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Valuation and Capital

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Content

- The Importance of Valuation

- Valuation and Capital

- Fundamentals of Market Consistent Valuation

- Risk Margin

- The Cost of Capital Rate

- Future Challenges

The Importance of Valuation

One important area is the treatment of the annuity business, where the UK is somewhat of an outlier in the extent of private annuity provision and where that provision could become more important as defined benefit pensions continue to decline and defined contribution pensions requiring annuitisation grow in importance. A prudent approach to annuity capital requirements, with adequate recognition of the probability of bond default, is clearly important, but it is also important to recognise that the annuity business in particular is different from the business of banking, not subject to liquidity risk, and specifically focused on matching long-term liabilities with long-term assets. The new Solvency II capital regime therefore needs explicitly to recognise that there is an illiquidity premium in bond yields, while making sure that we do not overstate that illiquidity premium and understate probabilities of default.

Adair Turner, Chairman FSA, 9 June 2009

Das Zweite, was einen erfreulichen und wichtigen Stellenwert hatte, auch aufgrund von Einlassungen der Bundeskanzlerin, sind die Bilanzierungsregeln, die nach wie vor einen sehr prozyklischen Effekt haben und bezüglich derer ich im Augenblick sehr aufmerksam die Debatte in den USA verfolge, wo der Kongress initiativ geworden ist und die dortige Einrichtung veranlasst hat, die Banken über eine Beweislastumkehr auch in die Lage zu versetzen, sich nicht nach der Fair-Value-Methode immer weiter in den Sumpf hinein zu begeben, sondern endlich in einer Spiralbewegung nach oben wieder den Kopf über Wasser zu bekommen

Peer Steinbrück, German Finance Minister 20 March 2009

The Importance of Valuation

"The freezing of the mortgage backed securities market, the "mark to market" losses that decimated AIG's book equity, the resulting downgrades by the rating agencies and the collateral posting requirements that arose after the downgrades were beyond our control."

Statement of Robert B. Willumstad before the US House of Representatives Committee on Oversight and Government Reform, October 7, 2008
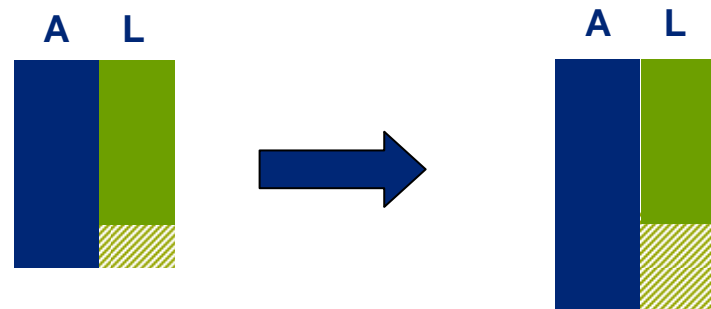
"If more institutions had properly valued their positions and commitments at the outset, they would have been in a much better position to reduce their exposures,"

Letter to the Editor, the Financial Times by Lloyd Blankfein, February 9, 2009

Capital Creation Ex Nihilo
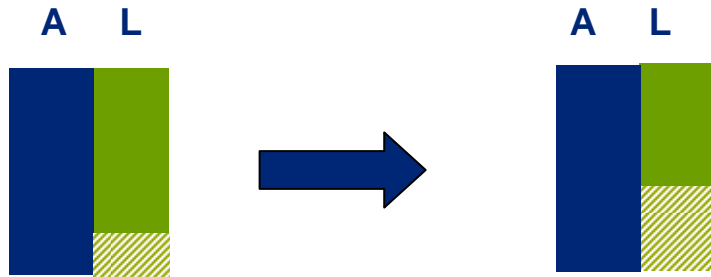
Illiquidity premium approach: Declare liabilities lower by discounting with higher spread

IFRS approach: Declare non-performing assets as hold-to-maturity

Situation for taxpayers: a difficult to value liability and an equally uncertain asset

Valuation

Valuation depends on the purpose

- What is the cost of holding the liabilities for the insurer
- What is the cost of holding a insurance portfolio in a run-off situation
- What is the cost of holding a insurance portfolio in a going-concern situation
- What is the value of a portfolio that is consistent with how markets price cash flows
- What price should be charge for selling a portfolio of liabilities
- What is the price for a portfolio of liabilities in an arm-length transaction?
- What premium should be charged for an insurance liability
- Etc.

Valuation

Initial liabilities

Discretionary policyholder benefits reduced
and part used as available capital

Further losses require more liability
elements to be used to buffer risks

Further losses eat through all hybrid
elements of the liabilities and company
enters run-off; risk margin and best
estimate change due to run-off situation

Capital Lost

Deferred tax liabilities

Subordinated Loans

Discretionary
policyholder benefits

Risk margin

Best estimate of
insurance liabilities
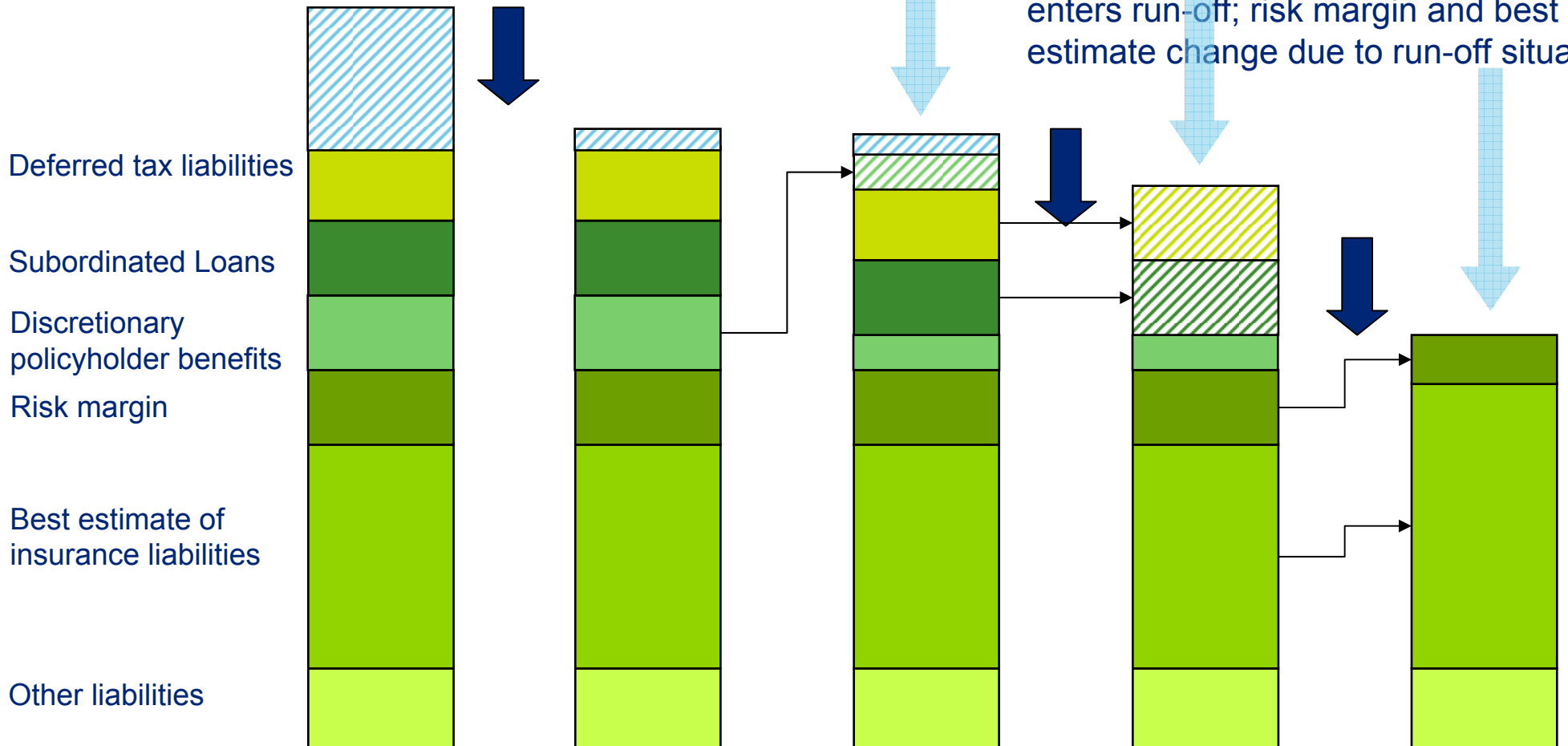
Other liabilities

Valuation

Some properties often required of valuation

The valuation should be

- **Independent** of the insurer holding the liabilities
- **Additive:** The value of the sum of two portfolios should be the sum of the values of the portfolios
- **Independent** of assets backing the liabilities
- The valuation should be **implementable**
- The valuation should be **consistent** (across different dimensions)
- The valuation should be **uncontroversial**: based on well-established principles and accepted valuation principles
- The valuation should be **specifiable** and **auditable**
- The valuation should give appropriate **incentives**
- etc. etc.

In practice, no valuation standard can satisfy all requirements at the same time and choices have to be made

Valuation and Capital

Required capital is determined by how the balance sheet at a given future time potentially looks like

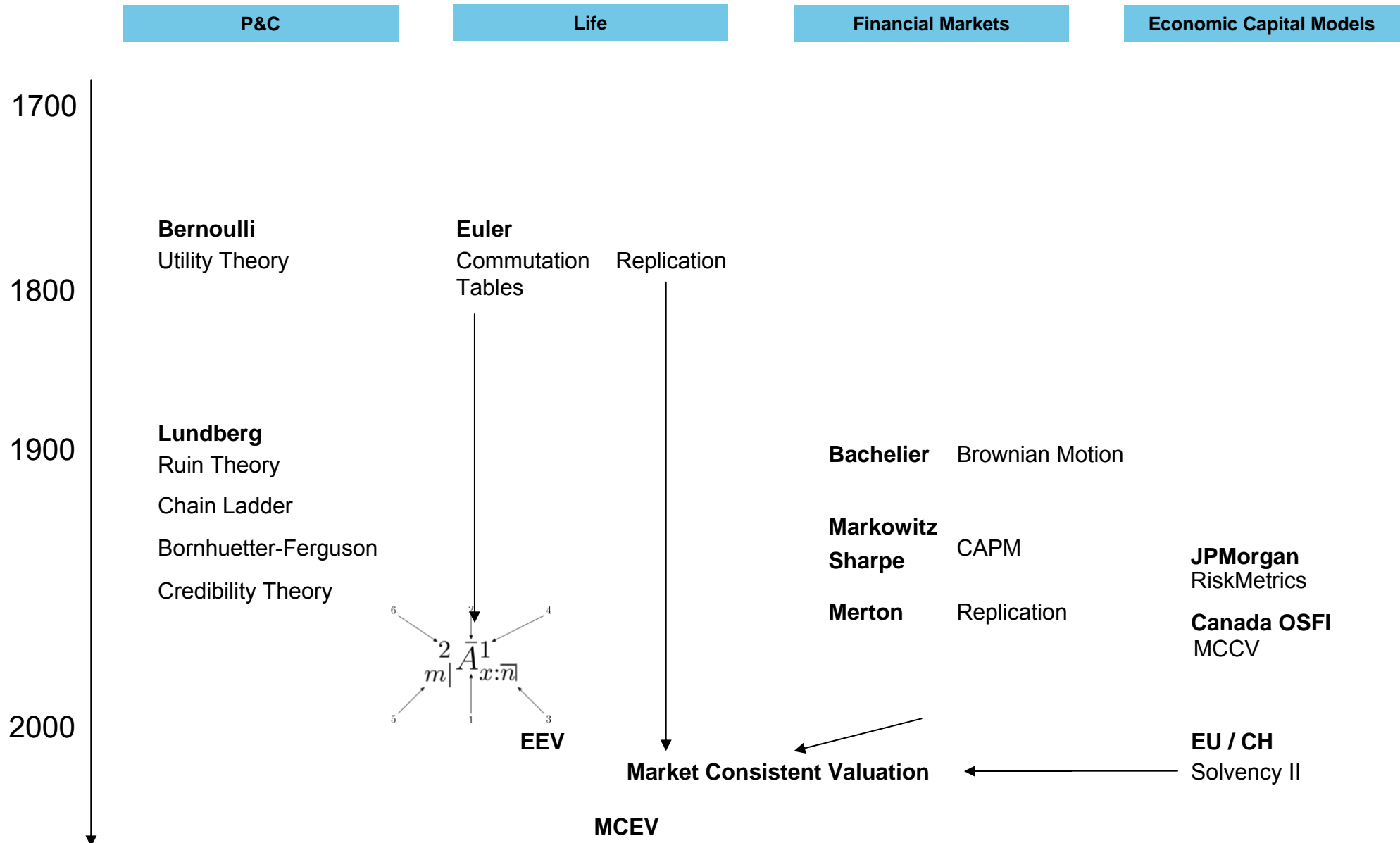**Hypothetical balance sheets at t=1**

Balance sheet at t=0

t=0

t=1
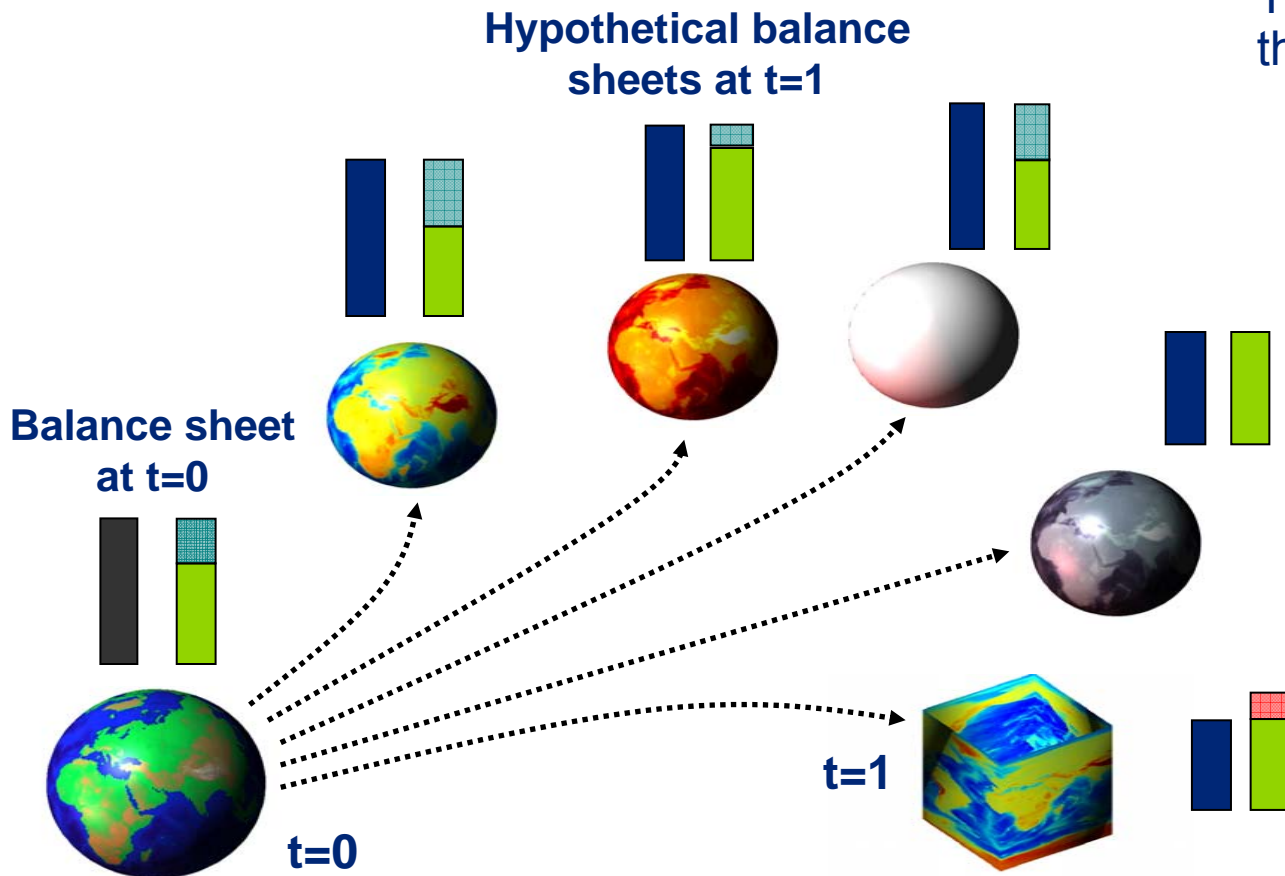
The balance sheet at t=1 differs from the one at t=0, e.g. due to:

- Changes in the financial markets (interest rates, real estate prices, …)
- Losses and catastrophes
- New information leading to a revaluation of the liabilities (e.g. asbestos)
- Capital received from or transferred to the group, reinsurers,…
- Hybrid instruments switching from liabilities to equity
- Dividends paid, profit participation for policyholders

The balance sheet (and therefore required capital) depend on the valuation standard used. Off-balance sheet items, lack of discounting, etc. all have strong impact on required capital
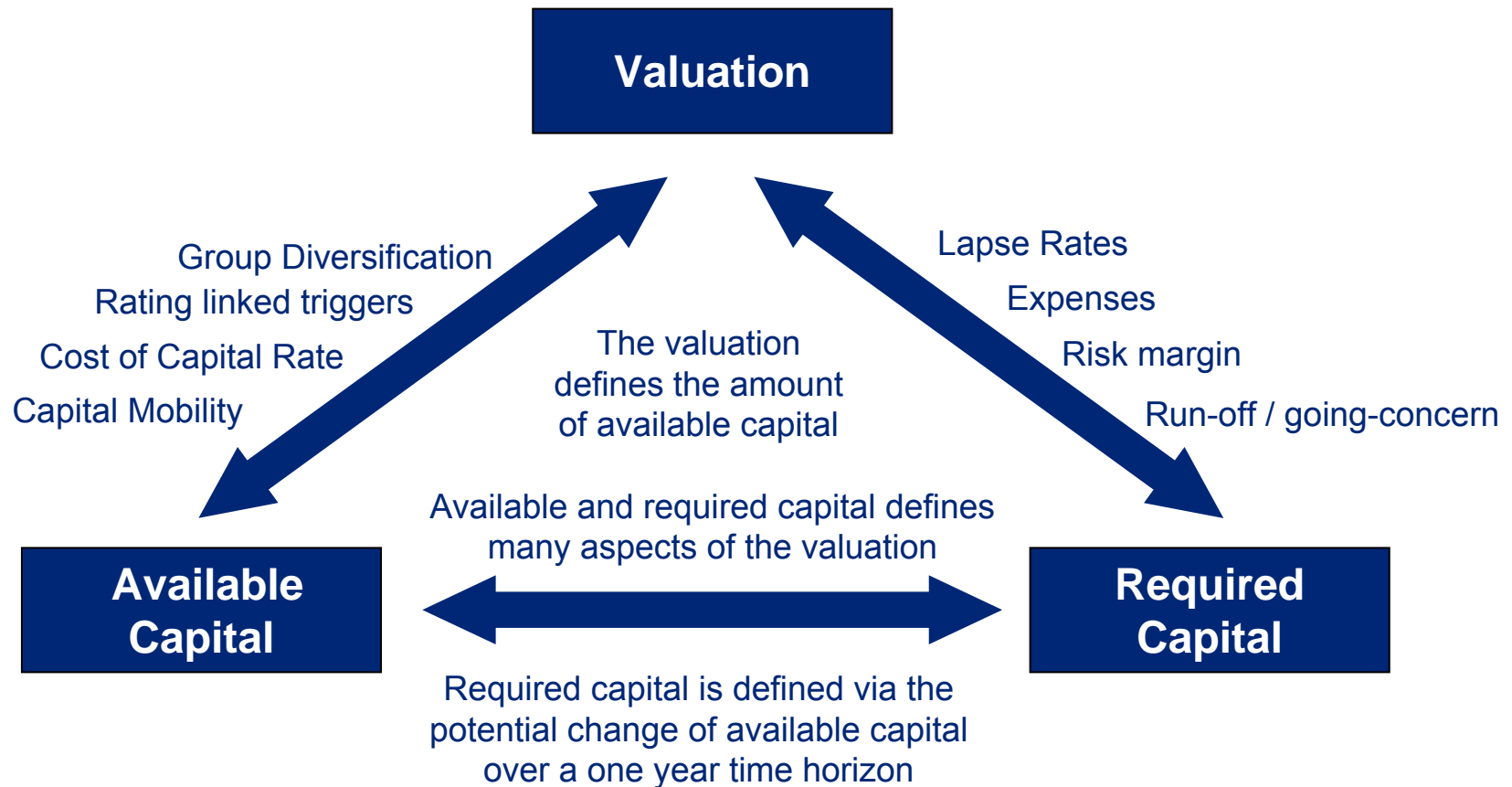
Valuation and Capital: Convergence

P&C	Life	Financial Markets	Economic Capital Models

1700

1800

Bernoulli
Utility Theory

Euler
Commutation
Tables

Replication

1900

Lundberg
Ruin Theory

Chain Ladder

Bornhuetter-Ferguson

Credibility Theory

Bachelier   Brownian Motion

Markowitz
Sharpe   CAPM

Merton   Replication

JPMorgan
RiskMetrics

Canada OSFI
 MCCV

$$_{m|}\bar{A}^{1}_{x:\overline{n|}}$$

2000

EEV

Market Consistent Valuation

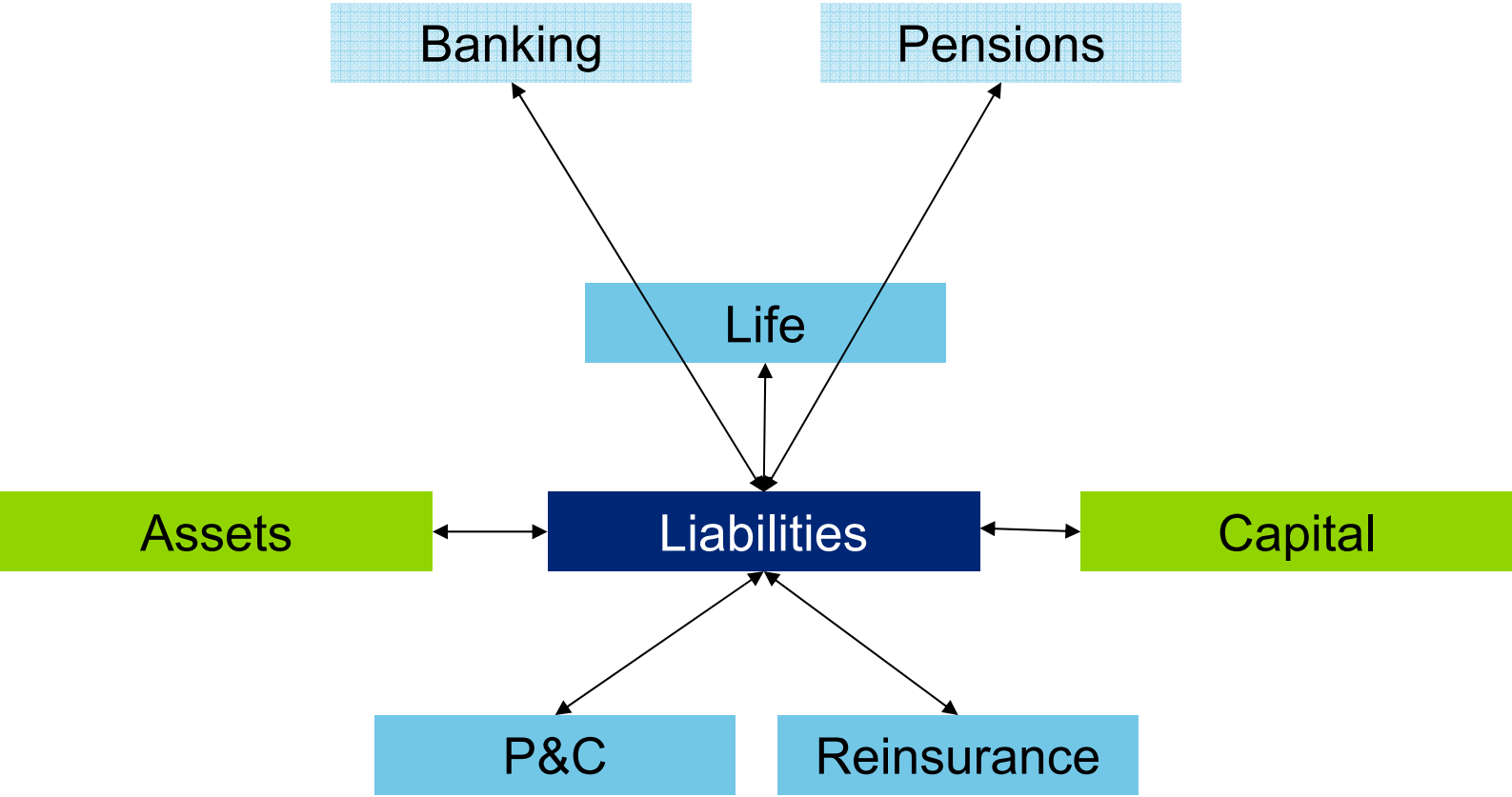**EU / CH**
Solvency II

MCEV

Valuation and Capital

Valuation and Capital can not be separated

The **valuation** determines **available capital**

**Required capital** is determined by the change in available capital over a one year time horizon

Valuation

Group Diversification
Rating linked triggers
Cost of Capital Rate
Capital Mobility

The valuation defines the amount of available capital

Lapse Rates
Expenses
Risk margin
Run-off / going-concern

Available Capital

Available and required capital defines many aspects of the valuation

Required capital is defined via the potential change of available capital over a one year time horizon
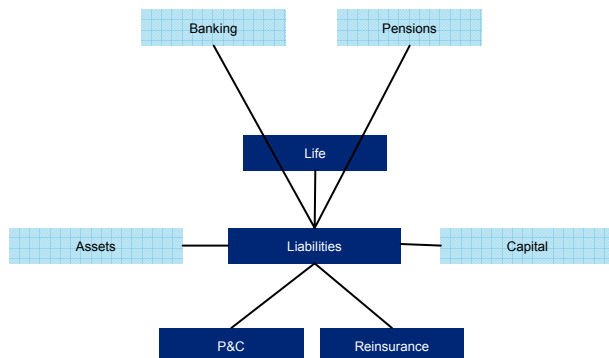
Required Capital

Consistencies

Consistency
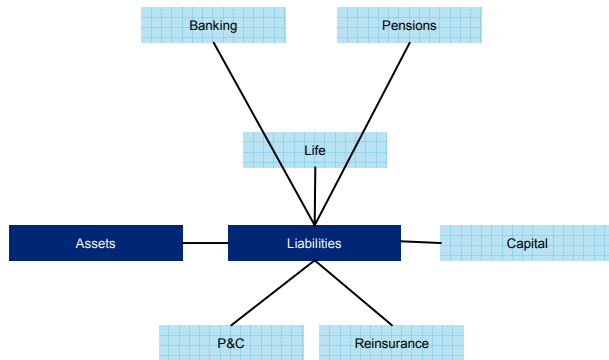
If assets are valued market consistently (Fair Value), then consistency puts constrains on the liability valuation → market consistent valuation of insurance liabilities
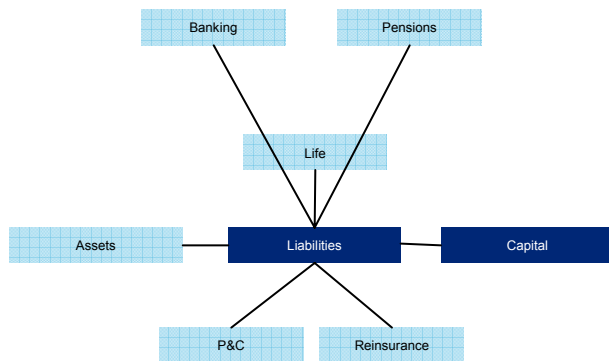
If required capital is chose to have a one-year time horizon, this equally puts constrains on the liability valuation

Consistency between Life, P&C and Reinsurance valuation requires common methodology, common approach to discounting etc.

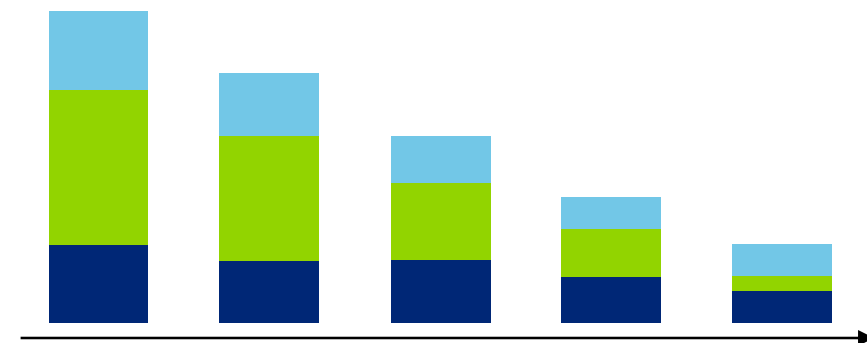# Fundamentals of Market Consistent Valuation

Market consistent valuation tries to answer the question how a given cash flow would be valued in a given **replicating market**, consisting of deeply traded financial instruments. In such a replicating market, the market value of financial instruments can be observed, making the valuation transparent and comparable.

Market consistent valuation **does not imply** that the insurance liabilities are actively traded. If they were, the concept of a replicating market would be unnecessary since the market consistent value would be equal to the observed prices with which the liabilities would trade.

Market consistent valuation is based on most recent, credible information and takes into account all relevant risk factors → market consistent valuation reacts to changes in risk factors and is suitable for an economic capital model

The market consistent value of liabilities covers all the **expected** costs of a liability cash flow:

- claims costs
- expense costs
- costs for capital necessary to support the liabilities

■ Expense costs

■ Claims cost
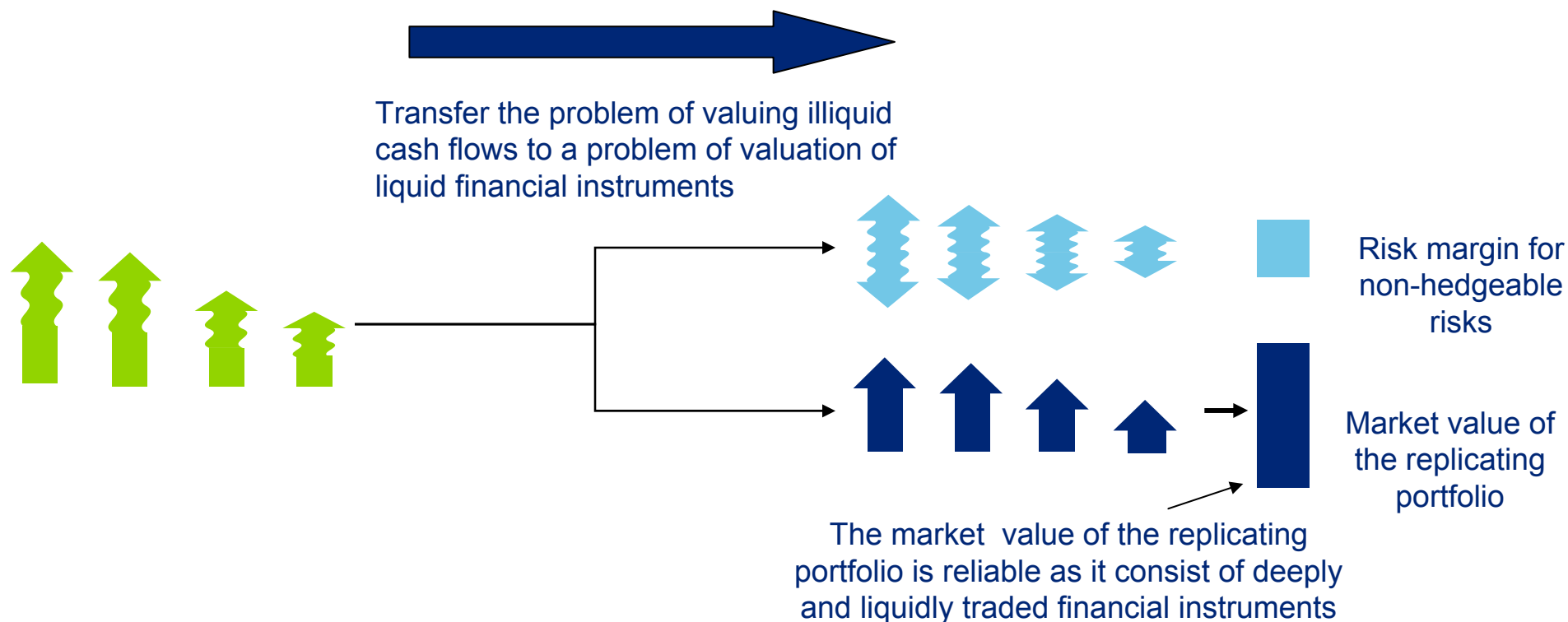
■ Cost for capital

Fundamentals of Market Consistent Valuation

Insurance Liabilities

No reliable market prices exit

Replicating Market

Reliable market prices exit

Transfer the problem of valuing illiquid cash flows to a problem of valuation of liquid financial instruments

Risk margin for non-hedgeable risks

Market value of the replicating portfolio

The market value of the replicating portfolio is reliable as it consist of deeply and liquidly traded financial instruments

The whole point of market consistent valuation consists of transferring the problem of valuing illiquid insurance liabilities to a setting where reliable market prices are available

Market consistent valuation of insurance liabilities does not rely on the Efficient Market Hypothesis but on the law of one price only

Valuation, Capital and Lack of Uniqueness

The market consistent value of an insurance liability is in general also not independent of the insurer holding it but it depends on the financial state of the insurer

The **risk margin** depends on the capital of the insurer
- Group diversification might reduce in case of financial stress, increasing then the cost of capital for non-hedgeable risks
- Diversification differs between going-concern and run-off situation etc.

**Cash flows** of insurance liabilities depend on the financial state
- Cash flows for run-off differ from cash flows in going-concern, expenses and lapses, cost of capital etc. differ

Assuming a current exit framework (i.e. valuing the liabilities for a hypothetical 3rd party) is no solution, since the insurance liabilities then depend on the specification of the 3rd party

Solvency II assumes an empty undertaking as a 3rd party that takes over only one Line of Business: While this makes the valuation partly entity-independent, this is more than compensated with a lack of realism. However, Solvency II allows to take internal and external reinsurance to be taken into account in the calculation of the risk margin which is again entity specific

Market Consistent Valuations
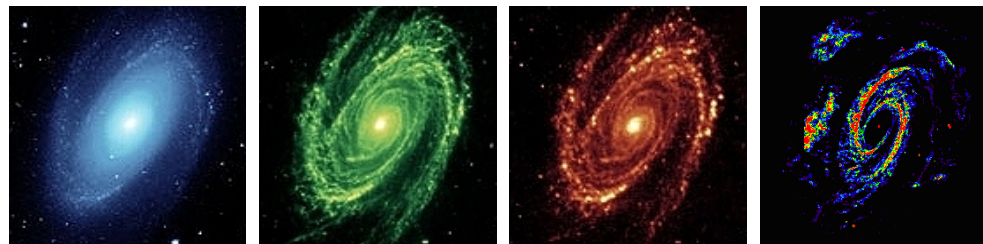
Different valuations reveal different truths
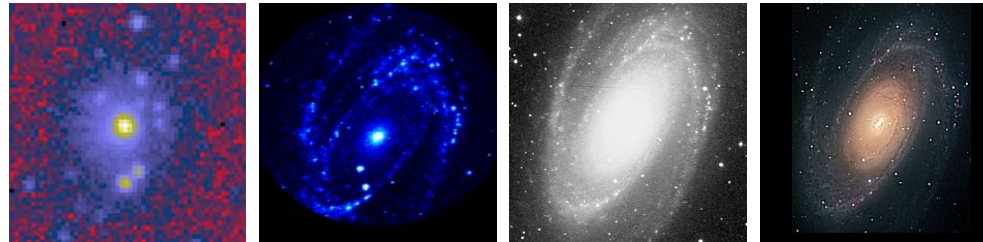
M81 spiral galaxy

|			
X-Ray: ROSAT	Ultraviolet: ASTRO-1	Visible: DSS	Visible: R. Gendler
Near Infrared: Spitzer	Mid Infrared: Spitzer	Far Infrared: Spitzer	Radio: VLA

Source: http://coolcosmos.ipac.caltech.edu/cosmic_classroom/multiwavelength_astronomy/multiwavelength_museum/m81.html

- **Solvency II:** Value of a liability (undiversified LoB) for an empty shell company

- **SST:** Settlement value in case of run-off

- **MCEV:** Present value of shareholders' interests in the earnings distributable from assets allocated to the covered business

- **IFRS Phase 2 Current Exit**: the amount the insurer would expect to pay at the reporting date to transfer its remaining contractual rights and obligations immediately to another entity.

- **IFRS Phase 2 Current Fulfilment Value:** Expected present value of the cost of fulfilling the obligation to the policy holder over time

Risk Margin

The risk margin covers the cost of capital to support the non-hedgeable risks during the lifetime of the insurance liabilities

Example: Solvency II
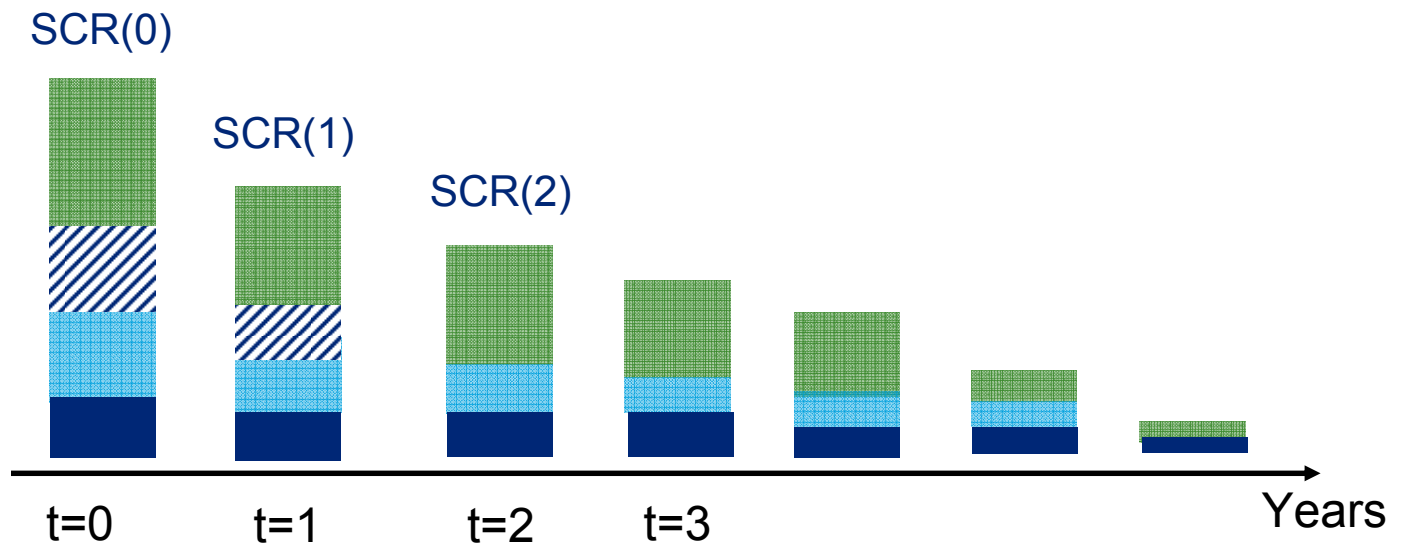
Premium risk

Reserve risk

Market and credit risk

Operational Risk

Risk Margin Calculation

The capital and the cost of capital needed in future years to buffer non-hedgeable risk is random and depends on losses, changes in the financial market, changes in the set of deeply and liquidly traded financial instruments, etc.

Capital C(t) needed to buffer non-hedgeable risk in future years in a given scenario

scenario

scenario

scenario

t=0

t=1

t=2

t=3
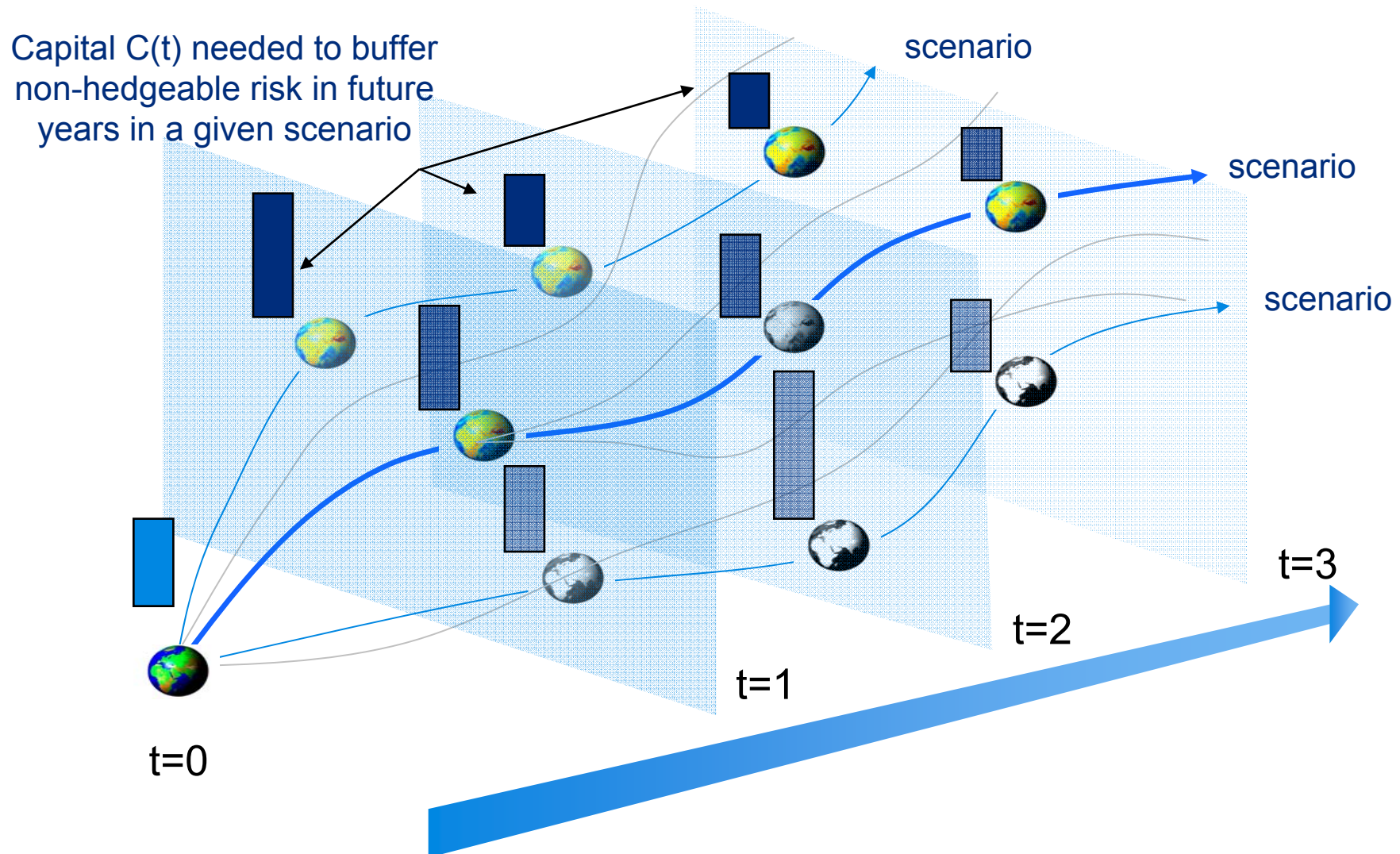
Circularity of the Risk Margin

• The calculation of future capital SCR(t) requires the calculation of the risk margin RMt) which in turns requires knowing future capital SCR(t)

$$SCR(t)=VaR(\mathbf{AC(t+1)}-\mathbf{AC(t)})$$
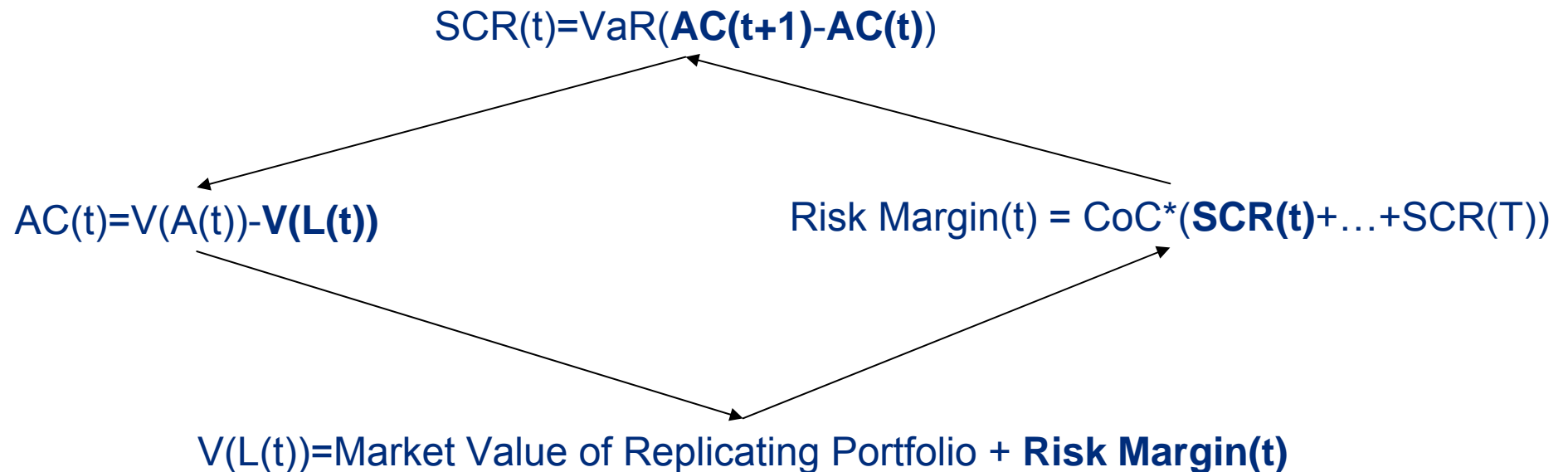
$$AC(t)=V(A(t))-\mathbf{V(L(t))}$$

$$\text{Risk Margin(t)} = CoC*(\mathbf{SCR(t)}+\ldots+SCR(T))$$

$$V(L(t))=\text{Market Value of Replicating Portfolio} + \mathbf{Risk\ Margin(t)}$$

This is not really an issue, because *SCR* is calculated given the information at time t, and the risk margin is known at time t

The risk margin can be calculated – in theory – explicitly by backward recursion

Risk Margin

The currently used approach of calculating the risk margin in Solvency II and the Swiss Solvency Test contains a number of implicit and explicit simplifications and assumptions

General recursive formulation for the market consistent value of liabilities

$$B(t,t+1)^{-1} \cdot C(t) + CoC(t) \cdot C(t)$$
$$= E\left[1_{A_t} \cdot \left\{ B(t,t+1)^{-1} C(t) + V_{t+1}(RP_t) - X_t - V_{t+1}(L) \right\} \middle| F_t \right]$$

Formulation splitting the risk margin and the best estimate (or the market value of the replicating portfolio)

$$RM = E\left[\sum_{t \geq t_0} B(0,t) \cdot CoC(t) \cdot C(t) \right]$$

$$RM = \sum_{t \geq t_0} B(0,t) \cdot E\left[CoC(t) \cdot C(t) \right]$$

Independence of CoC rate and capitalization in time

$$RM = \sum_{t \geq t_0} B(0,t) \cdot E\left[CoC(t) \right] \cdot E\left[C(t) \right]$$

Taking long term average of CoC rate

$$RM = E\left[E\left[CoC(t) \right] \right] \cdot \sum_{t \geq t_0} B(0,t) \cdot E\left[C(t) \right]$$

Using SCR and 6% as a proxy for economic capital and the insurer's capital costs

$$RM = 6\% \cdot \sum_{t \geq t_0} B(0,t) \cdot E\left[SCR(t) \right]$$

Risk Margin

The exact calculation requires:

Stochastic model of annual loss & expense payments
→ Practical issue: Only nominal ultimate loss distribution available?

Filtration: Model for flow of information about the loss payments
→ Practical issue: "Stochastic-in-stochastic": resulting model needs to be computationally tractable
→ The number of possible future states (usually) blows up
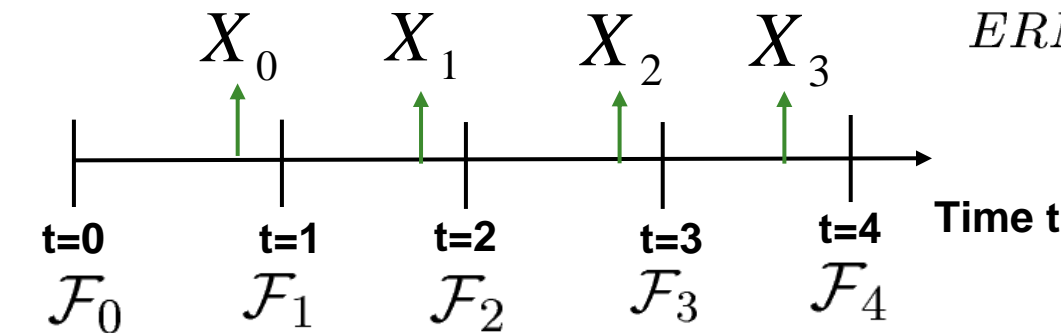
$$ERM_0 = \sum_{t \geq 0} \mathrm{pv}_{(t+1 \to 0)} \left(\mathbb{E} \{ \eta \cdot SCR_t \} \right)$$

How does distribution of e.g. X3 change over time

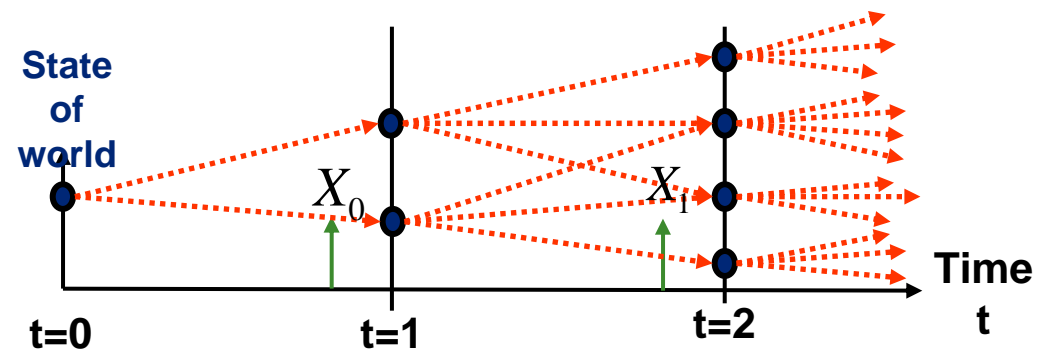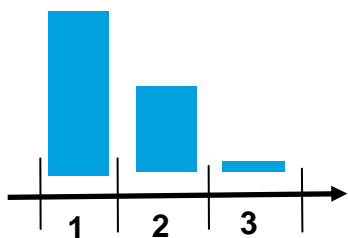# Risk Margin: Pragmatic Calculations

Proxy approaches

- Calculate the risk margin by projecting forward the first year capital proportionally to some easy to calculate quantity (e.g. best estimate)

$$\frac{SCR_t}{\text{Proxy}_t} = \text{constant}$$

The proxy should express how quickly information is revealed and thus how fast risk is reduced

Short-tail

Long-tail
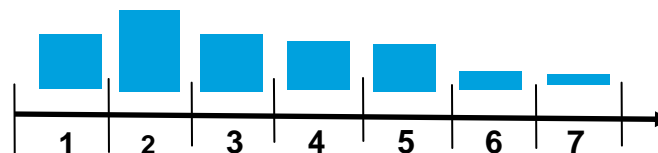
Hybrid approaches

- Create a tractable synthetic model for the flow of information
- One application: Apply hybrid models to sample contracts to find best proxy; then calculate with proxies only

Some proxies used:

Solvency II QIS 4 simple proxy
- Risk margin = fixed % of best estimate

SST standard model non-life, Solvency II non-life
- Expected outstanding paid losses
→ Proxy = best estimate of outstanding payments

Solvency II QIS 4 non-life & life
- A simplification based on this, using the duration of best estimate

Swiss life companies (MCEV, some for SST)
- Proxy = Solvency 1 capital = max of % technical reserves and % annual premium

Some life business
- Annual premiums, sum of future premiums

Cost of Capital Rate

What is the appropriate cost of capital rate for the purpose of market consistent valuation?

- GNAIE proposed to use a CoC rate with reference to those used for pricing, e.g. 10% - 40% over risk-free

- Problems with this approach
  - Pricing and valuation are different, pricing contains profit expectation or the price can be set low to gain market share
  - It would perpetuate the current system of valuation used in jurisdictions that do not yet use market consistent valuation

- The CRO Forum proposes to use a CoC rate based on a frictional cost approach
  - Frictional cost is appropriate but difficult to estimate. Observed cost of capital rate contain elements that are not relevant for valuation purposes, e.g. profit expectations of investors etc.

Cost of Capital Rate

- The CRO Forum explored the following approaches:
  - Frictional Cost of Capital (FCoC);
  - Market Price of Risk Approach (MPR); and
  - An estimation of the Equity Risk Premium using the CAPM and the Fama French 2 Factor (FF2F) Asset Pricing Model

- The FCoC method explicitly models double-taxation and financial distress costs. It does not model agency costs.

- The MPR and the FF2F approaches are "total return" approaches, i.e. they provide an indication of the overall rate of return that might be demanded by an equity investor. They include components that are not part of a cost of capital rate for valuation purposes: return on franchise value and return on hedgeable risk (predominantly ALM-type risk). These components would ideally be stripped out, which is however not possible with existing data

- For the MPR and FF2F approaches, the Weighted Average Cost of Capital (WACC) technique was used to adjust the costs of equity for an assumed typical insurer capital structure and recognizing the potentially lower cost of debt funding.
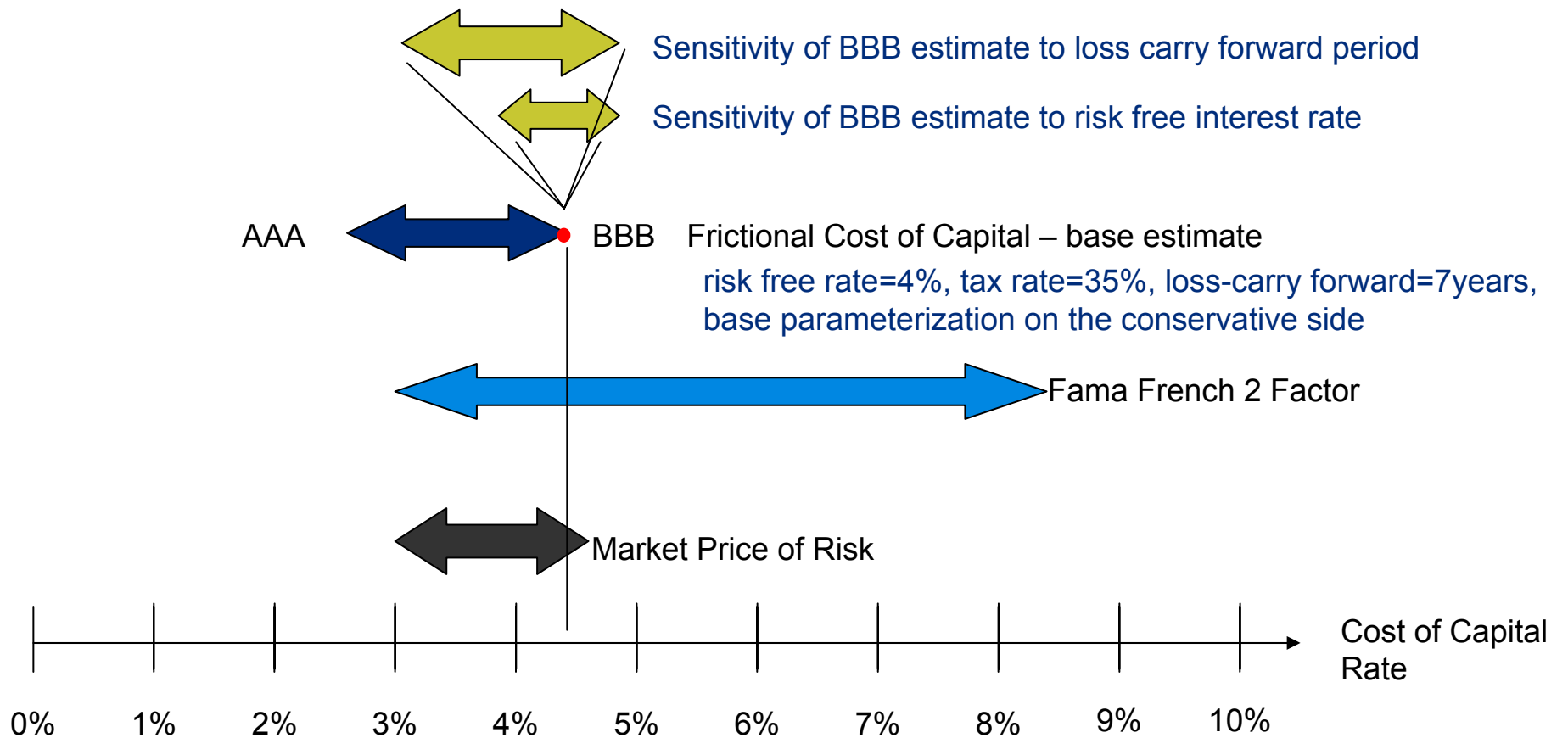
Cost of Capital Rate

- For which costs should investors be compensated? Hedgeable risks and expected economic profit?

- **Base cost of capital:** Since hedgeable risks are excluded from the capital used in the calculation of MVMs, they should also be excluded from the cost of capital rate. Therefore, for the purposes of market consistent valuation, the base cost of capital, which is associated with hedgeable financial risks, is not relevant to the cost of capital rate

- **Expected Economic Profit:** Since capital is associated with an existing book of business, the cost of capital rate should only reflect risks associated with the current liabilities, not those associated with future business that has not been written. However, the expected economic profit reflects the expected return on franchise value, which is a measure based on the market's perception of ability to create value through future new business. As such, the return on franchise (and consequently, expected economic profit) should be priced for in new business pricing, but not in determining the value of existing business under a fair value approach

    - Therefore, for the purposes of the MVM calculation, investors only need to be compensated for frictional costs

Market Value of Liabilities for Insurance Firms, Foundation elements for Solvency II, The Chief Risk Officer Forum

Cost of Capital Rate: Frictional Cost Approach

- A simple model to approximate the cost of capital rate:

- Frictional Costs are composed of :

- **Financial distress costs**, due to the fact that the insurer is regulated and has to satisfy solvency requirements

- **Double taxation costs** which are incurred since insurers' profits are taxed in most jurisdictions, leading to additional costs for shareholders.

- **Agency costs,** due to the misalignment of the interests of management with the interests of the shareholders. In addition, we consider lack of transparency and informational asymmetry also as part of agency costs.

- Of the above components, agency costs are difficult to model. However, agency costs are most relevant for well capitalized firms (when senior management becomes tempted to buy company jets and go on an acquisition spree)

- The simple model quantifies financial distress and double taxation costs

Cost of Capital Rate Estimates

Sensitivity of BBB estimate to loss carry forward period

Sensitivity of BBB estimate to risk free interest rate

AAA   BBB   Frictional Cost of Capital – base estimate

risk free rate=4%, tax rate=35%, loss-carry forward=7years, base parameterization on the conservative side

Fama French 2 Factor

Market Price of Risk

Cost of Capital Rate

0%   1%   2%   3%   4%   5%   6%   7%   8%   9%   10%

Cost of Capital Rate: Frictional Cost Model

- In the first approximation, the cost of capital rate does not depend on the company's volatility of P&L, it only depends on its capitalization level.

- The cost of capital rate depends linearly on a jurisdiction's tax rate for all confidence levels. This means that the cost of capital rate (and therefore the risk margin) in a jurisdiction with a tax rate of 10% is only half of that in a jurisdiction with a tax rate of 20%.

- The cost of capital rate depends on the loss carry-forward period of a jurisdiction. The longer the period, the lower the cost of capital rate

- The cost of capital rate does not depend on the business written, i.e. the cost of capital rate should be the same for life insurers, P&C insurers, monoliners, reinsurers etc., as long as they are capitalized to the same confidence level.

- For highly capitalized companies, the cost of capital rate is determined mainly by the cost of double taxation as in this case the cost of financial distress is negligible.

- The absolute value of the risk margin is relatively insensitive to the confidence level to which the company is capitalized to. That means that the risk margin can be determined for example by defining the CoC rate for a BBB rated company (i.e. a confidence level α of 0.995) with the capital base for the risk margin calculation defined by the Solvency II SCR. This would correspond to the way the risk margin is defined by Solvency II and the SST.

Cost of Capital Rate: Frictional Cost Model

- The Cost of Capital Rate depends on the risk free rate (by the double taxation cost)

- If the EU economy enters a high inflation phase, the currently used 6% will likely be not sufficient

- The Cost of Capital Rate is stochastic; is taking the long-term average appropriate for all liabilities?

Future Challenges

- Different market consistent valuation will have to be reconciled

- Ideally, one single valuation engine and capital model will encompass different market consistent valuation standards

- Single data warehouse to achieve consistency, auditability and reconcilability

- While the parameterization of market consistent valuations is more objective, the simplifications used to replicate cash flows and calculate require judgment

- Market consistent valuation requires explicitly the modeling of the long-term economic state

- More research will be required on proxies to calculate the risk margin

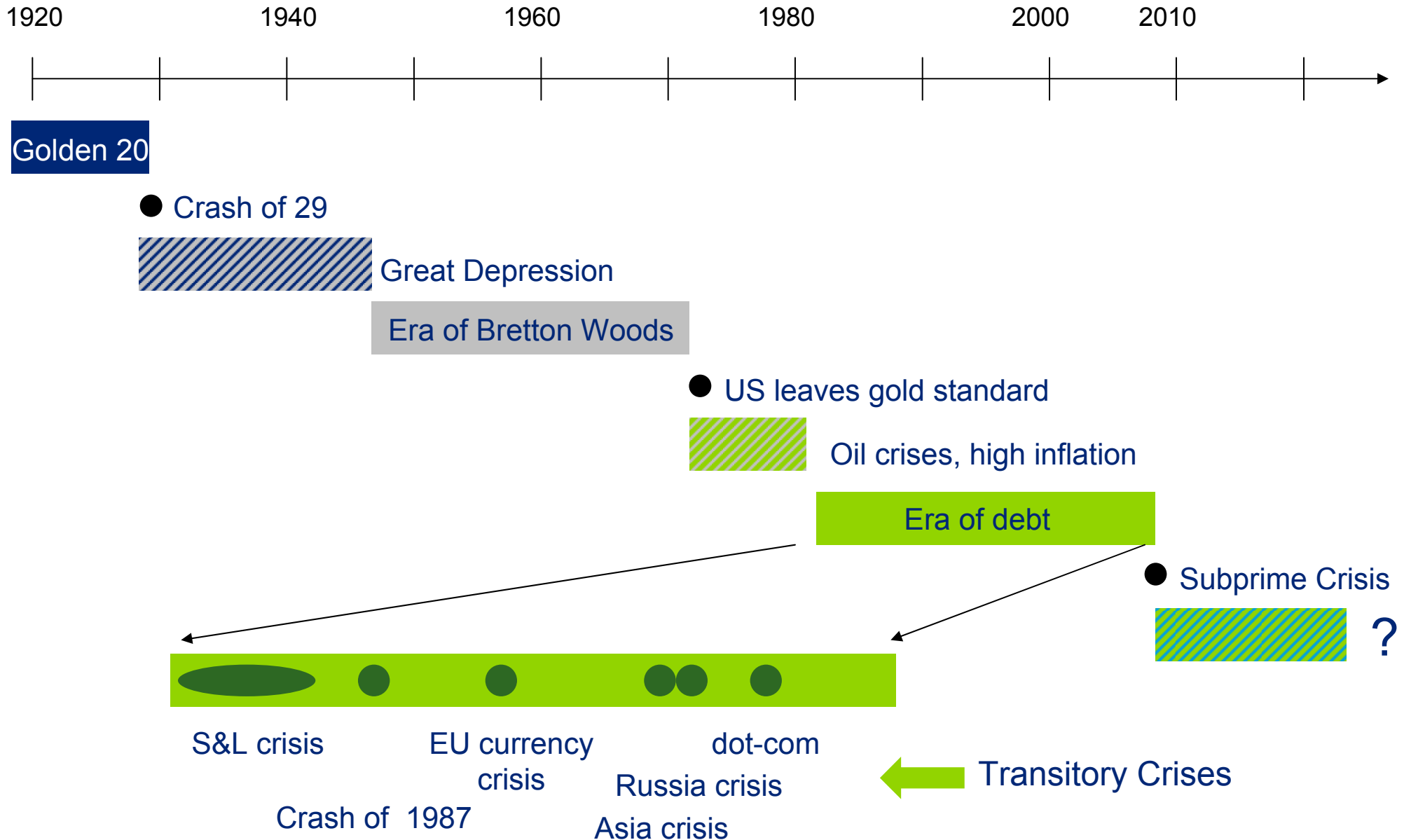- A clear distinction between concepts and implementation should be achieved

Long-Term Economic Predictions

Transitory Crises   Structural Crises
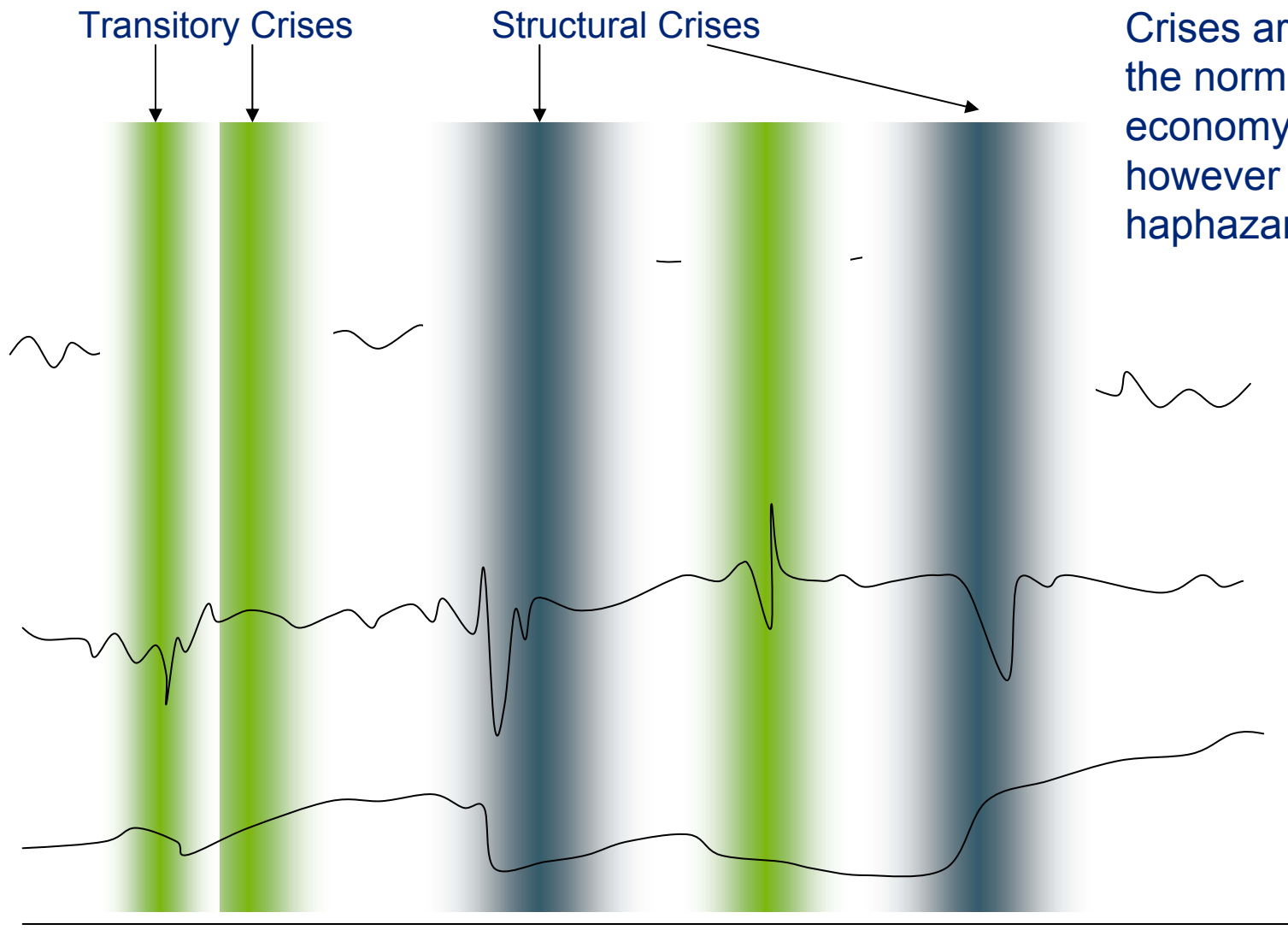
Crises are not exceptions but the normal case in the economy. Many models however treat them in a haphazard or ad-hoc manner

Long-Term Economic Predictions

1920   1940   1960   1980   2000   2010

Golden 20

● Crash of 29

Great Depression

Era of Bretton Woods

● US leaves gold standard

Oil crises, high inflation

Era of debt

● Subprime Crisis

?

S&L crisis   EU currency crisis   dot-com

Crash of 1987   Russia crisis   Asia crisis

← Transitory Crises

Long-Term Economic Predictions

Prediction is very difficult, especially about the future

Niels Bohr

There are a number of problems to consider in valuation for insurance liabilities

- Econometric models are often calibrated to past data only and can often not cope with structural changes.
- The longer a given economic states is going-on, the more difficult it becomes for modelers to take into account effects outside the experience during the last years
- Economics is not physics; linkages, dependencies etc. can change suddenly, making historical data less applicable
- Perhaps because there is no satisfactory theory, economics is often dominated by dogma and ideology

What can be done:

- Scenario analysis
- Not relying solely on historical data
- More explanatory models, explicitly modeling only a small number of key variables and derive dependent variables

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