Value-at-Risk: Evolution, Deficiencies and Alternatives

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Learning Without Bounds

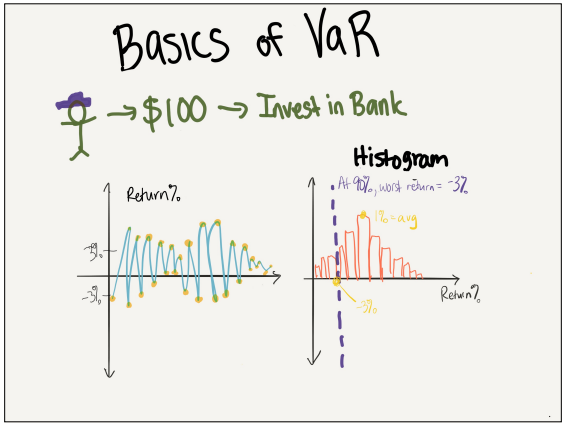
Video By: Roger Rosales, FSA, CERA

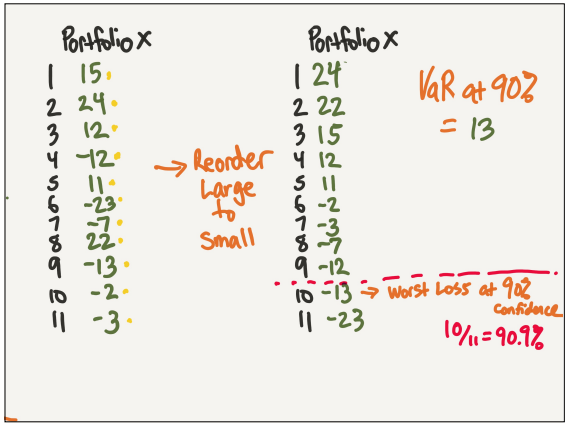
VaR: Value at Risk

"With a certain level of confidence, how much could we lose within the next day?"

"Our 5% 1-day VaR is $100 million."

–Risk Manager





VAR using Normal Distribution

$VaR = E(r_S) - Z \cdot \sigma_S$

- $E(r_S)$: return on asset or portfolio
- Z: confidence level translated to Z
- σ_S: standard deviation

ex. $E(r_S) = 3\%$

95% CI → $Z = 1.645$

$\sigma_S = 0.5\%$

$VaR = 3\% - 1.645(0.5\%)$

VaR's Shortcomings

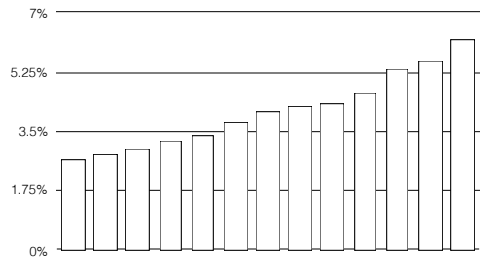
VaR is Not Coherent

Properties of a Coherent Risk Measure

- **X** Subadditivity **VaR fails here**
- Monotonicity
- Positive Homogeneity
- Translation Invariance

Assumes returns are normally distributed

Asset Returns



Inconsistency in Methods across Companies

Too much reliance on history and the observation period

Agency Problems

Regulatory Disclosure

Quiz

Identify the shortcomings of VaR

Shortcomings of VaR

Not Coherent

Assumes returns are normally distributed

Inconsistency in Methods

Historical Data and Observation Period

Agency Problems

Regulatory Disclosure

Alternatives to VaR

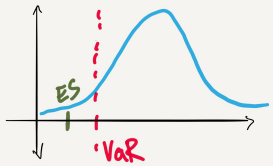
Expected Shortfall

The expected loss at the worst q% of cases

$ES(X) = -E[X \mid X < -VaR(X)]$

Expected Shortfall

$$ES(X) = -E[X \mid X < -VaR(X)]$$



Conditional VaR (CVar)

The weighted average of VaR and ES

Modified VaR (mVaR)

Let's take VaR and adjust for skewness and kurtosis

CoVaR

Stress the sector or the company and then calculate VaR

$\Delta CoVaR = CoVaR - VaR$

Alternatives to VaR

Expected Shortfall

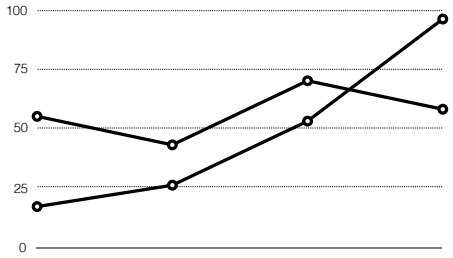
Conditional VaR (CVaR)

Modified VaR (mVaR)

CoVaR

Complementary Tools

Stress Testing



Use Sensitivity Analysis and Stress Scenarios

Stressed VaR

Stress the input parameters using tails of historical data and expert judgment

Risk Management

Complementary Tools to VaR

Stress Testing

(Sensitivity Testing & Stress Scenarios)

Stressed VaR

General Risk Management

Unquantifiable Side of Risk Management

Recap

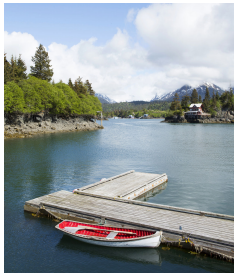
What is VaR?

VaR's Shortcomings

Alternatives to VaR

Complementary Tools

Unquantifiable Side of Risk Management



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