Risk and Return

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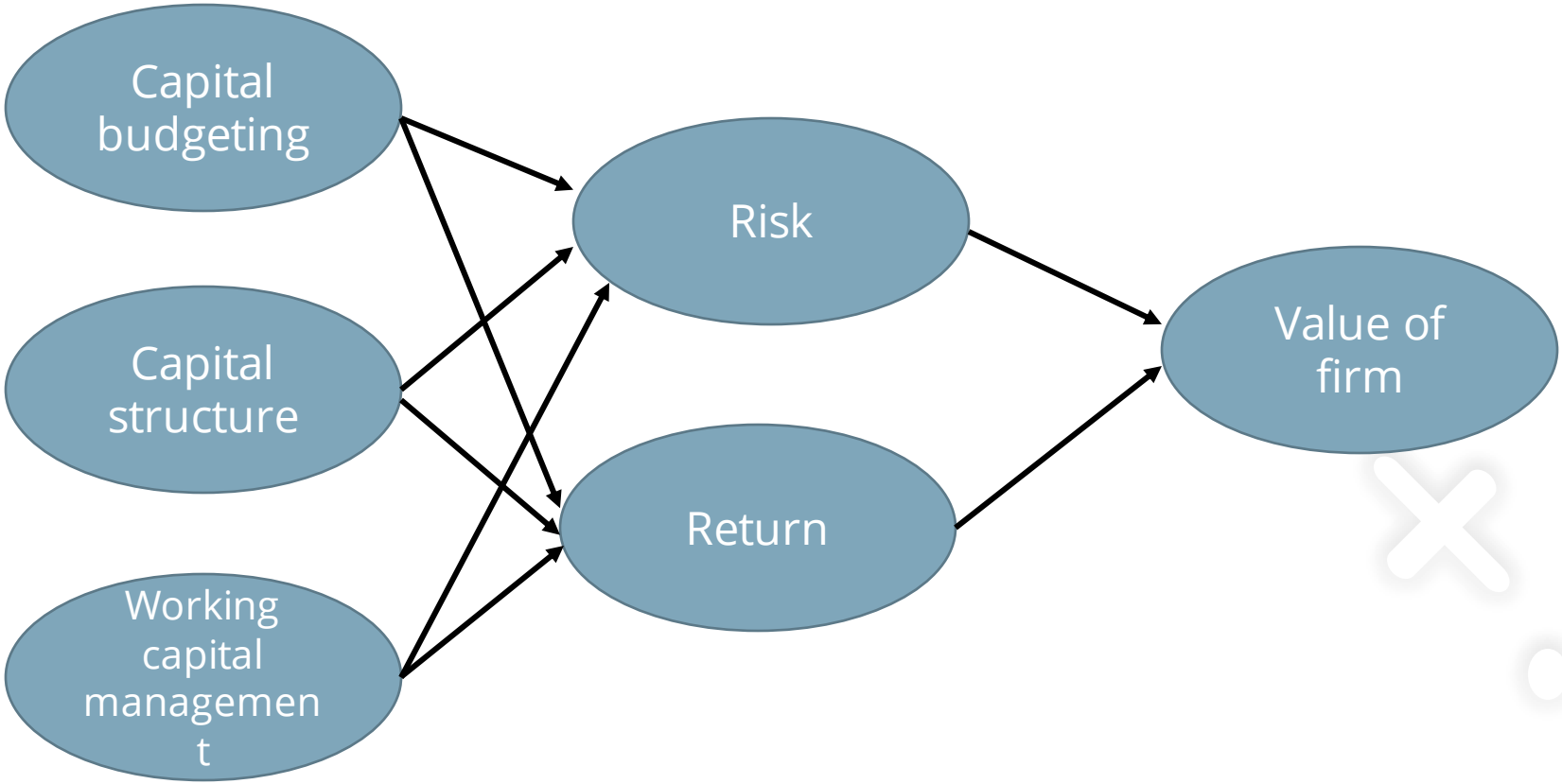
Financial Management

University Elective

Risk is All Pervasive!

- Every decision has a element of risk
- Assessment of risk is an important part of decision making



Decision-making and Risk

- Objective is not to eliminate or avoid risk but determine whether it is worth bearing
- Future cashflows, risk-adjusted discount rate and present values
- Riskiness of a financial asset is measured in terms of the riskiness of its cash flows
- Riskiness of an asset may be measured on a stand-alone basis or in a portfolio context

Topics Covered

- Risk and return of a single asset
- Risk and return of a portfolio
- Measurement of market risk

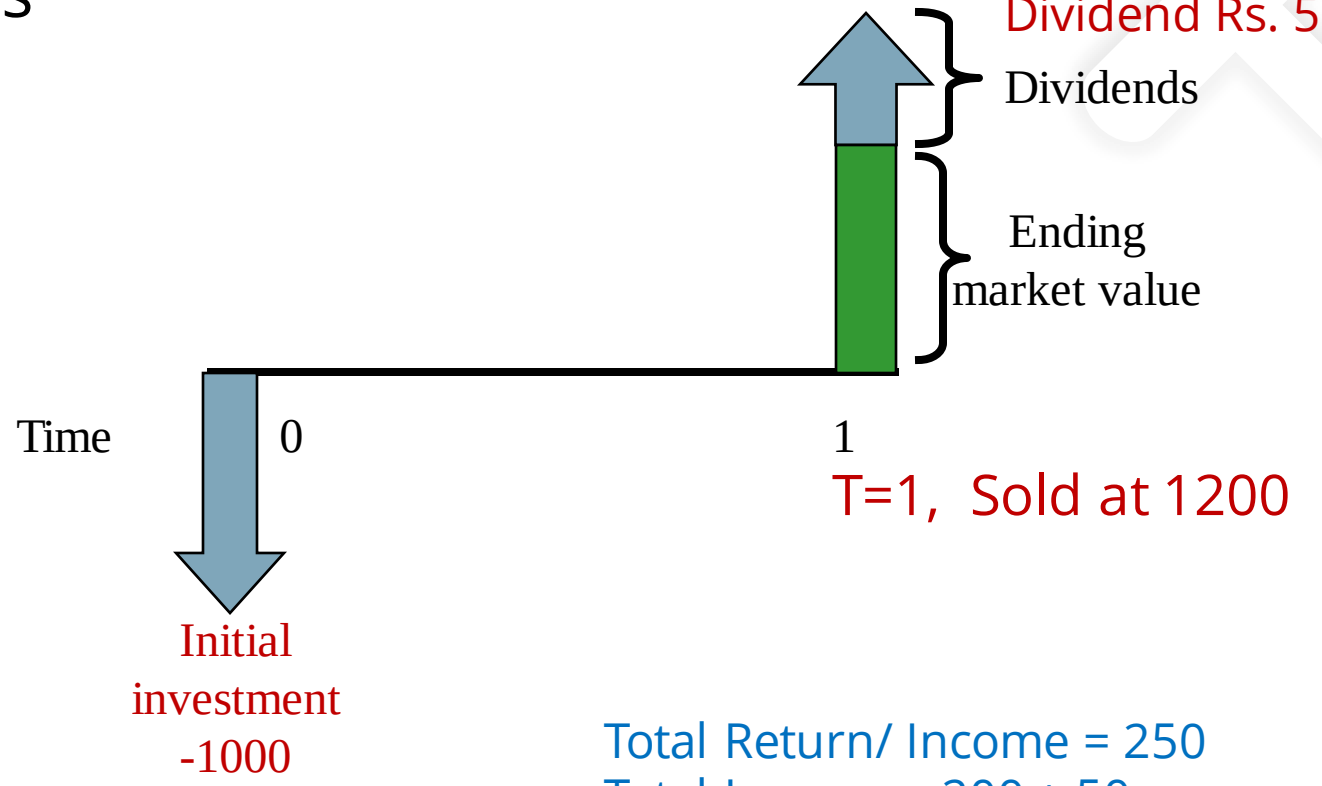
Rate of Return

- Rate of return =

$$\left(\frac{\text{Annual income} + \text{Ending price} - \text{Beginning price}}{\text{Beginning price}} \right)$$

- Based on the probability distribution of the rate of return, two key parameters may be computed: expected rate of return and standard deviation

Returns

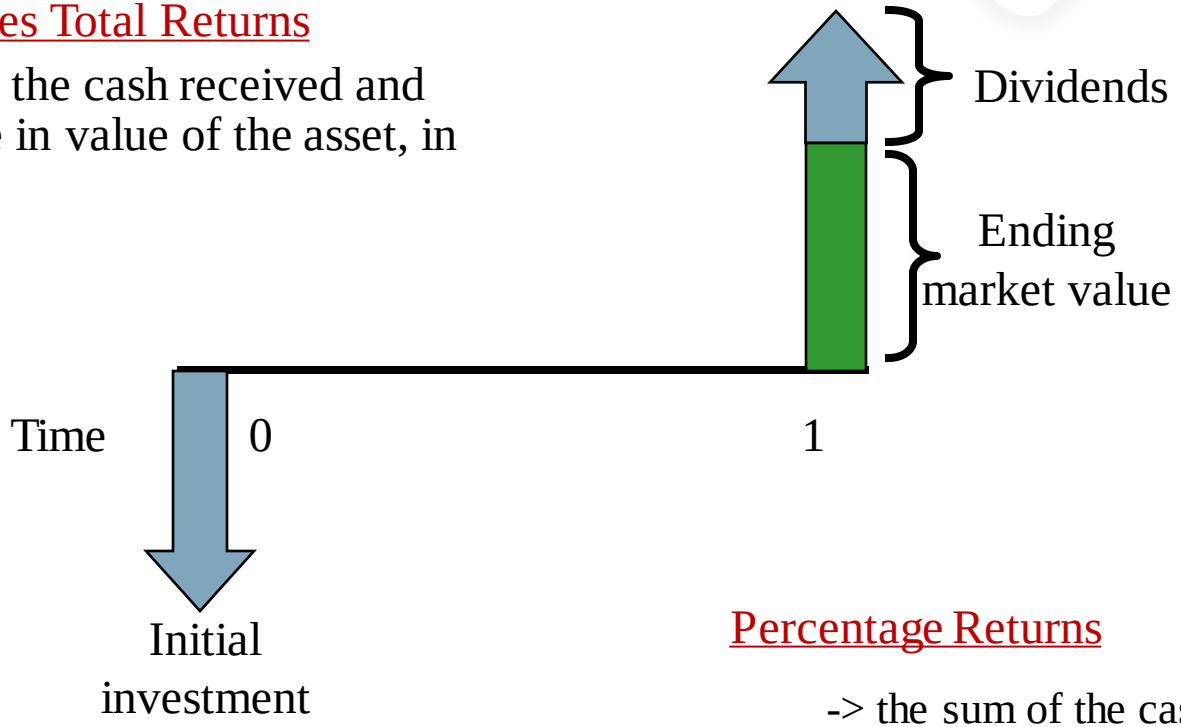


Total Return/ Income = 250
Total Income = 200 + 50
Total Income = Capital gain + Fixed Income

Returns

- Dollar/Rupees Total Returns

  the sum of the cash received and the change in value of the asset, in dollars.



Percentage Returns

-> the sum of the cash received and the change in value of the asset, divided by the initial investment.

Calculation of Returns

- Suppose you bought 100 shares of XYZ Co. one year ago at $45 per share. Over the last year, you received $27 in dividends (27 cents per share × 100 shares). At the end of the year, the stock sells for $48 per share. How did you do?

Expected Rate of Return

- Single asset
- The expected rate of return is the weighted average of all possible returns multiplied by their respective probabilities
- E(R) =$\sum piRi$

Average Annual Return

- Arithmetic mean (of realised returns)
- Sum of observations/number of observations
- Geometric mean (compound growth rate)
- $[(1+R1)\ (1+R2)...(1+Rn)]^{1/n} - 1$

Year	1	2	3	4	5
Returns (%)	19	14	22	-12	5

Risk

- Uncertainty
- Deviation from an expected outcome
- Expected outcome is ‘return’
- Fluctuations/volatility/variability
- Assessment of risk based on historical behaviours/outcomes
- Deviation from historical returns

Variance of Returns (Risk)

- Measured by variance or standard deviation
- Variance $\sigma^2 = \sum(Ri - \overline{R})^2/n - 1$
- Standard deviation is the square root of variance

Measurement of Risk

- Single asset
- Risk refers to the dispersion of a variable
- It is commonly measured by variance or standard deviation
- $\sigma^2 = \sum pi\ (R_i - \overline{R})^2$
- Standard deviation is the square root of variance

Expected Return and Risk on Portfolio

- Weighted average of expected returns on the assets consisting a portfolio
- $\mathrm{E}(R_p) = \Sigma w_i \, \mathrm{E}(R_i)$
- Risk: $\sigma^2 = \sum pi \, (R_i - R)^2$

Diversification and Portfolio Risk

- As more and more securities are added to a portfolio, its risk reduces, but at a decreasing rate
- Total risk = unique risk + market risk
- Unique risk of a security represents that portion of its total risk which stems from firm specific factors. It can be diversified by combining with other securities (diversifiable or unsystematic risk)
- Market risk of a security represents that portion of its risk which is due to economy wide factors (non-diversifiable or systematic risk)
- Market risk of a security reflects its sensitivity to market movements. It is called beta

DIVERSIFICATION AND PORTFOLIO RISK

Probability Distribution of Returns

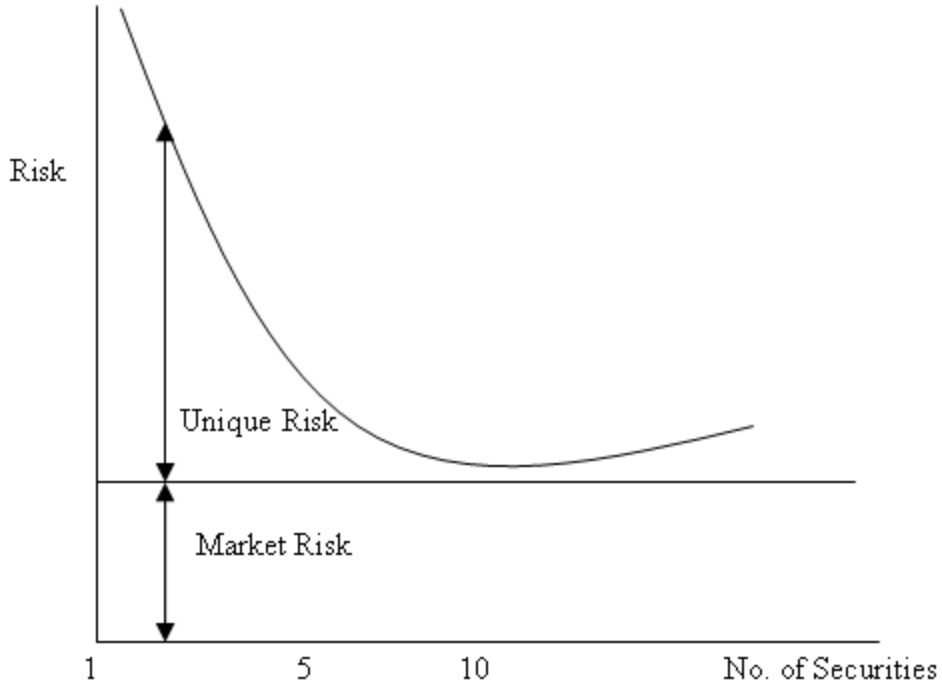
State of the Econcmy	*Probability*	*Return on Stock A*	*Return on Stock B*	*Return on Portfolio*
1	0.20	15%	-5%	5%
2	0.20	-5%	15	5%
3	0.20	5	25	15%
4	0.20	35	5	20%
5	0.20	25	35	30%

Expected Return

Stock A : 0.2(15%) + 0.2(-5%) + 0.2(5%) +0.2(35%) + 0.2(25%) = 15%
Stock B : 0.2(-5%) + 0.2(15%) + 0.2(25%) + 0.2(5%) + 0.2(35%) = 15%
Portfolio of A and B : 0.2(5%) + 0.2(5%) + 0.2(15%) + 0.2(20%) + 0.2(30%) = 15%

Standard Deviation

Stock A : $\sigma^2_A = 0.2(15-15)^2 + 0.2(-5-15)^2 + 0.2(5-15)^2 + 0.2(35-15)^2 + 0.20\,(25-15)^2$
$= 200$
$\sigma_A = (200)^{1/2} = 14.14\%$
Stock B : $\sigma^2_B = 0.2(-5-15)^2 + 0.2(15-15)^2 + 0.2(25-15)^2 + 0.2(5-15)^2 + 0.2\,(35-15)^2$
$= 200$
$\sigma_B = (200)^{1/2} = 14.14\%$
Portfolio : $\sigma^2_{(A+B)} = 0.2(5-15)^2 + 0.2(5-15)^2 + 0.2(15-15)^2 + 0.2(20-15)^2 + 0.2(30-15)^2$
$= 90$
$\sigma_{A+B} = (90)^{1/2} = 9.49\%$


Risk
Unique Risk
Market Risk
1
5
10
No. of Securities

Measurement of Market Risk

- Market risk of a security reflects its sensitivity to market movements. It is called beta.
- It reflects the contribution of an individual stock to the risk of portfolio
- Beta for market portfolio is 1
- Beta of a security greater than 1, greater fluctuations than market portfolio and vice versa

Calculation of Beta

- Market model
- $R_{jt} = \alpha_j + \beta_j R_{Mt} + \varepsilon_j$
- β_j = Cov $(R_j R_M)/\sigma^2$
- Cov = covariance between the return on security j and the return on market portfolio M. It is equal to:
- $\Sigma\ (R_{jt} - R_j)(R_{Mt} - R_M)/(n\text{-}1)$
- Alpha : $\alpha_j = R_j - \beta_j R_M$
- $R_{jt} = \alpha_j + \beta_j R_{Mt} + \varepsilon_j$ (Characteristic line)

Relationship Between Risk and Return

- Securities are risky because their returns are variable
- Common measure of variability – standard deviation
- Types of risk – unique and market
- Unique risk can be eliminated by portfolio diversification
- Contribution of security to portfolio risk is measured by beta
- What is the relationship between beta and return?

Capital Asset Pricing Model

- Developed by Sharpe, Lintner and Treynor
- CAPM – linear relationship between risk and return

$$E(R_i) = R_f + [E(R_M) - R_f]\beta_i$$

- Security market line
- Risk free return
- Risk premium
- Higher the beta, higher the return
- investors are compensated primarily for bearing market risk, but not unique risk

Coefficient of Correlation

- comovement
- correlation coefficient is simply covariance divided by the product of standard deviations.
- Co-variance i,j / SDi *SDj
- The correlation coefficient can vary between –1.0 and +1.0