Economic Capital in a Canadian Context

ERM Seminar

May 2005

Topics

1. **Rationale for Economic Capital**
2. **Canadian Regulatory Context**
3. **Economic Capital Principles**
4. **Economic Capital Issues**
5. **Economic Capital Benefits**

- **Appendix: Model Risk**

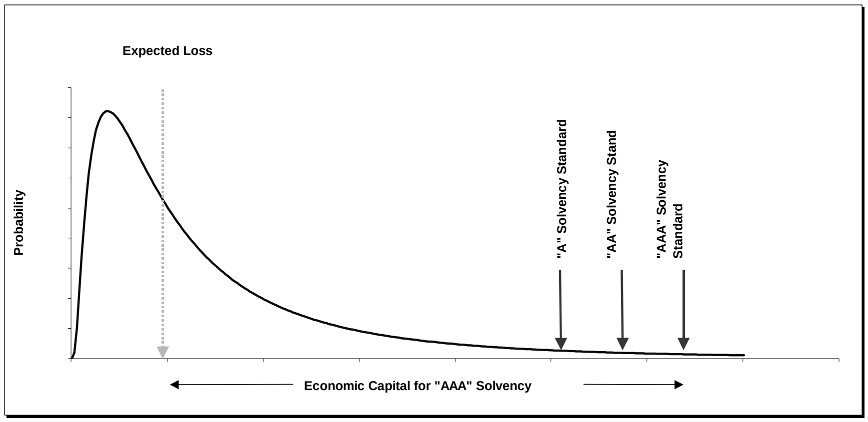
Rationale for Common Measurement

- **Help Ensure Solvency and Viability**
- **Consistent Understanding of Risk & Return**
- **Understand the Impact of Diversification**
- **Understand Contributions of Businesses to Value**
- **Appropriate Arbitrage of Regulatory Capital**
- **Influence Regulators & Anticipate Regulatory Direction**
- **Consistent Disclosure to Stakeholders**

Economic Capital – A Common Risk Measure

- **Comprehensive coverage of risk types (financial, insurance, credit, operational)**
- **All risks measured on a consistent basis.**
- **Time horizon harmonized across analysis.**
- **Confidence interval linked to strength.**
- **Forward-looking.**
- **Aggregated across the businesses**

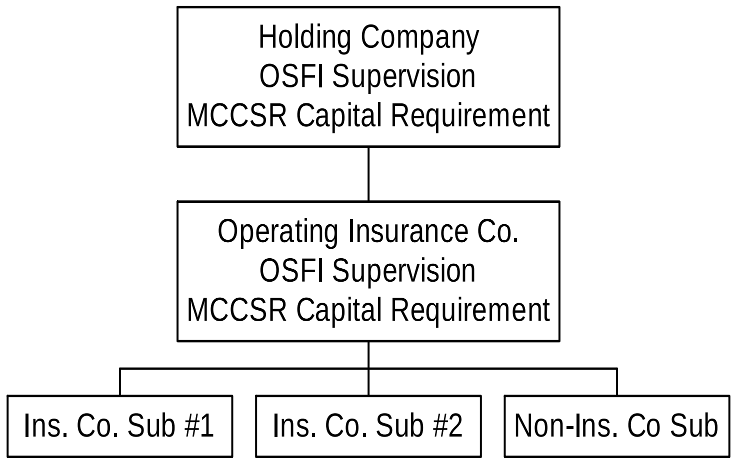
Illustration of Economic Capital



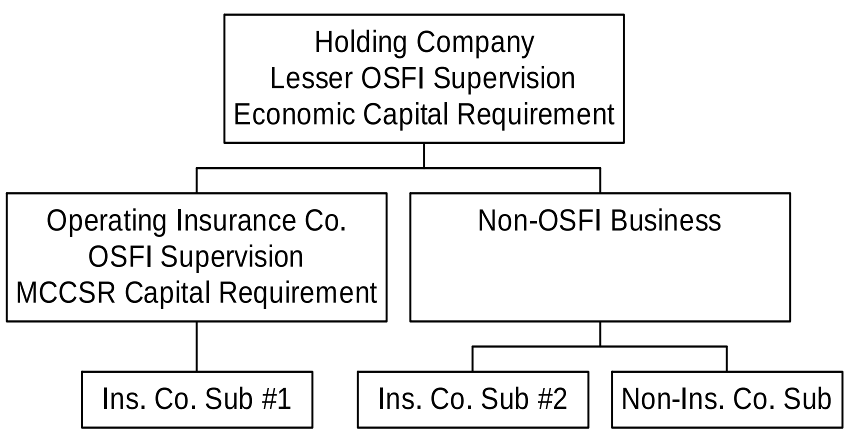
Economic Capital – Regulatory Direction

- **Holding Company Regime: OSFI (Canadian regulator) has indicated that company models will be used to set target capital at holding company level**
- **Operating Companies: Changes in capital will all be toward greater use of and reliance on modelled approaches**
- **International (IAIS) and Solvency II: Clear direction toward use of models**
- **Basel II: Banks are putting enormous resources into developing economic capital models**

Former Holding Co. Regime



New Holding Co. Regime



Key Principles – Holdco Capital

- Separation (at least initially) of Holdco & Opco perspectives
- Convergence of economic and regulatory perspectives
- Consistency with
  - IAIS principles & framework
  - Basel II / Banking principles & framework but recognize insurer risks can be different than banks even within broad categories such as Credit and ALM

Key Principles – Holdco Capital

- The "model" must
  - Capture all consolidated & unconsolidated operations
  - Reflect all risks including operational risks
  - Encourage good risk management practices (ie reflect appropriate credits for risk mitigation and diversification)
  - Focus on existing business (not future business yet to be written)
  - Consistently measure required and available capital

Key Principles – Holdco Capital

- **Required capital based on Total Balance Sheet Approach (TBSR)**

Required Capital = Total Assets for Specified Confidence Level **-** Liability Held on Balance Sheet

⇩

CTE (99) or 99.5% Confidence Level for one year horizon

- TBSR approach important given a) actuarial liabilities already include conservatism beyond best estimate liabilities b) the level of conservatism can vary by risk/company

Key Principles – Holdco Capital

- **Economic capital model can be a blend of economic models & operating MCCSR requirements**

Immaterial Risk | Material Risk

MCCSR ⟷ Economic Risk Model

MCSSR is reasonable risk measure | MCSSR is poor risk measure

- Bias should be to proper economic models for all material risks (but reasonableness of MCCSR as risk measure can dictate relative priority of introducing new models).

Key Principles – Holdco Capital

Specific Issues

- Internal model governance
  - **Regulatory approval of models**
  - **Company officer sign-offs**
- Economic capital must give appropriate credit for risk mitigants
  - **Diversification/correlation**
  - **Reinsurance – Capital Market Hedging**
  - **Risk sharing / pass through features**
- DCAT or similar stress testing still required
  - **Longer timeframe**
  - **Impact of new business & business plans**
  - **Risk mitigation actions analysis**

Economic Capital – Other Issues

- **Time Horizon and Level of Capital**
- **CTE vs. Percentile**
- **Reflecting "pass through"**
- **Quantifying Operational Risk**

Economic Capital Issues – Time Horizon and Level

- **Time horizon must be able to be modelled**
- **Time horizon must be consistent across risks**
- **Whatever horizon is used must still reflect lifetime liabilities (i.e. revalue at end of period)**
- **Level chosen will reflect the time horizon (a greater level will be chosen for a lesser horizon and vice versa – e.g. 99.95% for 1 year, 99.5% for 10 years)**
- **Level is chosen to provide a level of security, and based on desired ratings and commitments to stakeholders**

Direction: 1-Year Time Horizon

Economic Capital Issues – Measure: Percentile vs. CTE

- **The measure used must reflect risk appropriately**
- **The measure used must be consistent for all risks**
- **CTE is appropriate for measuring tail risks**
- **If there are substantial portion of the company's risks that have significant tail risk, then CTE may be more appropriate**
- **Level may reflect use of CTE or percentile (e.g. a higher level is appropriate if percentile is chosen, both numerically and to reflect potential for uncaptured risk)**

Direction: CTE(99.9)

Economic Capital Issues – Reflecting Pass-Through

- **Many insurance products have some degree of pass-through to policyholders; this should be reflected in economic capital determination**
- **Degree of pass-through varies by product and jurisdiction**
- **Ability to apply pass-through in practice must be assessed to determine appropriate offset to capital**
  - **Contractual constraints (e.g. minimum guarantees)**
  - **Actual practice of adjusting - expectations**
  - **Competitive constraints**

Economic Capital Issues – Quantifying Operational Risk

- **Operational risk is an extremely important risk**
  - **Most failures have operational roots**
- **What experience is appropriate to use for modelling operational risk?**
- **Must reflect long-term nature of liabilities**
- **Systems and processes and management will change over the lifetime of the liability**
- **Is it worth a lot of investment to model?**
- **Benchmarking approach**
- **Incentive to management**
  - **Modifiers based on assessments**

Benefits of Economic Capital

In addition to its use in determining appropriate levels of capital in the regulatory context, economic capital has other significant uses:

- **Risk-adjusted value of new business**
  - **VNB is a key metric, but needs to be risk-adjusted rather than relying on regulatory capital**
- **Establishment of risk tolerance limits**
  - **Need to be based on risk-adjusted returns (as well as other criteria)**

Appendix

Aggregation

&

Diversification

Economic Capital Issues – Aggregation

- **Risks must be aggregated to understand the overall risk profile – requires modelling and assumptions about correlations**
- **Copulas suggested by the International Actuarial Association (IAA) Working Group**
- **Must reflect correlation to understand risks…**

BUT

- **Must be very careful with assumptions about persistence of observed correlations in the tails**

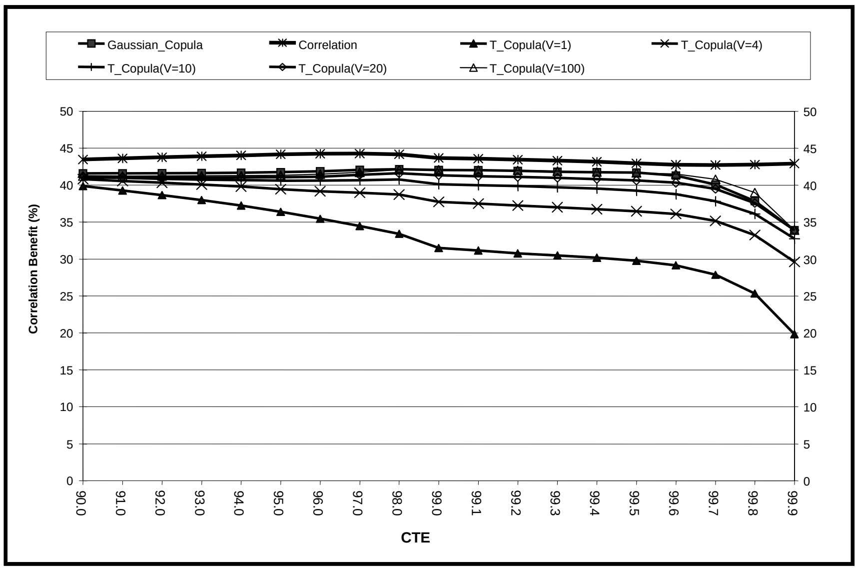
Economic Capital Issues – Aggregation

- **Correlation matrix approach (used in U.S. RBC formula) has significant weaknesses, particularly if non-normally distributed risks**
- **Copulas are a technique to aggregate via a multivariate uniform distribution**
- **T-Copula approach captures both marginal distribution of risks and joint probability of extreme values (tail dependencies of a T-copula are controlled by parameter)**
- **Data issues/calibration - a major factor**

Economic Capital Issues – Aggregation

- **The following chart shows the significant potential impact of aggregation, as well as the importance of choosing an appropriate method and assumptions for correlation – reductions range from 20% - 40%**
- **The simple correlation approach results in a consistent impact of correlation across different percentiles**
- **The T-Copula approach is important as it recognizes that correlations do not necessarily hold up in extreme situations**
- **Note that the data in the following chart is partially modelled, but largely hypothetical**

Percentage Reduction in Capital based on Different Parameters



Appendix

Model Risk

Importance of Model Risk:

Model risk is a general term referring to the possibility of loss or error resulting from the use of models. This risk has a number of components:

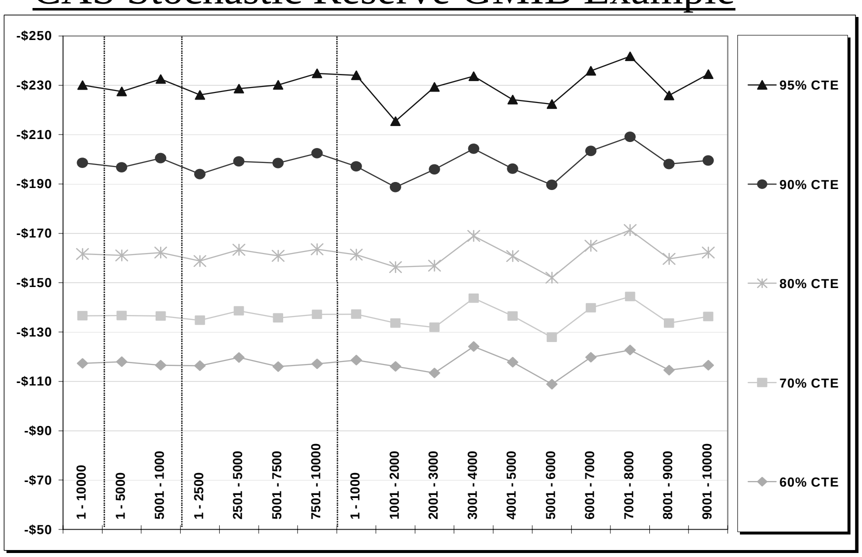
- **Model misspecification**
- **Assumption misspecification**
- **Inappropriate use or application**
- **Inadequate testing, validation, and documentation**
- **Lack of knowledge or understanding, user and/or management**
- **Inadequate systems structure and change management controls**
- **Error and negligence**

Illustration of Model Risk:

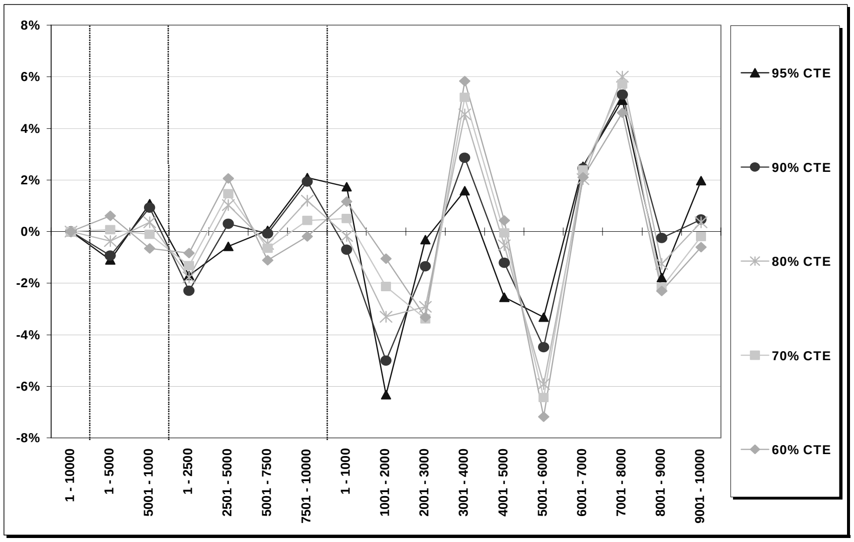
The following charts illustrate one particular type of model risk. It is inappropriate use of a model by using too few scenarios. The product illustrated is a GMIB product, and reserves are calculated using different numbers of scenarios. It is important to note that CIA standards prescribe only 1,000 scenarios. The charts illustrate that blindly following minimum CIA standards can result in substantial volatility.

- **The first chart shows the value of liabilities/capital calculated at different CTE levels (from 60 to 95); the red vertical lines separate sets of runs of 1,000 scenarios (the right-hand set of 10), to 4 sets of 2,500, 2 sets of 5,000 and 1 run of 10,000 (which is a relatively stable value); this illustrates the volatility purely from the number of scenarios**
- **The second chart shows the same information but showing the percentage difference in values; for example, this would say that if a reserve based on CTE(70) is run based on 1,000 scenarios, the result could vary by about 6% on either side of the "true" value**

CAS Stochastic Reserve GMIB Example



“Full Run” Relative Error Plot



MetLife

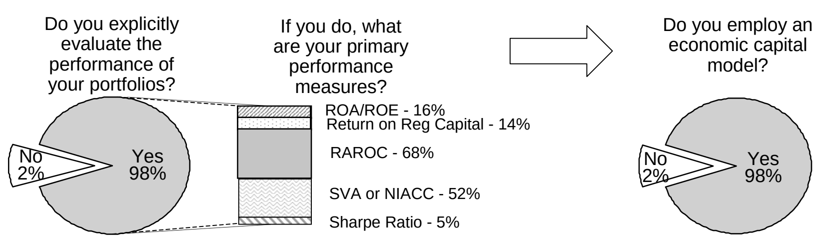
©UFS

Economic Capital

Robin F. Lenna
SVP, Chief Risk Officer

Reliance on Economic Capital

Essentially, all of the large, sophisticated banks rely on economic capital.



Source: Rutter Associates, 2004 Survey of Credit Portfolio Management Practices

But, the results from recent survey suggest that only about half of the insurance companies do

The economic capital process … … and questions to be answered

Question # 1: For what purposes will economic capital be used?

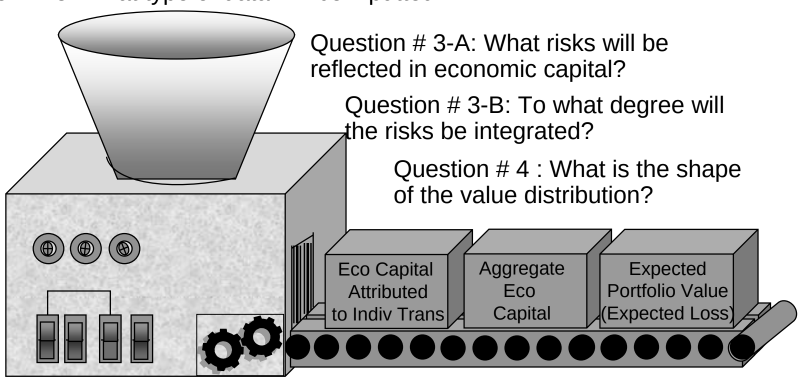
Question # 2: In what units will economic capital be defined?

Question # 5: What type of data will be inputted?

Question # 3-A: What risks will be reflected in economic capital?

Question # 3-B: To what degree will the risks be integrated?

Question # 4 : What is the shape of the value distribution?



Question # 6: How will risk be attributed to individual transactions?

Question # 1: For what purposes will economic capital be used?

Recent surveys suggest that, of insurance cos using economic capital, the uses of eco capital are

Five uses for Economic Capital	**at Enterprise Level**	**at Business Unit Level**	**at Product Level**
1. Assign [GAAP] equity to individual business units	**> 50%**	**> 50%**	**> 50%**
2. Provide guidance on capital adequacy (as an alternative to and/or comparison with statutory capital adequacy measures)	**> 50%**	**< 25%**	**< 25%**
3. Provide a measure with which to compare relative importance of risks - i.e., insurance, credit, interest rate, equity price, fx rate, and operational risk.	**?**	**?**	**?**
4. Attribute economic capital to individual products, so that RAROC or SVA can be used to evaluate the profitability of the product	**> 50%**	**> 50%**	**25%-50%**
5. Set limits	**?**	**?**	**?**

Question # 2: In what units will economic capital be defined?

- Should the focus of economic capital be on flows (e.g., earnings) or stocks (e.g., value)?
  - Recent survey evidence suggests that approx. one-half of insurance cos focus on flow factors (profit, earnings, or ability to make payments), while the other half focus on value

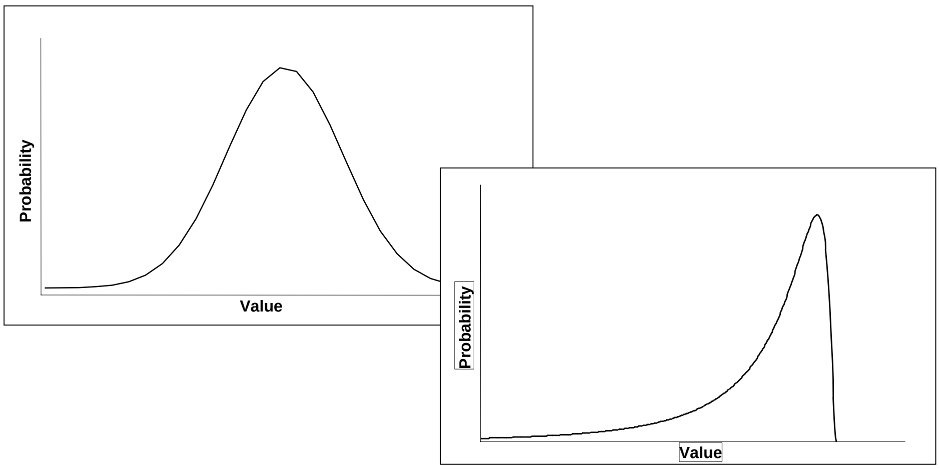
- If we focus on value, which one?
  - GAAP equity
  - Statutory capital and/or surplus
  - Market Value / Fair Value

Question # 3-A: What risks will be reflected in economic capital?
Question # 3-B: To what degree will the risks be integrated?

- Market Risk (i.e., financial prices)
  - Interest rates
  - Foreign exchange rates
  - Equity prices
  - Commodity prices
  - Credit spreads
- Default Risk
- Liquidity Risk
- Insurance Risk
  - Mortality
  - Morbidity
  - Underwriting
  - Catastrophe
  - Lapse/Surrender
- Operational

- Different risks types integrated into one model
  - Market Default, Liquidity, Insurance and Operational risks all included in the same model → Correlations between risk factors are embedded in the model (at the transaction level)
- Separate models for different risk types
  - Market risk ↔ VaR model
  - Default risk ↔ Credit Capital model
  - Liquidity risk ↔ Process model
  - Insurance risk ↔ Actuarial model
  - Operational risk will be discussed later

Question # 4 : What is the shape of the value distribution?



Question # 5: What type of data will be inputted?

- Historical data
- Current data – i.e., values implied from current market data
- “Pseudo data” – e.g., using Historical Simulation or Monte Carlo Simulation

Question # 6: How will risk be attributed to individual transactions?

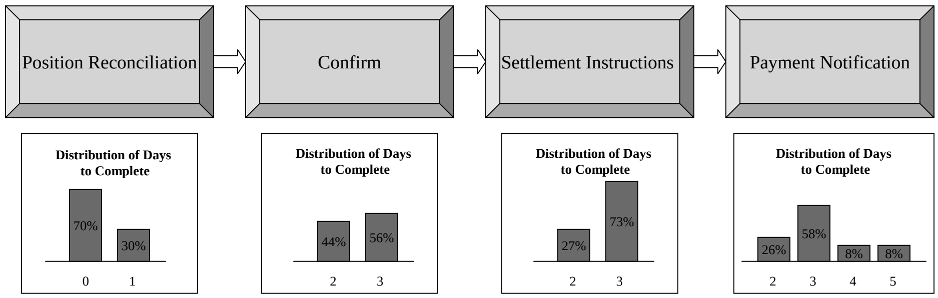
- "Risk Contributions" based on a standard deviation measure
- "Tail Based Risk Contributions"

Operational Risk: Frequency and magnitude of losses associated with operational risk (by risk type)

	Percentage of number of loss events	Percentage of gross loss amount	Percentage of net loss amount
Internal fraud	3%	7%	11%
External fraud	42% (1)	16% (3)	22% (2)
Employment practices and workplace safety	9% (3)	7%	9%
Clients, products and business practices	7%	13%	15% (3)
Damage to physical assets	1%	24% (2)	11%
Business disruption and system failures	1%	3%	–
Execution, delivery and process management	35% (2)	29% (1)	34% (1)

Source: Charles Smithson and Paul Song, " Quantifying Operational Risk," RISK, July 2004

Operational Risk – Measurement – Process Approach



Source: Charles Smithson and Paul Song, " Quantifying Operational Risk," RISK, July 2004

Operational Risk – Measurement – Factor Approach

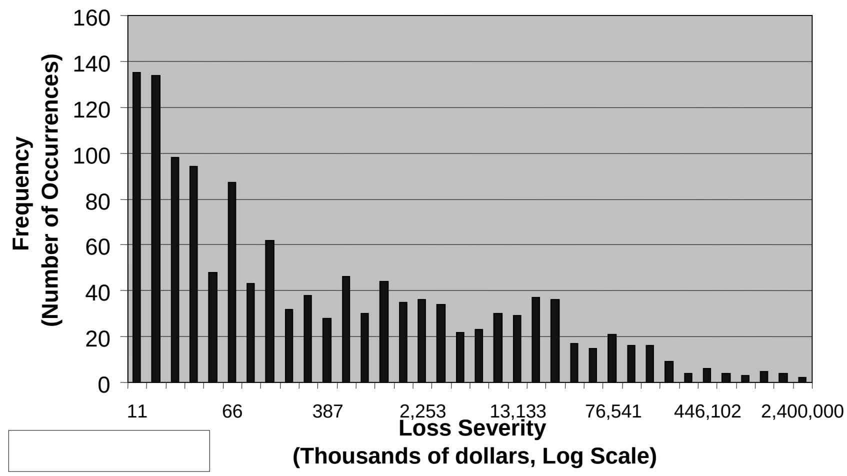
The analyst is attempting to identify the significant ***determinants*** of operational risk – either at the institution level or at the level of an individual business or individual process. The objective is to obtain an equation that relates the level of operational risk for institution *i* (or business *i* or process *i*) to a set of factors:

$$(\text{Operational Risk})i = \alpha + \beta(\text{Factor 1}) + \gamma\ (\text{Factor 2}) + \ldots$$

If she/he is able to identify the appropriate factors and obtain measures of the parameters (α, β, γ, …), the analyst can estimate the level of operational risk that will exist in future periods.

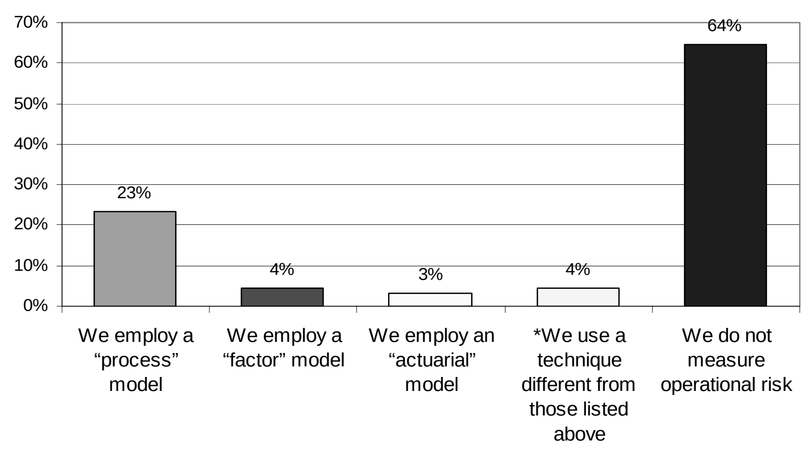
Source: Charles Smithson and Paul Song, " Quantifying Operational Risk," RISK, July 2004

Operational Risk – Measurement – Actuarial Approach



Source: Charles Smithson and Paul Song, " Quantifying Operational Risk," RISK, July 2004

Operational Risk
What measures are other institutional investors using?



Source: "2004-2005 Survey of Risk Measurement & Management Practices of Institutional Investors," New York University, HSBC Financial Products Institute, and Managed Funds Association, March 2005.

Economic Capital – Recent Trends in Implementation

ERM Symposium, Session CS B3
Chicago, IL
Monday May 2, 2005

Kevin Reimer, FSA, CFA
Phone (303) 894-4976 kevin.reimer@ing-im.com

ING

Agenda

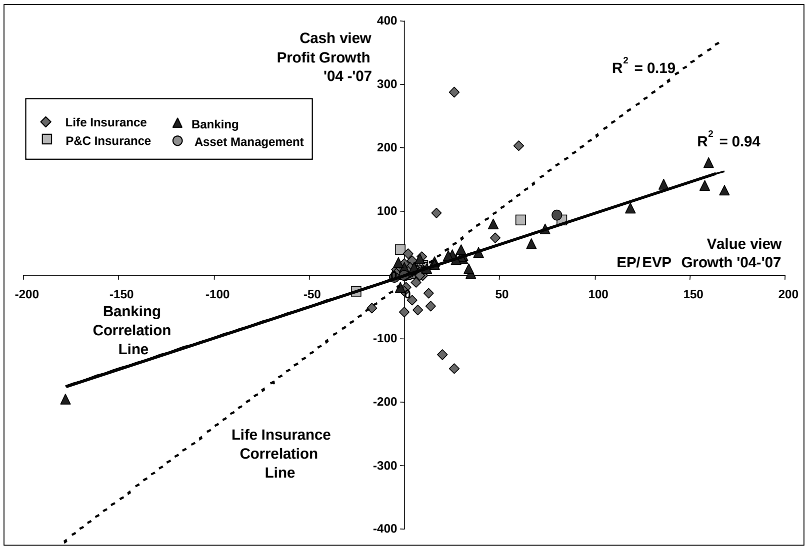
- **ING Group**
- Why Value-Based Metrics (and Economic Capital)?
- Measuring Performance
- ING Economic Capital Project
- Primary Risk Type Descriptions
- Benefits and Challenges
- Summary

ING: a World-wide group

Agenda

- ING Group
- **Why Value-Based Metrics (and Economic Capital)?**
- Measuring Performance
- ING Economic Capital Project
- Primary Risk Type Descriptions
- Benefits and Challenges
- Summary

Life Insurance Earnings Not Correlated to Value



Why Value-Based Metrics?

- Increasing internal/external emphasis
- Increasing focus on long term/value-based metrics
- ING's objectives:
  - Improve return on capital
  - Increase the rate of growth
- Total Shareholder Return (TSR)
  - A key part of ING's long-term incentive plan
  - TSR links value growth and profit growth
- GAAP Earnings and ROE continued importance

Why Economic Capital?

- Also Increasingly Important
- Risk Management and Performance Measurement
- Comprehensive
- Dynamic
- Reflects Current and Potential Market Conditions
- Reflects Risks and Business Controls Specific to ING
- Comparable
- Optimization and Managing
- Capital Protection and Deployment
- Economic Benefit

Agenda

- ING Group
- Why Value-Based Metrics (and Economic Capital)?
- **Measuring Performance**
- ING Economic Capital Project
- Primary Risk Type Descriptions
- Benefits and Challenges
- Summary

Measuring Performance

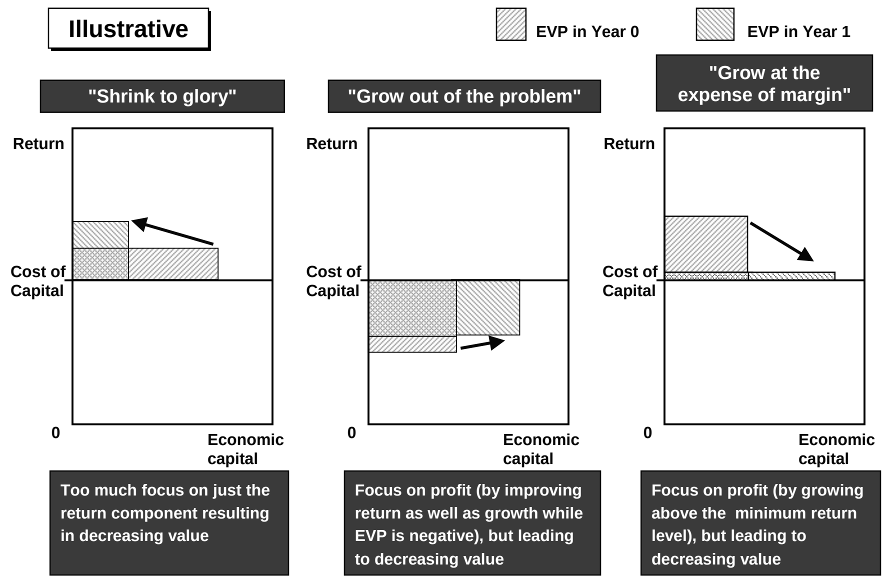
- Historically Key Indicators were:
  - Earnings Growth
  - Return on Equity (ROE)
  - Value New Business (VNB) or Internal Rate of Return (IRR)
- Weaknesses with these Indicators:
  - Quality vs. Quantity?
  - Reflection of Riskiness of the Business?
  - Consistency?
  - Single Period vs. Monitoring Emergence over Time?

A New Perspective with New Metrics

- New focus on relative market value of ING compared to its competitors
- **A focus on shareholders…**
  - Studies have shown that share price is strongly correlated with total shareholder return (TSR), which is strongly correlated with embedded value profit return
- **…and on Managing for Value (MfV)**
  - A management framework, which balances and reconciles the trade-offs involved in creating sustainable value

Metrics
• **TSR**
• **Embedded Value** (EV) • **After-tax GAAP Earnings** • **After-tax ROE** • **Return on EV/EV Profit** • **IRR of New Business** • **Economic Profit** • **RAROC**

Focus on the *change* in EV Profit avoids common pitfalls in trading-off return and growth



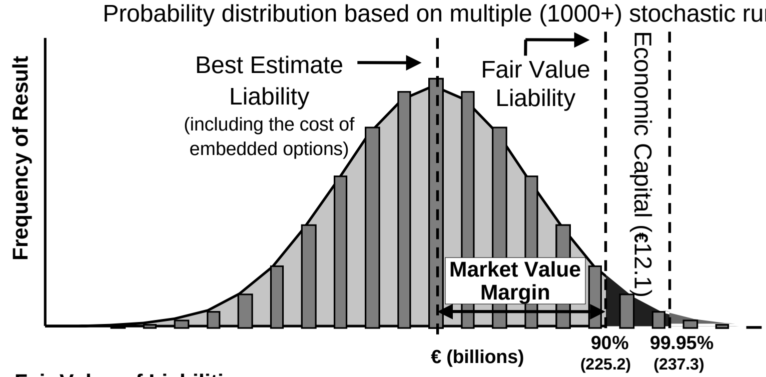
Agenda

- ING Group
- Why Value-Based Metrics (and Economic Capital)?
- Measuring Performance
- **ING Economic Capital Project**
- Primary Risk Type Descriptions
- Benefits and Challenges
- Summary

What is Economic Capital?

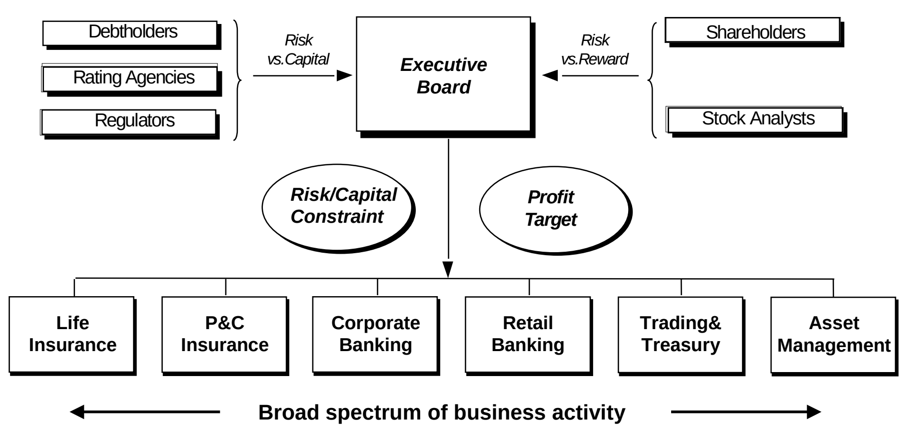
Economic Capital
"*Amount of capital required to protect the market value of the liabilities with a 99.95% one-sided confidence over a 1-year time horizon*"

Probability distribution based on multiple (1000+) stochastic runs.



Fair Value of Liabilities
- **Best Estimate Liability *plus* Market Value Margin ("MVM") for non-hedgeable risks**

Economic Capital – A Framework



Planned Implementation

Planning Period 2005 – 2007			
	2005	2006	2007
Capital	ICM V2.0 as basis	Full Adoption of EC in 2006	
Book Return	ROEC	Modified Book Value RAROC	
RAROC	Full marked to market RAROC on quarterly basis		
EV	ICM V2.0 for EV2005	Study Market-consistent EV	
Methods	EC-Studies / MVaR reporting - improve models/calculations		
Disclosure	True EC	RAROC & EC	

Agenda

- ING Group
- Why Value-Based Metrics (and Economic Capital)?
- Measuring Performance
- ING Economic Capital Project
- **Primary Risk Type Descriptions**
- Benefits and Challenges
- Summary

Primary Risk Types

- Market Risk
- Credit Risk
- Operational Risk
- Business Risk
- Other Risk Types
  - Mortality
  - Morbidity
  - P&C
  - Transfer

Other Considerations

- Market Value at Risk (MVaR)
- RAROC
- Market Value Balance Sheet
- Market Consistent Pricing
- Market Consistent Embedded Value

Agenda

- ING Group
- Why Value-Based Metrics (and Economic Capital)?
- Measuring Performance
- ING Economic Capital Project
- Primary Risk Type Descriptions
- **Benefits and Challenges**
- Summary

Benefits of Economic Capital

- Fresh look at Business Line Value Drivers
- Focus on one Measure of Capital
- Better Risk Measurement and Management
- Align Business Unit Goals with Share Price
- Diversification Benefits
- Uncover Hidden Risks and/or Profit Enhancers
- Consistent Measure Across Businesses
- Incentive to Optimize and Manage Risk/Return Tradeoff
- Capital Allocation
- “Nimble” Businesses can take Advantage of Drivers and be Rewarded

Challenges Implementing Economic Capital

- Need Clear, Easy to Implement Process and Tools
- Understanding Results
- Balancing Economic Capital with Requirements of Rating Agencies and Regulators
- Mapping to Local Accounting
- Specific Risk Calculations
- Diversification Benefits
- Adaptation
- Resources
- Measurement vs. Management Tool

Agenda

- ING Group
- Why Value-Based Metrics (and Economic Capital)?
- Measuring Performance
- ING Economic Capital Project
- Primary Risk Type Descriptions
- Benefits and Challenges
- **Summary**

Summary

- Why measure economic capital?
- Increasing demand to demonstrate to external parties that a company can manage its use of capital and understands risk/reward
- Many issues to consider among many stakeholders when trying to implement economic capital at a large, global financial services conglomerate
- Gradual convergence between regulatory capital models and internal risk models