

Information coefficient

Information Ratio: $IR = \frac{\alpha}{\sigma}$

Linear regression: $R_t - R_f = \alpha + \beta(R_m - R_f) + \epsilon$

Fundamental law of active management $IR \cong IC \times \sqrt{BR}$

- BR number of investments deployed
- IC correlation between predicted and actual value

Alpha scaling

$\alpha = \text{volatility} \times IC \times \text{score} \sim N(0, \text{volatility} \times IC)$

- volatility is **residual risk**
- IC: measures the correlation between forecasted **alphas** and actual asset **return**
- Score $\sim N(0,1)$: standard normal distribution
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vol

63. An analyst regresses the returns of 400 stocks against the returns of a major market index. The resulting pool of 300 alphas has a residual risk of 13.78% and an information coefficient of 12%. If the alphas are normally distributed with a mean of 0%, roughly how many stocks have an alpha greater than 3.24% or less than -3.24%?

A. 5
B. 15
C. 20
D. 45

Correct answer: C

Explanation:

The standard deviation of the alphas = Residual Risk (volatility) x Information Coefficient (IC) = 0.1378 * 0.12 = 0.016536.
3.24% is 1.96 times the standard deviation of the alphas. The alphas follow a normal distribution with a mean of 0, so about 5% of the alphas are out of the interval [-3.24%, 3.24%]. The total number of stocks is 400, so roughly there are 20 alphas that are out of the range.

Section: Risk Management and Investment Management
Reference: Richard Grinold and Ronald Kahn, *Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Controlling Risk*, 2nd Edition (New York: McGraw-Hill, 2000). Chapter 14, Portfolio Construction.
Learning Objective: Assess the impact of practical issues in portfolio construction, such as determination of risk aversion, incorporation of specific risk aversion, and proper alpha coverage.

Handwritten notes:
 $IC = 12\%$
 $IR = IC \times \sqrt{BR} = \frac{2}{0.4578}$

- Regression the returns of 400 stocks against return of a major market index.
- 400 stocks, 300 alphas, a residual risk volatility) 13.78% and information coefficient 12%
- 计算出的方差是 $s = \text{residual risk} \times IC = 13.78\% \times 12\% = 1.6536\%$
- 给定的[-3.24%, 3.24%] 是一个**置信区间**, 需要知道置信度
- 置信区间的定义是 $\bar{X} \pm Z \times s$
 - 给定的区间是对称的, 因此以算出均值是 $\mu = 0$

- 再计算临界值Z, 利用 $3.24 = 0 + Z * 1.653 \rightarrow Z = 1.9594$
- 计算置信度 $1 - \alpha$ 或者显著水平 α , 可以利用 $N(\alpha/2) = -1.96$ 反推。
- 但是因为 1.96 特殊。根据**双边检验**, **95%**对应的临界值就是 1.96
- 因此显著水平 $\alpha = 5\%$
- 题目问的是在置信区间**外**的数量, 那就是 $400 \times 5\% = 20$