Operational risk quantification
The quest for a meaningful approach and lessons learned from Basel

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Agenda

• Introduction
• Lessons learned from AMA
• Current industry & regulatory trends
• Simpler models
• Structured scenarios
Introduction

Introductory remarks

- Why is banking experience relevant for insurers
- Why is op risk getting more attention?
  - Financial crisis
  - Trust
  - High profile losses
- Why is op risk modelling hard
  - Breadth
  - Fat tails
  - Bottom up vs to down

Operational risk:
“The risk of loss resulting from inadequate or failed internal processes, people and systems or internal events’ (excluding strategic and reputational risk)”
**Definitions**

- **Operational risk**: “The risk of loss resulting from inadequate or failed internal processes, people and systems or internal events’ (excluding strategic and reputational risk)”

- **Loss**: Total direct financial loss relating to loss generating events that happen in the next 12 months

- **Loss event**: guidance not specific, but should aggregate cash flows that can be considered linked to a common underlying cause

- **Risk types**:

<table>
<thead>
<tr>
<th>L1</th>
<th>L2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business disruption and system failures</strong></td>
<td>Systems</td>
</tr>
<tr>
<td><strong>Clients, products and business practices</strong></td>
<td>Suitability, disclosure and fiduciary</td>
</tr>
<tr>
<td></td>
<td>Improper business practices</td>
</tr>
<tr>
<td></td>
<td>Product flaws</td>
</tr>
<tr>
<td></td>
<td>Selection, sponsorship</td>
</tr>
<tr>
<td></td>
<td>Advisory activities</td>
</tr>
<tr>
<td><strong>Damage to physical assets</strong></td>
<td>Disasters and other events</td>
</tr>
<tr>
<td><strong>Employment practices and workplace safety</strong></td>
<td>Employee relations</td>
</tr>
<tr>
<td></td>
<td>Safe environment</td>
</tr>
<tr>
<td></td>
<td>Diversity and discrimination</td>
</tr>
<tr>
<td><strong>Execution and process management</strong></td>
<td>Transaction capture, execution, maintenance</td>
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<tr>
<td></td>
<td>Monitoring and reporting</td>
</tr>
<tr>
<td></td>
<td>Customer documentation</td>
</tr>
<tr>
<td></td>
<td>Customer management</td>
</tr>
<tr>
<td></td>
<td>Trade counterparties</td>
</tr>
<tr>
<td></td>
<td>Vendors and suppliers</td>
</tr>
<tr>
<td><strong>External fraud</strong></td>
<td>Theft and fraud</td>
</tr>
<tr>
<td><strong>Internal fraud</strong></td>
<td>Unauthorised activity</td>
</tr>
<tr>
<td></td>
<td>Theft and fraud</td>
</tr>
</tbody>
</table>

**Pillar I operational risk**

Three approaches are available for Pillar I operational risk capital requirements. There was a fourth...

- **BIA**
  - Basic Indicator Approach.
  - Capital equal to a fixed percentage (15%) of gross income.
  - For banks with moderate exposure to operational risk losses.

- **TSA**
  - The Standardized Approach.
  - Capital equal to a fixed percentage of gross income based on individual business lines.
  - For banks with moderate exposure to operational risk losses.

- **AMA**
  - Advanced Measurement Approach.
  - Most sophisticated approach for quantifying operational risk based on the risk profile of the bank rather than its revenues; risk profile is measured by its historical losses and other forward looking estimates (control environment, scenario projections).
Lessons learned from AMA
Criticisms levelled at G1 AMA

- Lack of formal regulatory guidance or structure around methodology
- No general industry consensus around methodology and geographical differences in types of approach taken
- Models inadequately specified by loss data
- Inherent subjectivity in model approach
- Inherent reliance on subjective scenario assessments to inform forward looking view
- Excessive sensitivity to choice of unit of measure
- Difficult to link day to day EL drivers to the capital drivers – ie, difficulties with reconciling bottom up with top down
- And hence the difficult to evidence the Use Test

Example of pure scenario based approach

<table>
<thead>
<tr>
<th>Approach</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Average and Worst Case Estimation</td>
<td>Experts estimate likely and unlikely but “imaginable” loss levels</td>
</tr>
<tr>
<td>2: Worst Case + External “Tail Fatness” Estimation</td>
<td>Extreme “unimaginable” capital threshold loss estimated by statistical projection</td>
</tr>
</tbody>
</table>

- MF: Most likely frequency
- MS: Most likely severity
- F: Scenario frequency
- S: Scenario severity
- Poisson (mean = MF)
- Lognormal
  - Mu = ln(MS)
  - Sig= f(MF,MS,F,S)
31 March 2015

**How sensitive is the capital to the choice of severity distribution?**

<table>
<thead>
<tr>
<th>SBA 1</th>
<th>SBA 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lognormal severity</strong></td>
<td><strong>Pareto severity</strong></td>
</tr>
</tbody>
</table>
| - Average severity taken to be median  
  » Capital ~ $105MM | - Average severity taken to be median  
  » Capital ~ $900MM |
| - Average severity taken to be mode  
  » Capital ~ $35MM | |
| - Average severity taken to be mean  
  » Capital ~ $12MM | |

**What’s driving the capital?**

**How objective is LDA?**

- Choice of severity distributions
  - 2 parameter (e.g., lognormal & Pareto)
  - 3 parameter (e.g., Burr)
  - 4 parameter (e.g., GPD, G&H, lognormal mixture)
- Choice of parameter estimation methodology
  - MLE, moments, curve fitting
  - Tail weighted
  - Bootstrapping technique to improve robustness of results (GMM)
- Choice of modelling threshold
- Truncated fitting vs. shifted vs. raw
- Choice of goodness of fit (GofF) metrics
How sensitive is capital to the assumptions in an pure LDA model?

Based on the same data set, taken for the CPBP event type for a US bank

<table>
<thead>
<tr>
<th>Severity</th>
<th>Threshold</th>
<th>Parameter estimation</th>
<th>Capital at risk 99.9% (SMM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lognormal</td>
<td>$10,000</td>
<td>MLE / shifted</td>
<td>$612</td>
</tr>
<tr>
<td>Lognormal</td>
<td>$10,000</td>
<td>MLE / truncated</td>
<td>$5,200</td>
</tr>
<tr>
<td>Lognormal</td>
<td>$10,000</td>
<td>Tail fitting</td>
<td>$2,600</td>
</tr>
<tr>
<td>Weibull</td>
<td>$10,000</td>
<td>MLE / shifted</td>
<td>$78</td>
</tr>
<tr>
<td>Pareto</td>
<td>$10,000</td>
<td>MLE / shifted</td>
<td>$376</td>
</tr>
</tbody>
</table>

Losses above $10K: 84
Top 3: $10.2M, $28.8M & $62M

AMA stocktake

- 1000 flowers bloomed?
- In contrast to other risk types, there is little regulatory prescription on how to combine the four elements: internal data, external data, scenarios and BEICF
- Practice varies internationally: US historically more loss data driven vs. Europe more scenario driven
- Regulatory concerns similar internationally: use test, robustness, comparability
- Only one of the main UK banks is AMA, but this will change
- Scenario practices of various levels of sophistication and meaningfulness
- G1 now tends to refer to AMA models 2004-2013, and G2 is future – bar raised
- There are significant developments on-going both in industry practice and regulatory landscape
Current industry and regulatory trends

Key development areas

Simpler models
- Simplification of traditional "model"
- More consensus around how to combine the four elements
- Anchoring of key parameters
- Industry lobbying
- Increased recognition of insurance
- Managed sensitivity to large industry events
- Higher model risk management expectations – ie, change control, model run process, key man risk, etc.
- Higher expectations for senior management understanding and role in governance

Role of scenarios and BEICF
- Increased role of scenario assessments and BEICF in models as opposed to loss data
- More bespoke and more structured scenario assessments
- Increasingly explicit linkage between scenario assessments and BEICF – introducing dynamics
- Collective of additional data to support scenario assessments
- Use of statistical tools in scenario workshops
- Scenarios that enable “what if” analysis to be perform
Model related regulatory developments

- Likely upward recalibration of TSA
- Likelihood that TSA will become floor for AMA
- Increasing regulator scrutiny around model sensitivities to assumptions
- Higher expectation around structuring of scenario assessments
- Higher expectations around evidencing Use Test
- Increased specificity of approach for different risks
- Still no further guidance / structure on modelling approaches, but likelihood that a model based approach will remain available

Other current industry trends

- Bespoke treatment / carving out of specific risk types – eg, conduct risk
- Movement towards “hybrid” models (part scenario / part LDA) in which:
  - Data (often ORX) used to inform mathematical / distribution shape assumptions
  - ILD & Scenarios used to inform calibration
- Use of direct analogies with credit risk in terms of approach to measuring exposure in scenario assessments and in some cases also capital estimation methodology
- Multi-faceted rather than pure risk-based allocation methodology
- Increased awareness of sensitivity to model methodology assumptions and some success in mitigation through use of robust estimators
- Movement away from use of Pareto distributions
- More conservative copula choices (movement away from Gaussian)
Anchoring of key parameters

STORM approach to severity modelling

Real time feedback from model allows scenario participants to validate their assessments

Scenario outputs
- Scenario assessment – provides scale of losses
- External data – provides shape of losses

Model
- Tail fatness parameter lookup tables based on internal / external data

Tail fatness parameter lookup tables based on internal / external data

<table>
<thead>
<tr>
<th>Tail</th>
<th>Sigma</th>
<th>Basel ET</th>
<th>Tail</th>
</tr>
</thead>
<tbody>
<tr>
<td>V thin</td>
<td>1.7</td>
<td>V fat</td>
<td></td>
</tr>
<tr>
<td>Thin</td>
<td>1.9</td>
<td>CPBP</td>
<td>fat</td>
</tr>
<tr>
<td>Fat</td>
<td>2</td>
<td>IF</td>
<td>medium</td>
</tr>
<tr>
<td>Fat</td>
<td>2.2</td>
<td>EP</td>
<td>medium</td>
</tr>
<tr>
<td>V fat</td>
<td>2.4</td>
<td>EPWS</td>
<td>medium</td>
</tr>
<tr>
<td>V fat</td>
<td>2.4</td>
<td>EP</td>
<td>medium</td>
</tr>
</tbody>
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Monte-Carlo Simulation or Fast Fourier Transform

Monte-Carlo Simulation or Fast Fourier Transform

Frequency distribution (Poisson)
- Severity distribution (e.g. Lognormal)
  - Compound Loss Distribution

Back-testing:
- Test against internal and external loss data
- If significant difference – revisit scenario assessment / calibration

Scenario assessment
- And or ILD
  - 10 losses per year
  - 1 in 20 years there is an event greater than $10M
  - LDA estimates of 1/20 year loss
Structured scenarios

Scenario “mini-models” – what are they

- More explicit consideration of supporting data
- Mechanical linkage with BEICF
- Workshop output is the structure to get the answer, rather than just the answer
- This could be simple formulae or a simulation structure
- Linkage to BEICF provides triggers / a process for intra-cycle scenario updates
- Enables “what if”
Scenario “mini-models”

- More structured scenario assessments
  - Provide a risk event type specific explanation of scenario frequency and severity estimates
  - Increased linkage with Business Environment and Internal Control Factors

**Example mis-selling scenario**

- “From the period of July 2007 to June 2013, Protect It All “PIA” Insurance Company sold X million You Don’t Need “YDN” insurance policies and received £Xm in premium.
- Over the same period they renewed Xm YDN policies and received £Xm in payments. YDN had an automatic renewals approach unless a customer contacted to cancel after receiving renewal documentation.
- As a result PIA are fined £Xm by the regulator and faced total costs of £Xm for mis-selling insurance products.

<table>
<thead>
<tr>
<th>1. Determine coverage of Unit of Measure</th>
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</thead>
<tbody>
<tr>
<td>Retail products / suitability</td>
</tr>
<tr>
<td>Key product YDN as “representative”</td>
</tr>
<tr>
<td>2. Determine drivers of exposure, e.g.</td>
</tr>
<tr>
<td>Number of products sold</td>
</tr>
<tr>
<td>Premium received for product</td>
</tr>
<tr>
<td>Gross profit margin</td>
</tr>
<tr>
<td>Duration product sold</td>
</tr>
<tr>
<td>Rate of growth of sales</td>
</tr>
<tr>
<td>Interest rate at which customers would be reimbursed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Determine drivers of loss realisation % of exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed of detection</td>
</tr>
<tr>
<td>Magnitude of misconduct (this can be linked to conduct risk models)</td>
</tr>
<tr>
<td>Duration of litigation / legal settlement period</td>
</tr>
<tr>
<td>Regulator sentiment</td>
</tr>
<tr>
<td>Compensation rate</td>
</tr>
<tr>
<td>Remediation costs</td>
</tr>
</tbody>
</table>
Scenario “mini-models” – illustrative example cont.

Basic “representative” scenario is that YDN is mis-sold and this gets media attention

Exposure

Loss realisation as % of exposure

Severity

Frequency

1/20

Model

Business environment factors and judgement

External data, internal scores and judgement

Recap and Q&A
Agenda

• Lessons learned from AMA
• Current industry & regulatory trends
• Simpler models
• Structured scenarios

• Questions