Market Risk
Economic Capital
Summary

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Background

◆ Financial business is exposed to many types of risk due to the nature of business.
◆ To guard against the risk, financial institutions must hold capital in proportion to the potential risk.
◆ Market risk economic capital is intended to capture the value change due to changes in market risk factors.
Economic Capital (EC) Definition

- Economic loss is the loss in economic due to market movement.
- EC is intended to cover unexpected losses rather than expected loss, illustrated as follows.
Market Risk EC

Economic Capital vs Regulatory Capital

- **Economic Capital (EC)**
  - EC is an internal measure for internal risk control purpose.
  - EC is statistically measured for 1-year time period at 99.95% confidence level (consistent with the probability of default (0.05%) targeted by most institutions)

- **Regulatory Capital (RC)**
  - RC is an external measure used by regulators.
  - RC is statistically measured for 10-day time period at 99% confidence level
Economic Capital Calculation

- Economic Capital falls into the category of Value at Risk (VaR) measures as both try to capture value change due to market movement.
- Most institutions use the existing VaR system to compute economic capital.
- VaR system computes the market risk of 1-day time period at 99% confidence level, while EC measures the market risk of 1-year time period at 99.95 confidence level.
- Scaling methodology is the key to compute economic capital, i.e., scaling from 1-day to 1-year and from 99% to 99.95%.
Economic Capital Scaling Methodology

-Time horizon Scaling: scaling 1-day VaR to 1-year VaR

-The simplest and most commonly used approach is

\[ \text{VaR (1-year, 99\%CL)} = \sqrt{T} * \text{VaR(1-day, 99\%CL)} \]

where \( T = 365 \) for calendar days or \( T = 250 \) for business days and \( \text{CL} = \text{confident level} \).

-Assumptions of this scaling formula

- 1-day loss distribution is independently and identically distributed (IID)
- Constant mean and volatility
- No autocorrelation

-Comments: This approach is very simple and intuitive but most likely under-estimates risk as the assumptions don’t match reality.
Economic Capital Scaling Methodology (Cont’d)

◆ Confidence level scaling: scaling 99% VaR to 99.95% VaR

◆ There are many different approaches to scale 1-year VaR at 99% confidence level to 1-year VaR at 99.95% confidence level.

◆ One popular approach is based on Extreme Value Theory.

◆ Assuming the loss distribution follows t-distribution, the scaling factor for confidence level change is given by

\[ K = \left( \frac{1 - 99\%}{1 - 99.95\%} \right)^r \]

where \( r \) needs to be calibrated based on 1-year loss distributions
Economic Capital Result

Final economic capital:

\[ EC = \text{VaR (1-year, 99.95\%CL)} = K \times \sqrt{T} = K^* \sqrt{T} \times \text{VaR (1-day, 99\%)} \]

where \( \text{VaR} \) includes general \( \text{VaR} \), equity specific \( \text{VaR} \), debt specific \( \text{VaR} \).
Thanks!

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