

PORTFOLIO MANAGEMENT

- A portfolio is a set of investments.
- An investor may put all of his money in single investment or can build a portfolio by dividing his funds for investments in several securities.
- The portfolio theory sets the rules for portfolio building.

Return

- Return from an investment is change in its value over time.
- The rate of return (%) is change in value of investment during a period expressed as percentage on opening value of Investment.

Formula:

Arithmetic Mean = $(R_1 + R_2 + R_3 \dots R_n) / N$

Where, R_1 = Return in Year 1 expressed as %
 N = Number of years

Returns from Listed Securities:

Dividends is one form of returns. Capital appreciation can be the second form of return.

Formula: $R = \{(P_1 - P_0) + D_1\} / P_0$

Where,

R = Return from the investment during the period.
 P_1 = Market price at the end of the period
 P_0 = Market price at the beginning of the period
 D_1 = Dividends.

Expected Return:

ER is the weighted average return with probabilities as weights.

Formula: $R = \sum P \times R$

Where, P = Probability;
 R = Return %

Risk

A situation where,

- ✓ Several outcomes, say a range of outcomes, are possible
- ✓ Within this range, any one outcome can occur
- ✓ Each possible outcome has a known probability
- ✓ Such probabilities are assessed by reference to past information

Risk - An expression of the possibility that the actual outcome will differ from expected outcome.

Standard Deviation

- The risk associated with the project can be expressed, as the extent to which the actual value of outcome will differ from the expected value.
- This risk is measured with the help of a statistical tool known as Standard Deviation.
- Higher the SD, higher is the risk associated with a project

Formula: $\sigma = \sqrt{\sum P \times d^2}$

where,

σ	=	Standard Deviation (Sigma)
P	=	Probability of occurrence
d	=	Deviation from mean

Risk free Security

For a security to be called “Risk-Free”, it should meet atleast two basic criteria:

1. These securities should be highly liquid. (readily tradable and be of short-term maturity).
2. They should be capable of generating a return, with negligible variation from expected levels.
(fixed income security or one where the return is guaranteed)

Portfolio Return

- The return of a portfolio is the weighted average return of the securities constituting the portfolio with the value of investment being the assigned weight.

Step 1: Compute the expected return of **each stock** taking into account the various observations and the probabilities of occurrence.

$$\underline{R} = P \times R$$

Step 2: Compute the return of the **portfolio** by using the formula $\underline{R}_p = W \times R$.

Covariance

- The link between the variability of returns in 2 independent Securities is called the Covariance.
- Covariance is a measurement of the Co-movement between two variables.

Formula:
$$\text{Cov} = \sum dx \times dy \times P$$

Where,

$$\begin{aligned} dx &= R_x - \underline{R}_x \\ dy &= R_Y - \underline{R}_Y \\ P &= \text{Probability} \end{aligned}$$

- The Covariance between two securities may be positive, negative or zero.
- ✓ A **positive value** for covariance indicates that the returns on two assets tend to go together
- ✓ For instance, if return on X is above par, then return on Y is also likely to be above par.
- ✓ A **negative value** for covariance indicates that the returns on two assets bear a tendency to offset each other.
- ✓ A **zero value** for covariance would imply that there is no distinct relationship between the movements in returns in respect of two securities.

Correlation Coefficient

- It is a measure of closeness of the relationship between two random variables and is bounded by the values +1 and -1.
- Portfolio risk will be maximum when two components of a portfolio stand perfectly positively correlated; and will be minimum when the same are perfectly negatively correlated.

Formula:
$$r = \text{Cov } xY / (\sigma x) \times (\sigma Y)$$

Measurement of Risk in a Portfolio of 2 Securities

Formula Method: The 3 essential elements for portfolio risk are:

Element 1: SD of each security

Element 2: Proportion of investment in each security

Element 3: Covariance of the pair of securities

Step 1: Compute covariance between the two stocks

Step 2: Compute correlation

Step 3: Apply the formula

$$\sigma_P = \sqrt{(\sigma_X)^2 (W_X)^2 + (\sigma_Y)^2 (W_Y)^2 + 2 (\sigma_X) (\sigma_Y) (W_X) (W_Y) \text{Corr}_{XY}}$$

Where,

$(\sigma_X)^2$	= Variance of security X
$(\sigma_Y)^2$	= Variance of Security Y
$(W_X) \& (W_Y)$	= Proportion of investment in security X & Y
Corr_{XY}	= Correlation coefficient of Security X & Y

Or

$$\{\text{Cov}_{XY} / (\sigma_X) \times (\sigma_Y)\}$$

Portfolio – Lower Risk

Identification of portfolio in which risk is lowest

Formula:

$$W_X = \{(\sigma_Y)^2 - \text{Cov}_{XY}\} / \{(\sigma_X)^2 + (\sigma_Y)^2 - 2 \text{Cov}_{XY}\}$$

Note: This formula will not apply when Correlation is +1, because at that correlation risk reduction is not possible.

Portfolio Risk of 'n' securities

- The variance of the return on a portfolio with many securities is more dependent on the co-variances between the individual securities rather than on the variances of the individual securities.

Matrix Method : Step 1: Gather the following information, viz.

- ✓ Proportion of investment for each security
- ✓ Variance of each security, and
- ✓ Covariance of each security with every other security in the portfolio.

Step 2: Construct a square matrix, and indicate the weights (proportion of investments) both along rows and columns.

- ✓ Plot variance of individual securities (with itself) along diagonal cells.
- ✓ Plot Covariance of each pair in the respective boxes.
- ✓ Ensure that each cell contains either Variance or Covariance
- ✓ For an example of a portfolio with four securities with weights in the ratio of 10/20/30/40, the matrix will be

Step 3: Derive a result for variance by applying a simple multiplication rule.

- Each cell content is multiplied with the weights shown in its respective row and column
- Aggregate of all the products is Variance of Portfolio
- Find the square root of variance to get SD for the portfolio.

Method 2: Formula Method

Standard Deviation of a Portfolio

$$\sigma_P = \sum X_i * X_j * \sigma_i * \sigma_j * \rho_{ij}$$

Where,

X_i = Proportion of investment of security i

X_j = Proportion of investment of security j

σ_i = SD of Security i

σ_j = SD of Security j

ρ_{ij} = Correlation coefficient of returns of securities i and j.

Capital Market Line (CML)

CML suggests that given an opportunity to borrow and lend at the risk free rate of interest, all investors will invest in a portfolio located on the CML

- ✓ Portfolios on the CML will comprise the market portfolio of risky assets, with either lending or borrowing at the risk free rate of interest.
- ✓ The CML gives the market price for risk (Market risk premium)
- ✓ The slope of CML is of vital relevance.
- ✓ The CML denotes the risk-return relationship of the capital market as a whole., i.e. the compensation that an investor can expect from the market, in excess of risk free return.

Formula: $\lambda = (R_m - R_f) / \sigma_m$

R_m = Return from Market

σ_m = SD of the market

R_f = Risk free rate of return

λ (lamda) = Market price of Risk

Beta

- Beta is a measure of non-diversifiable risk.
- Beta of a stock measures the sensitivity of the stock with reference to a broad based market index. (Sensex)

For instance,

- ✓ A beta of 1.2 for a stock would indicate that this stock is 20% riskier than the Index.
- Beta of a portfolio is the weighted average Betas of securities comprising the portfolio
- ✓ A beta of 0.9 would indicate that this stock is 10% less risky than the Index.
- ✓ A beta of one would mean that the stock is as risky as the stock market index.
- Expected risk premium is Beta times the market risk premium
- Beta measures the stock's volatility with reference to the market index.

- Beta value of a stock can be any number
- ✓ If the beta of a stock is greater than one – High Beta Stock
 - Such stocks are riskier than the “stock market”.
 - They move faster than the movement in the stock market.
 - If the market goes up, this stock goes up faster.
 - If the market falls, this stock falls faster.
- ✓ If the beta of a stock is less than one – Low Beta Stock
- ✓ Stocks with a beta of one are called Unity Stocks

Calculation of Beta:

Single Security: β value is the standardised measure of covariance of return on a security and the return on the market.

Formula:

$$1. \quad \beta = (\sum XY - n \bar{X} \bar{Y}) / (\sum Y^2 - n \bar{Y}^2)$$

Where,

X = Return (%) from the stock

Y = Return (%) from the stock market as a class

n = number of observations

$\bar{X}$ = Arithmetic mean of rate of returns from the stock.

$\bar{Y}$ = Arithmetic mean of rate of returns from the market.

$$2. \quad \beta = \text{Covariance } j m / \text{Variance } m$$

Where,

Covariance $j m$ = Covariance between stock and market

Variance m = Variance of the market

$$3. \quad \beta = (\sigma_j / \sigma_m) \text{Corr } j m$$

Where,

σ_j = SD of Stock

σ_m = SD of Market returns

Corr $j m$ = Correlation between returns from Stock and Stock Market

Capital Asset Pricing Model

Risk Return Trade Off (CAPM)

- CAPM provides the link between return and non-diversifiable risk.
- An investor can use CAPM to assess the extent of additional return over risk-free return, for a given level of systematic risk of a risky investment.
- The excess return earned over and above the risk free return is called the Risk Premium ($R_m - R_f$)
- Risk premium a stock should earn is beta times the risk premium from market $\{ \beta \times (R_m - R_f) \}$
- Therefore, the total return from an investment is the risk free rate of return plus the risk premium.

Formula: $R_j = R_f + \{ \beta \times (R_m - R_f) \}$

Under Valued / Over Valued Stocks

- ✓ Such stock gives less return than what it should give.
- ✓ Hence, such stocks should be sold.

Rule 3: CAPM = Expected Return – **Hold**

- ✓ If the required return equals the expected return, the stock is rightly valued.
- ✓ Such stocks are to be held.