



# Market Risk Economic Capital

## Summary

- ◆ Background
- ◆ Economic Capital (EC) Definition
- ◆ Economic Capital vs Regulatory Capital
- ◆ Economic Capital Calculation
- ◆ Economic Capital Scaling Methodology
- ◆ Economic Capital Result

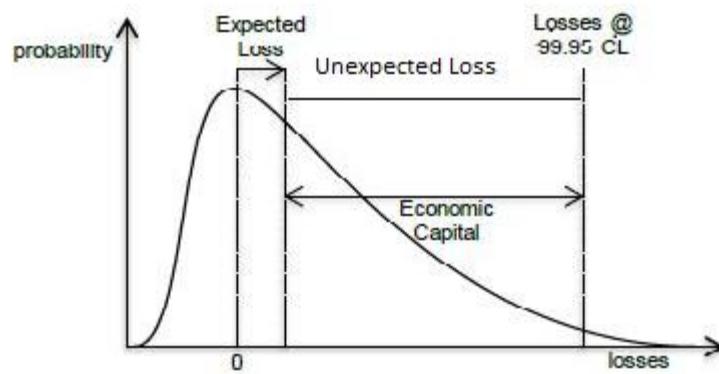
## Background

- ◆ 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.

Portfolio Loss Distribution



## 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 CL = 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:

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

where VaR includes general VaR, equity specific VaR, debt specific VaR.

# Thanks!



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