A Large Scale (Basel II Compliant) Application of Operational Risk

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Acknowledgements

Collaborators

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Outline

- Structure of CSIRO presentations
- Motivation (Basle I and Basel II) – brief history
- What is Operational Risk? – some important risks
- Implications of Basel II (the New Accord)
- Advanced Measurement Approaches (AMA)
- Loss Distribution Approach (LDA)
- Capital allocation (annual capital charge)
- AMA Accreditation
- Large scale application at Commonwealth Bank
- Conclusions
- References (a rapidly growing area)

Structure of CSIRO talks

- **John** – general introduction to op risk and brief description of the large scale project at Commonwealth Bank www.cba.com.au

- **Pavel** – modelling and quantification for the project – the financial mathematics and statistical methods in the project, the challenges, etc.

Motivation (Basle I and Basel II)

- 1988 Basle I Accord – Basel Committee on Banking Supervision (BCBS) – credit risk and market risk explicitly addressed, assumption about op risk.
- Since then, attention to and quantitative modelling of op risk has evolved rapidly.
- All BCBS publications
  http://www.bis.org/bcbs/publ.htm
- BCBS publications relating to operational risk
  http://www.bis.org/bcbs/publ_10.htm

Motivation (Basle I and Basel II)

Brief history

- July 1988 – Basle Capital Accord (Basle I)
- June 1999 – Capital charge for other risks (including operational risk) proposed under Basle CP1.
- Jan 2001 Consultative Paper – Capital charge for operational risk proposed under Basel CP2.
- Jan 2001 – Consultative Document – "Operational Risk"
- Sept 2001 – "Working Paper on the Regulatory Treatment of Operational Risk"

Brief history

- **Sept 2001 – "Working Paper on the Regulatory Treatment of Operational Risk“**
  - **describes Advanced Measurement Approaches, Standardised Approach and Basic Indicator Approach**
  - **an overview of best practices around developing risk mitigation programs, guidelines on loss categories, monitoring risks, examples of mathematical methods**
  - **examples of how capital charge for op risk may be calculated.**

Brief history

- Feb 2003 – "Sound Practices for the Management and Supervision of Operational Risk"
  (10 Principles)
- Apr 2003 – Consultative Paper (CP3) – The New Basel Capital Accord (Basel II)
  http://www.bis.org/publ/cp3full.htm
  http://www.bis.org/bcbs/bcbscp3.htm
- Apr 2003 – "Overview of the New Basel Capital Accord "
  http://www.bis.org/publ/cp3ov.htm
- Aug 2003 – The Joint Forum – "Operational risk transfer across financial sectors"
- Jan 2004 – "Principles for the home-host recognition of AMA operational risk capital"
- June 2004 – "International Convergence of Capital Measurement and Capital Standards: a Revised Framework" (Basel II)
  http://www.bis.org/publ/bcbs107.htm (see bcbs107.pdf)
- July 2004 – "Implementation of Basel II: Practical Considerations"

Motivation (Basle I and Basel II)

- **Basel II recognises the importance of the potential impact of losses due to op risk and requires that banks hold adequate capital to protect against these losses.**
- **Increasing number of high-profile op loss events worldwide has led banks and regulators to view op risk management as an increasingly important process.**
- **In Australia, the national regulator (APRA) is now applying the same detailed scrutiny to op risk as previously to credit risk and market risk.**

What is Operational Risk?

The BCBS (Basel Committee on Banking Supervision) has defined op risk as:

'the risk of loss resulting from inadequate or failed internal processes, people and systems, or from external events'

- **a fairly general definition, hence some debate about inclusion of losses due to changes in business environment.**
- **emergence of Strategic Business Risk and Legal Risk.**

What is Operational Risk?

- The BCBS acknowledges that op risk has a variety of meanings to different banks within the banking industry.
- Banks tend to adopt their own definition of op risk.
- A clear understanding of what is meant by op risk is critical to effective management and control.
- Important that any definition:
  - covers the full range of op risks facing the particular bank, and
  - focuses on the most significant causes of severe losses due to day-to-day operations.

What risks are important?

Within the banking industry, the BCBS has identified the following op risk event types that can cause substantial losses (from Annex 7 in the New Accord):

- **Internal fraud eg intentional misreporting of positions, employee theft, and insider trading on an employee's own account.**
- **External fraud eg robbery, cheque forgery, damage from computer hacking (cyber crime).**
- **Employment practices and workplace safety eg workers' compensation claims, violation of employee OH&S rules, union activities, discrimination claims, and general liability.**

What risks are important?

- **Clients, products and business practices** eg breaches of trust, misuse of confidential customer information, improper trading activities on the bank's account, money laundering, sale of unauthorised products.
- **Damage to physical assets** eg terrorism, vandalism, earthquakes, fires, floods.
- **Business disruption and system failures** eg hardware and software failures, telecommunication problems, utility outages, computer viruses, cyber crime.
- **Execution, delivery and process management** eg data entry errors, collateral management failures, incomplete legal documentation, unapproved access given to client accounts, non-client counterparty mis-performance, vendor disputes.

Other important operational risks

- rogue traders, "bad apples", genuine human error, poor routine decision making, laissez-faire management
- sudden mistakes of business partners or outsources, hidden incompetence at multiple levels of an organisation, sudden power outage
- domino effect of loss events leading to failure

Result: it's a risky business!

- **Successful operational risk management is a challenge - distributed nature of the risks - unpredictable low-frequency, high-loss fat tail events.**
- **Rigorous op risk management facilitates an effective response to loss events.**
- **See References – eg Douglas Hoffman.**

Implications of Basel II (the New Accord)

- **Under the Basel II framework, banks have the option of estimating operational risk using one of three approaches with increasing sensitivity to risk:**
  (1) the Basic Indicator Approach,
  (2) the Standardised Approach, or
  (3) Advanced Measurement Approaches (AMA).

- **The first two approaches are provided for banks with low exposure to operational risk. They require that banks hold enough capital to cover operational risk as a fixed proportion of a specified risk measure.**

Advanced Measurement Approaches

- Third approach, AMA, adopted by the major banks in Australia

- Loss Distribution Approach (LDA)
- Direct loss and indirect loss
- (Key) risk indicators
- Scenario analysis
- Internal and external (eg Fitch) loss data
- Hybrid approaches?

Loss Distribution Approach

LDA

- **Expected loss (EL)**
  eg mean, median, mode

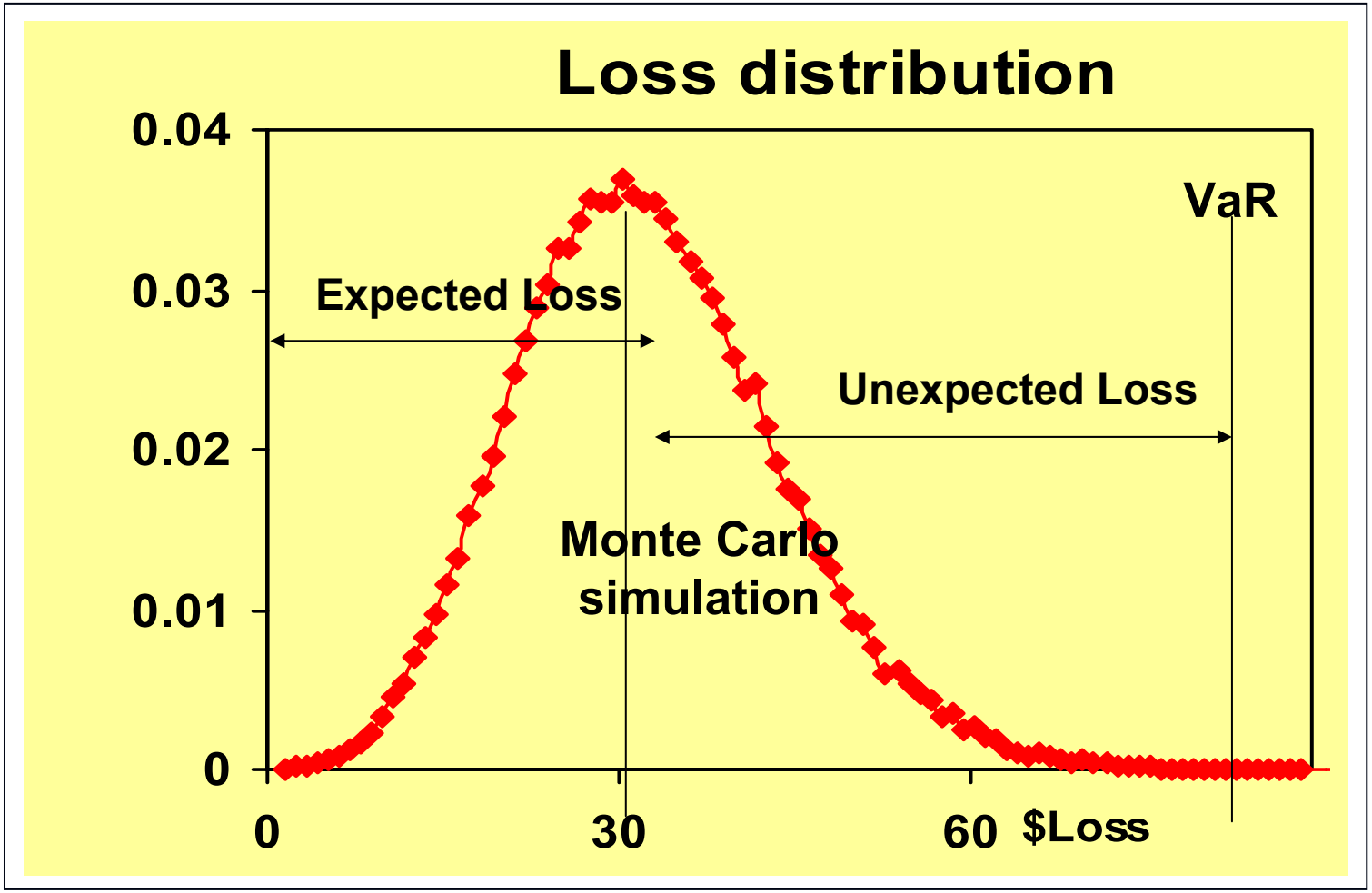
- **Value-at-Risk (VaR)**
  – defined at the desired rating level eg 0.999
  st Prob [Loss <= VaR] = 0.999 (ie quantile)

- **Unexpected loss (UL)**
  UL = VaR–EL

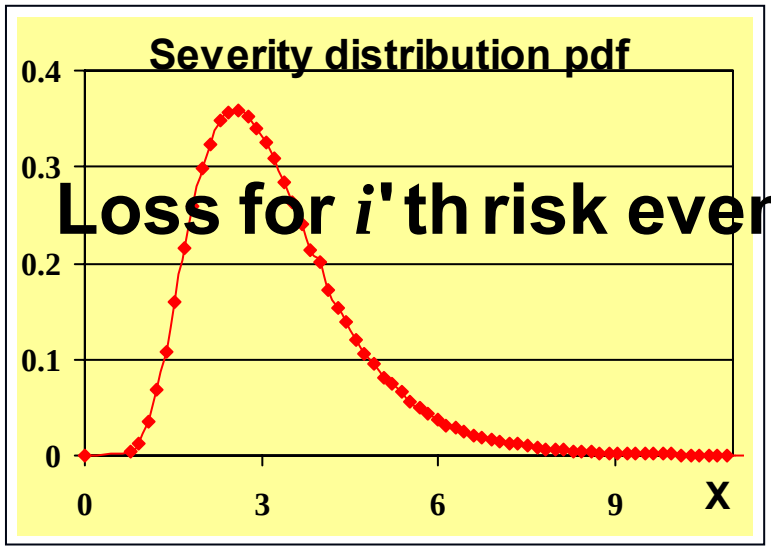
Capital Allocation (Annual Capital Charge)

Unexpected loss = VaR–Expected Loss

Prob [Loss <= VaR] = 0.999

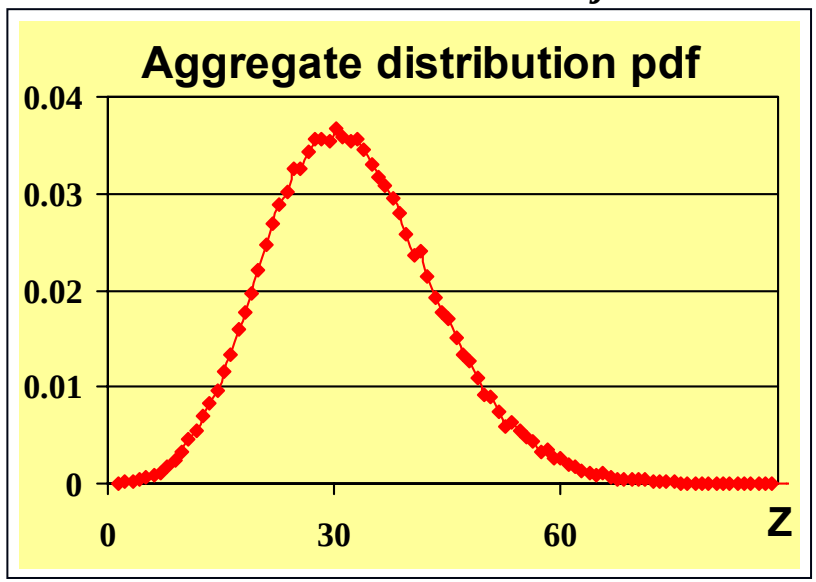


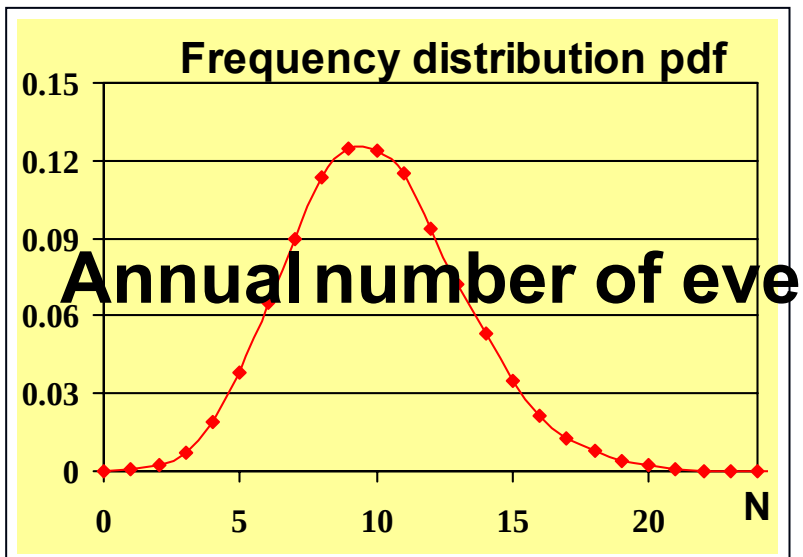
Single risk – annual loss over one year



Loss for i'th risk event X_i

Annual Loss $Z_i = \sum_{j=1}^{N_i} X_{ij}$





Annual number of events N_i

AMA Accreditation

Some of the advantages of AMA accreditation

- Potential reductions in regulatory capital
- Competitive advantage through better pricing for op-risk
- Saving of funding costs due to reduced regulatory and economic capital
- Reduce operational losses through more effective monitoring
- Improve preventative mechanisms
- Focus on reliability of critical processes
- Potentially, standards in common internationally eg with Sarbanes-Oxley

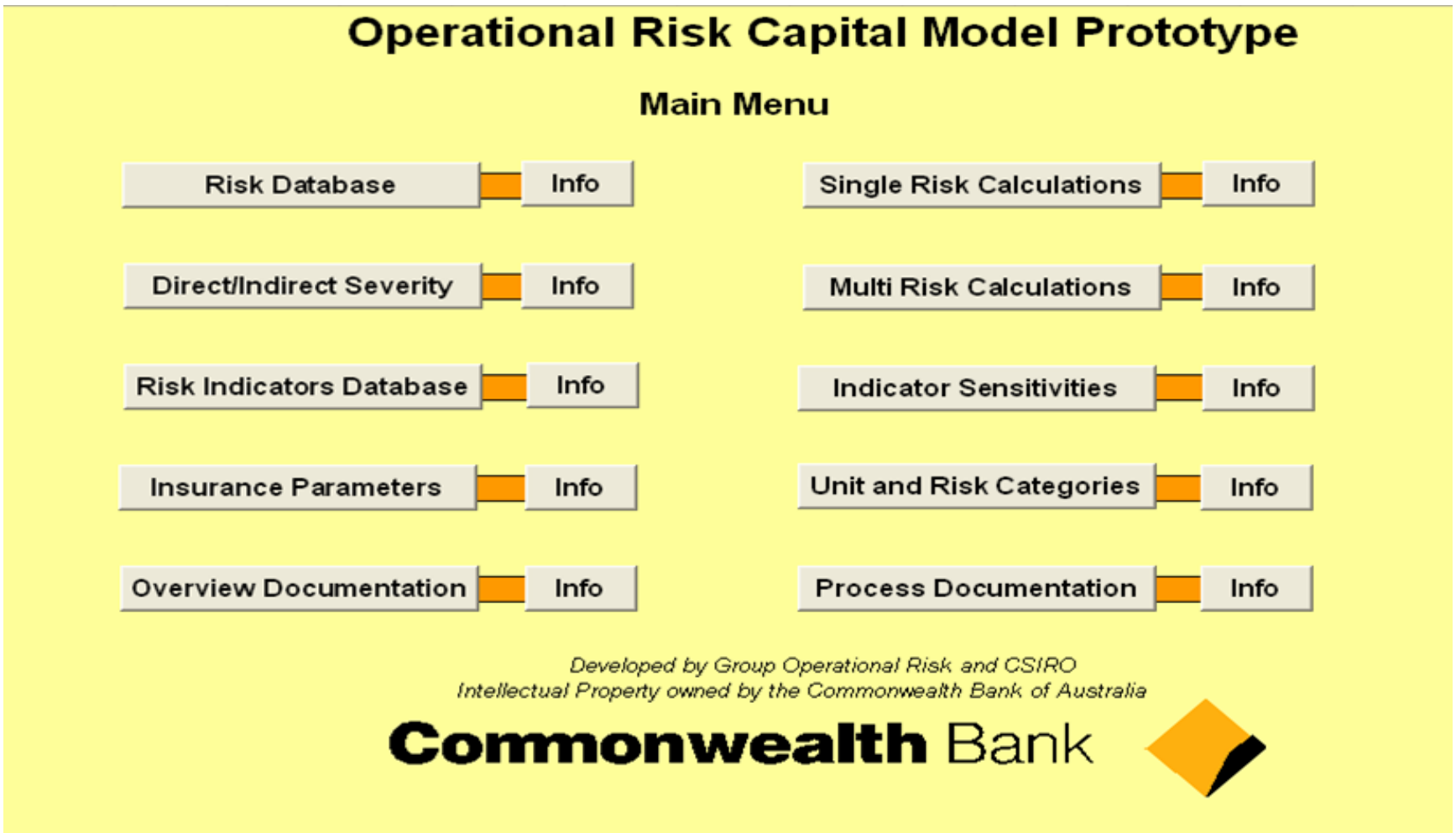
Large scale application at Commonwealth Bank

- Brief history of large project
  - user acceptance testing of GORMS by CSIRO 1999/2000
  - choice of distributions by experts for Monte Carlo simulation
  - modifications and suggestions (eg collect internal data)
  - copula for correlation
- Collaboration on prototype development

The prototype software

- Hierarchical tree structure – combination of business unit and risk event type at each node
  - three levels of business units
  - three levels of risk
- 23 risk categories relate to areas such as customers and relationships, reputation, security, suppliers, technologies, business processes and products, accounting and admin, regulatory changes, etc.

Prototype
— interim solution during full system build



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Large scale application at Commonwealth Bank

- Bank decides to build customised system rather than buy off-the-shelf product
- Tender process
- Software development team formed
- Web-based system built in .Net, C#, Fortran
- Following rigorous SDLC
- Close liaison with the users – requirements defined in business requirements document
- Tech Specs (SRS) documents being written, review and change control

Recap

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Conclusions

- A relatively new discipline for statisticians
- Many challenges eg
  - internal data
  - combining internal, external data and expert opinions for estimation of operational risk
  - modelling dependence between operational risks
  - modelling insurance
  - censoring (reporting above a certain threshold)
  - practical application of methods for modelling extreme values
  - appropriate use of mixture distributions

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