RISK AND RETURN

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CONCEPT OF RETURN

- Return: The gain (or loss) from an investment.
- Returns can be classified as:

RETURN

- REALISED RETURN
  - Return earned in past
- EXPECTED RETURN
  - Return expected to be earned in future

COMPONENTS OF RETURN

YIELD

(Periodic cash payments in the form of interest or dividends)

CAPITAL GAIN/ LOSS

(Appreciation (or depreciation) in the price of the asset)

MEASUREMENT OF RETURN

$$\text{Rate of return(k)} = \frac{D_t + (P_t - P_{t-1})}{P_{t-1}}$$

- where D_t is the cash flow receivable at time t

  P_t is the Price of the security at the end of the holding period

  and P_{t-1} is the Price of the security at the beginning of the holding period.
- D_t represents dividend payments in case of stocks and coupon payments in case of bonds or debentures.

PROBABILITY AND RATE OF RETURN

- Probability of an event gives the possibility of the occurrence of an event.
- $$\text{Expected rate of return}(\bar{k}) = \sum_{i=1}^{n} P_i k_i$$

where P_i is the probability associated with the i^{th} possible outcome

k_i is the rate of return from the i^{th} possible outcome

CONCEPT OF RISK

- Risk is the variability or dispersion between actual and estimated return.
- Higher the variability, greater the risk of the project.
- Relationship between return and risk can be explained by:

Return = Risk-free rate + Risk Premium

Higher the risk, greater the return.

- Risk-return Trade-off.

SOURCES OF RISK

- **INTEREST RATE RISK** : Variability in security's return due to change in level of interest rates.
- **MARKET RISK**: Variability in security's return due to fluctuations in the securities market.
- **INFLATION RISK**: Reduction in purchasing power due to rise in inflation.
- **BUSINESS RISK**: Risk of doing business in a particular industry.
- **FINANCIAL RISK**: Risk arising due to use of debt financing.
- **LIQUIDITY RISK**: Risk associated with the secondary market in which the security is traded.

MEASUREMENT OF RISK

1) Standard Deviation

- It is an absolute measure of dispersion.
- Indicates average distance from the mean return.
- It is computed as:

$$\sigma = \sqrt{\sum_{i=1}^{n} P_i (k_i - \bar{k})^2}$$

where k_i is the return from the i^{th} outcome
and P_i is the probability of the i^{th} outcome.

Example: Comparison of risks of securities

- Compare the risk and return for X and Y securities.
- X Ltd. has the following probability distribution

Return (k_i)	6%	8%	10%	12%	14%
Probability (P_i)	0.05	0.15	0.60	0.15	0.05

- Y Ltd. has the following probability distribution:

Return (k_i)	-100%	0%	15%	30%	130%
Probability (P_i)	0.15	0.20	0.30	0.20	0.15

Solution:

- Risk and return for X Ltd.

Return (k_i)	6%	8%	10%	12%	14%
Probability (P_i)	0.05	0.15	0.60	0.15	0.05

$$\bar{k} = (0.05)(0.06) + (0.15)(0.08) + (0.60)(0.10) + (0.15)(0.12) + (0.05)(0.14)$$

$$= 0.10 \text{ i.e } 10\%$$

$$\sigma = \sqrt{\sum_{i=1}^{n} P_i (k_i - \bar{k})^2}$$

$$\sigma = \sqrt{\begin{array}{l}(0.05)(0.06-0.10)^2 + (0.15)(0.10-0.08)^2 + (0.60)(0.10-0.10)^2 \\ + (0.15)(0.12-0.10)^2 + (0.05)(0.14-0.10)^2\end{array}} = 1.7\%$$

Risk and Return for Y Ltd.

Return (k_i)	-100%	0%	15%	30%	130%
Probability (P_i)	0.15	0.20	0.30	0.20	0.15

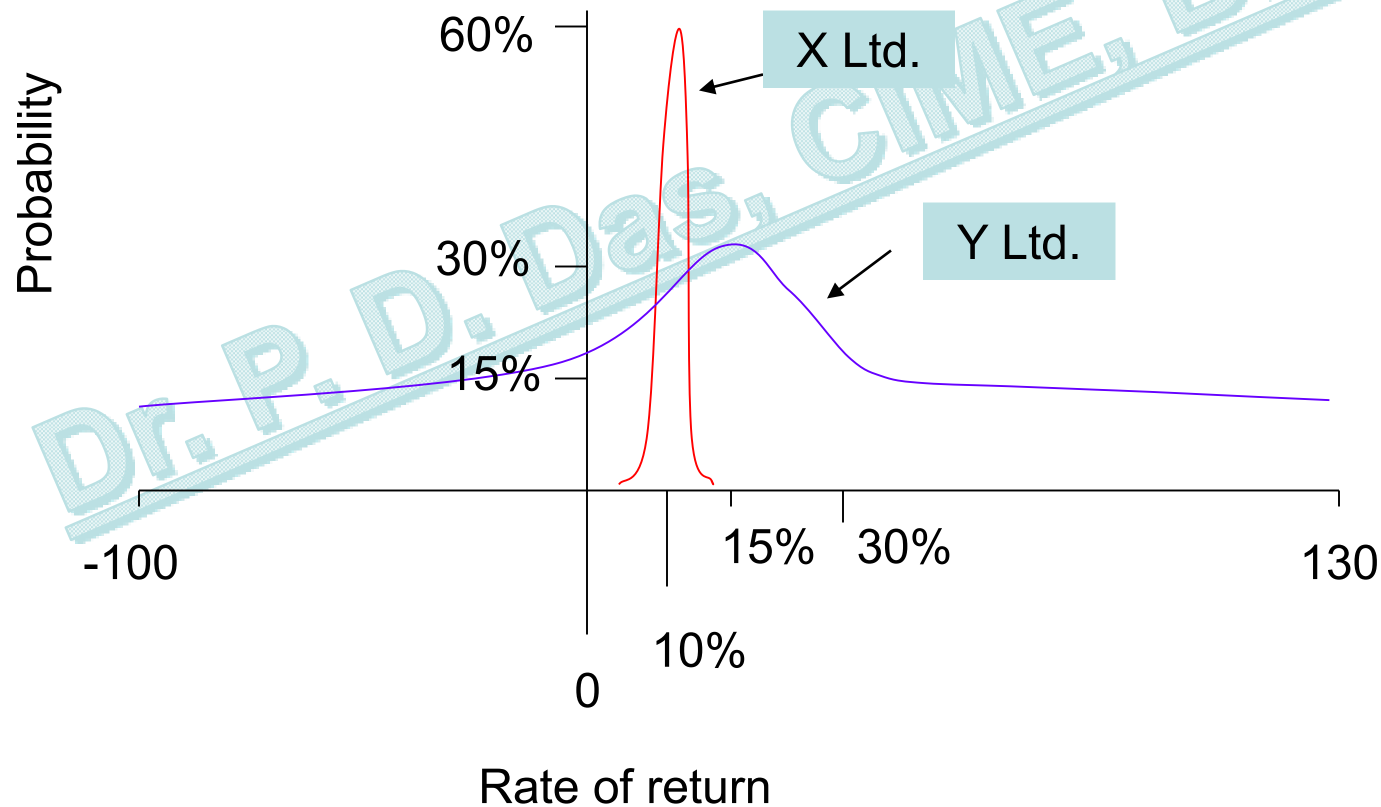
$$\bar{k} = (0.15)(-1.00) + (0.20)(0.00) + (0.30)(0.15) + (0.20)(0.30) + (0.15)(1.3)$$
$$= 15.00\%$$

$$\sigma = \sqrt{\sum_{i=1}^{n} P_i (k_i - \bar{k})^2}$$

$$\sigma = \sqrt{\begin{matrix}(0.15)(1.00 - 0.15)^2 + (0.20)(0.00 - 0.15)^2 + (0.30)(0.15 - 0.15)^2 + \\ (0.20)(0.30 - 0.15)^2 + (0.15)(1.3 - 0.15)^2\end{matrix}} = 63.7\%$$

INFERENCE

- In terms of returns Y Ltd. is better than X Ltd. but it is more risky.
- In terms of risk, X Ltd. is better than Y Ltd. but it offers less returns.



2) Coefficient of variation

- It is a relative measure of dispersion.
- Computed as ratio of standard deviation to the mean.

$$CV = \frac{\sigma_{\bar{x}}}{\bar{x}}$$

- For the previous example:
- $CV_x = 0.17$
- $CV_y = 4.25$

CONCEPT OF A PORTFOLIO

- **Portfolio**: Group of assets held by an individual.
- **Purpose of Constructing a Portfolio: **To reduce risk with the help of diversification.
- **Assumptions of Portfolio Theory:**

  - Investors are risk-averse.

  - Security returns are normally distributed.
- **Portfolio return**

$$k_p = \sum_{i=1}^{n} w_i k_i$$

- **Portfolio risk**

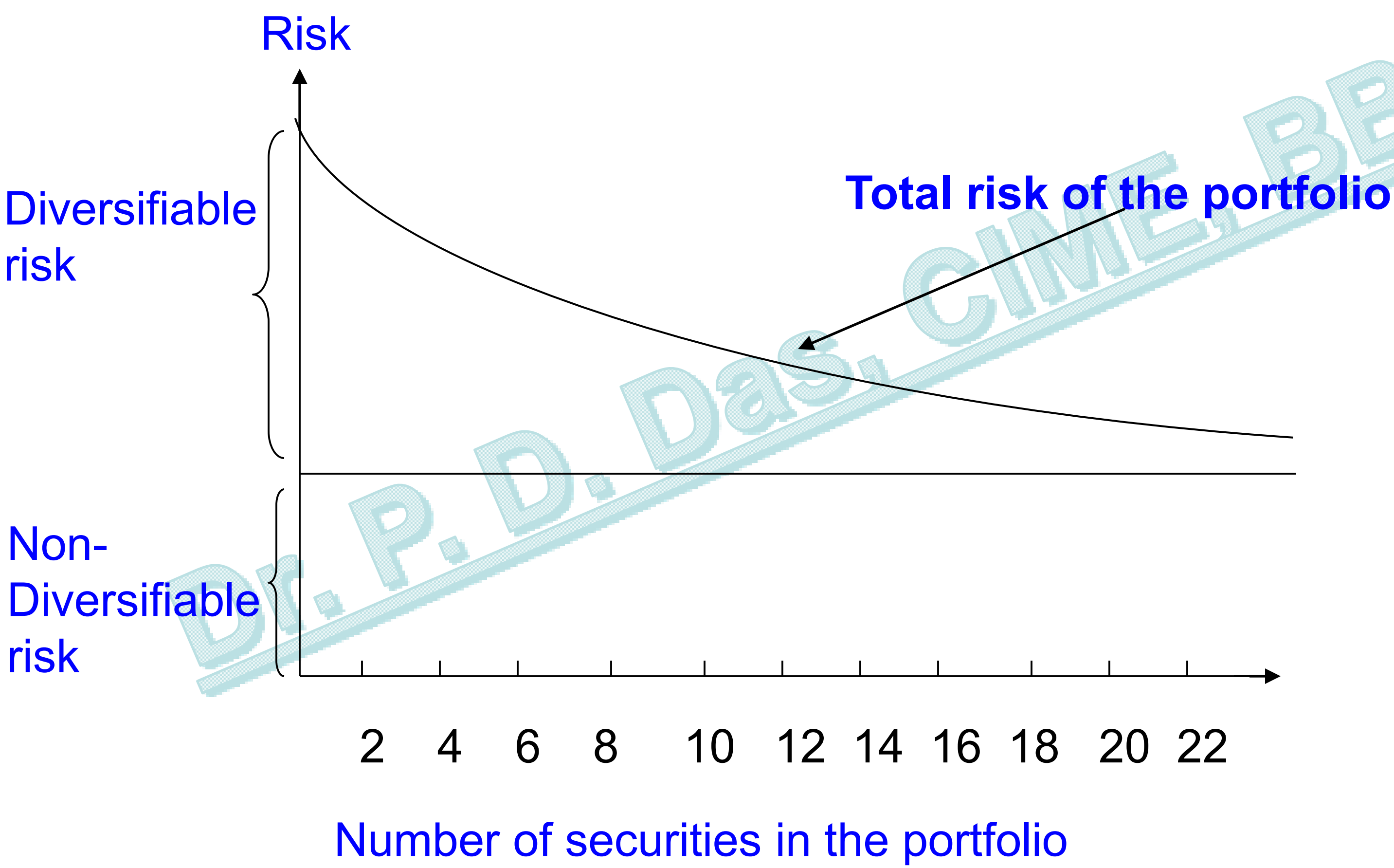
$$\sigma_p = \left[\sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j \rho_{ij} \sigma_i \sigma_j \right]^{1/2}$$

DIVERSIFICATION

RISKS AFFECTING A PORTFOLIO

DIVERSIFIABLE RISK OR UNSYSTEMATIC RISK	NON-DIVERSIFIABLE OR SYSTEMATIC RISK
Risks arising from uncertainties that are unique to an individual security	Risks arising on account of economy-wide uncertainties

RISK REDUCTION THROUGH DIVERSIFICATION



BETA: A MEASURE OF THE SYSTEMATIC RISK

- Beta: Measures risk associated with a security relative to market portfolio.

$$\beta_j = \frac{Cov(k_j, k_m)}{Var(k_m)}$$

- $\beta > 1.0$ indicates above- average risk
- $\beta = 1.0$ indicates average risk.
- $\beta < 1.0$ indicates a less riskier asset than the market.

SHARPE'S SINGLE INDEX MODEL

- Establishes linear relationship between return on security and market return.
- Mathematically expressed as:

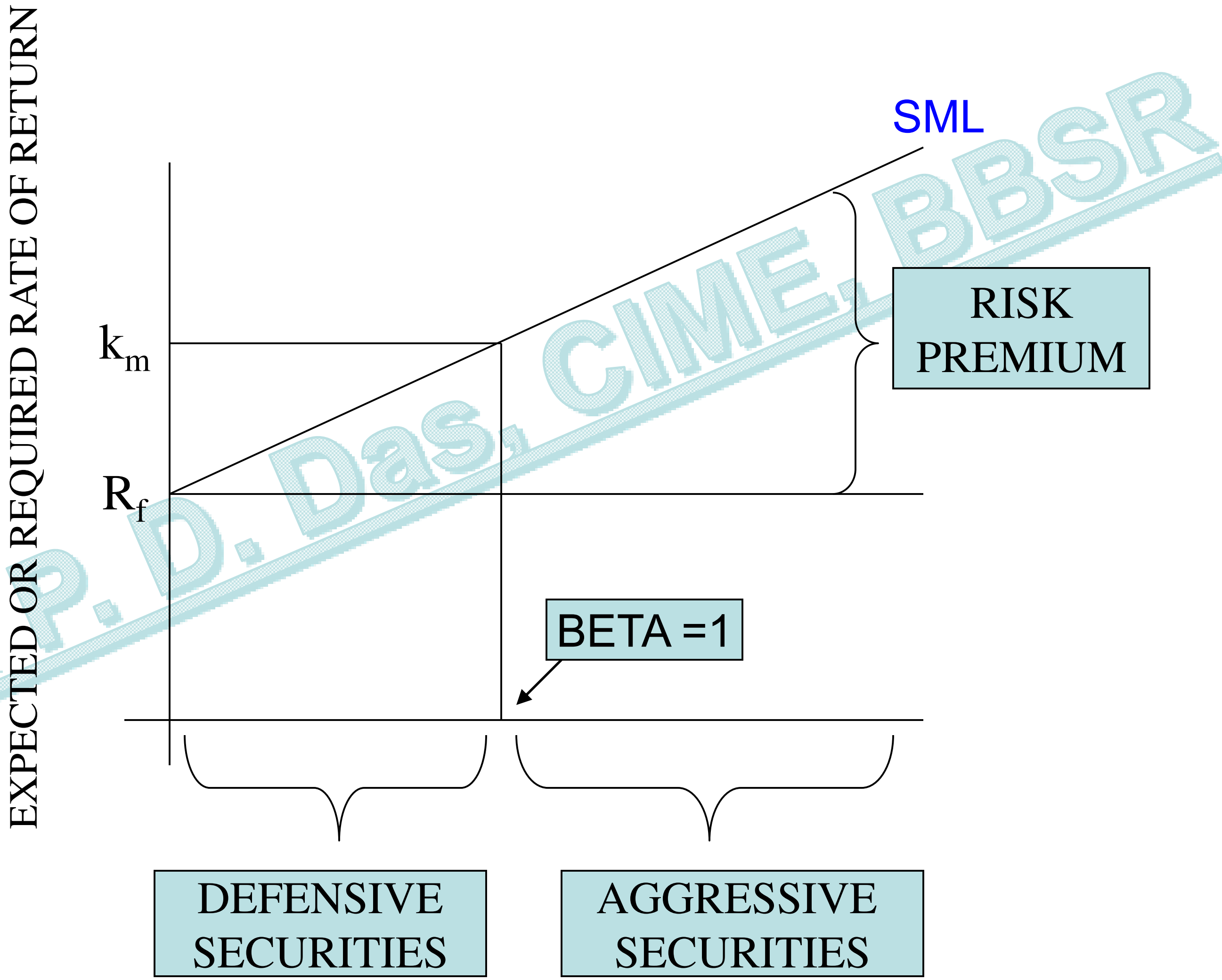
$$k_j = \underbrace{\alpha_j}_{\text{Intercept}} + \underbrace{\beta_j}_{\text{Slope}} k_m + \underbrace{e_j}_{\text{Residual return}}$$

CAPITAL ASSET PRICING MODEL

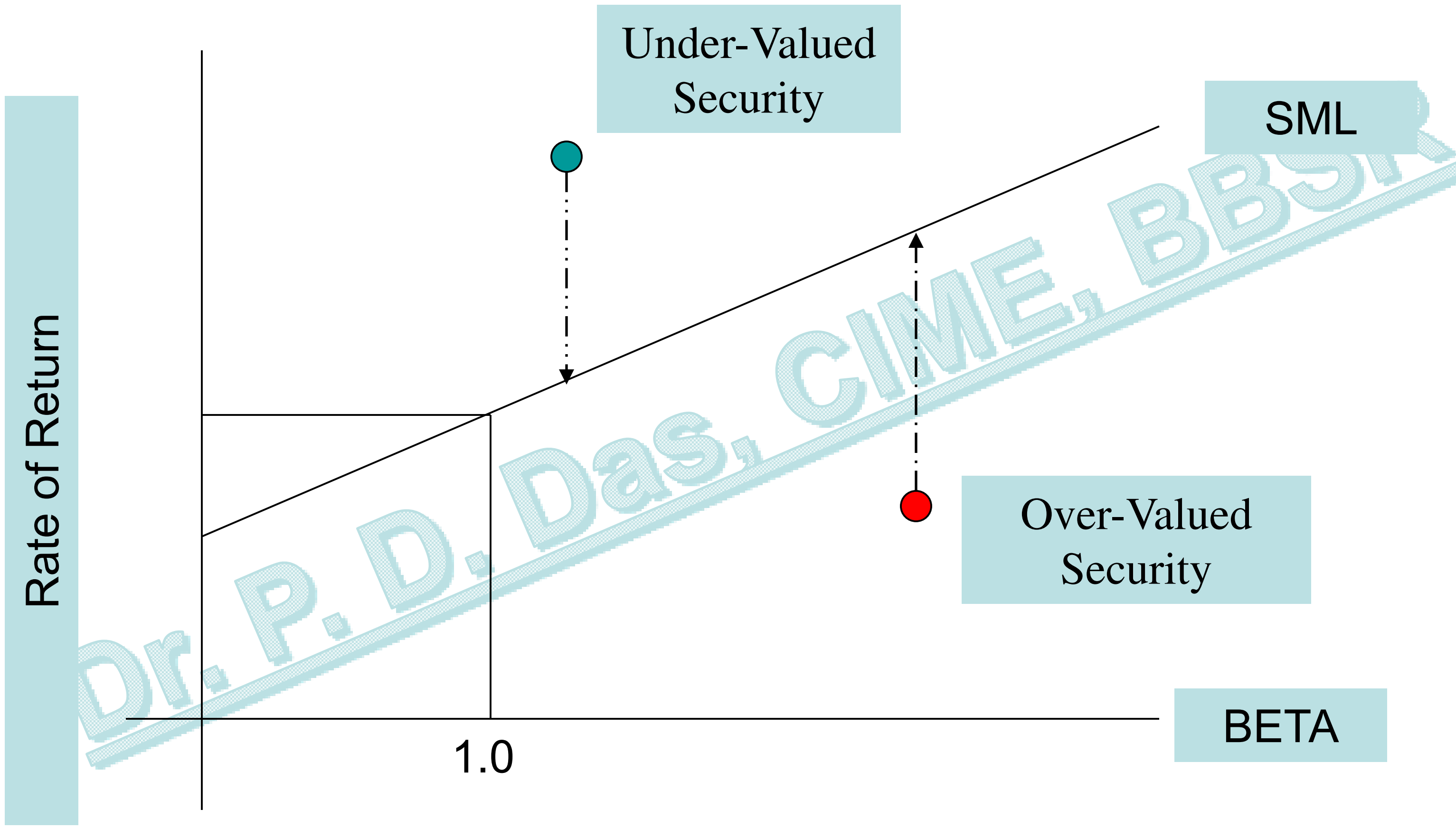
- Establishes linear relationship between return on security and systematic risk
- Mathematically expressed as:

$$k_j = \underbrace{R_f}_{\text{Risk-free rate}} + \overbrace{\beta_j \underbrace{(k_m - R_f)}_{\text{Market Risk Premium}}}^{\text{Security's Risk Premium}}$$

SECURITY MARKET LINE



PRICING IMPLICATIONS OF THE SML



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