Portfolio Important formulas

MPT

1. Covariance between two stocks

$$Cov(x,y) = \text{net risk of stock } x \times \text{net risk of stock } y$$

2. $$r_{xy} = \frac{Cov(x,y)}{\sigma x \cdot \sigma y}$$

3. $$Cov(x,y) = r_{xy} \cdot \sigma x \cdot \sigma y$$

4. Weights of minimum risk portfolio

$$W_x = \frac{\text{risk reduction of } y}{\text{risk reduction of } x + \text{risk reduction of } y} = \frac{\sigma_y^2 - Cov(x,y)}{\sigma_x^2 - Cov(x,y) + \sigma_y^2 - Cov(x,y)}$$

$$W_y = 1 - W_x$$

5. $$\text{Return of Portfolio} = W_x \cdot R_x + W_y \cdot R_y + \cdots\cdots$$

6. $$\text{S.D. of Portfolio (2 stocks)} = \sqrt{W_x^2 \sigma_x^2 + W_y^2 \sigma_y^2 + 2 W_x W_y Cov(x,y)}$$

7. $$\text{S.D. of Portfolio (3 stocks)} = \sqrt{W_x^2 \sigma_x^2 + W_y^2 \sigma_y^2 + W_z^2 \sigma_z^2 + 2 W_x W_y Cov(x,y) + 2 W_y W_z Cov(y,z) + 2 W_x W_z Cov(x,z)}$$

SIM and CAPM

$$\text{Beta} = \frac{\text{Changes in stock return}}{\text{Changes in market return}} \quad ; \quad \text{OR}$$

$$\text{Beta} = \frac{\text{Net risk of stock}}{\text{S.D. of market}}$$

$\Downarrow$

$$\text{Net risk of stock} = \beta_x \cdot \sigma_m$$

$$\text{Beta} = \frac{Cov(x,m)}{\sigma^2_m} \qquad Cov(x,m) = \text{Beta} \times \sigma^2_m$$

$$Cov(x,y) = \text{Net risk of stock } x \times \text{Net risk of stock } y$$

$$= \beta_x \cdot \sigma_m \times \beta_y \cdot \sigma_m$$

$$= \beta_x \cdot \beta_y \cdot \sigma^2_m$$

$$r_{xm} = \frac{Cov(x,m)}{\sigma_x \cdot \sigma_m}$$

$$r_{xm} = \frac{\text{net risk of stock } x \times \cancel{\text{net risk of market } m}}{\sigma_x \cdot \cancel{\sigma_m}}$$

$$\therefore \text{net risk of stock } x = r_{xm} \cdot \sigma_x$$

$$\text{Net risk of stock} = \beta_x \cdot \sigma_m = r_{xm} \cdot \sigma_x$$

$$\therefore \beta_x = \frac{r_{xm} \cdot \sigma_x}{\sigma_m}$$

Characteristic line

$$\alpha = \bar{R}_i - \beta \cdot R_m$$

The equation of characteristic line : $\bar{R}_i = \alpha + \beta \cdot R_m$

Dont kill R_m

Total Risk of a stock = Systematic Risk of stock + Unsystematic Risk of stock

$$\sigma^2_x = \beta^2 \cdot \sigma^2_m + \sigma^2_{ex}$$

Unsystematic Risk of stock = Total Risk of stock − Syst. Risk of stock

Portfolio

Systematic Risk of Portfolio = $\beta^2_p \cdot \sigma^2_m$

Unsystematic Risk of Portfolio = $w^2_A \cdot \sigma^2_{eA} + w^2_B \cdot \sigma^2_{eB}$ ....

CAPM

The equation of Security market line : $E(R) = R_f + (R_m - R_f)\beta$

Dont kill Beta

Sharpe Ratio {SR} $= \dfrac{\bar{R}_i - R_f}{S.D.}$

Treynor Ratio {TR} $= \dfrac{\bar{R}_i - R_f}{Beta}$

Jensen's Alpha : $\alpha = \bar{R}_i - R_f + (R_m - R_f)\beta$

$r_{xy} = r_{xm} \times r_{ym}$

Co-efficient of determination $= r^2$

Co-efficient of variation $= \frac{SD}{mean} \times 100$

APT

$E(R) = R_f + \beta_1 \lambda_1 + \beta_2 \lambda_2 + \beta_3 \lambda_3 \ldots\ldots$

or

R_f + {Factor 1 Risk Premium × Factor 1 sensitivity} +
{Factor 2 Risk Premium × Factor 2 sensitivity} +
{Factor 3 Risk Premium × Factor 3 sensitivity}
....

Capital market line

Equation is $E(R) = R_f + (R_m - R_f) \frac{\sigma_p}{\sigma_m}$

Inv in R_f and Inv in R_m → Lending Portfolio {under market portfolio}

Borrow in R_f and Inv in R_m → Borrowing Portfolio {over market portfolio}

Efficient Frontier line

Combinations	Returns	Risk
A	8%	5%
~~B~~	~~8%~~	~~6%~~
~~C~~	~~7%~~	~~6%~~
D	10%	8%
~~E~~	~~9%~~	~~8%~~
F	12%	10%
~~G~~	~~12%~~	~~12%~~
H	14%	14%