Presentation is based on the literature review I conducted for my MPhil degree.

- Introduction to Operational Risk
- Why OpRisk is important to pension funds
- A framework to measure OpRisk
  - Scalars
  - Loss Distribution Approach
  - Bayesian Belief Networks
  - Black Swan Approach

Basel II defines OpRisk as

“The risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events”

Remark: Basel II definition includes legal risk but excludes reputation and strategic risk

"Operational risk is arguably the largest risk faced by superannuation funds given that investment and market risk is usually borne by fund members."

- Australian Government Treasury, 2000
Motivation Behind the Proposed Framework

- Scarcity of operational loss data.
- Issues with combining expert opinion (especially qualitative opinion).
- Difficulty in modeling low frequency – high severity losses.
- What about risk that cannot be modeled?
- Difficulty in modeling dependency between different types of OpRisk.
- Current models only aim at measuring the capital charge. They do not provide behavioral modification incentives to actively manage operational risk.

Framework – Rumsfeld Approach

- **Operational Risk**
  - Known-Known: Risk that we know exist and can be modeled.
  - Known-Unknown: Risk that we know exist but cannot model.
  - Unknown-Unknown: Risk that we don’t know exist.

Many methods

- **Black Swan Approach**
- **Risk Margin**

1. Scalars (Known-Known OpRisk)
   - Assumes OpRisk to be a pre-determined percentage of a business scalar such as gross income, operational costs, etc.
   - E.g. – Standardized Approach for Banks

   \[
   \text{Capital Charge} = \beta \cdot \max\left(0, G_{i,j} - \theta\right)
   \]

   - \(G_{i,j}\) is the annual gross income for the \(i^{th}\) year on \(j^{th}\) business line.
   - \(\beta\) is the scalar, set by the regulator for each of the business areas.

2. Loss Distribution Approach (Known-Known OpRisk)
   - LDA categorize the risk events on a matrix by business line and event type.

   \[
   \text{Capital Charge} = \sum_i \sum_j \text{VaR}
   \]
2. Loss Distribution Approach - Issues

- Conventional frequency and severity distributions are not suitable to model OpRisk
  - Proposition: Use of EVT to model extreme percentiles (Moscadelli, 2004)

- Results backward looking

- Limited behavioral incentives

3. Bayesian Networks (Known-Known OpRisk)

- A type of causal model which employ Bayesian probability theory to model cause and effect in a system.

- Can model events where casual events exist but deterministic relationships cannot be obtained

- Applications of BBNs can be found in Nuclear industry, Aviation, Medical diagnosis, Data mining, and Intelligent trouble shooting systems.

![Simple Bayesian Network to Model Losses due to Internal Fraud](image1)

![Simple Bayesian Network to Model Losses due to Internal Fraud](image2)
• Results are directly linked to operational process
• Easy to account for changes in the business and control environment (i.e. forward looking)
• Elegant way to combine expert opinion
• Behavioral incentive
• Can be used to assess cost-benefit of management strategies
• Elegant way to account for dependencies

A slightly modified version of the "Loss-given-default" approach of Solvency II

Methodology
1) Identify the types OpRisk classes that we cannot model.
2) Obtain industry loss data for each risk class and make corrections for inherent bias.
3) Use the adjusted data to find the maximum operational loss experienced by similar organizations in the industry under each OpRisk class.
4) Survivability of the firm is stress tested against the maximum loss. If the firm cannot survive, then necessary capital or risk management practice is put forward.

• Reporting bias – occurs when different thresholds have been used by institutions to report losses
• Control bias – occurs when data is collected from institutions with different control systems
• Scale bias – occurs when data is collected from institutions with different sizes
Rumsfeld Approach – Categories OpRisk into three categories

- **Known-known risk**
  - Many methods available to model these risk
  - Scalars, LDA, Etc.
  - Bayesian Belief Networks useful to quantify particular high risk areas – e.g. fraud

- **Known-Unknown risk**
  - Cannot model
  - Use Black-Swan Approach

- **Unknown-Unknown risk**
  - Set a risk margin

Expert opinion

- Benchmark against the capital held by similar business lines in the industry for unknown-unknown risk
- A proxy measure rather than a real quantification.