

# Solvency I

The existing solvency margin requirements were established in 1973 under the First Non-Life Directive (73/239/EEC) and in 1979 under the First Life Directive (79/267/EEC). The third generation of life (92/96/EEC) and non-life (92/49/EEC) Insurance Directives established the single market for insurance in the mid-1990s. This gave the EU one of the most competitive insurance markets in the world. Insurance undertakings, on the basis of authorization in any one Member State, are entitled to sell throughout the EU without any price control or prior notification of terms and conditions (except for compulsory insurance). This system relies on mutual recognition of the supervision exercised by different national authorities according to rules harmonized to the extent necessary at the EU level. The requirement for insurance undertakings to establish an adequate solvency margin is one of the most important common prudential rules.



## Solvency I vs. Solvency II

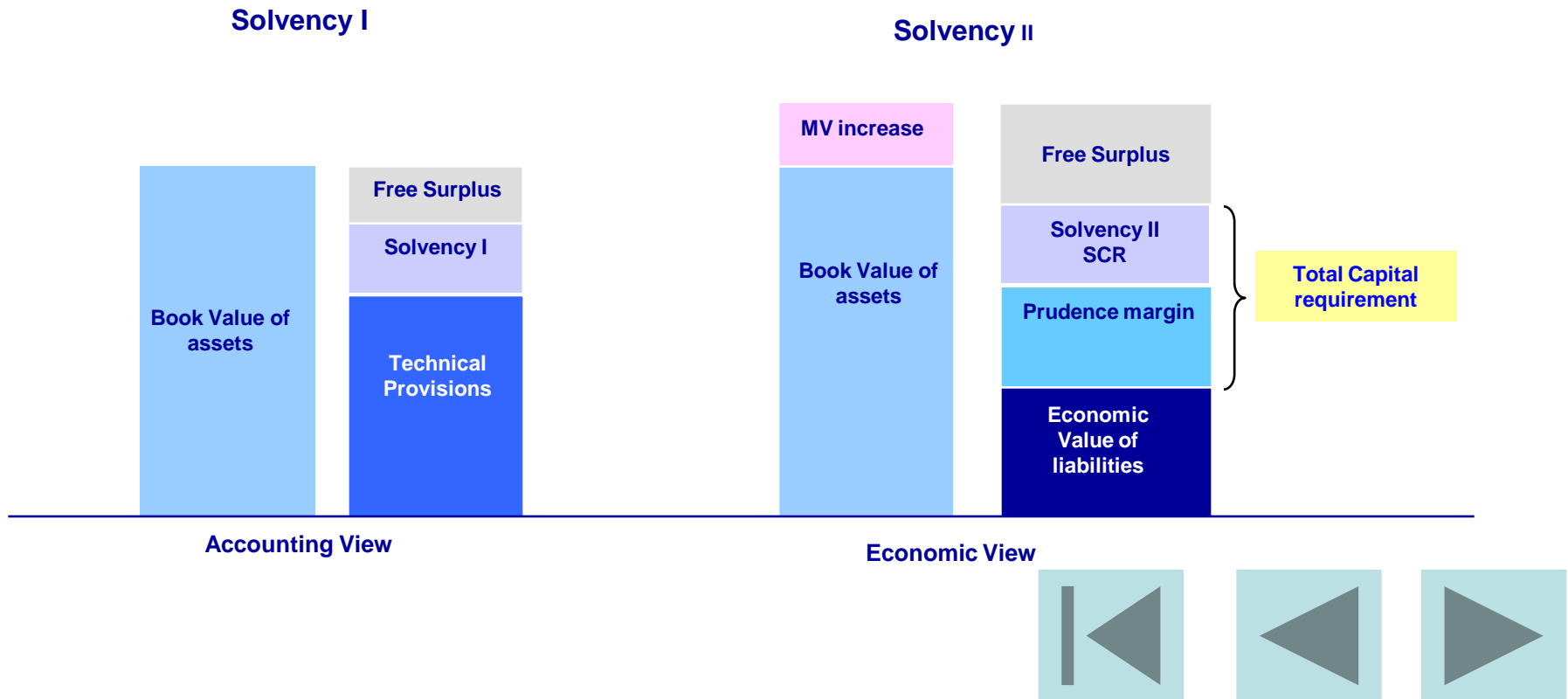
Whereas Solvency I phase aimed at revising and updating the current EU solvency regime, the Solvency II project has a much wider scope.

Solvency I has established more realistic minimum capital requirements, but still it does not reflect the true risk faced by insurance companies. Solvency II will bring the harmonization of asset and liabilities valuation techniques across EU. Even to mention different approaches to value assets – by historical or amortized cost and by market value.



# Solvency I vs. Solvency II

The following graph presents how Solvency II differs from Solvency I.



# Solvency I vs. Solvency II

Current Solvency I rules cannot cope with the variety of insurance company risks profiles and are therefore not aligned with the economics of the business & risks.

How the Solvency II requirements compare with Solvency I depend on a number of company specific factors including

- Current levels of prudence margin in provisions
- Current levels of unrealised capital gains allowed for in Solvency I
- Actual level of risk and diversification

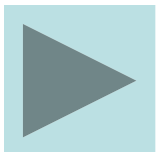


# SOLVENCY II PROJECT

## **Aims and purposes**

Overall aims of Solvency II:

- Establish a match to insurer's individual risk-profile
- Bring assets and liabilities into fair value basis, if possible consistent with IASB
- Harmonise standards across EU
- Set higher capital requirements to permit timely intervention

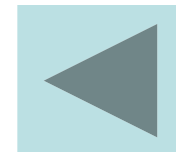


# SOLVENCY II PROJECT

## **What are the purposes of solvency II ?**

The industry strongly supports a Solvency II framework which aims to achieve the following:

- “Gives an incentive to the supervised institutions to measure and properly manage their risks” (Framework for Consultation on Solvency II)
- Contribute to a “better managed and more competitive insurance industry that can better perform its key function of accepting and spreading risk” (Commissioner McCreevy)
- Encourages a single European market for financial services
- “Enables an institution to absorb significant unforeseen losses and gives reasonable assurance to policyholders” (Framework for Consultation on Solvency II)

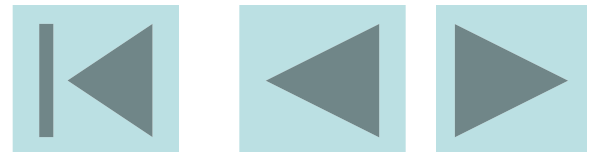


# SOLVENCY II PROJECT

## **Solvency II field study:**

- Guidance for market consistent valuation necessary
- Embedded option valuation to be developed further
- Equity risk and interest risk are most important
- Risk measurement: stress and scenario tests or economic models?
- Risk management: integrated risk management framework in place

Solvency II is in line with [Basel II](#) which set the new capital adequacy framework for banking sector.

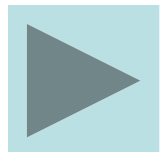
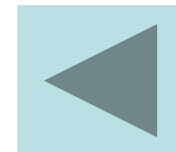


# SOLVENCY II PROJECT

## Industry Response

- Companies across the EU are evaluating impact of Solvency II on their activities.
- They were asked to run [stress tests](#) on balance sheets with assets at market value, including different types of risks as well as estimation of cost of insurance options and guarantees.
- Individual country initiatives: UK, Switzerland, Netherlands
- Others are evaluating impact of Solvency II
- Risk offices of major European (re)-insurers to promote best practice and set standards:

*Aegon, Allianz, Aviva, Axa, Converium, Fortis, Generali, Munich Re, Prudential, Swiss Re, Winthertur, Zurich*

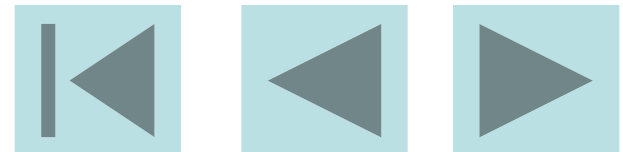


# SOLVENCY II PROJECT

## **Framework**

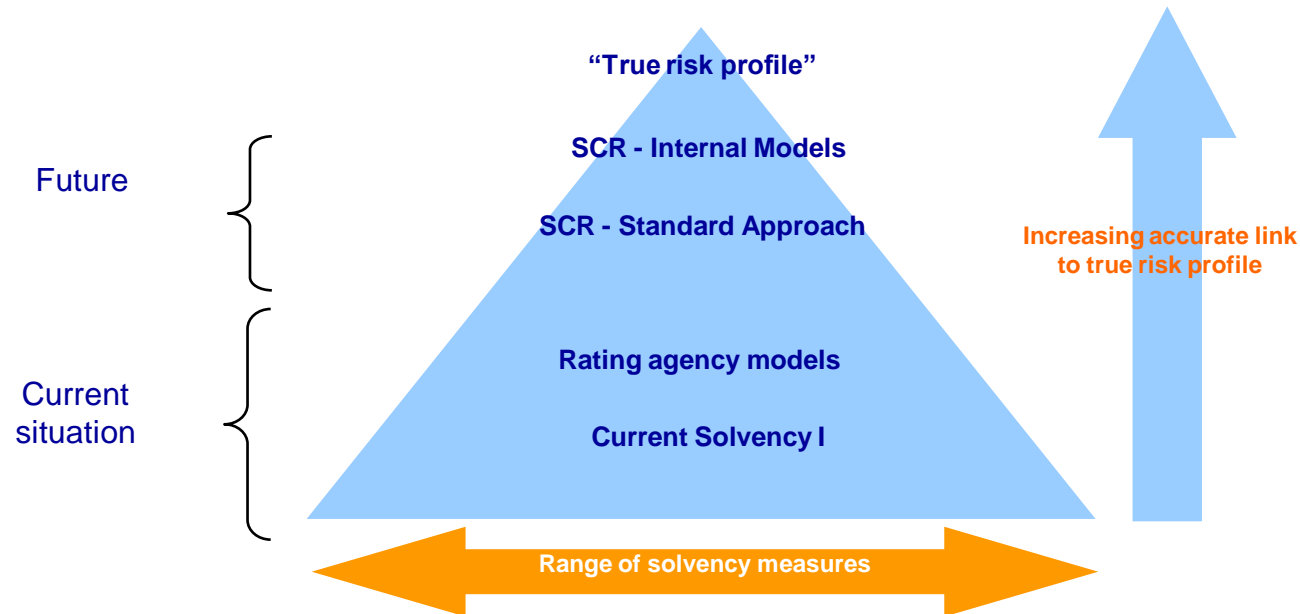
A risk based solvency framework

The risk measurement process needs to cover all potential risks to which insurance company has exposure. A solvency framework is set to define the financial ability to fulfill the obligations when they become due.



# SOLVENCY II PROJECT

A key aim for the industry is to move from a situation of multiple (and sometimes conflicting) solvency constraints to discussions around a single risk based economic framework, as presented in the figure below.



# SOLVENCY II PROJECT

The current situation shows that many country supervisors have set additional local requirements on either solvency regulations or provision calculations. At the same time rating agencies have developed their own solvency models or rules of thumb and companies have developed internal models to analyse the risks more accurately. The increasing accurate link to true risk profile will lead to standard approach on Solvency Capital Requirements and encourage insurance companies to build the internal models that reflect their individual profiles.



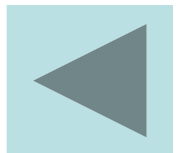
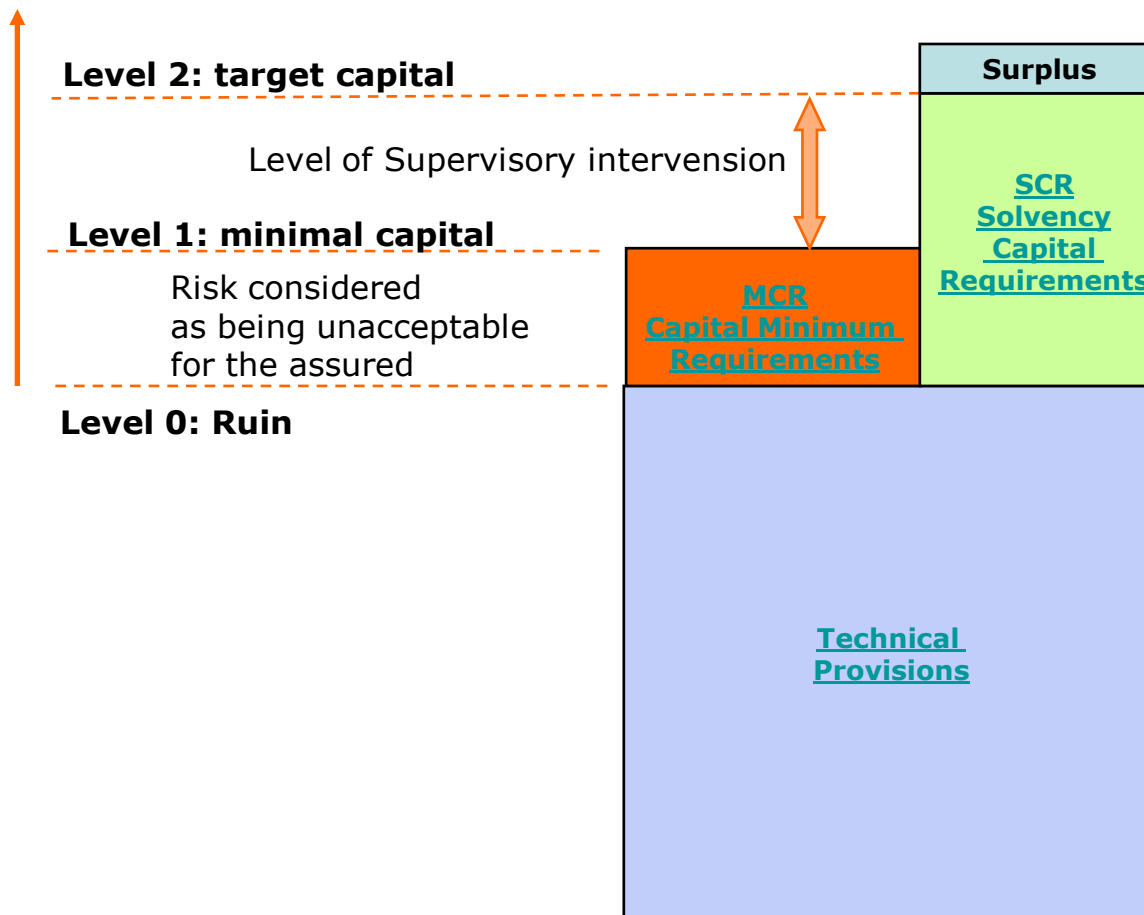
# PILLAR I - MINIMUM CAPITAL REQUIREMENT

- Safety nets/measures (MCR – Minimum Capital Requirement and SCR - Solvency Capital Requirement)
- **Technical Provisions**
- Forms of eligible solvency capital
- **Internal model based approach**



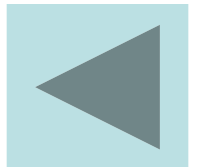
# PILLAR I - MINIMUM CAPITAL REQUIREMENT

- The primary interest of Pillar I concerns the capital requirements - Minimum Capital Requirements MCR and Solvency Capital Requirements SCR.
- The figure below illustrates the relation between levels of capital requirements.



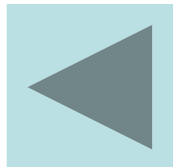
## PILLAR I - MINIMUM CAPITAL REQUIREMENT

- **Solvency Capital Requirement (SCR)** - The SCR reflects a level of capital that enables an institution to absorb significant unforeseen losses and that gives reasonable assurance to policyholders and beneficiaries.



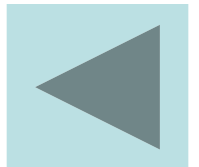
## PILLAR I - MINIMUM CAPITAL REQUIREMENT

- **Minimum Capital Requirement (MCR)** - The MCR is intended to be a safety net and reflects a level of capital below which ultimate supervisory action would be triggered.



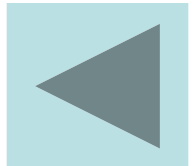
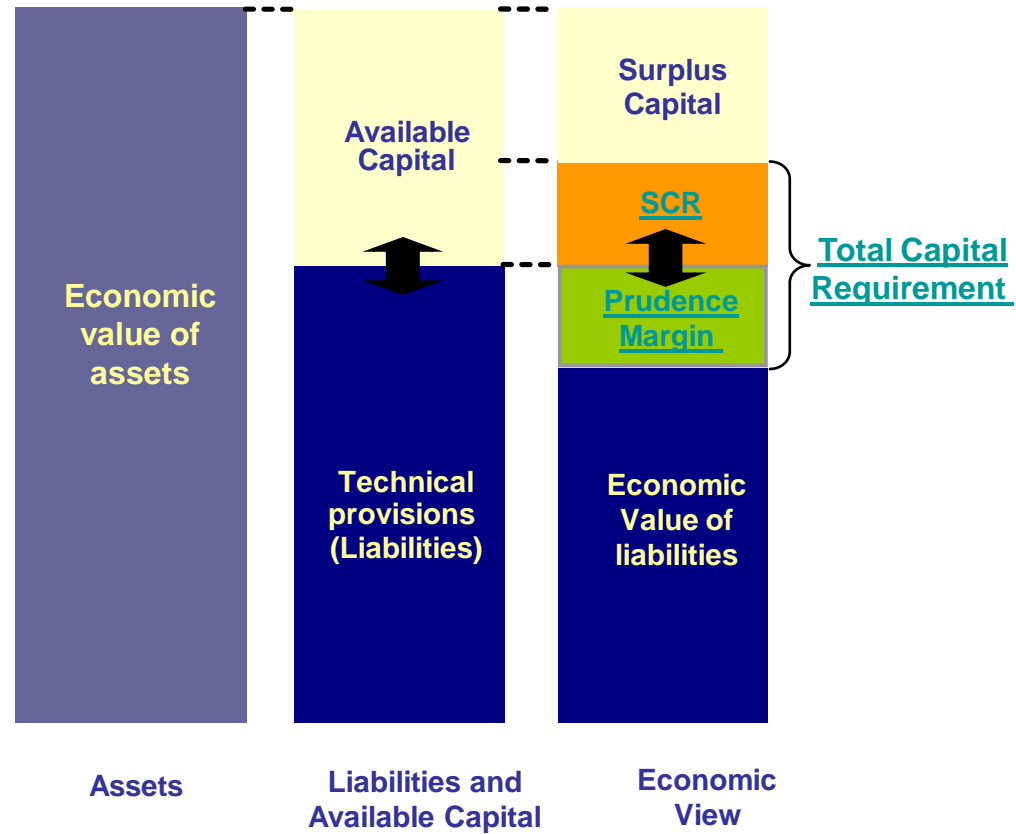
## PILLAR I - MINIMUM CAPITAL REQUIREMENT

- **Technical Provisions** – This represents the amounts set aside in order for an insurer to fulfil its obligations towards policyholders and other beneficiaries. It may include some element of prudence.



# PILLAR I - MINIMUM CAPITAL REQUIREMENT

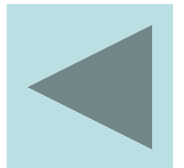
## View on capital



# PILLAR I - MINIMUM CAPITAL REQUIREMENT

The **SCR** is the amount of capital required from shareholders and will depend on the level of **Prudence**.

The sizes of the prudence margin and the SCR are linked. In other words, if the prudence margin is calibrated in such a way that it is relatively large (offering a significant level of protection) the SCR should be calibrated to be relatively low – and vice-versa.

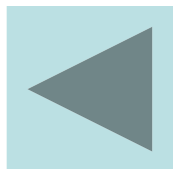


# PILLAR I - MINIMUM CAPITAL REQUIREMENT

## **Prudence Margin**

As a starting point, the prudence margin on top of the best estimate of liabilities should be calculated using a specific confidence interval e.g. 75% (in line with the EC progress note from 22/2/2005).

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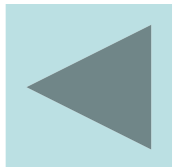


# PILLAR I - MINIMUM CAPITAL REQUIREMENT

**Total Capital Requirement** is the amount required above the economic value of liabilities. Total Capital Requirement should be based on the total balance sheet i.e.:

Volatility of liabilities, volatility of assets, taking into account how they interact.

Total Capital Requirement is therefore **independent** of the level of any **Prudence Margin**



## PILLAR II – SUPERVISORY REVIEW

Pillar II is needed, in addition to the first pillar, since not all types of risk can be adequately assessed through solely quantitative measures. Even for those risks that can be assessed quantitatively, their determination for solvency purposes will require independent review by the supervisor or by a designated qualified party.

Such review will enable supervisory intervention if an insurer's capital does not sufficiently buffer the risk.



## PILLAR II – SUPERVISORY REVIEW

- **Internal control and risk management**
- **Supervisory review process – quantitative tools**
- **Transparency of supervisors**
- **Target level intervention**
- **Cooperation and communication of supervisors**
- **Investment management rules and asset-liability rules**

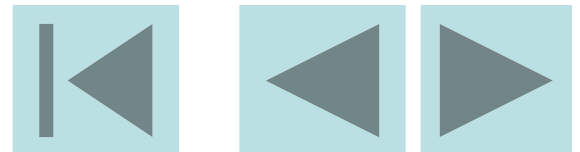


# PILLAR II – SUPERVISORY REVIEW

## **Risk identification:**

Risk is inherent in each operation of an insurer and it includes many internal dependencies that require an integrated approach to risk or solvency assessment.

As a general principle, a Pillar I treatment may be applied to any risk which is susceptible to quantification or limitation.



# PILLAR II – SUPERVISORY REVIEW

**PILLAR  
III**



## Insurance

Mortality  
Morbidity  
Underwriting  
Catastrophe  
Policyholder actions

## Market

Equities  
Property  
Interest rate  
Inflation  
Currencies

## Credit

Reinsurance  
Derivative counter-parties  
Corporate bonds

## Liquidity

Cash flow matching

## Operational

Systems  
controls  
procedures

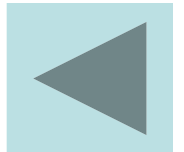
## Concentration

Increased exposure to losses due to  
concentration of investments

# PILLAR II – SUPERVISORY REVIEW

## **Insurance risk**

- The risks within the underwriting risk category are associated with both the perils covered by the specific line of insurance (fire, death, motor accident, windstorm, earthquake, etc.) and with the specific processes associated with the conduct of the insurance business.
- Sources of underwriting risk: process, premium calculation, product design, claims retention, policyholder behaviour and reserving risk.



# PILLAR II – SUPERVISORY REVIEW

## **Market Risk**

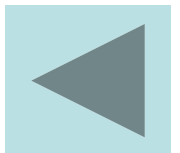
- Exposure to changes in level and volatility of financial securities
- Broken down into: interest rate, inflation, equity, real estate, commodity prices, exchange risk.
- Sources of market risk: interest rate volatility, price volatility, exchange volatility, asset/liability mismatch risk, reinvestment risk.
- Market risk relates also to the value of derivative instruments, such as options, futures and swaps.



## PILLAR II – SUPERVISORY REVIEW

### **Credit risk:**

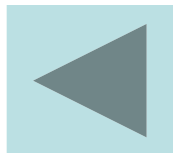
- Risk of default or change in creditworthiness of debtors, counterparties (*e.g. on reinsurance contracts, derivative contracts or deposits given*) and intermediaries where institutions have claims.
- Sources of credit risk: commercial credit, invested asset, political and country risk
- In order to limit the possibility for arbitrage of credit risk from the banking to the insurance sector credit risk quantification follows as closely as possible the one used by the banking regulator.
- Therefore, a credit risk charge is calculated using an approach compatible to Basel II. This charge is then added to the target capital for insurance and market risks.
- The internal model for credit risk have to be calibrated to the same risk measure as used by Basel II, namely the Value at Risk on the 99% quantile.



## PILLAR II – SUPERVISORY REVIEW

### **Liquidity risk**

- Liquidity risk involves risk from limited availability of readily tradable investments to cover the expected cash flows arising from its liabilities
- Losses due to liquidity risk can occur when company has to borrow unexpectedly or sell assets for an unanticipated low price.
- The liquidity profile of a company is a function of both its assets and liabilities.
- Sources of liquidity risk: cash calls following major loss events, a credit rating downgrade, deterioration of economy



# PILLAR II – SUPERVISORY REVIEW

## **Operational risk**

- Operational risk, for capital purposes, is defined as “the risk of loss from inadequate or failed internal processes, people, systems or from external events.
- Operational risks are difficult to quantify so a qualitative assessment approach will initially be used. Capital requirements for these risks would be too arbitrary.
- Sufficient empirical data are not yet available. However, banks are now compiling such data to comply with Basel II. It is therefore conceivable that operational risk could be quantified in the future if insurance companies were to compile relevant data.



## PILLAR II – SUPERVISORY REVIEW

### **Concentration risk:**

- The risk of increased exposure to losses due to concentration of investments or risk exposure in a geographical area, economic sector or individual investments.
- Concentration risk may exist at either the legal entity level or the group level (after the holdings of all legal entities have been consolidated) or both.

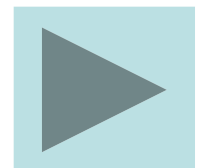


# PILLAR II – SUPERVISORY REVIEW

## The Risk Management Revolution

- Companies can fail if they do not implement and ensure adherence to effective internal control in the field of risk management.
- Insurers face much the same problems concerning risk as banks. Managers must decide what risks to accept, and on what term to accept them; what new risks to take on.

**They need to manage the risk.**

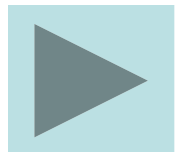
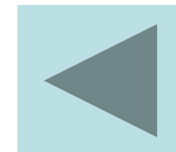


# PILLAR II – SUPERVISORY REVIEW

## Risk Measurement

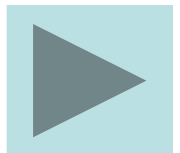
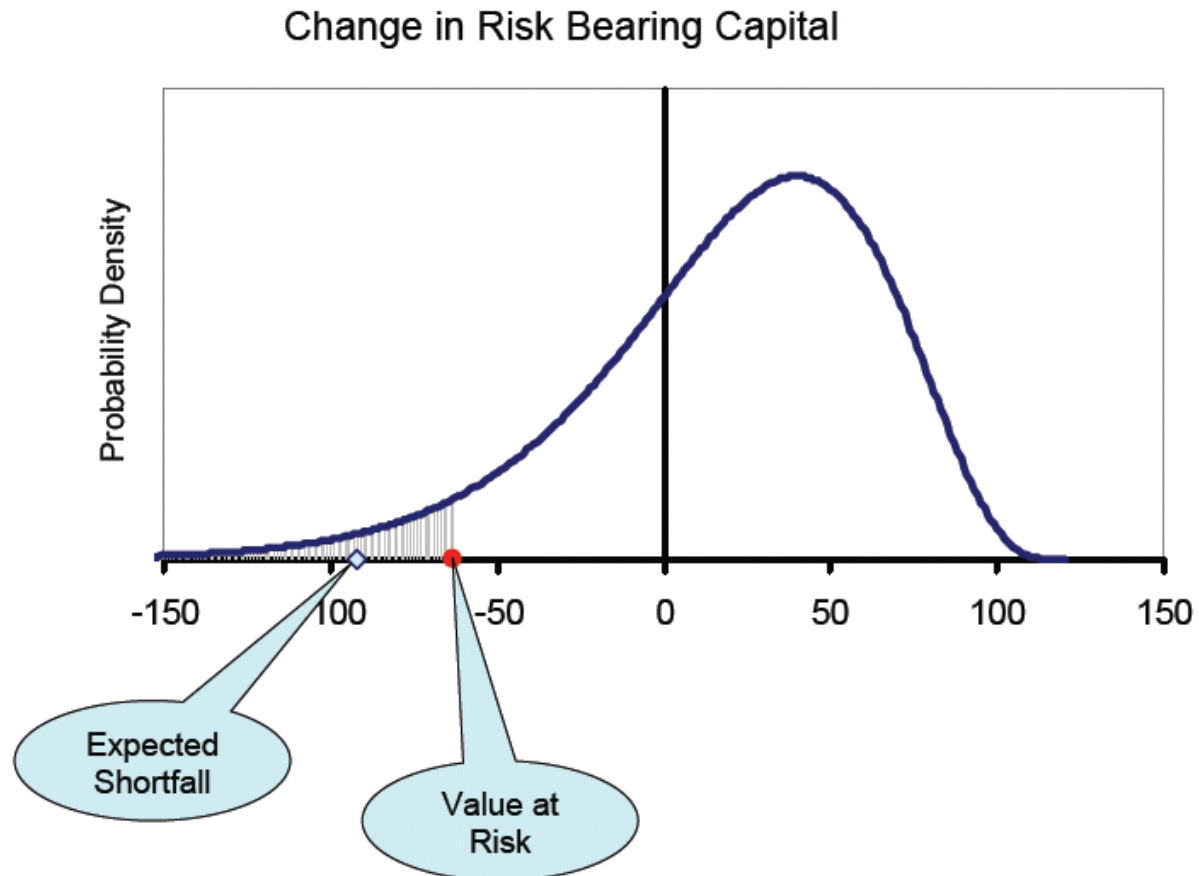
Transformation of the practice of risk management consist of the following issues:

- Development of new theory and its rapid translation into practical applications (e.g. Black-Scholes option pricing model / Deflators)
- Development of risk management methodologies for measuring risk in practice (e.g. Value at Risk, Tail Value at Risk, Risk Based Capital).



# PILLAR II – SUPERVISORY REVIEW

## Risk Measurement



# PILLAR II – SUPERVISORY REVIEW

## Risk Measurement

### Risk Measure VaR

$$VaR_{\alpha}(X) := \sup(x : P(X \leq x) \leq \alpha)$$

### Risk Measure Expected Shortfall

$$ES_{\alpha}(X) = E[X | X \leq VaR_{\alpha}(X)]$$



## PILLAR II – SUPERVISORY REVIEW

**Black Scholes** – One of the most widely used closed form solutions for calculation of cost of guarantees. **Black – Scholes** formula can be used to value the option component of insurance contracts. The **Black- Scholes** model was developed as a tool to value stock options and requires the following information: strike price, stock price, duration, volatility, risk free rate of interest. Many insurance contracts with maturity guarantees can be thought of as an option on the underlying asset share. For example an endowment policy is in-the-money at maturity if the guaranteed benefits exceed the asset share.



## PILLAR II – SUPERVISORY REVIEW

**Deflators** – The use of deflators is not limited to the valuation of financial instruments, but also includes the valuation of corporations and liability cash flows. The guaranteed benefits on variable annuity contracts can be thought of as policyholder options, which may be valued much like call options on assets. The average market value of the excess of the guaranteed benefit cash flows over the funded account values, calculated using deflators, represents the current cost of hedging all of the risk associated with the guaranteed benefits. It is that value that is required in order to adjust the embedded value...



## PILLAR II – SUPERVISORY REVIEW

**VaR** - A 'risk measure' of the potential financial loss in the investment portfolio or on the whole balance sheet. Value at risk provides an estimate of the worst expected loss over a certain period of time at a given confidence level.

**Example:** a 12 month value at risk with a 95% confidence level of €1 million means that an insurer would only expect to lose more than €1 million 5% of the time or once in 20 years.



## PILLAR II – SUPERVISORY REVIEW

**TailVaR** - The concept of 'coherence' has been introduced in actuarial literature to describe risk measures that possess a desirable set of consistency features. **TailVaR** is an example of a coherent risk measure. One desirable feature is 'subadditivity', which means the aggregation of risks does not lead to an increase in overall risk. **VaR**, by contrast, does not enjoy this property, except in the case of normally distributed risks. For these reasons, **TailVaR** is the risk measure that the IAA Insurer Solvency Assessment Working Party has suggested to use for the purpose of setting solvency requirements.

On a fundamental level, **TailVaR** would encourage supervisors, undertakings and policyholders to consider the consequences of a potential default, rather than focussing simply on the probability of insolvency. To some extent, a comparison could be drawn with the advanced approach to credit risk in the banking sector, where undertakings consider both the Probability of Default (PD) and the Loss Given Default (LGD)



## PILLAR II – SUPERVISORY REVIEW

**RBC** (Risk Based Capital) – Capital requirement is directly related to its risk profile & risk tolerance:

- Economic or risk based capital is the capital needed to attain the risk coverage, consistent with the firm's or desired credit rating
- The coverage level is applied consistently to all businesses and portfolios
- **Example:** 50 000 scenarios were run for several test initial surplus amounts, calculating the resulting gain or loss and accumulated surplus amount per €1 of earned premium. The gain or loss is the sum of the €1 premium plus expected interest on reserves and accumulated surplus less the randomly generated claim cost, expected expenses and taxes. Ruin occurs when the resulting accumulated surplus falls below zero in any year of the projection period. By interpolation and successive iterations of the process the beginning surplus is found that results in 5% probability of ruin. This is the **RBC** amount when expressed totally as percent of premium.



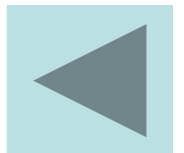
## PILLAR II – SUPERVISORY REVIEW

### **Supervisory review process:**

- The control will lead to qualitative control of risk management by the supervisory authority
- Increased requirements for capital adequacy will be possible
- The use of risk management models will be of relevance for competition, especially if linked with the level of own funds requirements.
- Processes of risk management will become increasingly important for supervision.

The regime aims to:

- Be transparent
- Allow earlier regulatory intervention
- Be risk sensitive
- To completely capture the risks arising from an individual company's business



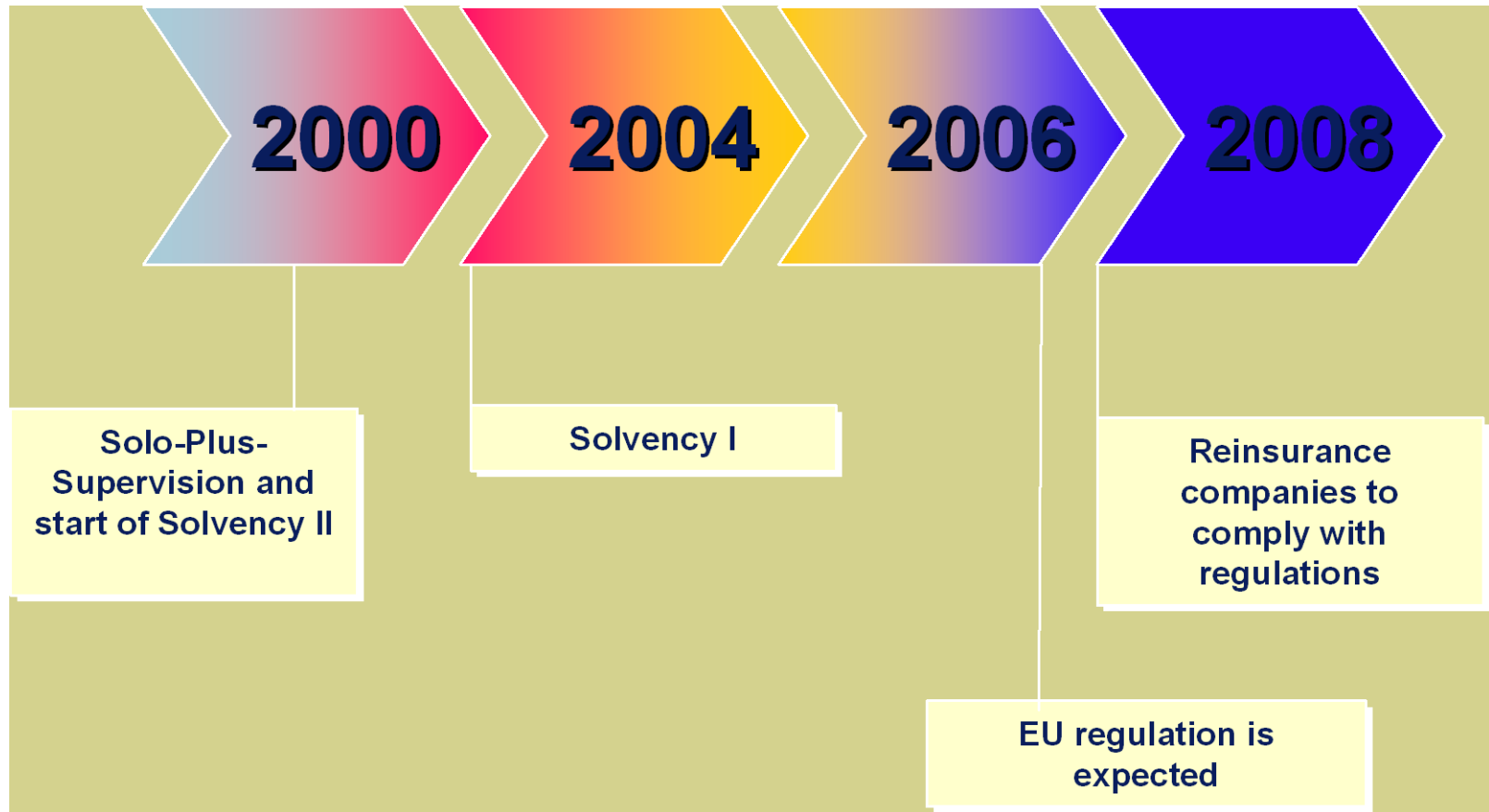
## PILLAR III – MARKET DISCIPLINE

The III Pillar brings in a “disciplinary effect” on corporate management and transparency in markets. It defines principles for the disclosure of information to policyholders, investors, rating agencies and other interested parties so they obtain a comprehensive picture of an insurer’s risk.

- Disclosure regarding Capital structure - including ‘realistic free assets’
- [Risk management](#) and control as well as [risk measurement](#)
- [Risk profile](#)
- Capital adequacy
- Market disciplining of institutions for risk management performance



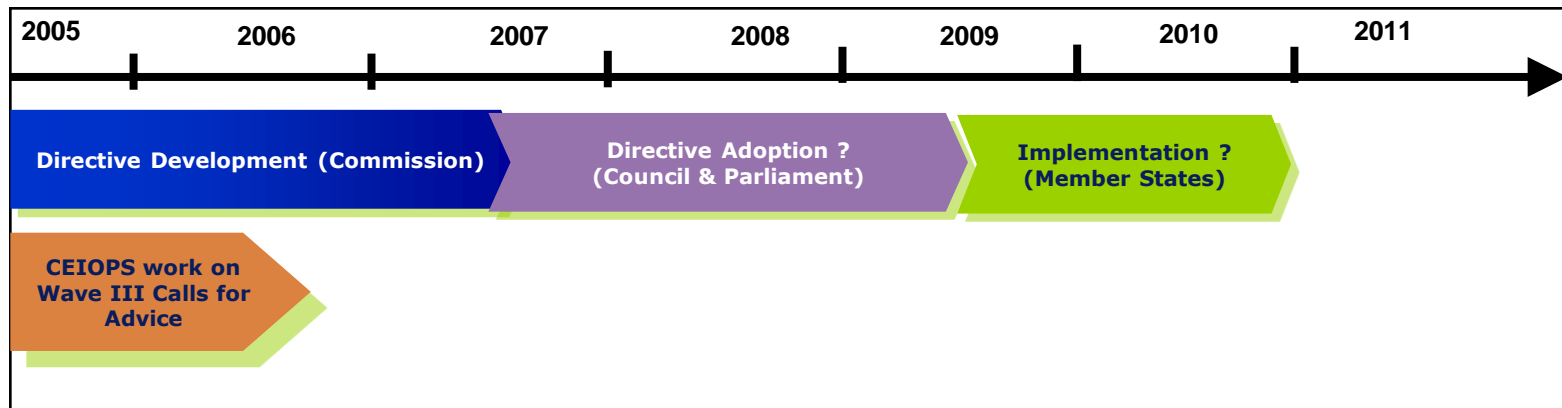
# SOLVENCY II – TIMETABLE



# SOLVENCY II – TIMETABLE

## Solvency II Timetable for 2005-2006

- Key decisions likely to be made during 2006
- Implementation date still uncertain
- Significant resources required for implementation



# STARTING POINTS

## **What should be done to fulfil the requirements of Solvency II:**

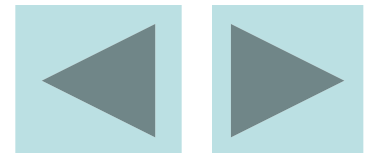
- Preparation of a coherent risk-based framework
- Setting the economic valuation of assets and liabilities
- Identification of risks and managing the risks
- Applying the two tier approach with an absolute minimum (MCR) a target (SCR) and a ladder of intervention between the two.
- The harmonisation should be achieved across all pillars and across all countries in Europe.



# STARTING POINTS

## **Solvency II pre-cursors**

- [ICA \(Individual Capital Assessment\)](#)
- Individual Country Solutions:
  - [SST](#)
  - [FTK](#)

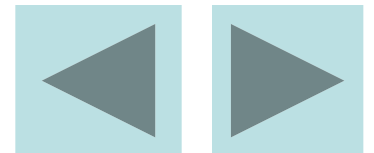


# STARTING POINTS

## **ICA (Individual Capital Assessment)**

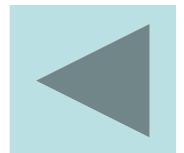
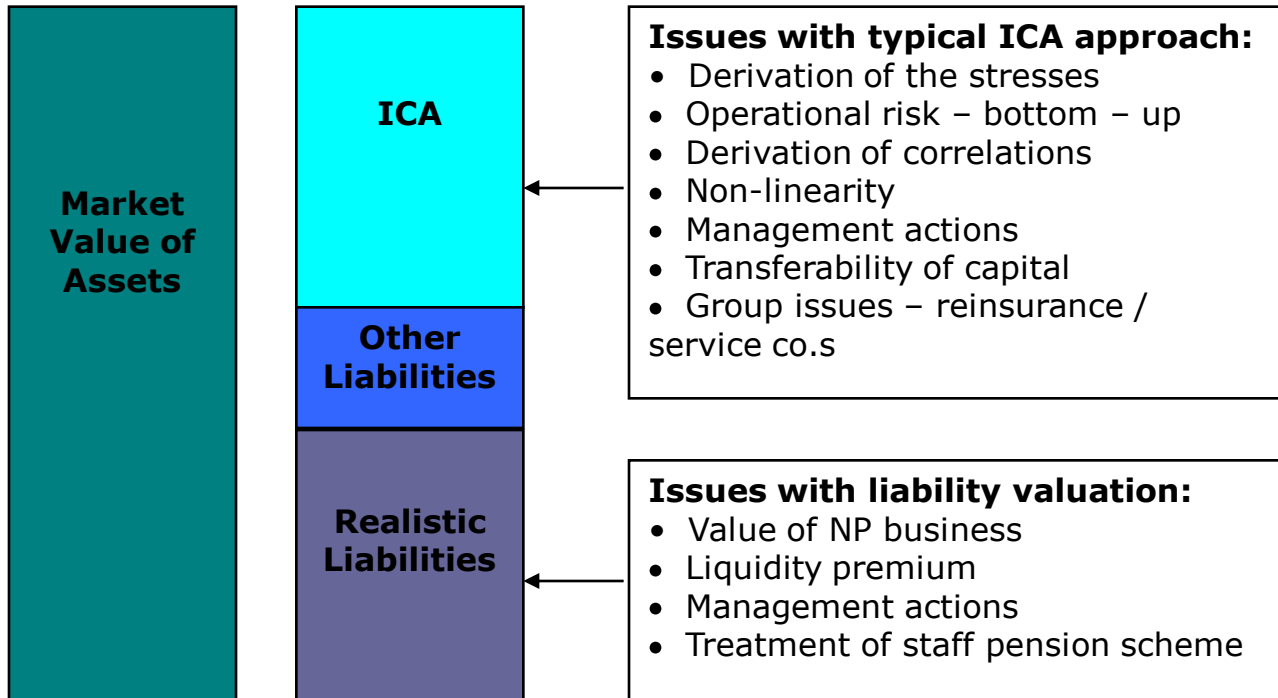
- ICA applies to both Life and Non-Life insurers
- ICA is mainly principles based
- Some guidance by Actuarial Profession
- Covers market, credit, insurance, liquidity, operational and group risks
- Significant freedom in choice of models

ICA lays much of the groundwork for Solvency II and has proven a useful risk management platform. However, some areas of Solvency II may well impose different standards.



# STARTING POINTS

## The ICA concept

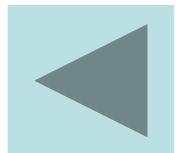


# STARTING POINTS

## **The FTK**

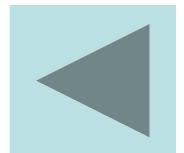
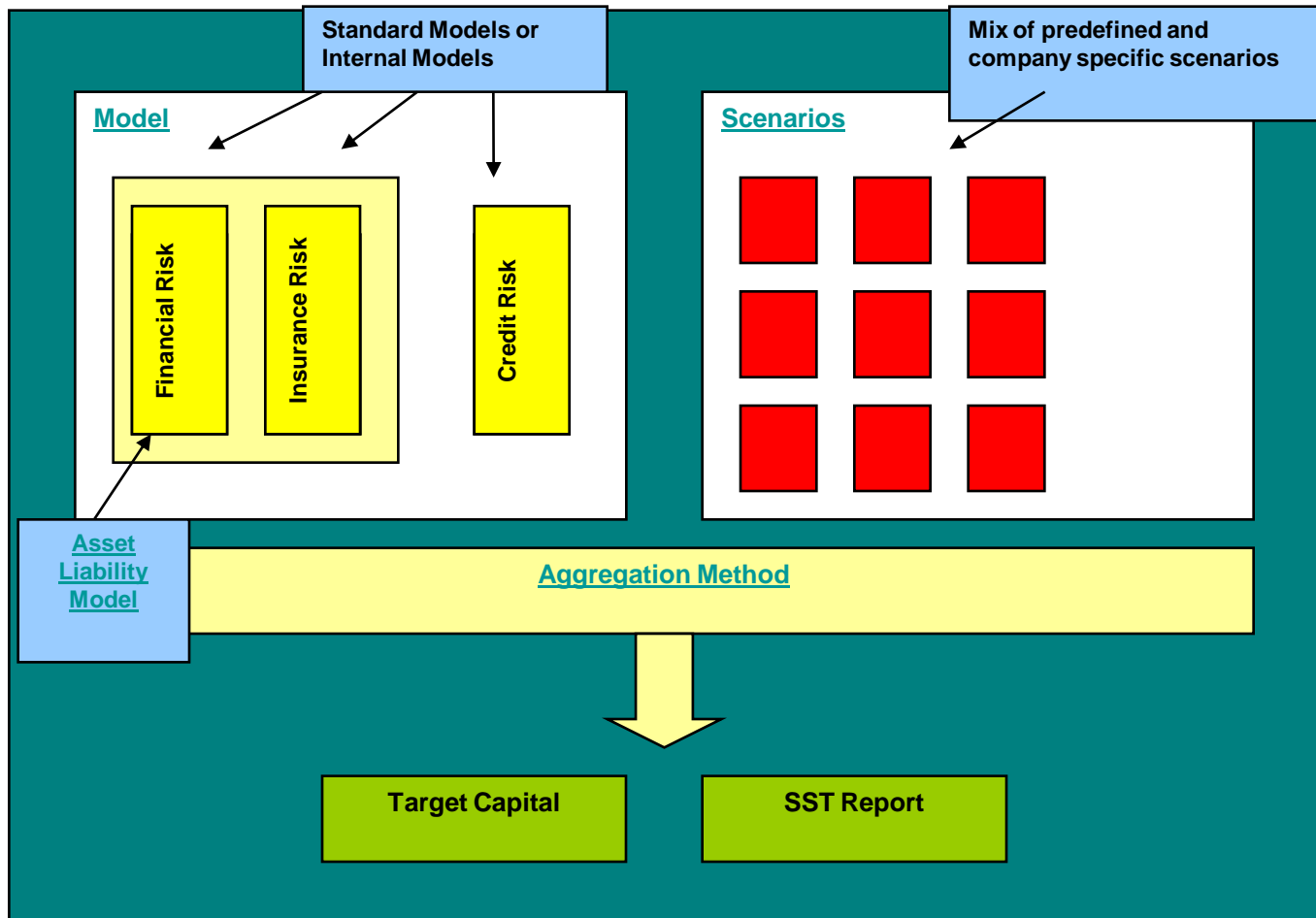
The aim of FTK was to improve insight into institution's financial position and its possible development over the short and medium term.

- For insurers, FTK will have a supplementary role in early years, probably until Solvency II is embedded in legislation
- For pension funds, the capital requirements are in line with the Main Principles for Regulation of the Financial Supervision of Pension Funds in the Pensions Act memorandum



# STARTING POINTS

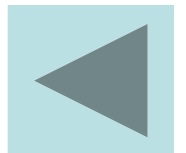
## The SST



# STARTING POINTS

## **The SST Concept**

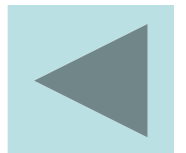
- Assets and liabilities are valued market-consistently
- Relevant risks are market, credit and insurance risks



# STARTING POINTS

## **The SST Concept**

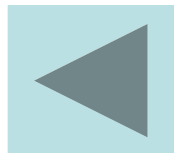
There are scenarios to take into account rare events or risks not covered by the standard models.



# STARTING POINTS

## The SST Concept

The results of the standard models and the evaluation of the scenarios are **aggregated** to determine the target capital.

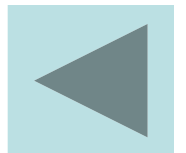


# STARTING POINTS

## **The SST Concept**

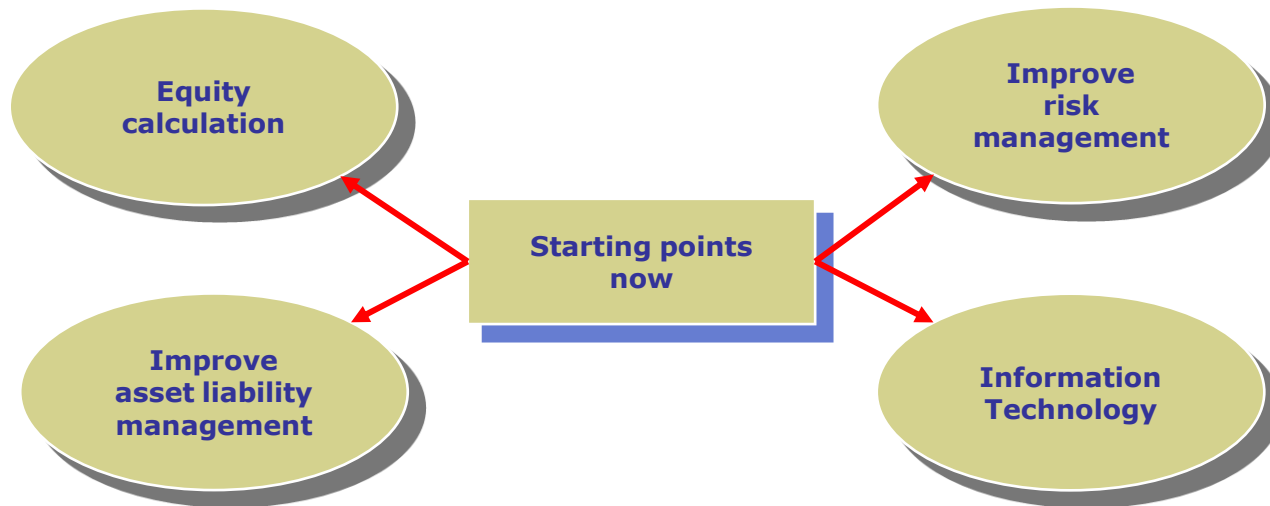
Internal models can be used to for the calculation of target capital.

The assumptions and internal models used have to be documented in an SST report.



# STARTING POINTS

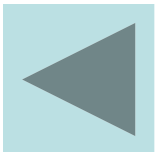
The figure below presents starting steps that need to be taken in order to meet the Solvency II requirements



# STARTING POINTS

## **Equity calculation**

- Increased equity, especially in the case of life insurance companies
- Reallocate investments



# STARTING POINTS

## **Improve Asset&Liability management will involve**

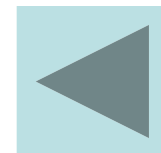
- Identifying the changes to existing valuation methodologies.
- Applying stochastic techniques, understand interactions between assets and liabilities.



# STARTING POINTS

## **Improve risk management**

- Likely consequences of the introduction of Solvency II include well diversified insurance groups having good risk management processes. The risk based approach by insurance supervisors should lead to the recognition of internal risk models as a way to decrease the amount of capital required.
- Improving the risk orientated management will involve:
  - Seek additional reinsurance cover
  - Manage costs
  - Divest or acquire of operations or lines of business
  - Revise pricing strategy
  - Solvency compatible business strategy



# STARTING POINTS

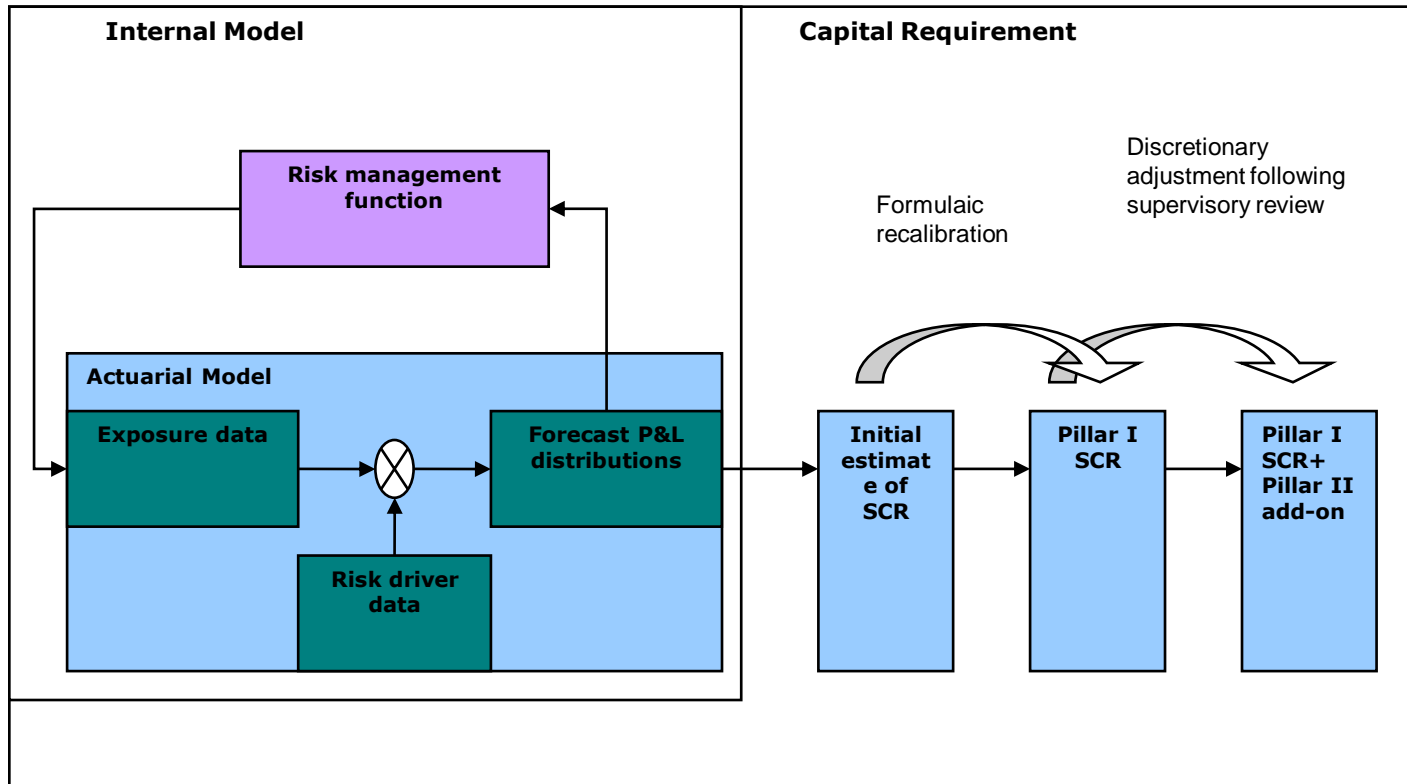
## **Improving the information technology:**

- Create Solvency II compatible processes, systems and controls to prevent breakdowns
- Infrastructure requirement that pertains to enterprise-wide management reporting
- Implementation of robust data management system



# MODELLING

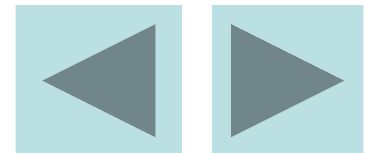
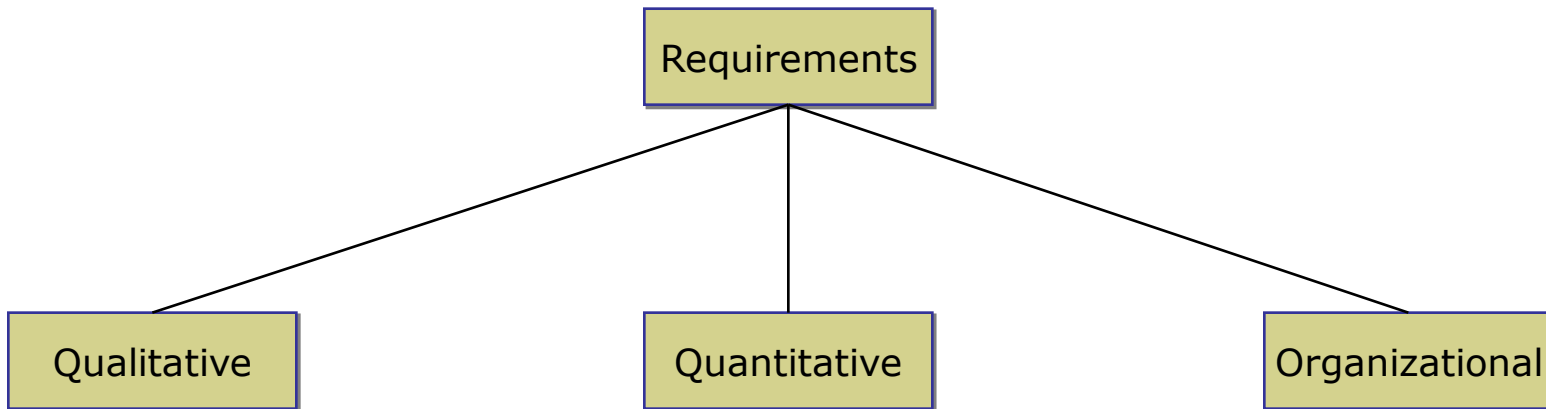
## Internal Models



# MODELLING

## Internal Models – Validation

Internal models are permitted provided they meet certain requirements prescribed by the supervisory authority.

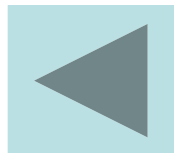


# MODELLING

## **Internal Models – Validation**

### Qualitative requirements

- All relevant risk factors must be factored into the internal models. The dependency structure of the risk factors must be taken into account.
- Data and parameters in internal models must be up-to-date and relevant for the insurance company.
- The appointed actuary has to assess the model risk and stability of the results by means of a sensitivity analysis, back-testing, or similar methods.
- The internal models must be reviewed regularly and adjusted if necessary.

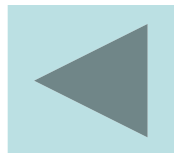


# MODELLING

## **Internal Models – Validation**

Quantitative requirements

The market-consistent value must be used for all items and the internal models must be calibrated to the specified confidence level and risk measure.

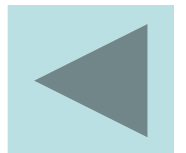


# MODELLING

## **Internal Models – Validation**

Organizational requirements:

Internal models need to be deeply embedded within an appropriate organizational framework. In particular, they need to be integrated into the company's daily risk-management processes, regularly updated and tested.



# MODELLING

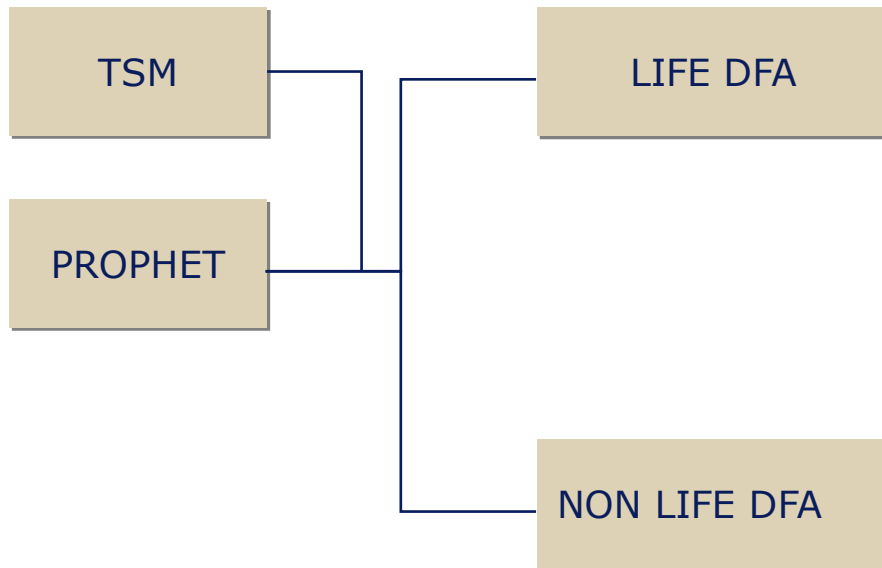
## **About the DFA**

DFA is an adapted library for Prophet, which provides code for a rapid calculation engine for the stochastic modeling of Life and Non-Life insurance. It is designed for and achieves very rapid run-times, typically two orders of magnitude faster than other software. It is also designed for very rapid implementation/calibration.



# MODELLING

Dynamic Financial Analysis is taking its place at the cornerstone of insurance company management. Encouraged by regulation and policyholder security, companies are focusing on capital management as an integral part of their business.



# MODELLING

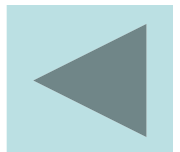
## THE SMITH MODEL

- The Smith Model (TSM) developed by Deloitte, represents the industry's most sophisticated suite of probability and risk modeling tools.
- With countries applications, from pricing complicated financial contracts and valuing guarantees, to assessing capital requirements or managing financial risk, TSM is able to meet the individual needs of insurance company.

Capital  
Modelling

Market  
Modelling  
Consistent  
Valuation

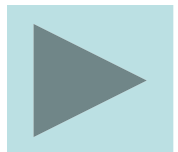
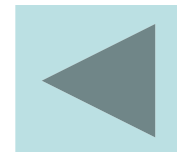
TSM  
Output



# MODELLING

## Capital Modelling

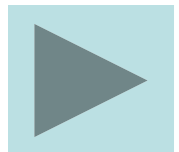
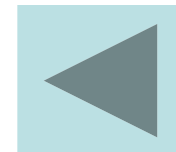
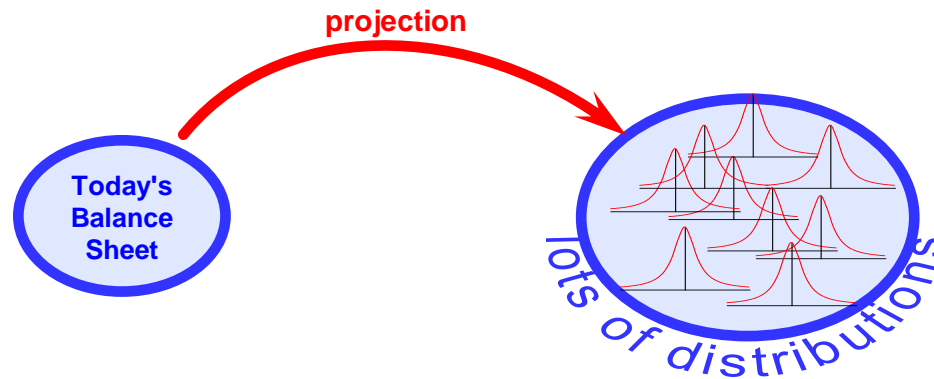
TSM is able to create the thousands of projections, for whatever index – for example, government and corporate bonds return, interest rates, equity markets or currency exchange rates. Since it is compatible with all leading projections systems, such as Prophet, TSM can provide the assumptions for insurers' model offices, whether they are for future investment returns, valuation bases and expenses, or the behavior of policyholders and management.



# MODELLING

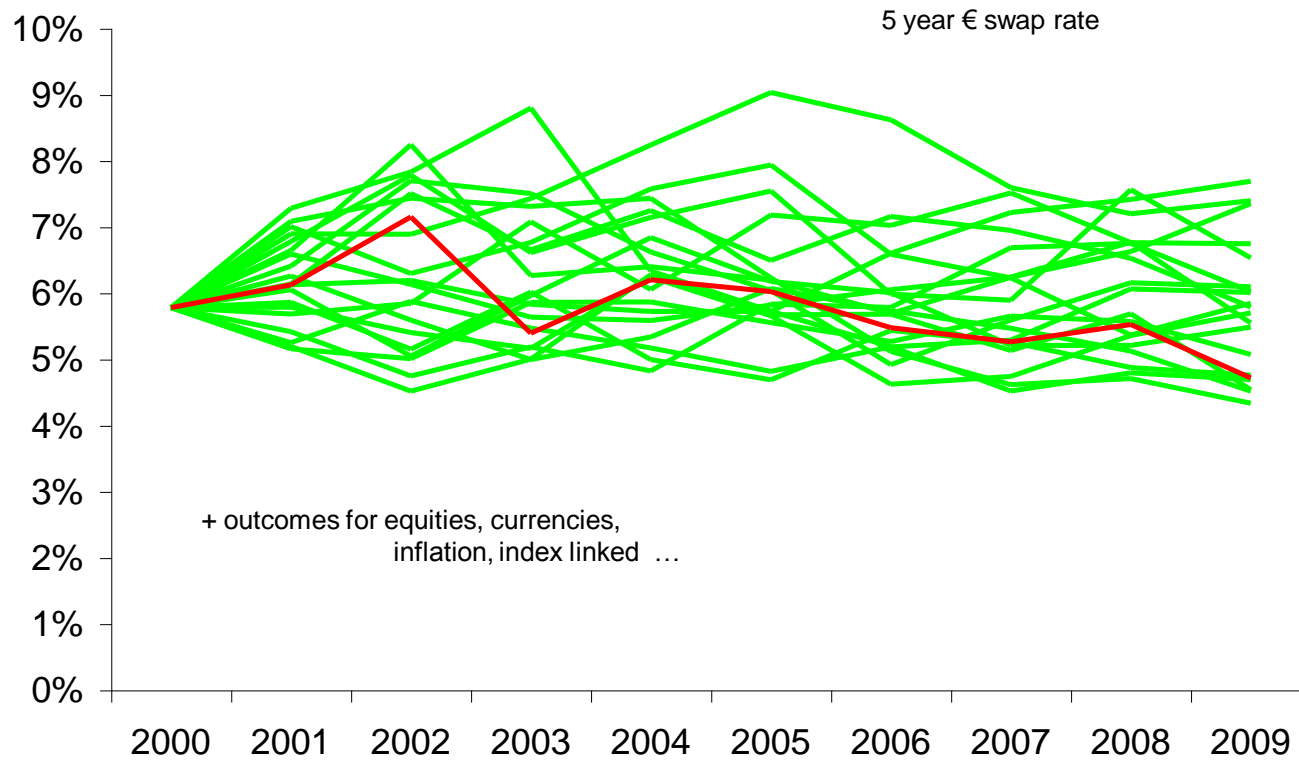
## Economic Scenario Generator

In addition TSM can be used to investigate capital adequacy, since many regulators and insurance firms now think about their capital needs in terms of probability of ruin.



# MODELLING

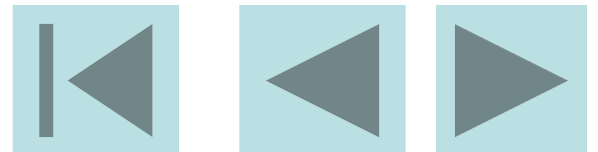
## Economic Scenario Generator Outcome



# MODELLING

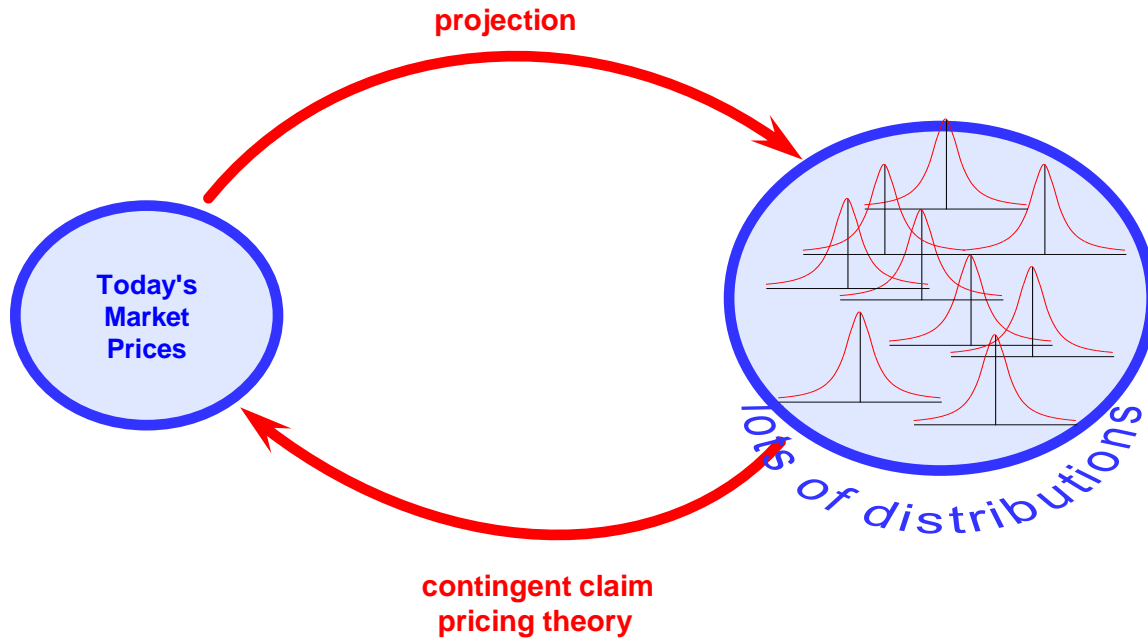
## Market Consistent Valuation

- Market consistency in valuation means performing sets of standard market-consistent simulations covering major world economies every quarter.
- TSM's flexibility makes it a highly effective tool for valuing liabilities, embedded guarantees or business (for mergers and acquisitions). To reflect the subtleties of market prices, flexible parameter choice is vital.



# MODELLING

## Using TSM to Value Cash Flows



# MODELLING

## TSM Output

### Core Assets

**Standard Data**  
**Automatic Process**  
Government bonds  
Equities  
Index-Linked  
Currencies  
Overseas bonds  
Overseas equities

### Wrap Classes

**Limited Data**  
**Standard Process**  
Property  
Commercial  
Residential  
Corporate Bonds  
Mortgages  
Swaps

### Exotic Assets

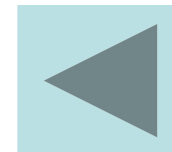
**Limited Data**  
**Bespoke Process**  
Options  
Structured Products  
Swaptions  
Securitisations



# MODELLING

## PROPHET

- The Prophet workspace provides the „engine“ for the DFA model. All DFA calculations are specified within the Prophet „library“. The library is open to inspection and may readily be adjusted by users.
- Prophet provides a framework for the development and running of one or more financial models to generate timely statutory and management information.
- Prophet has an extensive range of facilities for pricing, profit testing, valuation, ALM, and model office work.

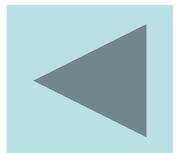


# MODELLING

Using Prophet you can perform comprehensive calculations such as:

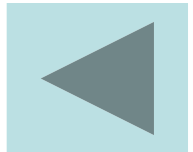
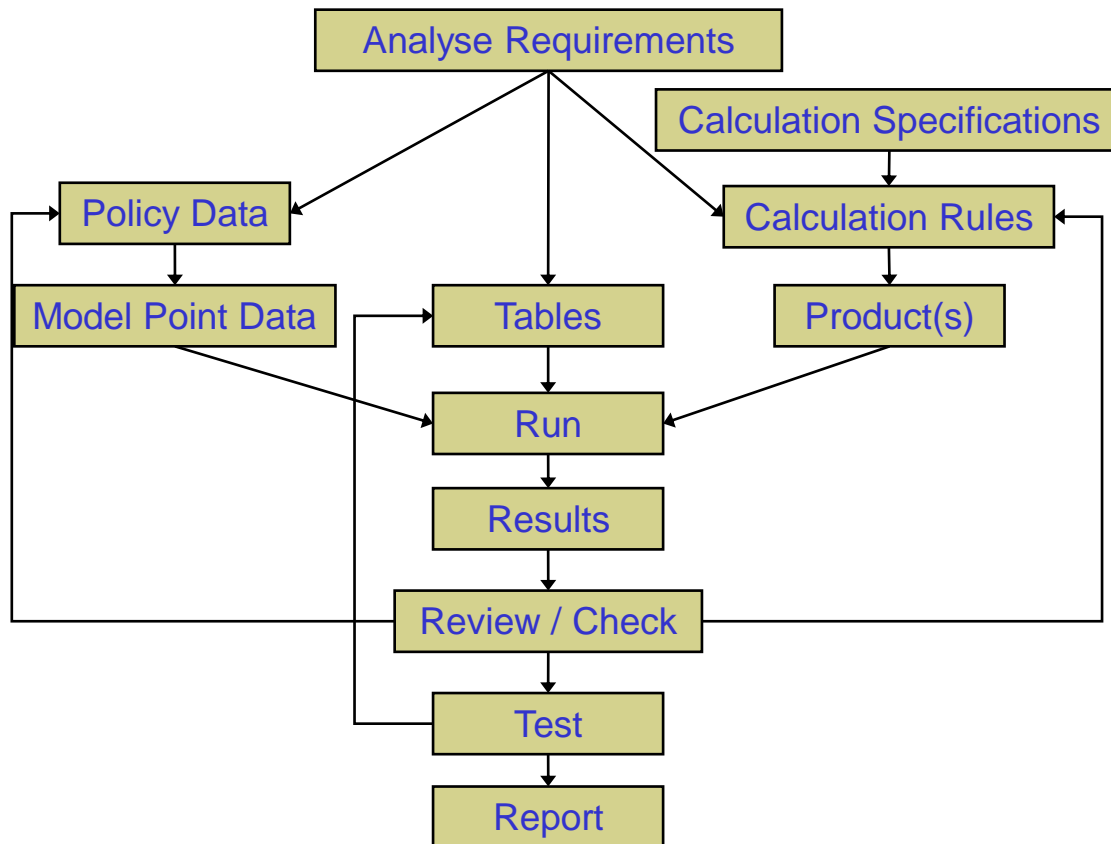
- Asset/liability modelling and cash flow testing
- Stochastic projections
- Product pricing and design
- Budgeting and planning
- Statutory valuations
- Embedded value calculations
- Appraisal valuations
- Financial reporting
- US GAAP reserves and profits, including
- Purchase GAAP
- Experience analysis

## [The Modelling Process](#)



# MODELLING

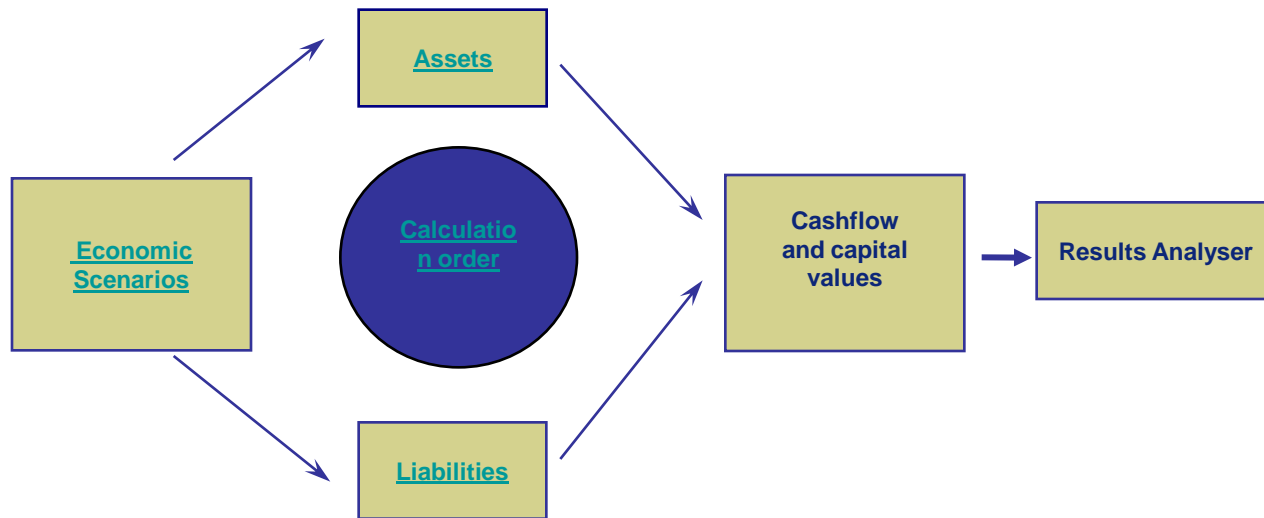
## The Modelling Process



# MODELLING

## LIFE DFA

### LIFE INSURANCE COMPANY MODEL



# MODELLING

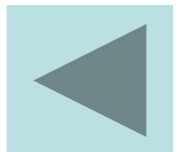
## **Asset Types**

- Bonds
  - Fixed rate government bonds
  - Floating rate government bonds
  - Fixed rate corporate bonds
  - Floating rate corporate bonds
  - Index Linked bonds
- Equities
- Options – Puts and Calls
- Swaps – Fixed for Floating and Floating for Fixed
- Swaptions
- Caps and Floors
- Property
- Cash

## **Asset Model**

Assets are modeled based on two groups:

- Technical assets covering insurance liabilities for all insurance groups.
- Shareholders assets for covering non-technical liabilities
- For each modeled group a separate structure of assets is modeled based on the pre-defined types of assets.



# MODELLING

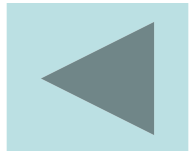
## **Liability Types:**

Continental liability types modelled include:

- Endowments
- Pure Endowments
- Term Assurances
- Annuities (immediate and deferred)
- Savings with profit sharing (or capitalisation)
- Unit Linked
- Group Pensions (Not covered in this module)

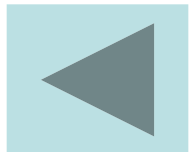
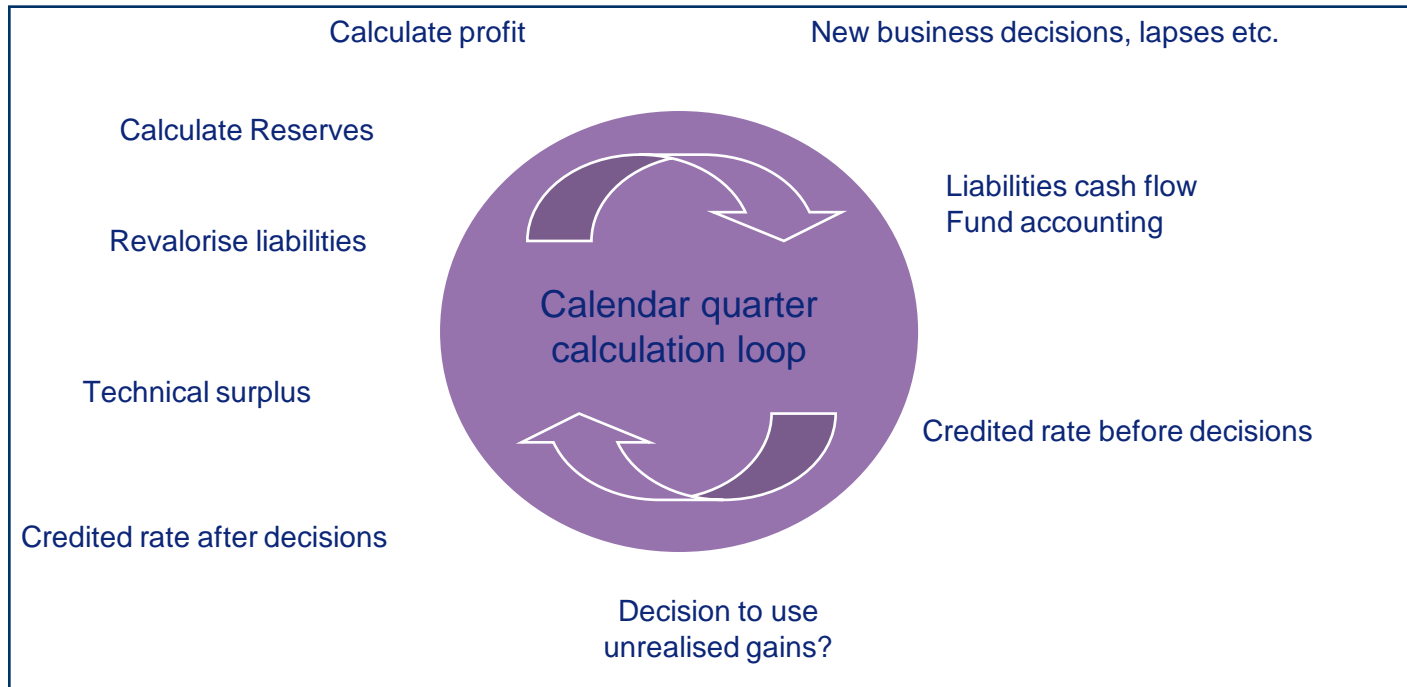
## **Various flavours:**

- Regular and single premiums
- Risk premium (term) or yearly renewable
- Increasing premiums



# MODELLING

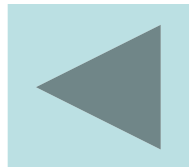
## Calculation Order



# MODELLING

## Uses Of The Model

- Market consistent cash flow valuation
- Risk based management, reporting and supervision
- [Dynamic Stochastic Modelling](#)
- Strategy work for:
  - Asset liability modelling
  - Investment decisions
  - Profit sharing rules
  - Capital requirements
  - Pricing and design of new business
    - Fair values and guarantee costs
    - Other risks credit, mortality, lapse.

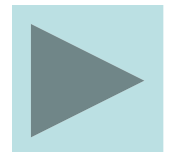
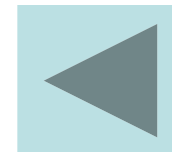
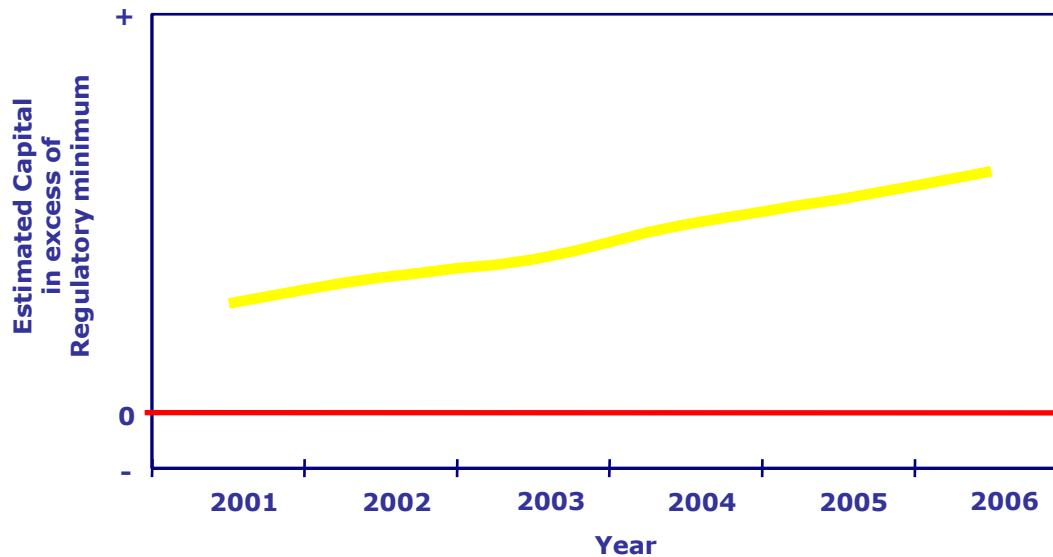


# MODELLING

## Dynamic Financial Analysis

Stage 1

Financial Budgeting = Deterministic projection with one set of market assumptions

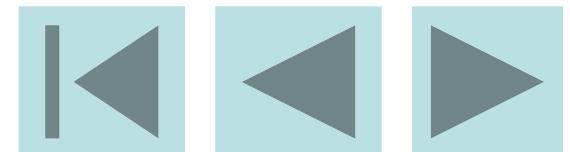
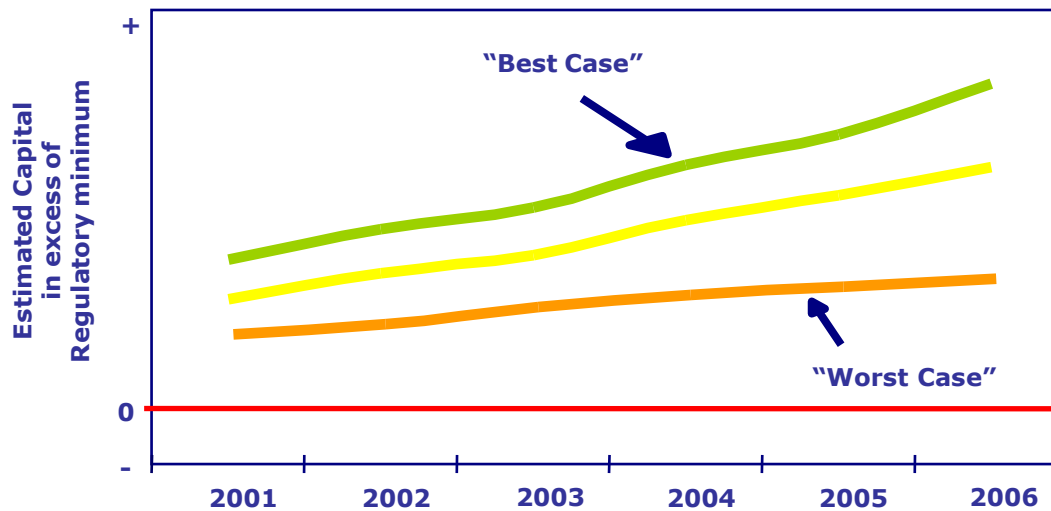


# MODELLING

## Dynamic Financial Analysis

### Stage 2

Sensitivity or Stress Testing = Deterministic modeling that incorporate "best case" and "worst case" scenarios along with the expected outcome

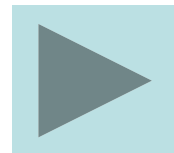
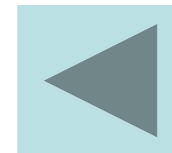
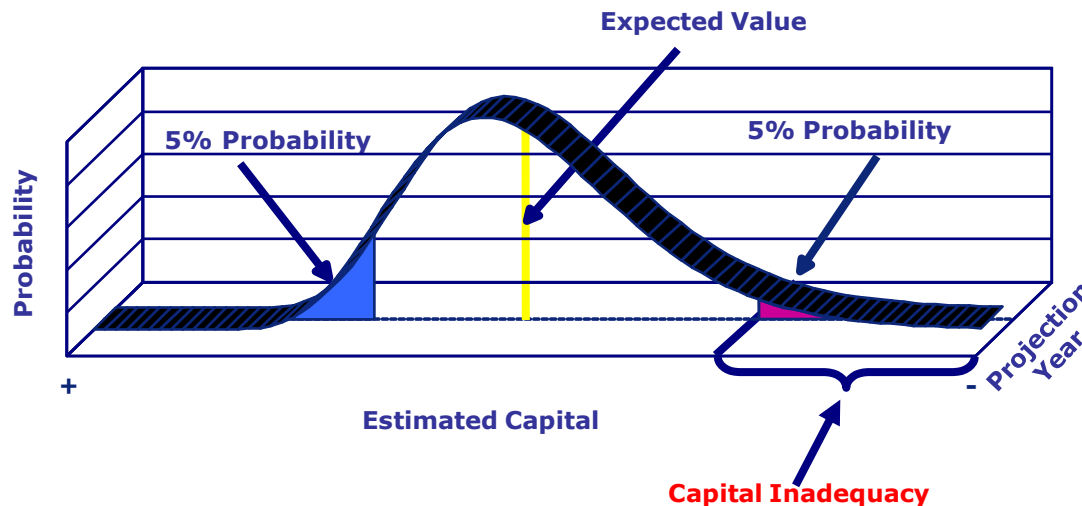


# MODELLING

## Dynamic Financial Analysis

### Stage 3

Stochastic Modeling = Modeling that describes critical assumptions and their combined financial implications in terms of ranges of possible outcomes

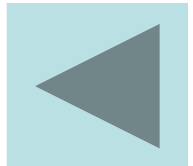
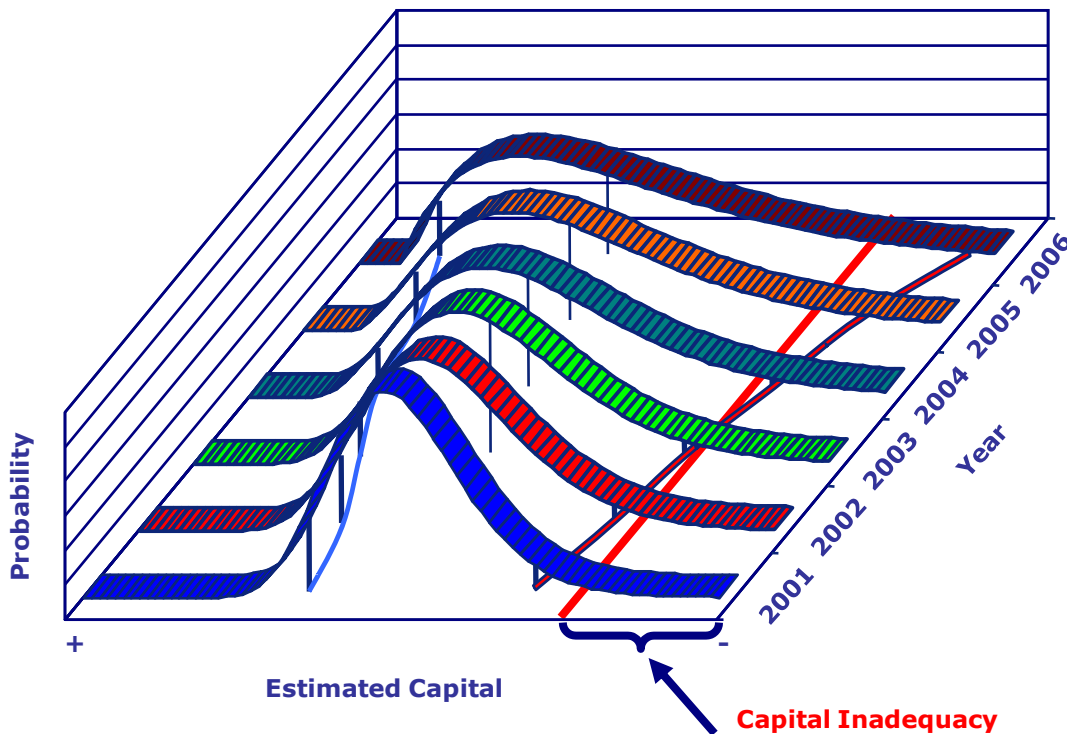


# MODELLING

## Dynamic Financial Analysis

Stage 4

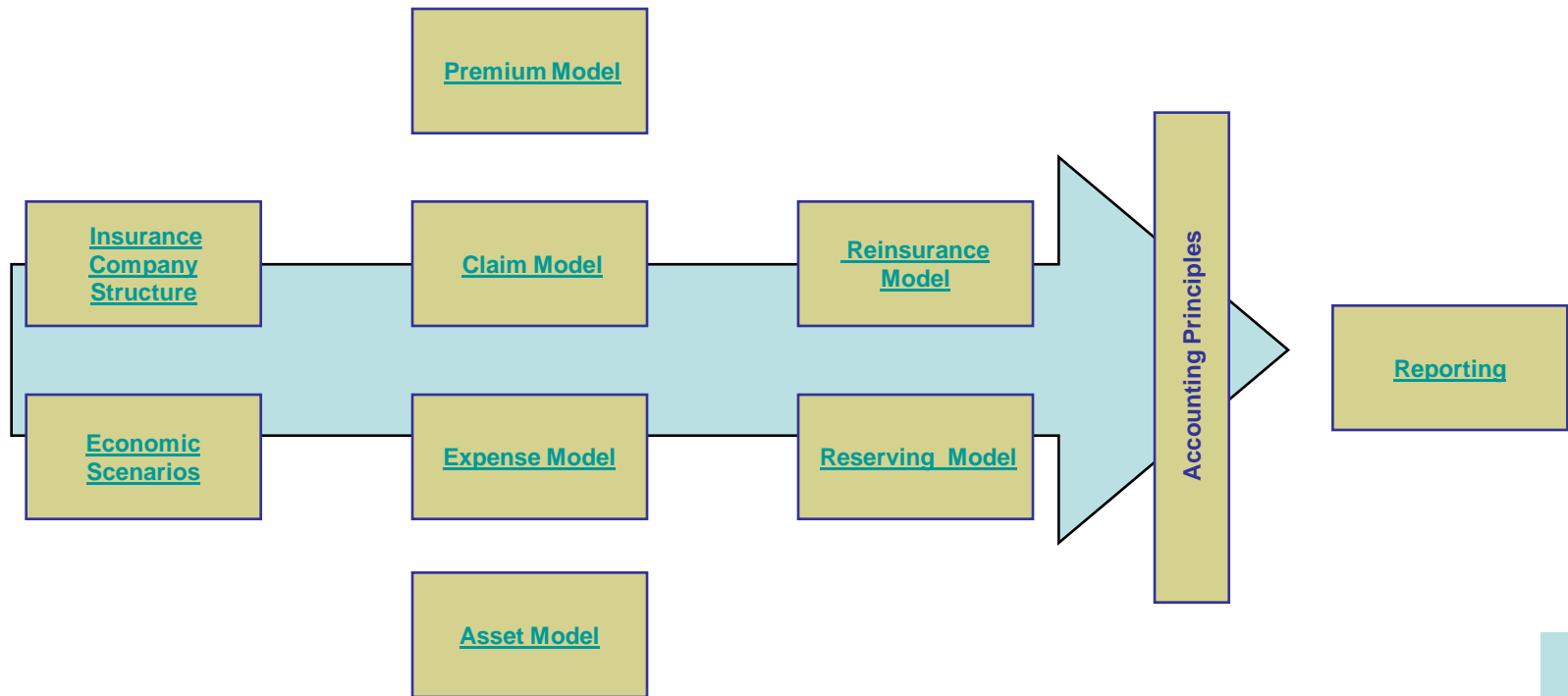
Dynamic Modeling = Stochastic modeling that incorporates feedback loops and "management decisions" into the model calculation



# MODELLING

## NON LIFE DFA

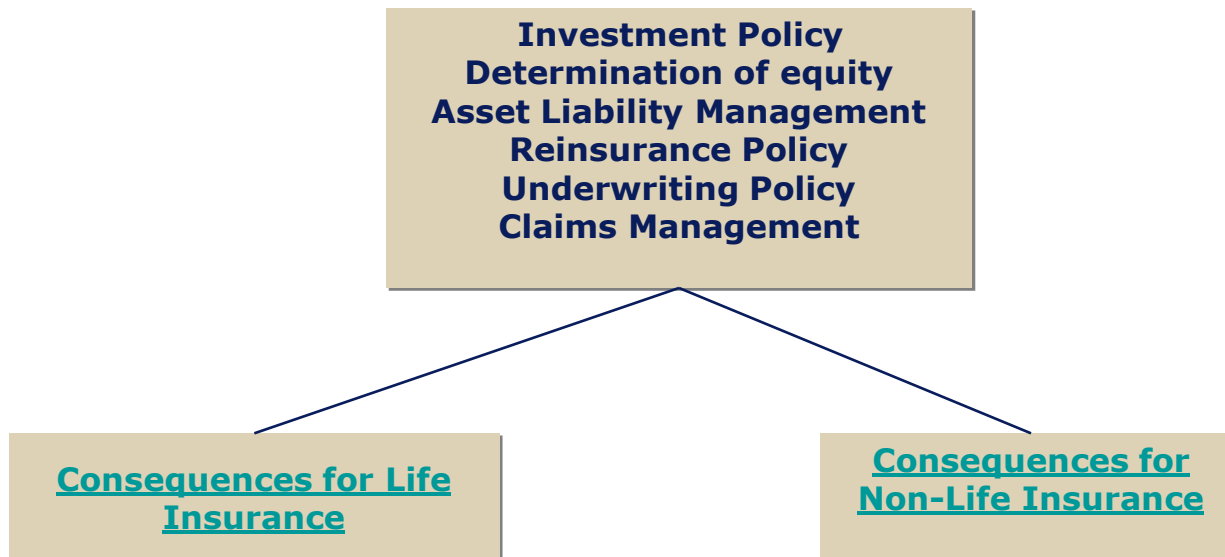
Non-Life insurance company model



# CONSEQUENCES

## Expected consequences for the insurance industry

Solvency II will bring some improvement on current overview of insurance activity. The emphasis is placed equally on running the insurance business effectively and formal compliance with the regulations.



# CONSEQUENCES

## **Consequences of Solvency II for Life Insurance:**

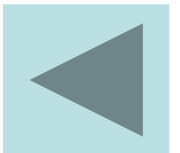
- Increased orientation on capital costs in product development, pricing of guarantees and options.
- Trend in Profit Sharing System towards disclosure of gain shares of the customers on the end of the contract period.
- Strategies Capital Investments – Portfolio strategy, attention to the needs of liabilities



# CONSEQUENCES

## **Consequences of Solvency II for Non Life Insurance:**

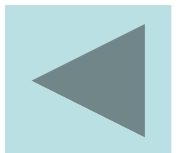
- Possible trends to increasing possibilities for premium adjustment
- Trends to possible claims-experience premiums (bonus-malus systems)
- Enlargement of the exclusion clauses
- Special combination products (bundling of different risks)
- Strategies Capital Investment – increasing influence of asset – liability aspects also in non- life business



# SOLVENCY II PROJECT

## **Stress tests:**

- Stress tests are necessary tool for insurance management.
- Stress tests are fundamental element of an insurer's overall risk management framework and capital adequacy determination. They help the insurer in making decisions on what action is needed to ensure that there is no undue risk.
- One purpose of testing is to measure the level of consistency in the testing done by the insurers and thus to enhance the confidence in these tests.
- Various modelling techniques are used in stress testing. Common methods used are based on static or dynamic modelling and deterministic or stochastic approaches.

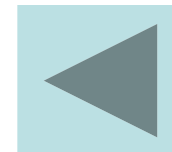


# MODELLING

## What can Prophet DFA do for you?

Prophet DFA can help evaluate the consequences of the many strategic decisions facing insurers. Users of the model have addressed a wide range of issues including:

- Allocation of capital to business units and classes of business
- Setting risk – adjusted performance targets for business units
- Monitoring actual performance against targets
- Planning for future solvency and capital requirements.
- Testing business strategies such as:
  - Reinsurance purchasing
  - Asset allocation Overall capital requirements
  - Dividend strategy
  - Expanding/contracting lines of business
  - Acquisitions and disposals

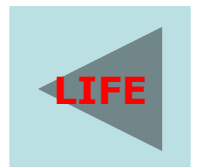
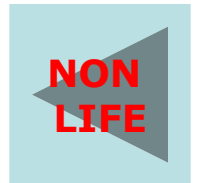


# MODELLING

## Economic model

The Economic supporting Prophet DFA provides all economic variables (CPI, claims inflation, exchange rates and asset returns) over the projection period. This provides a self consistent economic environment for each model simulation.

We recommend that Deloitte's proprietary model „The Smith Model“ (TSM) is used as this has a number of desirable features not present in other commercially available economic models.



# MODELLING

## **Insurance Company Structure**

### Organisational Structure

- Organisational structures are dealt with by defining “Entities”. An Entity will usually represent a legal entity that may be part of a group structure and can be an Insurance company, Captive or Holding Company.
- Lines of Business
  - Individual lines of business are separately defined with unique sets of
  - assumptions describing premiums, loss distributions, expenses, commissions
  - and other class specific issues.



# MODELLING

## **Assets**

Any asset included within the economic file can be allocated in any proportion to individual lines of business or else at an entity level. Asset returns are split by both growth and income.



# MODELLING

## Reinsurance

Most common types of reinsurance are in a flexible and general format, including:

- Surplus Lines
- Quota Share
- Excess of Loss (including Catastrophe covers)
- Aggregate Excess of Loss (including Catastrophe covers)
- Stop Loss



# MODELLING

## **Reporting**

Each line of business, entity and reinsurance treaty is associated with a “base economy” and a “reporting economy”. The reporting economy determines the exchange rates used when results are output. The base economy determines the assets returns, CPI etc that should be read from the econometric simulations.



# MODELLING

## Premium Model

- Premium written is modelled through the application of the estimated written premium in the first period of projection and the series of volumes multipliers in later periods.
- Earned premium is modelled through defining earned premium pattern, resulting from the analysis of historical data.
- The value of premiums receivable and premiums paid is modelled through defining the premium pattern, resulting from the analysis of historical data.



# MODELLING

## Claims Model

- Claims are modeled as a product of claim ratio (generated from a chosen probability distribution) and premium income estimated in the given period.
- Claims paid are modelled by an application of claims paid scheme received upon the analysis historical data.
- Process of paid claims can also be subject to random generating fluctuations.



# MODELLING

## Reserving Model

- The model includes four types of reserves:
  - Unearned Premium Reserve,
  - Outstanding claims reserves,
  - Claims handling reserves,
  - Equalisation reserve.
- Reserves are calculated separately for each insurance group based on selected parameters.
- Unearned premium reserve is calculated based on earned premium pattern.
- Claims handling reserves is calculated based on proportional loading on outstanding claims reserve.



# MODELLING

## **Expense Model**

- The modeled types of expenses are:
  - Acquisition costs
  - Administration expenses
  - Claims handling expenses
  - Reinsurance commissions
- Acquisition costs are defined as a percent of premium written or by per policy.
- Administration expenses are modeled as three types:
  - Fixed (nominal)
  - Variable per policy
  - Variable as percent of premium earned / written)
- Claim handling expenses are modeled as a percent of claims paid.
- Reinsurance commissions are modeled as percent of ceded premium.



# Solvency II vs. Basel II

