KPMG

cutting through complexity

101: Risk Driver Calibration

2015 Risk and Investment Conference – Introductory Cross Practice Workshop

3pm, Thursday 4 June 2015

Newport – David Honour and Joshua Waters

Contents

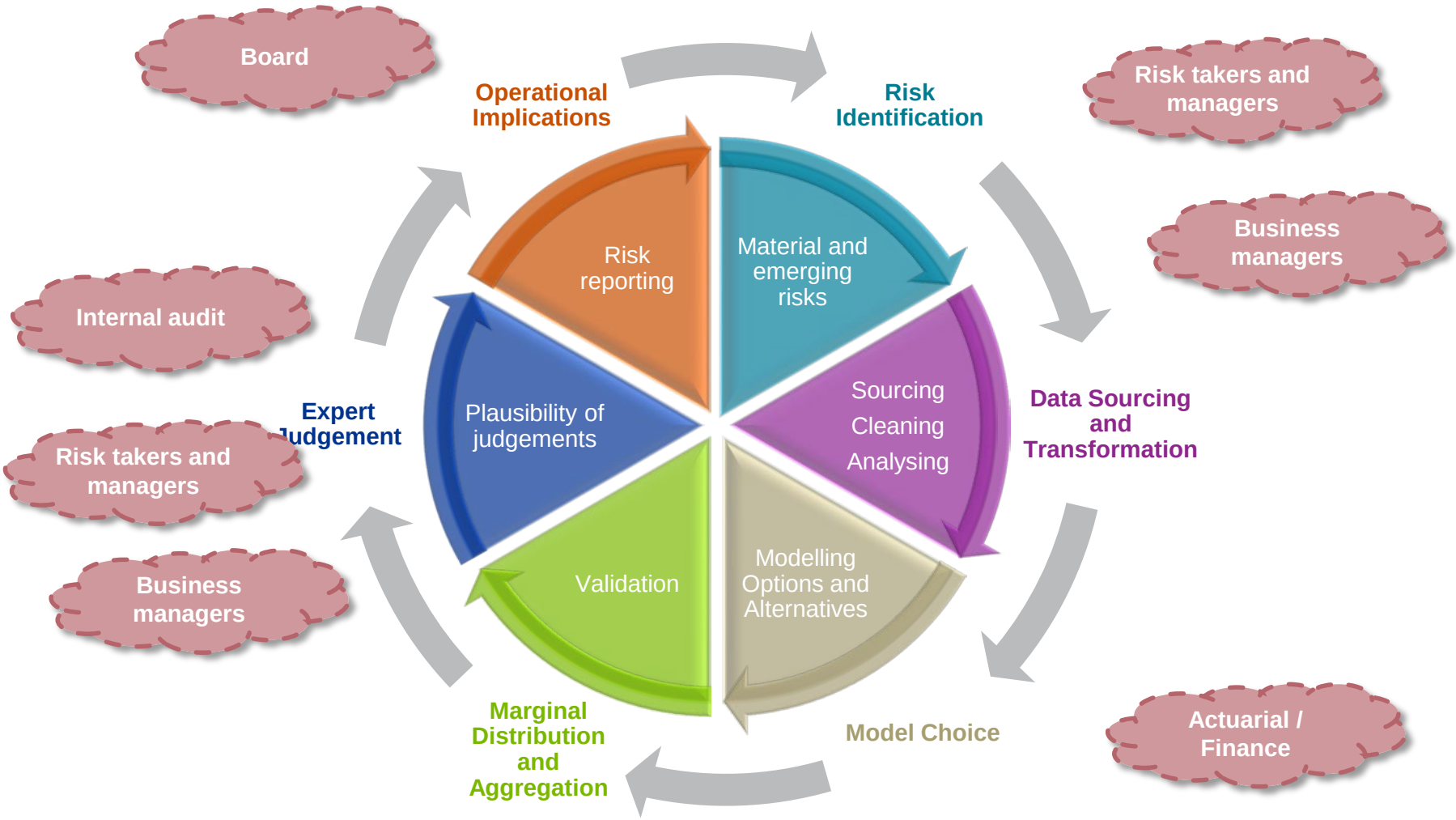
Risk Driver Calibration: why bother?

How can you optimise shareholders return per unit of risk and protect policyholders if you don't understand the nature of the risks driving your business?

Improved risk management. Avoid crises and stop fighting fires.

Better incentives for investment managers and pricing teams. Aligned with shareholders.

Risk Driver Calibration: Life cycle



Risk Identification

Key sources for Risk Identification	
ORSA	■ Stress and Scenario Testing ■ Reverse Stress Testing
Audit	■ Internal Audit ■ External Audit
Regulator	■ Supervisory Statement ■ Capital Add On
Consultancy	■ Industry Benchmarking ■ Market Surveys
Models	■ Asset Model Inputs ■ Liability Model Inputs
Attribution	■ Capital Attribution ■ Profit and Loss Attribution
ID Exercise	■ Top Down Risk Assessment ■ Bottom Up Risk Assessment
Risk Register	■ Risk Breaches ■ Near Misses

- What is out of scope?
- Is the risk quantifiable?
- What is the time horizon?
- What is our exposure?
- What are the sub-categories of a risk?

Industry developments:
PRUDENTIAL have publically stated that they are building their own Economic Capital model with a longer time horizon e.g. the ninty percentile to run-off

Back up the calibration with…

MULTIPLE SOURCES

Multiple Sources

Historical Data Sources

Basis Risk

Forward Looking Data Sources

Modelling Implications

To fit the model use…

Transformations

Transformations

Classical Transformations

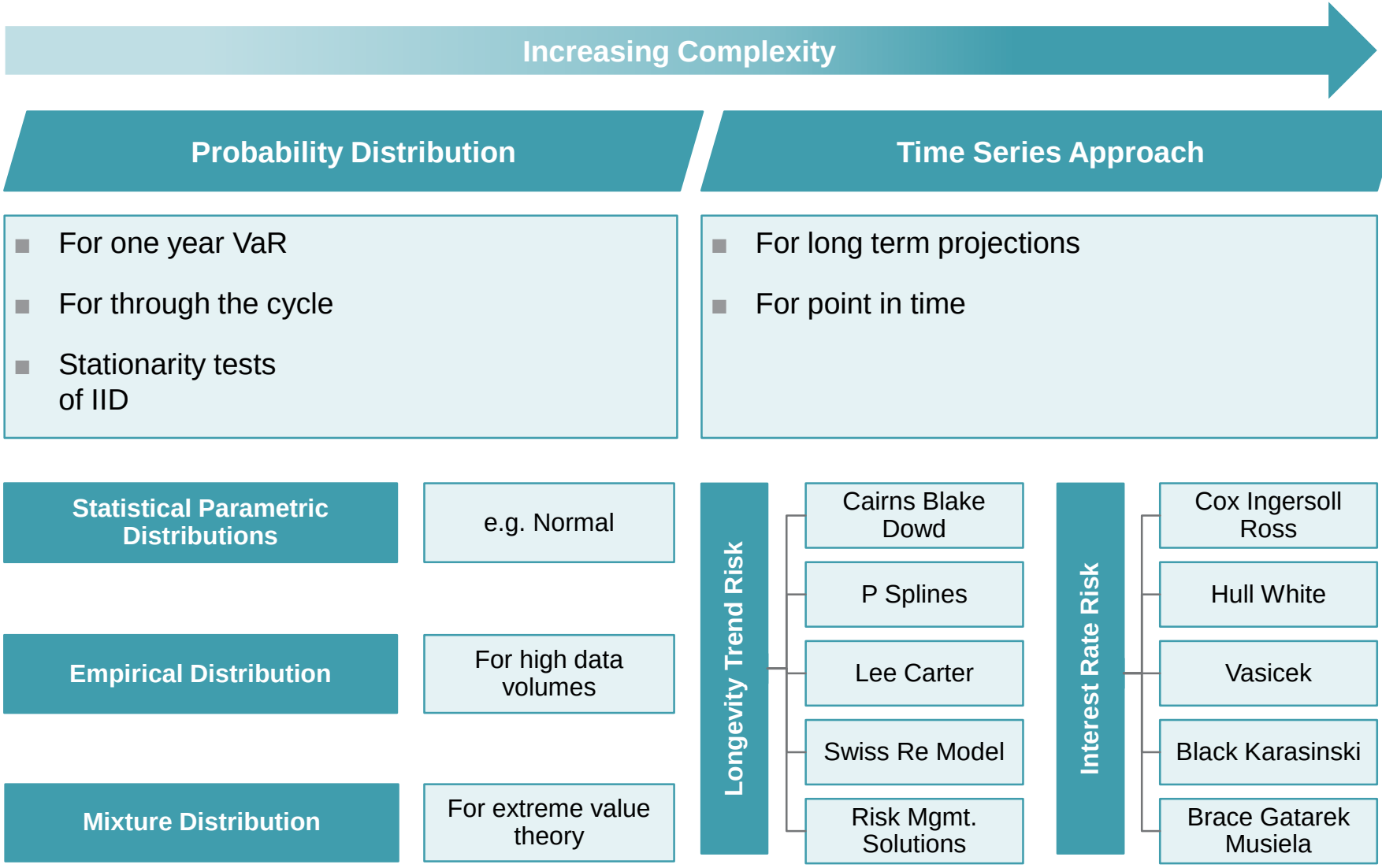
- Deciding approach to data outliers
- Removing biases such as autocorrelation
- Choosing how to express risk e.g. excess equity returns
- Filling in gaps – missing data
- Extending the data series
- Using overlapping data

Transforming To Facilitate Modelling

- PCA – reduces the number of dimensions without losing the information.
- Lambda transform – squeezes and stretches the data, so that a simple model can be used.
- Explaining the impact to management.

Have a beauty parade for…

Model Selection



Isolate the risk to set…

MARGINAL DISTRIBUTION

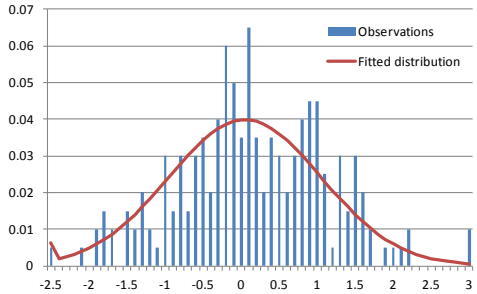
Marginal Distribution

Distribution	Calibration	Validation
Normal	Method of Moments	Graphical Tests
Student's t	Maximum Likelihood Estimation	Academic Statistical Tests
Laplace	Quantile Fitting	Monte Carlo Statistical Tests
Gumbel	Best Linear Unbiased Estimator	
Reverse Gumbel		
EGB2		

Visual analytics – Marginal distributions

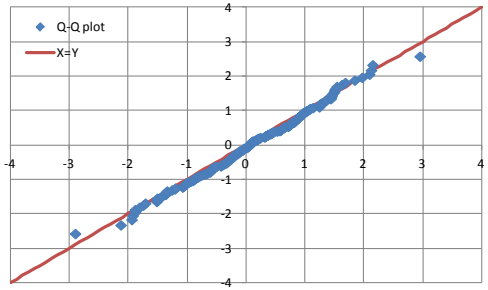
Analysis

Histogram of Data vs Fit



Fit reasonable relative to the distribution of historical data

Q-Q plot



Q-Q plot shows close alignment of percentiles, with some deviation in tails

Analysis of moments

Test	Data	Fitted
Mean	0.03	0.00
Standard Deviation	1.04	1.1
Skewness	0.05	0.10
Kurtosis	0.21	0.20

Fitted moments are sufficiently close to those in the data

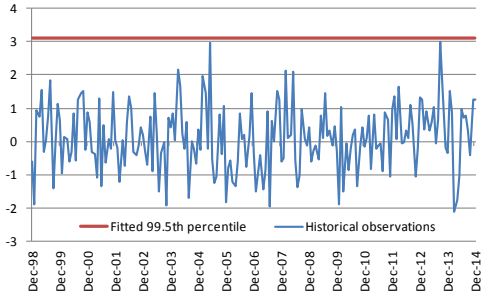
Testing

Goodness of Fit

Test	Test Stat	Critical Value	Decision
Chi-Squared	1.56	1.23	Accepted
Kolmogorov-Smirnov	2.41	2.32	Accepted
Anderson-Darling	1.01	1.51	Rejected

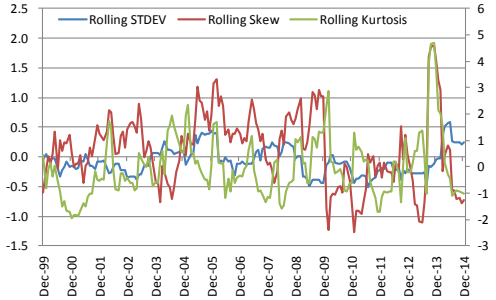
Passes and fails on goodness of fit tests will need to be rationalised

Back-testing key percentiles



Fitted 1-in-200 appears sufficiently onerous compared with historical data

Stationarity tests



Tests show moments to be reasonably static through time in the data

Make sure to reflect your own…

DEPENDENCIES

Dependencies

CALIBRATION CHALLENGES

- Tail dependency
- Tail vs. body correlation
- Data scarcity
- Number of free parameters
- Asymmetry
- Explaining the approach
- Reflect causal relationships
- Maintain mathematical properties

MODELS

Correlation Matrix

- e.g. Standard Formula SCR

Gaussian Copula

- Allows for wider range of marginal distributions

Causal Models

- e.g. Bayesian Networks for operational risk

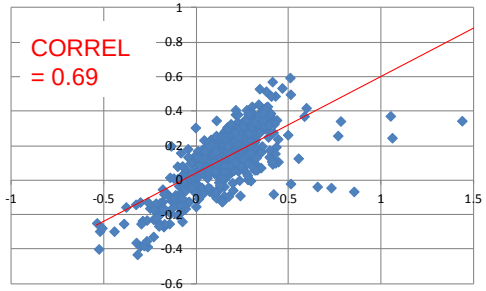
Advanced Copula

- e.g. Archimedean, Student's t or Vine copulas

Visual analytics - Dependencies

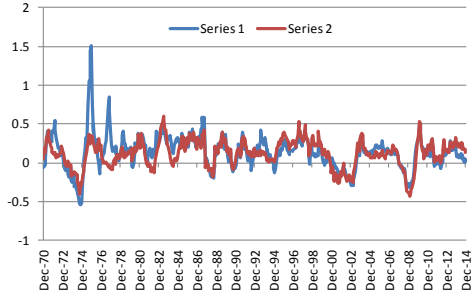
Body correlation

Visual inspection of correlation



Visual inspection of data supports calibrated correlation coefficient

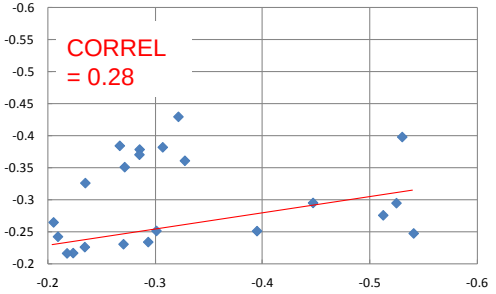
Visual inspection of time series



Visual inspection of time series data supports strong correlation

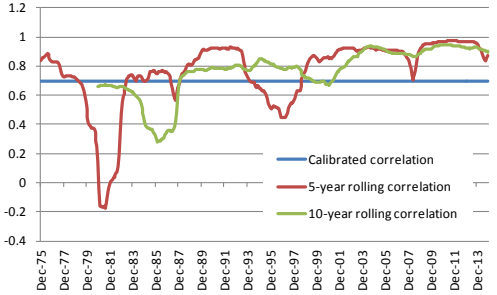
Conditional properties

Analysis of tail correlation



Tail correlation does not significantly exceed body correlation

Analysis of rolling correlations



Correlations appear to increase over time, suggesting uplift may be required

Use workshops to set…

EXPERT JUDGEMENT

Expert Judgement

Finding the Experts

- Relevant credentials
- Training to identify and avoid any inherent biases
- Representation from all the affected business functions

Dealing with uncertainty

- Facilitating the expression of a range of opinions
- Identifying all the plausible choices
- Considering the data analysis, acknowledging the data limitations
- Documenting the rationale for the final judgement
- Assessing the confidence in the judgement

Managing the Expert Judgement

- Determine update time and event based update triggers
- Assess the materiality of the judgement
- Record the judgement in the Expert Judgement log
- Evidence the review and challenge of the Expert Judgement
- Record the disagreements and challenges transparently

Go full circle to manage…

OPERATIONAL IMPLICATIONS

Operational Implications

Board

Business managers

Risk managers

Risk takers

Risk experts

Risk Identification

Finance

Actuarial

Risk Management

Risk Calibration

Internal audit

Risk

Summary and questions…please!

Back up with…

MULTIPLE SOURCES

To get the best fit use…

TRANSFORMATIONS

Have a beauty parade for

MODEL SELECTION

Isolate the risk to set…

MARGINAL DISTRIBUTION

Reflect your own…

DEPENDENCIES

Use workshops to set…

EXPERT JUDGEMENT

Go full circle to manage…

OPERATIONAL IMPLICATIONS

Presenters

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- Director at KPMG
- David leads KPMG's Actuarial European Economic Capital (EC) Field of Expertise Team

Joshua Waters FIA CERA CQF

- Joshua Waters is an Executive Life Advisor in KPMG's Life Actuarial Practice

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