VaR

市场里的 VaR = WCL = P_worst – P_original, 比如 5%quantile

Normal VaR

Intuitively, the VaR for a given confidence level d
losses from the remaining distribution. The VaR
distribution. Hence, the calculated value at risk is
positive value since the negative amount is implie
equation form, the VaR at significance level α is:

$$\text{VaR}(\alpha\%) = -\mu_{P/L} + \sigma_{P/L} \times z_\alpha$$

Credit

Credit VaR

Credit Risks and Credit Derivatives

和市场的一样，最坏情况下的价格 – 初始价格

Example: Compute VaR using CreditMetrics[4]

Suppose your portfolio contains a senior unsecured bond issued by Triple-Bee, Inc. The bond with a credit rating of BBB matures in five years and pays a 6% coupon. If the recovery rate is 51.13%, what is the 1% credit VaR, given the following 1-year forward zero rates for the next four years and the 1-year transition probabilities of a bond with a BBB rating? Assume the bond's market price is $106.

Year-End Rating Class	*Probability of Migrating from BBB (%)*	*Cumulative Probability (%)*	*Bond Value Plus Coupon*	*(Probability) × (Bond Value Plus Coupon)*
AAA	0.02	100.00	109.37	0.022
AA	0.33	99.98	109.19	0.360
A	5.95	99.65	108.66	6.465
BBB	86.93	93.70	107.55	93.493
BB	5.30	6.77	102.02	5.407
B	1.17	1.47	98.10	1.148
C	0.12	0.30	83.64	0.100
Default	0.18	0.18	51.13	0.092

The cumulative probability column in Figure 9 estimates the first percentile. The expected bond value of 98.10 is at 1.47% in the cumulative distribution and is used as a proxy for the first percentile. Since credit VaR is the difference between the current bond price and the first percentile, the credit VaR for a bond with a current price of 106 is estimated to be $7.90 (= 106 – 98.10).

Portfolio Credit Risk

- 定义的是 VaR = WCL – EL = UL

The effects of default, default correlation, and loss given default are important determinants in measuring credit portfolio risk. A portfolio's **credit value at risk** (credit VaR) is defined as the quantile of the credit loss less the expected loss of the portfolio. Default correlation impacts the volatility and extreme quantiles of loss rather than the expected loss. Thus, default correlation affects a portfolio's credit VaR.

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Investment
Portfolio Risk: Analytical Methods

Diversified Portfolio VaR

Diversified VaR is simply the VaR of the portfolio where the calculation takes into account the diversification effects. The basic formula is:

$$VaR_p = Z_c \times \sigma_p \times P$$

where:
Z_c = the *z*-score associated with the level of confidence *c*
σ_p = the standard deviation of the portfolio return
P = the nominal value invested in the portfolio

31. Consider a USD 1 million portfolio with an equal investment in two funds, Alpha and Omega, with the following annual return distributions:

Fund	Expected Return	Volatility
Alpha	5%	20%
Omega	7%	25%

Assuming the returns follow the normal distribution and that there are 252 trading days per year, what is the maximum possible daily 95% Value-at-Risk (VaR) estimate for the portfolio?

A. USD 16,587
B. USD 23,316
C. USD 23,459
D. USD 32,973

Answer: B

This question tests that the candidate understands correlation in calculating portfolio VaR. From the table, we can get daily volatility for each fund:

Fund Alpha volatility: $0.20 / 252^{0.5} = 1.260\%$

Fund Omega volatility: $0.25 / 252^{0.5} = 1.575\%$

C. USD 23,459

D. USD 32,973

Answer: B

This question tests that the candidate understands correlation in calculating portfolio VaR. From the table, we can get daily volatility for each fund:

Fund Alpha volatility: $0.20 / 252^{0.5} = 1.260\%$

Fund Omega volatility: $0.25 / 252^{0.5} = 1.575\%$

Portfolio variance:

$0.5^2 \times 0.01259^2 + 0.5^2 \times 0.01574^2 + 2 \times 0.5 \times 0.5 \times 0.01259 \times 0.01574 \times \rho$

Portfolio volatility = (portfolio variance)$^{0.5}$

Portfolio volatility is least when $\rho = -1 \rightarrow$ portfolio volatility = 0.1575%

Portfolio volatility is greatest when $\rho = 1 \rightarrow$ portfolio volatility = 1.4175%

Therefore, 95% VaR maximum is $1.645 \times 0.014175 \times 1{,}000{,}000$ = USD23, 316

32. A portfolio consists of two positions. The VaR of the two positions are $10 million and $20million. If the returns of the two positions are not correlated. The VaR of the portfolio would be closest to:

A. $5.48million

B. $15.00million

C. $22.36million

D. $25.00million

Answer: C

For uncorrelated positions, the answer is the square root of the sum of the spread VaRs: