**Unit–II: Fixed Income Securities - Analysis, Valuation and Management**:

Features and types of debt instruments, Bond indenture, factors affecting bond yield. Bond yield measurement-Current yield, holding period return, YTM, AYTM and YTC.

Bond valuation; Capitalization of income method, Bond-price theorems, Valuation of compulsorily / optionally convertible bonds, Valuation of deep discount bonds. Bond duration, Macaulay’s duration and modified Macaulay’s duration. bond convexity, Considerations in managing a bond portfolio, term structure of interest rates, risk structure of interest rates. Managing Bond Portfolio: Bond immunization, active and passive bond portfolio management strategies.

**Meaning of Debt Instrument:**

A debt instrument is a paper or electronic obligation that enables the issuing party to raise funds by promising to repay a lender in accordance with terms of a contract.

**Features of Debt Instruments:**

**Each** debt instrument has three features:

1. Maturity,
2. Coupon and
3. Principal.

Maturity: Maturity of a bond refers to the date, on which the bond matures, which is the date on which the borrower has agreed to repay the principal. Term-to-Maturity refers to the number of years remaining for the bond to mature.

Coupon is the interest rate attached to the amount and Principal is the original amount issued.

**Types of debt instruments:**

A debt instrument is a paper or electronic obligation that enables the issuing party to raise

funds by promising to repay a lender in accordance with terms of a contract.

There are different kinds of Debt Instruments available in India such as:

1. Bonds.
2. Certificates of Deposit.
3. Commercial Papers.
4. Debentures.
5. FD.
6. G - Secs (Government Securities)
7. National savings Certificate (NSC)

**Bond indenture, Factors affecting bond yield:**

Understanding the factors involved with different yields will let us understand & select bond investments that meet our personal risk tolerance.

The following are the factors affecting bond yield: -

* Yield vs. Risk. Prices and yields in the bond market always reflect the risk involved with a specific bond investment. ...
* Credit Quality. ...
* Time To Maturity. ...
* Inflation
* Expectations etc.

**Bond Yield Measurement:**

The Value of a bond – or an asset, real or financial – is equal to the present value of the cash flows expected from it. Hence, in determining the value of a bond requires:

1. An estimate of expected cash flows;
2. An estimate of the required return

To simplify out analysis of bond valuation, we will make the following assumptions: -

1. The coupon interest rate is fixed for the term of the bond;
2. The coupon payments are made every year and the next coupon payment is receivable exactly a year from now.
3. The bond will be redeemed at par on maturity.

Hence the value of a bond is calculated with the following formulae:-

 n C M

P = ∑ ------ + --------

 t=1 (1 + r)t (1 + r)n

Where: -

P – is the value (in Rs.)

n – is the number of years to maturity,

C- is the annual coupon payment (in Rs)

r – is the periodic required return,

M- is the maturity value, and

t- is the time period when the payment is received.

Since the stream of annual coupon payments is an ordinary annuity, we can apply the formula for the present value of an ordinary annuity.

Hence the bond value is given by the formula:

P = C x PVIFAr,n + M x PVIFr,n

**Problems:**

1. **A Rs. 100 par value bond bearing a coupon rate of 12% will mature after five years. What is the value of the bond, if the discount rate is 15%?**

**Ans.** Since the annual interest payment will be Rs. 12 for five years and the principal repayment will be Rs.100 after five years, the value of the bond, at a discount rate of 15%, can be calculated with the formula: -

P = C x PVIFAr,n + M x PVIFr,n

P = 12 x (3.352 **tab:A4**) + Rs.100 x (0.497 Tab:A3)

= Rs. 40.22 + 49.70 = Rs. 89.92.

**Current yield:**

The current yield relates to the annual coupon interest to the market price. It is expressed as: -

 Annual Interest

 Current Yield = -------------------

 Price

**Problem 2:**

**Calculate, the current yield of a 10 year, 12 percent coupon bond with a par value of Rs. 1000 and selling for Rs.950.**

**Ans.**

 Annual Interest

 Current Yield = -------------------

 Price

 Rs. 120

 Current Yield = ---------- = 0.1263 or 12.63%

 Rs. 950

**Holding period return:**

Holding period of return is when an investor buys a bond and sells it after holding for a period. The rate of return in that holding period is calculated as:

 Price gain or loss during the holding period + Coupon interest

Rate, if any

Holding Period Return = ---------------------------------------------------------------------------

 Price at the beginning of the holding period.

The holding period rate of return is called the one period rate of return. This holding period return can be calculated daily or monthly or annually.

**Yield to Maturity (YTM):**

When we purchase a bond, we are not quoted with a promised rate of return. Using the information on bond price, maturity date, and coupon payments, we figure out the rate of return offered by the bond over its life.

Popularly referred to as the Yield to Maturity (YTM), it is the discount rate that makes the present value of the cash flows receivable from owning the bond equal to the price of the bond. The computation of YTM requires a **trial and error procedure**.

**Problem 3:**

**A Rs.1000 par value bond is available, carrying a coupon rate of 9% and maturing after 8 years. The bond is currently selling for Rs.800. What is the YTM on this bond?**

**Ans.** The YTM can be calculated with the following formula:

Current SP = C x PVIFAr,n + M x PVIFr,n

800 = 90 (PVIFAr,8 yrs) + 1000 (PVIFr,8 yrs)

Let us begin with a discount rate of 12%. Putting a value of say 12% (under trial & error method) for r, we find that the right hand side of the above expression is:

90 (4.968) + 1000 (0.404) = Rs. 851.12

Since this value (Rs. 851.12) is greater than Rs. 800, we have to try a higher value for r. let us try r = 14%. This makes the right hand side equal to:

90 (4.639) + 1000 (0.351) = Rs. 768.51.

Since this value is less than Rs. 800, we have to try a lower value for r. let us try r = 13%. This makes the right hand side equal to:

90 (4.800) + 1000 (0.376) = Rs. 808.

Thus, r lies between 13% and 14%. Using a linear interpolation in the range 13% to 14%, we find that r is:

 808 - 800

 13% + ----------------- x (14% - 13%) = 13.2%

 808 – 768.1

**AYTM and YTC:**

**Yield To Call:**

Some bonds carry a call feature that entitles the issuer to call (buy back) the bond prior to the stated maturity date in accordance with a call schedule (which specifies a call price for each call date). For such bonds, it is a practice to calculate the yield to call (YTC) as well as the YTM.

The procedure for calculating the YTC is the same as for the YTM. Mathematically the YTC is the value of r in the following equation:

 n C M

P = ∑ ------ + --------

 t=1 (1 + r)t (1 + r)n

where C is the annual interest (in rupees), M is the call price (Rs.) and n is the no. of years until the assumed call date.

**Bond valuation:**

Bond valuation is the process of determining the fair price of a bond. As with any security or capital investment, the fair value of a bond is the present value of the stream of cash flows it is expected to generate. Hence, the price or value of a bond is determined by discounting the bond’s expected cash flows to the present using the appropriate discount rate.

**Capitalization of income method:**

Capitalization of income method of valuation is an approach to valuing financial assets. It is based on the concept that the ‘true’ or intrinsic value of a financial asset is equal to the discounted value of future cash flows generated by that asset.

**Bond-price theorems:**

The findings of Bond prices and yields over decades of experiments carried also known as Bond Price Theorems, states that: -

1. Bond prices and yields move in opposite directions.
2. Bond prices are more sensitive to yield changes, the longer their maturities.
3. The price sensitivity of bonds to yield changes increases at a decreasing rate with maturity.
4. High coupon bond prices are less sensitive to yield changes than low coupon bond prices.
5. With changes in yield of a given no. of basis points, the associated percent gain is larger than the percent loss.

The ‘bond price theorems’ simply represent mathematical properties of the bond price formula.

**Valuation of Compulsorily Convertible bonds:**

If we own a compulsory convertible bond (either partly or fully) we receive: -

1. A certain no. of equity shares on part/full conversion.
2. A certain stream of interest and principal repayments. Hence, the value of such a bond is equal to the sum of two components: -
3. The present value of equity shares receivable on conversion;
4. The present value of interest and principal payments receivable on the bond.

**Valuation of Optionally Convertible Bonds:**

An optionally convertible bond may be viewed as a bond warrant package. Its value is a function of three factors:

1. Straight bond value
2. Conversion value
3. Option value.

Value of the convertible bond = Max (Straight bond value, conversion value) + Optional value.

**Valuation of deep discount bonds:**

Deep discount bond is a bond trading at a discount of 20% or more of its par value. It is a common occurrence with zero-coupon bonds, but may also happen with interest bearing bonds for reasons such as too low interest rate or a sudden plunge (fall) in the bond issuer’s credit rating.

**Bond duration:**

The duration of a financial asset measures the sensitivity of the asset’s price to interest rate movements, expressed as a no. of years. The reason for expressing this sensitivity in years is that the time that will elapse until a cash flow is received, allows more interest to accumulate.

 0 1 2 3 4 5 6 7 8 9 10 years

 Duration of a Bond

**Macaulay’s duration and modified Macaulay’s duration:**

**Macualay’s duration:**

Macaulay duration, named for Frederick Maculay, who introduced the concept, is the weighted average maturity of a bond where the weights are the relative discounted cash flows in each period.

 ∑ (Cashflow discovered with yield to maturity x Time to cashflow)

Maculay Duration = ----------------------------------------------------------------------------------

 Price of the bond

**Modified Macaulay’s duration:**

Modified duration is a modified version of the Macaulay’s model that accounts for changing interest rates, because they affect yield, fluctuating interest rates will affect duration. So this modified formula shows how much the duration changes for each percentage change in yield.

 Macaulay Duration

Modified Macaulay’s duration = -----------------------

 YTM

( 1 + -------)

n

**Considerations in managing a bond portfolio:**

**Term structure of interest rates:**

The Term Structure of interest rates represents the relationship between interest rates or bond yields and different **terms** or **maturities**. The term structure of interest rates is also known as a yield curve and it plays a central role in an economy.

The term structure reflects expectations of market participants about future changes in interest rates and their assessment of monetary policy conditions.



**BREAKING DOWN 'Term Structure Of Interest Rates':**

In general terms, yields increase in line with maturity, giving rise to an upward sloping yield curve or a "normal yield curve." One basic explanation for this phenomenon is that lenders demand higher interest rates for longer-term loans as compensation for the greater risk associated with them, in comparison to short-term loans. Occasionally, long-term yields may fall below short-term yields, creating an "inverted yield curve" that is generally regarded as a harbinger of recession.

**Managing Bond Portfolio:**

**Bond immunization:**

Bond immunization strategy is a strategy to derive a specified rate of return regardless of what happens to market interest rates over holding period.

Seeks to offset the opposite changes in bond valuation caused by price effect and reinvestment effect, which can explained as under: -

1. Price effect: change on bond value caused by interest rate changes.
2. Reinvestment Effect: as coupon payments are received, they are reinvested at higher or lower rates that original coupon rate could be.

**Active and passive bond portfolio management strategies:**

**Active Strategy:**

With an active fund management strategy, the portfolio manager constantly makes decisions and appraises the value of investments within the portfolio by collecting information, using forecasting techniques, and predicting the future performance of the various asset classes, market sectors, individual equities or assets.

**Passive Strategy:**

A passive strategy usually involves holding a portfolio of assets for a long period of time (several years). This strategy does not require the fund manager to outperform an index or to try to select undervalued assets.

**END OF UNIT: 2**