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.
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
    \[ \text{VaR (1-year, 99\%CL)} = \sqrt{T} \times \text{VaR(1-day, 99\%CL)} \]
    where \( T = 365 \) for calendar days or \( T = 250 \) for business days and \( \text{CL} = \text{confident level} \).
  - Assumptions of this scaling formula
    1. 1-day loss distribution is independently and identically distributed (IID)
    2. Constant mean and volatility
    3. 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.
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 VaR includes general VaR, equity specific VaR, debt specific VaR.
Thanks!

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