

The Actuarial Profession
making financial sense of the future

Life Conference 2011
Jonathan Humphries (Aon) and Sandy Trust (KPMG)



Using Operational Risk to deliver shareholder value whilst meeting regulatory expectations

21st November 2011

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Agenda

- Introduction
- Why is Operational Risk important?
- Evolving market practices
- Foundation to a robust framework
- Operational risk quantification
- Operational risk measurement (modelling)
- Unlocking the value of insurance (corporate programme)
- Conclusions

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Introduction

Regulatory expectations

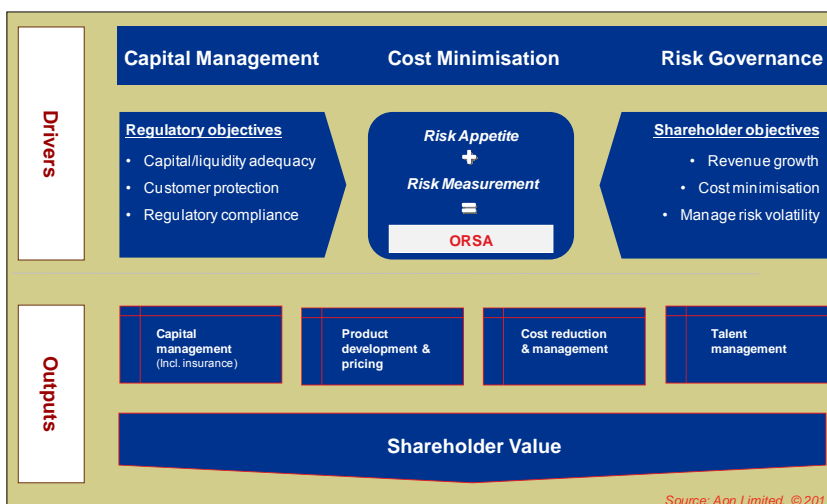
- The financial crisis of 2008 highlighted the need for firms to improve their management of risk with a particular focus on Governance, Frameworks and Operational Risk
- No matter how large or sophisticated a firm is, operational risk has been at the centre of many high profile losses
- Examples of such losses include the recent setting aside of some £3bn to cover claims against Payment Protection Insurance by Lloyds Banking Group in the UK
- The current focus within institutions on business efficiency, cost cutting and change will likely lead to significant 'tail risk' in the future. Understanding these dynamics will create a competitive advantage in an increasingly capital tight environment
- Globally, regulators are putting considerable emphasis on the need for firms to:
 - Quantify their ability to absorb losses and define their risk appetite
 - Understand their exposure to potential loss – expected and unexpected
 - Ensure the business is effectively capitalised. This is encapsulated in the Own Risk Self Assessment Process (ORSA)

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Introduction

Business drivers



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Introduction

It can't happen here

- **PPI**
 - Lloyds Banking Group: £3.2 billion (first nine months of 2011)
- **Hartford**
 - In April 2004, the American insurer The Hartford Financial Services Group Inc. agreed to pay \$1.15bln to resolve an asbestos-related lawsuit
 - The litigation was based on a coverage dispute after the client exhausted its policy limit but alleged that earlier policies should cover all claims
- **Asbestos related lawsuit**
 - Eight product liability insurers in the United States were involved in litigation initiated in 2004 by a policyholder after the insurers refused to indemnify asbestos-related claims
 - By 2006, the litigation was resolved by all parties
 - Liberty Mutual: \$15.4mln in June 2004
 - Lloyd's \$19.95mln
 - AIG paid \$103mln to resolve its portion of the lawsuit
 - Federal \$4mln
 - Mount McKinley and Everest \$10.75mln each
 - Harper \$1.4mln
 - St. Paul, \$25mln

Source: OpBase, Aon's proprietary operational risk loss event database

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Introduction

It can't happen here

- **Large European banc-assurer:**
 - Maximum possible single loss < Euros 100m
 - We knew of two events with a liability of up to 5 times this maximum
 - Risk management assumed such data to be irrelevant when controls taken into consideration

FSA fines Scottish Equitable £2.8m plus £60m redress

16 December 2010 0:00 am | Updated: 16 December 2010 11:03 am | By [Nicole Blackmore](#)

[Print](#) [Email](#) [Share](#) [Comments \(15\)](#) [Save](#)



The FSA has fined Scottish Equitable £2.8m for causing significant consumer detriment through poor administrative procedures.

Scottish Equitable will pay consumer redress of about £60m, of which £30m will have been paid by the end of the year. Scottish Equitable is the legal name for Aegon's UK life and pensions business, which now trades under the Aegon brand.

FSA fines Standard Life £2.45m

By Lucy Warwick-Ching
Published: January 20 2010 12:19 | Last updated: January 20 2010 19:07

The Financial Services Authority has fined **Standard Life** £2.45m (\$3.99m) for misleading thousands of customers in its Pension Sterling Fund about the investment risk profile of the fund.

The **City watchdog** said on Wednesday that the fund's customers, of which there were 90,000 as of December 23 2006, had been told that all of the fund was invested in cash when in fact most of the fund was invested in floating rate notes.

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Why is operational risk important?

Economic capital (ECap) in the context of Operational risk

The Beginnings of ECap – 1,200 BC

- Dates back to the ancient Phoenicians, who took rudimentary tallies of frequency and severity of illnesses among rural farmers to gain an intuition of expected losses in productivity
- These calculations were advanced by correlations to predictions of climate change, political outbreak, and birth rate change

Economic Capital Now

- Economic capital is the amount of risk capital, assessed on a realistic basis, which a firm requires to cover the risks that it is running or collecting as a going concern, such as market risk, credit risk, and operational risk
- The amount of money which is needed to secure survival in a worst case scenario

Operational Risk ECap

- Risk identification & assessment – which risks require capital to be held against them
- For each risk, hold an amount of capital equal to the expected loss, in the worst case scenario (usually defined as a 1-in-200 year event)
- $\text{Expected loss} = \text{Frequency of risk} * \text{Impact of risk (calculated net of controls)}$
- Diversification
- One year time horizon



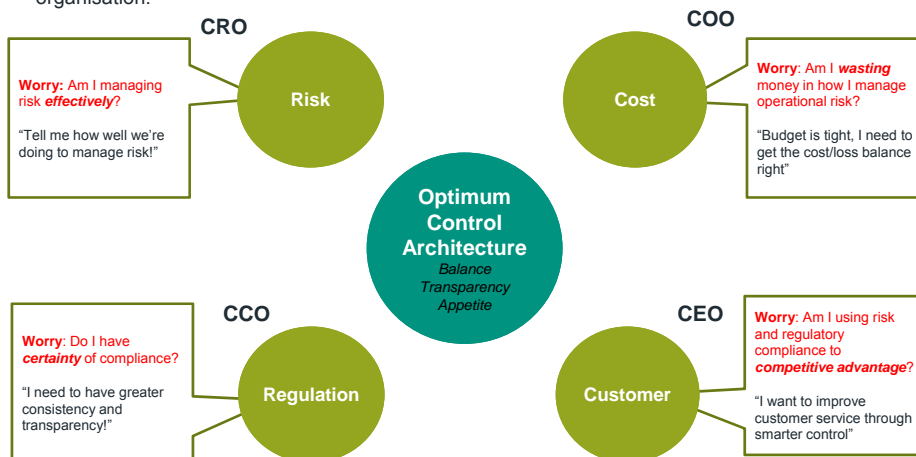
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Why is operational risk important?

Four perspectives of operational risk management

We believe there are four main drivers for the optimum risk management system in an organisation:



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Evolving market practices

What would I like my operational risk model to do?

- Calculate Economic Operational Risk Capital ✓
- Allocate capital across business units ✓
- Allocate capital across risk types ✓
- Facilitate profit and loss attribution ✓
- Facilitate control cost effectiveness reviews ✓
- Meet regulatory requirements ✓

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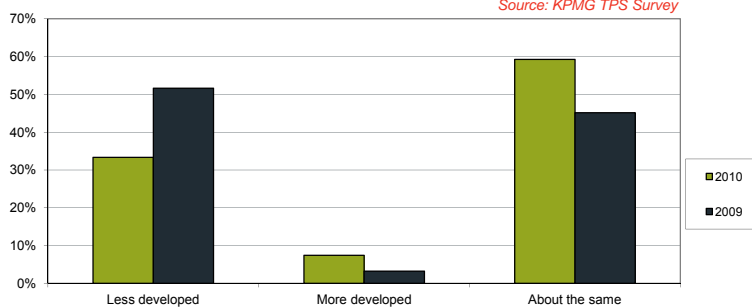
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Evolving market practices

Sophistication of operational risk methodology

Sophistication of operational risk approach compared to rest of the ICA

Source: KPMG TPS Survey



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Evolving market practices

Operational risks modelled in the ICA

Source: KPMG TPS Survey

| Operational Risk Type | Response Year | | |
|--|---------------|------|------|
| | 2010 | 2009 | 2008 |
| Pension scheme deficits | 29% | 16% | 65% |
| Systems and technology risks | 96% | 90% | 81% |
| Reputational risk | 68% | 77% | 68% |
| Marketing and distribution risks | 79% | 71% | 69% |
| Legal risks | 96% | 97% | 78% |
| Management of employees (including for example strikes, fraud, etc.) | 93% | 90% | 81% |
| Difficulty in recruiting qualified staff | 86% | 74% | 63% |
| Breach of underwriting guidelines | 68% | 65% | 66% |
| Business continuity | 96% | 87% | 81% |
| Staff retention and recruitment | 86% | 81% | 74% |
| Problems with outsourcers | 93% | 81% | 79% |
| Management control failures | 100% | 87% | 78% |
| Claims mis-handling | 82% | 77% | 74% |
| Incomplete data | 89% | 68% | 73% |
| Incomplete documentation | 61% | 52% | 73% |
| Mis-pricing or not treating customers fairly | 89% | 71% | 80% |

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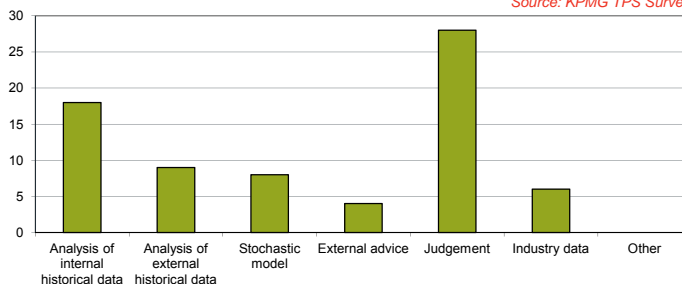
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Evolving market practices

Setting the 1-in-200 year event

Method of setting operational risk stress tests to be 1 in 200 year events

Source: KPMG TPS Survey

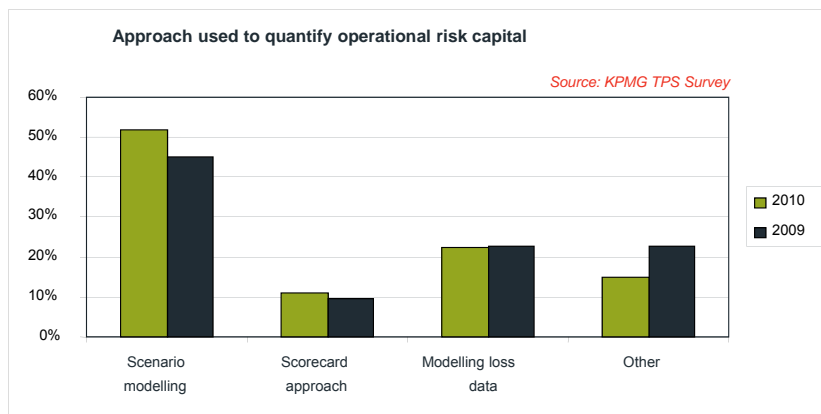


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Evolving market practices

Quantifying operational risk capital

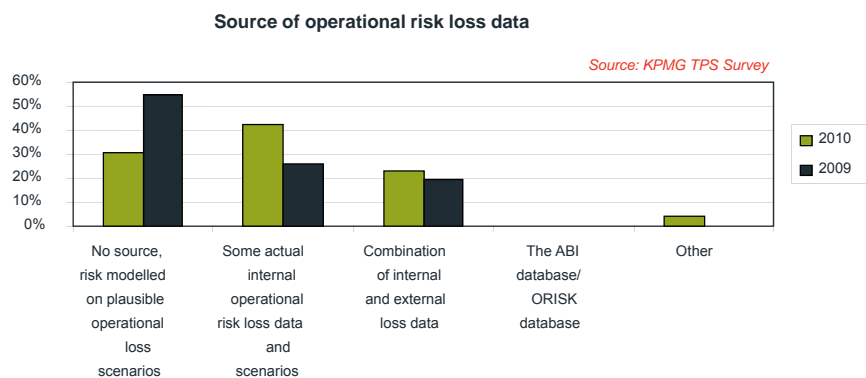


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Evolving market practices

Use of loss data



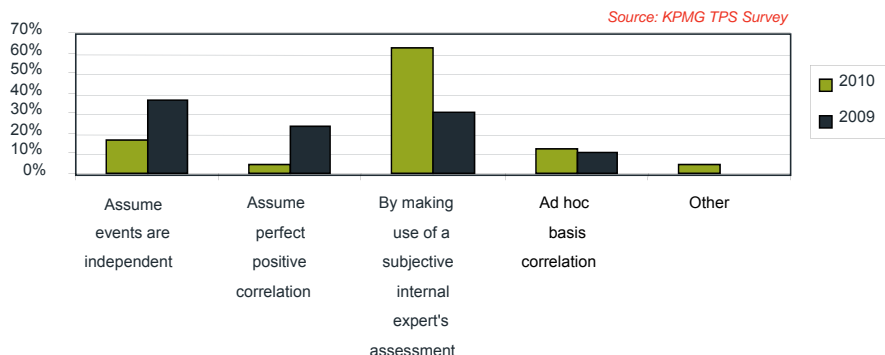
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Evolving market practices

Correlation assumptions

Allowance for diversification benefits between individual operational risk events

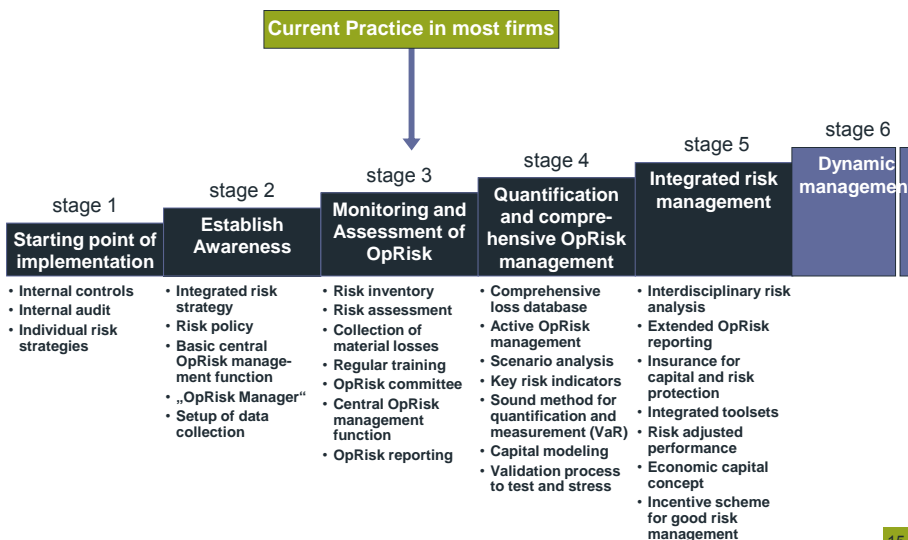


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Evolving market practices

A view of the current industry status

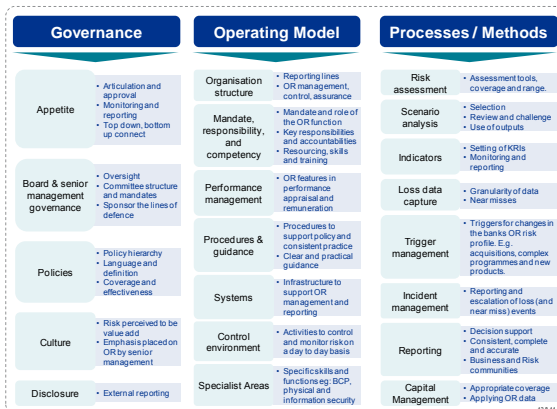


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Foundation to a robust framework

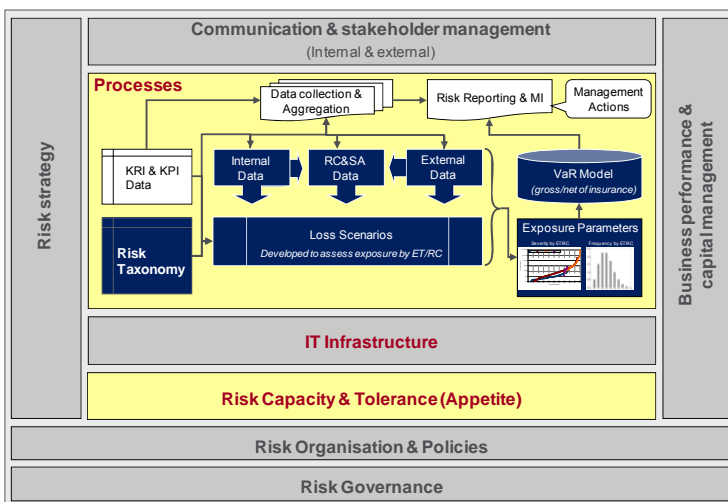
An example framework



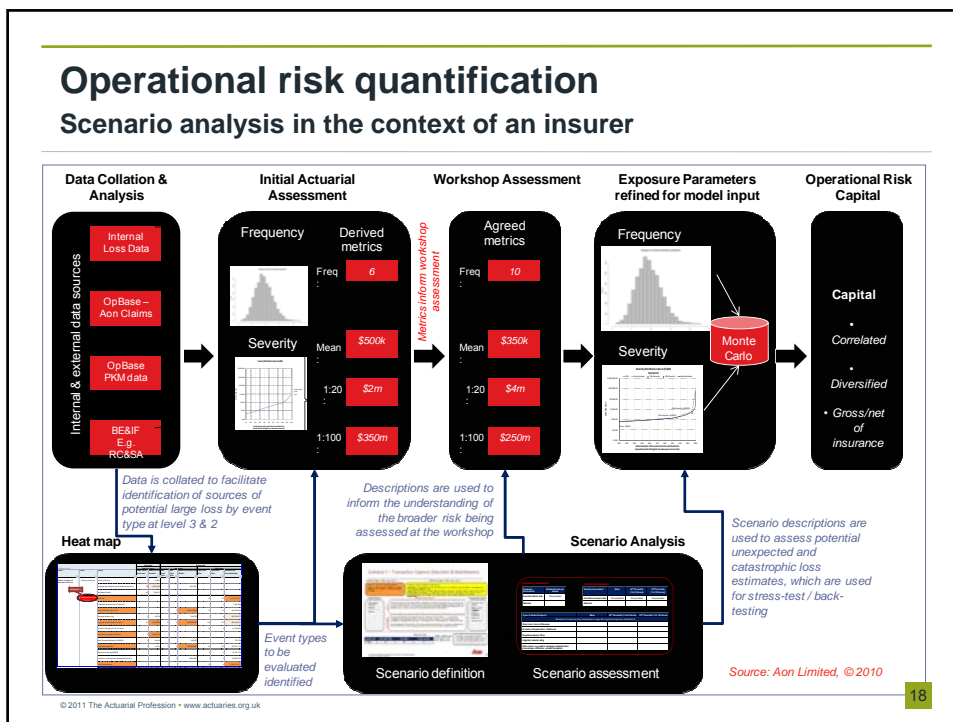
Underlying analyses include mapping of current activities and suggested 'target state'

Foundation to a robust framework

Another sample framework, incl. key processes



Source: Aon Limited, © 2011



Operational risk quantification

Role of internal data, external data and scenarios

- The current economic environment has shown a number of institutions have underestimated their exposure to risk
- Historical internal losses do not provide a good understanding of exposure to unexpected loss
- External data used in isolation does not take into consideration an organisations specific dynamics and controls
- Scenarios provide an excellent mechanism to enable organisations to:
 - identify possible future events that could give rise to unexpected loss
 - assess their exposure for expected, 1:5, 1:20, 1:100 loss estimates, etc
 - identify control & transfer mechanisms
- OpBase, Aon's proprietary source of external data, is a powerful tool for developing scenarios & estimating exposure

| Expected Loss | Unexpected Loss | Catastrophic Loss |
|---|--|---|
| <ul style="list-style-type: none"> Review internal loss data Review Risk Register (RC&SA results) | <ul style="list-style-type: none"> Review Risk Register (RC&SA results) Analysis of peer data in OpBase™ (Aon claims losses) Consideration of scenarios Identify relevant scenarios Assess exposure to relevant scenarios | <ul style="list-style-type: none"> Analysis of peer data in OpBase™ (Publicly sourced information) Consideration of scenarios Identify relevant scenarios Assess exposure to relevant scenarios |

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Operational risk quantification

Role of internal data, external data and scenarios

- The following table provides a comparison of data contained within various different data sources (based on data as at 2008) including:
 - 2008 BIS loss data collection exercise results
 - ORX & ORIC
 - OpBase – two data sets: (i) Aon claims losses; and (ii) publicly sourced losses

| Banking Loss amounts (€ million) | 2008 LDCE ¹ data | | | ORX Data ² | | | OpBase™ data ³ | | |
|--|-----------------------------|----------|--------------|-----------------------|----------|--------------|---------------------------|----------|--------------|
| | # losses | Σ Losses | Average loss | # losses | Σ Losses | Average loss | # losses | Σ Losses | Average loss |
| All losses | 10,052,796 | 64,221 | 0.006 | 124,000 | 39,786 | 0.3 | 16,271 | 266,305 | 16.4 |
| Losses > 1 million | 3,582 | 38,793 | 10.830 | 3,296 | 29,792 | 9.0 | 2,444 | 265,631 | 108.7 |

| Insurance Loss amounts (€ million) | ORIC ⁴ Data | | | OpBase™ data ³ | | |
|--|------------------------|----------|--------------|---------------------------|----------|--------------|
| | # losses | Σ Losses | Average loss | # losses | Σ Losses | Average loss |
| All losses | | | | 1,388 | 379 | 0.273 |
| Losses > 1 million | | | | N/A | N/A | N/A |

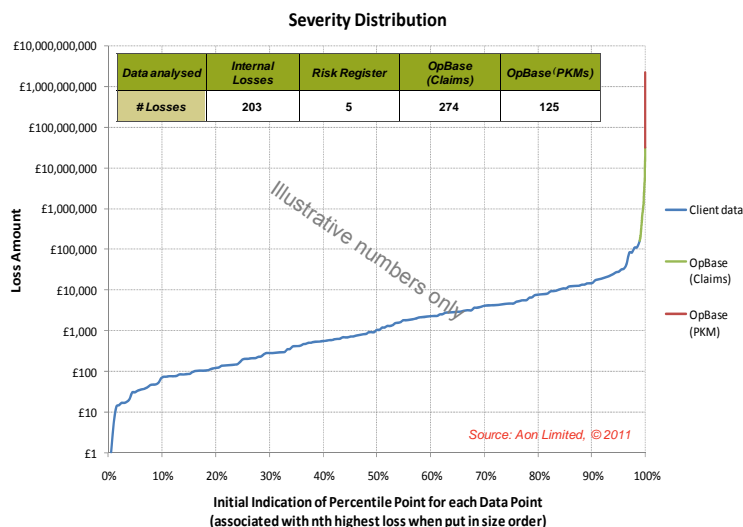
Notes:
 1) LDCE: 119 participating institutions from 17 countries
 2) ORX: Data collection threshold – €20,000, losses reported in period from 1 January 2002 to 31 December 2008
 # participants rising from 12 in 2002 to 52 in 2008
 3) OpBase: Losses have not been revealed to provide consistency in comparison with other data-sets
 Data originates from more than 1,600 financial institutions globally

Source: Aon Limited, © 2011

- Since 2004, the ORX database (covering operational risk losses in Banking) has recorded over \$41,110 million! (excludes losses from Enron and Worldcom scandals).
- What % of your undertaking's ICA capital is allocated to operational risk?

Operational risk quantification

Case study - Scenario development (severity plot for calibration)



Operational risk quantification

Case study – Illustrative summary of scenario analysis results

| # | Event taxonomy | | Frequency | | Severity | | Commentary |
|----|--|--|-----------|-----------|------------|-------------|---|
| | ET1 | ET2 | # / annum | Mean | 1 in 20 | 1 in 100 | |
| 1 | Business disruption & systems failures | Systems | 1.0 | 1,000,000 | 25,000,000 | 45,000,000 | Every 100 years a loss of £45m or more is likely to occur |
| 2 | Clients, products & business practices | Improper business or market practices | 2.0 | 500,000 | 10,000,000 | 15,000,000 | Every 50 years a loss of £15m or more is likely to occur |
| 3 | | Suitability, disclosure & fiduciary | 10.0 | 100,000 | 1,000,000 | 15,000,000 | Every 2 years a loss of £1m or more is likely to occur |
| 4 | | Indirect losses | 4.0 | 150,000 | 3,000,000 | 7,000,000 | Once every 5 years a loss of £3m or more is likely to occur |
| 5 | Damage to Physical assets | Disasters and other events | 0.50 | 15,000 | 1,000,000 | 100,000,000 | Once every 200 years a loss of £100m or more is likely to occur |
| 6 | Employment practices & workplace safety | Diversity & discrimination | 0.3 | 50,000 | 250,000 | 5,000,000 | Once every 300 years a loss of £5m or more is likely to occur |
| 7 | | Employee relations | 0.5 | 25,000 | 100,000 | 1,000,000 | Once every 200 years a loss of £1m or more is likely to occur |
| 8 | Execution, delivery & process management | Trade counterparties | 10.0 | 20,000 | 80,000 | 500,000 | Once every 10 years a loss of £0.5m or more is likely to occur |
| 9 | | Transaction capture, execution & maintenance | 75.0 | 12,000 | 80,000 | 150,000 | Once every 1.3 years a loss of £150k or more is likely to occur |
| 10 | External fraud | Systems security | 6.0 | 20,000 | 500,000 | 2,000,000 | Once every 17 years a loss of £2m or more is likely to occur |
| 11 | | Theft & fraud | 10.0 | 5,000 | 50,000 | 2,000,000 | Once every 10 years a loss of £2m or more is likely to occur |
| 12 | Internal fraud | Theft & fraud | 0.5 | 1,000,000 | 10,000,000 | 65,000,000 | Once every 40 years a loss of £10m or more is likely to occur |
| 13 | | Unauthorised activity | 12.0 | 30,000 | 100,000 | 2,000,000 | Once every 8 years a loss of £10m or more is likely to occur |

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Operational Risk quantification

Frequency

Either an operational loss event occurs within the specified time period, or it does not!

Therefore use a discrete distribution to model frequency...

Poisson

Parameter λ is equal to both the mean and variance of the Poisson distribution

eg if the frequency distribution for an error in financial reporting is distributed Poisson (3) with a one year time horizon, then the expectation is that on average, an error occurs 3 times a year

The Poisson distribution has some nice properties:

1. The probability of a loss event is the same for time intervals of equal length,
2. The probability of a loss is independent across intervals
3. If operational losses follow a Poisson distribution, then when subdivided into different categories, the distribution of losses in the different categories is also Poisson but with a new parameter



Negative Binomial

A shortcoming of the Poisson is the assumed equality of the mean and variance – thus the model can underestimate the amount of dispersion in the observed outcomes. The negative binomial is a commonly used generalisation of the Poisson which allows more variability than the Poisson

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Operational risk quantification

Severity

Severity

When an operation risk event occurs – there will be a financial impact, or loss

- Perfect world – fit a loss distribution with reference to loss data
- The world is not perfect and loss data alone will not suffice
- Reality – the lognormal distribution is relatively straightforward to fit

Lognormal

Nice properties:

- Generates only positive values, is positively skewed
- Can be fitted with only two input parameters

Drawbacks

- The lognormal distribution may not capture thick tails that generally occur in Operational risk events

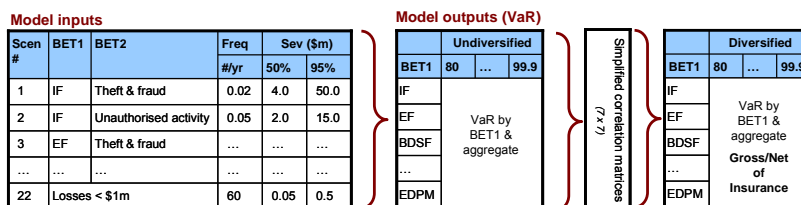
Other distributions that could be used to model severity include:

Generalised Pareto, Exponential, Beta, Weibull

Operational risk measurement (modelling)

Building a model to quantify VaR

- The following table shows how parameters derived for multiple scenarios feed into each of the ET1 categories to enable quantification of VaR
- Similarly, purely data driven models can calibrate parameters according to the same ET1 & ET2 categories



Source: Aon Limited, © 2011

Operational risk measurement (modelling)

Assumptions - Correlations

Correlations

What about correlations between operational risks?

- Perfect world – fit correlations with reference to loss data
- Reality – lack of data means expert judgement must be used

Considerations:

1. What level of diversification is appropriate between different operational risk types?
2. Is it realistic to set diversification benefits between individual risks, or at a higher level?
3. Correlations may not be symmetric – for example, an IT risk that causes salaries to stop being paid may result in a people risk as staff leave, however, staff leaving would not necessarily result in an IT risk
4. Correlation matrix vs. more sophisticated copula approach
5. Tail dependency now required by regulators
6. Do correlations change over time/at the tail?

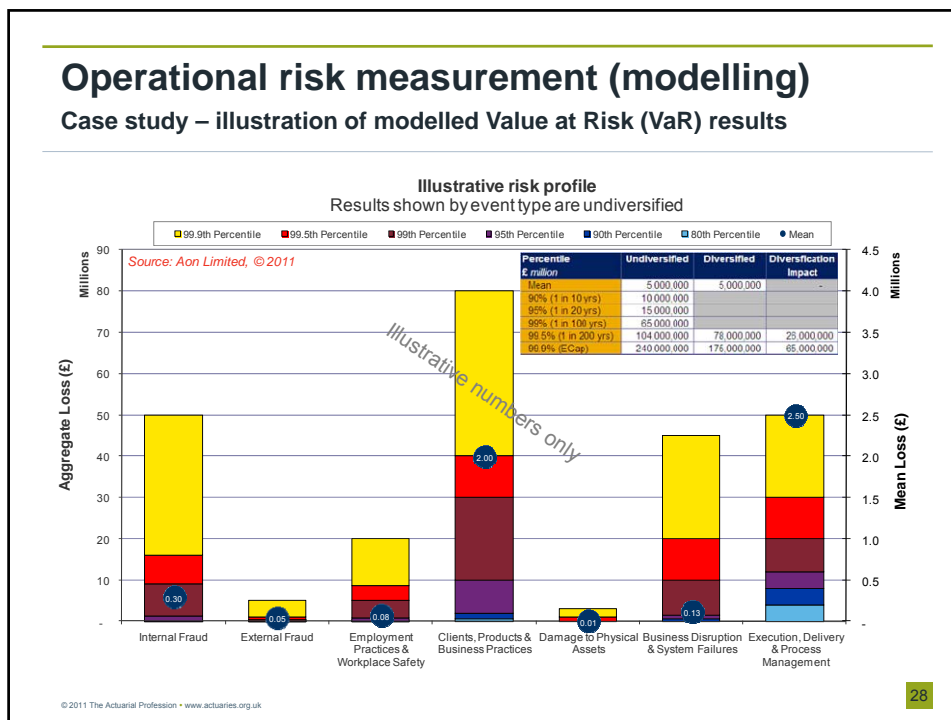
Operational risk measurement (modelling)

Case study – illustration of modelled Value at Risk (VaR) results

- The following slide summarises the undiversified and diversified risk profile for a firm at different percentiles, e.g. 95%, (1 in 20 years), 99% (1 in 100 years), etc.
 - 'Undiversified' refers to the relative amounts of capital (Value at Risk ~ VaR) at the respective percentiles assuming that all Level 1 Event Types are fully dependent (i.e. the worst case on any one event type leads to the worst case occurring on each of the other event types)
 - 'Diversified' refers to the relative amounts of capital at the 99.5%ile for Regulatory Capital (or alternative selected confidence interval for calculating Capital at Risk) assuming there is some relative dependency between Level 1 Event Types (i.e. the correlation matrix reflects the extent to which losses in any one year for a certain event type will affect others)
- The main highlights from the following slides are:
 - Aggregate 99.5% VaR:
 - Undiversified ~ £104 million
 - Diversified ~ £78 million
 - Key risk spikes are:
 - Clients, Products & Business Practices
 - Business Disruption & System Failure

Operational risk measurement (modelling)

Case study – illustration of modelled Value at Risk (VaR) results



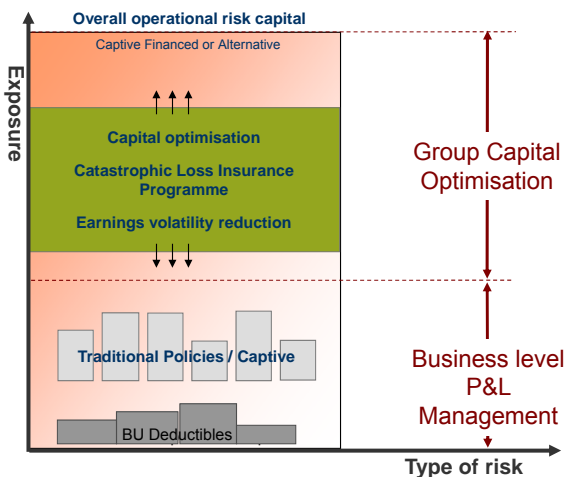
Unlocking the value of insurance

Introduction

- Many programmes are fragmented
- Insurance has an important role to play in both:
 - Business unit P&L management; and
 - Group capital management
- The development of operational risk models is enabling us to:
 - Understand the greatest risks faced and their quantum from an insurable and uninsurable perspective
 - Assess the value of existing programmes
 - Identify those solutions offering greatest value
 - Optimise an organisation's risk finance structure

Unlocking the value of insurance

The role of different financing products/tools



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Unlocking the value of insurance

Understanding the relationship between events and policies

- Insurance has a long history of responding to operational risk
- But, individual events link to multiple policies and multiple events link to single policies
- Response is also affected by whether a loss occurs on a 1st party or 3rd party basis
- The relationship is complex

| Event Type Level 1 | Event Type Level 2 | Mapping to Policies |
|--|--|---|
| Internal Fraud | Unauthorised activity | 1 st ~ BBB, UT 3 rd ~ PI |
| | Theft & fraud | 1 st ~ BBB, Cyber, Property 3 rd ~ PI |
| External Fraud | Theft & fraud | 1 st ~ BBB, Cyber, Property 3 rd ~ PI |
| | Systems Security | 1 st ~ BBB, Cyber, Property 3 rd ~ PI |
| Employment Practices & Workplace Safety | Employee Relations | 3 rd ~ EPL, GL |
| | Safe Environment – Employees | 3 rd ~ EL, GL |
| | Safe Premises – Invitees | 3 rd ~ GL |
| | Diversity & Discrimination | 3 rd ~ PI, GL |
| Clients, Products & Business Practices | Suitability, Disclosure & Fiduciary | 3 rd ~ PI, Cyber |
| | Improper Business / Market Practices | 3 rd ~ PI, Cyber, GL |
| | Product Flaws | 3 rd ~ PI, GL |
| | Selection, Sponsorship & Exposure | 3 rd ~ PI |
| | Advisory Activities | 3 rd ~ PI, Cyber |
| Damage to Physical Assets | Disasters & Other Events | 1 st ~ Property |
| | Business Disruption & Systems Failure | 1 st ~ Property, Cyber, BBB 3 rd ~ Cyber |
| Execution, Delivery & Process Management | Transaction Capture, Execution & Maintenance | 3 rd ~ PI |
| | Monitoring & Reporting | 3 rd ~ PI |
| | Customer Intake, Documentation | 3 rd ~ PI |
| | Customer Account Management | 3 rd ~ PI, Cyber |
| | Trade Counter-parties | 3 rd ~ PI |
| | Vendors & Suppliers | 3 rd ~ PI, GL |

Source: Aon Limited, © 2011

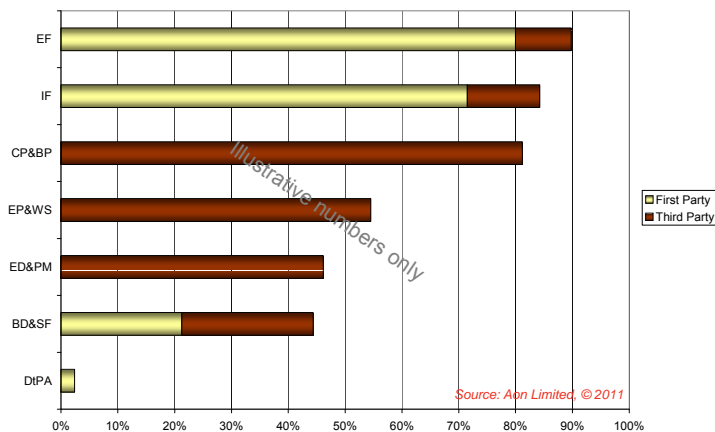
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Unlocking the value of insurance

Quantifying insurance impact

- Calculating 'probability of insurance recovery'



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Unlocking the value of insurance

Quantifying insurance impact

- The following chart shows the impact of an insurance structure on the underlying exposures:
 - In the aggregate
 - By event type
- We can see the impact of insurance at different confidence levels, e.g. 80% (1 in 5 years), 99.5% (1 in 200 years)

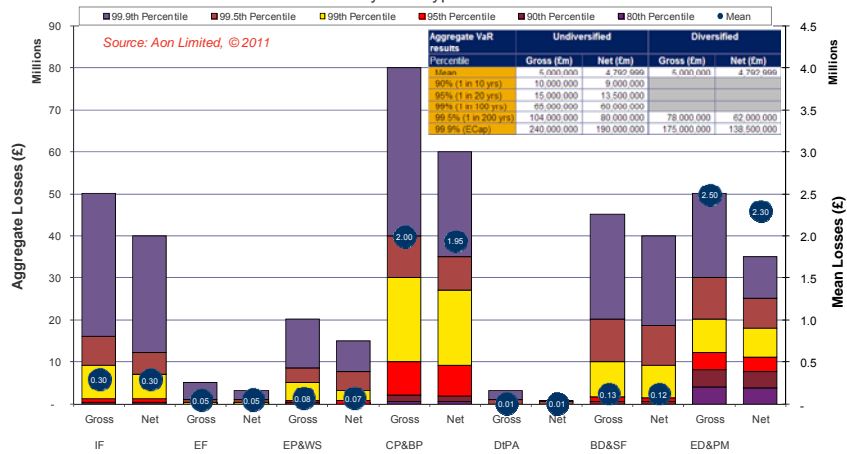
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Unlocking the value of insurance

Quantifying insurance impact – Gross/net of crime / professional liability

Illustrative risk profile - gross & net of insurance
Results shown by event type are undiversified



Note:
This case study uses an overall diversified capital number of £190 million for illustrative purposes only.
Insurance programme considered includes Crime & Professional Liability with a limit of £50m

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Unlocking the value of insurance

Capital optimisation

- We have demonstrated the impact of a single insurance structure on the firm's underlying risk profile
- But, is this the optimal structure?
- We can now test different structures varying:
 - Coverage
 - Limits
 - Deductibles
- Through this process, typically analysing hundreds or thousands of alternatives, we can:
 - Identify the range of structures offering greatest capital efficiency
 - The best solution will be determined by risk appetite
 - Evaluate the benefits, costs and value of the options

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Conclusions

- Operational Risk has been at the centre of many high profile losses and failures
- The current focus within institutions on business efficiency, cost cutting and change will likely lead to significant 'tail risk' in the future
 - Understanding these dynamics will create a competitive advantage for firms
 - There tools and techniques available enable firms to deliver significant shareholder value from the management of operational risk
- The implementation of a robust operational risk measurement and management framework will enable firms to:
 - Reduce costs through more efficient control frameworks
 - Manage volatility and optimise the financing of capital
- Solvency II?

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making financial sense of the future

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Using Operational Risk to
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