



17TH EAST ASIAN ACTUARIAL CONFERENCE  
15-18 October 2013  
Resorts World Sentosa, Singapore

# Agile Capital Modelling



## Contents

- Introduction
- Capital modelling
- Capital modelling – snakes and ladders
- Software development
- Agile software development
- Agile capital modelling





## Capital Modelling Objectives

- Some key objectives of capital models
  - ✓ Calculate regulatory (e.g. SII) capital
  - ✓ Calculate economic capital
  - ✓ Calculate capital benefit of new portfolios and products
  - ✓ Evaluate reinsurance options
  - ✓ Testing business plan
  - ✓ Capital allocation
  - ✓ Asset Liability management
  
- Parameterisation
  - How the data constrains us



## Regulatory Capital Regimes

- Solvency II
- Enterprise Risk Management ( S&P, AM Best )
- Singapore RBC
- Malaysia ICAAP
- Indonesia FCR
- Japan Solvency
- Australia APRA
- And others



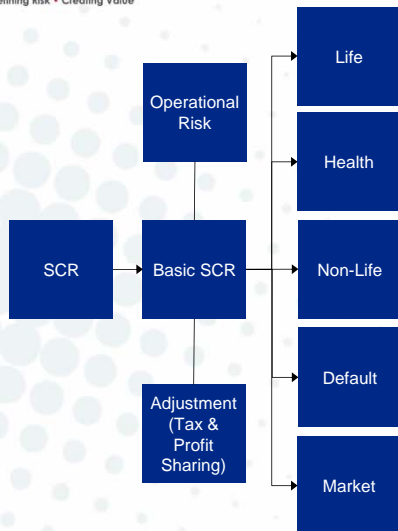


# Regulatory Capital - 3 Pillars

Pillar 1 Quantitative Requirements	Pillar 2 Supervisory Review	Pillar 3 Disclosure Requirements
<ul style="list-style-type: none"> <li>Capital Requirements                             <ul style="list-style-type: none"> <li>Solvency Capital Requirement (SCR)</li> <li>Minimum Capital Requirement (MCR)</li> </ul> </li> <li>Calibrated to 99.5% VaR of deterioration in Balance Sheet Net Asset Value over 1 year.</li> <li>Fair value balance sheet</li> </ul>	<ul style="list-style-type: none"> <li>Systems of governance</li> <li>Own Risk &amp; Solvency Assessment (ORSA)</li> <li>Supervisory review process                             <ul style="list-style-type: none"> <li>Assessment of quantitative and qualitative requirements</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Solvency and Financial Condition Report (SFCR)                             <ul style="list-style-type: none"> <li>Greater transparency to investors</li> </ul> </li> <li>Report to Supervisors (RSR)                             <ul style="list-style-type: none"> <li>Quarterly and annual reporting requirements</li> </ul> </li> </ul>



# Standard Formula



- Impact of longevity, mortality, disability / morbidity, revision, lapse and catastrophe risk
- Opportunity for longevity protection reinsurance and pandemic cover (significant capital charges under Standard Formula)
- Life type risk categories:** mortality, longevity, disability, expense, revision, lapse, catastrophe
  - Similar reinsurance opportunity to life for longevity risk
- Non-life risk categories:** premium / reserve, lapse, cat
- Premium risk (new business and reserves)
- Lapse risk
- Catastrophe risk
  - Natural and man-made
- Covers reinsurance, derivative counterparties, cash at bank, etc
- Significant step in the capital charge for credit ratings A or below
- Unrated counterparties attract significant capital charges
- Stress tests balance sheet against 1 in 200 impact of:
  - Interest rates, credit spread, equities, property, currency etc
- Mismatching asset and liability duration and currency attracts significant capital charge

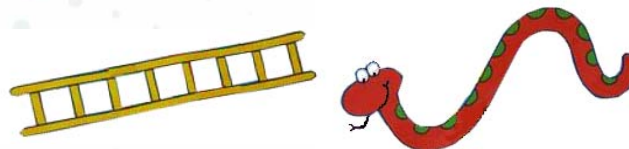


## Capital Modelling snakes and ladders



## Snakes and ladders

- **Massive Scope**
  - **Cause:** Organizations often attempt to build entire economic model and satisfy a number of different stakeholders
  - **Issues:** Building of the model takes too long, Organization receives little benefit, modeling project loses momentum or dies
  - **Recommendation:** Start with smaller specific modules and gradually increase the scope and functionality of the model; Consider development of a model plan; Iterate development; Use simple placeholders for other parts of the model; Provide reports to Stakeholders

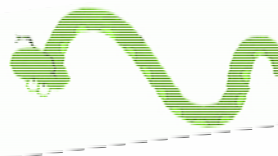
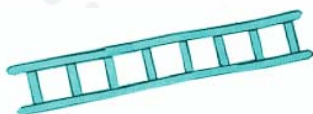


## Snakes and ladders



- **Level of Detail**

- **Cause:** Organizations try to replicate the level of detail in their deterministic financial projections
- **Issues:** Refining of the model to get this level of detail has little impact on modeling results and becomes a time consuming and laborious exercise
- **Recommendation:** Employ the strengths of stochastic modeling and focus on key financial items and ratios/metrics; Alternatively consider more granular models to perform specific functions (e.g. prospective UW, catastrophe risk management)



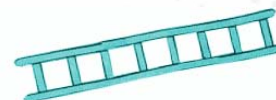
Proprietary & Confidential

9

## Snakes and ladders

- **Too Many Variables**

- **Cause:** Organizations seek to build a comprehensive and accurate model and ensure no risks are overlooked
- **Issues:** Inability to decipher output, organizations gain a false sense of precision - the more variables, the greater the degree of difficulty in getting the interrelationships (dependencies, correlations) correct
- **Recommendation:** Focus on key variables, use “What if” features of ReMetrica to determine the risk drivers and isolate their impact and/or examine specific risks and scenarios



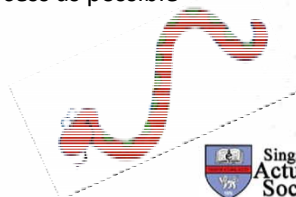
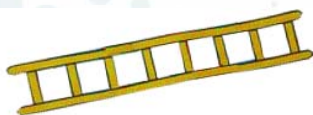
Proprietary & Confidential

10

## Snakes and ladders

- **Data Availability**

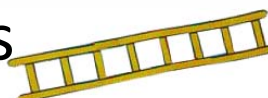
- **Cause:** Organizations may fail to realize that to achieve their modeling objectives they need to provide a significant amount of data
- **Issues:** Organizations don't fully appreciate the type of data required; Some organizations expect the model to provide parameters, when in actuality the actuarial work to develop parameters is done outside the model
- **Recommendation:** Ensure in-house modelers understand how parameters for the model are established; Start procuring the required data and developing (or acquiring) parameters as early in the process as possible



Proprietary &amp; Confidential

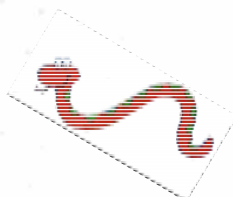
11

## Snakes and ladders



- **Lack of Dedicated Resources**

- **Cause:** Organizations place modeling responsibilities on already strained resources, frequently it is an add-on to someone's day job
- **Issues:** Initial phases of customizing and parameterizing the model is time consuming; resources may also be needed to independently validate the model
- **Recommendation:** Organizations need to provide temporary relief of some responsibilities for modeling staff or add resources or adjust expectations; plan ahead on how the model will be tested and validated



Proprietary &amp; Confidential

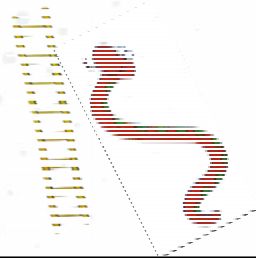
12



## Snakes and ladders

- **Elevated Expectations**

- **Cause:** Organizations establish aggressive timelines for building, testing and implementation; organizations may increase the scope of the model or tighten timeframes to meet organizational objectives (Board or rating agency meetings)
- **Issues:** Modeling may be delayed due to the absence of data and organizations may not allow sufficient time for testing and validation of the model
- **Recommendation:** Set realistic timeframes for building and testing of the model and don't change the scope appreciably without considering the impact to the timeline



Proprietary & Confidential

13

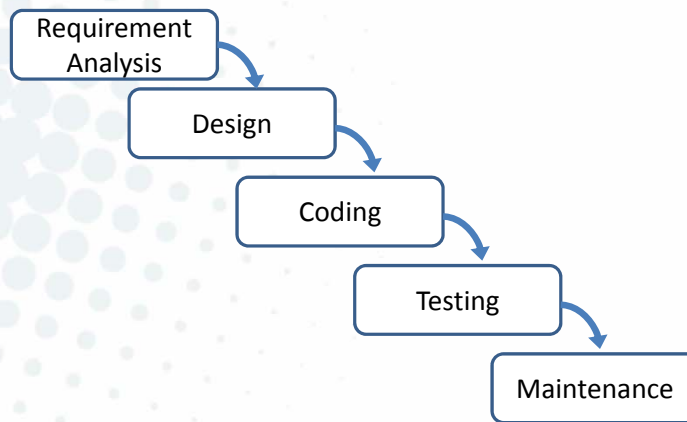


## Software Development



## Software Development

- Traditional Software development process - waterfall



## Software Development

- Issues with waterfall approach
  - Long time before see results
  - Result doesn't reflect actual needs of stakeholders
  - Problems early in process difficult to correct
  - Software releases are too late
  - Time 'wasted' on unnecessary features
  - Too late to make key improvements / changes





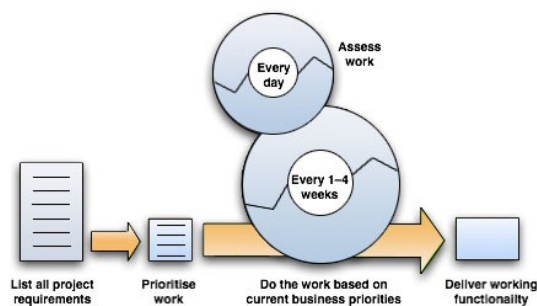
## Software Development

- Agile Software development process

- Don't try to analyse everything up front
- Do many small iterations
- Set milestones for individual tasks
- Keep as simple as possible
- Get feedback from stakeholders

- But discipline required:

- Version control
  - Continuous testing
    - Unit tests, regression tests
  - Continuous documentation
- Software should always be ready to deliver!



## Agile Practices & Lessons Learned

- **Actively manage the scope of the model**

- Start with specific applications/goals
- Don't try to build a model that does everything on Day 1
- Don't try to please all stakeholders
- Be realistic with representations made to rating agencies

- **Models are tools to aid decision-making, not supplant it**

- In most cases, model results are used to support a management decision
- It can take several iterations of the model – and events – for management to start to find the models useful





## Agile Practices & Lessons Learned

- **Focus on the key risks as opposed to trying to model all risks**
  - Many organizations lack the data to model operational and strategic risks
  - Use scenario testing to help plan for other risks not in the core model and to develop plans for contingencies
  - Don't try to incorporate risks where there is insufficient data
- **Stochastic models do not lend themselves to detailed accounting treatments**
  - Tax treatments
  - Intercompany eliminations or intercompany transfers
  - Provision for reinsurance calculation
  - Amortization, depreciation, accruals, allowances, fees, etc.

Proprietary & Confidential

19



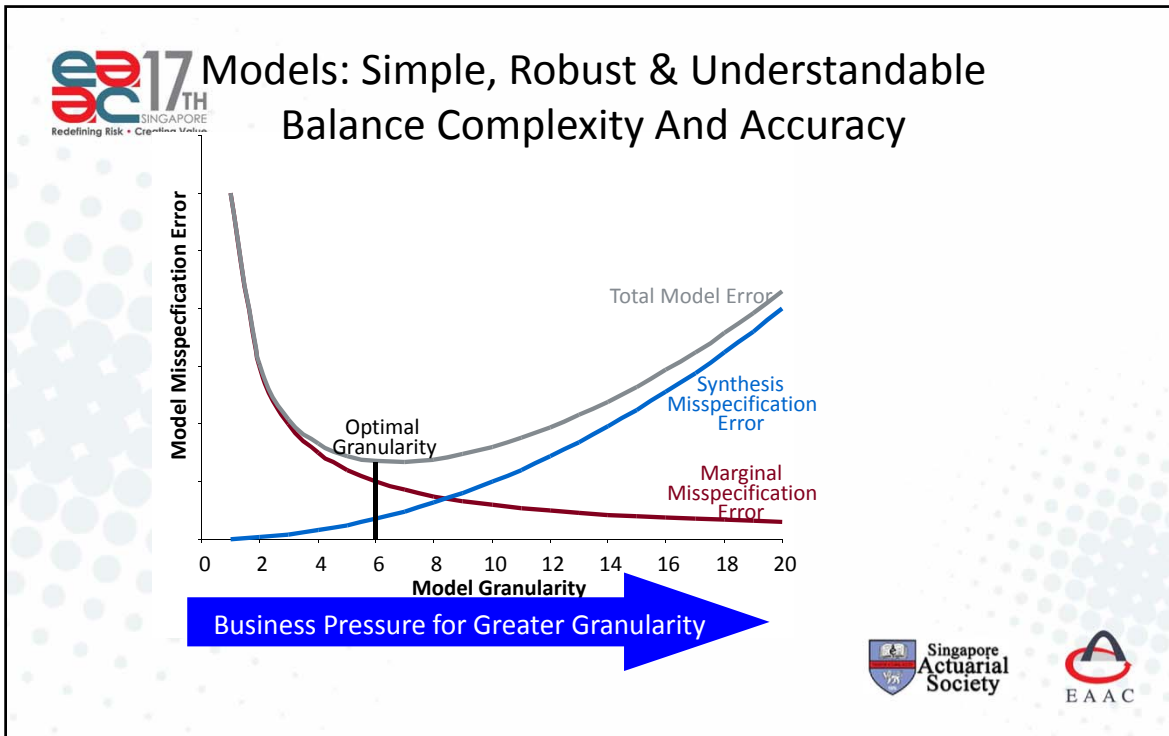
## Agile Practices & Lessons Learned

- **Educate stakeholders on how to view modelled results**
  - Don't use the same view (ratios and metrics) that were used in deterministic approaches
- **Models are driven by the assumptions, so the need to validate the model is critical**
  - Most organizations need to spend more time validating and back-testing their models
  - Use sensitivity testing (altering one variable at a time) to understand what is driving results
- **Too much complexity will erode the credibility of the model**
  - There is a point where extensive complexity and granularity overshadows accuracy and introduces increased risk of model misspecification error

Proprietary & Confidential

20





**eaac 17<sup>TH</sup> SINGAPORE**  
Redefining Risk • Creating Value

## How Long Does It Take To Build A DFA Model

- **Variables**
  - Scope of the model
  - Internal & external resources to support the modelling project
  - Availability & suitability of data
  - Speed of decision-making regarding modelling Issues
- **Model Scope**
  - Purpose, scope and level of detail (number and types of time intervals e.g. monthly, annually, number of years, number of lines of business, number of companies, inter-company reinsurance, types of assets, types of risks e.g. include credit risks, desired output, e.g. financial statements )
- **What's Time Consuming with Respect to Model Building**
  - Determining purpose and design
  - Gathering data and inputs
  - Designing outputs
  - Building/Customizing a Model
  - Assumptions/Parameterising (Usually the most time consuming part)
  - Testing and validation (ongoing)

Proprietary & Confidential

22

Singapore Actuarial Society

E A A C

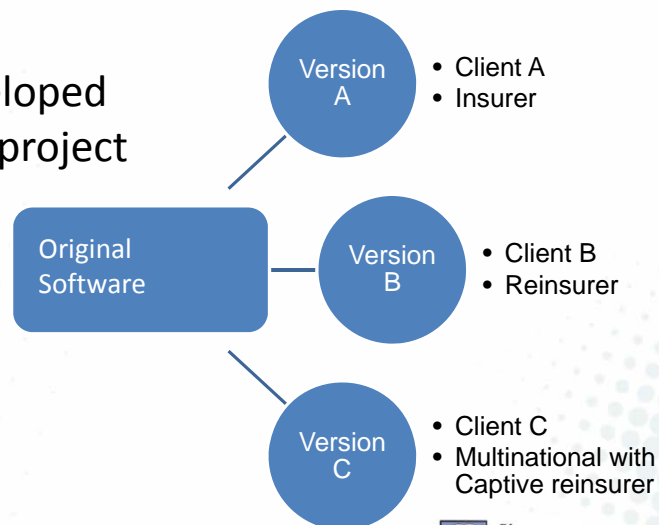


## Software for Agile Capital Modelling



## Agile Capital Modelling Software

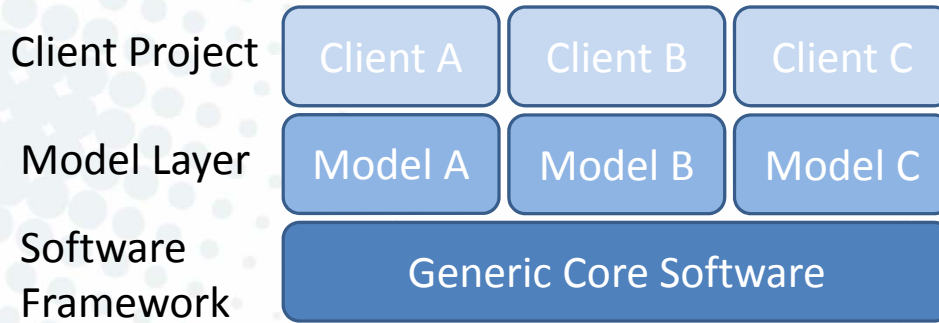
- Originally we developed software for each project
- Many problems
  - Slow
  - Error prone
  - Unmaintainable





# Agile Capital Modelling Software

- New approach required – graphical models



# Agile Capital Modelling

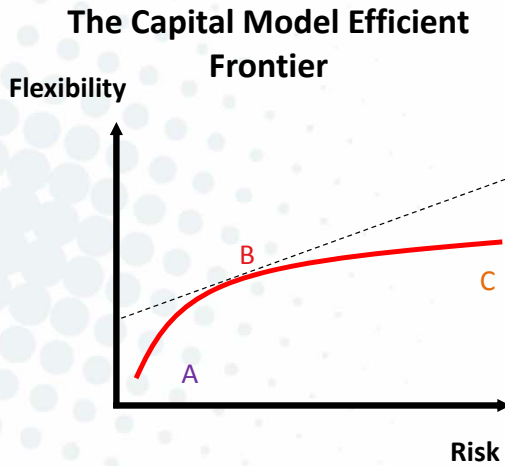
The screenshot shows the ReMetrica Enterprise Edition software interface. The main workspace displays a graphical model with various components like 'Marine', 'Large', and 'Reinsurance Manager' connected by lines. A 'Model Hierarchy' pane on the right shows a tree view of the model structure. A 'Component Palette' on the bottom right lists various pre-built components such as 'Augmented Reserve', 'Business Entity', 'Cat Event', and 'Cat Event By Year'. A yellow callout box with an arrow pointing to the component palette contains the following text:

- Intuitive graphic user interface
- No programming required
- Comprehensive library of pre-built components





# Agile Capital Modelling



**A – Black Boxes:** easy to use but limited flexibility, especially as a group aggregation tool

**B – Agile Capital Model:** Predefined and tested logic, but customisable if required. Powerful and fast whilst minimising risk – ReMetrica platform

**C – Programming Environments:** Flexible but modelling becomes a high risk software project distracting management from the core business



Thank You

Contact: Paul Maitland  
 Aon  
 London and Singapore  
 Paul.maitland@aonbenfield.com

