

Principles of Scenario Planning Under Solvency II

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Agenda

- » Overview of Scenarios
 - » Parallels between Insurance and Banking
 - » Deterministic vs. Stochastic scenarios
- » Best Practices for Insurers
 - » Stylized facts
 - » Sources of information: data & expert judgement
 - » Informational weighting schemes and data
 - » Stochastic Economic Scenario Generators
- » Practical Applications & Challenges
 - » Use of scenarios for economic capital – beyond regulation
 - » Challenges faces with implementing scenario-based solutions
- » Conclusions & Questions

Overview of Scenarios

Principles of Scenario Planning Under Solvency II

Stress Testing Parallels: Insurance & Banking

Banking – Comprehensive Capital Analysis and Review & Dodd-Frank

- » One or several extreme but plausible adverse scenarios
- » Assess expected impact of scenarios on the firm's capital and liquidity positions

- » Stress tests can be:
 - » Bank-wide or specific areas
 - » Top-down or bottom up
 - » Used across the bank: ALM, planning, credit risk, liquidity risk...

- » Useful to consider the methodologies used by banks in the context of Insurance:
 - » Multi-period stress testing
 - » Multi-period capital projection
 - » Multi-period business planning

Stress Testing Parallels: Insurance & Banking

Insurance - Solvency II Own Risk and Solvency Assessment (ORSA)

How capital requirements (regulatory, economic, ratings) progress over time across a range of scenarios.

- » ORSA is emerging as a global regulatory standard
 - » Pillar II of EU Solvency II
 - » US and Canada have each proposed ORSA frameworks for 2014 implementation
 - » Core part of International Association of Insurance Supervisors (IAIS) Common Framework

- » ORSA implementation approaches may have local differences, but in all cases they require insurance firms to make assessments of their current and future solvency capital requirements.

Generating Multi-Timestep Macro Stress Scenarios

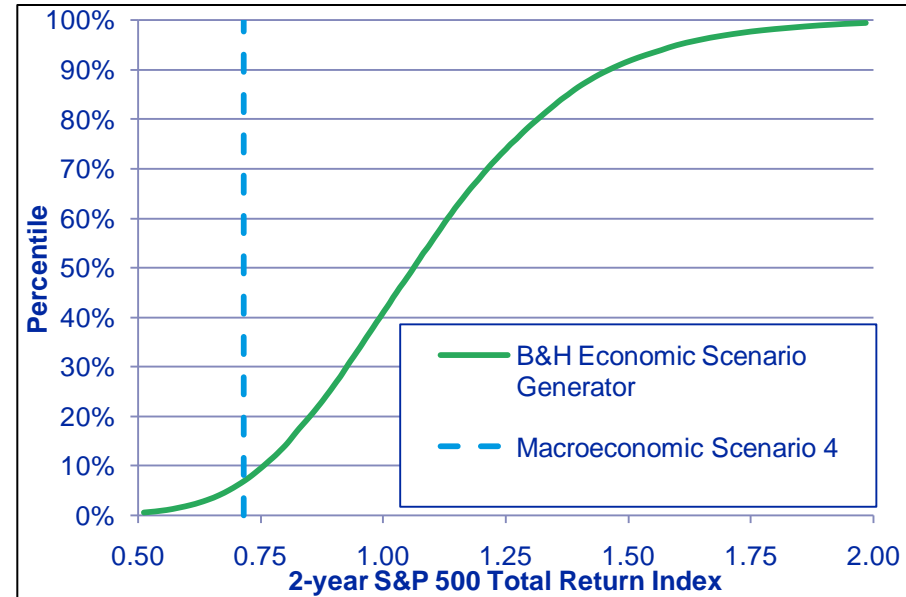
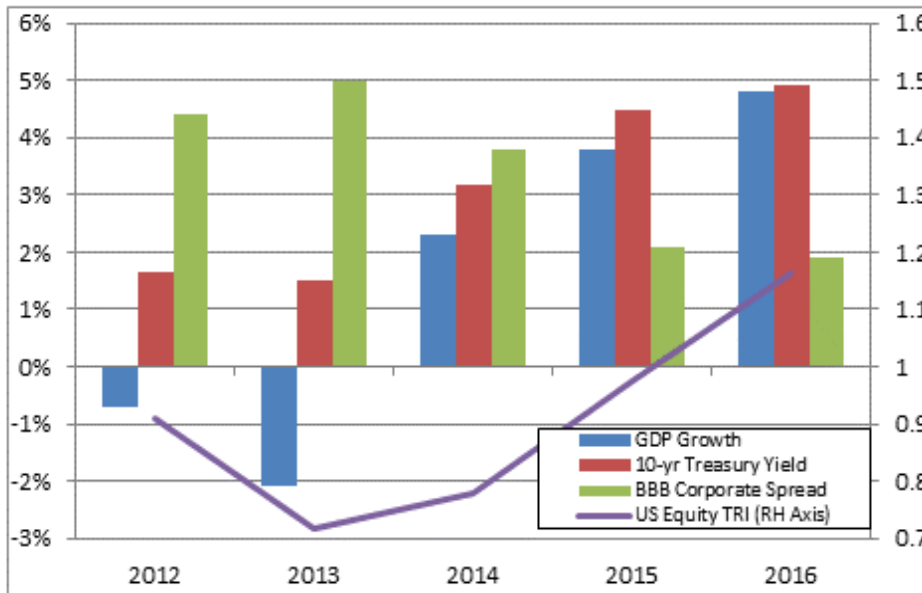
Non-prescriptive nature of ORSA means firms can select between **deterministic** and **stochastic** scenarios to project their business.

Deterministic Scenarios	Stochastic Scenarios
Management can prescribe outcomes directly	Capture a wide range of outcomes
Scenario probabilities are estimated	Probabilistic measure of outcomes
Not overly complex to create and run	Computationally intensive esp. where liabilities include options & guarantees

NAIC: A firm's own specific set of risk exposures should drive identification of relevant stress tests

Developing Stress Test Scenarios for Multi-Timestep Solvency Projections

- » 5-year paths projected for Protracted Slump (Scenario 4)

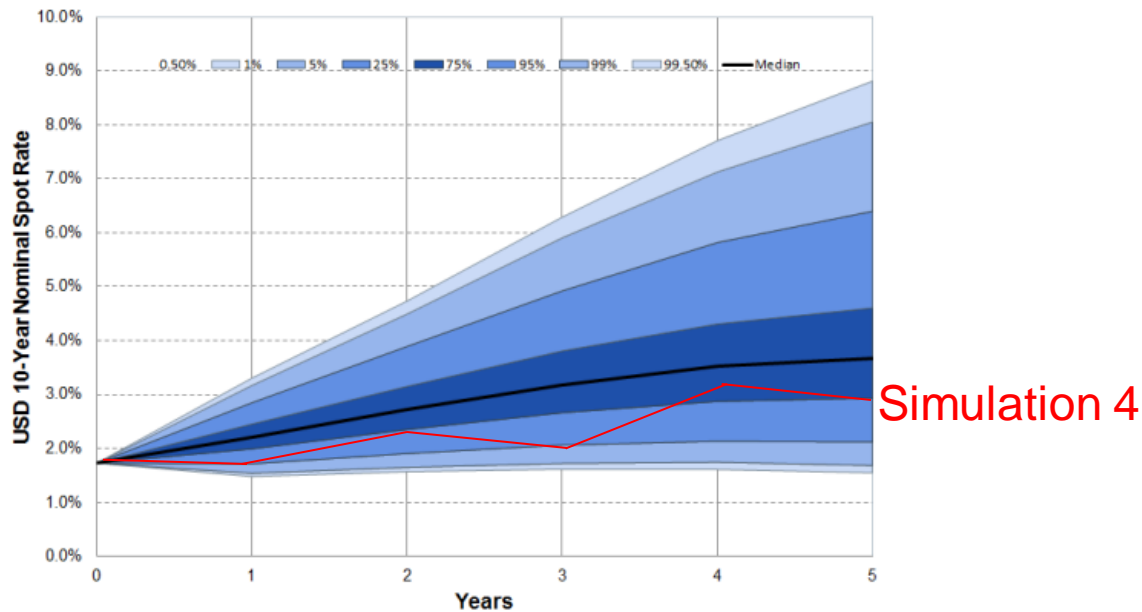


- » MA has experience in developing macro-economic stress test scenarios for applications such as bank stress testing
- » MA ESG can be used to validate the probabilistic strength of these scenarios

Stochastic Economic Scenario Generator

The ESG uses Monte Carlo Simulation to generate thousands of simulations of risk factors across multiple time periods.

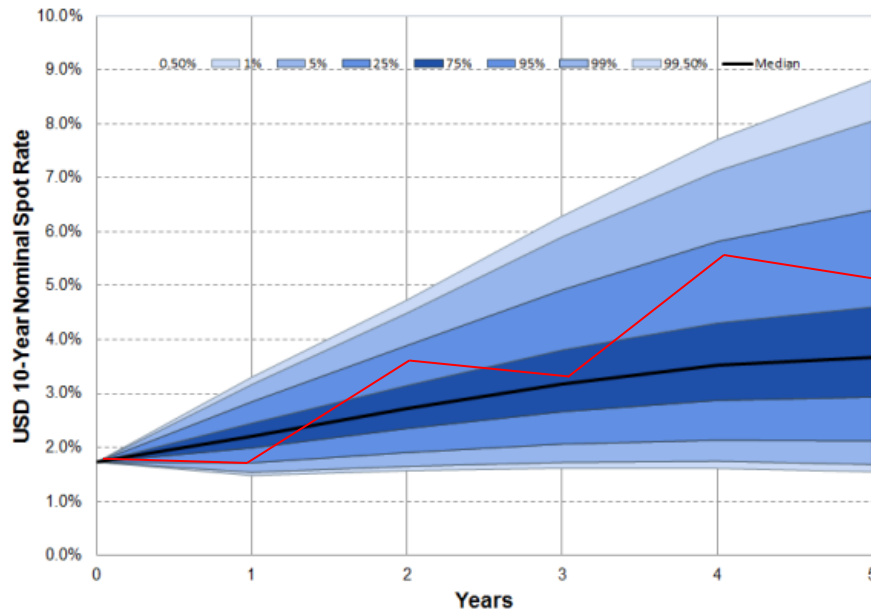
Example: 10-year Spot Rate Projected over 5 years



Stochastic Economic Scenario Generator

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Example: 10-year Spot Rate Projected over 5 years

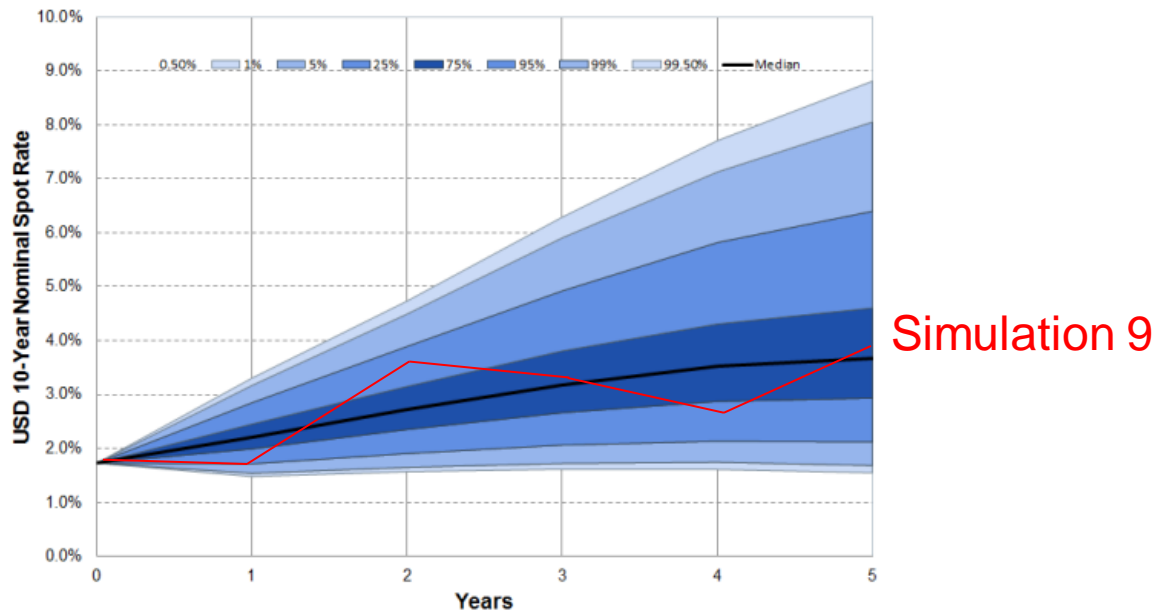


Simulation 348

Stochastic Economic Scenario Generator

The ESG uses Monte Carlo Simulation to generate thousands of simulations of risk factors across multiple time periods

Example: 10-year Spot Rate Projected over 5 years



Best Practices for Insurers

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Stylised Facts & Data

Goal is to produce **realistic** and **justifiable** projections of financial and macroeconomic variables.

Use all credible historical **data**, market expectations via **options** and expert **judgement**.

Our approach involves 3 main activities:

- 1) Developing and documenting a set of stylized facts and beliefs.
- 2) Use these to select/build/structure, calibrate and validate models.
- 3) Look at real world markets to validate and review the stylized facts and models.

These are all ongoing activities:

- » Frequent calibration
- » Regular Real World Target updates and methodology reviews

Weighting Schemes & Data

Calibration is an art

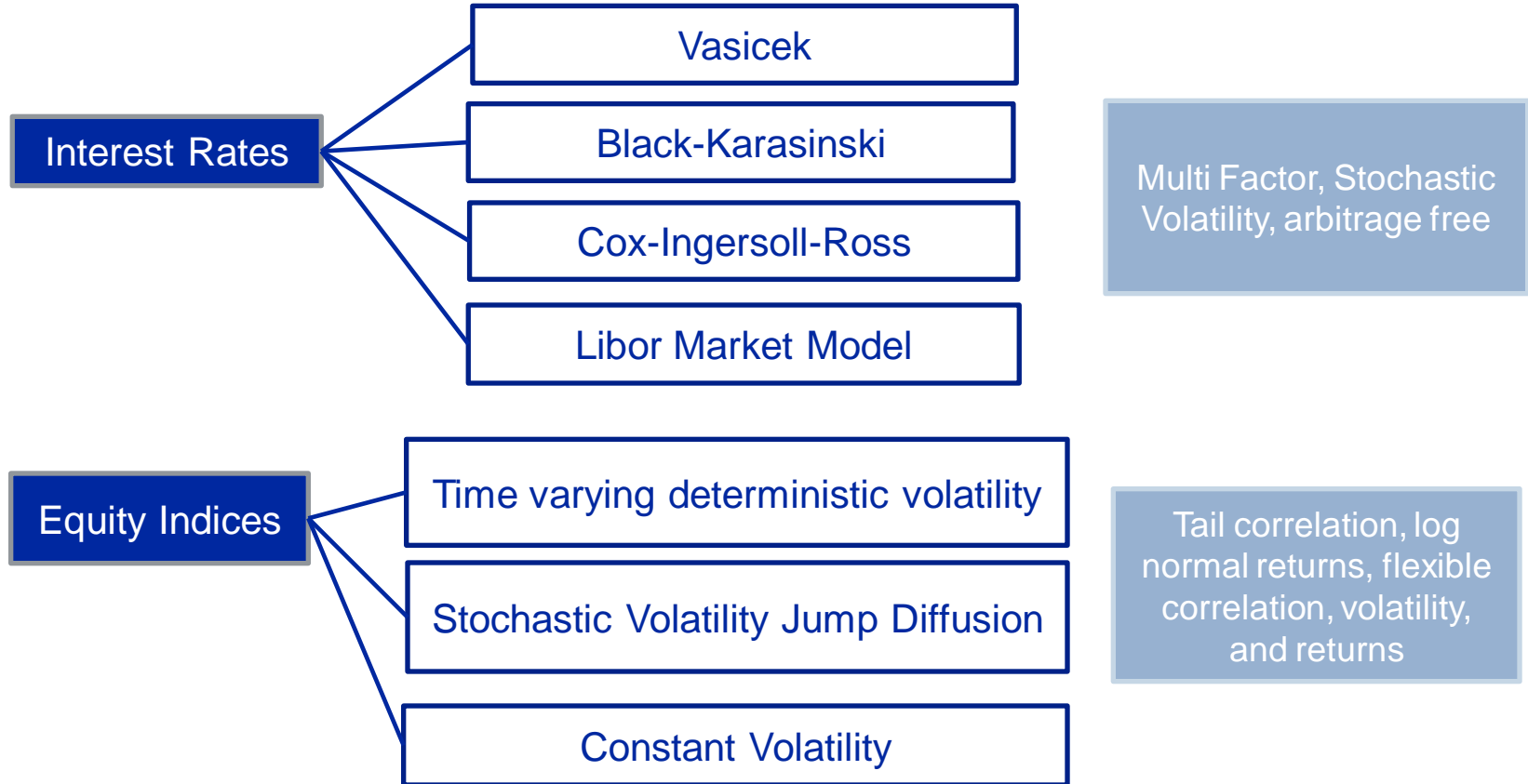
- » Subjectivity in: data sources, data policies, weighting, judgement

Goal is to produce **realistic** and **justifiable** projections of financial and macroeconomic variables.

Use all credible data available:

- » Combine with market data of expectations: e.g. option implied volatility, consensus data
- » Filter and clean data: liquidity of instruments, depth of market
- » Exponentially-weighted moving average ensures more weight is placed on recent observations
- » Consistency across asset classes

Models & Calibrations



And others for credit, inflation, exchange rates, MBS, derivatives etc.

All models documented in academic literature and MA research papers

Stochastic Economic Scenario Generator

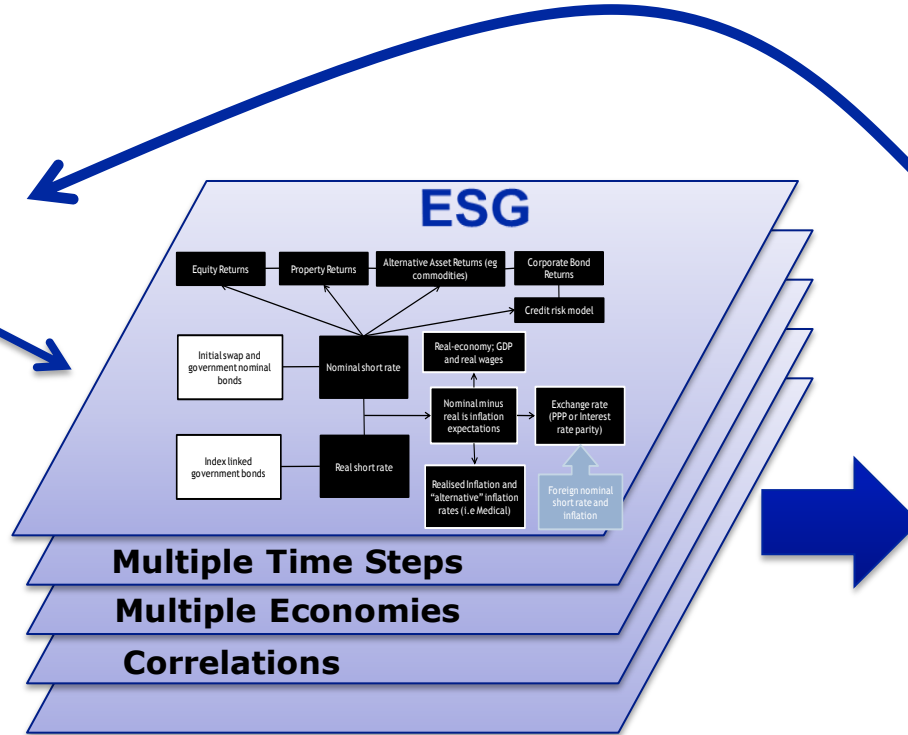
Historic Analysis & Expert Judgement

Establish economic targets for factors of Interest:

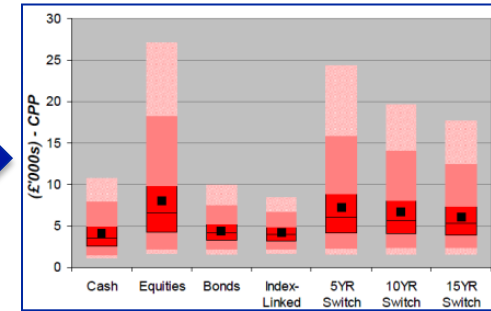
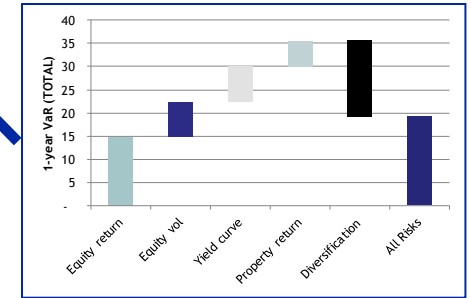
- Interest rates
- Equity
- Credit
- Correlations
- Alternatives

Stochastic Models

Choose models that will best represent the risk factors and the specific modelling problem.



Calibrate – Establish model parameters to meet targets



Visualise Output
Validation
Communication

Practical Applications & Challenges

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1-Year Value at Risk

Pillar I requirement is to calculate a 1-year Value at Risk at the 99.5th percentile (1 in 200 year loss) on the balance sheet.

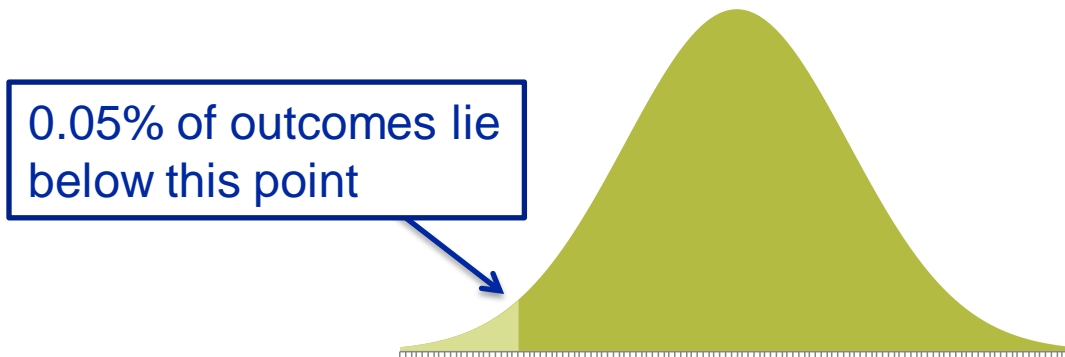
Insurers need to ensure that they have adequate capital resources

- » How much capital does the insurance company need to hold today for there to be an X% probability that this capital will be sufficient to fund all liability cashflows?

Value at Risk:

- » Does the company have sufficient capital to survive a 1/200 year event in the next year e.g. asset values drop or many claims are made?

Distribution of Capital



Projecting the Balance Sheet

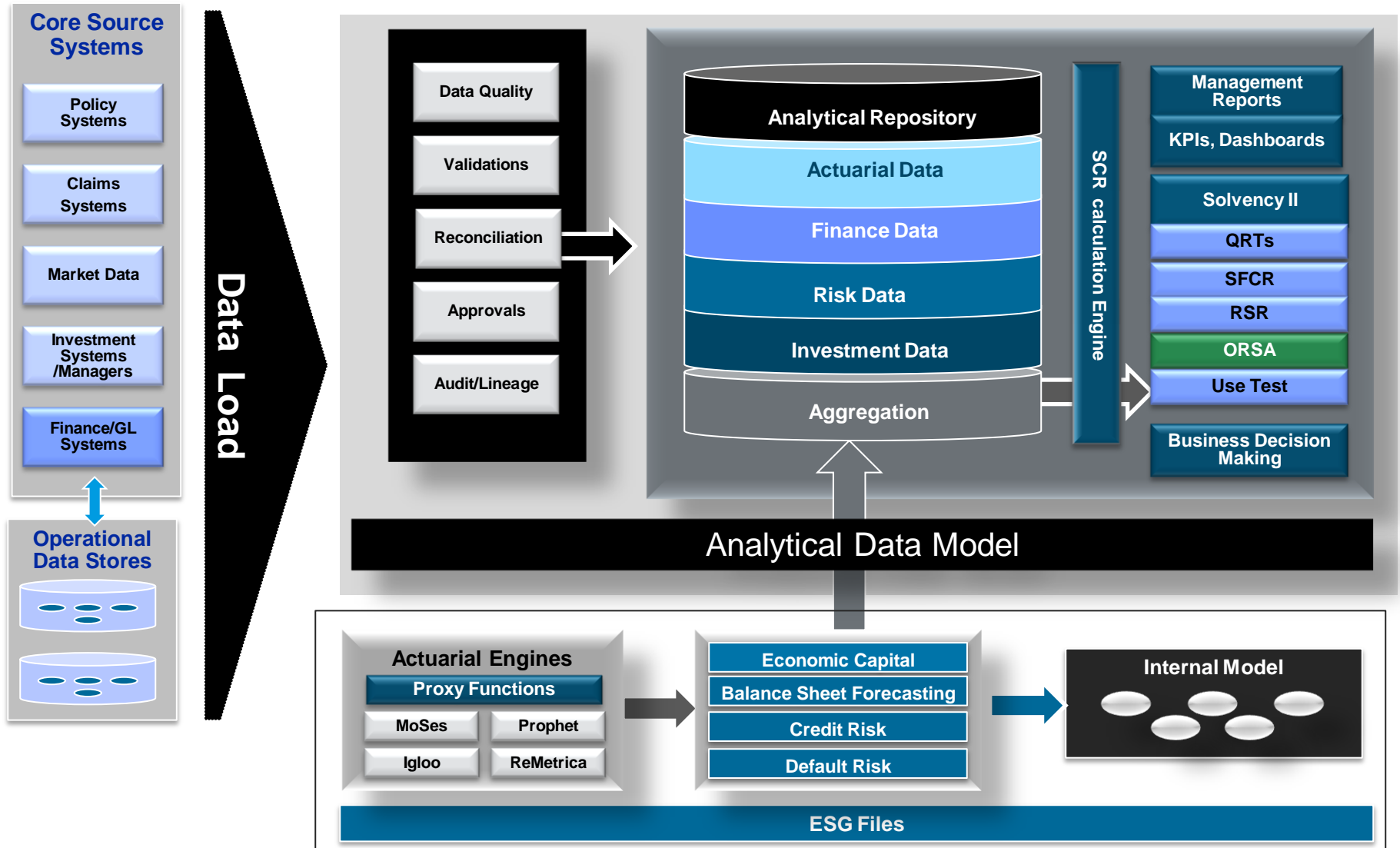
Problems:

- Calculation is prescriptive & subjective
- Point In Time vs. Through The Cycle
- Model challenges
- Frequency
- Time taken to calculate
- Value-add: Regulatory vs. economic
- Communication

Beyond Regulation: ORSA

- » Modelling requirements of ORSA could be considered in three categories:
 - » **Backward-looking**
 - Analysis of annual change in Pillar 1 regulatory reserves
 - » **Current-looking**
 - Real-time monitoring of Pillar 1 regulatory capital requirements
 - Own assessment of current solvency capital requirements
 - » **Forward-looking**
 - Multi-timestep forward projection of solvency capital requirements (regulatory capital and / or economic capital)
- » Companies should not miss the opportunity to maximise the benefits of ORSA for both regulatory and economic capital

Insurers Require Modular & Flexible Solutions



Conclusions & Questions

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Conclusions & Questions

- » Insurers can learn from Bank stress testing practices and there are strong parallels.
- » Insurers using stochastic scenarios can validate these using deterministic scenarios for ORSA purposes.
- » Insurers & Banks using deterministic stresses can benchmark these against stochastic distributions produced by an ESG.
- » The choice a firm makes to use deterministic vs. stochastic scenarios depends on risk management strategy – ORSA is flexible in this way.
- » Scenario generation is a key component of the ORSA and companies can extract significant value from the process.
- » Pillar I requirement is to calculate a 1-Year VaR, insurers should not miss the opportunity to make maximum use of this opportunity.
- » ORSA solutions exist and the architecture is flexible enough to meet changing business requirements over time.