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

Mark London - EY

31 March 2015

Agenda

- Introduction

- Lessons learned from AMA

- Current industry & regulatory trends

- Simpler models

- Structured scenarios

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Introduction

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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
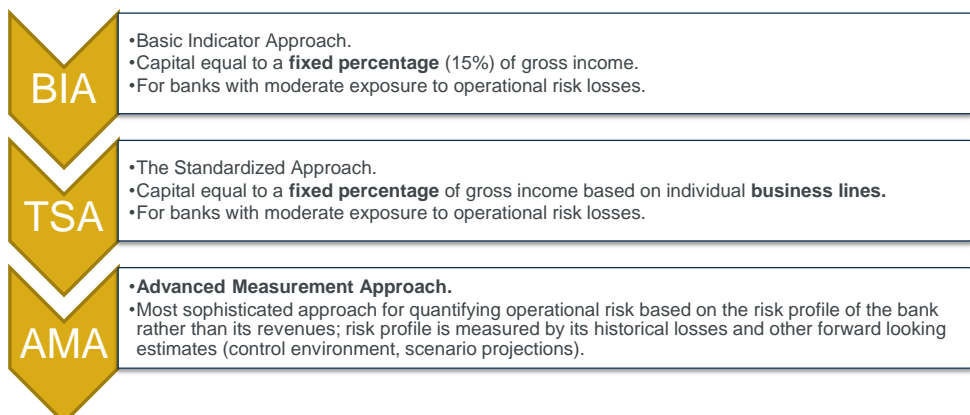
- **Risk types:**

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

31 March 2015   5
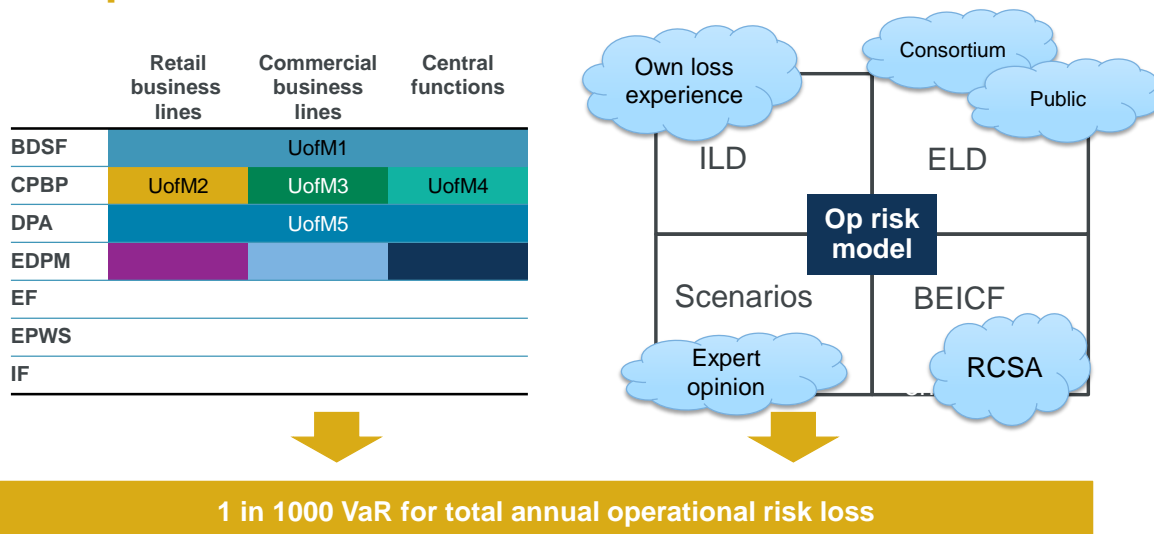
Pillar I operational risk

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).

31 March 2015   6

3

Components

	Retail business lines	Commercial business lines	Central functions
BDSF	UofM1		
CPBP	UofM2	UofM3	UofM4
DPA	UofM5		
EDPM			
EF			
EPWS			
IF			

1 in 1000 VaR for total annual operational risk loss

Own loss experience — ILD

Consortium — Public — ELD

Op risk model

Scenarios — Expert opinion

BEICF — RCSA

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# Lessons learned from AMA

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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

31 March 2015   9

Example of pure scenario based approach
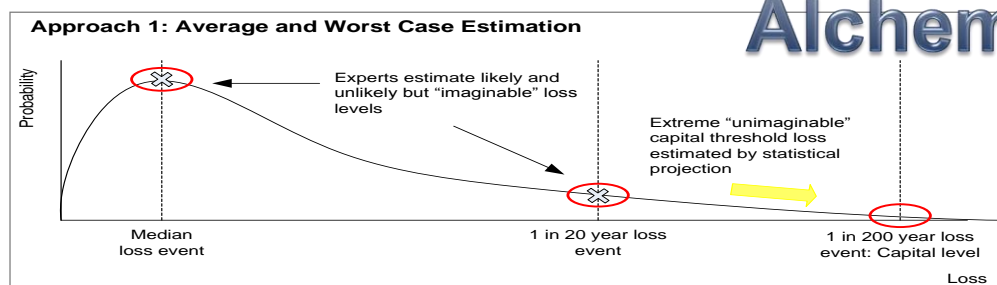
- ► MF: Most likely frequency
- ► MS: Most likely severity
- ► F: Scenario frequency
- ► S: Scenario severity

- ► Poisson (mean =MF)
- ► Lognormal
  - ► Mu = ln(MS)
  - ► Sig= f(MF,MS,F,S)

31 March 2015   10

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

> 10 losses per year; average single loss $50K; 1/20 years loss exceeds $10MM

SBA 1

Lognormal severity

- Average severity taken to be median
    - » Capital ~ $105MM
- Average severity taken to be mode
    - » Capital ~ $35MM
- Average severity taken to be mean
    - » Capital ~ $12MM

SBA 2

Pareto severity

- Average severity taken to be median
    - » Capital ~$900MM

What's driving the capital?

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11

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
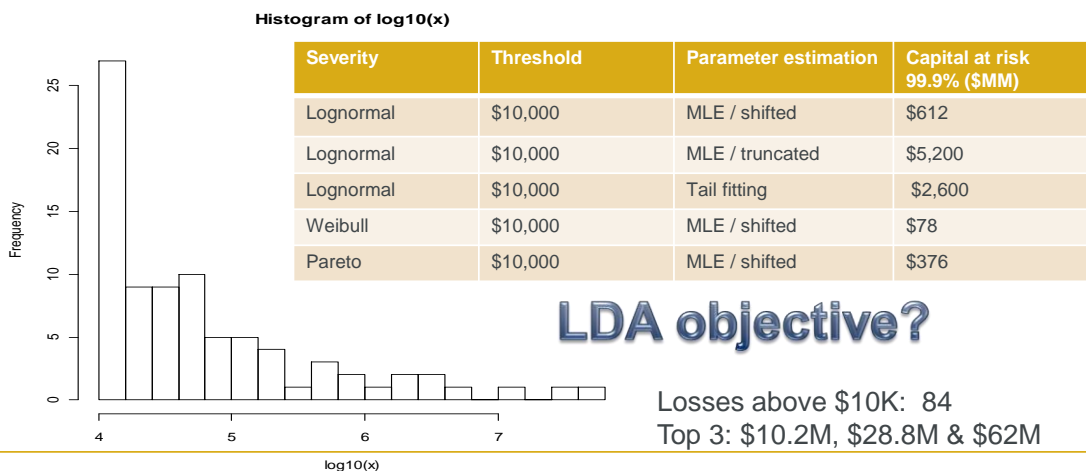- Choice of goodness of fit (GofF) metrics

Many choices!

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12

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

Histogram of log10(x)

Severity	Threshold	Parameter estimation	Capital at risk 99.9% ($MM)
Lognormal	$10,000	MLE / shifted	$612
Lognormal	$10,000	MLE / truncated	$5,200
Lognormal	$10,000	Tail fitting	$2,600
Weibull	$10,000	MLE / shifted	$78
Pareto	$10,000	MLE / shifted	$376

LDA objective?

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

13

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

14

Current industry and regulatory trends

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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

16

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

17

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

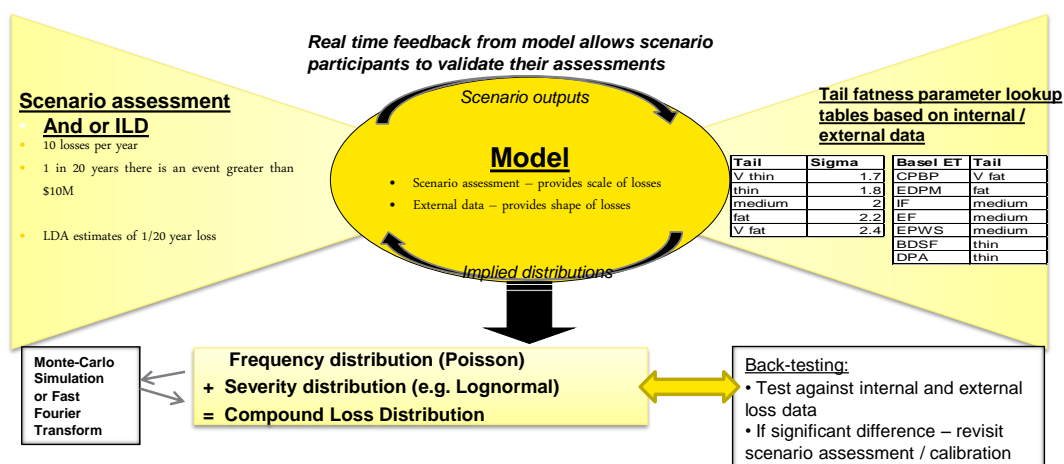- More conservative copula choices (movement away from Gaussian)

18

Anchoring of key parameters

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STORM approach to severity modelling

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

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

Scenario outputs

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

Implied distributions

Tail fatness parameter lookup tables based on internal / external data

Tail	Sigma		Basel ET	Tail
V thin	1.7		CPBP	V fat
thin	1.8		EDPM	fat
medium	2		IF	medium
fat	2.2		EF	medium
V fat	2.4		EPWS	medium
			BDSF	thin
			DPA	thin

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

20

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 <u>risk event type specific</u> explanation of scenario frequency and severity estimates

  - <u>Increased linkage</u> with Business Environment and Internal Control Factors

BEICFs

RCSA inputs / outputs	E.g.
KRIs	► Business volumes
	► Time to discovery
Issues Tracking	► Legal settlement period
	► Growth rates
Business environment metrics	► Income
	► Compensation rate
	► Complexity score
	► Etc.

BEICF based formula

$F(x,y,z)$

Model inputs

Benchmark against data
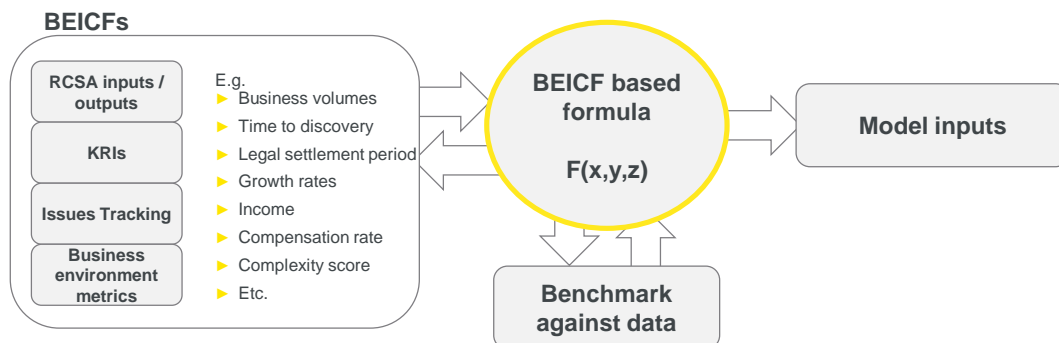
23

Scenario "mini-models" – what are they

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 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.*

1. Determine coverage of Unit of Measure	**3. Determine drivers of loss realisation % of exposure**
• Retail products / suitability	• Speed of detection
• Key product YDN as "representative"	• Magnitude of misconduct (this can be linked to conduct risk models)
2. Determine drivers of exposure, e.g.	• Duration of litigation / legal settlement period
• Number of products sold	• Regulator sentiment
• Premium received for product	• Compensation rate
• Gross profit margin	• Remediation costs
• Duration product sold	
• Rate of growth of sales	
• Interest rate at which customers would be reimbursed	

24

Scenario "mini-models" – illustrative example cont.
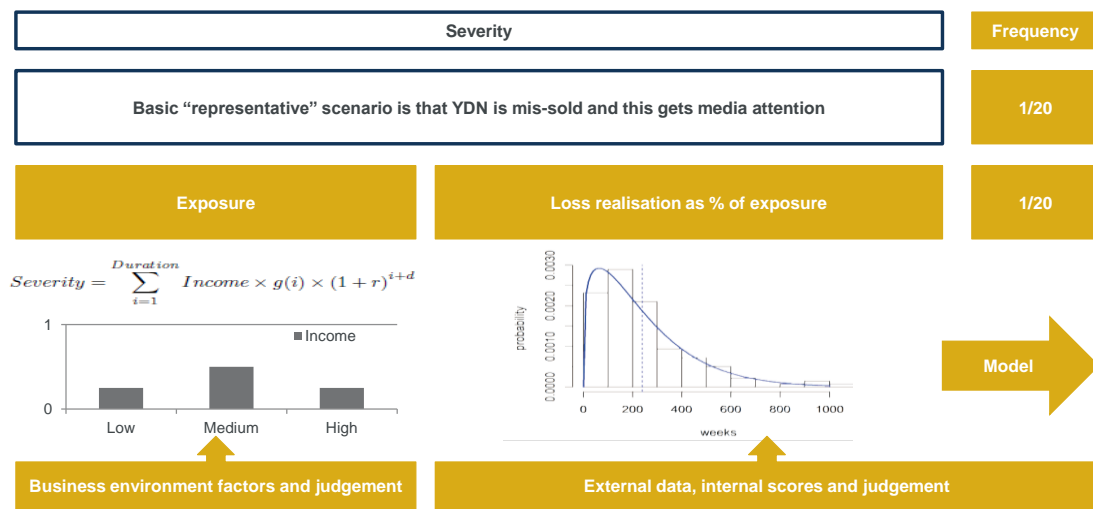
Severity	Frequency
Basic "representative" scenario is that YDN is mis-sold and this gets media attention	1/20

Exposure	Loss realisation as % of exposure	1/20

$$Severity = \sum_{i=1}^{Duration} Income \times g(i) \times (1+r)^{i+d}$$

Model

Business environment factors and judgement

External data, internal scores and judgement

25

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Recap and Q&A

Agenda

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

- Questions

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Thanks

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