



# Operational Risk Scenario Modelling

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Scenario analysis is typically used by firms to better understand the operational risks they face and assess the possible impacts should they occur. To link scenarios to capital the industry is increasingly turning to statistical models to extrapolate the insights of business experts to the confidence level required.

## A typical approach

- Operational risk is typified by low frequency high impact loss associated with people, processes, systems and external events.
- The Regulator encourages firms to capitalise against such risks at a 99.9% confidence level (banks) or 99.5% (insurers) over a one-year time horizon.
- Most firms do not have sufficient internal data to model historic operational risk loss to this required confidence level and instead look to scenario analysis.
- Under a scenario analysis approach the most significant operational risks faced are identified through a process informed by Risk and Senior Management insight.
- For each significant operational risk key business stakeholders together with Risk will develop an associated scenario. The insights of business experts are informed where available by internal and external loss events, key risk indicators, risk control and internal audit assessments, business plans and business environment variables.
- This provides a forward looking view of the risks faced and an assessment of their severity and expected frequency should they occur.
- The application of a statistical model permits an extrapolation of the frequency and severity estimates provided by the business experts to the confidence level required.

In recent years a common approach to modelling the outcomes from operational risk scenario analysis has emerged. Such approaches are widely used within the Financial Services industry as part of Pillar 2 capital assessments for operational risk.

## Model inputs and outputs

- The inputs to the model, taken from the scenario analysis process, are:
  - An expected loss event frequency per year for each scenario.
  - Two estimates of loss severity, and associated frequencies, for each scenario - e.g. a mid-career event (e.g. 1 in 20 years) and a working lifetime event (e.g. 1 in 40 years).
  - An estimate of correlation between each scenario.
- The expected loss event frequency is used to model the frequency of loss events for each scenario
- The loss severities, and associated frequencies, are used to model the severity of loss for each scenario
- The frequency model determines the number of events that occur in a given year and the severity model gives the impact of each event. Summing impacts gives the total loss per year and repeating the process a sufficient number of times gives a loss profile from which the loss at the required confidence level is found.
- The key outputs from the model are:
  - An estimate of loss over a one-year time horizon at the required confidence level for each scenario.
  - The sum of these estimates to give the undiversified estimate of loss at the required confidence level (assumes 100% correlation – all events occur at the same time).
  - The diversified estimate of loss at the required confidence level (less than 100% correlation).
- Correlations between each scenario are used to model the correlation between losses needed to provide an estimate of the diversified loss at the required confidence level.

The approach used to model the outcomes from operational risk scenario analysis is based on the experience of regulatory accepted operational risk models and typically observed industry practices.

## High level methodology

- The loss event frequency can be model using a Poisson distribution, to allow for the possibility of more than one event occurring over the one year time horizon, or a Bernoulli distribution if only a single event per annum is required.
- The loss event severity can be modelled using a lognormal or a Pareto distribution. Both have a heavy tail and are therefore often applied when modelling the low frequency high impact nature of operational risk.
- For each scenario a Monte-Carlo process is used to simulate the number of events that occur in a given year and the severity of each event. Summing impacts gives the total loss per year and repeating the process gives a loss profile for each scenario. Up to 5 million repetitions (simulations) per scenario can be used to give a highly convergent output.
- To calculate the diversified loss the model uses a routine referred to as a 'copula' to impose the correlations between the risk scenarios. A copula is a probability distribution that can be used to model the dependency between multiple variables. The model offers two copulas; the Gaussian Copula and the Student-t Copula.

The elanev™ Operational Risk Scenario Model technical document provides further details on the above.

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