Seeing Beyond Risk

Canadian Institute of Actuaries

Institut canadien des actuaires

Voir au-delà du risque



Canadian Institute of Actuaries | L'Institut canadien des actuaires

2007 General Meeting

Assemblée générale 2007

Montréal, Québec



PD-22 : Risk Management outside the Insurance Industry

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November 30, 2007

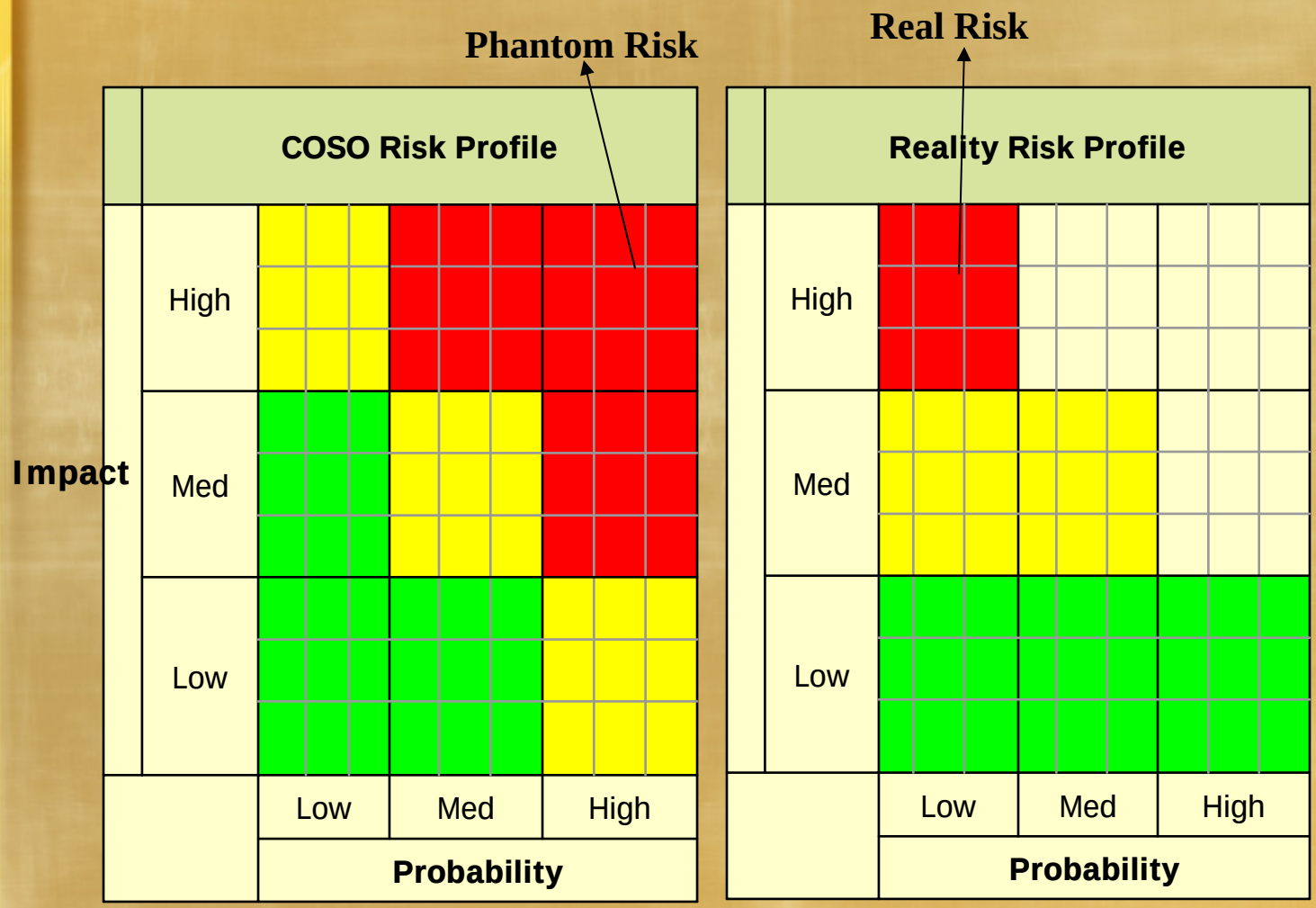
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Risk Management Framework

AS/NZ2	Generic	COSO
Establish Context	Establish Goals	**Objective Setting**
Identify	Identify	**Event Identification**
Analyze	Quantify	**Risk Assessment**
Evaluate	Solve	**Risk Response**
Treat	Execute	**Control Activities**
Communicate	Communicate	**Information / Communications**
Monitor	Monitor	**Monitoring**

Comparison of Risk Profiles
COSO and Risk Management Reality



Source: Adapted from : Why COSO is Flawed, January 2005 ; Ali Samad-Khan

Comparison of Market Risk
Financial and Non-Financial Companies

Tasks*	Financial	Non-Financial
• Identification	✓✓✓	✓✓✓
• Assessment	✓✓	✓✓
• Monitoring	✓✓	✓
• Control / Mitigation	✓✓	✓

*based on Basel Committee on Banking Supervision

Categorization of Risks
Financial and Non- Financial Companies

- Strategic Risk
  - Business planning
  - Resourcing
  - Acquisitions, divestitures and mergers
  - Reputation/brand
  - Competition
  - Customer
- Financial Risk
  - Market
  - Credit
  - Liquidity
  - Foreign exchange
  - Interest
  - Commodity

Categorization of Risks
Financial and Non- Financial Companies

- Operational Risk
  - People
  - Processes
  - Systems
- Legal Risk
  - Ethics/ code of conduct
  - Social responsibility
  - Litigation
- Regulatory
  - Capital Structure
  - Compliance
  - Governance
  - External relations and reporting
  - Tax

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Example: Categorization of Risk for DC Plan (Illustrative)

DC Plan Risks	Description of Risk	Applicability to DC Plans
Design	Risk of providing less than the intended level of retirement income	Will the DC plan deliver income replacement levels at the target investment return and retirement age? If not (either too high or too low), what are the potential risks to the plan sponsor?
Investment	Risk of not achieving desired / target level of investment return	Can the desired / target investment return be achieved by utilizing the investment options available to employees?
Legal	Risk of failing to meet explicit , or implied contractual commitments	Have you clearly articulated your commitments in employee communications, or relevant documentation? Are you delivering on these commitments?
Longevity	Risk of outliving retirement funds based on standard life expectation	Have employees been made aware of their likelihood of outliving their DC account balances?
Market	Risk exposure to potential fall in asset value, or capital loss	Are there safeguards to ensure that employees nearing retirement are not exposed to significant loss of principal?
Operational	Risk due to inadequate processes, systems or ill-trained people	Are there performance standards internally and with external vendors to ensure first-rate service to employees?
Strategic	Risk of failure to meet business objectives	Does the DC plan support business and human resource objectives? For example, attraction / retention strategy

ERM and Rating Agencies

- Rating agencies have determined that a company's ERM capability is a key indicator of:
  - The quality of management
  - Creditworthiness

  irrespective of the type of company (financial, non-financial)

- Moody's has been applying their Risk Management Assessments (RMA) on a selective basis since 2004 covering:
  - Risk Governance , Risk Management, Risk Analysis and Quantification and Risk Infrastructure and intelligence

- S&P (November 15, 2007 Request for Comments) is viewing ERM as a framework of the company's approach to managing risk; it is planning to focus on :
  - Risk Culture and Governance
  - Risk Controls
  - Emerging Risk Preparation
  - Strategic Risk Management

Case Studies

- Case studies are excerpts from specific projects .
- The issues have been simplified, altered and revised to provide some key learnings.
- Case studies cover :
  - Employee Stock Option Valuation
  - Evaluating Investments
  - Weather Derivatives
  - Defined Contribution Risk

Case #1: Employee Stock Option Valuation

- Issue Definition :
  - FAS 123 encourages use of fair-value to account for stock options
  - Proposes use of Black Scholes, or Binomial Method with maturity parameter as the expected life
  - Value must be adjusted for possibility of employee leaving the company during the vesting period (simply reducing the life of option is not theoretically sound)
  - Consider that employee may leave after the vesting period prior to maturity

- Stock Option Valuation Methods
  - Black Scholes : European options
  - Binomial Method : European or American options

Case #1: Employee Stock Option Valuation

- Solution :Bermudan Model
  - Incorporate mixture of European and American options
  - Handle the fact that employees may leave during the vesting period
  - Recognize differences in employees' strategies through barrier type options
  - Account for negative correlation between stock price and exit rate

- Comparison of Results
  - Black Scholes : $7,910,000
  - Bermudan (3% exit rate) : $7,219,000
  - Bermudan (0% exit rate) : $7,907,000

  Using Black Scholes "as-is" overestimates the value of the options

Case #2: Evaluating Investments

- Issue Definition
  - Purchase rights to a natural gas pipeline; or
  - Purchase rights to a partial interest in a power plant with an option to buy the remainder in five years
- General solution
  - Focus on measuring risk using VaR
  - Use single point distribution – amount of money that we could lose in a defined time horizon at a given confidence level
  - Advantage : information on risk and distribution is summarized in a single number
  - Drawback : VaR is a short term measure and the wrong metric to value investment opportunities

Case #2: Evaluating Investments

- Optimal Solutions
  - Focus on measuring risk and value using CFaR / EaR and Real Options
    - CFaR or a similar “dollars-at-risk” metrics can be a powerful tool for explaining the potential impact of various market variables and hedging strategies – minimizes unpleasant surprises
    - Careful simulation will assist in determining the overall exposure, the value of the upside (real options), and natural risk mitigating on the downside.
    - Determine the probability of a specific profit and loss outcome
    - Identify specific price scenario that leads to the greatest profit or loss

Case #3: Weather Derivatives

- Issue Definition
  - Weather derivatives share similarities with other markets but applying existing models could produce unintended results
  - Trading group trades derivatives based on temperature
- General solution
  - Apply existing models without examining the dynamics of the market, for example:

	Model	Arbitrage	Term Structure
Natural Gas	GBM*	Yes	Medium High
Temperature	ABM**	No	Extreme

*Geometric Brownian Motion

**Arithmetic Brownian Motion

Case #3: Weather Derivatives

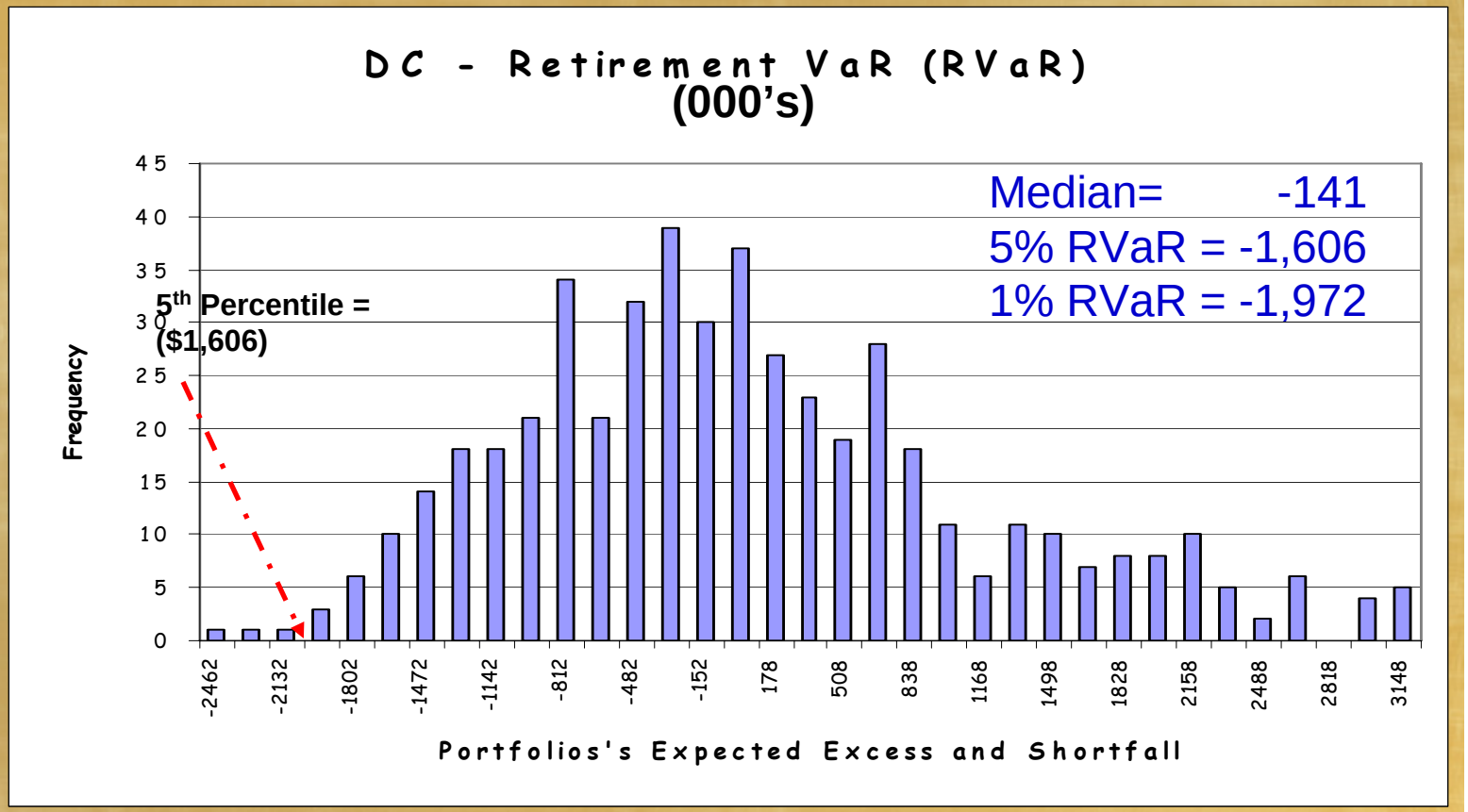
- Solution for Price Process
  - Financial assets – Forward prices follow GBM
  - Significant property of GBM : prices cannot go negative; inappropriate for temperature derivatives as temperatures do go below zero
  - Temperature models – use ABM
  - Volatility
    - GBM – based on percentage returns
    - ABM – based on actual changes
  - Seasonality - Standard deviations may be much higher in the winter than in the summers
  - Cash and Carry arbitrage – buy asset in spot market and sell it forward; none possible in weather
  - Term structure – weather- low volatility on contracts greater than a few weeks; high volatility on short contracts

Case #4: Defined Contribution Plans

- Issue Definition
  - Quantify risk in a Defined Contribution (DC) Plan from :
    - Design risk due to non-delivery of pension promise
    - Investment risk due to current investment options
    - Other risks (based on sophistication of the modelling, for example, mortality risk)
- General Solution
  - Determine the pension/lump sum shortfall on number of deterministic basis (investment return, mortality)
- Optimal Solution
  - Determine VaR for the portfolio
    - "The DC Plan (portfolio) has a Retirement VaR (RVaR) of $2m at 5% over the employees' working lifetime"
    - The DC Plan has 5 in 100 chance that it will have a shortfall of at least $2,000,000 over the accumulation period

Case #4: Defined Contribution Plans

Each portfolio consists of 4,500 employees



Actuarial Perspective: What is the plan sponsor's downside risk?
5% chance that the "shortfall" (RVaR) will be $1,606

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End of Presentation

"Whatever you do will be insignificant, but it is very important that you do it"
Mahatma Gandhi
October 2,1869 – January 30, 1948