# SECURITY VALUATION + BUSINESS VALUATION

## Equity Valuation

### 1) Dividend Discount Model (DDM)

Intrinsic value of share at time t=0 ($IV_0$)

$$= \frac{D_1}{1+R_e} + \frac{D_2}{(1+R_e)^2} + \frac{D_3}{(1+R_e)^3} + \ldots\ldots$$

$D_1, D_2, D_3, \ldots\ldots \rightarrow$ Forecasted Dividends

$R_e \rightarrow$ Required rate of return



#### i) No growth DDM

Here, dividend payout ratio = 100%

$\therefore$ DPS = EPS

$$\boxed{IV_0 = \frac{EPS}{R_e}} = \frac{DPS}{R_e}$$

eg A Ltd. is a no growth firm with EPS = 100.
Equity capitalisation rate = 12%.

Find the price at which stock of A Ltd. is presently trading.

$EPS = 100$ , $R_e = 12\%$

$$IV_0 = P_0 = \frac{EPS}{R_e} = \frac{100}{0.12}$$

$$= ₹833.33$$

## ii) Constant Growth DDM

$$IV_0 = \frac{D_1}{R_e - g}$$

where $R_e$ = equity capitalisation rate

$g$ = sustainable growth rate

$D_1$ = Expected Dividend

eg A Ltd. pays a dividend of ₹20/share ($D_0$). This is expected to grow @ 10% p.a forever. If required rate of return is 15%, find out the intrinsic value of share.

$D_0 = 20$

$g = 10\% = 0.1$

$R_e = 15\% = 0.15$

$D_1 = D_0(1+g)$

$= 20(1+0.1)$

$= 22$

$$IV_0 = \frac{D_1}{R_e - g} = \frac{22}{0.15 - 0.1} = ₹440$$

**Sustainable growth rate** [Refer Question 5]

$$g = br$$

where b = Retention ratio = 1 - Dividend payout ratio

r = Return on Equity (ROE)

$$ROE = \frac{PAT}{\text{Net worth}} \quad \text{or} \quad \frac{EPS}{BVPS}$$

## iii) Multiple Growth DDM

[Refer Question 2]

## Comparison b/w E(R) & Re

- Expected Rate of Return [E(R)] is Internal Rate of Return (IRR) of the Stock.

PV of Outflows = PV of Inflows

$$P_0 = \frac{D_1}{1+E(R)} + \frac{D_2}{[1+E(R)]^2} + \ldots\ldots$$

with the help of interpolation we then find the E(R).

For constant growth model –

$$P_0 = \frac{D_1}{E(R)-g}$$

$$\boxed{E(R) = \frac{D_1}{P_0} + g}$$

- Required Rate of Return (Re) is the rate of return required by the investor for the risk which he is willing to take.

$$IV_0 = \frac{D_1}{Re - g}$$

<u>NOTE</u> : If $P_0 > IV_0$ implies $E(R) < Re$ and stock is overvalued and investor should take short position.

If $P_0 < IV_0$ implies $E(R) > Re$ and stock is undervalued and investor should take long


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position.

## Important points from comparison of RoE & Re

| | NPV | Conclusion |
| --- | --- | --- |
| i) RoE > Re | positive | growth will create value for investors |
| ii) RoE = Re | zero | growth will have no effect on value |
| iii) RoE < Re | negative | growth will destroy investor's wealth |



eg EPS of A Ltd. of next year is expected to be ₹ 15/share. Payout ratio = 100% and Re = 12%. Calculate share price at time t=0.

Additional information –

Now taking RoE as ① 15% ② 12% and ③ 10%. and payout ratio = 75%. Calculate share price at time t=0 in each of the 3 cases.

Also calculate Present Value of Growth Opportunities in all the 3 cases.

Share price at t = 0 $= \frac{EPS}{R_e}$

$= \frac{15}{12\%}$

= ₹ 125 / share

| | Case 1 | Case 2 | Case 3 |
|---|---|---|---|
| ROE (r) | 15% | 12% | 10% |
| Retention ratio (b) | 0.25 | 0.25 | 0.25 |
| g = b × r | 3.75% | 3% | 2.5% |
| $D_1 = (EPS)_{t=1}$ × payout ratio | 11.25 | 11.25 | 11.25 |
| Share price at t = 0 | $\frac{11.25}{12\% - 3.75\%}$ = 136.36 | $\frac{11.25}{12\% - 3\%}$ = 125 | $\frac{11.25}{12\% - 2.5\%}$ = 118.42 |

PV40 | 11.36 | 0 | -6.58

Required rate of return not given in question but Rm, Rf and β of stock is given then Re is computed with the help of CAPM.

$$R_e = R_f + (R_m - R_f)\beta$$

where $R_f$ = Risk free rate of return / yield on Govt. securities

$R_m$ = Return on market portfolio

$\beta$ = Beta of stock

$R_m - R_f$ = market risk premium

$(R_m - R_f)\beta$ = Security risk premium



## Free Cash Flow

Types of FCF

→ Free cash flow for firm (FCFF)

Free cash flow for equity (FCFE)

→ Discount FCFF @ Kc

Discount FCFE @ Ke

→ Gives value of firm    Gives value of equity

NOTE : Value of equity under FCFF = Value of firm − Value of debt

Value of firm / Enterprise value under FCFF

$$= \frac{FCFF_1}{1+K_c} + \frac{FCFF_2}{(1+K_c)^2} + \ldots\ldots$$

$$K_c = W_d K_d + W_e K_e$$

where $W_d$ = weight of debt
$W_e$ = weight of equity
$K_d$ = post tax cost of debt
$K_e$ = cost of equity

For computation of $K_c$, weights of equity and debt are determined as per target capital structure ①. If it is not given then as per ② market value and if that is also not given then as per book value ③.

## Calculation of FCFF

| | | |
|---|---|---|
| | Sales | xxx |
| Less : | Operating expenses excluding depreciation | (xxx) |
| | EBDIT | xxx |
| Less : | Depreciation | (xxx) |
| | EBIT | xxx |

(I) $NOPAT = EBIT(1-t)$

(II) $\text{Net investment} = CAPEX - Dep^{n} + \Delta WC$

$$FCFF = (I) - (II)$$
$$= NOPAT - \text{Net investment}$$

- **No Growth**

$$\text{Value of firm} = \frac{NOPAT}{K_c}$$

($\because$ in case of no growth, net investment will be zero)

- Constant Growth

$$\text{Value of firm} = \frac{FCFF_1}{K_c - g}$$

- Multiple Growth

[Refer Problem 24 and 39]

## Value of equity under FCFE

$$= \frac{FCFE_1}{1+K_e} + \frac{FCFE_2}{(1+K_e)^2} + \dots\dots$$

If target debt financing ratio is given -

$$\boxed{FCFE = PAT - NI(1 - W_d)}$$

where PAT = profit after tax

NI = Net investment

= CAPEX − Depⁿ + ΔWC

$W_d$ = weight of debt

**OR**

$$\boxed{FCFE = PAT - NI \times W_e}$$

## If target debt financing ratio not given –

$$FCFE = PAT - (\text{Net investment} - \text{Net borrowing})$$

(Net investment – Net borrowing) → Equity investment

and Net borrowing = Total borrowings less Repayments made

## Value of strategy [Refer Problem 46]

Value of Strategy = Post strategy Value – Pre strategy Value



- If gross profit margin remains constant then EBIT and NOPAT will increase at the same rate as sales.
- If asset turnover ratio remains constant then Capital employed (CE = FA + CA - CL) will increase at the same rate as sales.

$$\text{Net investment} = \text{Capex} - \text{Dep}^n + \Delta WC$$
$$= \Delta FA + \Delta CA - \Delta CL$$
$$= \Delta CE$$

- ## EVA & MVA

EVA = NOPAT − (WACC or Kc × Capital employed or Invested Capital)

MVA = Market value of company (less) Capital employed as per books

Also MVA = PV of all future EVA's discounted @ Kc

## ACCOUNTING BASED VALUATION

i) Net Assets Approach

$$\text{Value of the share} = \frac{\text{Economic value of Assets} - \text{Economic value of Liabilities}}{\text{No. of shares o/s}}$$

ii) Earnings Capitalisation Approach [Refer Problem 26]

$$\text{Value of the business} = \frac{\text{Normal earnings}}{\text{Capitalisation rate}}$$

iii) Yield Capitalisation Approach [Refer Problem 9]

$$\text{Value of share} = \frac{\text{Actual yield}}{\text{Expected yield}} \times \text{Paid up value per share}$$

## Exponential Moving Average (EMA)

$$EMA_t = a(P_t - EMA_{t-1}) + EMA_{t-1}$$

where, $a$ (exponent) $= \frac{2}{n+1}$

$P_t$ = Price of today

$EMA_{t-1}$ = Previous day EMA

$n$ = no. of days for which average is to be calculated

## Runs Test for testing weak form of efficient market hypothesis

Expected number of runs is calculated by using the following formula:

$$\mu_r = \frac{2n_1n_2}{n_1+n_2} + 1$$

Where, $n_1$ = number of + symbols
$n_2$ = number of − symbols

Standard deviation in runs test is calculated by using the following formula:

$$\hat{\sigma}_r = \sqrt{\frac{2n_1n_2(2n_1n_2 - n_1 - n_2)}{(n_1+n_2)^2(n_1+n_2-1)}}$$

lower limit: $\mu_r - t \times \hat{\sigma}_r$
upper limit: $\mu_r + t \times \hat{\sigma}_r$

If value of r lies between these limits then the market exhibits weak form of efficiency.

## Auto - Correlation Test

[Refer Q.1 (a) of Jan 2021 Paper
Or Q.58 of Question Bank]


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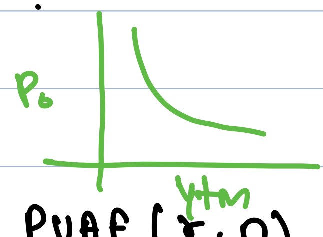
# Bond Analysis

$IV_0$ = PV of FCF's discounted at $R_e$
where $R_e$ = yield available on similar bonds

$P_0$ = PV of FCF's discounted at YTM of bond

$P_0 = IV_0$ → Bond is correctly priced
$P_0 > IV_0$ → Bond is overpriced and investor should take short position
$P_0 < IV_0$ → Bond is underpriced and investor should take long position.

<u>NOTE</u>: There is an inverse relationship b/w bond price and yield. Bond price (y-axis) vs yield (x-axis) curve is convex to the origin.




- **For Conventional Bonds**

$IV_0$ = Coupon Amount × PVAF (r, n) + Redemption Amount × PVIF(r, n)

$$Ytm = \frac{I + \frac{F-P}{n}}{\frac{F+P}{2}}$$

where $I$ = periodic Coupon amount
$F$ = Redemption amount
$P$ = current market price of the bond
$n$ = no. of remaining periods to maturity

$Ytm = Re$ ⇒ Bond is correctly priced ($P_0 = IV_0$)

$Ytm > Re$ ⇒ Investor should take long position. ($P_0 < IV_0$)

$Ytm < Re$ ⇒ Investor should take short position. ($P_0 > IV_0$)

- **For Perpetual Bonds**

$$IV_0 = \frac{A}{i}$$

$$Ytm = \frac{A}{P_0}$$

- **For Zero Coupon Bonds**

$$IV_0 = \text{Face value} \times PVIF(r, n)$$
$$= \frac{FV}{(1+r)^n}$$

$$ytm = \left(\frac{FV}{P_0}\right)^{1/n} - 1$$

- **For Unconventional Bonds**

$$IV_0 = \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_n}{(1+r)^n}$$

ytm = internal rate of return (IRR) at which PV of cash inflows is equal to PV of cash outflows.

**NOTE:** Current yield = $\frac{\text{Coupon Amount}}{\text{Price}} \times 100$

## Effective Duration of Bond [Method to find Price volatility if $\Delta y$ is given]

$$ED = \frac{P_2 - P_1}{2 P_0 \Delta y}$$

where $P_2$ = price of bond after decrease in yield.

$P_1$ = price of bond after increase in yield.

$P_0$ = current market price of the bond

$\Delta y$ = interest rate shock in decimals.

**NOTE:** If yield decreases, price of the bond increases at a faster rate and if yield increases, price of the bond decreases at a lower rate.

## Modified Duration [Method to find price volatility if $\Delta y$ is not given]

$$MD = \frac{D}{\left(1 + \frac{ytm}{n}\right)}$$

where D = Macaulay's Duration = $\frac{\sum wx}{\sum w}$

x = Time i.e. 1, 2, 3, 4, ....., n

w = PV of CF's discounted @ Ytm

**NOTE**: i) For ZCB, Macaulay's Duration (D) is equal to maturity (n)

ii) Higher the value of D, more volatile will be bond.

iii) $$D = \frac{CY}{Ytm} \times PVAF(Ytm, n) \times (1+Ytm) + \left(1 - \frac{CY}{Ytm}\right) \times n$$

iv) % Change in price of bond
= Modified Duration × Change in yield
= MD × $\Delta y$

v) For bond trading at par, CY = Ytm
D = PVAF(Ytm, n) × (1 + Ytm)

vi) For bond trading at par and with infinite maturity, $D = \frac{1 + ytm}{ytm}$

vii) Lower ytm / coupon bonds are more volatile than higher ytm / coupon bonds.

## Convexity (rate of change in duration)

- If interest rate shock not given, then

$$\frac{\sum wx(1+x)}{\sum w(1+r)^2}$$

- If interest rate shock is given, then

$$C^* \times (\Delta y)^2 \times 100$$

where $C^* = \frac{P_2 + P_1 - 2P_0}{2P_0(\Delta y)^2}$

## Term Structure of Interest Rates

→ Graphical presentation of term structure is known as yield curve.

→ Spot rate ($r_{0n}$) refers to ytm of ZCBs.

**Bootstrap Method**

Deriving term structure of interest rates with the help of coupon bearing bonds.

**Forward Rate**

Interest rate fixed today for borrowing or investing a sum of money at a future date.

$f(3,5)$ → 2 year forward at $t = 3$

or

2 year forward after 3 years

$$f(t_1, t_2) = \left[\frac{(1 + r_{0t_2})^{t_2}}{(1 + r_{0t_1})^{t_1}}\right]^{\frac{1}{t_2 - t_1}} - 1$$

e.g.

$$f(3,5) = \left[\frac{(1 + r_{05})^{5}}{(1 + r_{03})^{3}}\right]^{1/2} - 1$$

# Bond Equivalent Yield, Effective Annual Yield, Discount Yield and Holding Period Yield

## Bond Equivalent Yield or Nominal Interest Rate

$$= \frac{F-P}{P} \times 100 \times \frac{12}{n} \quad \text{(months)}$$

OR

$$\frac{F-P}{P} \times 100 \times \frac{365}{n} \quad \text{(days)}$$

## Effective Annual Yield

$$= \left[1 + \text{Nominal interest rate} \times \frac{n}{12}\right]^{12/n} - 1$$

OR

$$\left[1 + \text{nominal interest rate} \times \frac{n}{365}\right]^{365/n} - 1$$

## Discount Yield

$$= \frac{F-P}{F} \times 100 \times \frac{12}{n} \quad \text{(months)}$$

OR

$$\frac{F-P}{F} \times 100 \times \frac{365}{n} \quad \text{(days)}$$

Holding Period yield

$$= \frac{F - P}{P} \times 100$$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