Market Risk Economic Capital

Alex Yang

FinPricing

http://www.finpricing.com

Market Risk EC

Summary

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- Economic Capital vs Regulatory Capital
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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.

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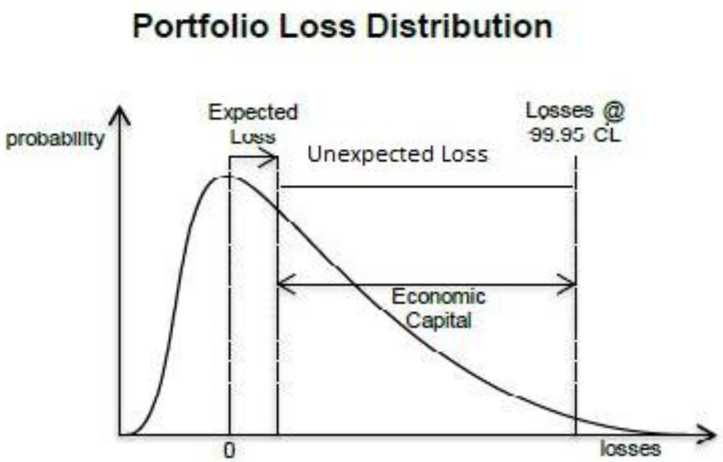
Economic Capital (EC) Definition

- 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.



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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

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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%

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Economic Capital Scaling Methodology

- Time horizon Scaling: scaling 1-day VaR to 1-year VaR
  - The simplest and most commonly used approach is

    VaR (1-year, 99%CL) = $\sqrt{T}$ * 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 realty.

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

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Economic Capital Result

- Final economic capital:

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

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

Thanks!

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