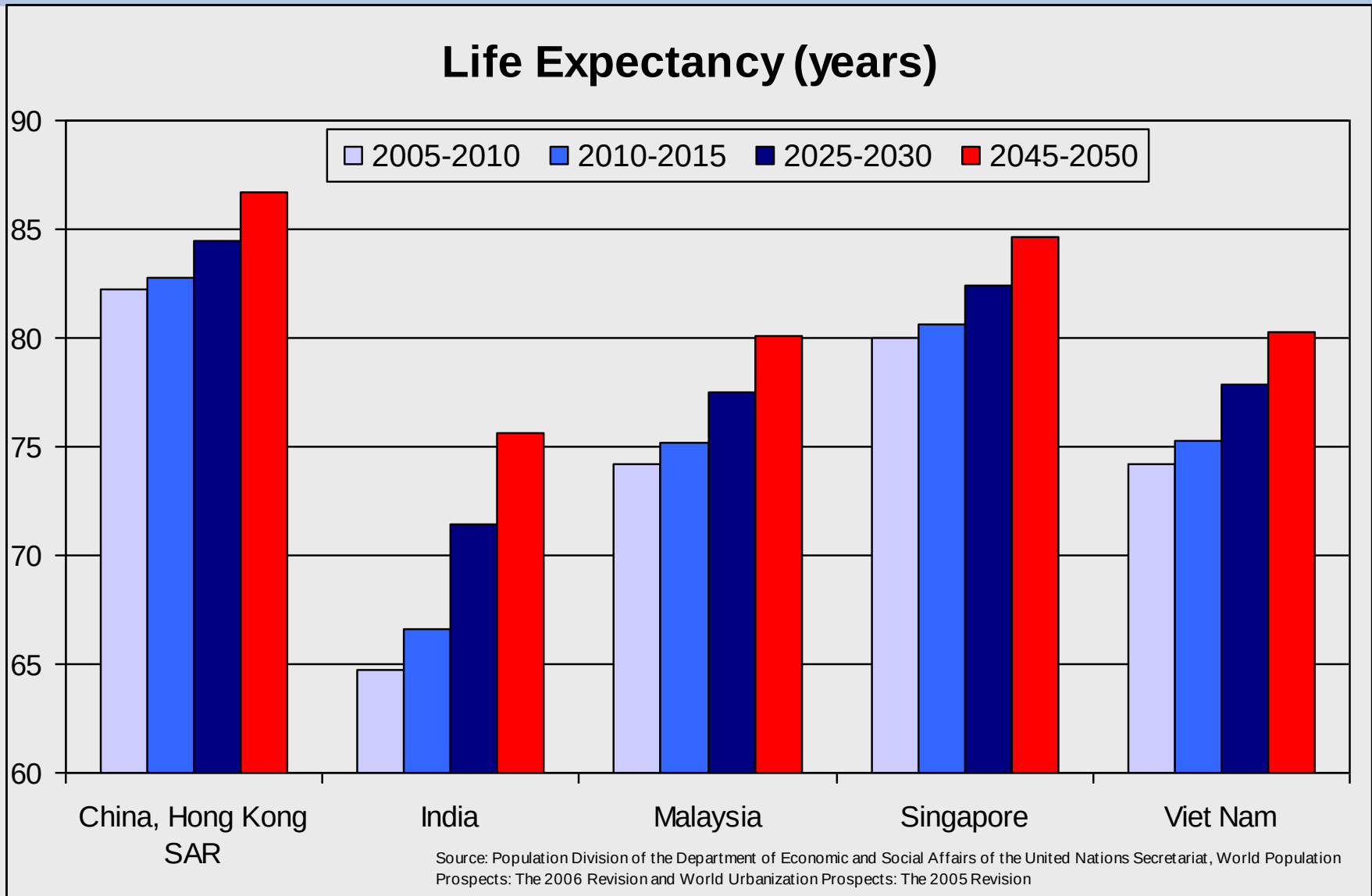
❑ The further the bubble is to the right, the **longer the life expectancy**, and

❑ the higher up the chart, the higher the **elderly dependency ratio** (the ratio of people over age 65 divided by the working population).

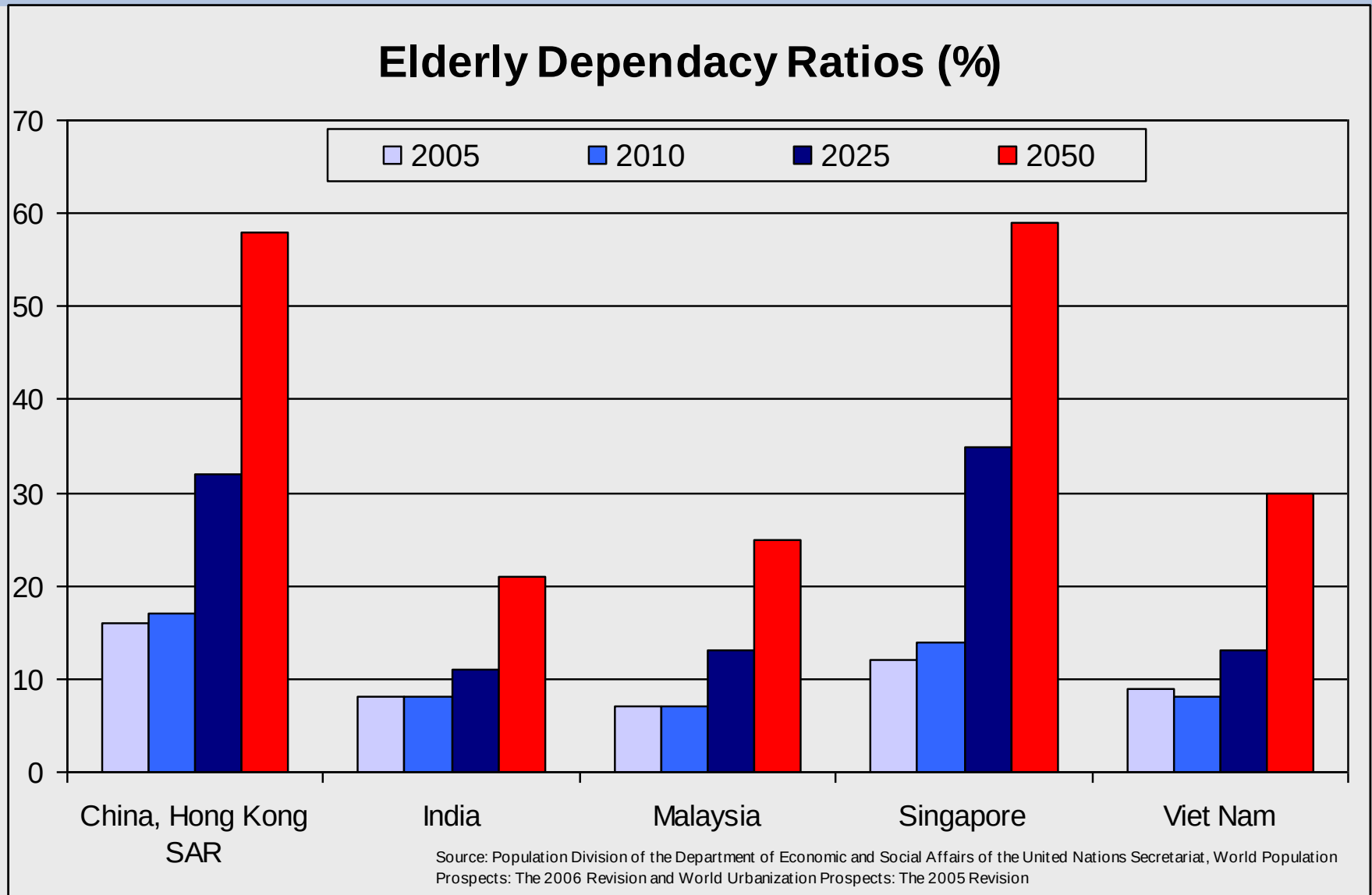
Demand for LTC: Percentage of the population aged 80+



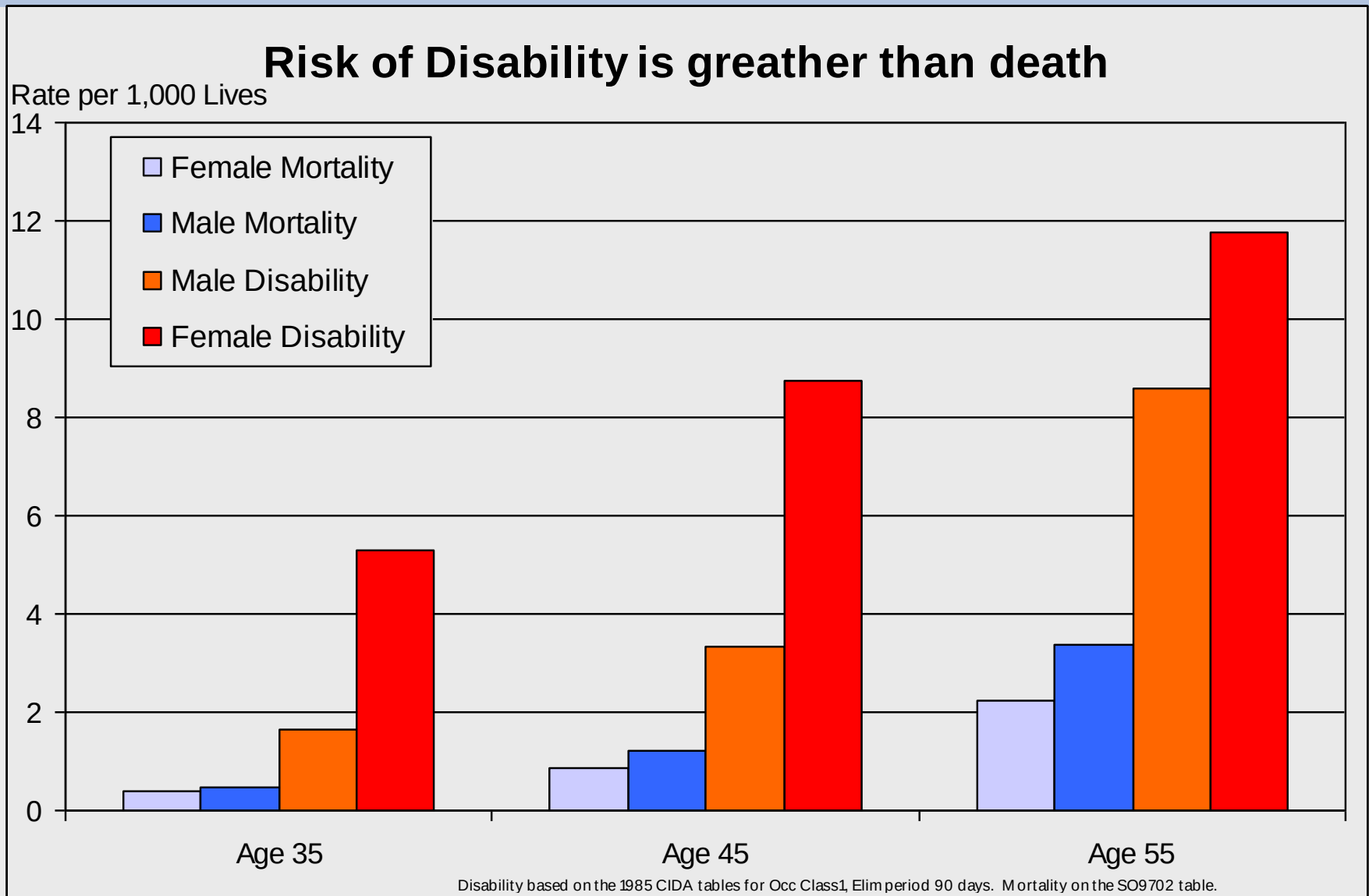
How long is LTC? - Increasing life expectancies



Demand for LTC: Increasing Elderly Dependency Ratios



Demand for DI products: Perception of need is underestimated



Impact of Changing Demographics on Products & Liabilities

- ☐ Products like **LTC** & **DI** will be in greater demand as populations age & social structures change
- ☐ **Income annuity** products will also be in higher demand – longevity risk
- ☐ Liabilities **duration** will be extended
- ☐ Will there be **available assets** to match this?
- ☐ Decreased **mortality** can mean higher incidences longer periods of **morbidity** – **CI**
- ☐ **Pricing** and **Reserving** can be a challenge

Age Diagnosed with Alzheimer's'	Number of years to live	
	Female	Male
Age 70	8	4.4
Age 85	3.9	3.3
Overall	6	4

Impact on Disability of an Economic Downturn

- ❑ Why are we concerned about **impact of economic downturn** on disability experience?
 - Increase in Incidence - economic downturn will invite more claims submissions
 - Lengthening of claim durations - existing claims will stay on claim longer
- ❑ Disability a **personal decision**? – job stress/security/satisfaction
- ❑ **Social Insurance** disability programs
- ❑ **Company** practices
 - Underwriting important!!
 - Claims adjudication practices

Impact on Disability of an Economic Downturn

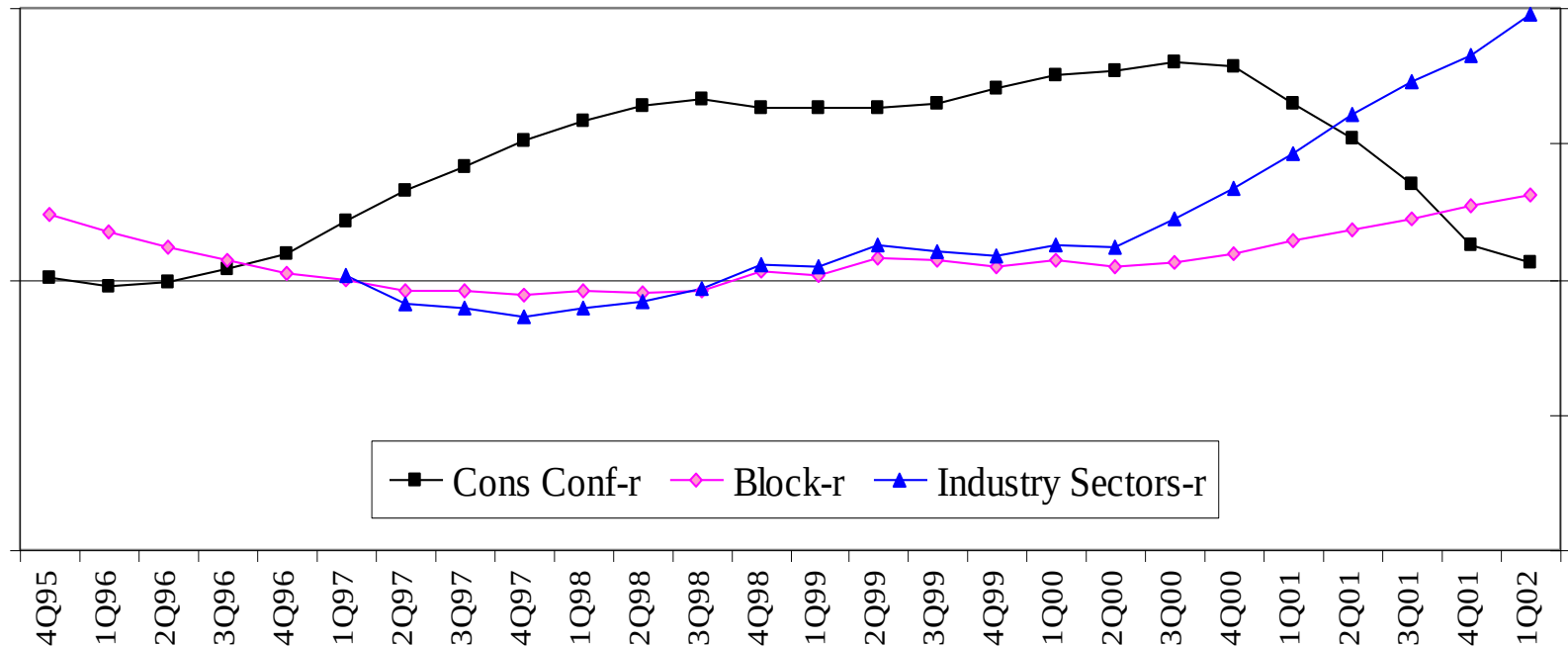
Why is it not easy to determine the impact of an economic downturn on US private disability insurance business?

- ❑ US insurers are **not required to publish** any incidence or recovery data
 - Loss ratio analysis is complicated by the setting of reserves

- ❑ Economic impact is not uniform across geographical regions, industries, or occupations
 - Insurers have different **business mix**
 - Individual Disability – typically marketed to doctors, lawyers, small business owners and high end professionals
 - Group LTD – depends on where the business is concentrated

Economic Impact on Disability (Group LTD)- Empirical Evidence

Consumer Confidence and Claim Incidence



The graph above was extracted from the actual SOA presentation. It does not offer a scale. It is meant to reflect relatively. The description provided in the transcript refers to the incidence of claims submitted for the Unum block (Block-r) and for “...some industrial classifications (SICs) that are grouped together to represent some industry sectors...” (Industry Sectors-r). The Consumer Confidence Index shows relative confidence compared to 1985 which was set to 100

DI Pricing, Valuation and Experience Analysis

- ❑ Update DI **morbidity study** to ensure pricing reflect most recent experience
- ❑ Increase **IBNR** by 5% at end of Q1
- ❑ Enhance audit sampling methodology for underwriting and claims to identify key factors that could result in **anti-selection** due to current economic turmoil
- ❑ Enhance DI **management reports**, especially related to new claims activity
- ❑ Analyze **claim results** from industries that are hardest hit by the recession
- ❑ Review claim incidence rates by **geography, age, case size** and other relevant segments
- ❑ Analyse **A/E claims** incidence results separately for each client **company**
- ❑ Adjust experience rating to reflect today's **economic reality**

Implications of Financial Crisis – according to CRO Forum

Integrated risk governance

- Sound and comprehensive internal risk governance
- Risk management needs to be preemptive, independent and empowered
- Clearly articulating and monitoring the company's risk tolerance
- Compensation should be based on risk-adjusted performance

Risk models

- Indispensable tools for variety of reasons, increasingly used for regulatory purposes
- But they can never be a substitute for common sense
- Require regular improvement in the light of experience and need the complement of sound management judgment to be effective

Liquidity risk management

- Liquidity risk distinct from risk to capital adequacy
- Liquidity risk management to rely on scenario testing
- Liquidity risk of insurers is fundamentally different from that of banks

Valuation and risk disclosure

- Renewed market confidence requires accurate valuation and the prompt disclosure
- Market-consistent valuation of both assets and liabilities should become the principle that underpins financial information and prudential oversight in insurance
- Rating agencies should be brought under supervision
- Use of ratings in financial regulation should be curtailed

Group supervision

- Crisis emphasizes the need for international cooperation among regulators
- Principle and economic risk-based approach for the supervision of groups needed
- Efforts of the IAIS should be strengthened by introducing binding standards that would accelerate regulatory convergence

Risk Modeling - Challenges for the next years

Model Enhancements

❑ Financial Crises

In the light of the financial crises models will need to be reviewed to evaluate how they stood the test of times

❑ Group Structures

Group structures need to be reflected appropriately when determining diversification benefits

Model Governance

▪ Documentation

Substantial documentation will be required to allow for the review and certification of internal models under regimes like Solvency II but also for reviews from other stakeholders such as rating agencies or auditors

▪ Validation

Calibration of risk models needs to be checked for appropriateness on an ongoing basis

▪ Use-test

Regulatory reviews will require internal models to be embedded in the risk steering

▪ P&L Attribution

Economic profits and losses need to be assigned to the risk drivers of the business (strong link to validation and use-test)

Increasingly companies will need to focus on the governance around the internal models to prepare for the various regulatory and other review processes

Models and what they tell us...

“It is a truism that every model is wrong. But can it be a surprise that those firms which have put the most effort into calculating and reporting these kinds of numbers are doing better than those that haven’t?”

Nick Dunbar, Life&pensions 11/2008

Risk models

These are indispensable tools for developing business, designing and managing products, valuing portfolios, gauging capital adequacy and increasingly used for regulatory purposes. Although their capabilities are numerous, they can never be a substitute for **common sense** as they do have significant inherent **limitations**. Risk models require regular improvement in the light of experience and need the complement of sound management **judgment** to be effective.

*CRO Forum, “Insurance Risk Management Response to the Financial Crisis”,
04/2009*

Financial Crisis and ERM

- ❑ Subprime crisis in 2007 and subsequent capital market crisis in 2008 constitute an **extremely taxing environment**
- ❑ First real **test** of ERM framework
- ❑ Highlights the **importance of risk management** in its original role – in addition to the business enabler
- ❑ Focus on managing **systemic risks** – do not diversify away – so hedge/transfer (*ref: Markowitz FAJ 2009*)
- ❑ Advancements in risk management – new fields such as **behavioral risk management** emerging (*AAA Contingencies July 2009*)

ERM Defined

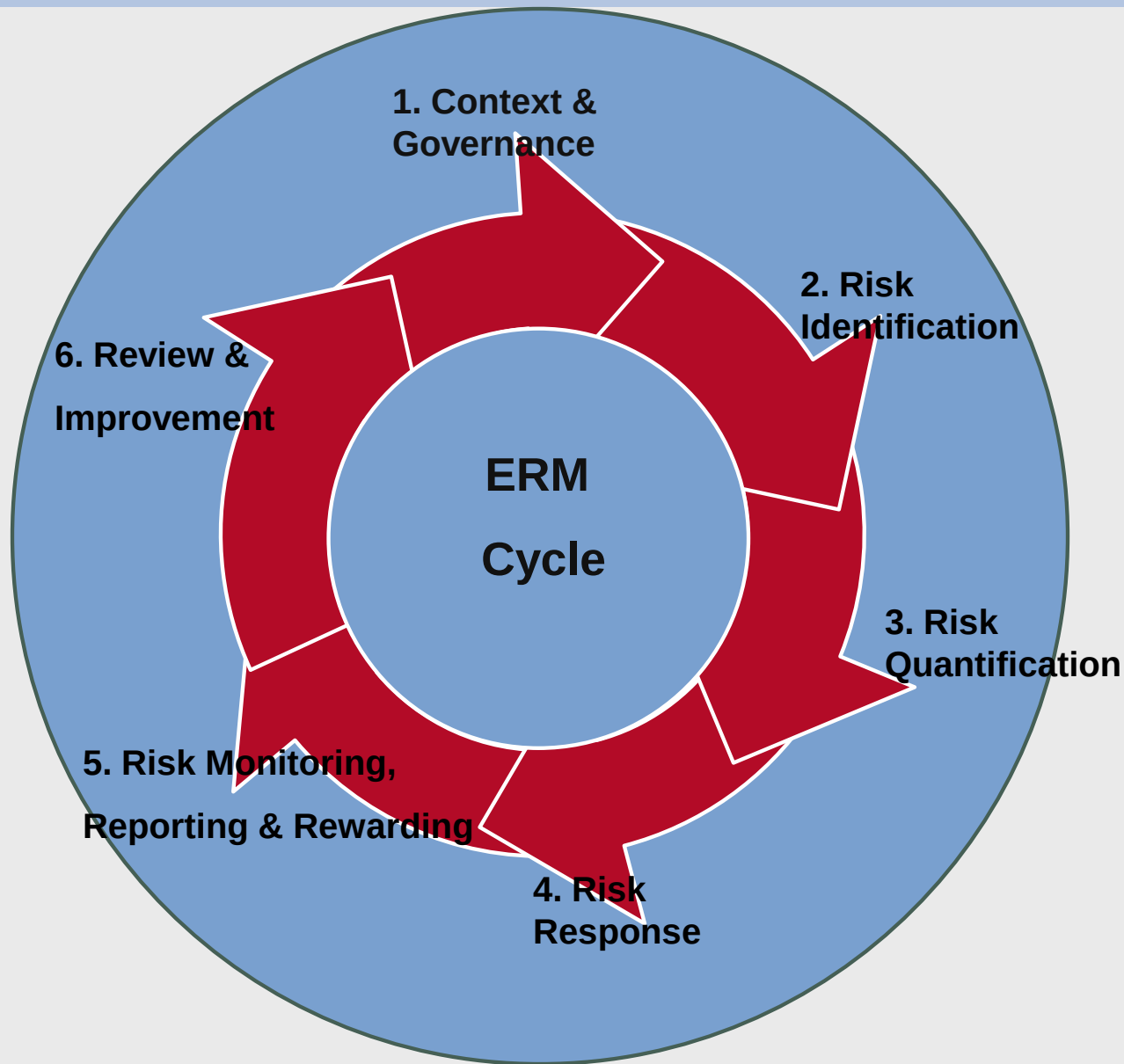
- ❑ Enterprise Risk Management (**ERM**) is the discipline by which an organization in any industry assesses, controls, exploits, finances & monitors risk from **all sources** for the purpose of increasing the organization's value to shareholders
- ❑ ERM is **co-ordinated** risk management - placing greater emphasis on **cooperation** among units to manage an organizations full range of risks as a whole
- ❑ ERM aims to seek out opportunities in risk
- ❑ Also know as:
 - Integrated Risk Management (IRM),
 - Holistic Risk Management,
 - Corporate Wide Risk Management,
 - etc.



The philosophy of ERM addresses issues that we, as a profession, have always dealt with

Source: The Actuary, July 2008

The ERM Cycle

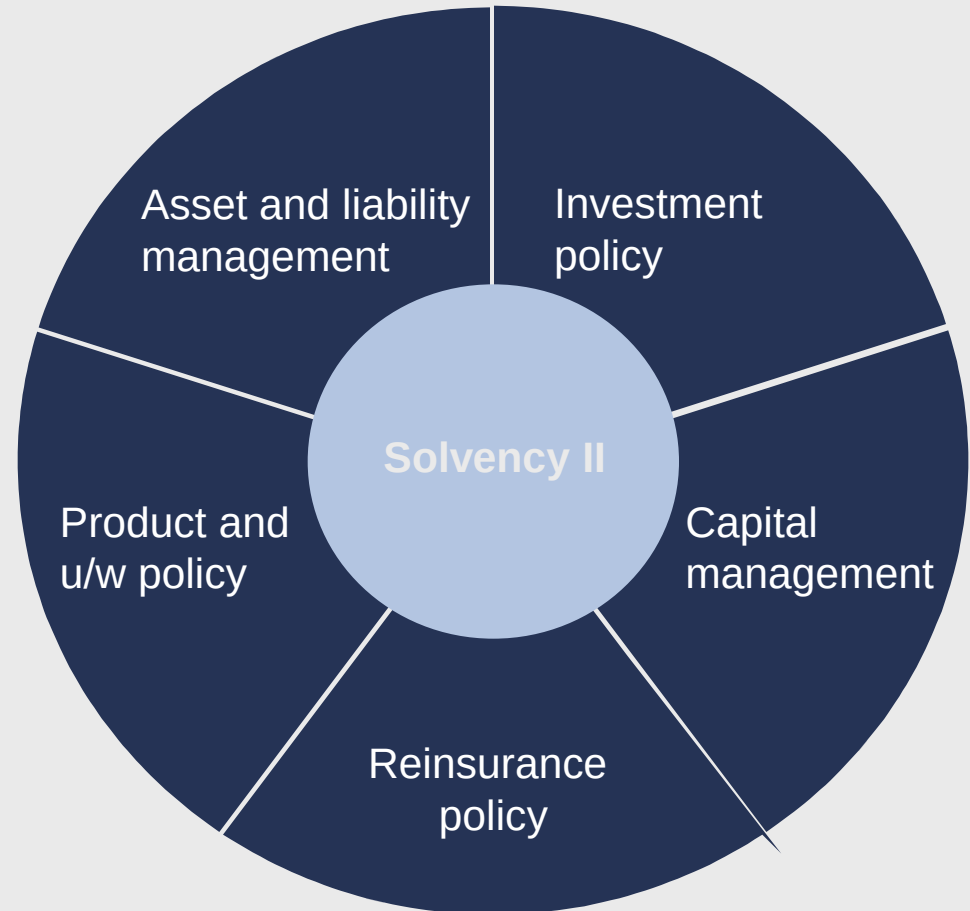


Increasing complexity requires risk-based approach to Solvency

Risk categories relevant to solvency and risk management (quantitative and qualitative):

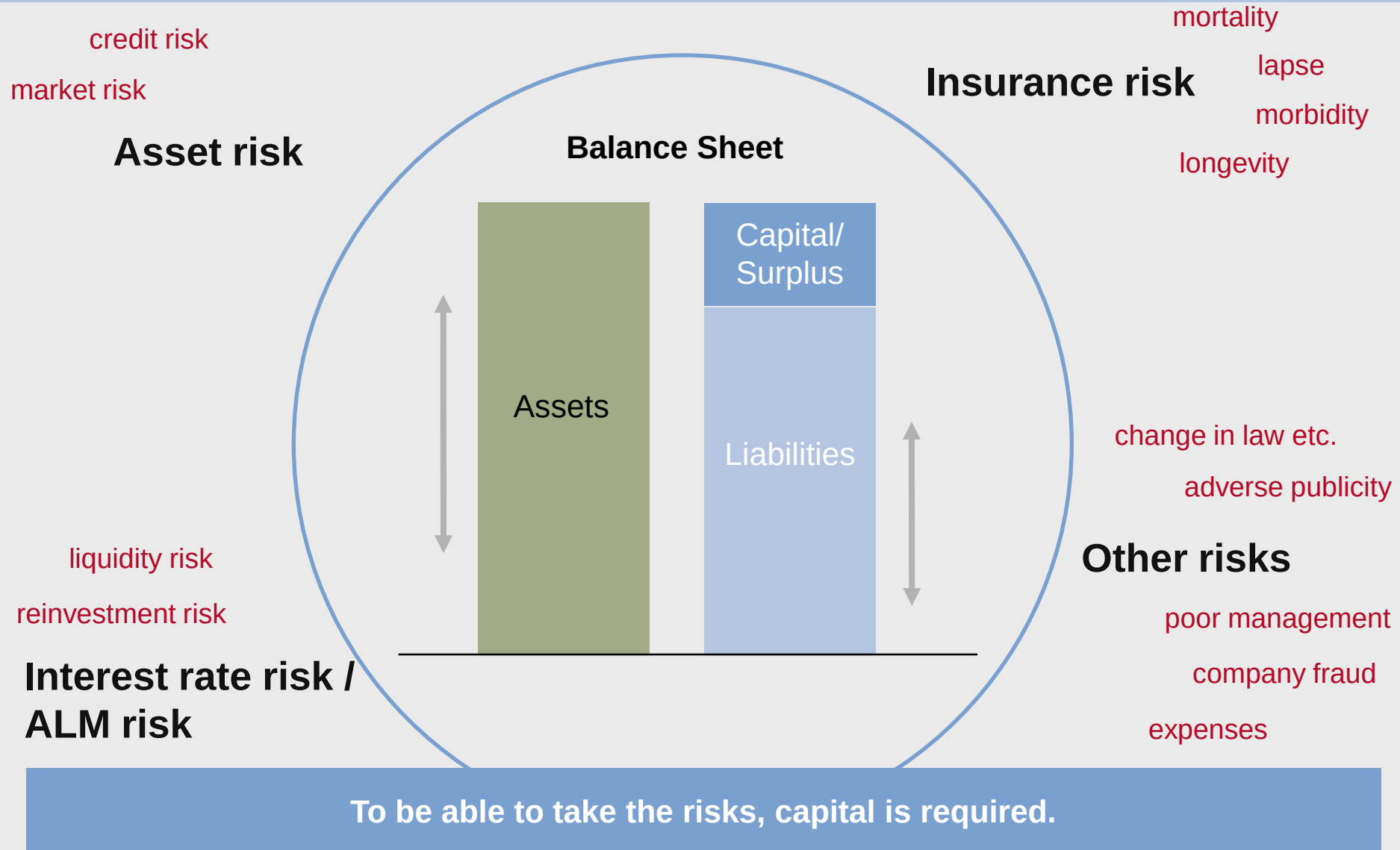
- Insurance / underwriting
- Investment, AL mismatch
- Credit
- Operational

Both standard formula and internal models eligible

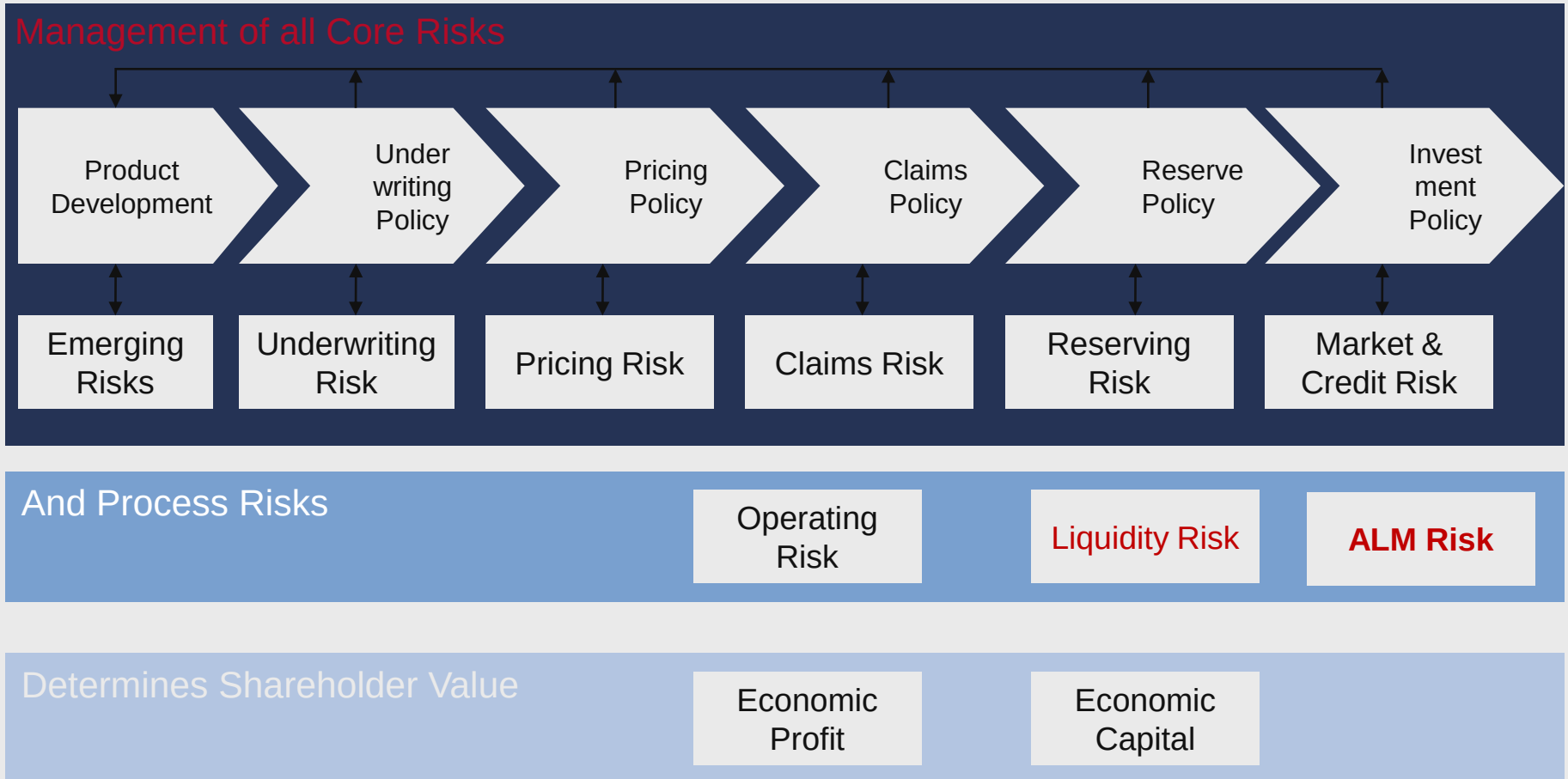


Solvency II as the driver of a more professional and holistic corporate management

Risk & Capital

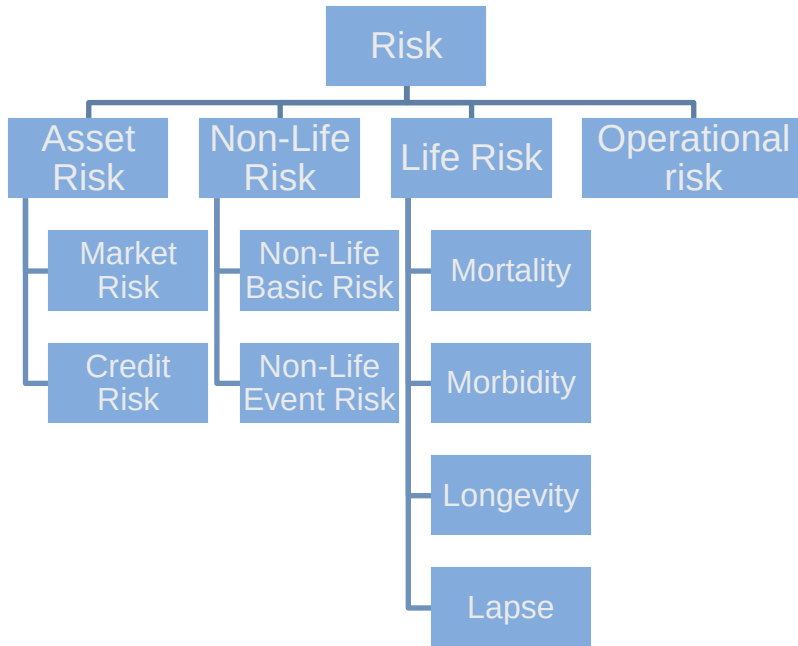


Insurance Risks along the Value Chain

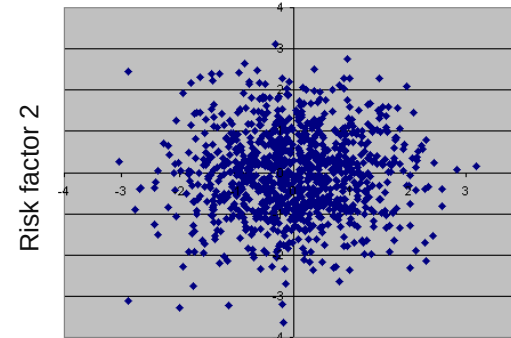
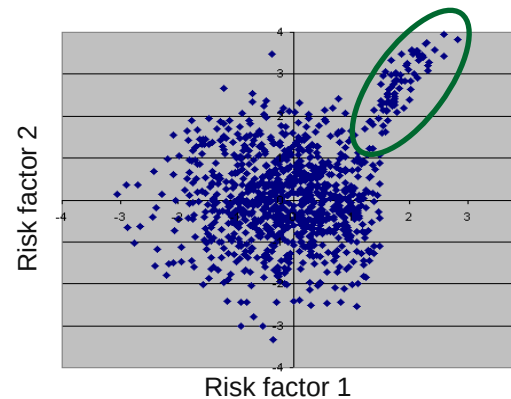


Aggregation of the individual blocks

Schematic View



Tail Dependencies



The individual risks are aggregated incorporating their nonlinear dependency structure represented by a rank correlation matrix and coefficients of upper tail dependency.

Capital Modelling Techniques

becomes more demanding and complex over the years

Increasing sophistication of risk modelling over time

Factor-based
approaches (e.g. early
RBC formulas)

Scenario testing
(e.g. embedded-value
sensitivities)

Stochastic bottom-up
modelling (e.g. internal
risk models)

PROS

- ❑ **Easy** to use, especially for smaller companies
- ❑ First **step** in the right direction

- ❑ **Captures** the magnitude of risks
- ❑ Based on **specific** portfolio characteristics

- ❑ Captures **all risks** and **interactions** of these risks down to the treaty level
- ❑ Use of **company-specific** information
- ❑ Capital **objectively** set for specified level of risk tolerance

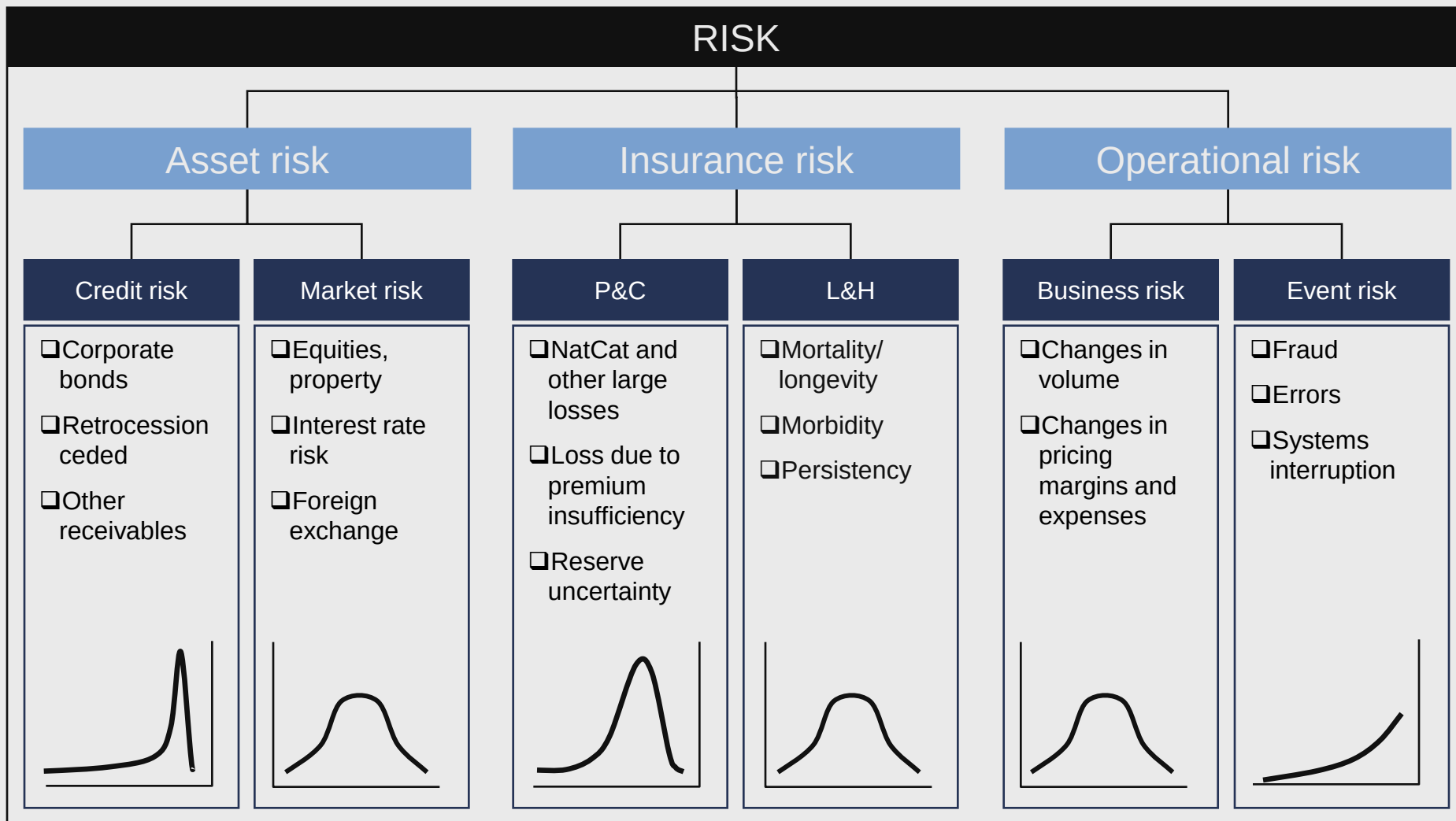
CONS

- ❑ Does not **capture** all risks
- ❑ Does not **accurately** represent the risks
- ❑ Does not capture **diversification** or interaction of risk types

- ❑ Scenario/Stress tests are usually **not standardised** or **calibrated** to risk tolerance
- ❑ Does not capture **interaction** of risk types

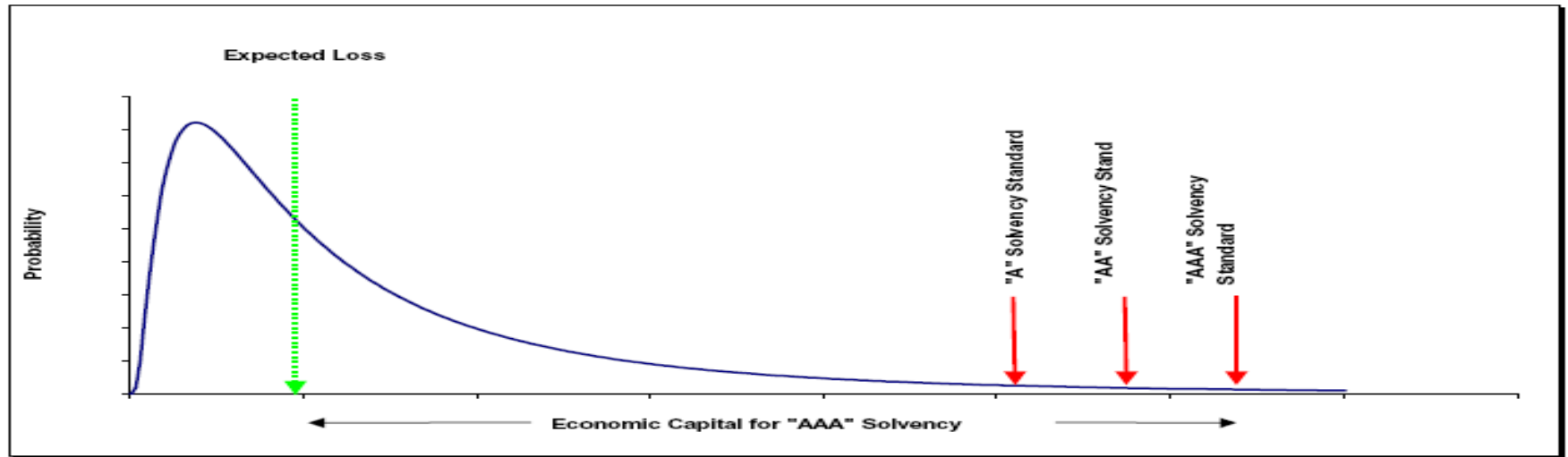
- ❑ Not yet **available** at most insurance companies
- ❑ Not yet fully embraced by all **supervisory** authorities and **rating** agencies

Modelling Individual Risks



Risk Quantification Techniques

- ❑ key modern technique is **Economic Risk Capital (ERC)**
- ❑ using **VaR**; **CTE**; etc, techniques
- ❑ increasingly **stochastic** modeling
- ❑ VaR is well established for **financial** risks (Jorion, etc.)
- ❑ one year view sometimes difficult to apply for business with long term **insurance** risks
- ❑ Also use “**Greeks**” to quantify risk inherent in hedging platforms



Modeling the Risk Components for Insurance Risks

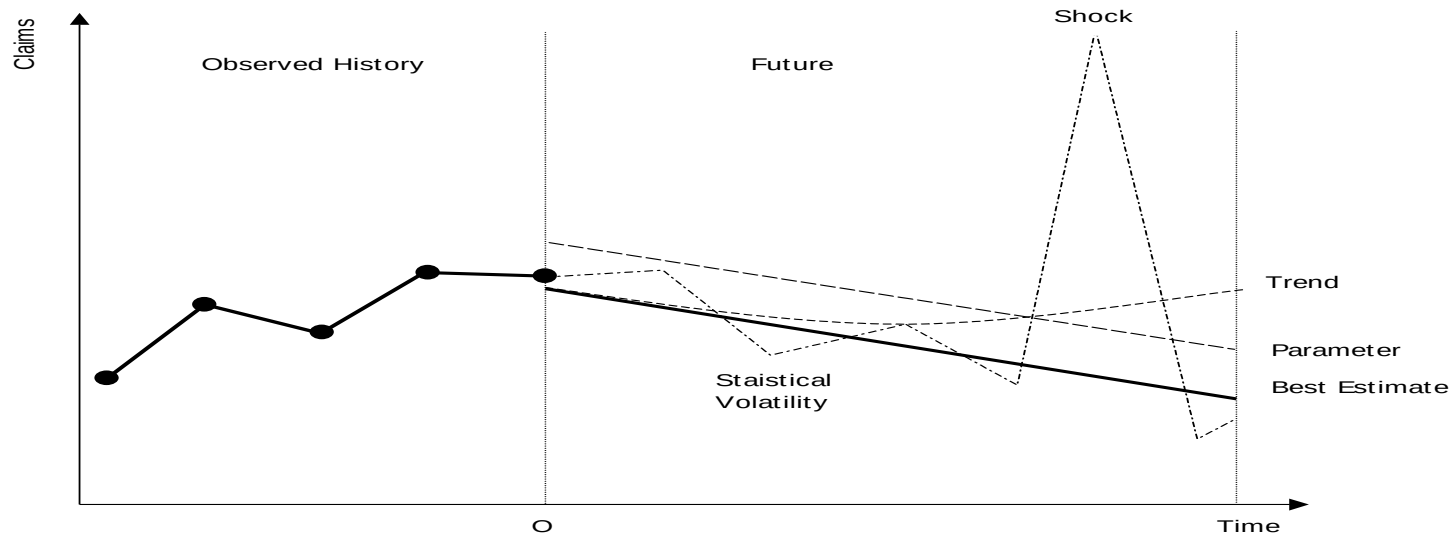
Major Risk Drivers

- Mortality
- Morbidity incidence
- Morbidity continuance
- Lapse

Risk Components

- Process Risk
- Calamity Risk
- Level Risk
- Trend Risk

Decomposing risks



Modeling the Risk Components for Insurance Risks

- ❑ **Process/Volatility** risk: *Lognormal* distribution
- ❑ **Calamity/Shock/Cat** risk: *Generalized Pareto* distribution
- ❑ **Level/Basis/Parameter** risk: *Lognormal* distribution
- ❑ **Trend** risk: *Lee-Carter* model

Lee Carter model

Widely-used by demographers in many countries

$$\ln(m_{x,t}) = \alpha(x) + \beta(x) \cdot \kappa(t)$$

age function

age function

time function
[often
modelled using
an ARIMA(0,1)
time series]

Generalized Linear Models (GLM's) Help Identify Key Risk Factors



Advantages

- ☐ Identification and quantification of statistic **significant risk factors**
- ☐ Achieving **confidence intervals**
- ☐ Linked analysis of **multiple factors** → Multiplicative model
- ☐ **Smoothed** incidence rates
- ☐ See **relations** between different factors

MCEV Cost of Capital & Frictionals...

$$\text{VANB} = \text{PVFP} - \text{CoNHR} - \text{PV_TaxCoC} - \text{PV_IExpCoC}$$

Allowance for non-hedgeable risks

Cost of non-hedgeable risks

Annual charge	Economic risk capital for non-hedgeable risk X Non-hedgeable risk rate
Cost of non-hedgeable risk	Present value of annual charge discounted at risk-free interest rate

Approach to calculating cost of non-hedgeable risk entirely in line with Munich Re's risk capital model

TaxCoC

Reflects the fact that the investment return on the assets backing RC is subject to taxation twice

IExpCoC

Reflects the expenses related to the investment of the assets backing RC

Thank you very much for your attention.

Questions?

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