CHAPTER 1
VALUATION OF SECURITIES
LEARNING OBJECTIVES

• Explain the fundamental characteristics of ordinary shares, preference shares and bonds (or debentures).

• Show the use of the present value concepts in the valuation of shares and bonds.

• Learn about the linkage between the share values, earnings and dividends and the required rate of return on the share.

• Focus on the uses and misuses of price-earnings (P/E) ratio.
3 INTRODUCTION

• Assets can be real or financial; securities like shares and bonds are called **financial assets** while physical assets like plant and machinery are called **real assets**.

• The concepts of return and risk, as the determinants of value, are as fundamental and valid to the valuation of securities as to that of physical assets.

• **Efficient capital market** implies a well-informed, properly functioning capital market.
CONCEPT OF VALUE

• **Book Value**- Book value per share is determined as net worth divided by the number of shares outstanding. Book value reflects historical cost, rather than value.

• **Replacement Value**- Replacement value is the amount that a company would be required to spend if it were to replace its existing assets in the current condition.
5 CONCEPT OF VALUE

- **Liquidation Value** - Liquidation value is the amount that a company could realise if it sold its assets, after having terminated its business.

- **Going Concern Value** - Going concern value is the amount that a company could realise if it sold its business as an operating business.

- **Market Value** - Market value of an asset or security is the current price at which the asset or the security is being sold or bought in the market.
6 FEATURES OF A BOND

• Long-term debt instrument or security.
• Can be secured or unsecured.
• Interest Rate or coupon rate is fixed
• Face Value or par value of Rs 100 or Rs 1,000, and interest is paid on face value.
• Maturity is fixed.
• Redemption value - may be redeemed at par or premium.
• Market Value- may be different from par value or redemption value as it is traded in the market.
BOND INDENTURES

- Contract between the company and the bondholders and includes
  - The basic terms of the bonds
  - The total amount of bonds issued
  - A description of property used as security, if applicable
  - Sinking fund provisions
  - Call provisions
  - Details of protective covenants
8 TYPES OF BONDS

- Bonds with maturity
- Pure discount bonds - The bond discount is the difference between the par value and the selling price.
- Perpetual bonds
9  BOND WITH MATURITY

Bond value = Present value of interest + Present value of maturity value:

\[ B_0 = \sum_{t=1}^{n} \frac{\text{INT}_t}{(1 + k_d)^t} + \frac{B_n}{(1 + k_d)^n} \]
10 EXAMPLE

 Suppose an investor is considering the purchase of a five-year, Rs 1,000 par value bond, bearing a nominal rate of interest of 7 per cent per annum. The investor’s required rate of return is 8 per cent. What should he be willing to pay now to purchase the bond if it matures at par?

 The present value of the bond \( B_0 \) as follows:

\[
B_0 = \frac{70}{(1.08)^1} + \frac{70}{(1.08)^2} + \frac{70}{(1.08)^3} + \frac{70}{(1.08)^4} + \frac{1000}{(1.08)^5}
\]

\[
B_0 = 70 \times 3.993 + 1,000 \times 0.681 = 279.51 + 681 = \text{Rs 960.51}
\]
The **yield-to-maturity** \((YTM)\) is the measure of a bond’s rate of return that considers both the interest income and any capital gain or loss. \(YTM\) is bond’s internal rate of return.

A perpetual bond’s yield-to-maturity:

\[
B_0 = \sum_{t=1}^{n=\infty} \frac{\text{INT}}{(1 + k_d)^t} = \frac{\text{INT}}{k_d}
\]
Current yield is the annual interest divided by the bond’s current value.

**Example:** The annual interest is Rs 60 on the current investment of Rs 883.40. Therefore, the current rate of return or the **current yield** is: \( \frac{60}{883.40} = 6.8 \text{ per cent} \).

Current yield does not account for the capital gain or loss.
For calculating the yield to call, the call period would be different from the maturity period and the call (or redemption) value could be different from the maturity value.

Example: Suppose the 10% 10-year Rs 1,000 bond is redeemable (callable) in 5 years at a call price of Rs 1,050. The bond is currently selling for Rs 950. The bond’s yield to call is 12.7%.

\[
950 = \sum_{t=1}^{5} \frac{100}{(1+YTC)^t} + \frac{1,050}{(1+YTC)^5}
\]
14 BOND VALUE AND AMORTISATION OF PRINCIPAL

Researchers (debenture) may be amortised every year, i.e., repayment of principal every year rather at maturity.

The formula for determining the value of a bond or debenture that is amortised every year, can be written as follows:

\[ B_0 = \sum_{t=1}^{n} \frac{CF_t}{(1+k_d)^t} \]

Note: Cash flow, \( CF \), includes both the interest and repayment of the principal.
Suppose the government is proposing to sell a 5-year bond of Rs 1,000 at 8 per cent rate of interest per annum. The bond amount will be amortised (repaid) equally over its life. If an investor has a minimum required rate of return of 7 per cent, what is the bond’s present value for him?
The outflows every year will consist of interest payment and repayment of principal for Year 1 through 5: Rs 200 + Rs 80 = Rs 280; Rs 200 + Rs 64 = Rs 264; Rs 200 + Rs 48 = Rs 248; Rs 200 + Rs 32 = Rs 232; and Rs 200 + Rs 16 = Rs 216 and the PV of bond is

\[ B_0 = \frac{280}{(1.07)^1} + \frac{264}{(1.07)^2} + \frac{248}{(1.07)^3} + \frac{232}{(1.07)^4} + \frac{216}{(1.07)^5} \]

\[ = 280 \times 0.935 + 264 \times 0.873 + 248 \times 0.816 + 232 \times 0.763 + 216 \times 0.713 \]

\[ = 261.80 + 230.47 + 202.37 + 177.02 + 154.00 \]

\[ = \text{Rs 1025.66} \]
The formula for bond valuation can be modified in terms of half-yearly interest payments and compounding periods as given below:

\[ B_0 = \sum_{t=1}^{2n} \frac{1/2(\text{INT}_t)}{(1+k_d/2)^t} + \frac{B_n}{(1+k_d/2)^{2n}} \]
EXAMPLE

Suppose, a 10-year bond of Rs 1,000 has an annual rate of interest of 12 per cent. The interest is paid half-yearly. What is the value of the bond if the required rate of return is 12 per cent?

18

\[
\sum_{i=1}^{20} \frac{60}{(1.06)^i} + \frac{1,000}{(1.06)^{20}} = 60 \times \text{Annuity factor (6\%, 20)} + 1,000 \times \text{PV factor (6\%, 20)}
\]

\[
= 60 \times 11.4699 + 1,000 \times 0.3118 = 688.20 + 311.80
\]

= Rs 1,000
• Pure discount bond do not carry an explicit rate of interest.
• It provides for the payment of a lump sum amount at a future date in exchange for the current price of the bond.
• The difference between the face value of the bond and its purchase price gives the return or YTM to the investor.
Example: A company may issue a pure discount bond of Rs 1,000 face value for Rs 520 today for a period of five years. The rate of interest can be calculated as follows:

\[
520 = \frac{1,000}{(1 + YTM)^5}
\]

\[
(1 + YTM)^5 = \frac{1,000}{520} = 1.9231
\]

\[
i = 1.9231^{1/5} - 1 = 0.14 \text{ or } 14\%
\]
21 PURE DISCOUNT BONDS

Pure discount bonds are called deep-discount bonds or zero-interest bonds or zero-coupon bonds.

The market interest rate, also called the market yield, is used as the discount rate.

Value of a pure discount bond $= PV$ of the amount on maturity:

$$B_0 = \frac{M_n}{(1+k_d)^n}$$
 EXAMPLE

Consider the IDBI bond with a face value of Rs 500,000 with a maturity of 30 years. Suppose the current market yield on similar bonds is 9 per cent. The value of the IDBI pure-discount bond today is as follows:

\[ B_0 = \frac{500,000}{(1.09)^{30}} = \text{Rs 37,685.57} \]
• **Perpetual bonds**, also called *consols*, has an indefinite life and therefore, it has no maturity value. Perpetual bonds or debentures are rarely found in practice.
EXAMPLE

Suppose that a 10 per cent Rs 1,000 bond will pay Rs 100 annual interest into perpetuity. What would be its value of the bond if the market yield or interest rate were 15 per cent?

The value of the bond is determined as follows:

\[ B_0 = \frac{\text{INT}}{k_d} = \frac{100}{0.15} = \text{Rs 667} \]
The value of the bond declines as the market interest rate (discount rate) increases.

The value of a 10-year, 12 per cent Rs 1,000 bond for the market interest rates ranging from 0 per cent to 30 per cent is shown in the figure.
The intensity of interest rate risk would be higher on bonds with long maturities than bonds with short maturities.

The differential value response to interest rates changes between short and long-term bonds will always be true. Thus, two bonds of same quality (in terms of the risk of default) would have different exposure to interest rate risk.

### Bond Value at Different Interest Rates

<table>
<thead>
<tr>
<th>Discount rate (%)</th>
<th>Present Value (Rs)</th>
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<tbody>
<tr>
<td></td>
<td>5-Year bond</td>
</tr>
<tr>
<td>5</td>
<td>1,216</td>
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<tr>
<td>10</td>
<td>1,000</td>
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<tr>
<td>15</td>
<td>832</td>
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<tr>
<td>20</td>
<td>701</td>
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<td>25</td>
<td>597</td>
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<td>30</td>
<td>513</td>
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</tbody>
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BOND MATURITY AND INTEREST RATE RISK
Bond Duration and Interest Rate Sensitivity

• The longer the maturity of a bond, the higher will be its sensitivity to the interest rate changes. Similarly, the price of a bond with low coupon rate will be more sensitive to the interest rate changes.

• The bond’s price sensitivity can be more accurately estimated by its duration. A bond’s duration is measured as the weighted average of times to each cash flow (interest payment or repayment of principal).
DURATION OF BONDS

• Let us consider two bonds with five-year maturity.

• The 8.5 per cent rate bond of Rs 1,000 face value has a current market value of Rs 954.74 and a YTM of 10 per cent, and the 11.5 per cent rate bond of Rs 1,000 face value has a current market value of Rs 1,044.57 and a yield to maturity of 10.6 per cent.

• Next we find out the proportion of the present value of each flow to the value of the bond.

• The duration of the bond is calculated as the weighted average of times to the proportion of the present value of cash flows.


30 VOLATILITY

 fkk The volatility or the interest rate sensitivity of a bond is given by its duration and YTM. A bond’s volatility, referred to as its modified duration, is given as follows:

\[
\text{Volatility of a bond} = \frac{\text{Duration}}{(1 + \text{YTM})}
\]

 fkk The volatilities of the 8.5 per cent and 11.5 per cent bonds are as follows:

\[
\text{Volatility of 8.5\% bond} = \frac{4.252}{(1.100)} = 3.87
\]

\[
\text{Volatility of 11.5\% bond} = \frac{4.086}{(1.106)} = 3.69
\]
31 THE TERM STRUCTURE OF INTEREST RATES

 GridBagConstraints Yield curve shows the relationship between the yields to maturity of bonds and their maturities. It is also called the term structure of interest rates.

 GridBagConstraints Yield Curve (Government of India Bonds)
• The upward sloping yield curve implies that the long-term yields are higher than the short-term yields. This is the normal shape of the yield curve, which is generally verified by historical evidence.

• Many economies in high-inflation periods have witnessed the short-term yields being higher than the long-term yields. The inverted yield curves result when the short-term rates are higher than the long-term rates.
THE EXPECTATION THEORY

• The expectation theory supports the **upward sloping yield curve** since investors always expect the short-term rates to increase in the future.

• This implies that the long-term rates will be higher than the short-term rates.

• But in the present value terms, the return from investing in a long-term security will equal to the return from investing in a series of a short-term security.
The expectation theory assumes:
- Capital markets are efficient.
- There are no transaction costs and
- Investors’ sole purpose is to maximize their returns.

The long-term rates are geometric average of current and expected short-term rates.

A significant implication of the expectation theory is that given their investment horizon, investors will earn the same average expected returns on all maturity combinations.

Hence, a firm will not be able to lower its interest cost in the long-run by the maturity structure of its debt.
THE LIQUIDITY PREMIUM THEORY

• Long-term bonds are more sensitive than the prices of the short-term bonds to the changes in the market rates of interest.

• Hence, investors prefer short-term bonds to the long-term bonds.

• The investors will be compensated for this risk by offering higher returns on long-term bonds.

• This extra return, which is called liquidity premium, gives the yield curve its upward bias.
THE LIQUIDITY PREMIUM THEORY

• The liquidity premium theory means that rates on long-term bonds will be higher than on the short-term bonds.

• From a firm’s point of view, the liquidity premium theory suggests that as the cost of short-term debt is less, the firm could minimize the cost of its borrowings by continuously refinancing its short-term debt rather taking on long-term debt.
THE SEGMENTED MARKETS THEORY

- The segmented markets theory assumes that the debt market is divided into several segments based on the maturity of debt.
- In each segment, the yield of debt depends on the demand and supply.
- Investors’ preferences of each segment arise because they want to match the maturities of assets and liabilities to reduce the susceptibility to interest rate changes.
THE SEGMENTED MARKETS THEORY

• The segmented markets theory approach assumes investors do not shift from one maturity to another in their borrowing—lending activities and therefore, the shift in yields are caused by changes in the demand and supply for bonds of different maturities.
• Default risk is the risk that a company will default on its promised obligations to bondholders.

• Default premium is the spread between the promised return on a corporate bond and the return on a government bond with same maturity.
## CRISIL’s Debenture Ratings

### High Investment Grades
- **AAA (Triple A): Highest Safety**
  - Debentures rated ‘AAA’ are judged to offer highest safety of timely payment of interest and principal. Though the circumstances providing this degree of safety are likely to change, such changes as can be envisaged are most unlikely to affect adversely the fundamentally strong position of such issues.
- **AA (Double A): High Safety**
  - Debentures rated ‘AA’ are judged to offer high safety of timely payment of interest and principal. They differ in safety from ‘AAA’ issues only marginally.

### Investment Grades
- **A: Adequate Safety**
  - Debentures rated ‘A’ are judged to offer adequate safety of timely payment of interest and principal; however, changes in circumstances can adversely affect such issues more than those in the higher rated categories.
- **BBB (Triple B): Moderate Safety**
  - Debentures rated ‘BBB’ are judged to offer sufficient safety of timely payment of interest and principal for the present; however, changing circumstances are more likely to lead to a weakened capacity to pay interest and repay principal than for debentures in higher rated categories.

### Speculative Grades
- **BB (Double B): Inadequate Safety**
  - Debentures rated ‘BB’ are judged to carry inadequate safety of timely payment of interest and principal; while they are less susceptible to default than other speculative grade debentures in the immediate future, the uncertainties that the issuer faces could lead to inadequate capacity to make timely interest and principal payments.
- **B: High Risk**
  - Debentures rated ‘B’ are judged to have greater susceptibility to default; while currently interest and principal payments are met, adverse business or economic conditions would lead to lack of ability or willingness to pay interest or principal.
- **C: Substantial Risk**
  - Debentures rated ‘C’ are judged to have factors present that make them vulnerable to default; timely payment of interest and principal is possible only if favourable circumstances continue.
- **D: In Default**
  - Debentures rated ‘D’ are judged to have greater susceptibility to default; while currently interest and principal payments are met, adverse business or economic conditions would lead to lack of ability or willingness to pay interest or principal.

### Notes:
1. CRISIL may apply “+” (plus) or “−” (minus) signs for ratings from AA to D to reflect comparative standing within the category.
2. The contents within parenthesis are a guide to the pronunciation of the rating symbols.
3. Preference share rating symbols are identical to debenture rating symbols except that the letters “pf” are prefixed to the debenture rating symbols, e.g. pfAAA (“pf Triple A”).

### Source:
Credit Rating Information Services of India Limited (CRISIL), www.crisil.com
A company may issue two types of shares:

- ordinary shares and
- preference shares

Features of Preference and Ordinary Shares

- Claims
- Dividend
- Redemption
- Conversion
The value of the preference share would be the sum of the present values of dividends and the redemption value.

A formula similar to the valuation of bond can be used to value preference shares with a maturity period:

\[ P_0 = \sum_{t=1}^{n} \frac{PDIV_1}{(1 + k_p)^t} + \frac{P_n}{(1 + k_p)^n} \]
Suppose an investor is considering the purchase of a 12-year, 10% Rs 100 par value preference share. The redemption value of the preference share on maturity is Rs 120. The investor's required rate of return is 10.5 percent. What should she be willing to pay for the share now? The investor would expect to receive Rs 10 as preference dividend each year for 12 years and Rs 110 on maturity (i.e., at the end of 12 years). We can use the present value annuity factor to value the constant stream of preference dividends and the present value factor to value the redemption payment.

\[
P_0 = 10 \times \left[ \frac{1}{0.105} - \frac{1}{0.105 \times (1.105)^{12}} \right] + \frac{120}{(1.105)^{12}}
\]

\[
= 10 \times 6.506 + 120 \times 0.302 = 65.06 + 36.24 = Rs101.30
\]

Note that the present value of Rs 101.30 is a composite of the present value of dividends, Rs 65.06 and the present value of the redemption value, Rs 36.24. The Rs 100 preference share is worth Rs 101.3 today at 10.5 percent required rate of return. The investor would be better off by purchasing the share for Rs 100 today.
The valuation of ordinary or equity shares is relatively more difficult. The rate of dividend on equity shares is not known; also, the payment of equity dividend is discretionary. The earnings and dividends on equity shares are generally expected to grow, unlike the interest on bonds and preference dividend.
DIVIDEND CAPITALISATION

- The value of an ordinary share is determined by capitalising the future dividend stream at the opportunity cost of capital.

- Single Period Valuation:
  - If the share price is expected to grow at $g$ per cent, then $P_1$:
    \[
    P_1 = P_0 (1 + g)
    \]
  - We obtain a simple formula for the share valuation as follows:
    \[
    P_0 = \frac{DIV_1}{k_e - g}
    \]
If the final period is \( n \), we can write the general formula for share value as follows:

\[
P_0 = \sum_{t=1}^{n} \frac{\text{DIV}_t}{(1 + k_e)^t} + \frac{P_n}{(1 + k_e)^n}
\]

- Growth in Dividends\( \text{Growth} = \text{Retention ratio} \times \text{Return on equity} \)
  \[g = b \times \text{ROE}\]

- Normal Growth\( P_0 = \frac{\text{DIV}_1}{k_e - g}\)

- Super-normal Growth
  Share value = PV of dividends during finite super-normal growth period
  \[+ \text{PV of dividends during indefinite normal growth period}\]
EARNINGS CAPITALISATION

• Under two cases, the value of the share can be determined by capitalising the expected earnings:
  • When the firm pays out 100 per cent dividends; that is, it does not retain any earnings.
  • When the firm’s return on equity (ROE) is equal to its opportunity cost of capital.
EQUITY CAPITALISATION RATE

- For firms for which dividends are expected to grow at a constant rate indefinitely and the current market price is given

\[ k_e = \frac{\text{DIV}_1}{P_0} + g \]
CAUTION IN USING CONSTANT-GROWTH FORMULA

- Estimation errors
- Unsustainable high current growth
- Errors in forecasting dividends
VALUING GROWTH OPPORTUNITIES

The value of a growth opportunity is given as follows:

\[ V_g = \frac{\text{NPV}_1}{k_e - g} \]

\[ = \frac{b \times \text{EPS}_1 (\text{ROE} - k_e)}{k_e (k_e - g)} \]
PRICE-EARNINGS (P/E) RATIO: HOW SIGNIFICANT?

- **P/E ratio** is calculated as the price of a share divided by earning per share.
- Some people use P/E multiplier to value the shares of companies.
- Alternatively, you could find the share value by dividing EPS by E/P ratio, which is the reciprocal of P/E ratio.
PRICE-EARNINGS (P/E) RATIO: HOW SIGNIFICANT?

- The share price is also given by the following formula:

\[ P_0 = \frac{\text{EPS}_{1}}{k_e} + V_g \]

- The earnings price ratio can be derived as follows:

\[ \frac{\text{EPS}_{1}}{P_o} = k_e \left[ 1 - \frac{V_g}{P_o} \right] \]
PRICE-EARNINGS (P/E) RATIO: HOW SIGNIFICANT?

- Cautions:
  - E/P ratio will be equal to the capitalisation rate only if the value of growth opportunities is zero.
  - A high P/E ratio is considered good but it could be high not because the share price is high but because the earnings per share are quite low.
  - The interpretation of P/E ratio becomes meaningless because of the measurement problems of EPS.