Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM. Risk & Return: Defining Risk and Return, Using Probability Distributions to Measure Risk, Attitudes Toward Risk, Risk and Return in a Portfolio Context, Diversification, The Capital Asset Pricing Model (CAPM).

BOND VALUATION: ANNUAL AND SEMI ANNUAL

What Is Bond Valuation?

Bond valuation determines the present value of a bond's future interest payments, also known as its cash flow, and the bond's value upon maturity, also known as its face value or par value. A bond's par value and interest payments are fixed. Bond valuation helps investors determine what rate of return makes a bond investment worth the cost.

Coupon rate: Some bonds have an interest rate, also known as the coupon rate, which is paid to bondholders semiannually. The coupon rate is the fixed return that an investor earns periodically until it matures.

Maturity date: All bonds have maturity dates, some short-term, others long-term. When a bond matures, the bond issuer repays the investor the full face value of the bond. For corporate bonds, the face value of a bond is usually Rs.1,000, and for government bonds, the face value is Rs.10,000. The face value is not necessarily the invested principal or purchase price of the bond

. // PAR VALUE IS THE FACE VALUE OF A BOND OR THE VALUE OF A STOCK CERTIFICATE STATED IN THE CORPORATE CHARTER//

Par value is the value of a single common share as set by a corporation's charter. It is not typically related to the actual value of the shares. In fact it is often lower. Any stock certificate issued for shares purchased shows the par value. When authorizing shares, a company can choose to assign a par value or not.

Current price: Depending on the level of interest rate in the environment, the investor may purchase a bond at par, below par, or above par. For example, if interest rates increase, the value of a bond will decrease since the coupon rate will be lower than the interest rate in the economy. When this occurs, the bond will trade at a discount, that is, below par.

Coupon Bond Valuation

Calculating the value of a coupon bond factors in the annual or semi-annual coupon payment and the par value of the bond.

The present value of expected cash flows is added to the present value of the face value of the bond as seen in the following formula:

$$V_{\text{coupons}} = \sum \frac{C}{(1+r)^t}$$

$$V_{\text{face value}} = \frac{F}{(1+r)^T}$$

where:

C = future cash flows, that is, coupon payments

r = discount rate, that is, yield to maturity

F = face value of the bond

t = number of periods

T = time to maturity

For example, let's find the value of a corporate bond with an annual interest rate of 5%, making semi-annual interest payments for two years, after which the bond matures and the principal must be repaid. Assume a YTM of 3%:
F = Rs.1,000 for corporate bond
Coupon rate annual = 5%, therefore, Coupon rate semi-annual = 5% / 2 = 2.5%
C = 2.5% x Rs.1000 = Rs.25 per period
t = 2 years x 2 = 4 periods for semi-annual coupon payments
T = 4 periods
r = YTM of 3% / 2 for semi-annual compounding = 1.5%
Present value of semi-annual payments = 25 / (1.015)1 + 25 / (1.015)2 + 25 / (1.015)3 + 25 / (1.015)4 = 96.36
Present value of face value = 1000 / (1.015)4 = 942.18
Therefore, the value of the bond is Rs.1,038.54.

Zero-Coupon Bond Valuation

A zero-coupon bond makes no annual or semi-annual coupon payments for the duration of the bond. Instead, it is sold at a deep discount to par when issued. The difference between the purchase price and par value is the investor's interest earned on the bond.

To calculate the value of a zero-coupon bond, we only need to find the present value of the face value. Carrying over from the example above, the value of a zero-coupon bond with a face value of Rs.1,000, YTM of 3%, and two years to maturity would be Rs.1,000 / (1.03)2, or Rs.942.59.

What is the current yield of a 10-year 12% coupon bond with a face value of Rs. 1000 and currently selling at Rs. 950?

- **Solution**:
  - Calculation of Current Yield:
    - $CY = \frac{In}{Po} \times 100$
    - $In = \text{Annual Interest} = 1000 \times 12\% = 120$
    - $Po = 950$
    - $CY = \frac{120}{950} \times 100 = 12.63\%$
  - **Interpretation**: Since the bond is currently selling at a discount ($950 < 1000$), hence the current yield of 12.63% is greater than the coupon rate of 12%.

b. Example 2 ¶

The face value of a bond is Rs. 1000 and it is currently selling at Rs. 1200 with a coupon rate of 12% and 10 years to maturity. Calculate the current yield from the bond.

- **Solution**:
  - Calculation of Current Yield:
    - $CY = \frac{In}{Po} \times 100$
    - $In = \text{Annual Interest} = 1000 \times 12\% = 120$
    - $Po = 1200$
    - $CY = \frac{120}{1200} \times 100 = 10\%$
  - **Interpretation**: Since the bond is currently selling at a premium ($1200 > 1000$), hence the current yield of 10% is lesser than the coupon rate of 12%.

2. Spot Interest Rate

a. Example

The face value of a zero coupon bond is Rs. 1000. It is currently selling at Rs. 797.19 and the investor will receive the principal amount of Rs. 1000 after two years of maturity of the bond. Calculate the spot interest rate on this zero coupon bond.

- **Solution**:
    - Calculation of spot interest rate on zero coupon bond:
        - $(1+k)^2 = \frac{FV}{PV}$
        - $(1+k)^2 = \frac{1000}{797.19} = 1.2544$
        - $(1+k) = \sqrt{1.2544}$
        - $k = 1.12 - 1 = 0.12 \text{ or } 12\%$

b. Example

The face value of a bond is Rs. 1000 and it is currently selling at Rs. 950 with a coupon rate of 10% and 5 years to maturity. Calculate the spot interest rate from the bond.

- **Solution**:
    - Calculation of spot interest rate:
        - $(1+k)^5 = \frac{FV}{PV}$
        - $(1+k)^5 = \frac{1000}{950} = 1.0526$
        - $(1+k) = \sqrt[5]{1.0526}$
        - $k = 1.01 - 1 = 0.01 \text{ or } 1\%$

3. Yield to Maturity

a. Example

Mr. Arun recently purchased a bond with Rs. 1000 face value at 10% coupon rate and 4 years to maturity. The bond makes annual interest payments. Mr. Arun paid Rs. 1032.40 for the bond. What is the bond yield to maturity?

- **Solution**:
  - Calculation of Bond yield to maturity:
    - $YTM = \frac{I+\frac{(F-P)}{n}}{0.4F+0.6P}$
    - $I = 1000 \times 10\% = 100$
    - $F = 1000$
    - $P = 1032.40$
    - $N = 4 \text{ Years}$
    - $T = 1032.40$
    - $YTM = \frac{100+\frac{(1000-1032.40)}{4}}{0.4\times1000+0.6\times1032.40}$
    - $= \frac{100+(-32.40)/4}{400+619.44}$
    - $= \frac{91.9}{1019.44}$
    - $YTM = 0.09 \text{ or } 9\%$

b. Example

A bond with a face value of Rs. 1000 and a coupon rate of 12% is issued three years ago is redeemable after five years from now at a premium of 5%. The interest rate prevailing in the market currently is 14%. Estimate the bond yield to maturity.

- **Solution**:
  - Calculation of Bond yield to maturity:
    - $YTM = \frac{I+\frac{(F-P)}{n}}{\frac{F+P}{2}}$
    - $I = 1000 \times 12\% = 120$
    - $F = 1000$
    - $P = 1050$
    - $N = 5 \text{ Years}$
    - $YTM = \frac{120+\frac{(1000-1050)}{5}}{\frac{1000+1050}{2}}$
    - $= \frac{120+(-10)/5}{1025}$
    - $= \frac{118}{1025}$
    - $YTM = 0.115 \text{ or } 11.5\%$

4. Yield to Call

a. Example

Let's say you buy a bond with a face value of Rs. 1,000 and a coupon rate of 5%. The bond matures in 10 years, but the issuer can call the bond for face value (Rs. 1,000) in two years if they choose. You buy the bond for Rs. 960, a discount to face value. Calculate the yield to call.

- **Solution**:
  - Calculation of Yield to call:
    - Formula: $YTC = \frac{Annual\ Interest + \frac{Redemption\ Value - Market\ Price}{N}}{\frac{Redemption\ Value + Market\ Price}{2}}$
    - $YTC = \frac{50 + \frac{(1000-960)}{2}}{\frac{(1000+960)}{2}}$
    - $= \frac{50+20}{980}$
    - $YTC = 0.071 \text{ or } 7.1\%$

A fixed rate of dividend is payable on preference shares. But payment of dividend is no legal binding. It is generally paid whenever the company makes sufficient profits.

If dividend is not paid to the preference shareholders it will affect the fund raising capacity of the company. Hence, dividends are regularly paid on preference shares except when there is no profits to pay dividends.

- The Preference Capital carries a cost. The Cost of Preference Capital is calculated as follows:

Cost of Preference Capital

$$Kp = \frac{R}{P}$$

Where,
Kp = Cost of Preference Capital
R = Rate of Dividend
P = Net Proceeds

Preference Shares may be issued at Par, Premium, Discount.

When Preference Shares are issued at Par:

Cost of Preference Capital

$$Kp = \frac{R}{P}$$

Where,

Kp = Cost of Preference Capital

R = Rate of Dividend

P = Net Proceeds

P = Net Proceeds = Face Value – Floatation Costs

When Preference Shares are issued at Premium:

Cost of Preference Capital

$$Kp = \frac{R}{P}$$

Where,

Kp = Cost of Preference Capital

R = Rate of Dividend

P = Net Proceeds

P = Net Proceeds = Face Value + Premium – Floatation Costs

When Preference Shares are issued at Discount:

Cost of Preference Capital

$$Kp = \frac{R}{P}$$

Where,

Kp = Cost of Preference Capital

R = Rate of Dividend

P = Net Proceeds

P = Net Proceeds = Face Value - Discount – Floatation Costs

23. A company issues 20,000 10% preference shares of Rs.100 each. Cost of issue is Rs.2 per share. Calculate cost of preference capital, if these are issued :

a. at par

b. at a premium of 10%

c. at a discount of 5%.

Solution:

a. When Preference Shares are issued at Par:

Cost of Preference Capital

$$Kp = \frac{R}{P}$$

Where,
Kp = Cost of Preference Capital
R = Rate of Dividend = 10% (20,00,000 * 10/100 = 2,00,000)
P = Net Proceeds

P = Net Proceeds = Face Value – Floatation Costs
= 20,00,000 – 40,000
= 19,60,000

Cost of Preference Capital

$$Kp = \frac{R}{P}$$

$$Kp = \frac{2,00,000}{19,60,000} * 100$$

$$\underline{\boldsymbol{Kp = 10.20\%}}$$

b. **When Preference Shares are issued at Premium:**

Cost of Preference Capital

$$Kp = \frac{R}{P}$$

Where,

Kp = Cost of Preference Capital

R = Rate of Dividend = 10% (20,00,000 * 10/100 = 2,00,000)

P = Net Proceeds

P = Net Proceeds = Face Value + Premium – Floatation Costs

= 20,00,000 + 10% of 20,00,000 – 40,000

= 20,00,000 + 2,00,000- 40,000

= 21,60,000

Cost of Preference Capital

$$Kp = \frac{R}{P}$$

$$Kp = \frac{2,00,000}{21,60,000} * 100$$

$$\underline{\boldsymbol{Kp = 9.26\%}}$$

c. **When Preference Shares are issued at Discount:**

Cost of Preference Capital

$$Kp = \frac{R}{P}$$

Where,

Kp = Cost of Preference Capital

R = Rate of Dividend = 10% (20,00,000 * 10/100 = 2,00,000)

P = Net Proceeds

P = Net Proceeds = Face Value - Discount – Floatation Costs

= 20,00,000 - 5% of 20,00,000 – 40,000

= 20,00,000 - 1,00,000- 40,000

= 18,60,000

Cost of Preference Capital

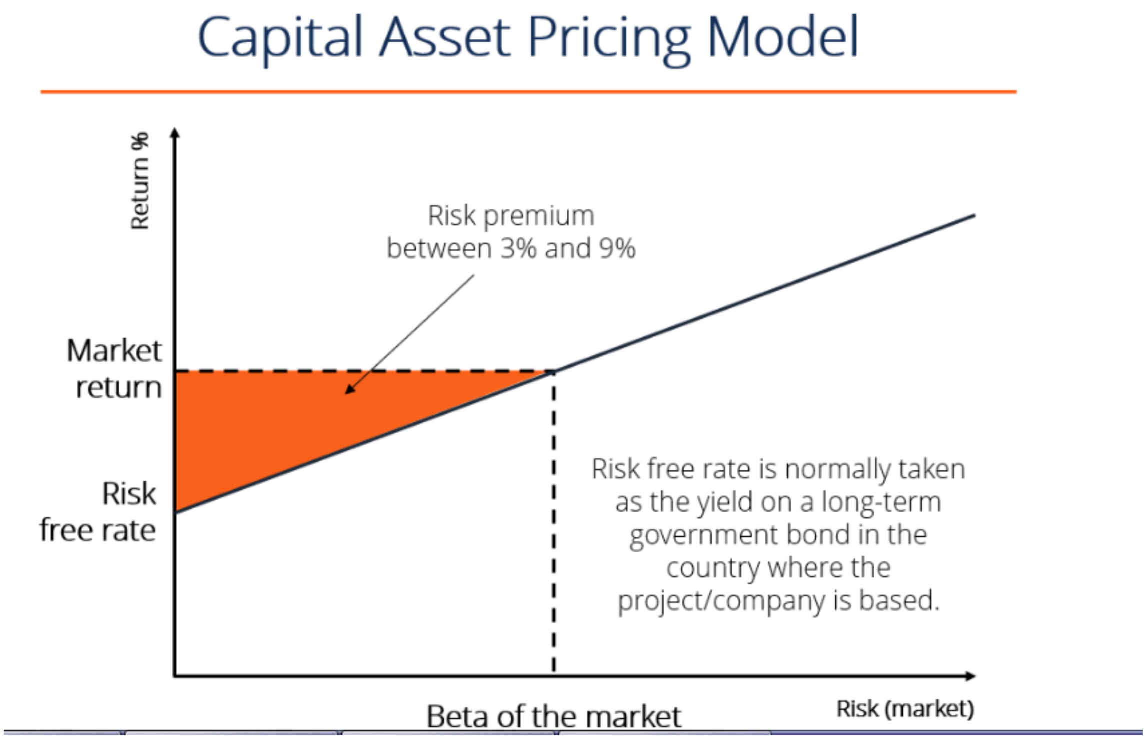
$$Kp = \frac{R}{P}$$

$$Kp = \frac{2,00,000}{18,60,000} * 100$$

$$\underline{\boldsymbol{Kp = 10.75\%}}$$

Capital Asset Pricing Model (CAPM).

The Capital Asset Pricing Model (CAPM) is a model that describes the relationship between the expected return and risk of investing in a security. It shows that the expected return on a security is equal to the risk-free return plus a risk premium, which is based on the beta of that security. Below is an illustration of the CAPM concept.



CAPM Formula and Calculation

CAPM is calculated according to the following formula:

$$Ra = Rrf + [Ba \times (Rm - Rrf)]$$

Where:

Ra = Expected return on a security
Rrf = Risk-free rate
Ba = Beta of the security
Rm = Expected return of the market

Note: "Risk Premium" = (Rm – Rrf)

The CAPM formula is used for calculating the expected returns of an asset. It is based on the idea of systematic risk (otherwise known as non-diversifiable risk) that investors need to be compensated for in the form of a risk premium. A risk premium is a rate of return greater than the risk-free rate. When investing, investors desire a higher risk premium when taking on more risky investments.

CAPM Formula

Expected Return =

Risk-Free Rate + (Beta x Market Risk Premium)

i.e. 12.5% = 2.5% + (1.25 x 8.0%)

Expected Return

The "Ra" notation above represents the expected return of a capital asset over time, given all of the other variables in the equation. "Expected return" is a long-term assumption about how an investment will play out over its entire life.

Risk-Free Rate

The "Rrf" notation is for the risk-free rate, which is typically equal to the yield on a 10-year US government bond. The risk-free rate should correspond to the country where the investment is being made, and the maturity of the bond should match the time horizon of the investment.

Professional convention, however, is to typically use the 10-year rate no matter what, because it's the most heavily quoted and most liquid bond.

Beta

The beta (denoted as "Ba" in the CAPM formula) is a measure of a stock's risk (volatility of returns) reflected by measuring the fluctuation of its price changes relative to the overall market. In other words, it is the stock's sensitivity to market risk. For instance, if a company's beta is equal to 1.5 the security has 150% of the volatility of the market average. However, if the beta is equal to 1, the expected return on a security is equal to the average market return. A beta of -1 means security has a perfect negative correlation with the market.

Market Risk Premium

From the above components of CAPM, we can simplify the formula to reduce "expected return of the market minus the risk-free rate" to be simply the "market risk premium". The market risk premium represents the additional return over and above the risk-free rate, which is required to compensate investors for investing in a riskier asset class. Put another way, the more volatile a market or an asset class is, the higher the market risk premium will be.

Why CAPM is Important

The CAPM formula is widely used in the finance industry. It is vital in calculating the weighted average cost of capital (WACC), as CAPM computes the cost of equity.

WACC is used extensively in financial modeling. It can be used to find the net present value (NPV) of the future cash flows of an investment and to further calculate its enterprise value and, finally, its equity value.

CAPM Example – Calculation of Expected Return

Let’s calculate the expected return on a stock, using the Capital Asset Pricing Model (CAPM) formula. Suppose the following information about a stock is known:

- It trades on the NYSE and its operations are based in the United States
- Current yield on a U.S. 10-year treasury is 2.5%
- The average excess historical annual return for U.S. stocks is 7.5%
- The beta of the stock is 1.25 (meaning its average return is 1.25x as volatile as the S&P500 over the last 2 years)

What is the expected return of the security using the CAPM formula?

Let’s break down the answer using the formula from above in the article:

- Expected return = Risk Free Rate + [Beta x Market Return Premium]
- Expected return = 2.5% + [1.25 x 7.5%]
- Expected return = 11.9%