

TOPIC

Unit 4

Calculation of YTM

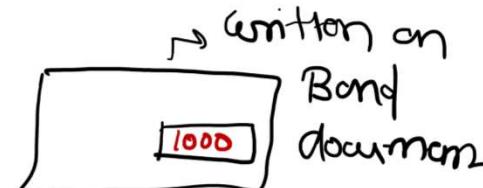
[Bond Valuation]

yield till maturity

TOPIC

Bond:- "Debt Instrument" → Normally unsecured

" Normally issued at discount and repaid at face value"



£1000

£800

* ZERO Coupon Bond ⇒ "Issued at heavy discount and repaid at face value and no Periodic Interest." ⇒ $FV = 100$] ⇒ No IP = 30] ⇒ Interest

e.g.: - 12% Bond of £ 10,000 issued at £ 9000 for 5 years and Interest Rate is 10%.

Coupon Rate ↓
↓
Actual Interest
Always apply
on face value

Face Value ↓
↓
Redemption Value

Issue Price ↓
↓
Tenure
↓
Maturity

$10000 \times 12\% = 1200$

1	1200
2	1200
3	1200
4	1200
5	1200
5	10,000

Investor Expectation
↓
Cost of Capital
↓
Discounting Rate

TOPIC

TERMS ASSOCIATED WITH BONDS

- Face Value: Also known as the par value
- Coupon rate: A bond carries a specific rate of interest \Rightarrow Actual Interest
- Maturity \Rightarrow Repay Period
- Redemption Value \Rightarrow Repay Value [Normally Face value]
- Interest Rate \Rightarrow Discounting Rate = Expectation of Investor
- Market Value \Rightarrow Stock Exchange Price

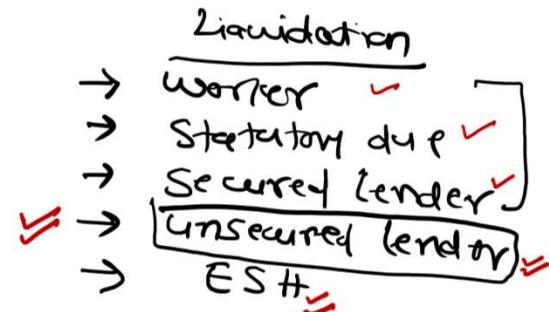


"Value written on Bond"

TOPIC

TYPES OF BONDS

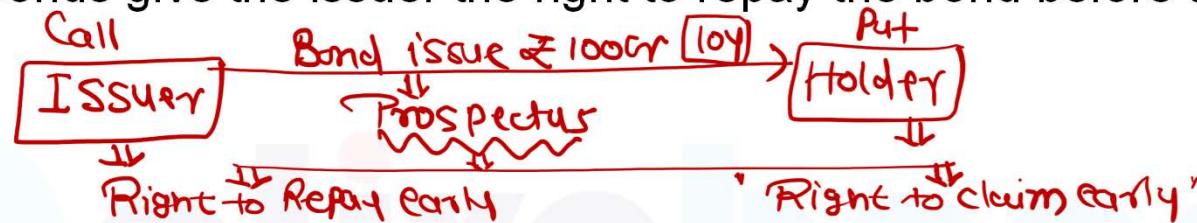
- Fixed rate bonds := Interest fixed
- Floating rate notes = Variable Interest \Rightarrow LIBOR + 4%
- Zero-coupon bonds = Issued at heavy disc., Paid at FV (no Periodic Interest)
- High-yield bonds (junk bonds) that are rated below investment grade by the credit rating agencies. As these bonds are riskier than the investment grade bonds, investors expect to earn a higher yield.
- Convertible bonds \Rightarrow 'Can convert into ESC.'
- Inflation-indexed bonds = Interest depends on inflation in market
- Other indexed bonds, for example equity-linked notes \Rightarrow "Return depends on Shares of Company"
- Asset-backed securities are bonds \Rightarrow "Value depends on Some Asset" = Gold Bond
- Subordinated bonds are those that have a lower priority than other bonds of the issuer in case of Liquidation.
 \hookrightarrow Unsecured Category



TOPIC

OPTIONALITY IN BONDS

Callability - Some bonds give the issuer the right to repay the bond before the maturity



Putability - Some bonds give the holder the right to force the issuer to repay the bond before the maturity date on the put dates.

TOPIC**Valuation of Bond [Intrinsic Value]**

→ Should be Value

⇒ Discounted Cash Flow

e.g.: - **12-1. Bond** rf **₹ 10,000** issued at **₹ 9000** for **5 years**, **Interest Rate @ 10%**.
 ⇒ Find Value of Bond ⇒ Suggest Buy/Sale @ **₹ 11000** **DISC Rate**

CF PVF@10%.

$$1 \checkmark 1200 \times 0.909 \checkmark = 1090.80 \checkmark$$

$$2 \checkmark 1200 \times 0.826 \checkmark = 991.20 \checkmark$$

$$3 \checkmark 1200 \times 0.751 \checkmark = 901.20 \checkmark$$

$$4 \checkmark 1200 \times 0.683 \checkmark = 819.6 \checkmark$$

$$5 \checkmark 1200 \times 0.621 \checkmark = 745.2 \checkmark$$

$$5. \checkmark 10000 \times 0.621 \checkmark = 6210 \checkmark$$

Intrinsic Value

$$1200 \div 1.10 = m+$$

$$= m+$$

$$= m+$$

$$= m+$$

$$= m+$$

$$10,000 \boxed{= S_{time}} m+ \Rightarrow MRC$$

$$\underline{\underline{10758}}$$

$$\frac{1200}{1.10} < 11000 \Rightarrow \boxed{Sale}$$

$$10000 \times 12.1 = 1200$$

$$Disc. Factor \left(\frac{1}{1+0.10} \right)^n$$

$$\frac{1}{1.10} \Leftarrow \frac{1}{1+0.10}$$

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HW 15% Bond of ₹ 100000 issued at 80000, Tenure = 6 years

/ ⇒ Find Value of Bond

$$\boxed{1,12,334}$$

⇒ Suggest Buy/Sale @ 1,10,000.

$$\boxed{\text{Buy}}$$

$$\Rightarrow \boxed{15000} \div \boxed{1.12} = \underbrace{m+}_{1y} = \underbrace{m+}_{2y} = \underbrace{m+}_{3y} = \underbrace{m+}_{4y} = \underbrace{m+}_{5y} = \underbrace{m+}_{6y}$$

$$\boxed{m+} \leftarrow m+ = 100000 \\ \boxed{1,12,334} \quad \boxed{6 \text{ times}}$$

HW 12-1. Bond ₹ 100000

Tenure 15 years
Interest 10-1%

$$\boxed{\frac{1}{1.10}}$$

$$12000$$

$$\Rightarrow \boxed{\text{Value}} = \boxed{1,15,212}$$

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e.g.: 12-1. Bond of £10,000, issued @ 8000, Interest Rate @ 10%.

$$\begin{aligned}
 & \text{CF} = 600 \\
 & \text{PV} @ 5\% = \frac{1}{1.05} \\
 & 1 \quad 600 \times 0.95 = \\
 & 2 \quad 600 \times 0.907 = \\
 & 3 \quad 600 \times 0.863 = \\
 & 4 \quad 600 \times 0.823 = \\
 & 5 \quad 600 \times 0.784 = \\
 & 6 \quad 600 \times 0.746 = \\
 & 6000 \times 0.746 = \underline{\underline{10,507}}
 \end{aligned}$$

$$\frac{1}{1.05} =$$

Tenure = 3 years

$$\begin{aligned}
 & \frac{600}{1.05} = m+ \\
 & 600 \div 1.05 = 6 \text{ times} \\
 & MRC \leftarrow m+ \leftarrow \underline{\underline{10000}} \\
 & \downarrow \quad \downarrow \quad \downarrow \\
 & 10,507 \Rightarrow \text{Bond Value}
 \end{aligned}$$

<u>Rate / 2</u>	<u>Time x 2</u>
Coupon Paid Semi-Annually	
Coupon Rate	Interest
$\frac{12\%}{2}$	$\frac{10\%}{2}$
6%	5%
	Tenure
	3×2
	6 years

* Current Yield on Bond :- " 12-1. Bond of £10000
 (Current MP) Market Price today

$$\begin{aligned}
 & \Rightarrow \frac{10000 \times 12\%}{12000} = \frac{1200}{12000} \times 100 = 10\%
 \end{aligned}$$

TOPIC

CURRENT YIELD ON BOND

Current yield = Coupon interest/current market price

YIELD-TO-MATURITY OF BOND

It is the rate of return earned by an investor, who purchases a bond and holds it until the maturity. The YTM is the discount rate, which equals the present value of promised cash flows to the current market price/ Purchase price.

Example:

Consider a Rs 1000 par value bond, whose current market price is Rs 850/-, The bond carries a coupon rate of 8% and has the maturity period of 9 yrs. What would be the rate of return that an investor earns if he purchase the bond and holds until maturity?

1	1200	x	PvEIRR 14.1.
2	1200	x	=] \Rightarrow PvIF
3	1200	x	= outflow
4	1200	x	=
5	1200	x	=
5	10000	x	<u>9000</u>

Internal Rate of Return

"A Rate at which discounted value of inflow equals to outflow"
 $PVIF = PVOF \Rightarrow NPV = 0$

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Eg:- Q1. Bond of ₹ 10,000, issued at ₹ 9000 find y_m if Tenure is 5 years

$$\Rightarrow \frac{\text{Interest} + \frac{\text{Red. Value} - \text{Issue Price}}{\text{Time}}}{\text{Red. Value} + \text{Issue Price}} \times 100$$

⇒ Interpolation
⇒ Cost of debt

$$= \frac{I + \frac{R_v - I_p}{n}}{\frac{R_u + N_p}{2}} \times 100$$

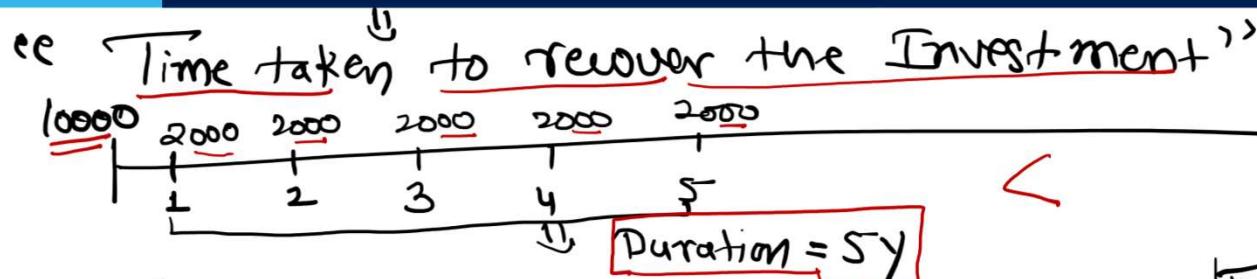
$$\Rightarrow \frac{1200 + \frac{10,000 - 9000}{5}}{10000 + 9000} \times 100 = \frac{1400}{9500} \times 100 = [14.741.]$$

	CF	PV @ 14.741.
1	1200	x
2	1200	x
3	1200	x
4	1200	x
5	1200	x
5	10000	x

$$1200 \div 1.1474$$

$$\frac{10000}{5} \equiv \frac{m}{\text{Time}}$$

* IRR = Rate at which
Your Inflow disc. Value
= Your outflow

TOPIC**Duration of Bond**

⇒ "Maturity and duration are two separate concepts."

10y = Maturity

- ⇒ $\begin{cases} \text{YTM} (\uparrow) \\ \text{Coupon Rate} (\uparrow) \\ \text{frequency of coupon} (\uparrow) \end{cases}$ $\Rightarrow \text{Duration} (\downarrow)$ "YTM, Coupon Rate, frequency have -ve relation with Duration"
- ⇒ Duration < Maturity
- ⇒ Perpetual Bond $\Rightarrow \text{Duration} = \frac{(1+r)}{r}$ Ex:- Find duration of 12-1. Perpetual Bond $\Rightarrow \frac{(1+0.12)}{0.12} = 9.33 \text{ years}$

TOPIC

PROPERTIES OF DURATION

- ✓ Duration is less than the term to maturity.
- ✓ Bond's duration will be equal to its term to maturity if and only if it is a zero coupon bond.
- ✓ The duration of perpetual bond is equal to $(1+r)/r$, where r = current yield of the bond. ↗
- ✓ The longer a coupon paying bond's term to maturity, the greater the difference between its term to maturity and duration.
- ✓ Duration and YTM are inversely related.
- ✓ Larger the coupon rate, smaller the duration of a bond.
- ✓ An increase in the frequency of coupon payments decreases the duration, while a decrease in frequency of coupons increases it.
- ✓ Duration of a bond declines as the bond approaches maturity

TOPIC

BOND PRICE VOLATILITY \Rightarrow "Impact of YTM on Bond Price"

$$\frac{\% \Delta \text{Price}}{\% \Delta \text{YTM}}$$

The sensitivity of the bond price to changes in the interest rates is called "Bond Volatility". Bond prices and YTM are inversely related

$$IE = \frac{\text{Percentage change in price for bond in period } t}{\text{Percentage change in yield to maturity for bond}}$$

$$\Rightarrow \begin{array}{l} \text{Price} \quad \frac{2023}{400} \rightarrow \frac{2024}{600} \\ \text{YTM} \quad \frac{20\%}{20\%} \rightarrow \frac{25\%}{25\%} \end{array} \quad \begin{array}{l} \frac{1 \cdot \Delta}{\frac{200}{400}} \times 100 = 50\% \\ \frac{5}{20} \times 100 = 25\% \end{array} \Rightarrow \frac{50\%}{25\%} = \boxed{2 \text{ times}}$$

* What if YTM change in 2025 by 20% find Change in
Bond Price = $20\% \times 2$ = 40% \Rightarrow $600 + 40\% = 840$
New Price

TOPIC

Q01. Bond ₹ 00000 Time 5Y. Value? if Disc. Rate is 15%.

$$1+r = 1+0.15$$

Buy/Sale if MP = ₹ 2,25,000

$$\begin{array}{c} 40,000 \boxed{\div} \boxed{1.15} \boxed{=} \boxed{M+} \\ \boxed{=} \boxed{M+} \\ \boxed{=} \boxed{M+} \\ \boxed{=} \boxed{M+} \\ \boxed{=} \boxed{M+} \end{array}$$

$$\begin{array}{c} \boxed{200000} \boxed{=} \boxed{M+} \boxed{MRC} \boxed{233522} \text{ Intrinsic Value} \\ \boxed{=} \boxed{Stime} \end{array} > \boxed{2,25,000} \Rightarrow \boxed{Buy}$$

TOPIC

Unit 5

Financial Mathematics /Forex Arithmetic

TOPIC

Why? \Rightarrow "Exchange of Currency" = Banking System

\Rightarrow Floor $\Rightarrow \$1 = ₹20$

System = $\begin{cases} \Rightarrow \text{Before 1991} = \text{Controlled by RBI} = \Rightarrow \text{Cap} \Rightarrow \$1 = ₹40 \\ \Rightarrow \text{After 1991} = \text{LERMS} \Rightarrow \text{Market driven Rate} - \begin{cases} \Rightarrow \text{Demand} \\ \Rightarrow \text{Supply} \end{cases} \\ [\text{Liberalised Exch. Rate Management System}] \end{cases}$

Quotation = $\begin{cases} \Rightarrow \text{Direct} \Rightarrow \$1 = ₹80 \Rightarrow 1 \text{ unit of Fc is given} \\ \Rightarrow \text{Indirect} \Rightarrow ₹1 = \$0.0125 \Rightarrow 1 \text{ unit of Hc is given} \end{cases}$

Cross Rate \Rightarrow Finding value of third currency by using two diff. currency $\boxed{\begin{array}{l} \$1 = ₹80 \\ ₹1 = ₹20 \\ \$1 = ₹? \end{array}}$

chain Rule \Rightarrow Process of finding Cross Rate is called chain rule

Value-date \Rightarrow Date of Accounting of Foreign Exch. trans. in books of A/c

Forward Point = $\frac{\text{Spot Rate} \times \text{Interest Rate diff.} \times \text{days}}{100 \times 365}$ \Rightarrow $\begin{cases} \Rightarrow \text{Forward Point} \\ \Rightarrow \text{Spot Rate} \\ \Rightarrow \text{Interest Rate diff.} \\ \Rightarrow \text{days} \end{cases}$

TOPICExchange Rates:

Type of Rate	Trans. day	Settlement day	Rate
Cash/Ready Rate (T)	<u>22.7.25</u>	<u>22.7.25</u>	<u>₹ 80</u> \approx
Tom Rate ($T+1$)	<u>22.7.25</u>	<u>23.7.25</u>	<u>₹ 81</u> \approx
Spot Rate ($T+2$)	<u>22.7.25</u>	<u>24.7.25</u>	<u>₹ 82</u> \approx
Forward Rate [Beyond $T+2$]	<u>22.7.25</u>	<u>24.10.25</u>	<u>₹ 85</u> \approx

\Rightarrow Premium :-

Today
 $\$1 = ₹80$

24.10.25

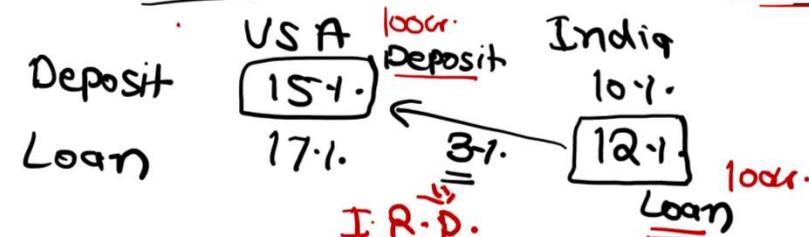
$\$1 = ₹85$ = Fc is expensive

\Rightarrow Discount :-

$\$1 = \underline{\underline{₹80}}$

$\$1 = \underline{\underline{₹70}}$ = Fc is cheap.

Arbitrage :- $\begin{cases} \Rightarrow 0 \text{ Invest } \checkmark \\ \Rightarrow 0 \text{ Risk } \checkmark \\ \Rightarrow + \text{ Return } \checkmark \end{cases}$



INTRODUCTION

When we talk of 'Foreign Exchange', we refer to the general mechanism by which a bank converts the currency of one country into that of another.

Three fundamental aspects of this general mechanism

- Almost every country has its own currency
 - Exchange from one currency for another is, mostly, put through by the banks
 - All exchanges of one currency for another are effected with the help of credit instruments.
- Prior to the modified 'Liberalised Exchange Rate Management System' (LERMS), the Reserve Bank fixed the buying and selling rates and the market would remain within the ceiling and the floor, thus fixed by the Reserve Bank.