Bond Valuation

Presented by:

Md. Shahbub Alam

Bond

Key Components of Bond

A **bond** is a fixed-income financial instrument that represents a loan made by an investor to a borrower (typically a corporation or government).

Key Components of Bond:

- **Face Value:** The amount that the bondholder will receive at maturity.
- **Coupon Rate:** The interest rate that the issuer pays on the bond's face value.
- **Maturity Date:** The date when the issuer repays the bond’s face value to the investor.

Bond

Key Components of Bond

- **Required Rate of Return (RRR):** The minimum rate of return an investor expects to earn from a bond, considering its risk level. It's also called the Discount Rate, Market Rate of Interest, Yield to Maturity, Cost of Capital, Hurdle Rate, or Risk-Adjusted Return. It is used to calculate the PV of a bond's future cash flows. RRR is determined using several approaches, such as:
  - ✓ RRR = Risk Free Rate + Risk Premium [e.g. 11.9% (from 10-year govt bond) + 2% = 13.9%]
  - ✓ RRR = Current yield of similar bond issues [e.g. Policy rate (repo rate), i.e. 10%]

Bond Type	Tenor	Face Value	Lot Size
Treasury Bill	91/182/364 days	BDT 100	Multiples; minimum auction bid amount BDT 100,000
Treasury Bond	2 yr to 20 yr	BDT 100	Multiples; minimum auction bid amount BDT 100,000
Corporate Bond	Typically, 5–20 yr	BDT 1,000	Multiples of Tk 1,000

Bond

Types of Bond

1. By Issuer

Type of Bond	Description
Government Bonds	Issued by national governments (e.g., Treasury Bonds in Bangladesh). Considered low risk.
Municipal Bonds	Issued by local government or municipal bodies.
Corporate Bonds	Issued by private or public companies to raise capital. Higher risk, higher return.

Bond

Types of Bond

2. By Interest Payment Method

Type	Description
Fixed Rate Bonds	Pay a fixed interest (coupon) periodically.
Floating Rate Bonds	Interest rate changes based on a reference rate [e.g., 91-day Bangladesh Compounded Rate (BCR) in Bangladesh].
Zero-Coupon Bonds	No periodic interest. Sold at a discount and redeemed at face value.
Perpetual Bonds	No maturity date; interest paid indefinitely.

Bond

Types of Bond

3. By Maturity Duration

Type	Description
Short-Term Bonds	Maturity less than 1 year (e.g., Treasury Bills).
Medium-Term Bonds	Maturity between 1–10 years.
Long-Term Bonds	Maturity over 10 years.

4. By Security

Type	Description
Secured Bonds	Backed by collateral (e.g., real estate, assets).
Unsecured Bonds (Debentures)	Not backed by collateral. Higher risk.

Bond

Types of Bond

5. Special Types

Type	Description
Convertible Bonds	Can be converted into company shares.
Callable Bonds	Can be redeemed by issuer before maturity. This feature benefits the bond-issuer if interest rates decline.
Puttable Bonds	Can be sold back to issuer by the investor before maturity. This feature benefits the bondholder if interest rates rise.
Green Bonds	Issued to fund environmentally friendly projects.
Islamic Bonds (Sukuk)	Shariah-compliant financial instruments that represent ownership in a tangible asset— not debt. Pay profit instead of interest (riba).
Subordinated Bonds	Lower priority in repayment during bankruptcy (common in bank Tier 2 capital).

Bond

Types of Bond

In Bangladesh – Common Bonds

Type	Examples
Government Bonds	BGTB (Bangladesh Government Treasury Bonds), Sanchayapatra
Floating Rate Bonds	3-Year Floating Rate Treasury Bonds
Corporate Bonds	Subordinated bonds from banks (e.g., City Bank, BRAC Bank)
Islamic Bonds (Sukuk)	Bangladesh's Green Sukuk Bond (first issued in December 2020)

Bond Price

Example: Redeemable Bond (With annual interest)

Unilever issued a £100 par value 20-year bond with a 10 per cent coupon five years ago. Assuming annual interest payments, what is the value of the bond today if the required rate of return is currently: (i) 8 per cent; (ii) 10 per cent; and (iii) 12 per cent?

Answer should show for each case whether the bond is trading at a premium, par or at a discount.

Answer:

Given that,

M = £100

I = £100×10% = £10

n = 15

(i) Here, r = 8% = 0.08

$$BV_0 = I\left\{\frac{1-(1+r)^{-n}}{r}\right\} + \frac{M}{(1+r)^n}$$

$$= £10\left\{\frac{1-(1+0.08)^{-15}}{0.08}\right\} + \frac{£100}{(1+0.08)^{15}}$$

$$= £85.60 + £31.50$$

$$= £117.10$$

In this case the bond is trading at a premium.

Bond Price

Example: Redeemable Bond (With annual interest)

(ii) Here, r = 10% = 0.10

$$BV_0 = I\left\{\frac{1-(1+r)^{-n}}{r}\right\} + \frac{M}{(1+r)^n}$$

$$= £10\left\{\frac{1-(1+0.10)^{-15}}{0.10}\right\} + \frac{£100}{(1+0.10)^{15}}$$

$$= £76.06 + £23.90$$

$$= £99.96$$

$$\approx £100$$

In this case the bond is trading at par.

(iii) Here, r = 12% = 0.12

$$BV_0 = I\left\{\frac{1-(1+r)^{-n}}{r}\right\} + \frac{M}{(1+r)^n}$$

$$= £10\left\{\frac{1-(1+0.12)^{-15}}{0.12}\right\} + \frac{£100}{(1+0.12)^{15}}$$

$$= £68.11 + £18.30$$

$$= £86.41$$

In this case the bond is trading at a discount.

Bond Price

Example: Redeemable Bond (With semi-annual interest)

Unilever has just issued a 20-year bond at £100 par value with a coupon rate of 12 per cent. Assuming 15 years to maturity and a required return of 10 per cent, calculate the bond's value paying interest semi-annually.

Answer:

Given that,

M = £100

I = £100×12% = £12

r = 10% = 0.10

n = 15

$$BV_0 = \frac{I}{2}\left\{\frac{1-\left(1+\frac{r}{2}\right)^{-n\times 2}}{\frac{r}{2}}\right\} + \frac{M}{(1+\frac{r}{2})^{n\times 2}}$$

$$= \frac{£12}{2}\left\{\frac{1-\left(1+\frac{0.10}{2}\right)^{-15\times 2}}{\frac{0.10}{2}}\right\} + \frac{£100}{(1+\frac{0.10}{2})^{15\times 2}}$$

$$= £6\left\{\frac{1-(1+0.05)^{-30}}{0.05}\right\} + \frac{£100}{(1+0.05)^{30}}$$

$$= £92.23 + £23.14$$

$$= £115.37$$

Bond Price

Example: Irredeemable Bond

If a bond has a par value of £100, pays a coupon interest rate of 10 per cent per year and the return currently required by investors in the market on similar risk bonds is 8 per cent, find the bond's value.

Answer:

Given that,

I = £100×10% = £10

r = 8% = 0.08

$$BV_0 = \frac{I}{r}$$

$$= \frac{£10}{0.08}$$

$$= £125$$

Bond Price

Example: Zero-Coupon Bond

Square Pharmaceutical issued a zero-coupon bond has a par value Tk. 1000 with 2 years of maturity. If the required rate of return is 8%, what will be value of the bond?

Answer:

Given that,

M = 1000

r = 8% = 0.08

n = 2

$$BV_0 = \frac{M}{(1+r)^n}$$

$$= \frac{1000}{(1+0.08)^2}$$

$$= 850.73$$

Yield Calculation Techniques

Current Yield

Current Yield is a measure of the income (interest or coupon) provided by a bond, relative to its current market price.

Example:
Suppose a bond has a face value of $1,000 with a Coupon Rate of 8%. If the current market price of the bond is $950, calculate the current yield.

Answer:
Given that,

Annual Coupon Payment = $1,000×8% = $80

$$\text{Current Yield} = \frac{\text{Annual Coupon Payment}}{\text{Current Market Price}}$$

$$= \frac{\$80}{\$950}$$

$$= 8.42\ \%$$

Yield Calculation Techniques

Yield to Maturity (YTM)

Yield to Maturity (YTM) is the total return an investor can expect to earn if the bond is held until its maturity date.

Example:

Calculate the yield to maturity (YTM) on a £100 par value bond with a 9 per cent coupon, 10 years to maturity, and which is currently trading at £108.

Answer:

$$YTM = \frac{I + \frac{M - BV_0}{n}}{\frac{M + BV_0}{2}}$$

$$= \frac{£9 + \frac{£100 - £108}{10}}{\frac{£100 + £108}{2}}$$

$$= \frac{£8.2}{£104}$$

$$= 7.88\%$$

Yield Calculation Techniques

Yield to Call (YTC)

Yield to Call (YTC) is the total return an investor can expect if the bond is called before its maturity date.

Example:

Consider a callable bond that has a face value of $1,000 and pays a annual coupon of 5%. The bond is currently priced at $950 and has the option to be called at $1,050 three years from now. Calculate the Yield to Call (YTC) for this bond.

Answer:

$$YTC = \frac{I + \frac{C - BV_0}{n}}{\frac{C + BV_0}{2}}$$

$$= \frac{50 + \frac{1{,}050 - 950}{3}}{\frac{1{,}050 + 950}{2}}$$

$$= \frac{83.33}{1{,}000}$$

$$= 0.0833 \text{ or } 8.33\%$$

Duration of Bond

Macaulay Duration & Modified Duration

The **duration** of a bond measures its sensitivity to changes in interest rates, representing the weighted average time it takes to receive all cash flows (coupons and principal). There are different types of duration, but the most common is **Macaulay Duration** and **Modified Duration**.

Example:

Calculate the Macaulay Duration and Modified Duration for a 3-year bond with a face value of $1,000, an annual coupon rate of 5%, and a yield to maturity (YTM) of 6%. Coupons are paid annually.

Answer:

Given that,

M = 1,000

C= 1,000 × 5% = 50

r= 6% = .06

Duration of Bond

Macaulay Duration & Modified Duration

Duration Calculation

Year (t)	PV factor @ 6% $\frac{1}{(1+r)^t}$	Cash flow C_t	PV of cash flow $\frac{C_t}{(1+r)^t}$	Year × PV of cash flow $t \times \frac{C_t}{(1+r)^t}$
1	0.9434	50	47.17	47.17
2	0.8900	50	44.50	89
3	0.8396	1050	881.60	2644.80
Total			973.27	2780.97

$$\text{Macaulay Duration} = \frac{\sum t \times \frac{C_t}{(1+r)^t}}{\sum \frac{C_t}{(1+r)^t}}$$

$$= \frac{2780.97}{973.27}$$

$$= 2.86 \text{ years}$$

Duration of Bond

Macaulay Duration & Modified Duration

$$\text{Modified Duration} = \frac{\text{Macaulay Duration}}{1+r}$$

$$= \frac{2.86}{1+.06}$$

$$= 2.70$$

Interpretation:

- Macaulay Duration = 2.86 years → The weighted average time to receive cash flows.
- Modified Duration = 2.70 → A 1% increase in yield would decrease the bond price by 2.70%.

Market Interest Rate and Bond's Price

Impact of Market Interest Rates on Bond Prices

When Market Interest Rates Rise Above the Coupon Rate:

- Existing bonds with lower coupon rates become less attractive because newly issued bonds offer higher yields.
- Investors demand a discount on the older bonds to compensate for the lower returns.
- Bond's price falls below its face value. inverse relationship

When Market Interest Rates Fall Below the Coupon Rate:

- Existing bonds with higher coupon rates become more attractive compared to new bonds offering lower yields.
- Investors are willing to pay a premium to secure the higher income stream.
- Bond's price rises above its face value.

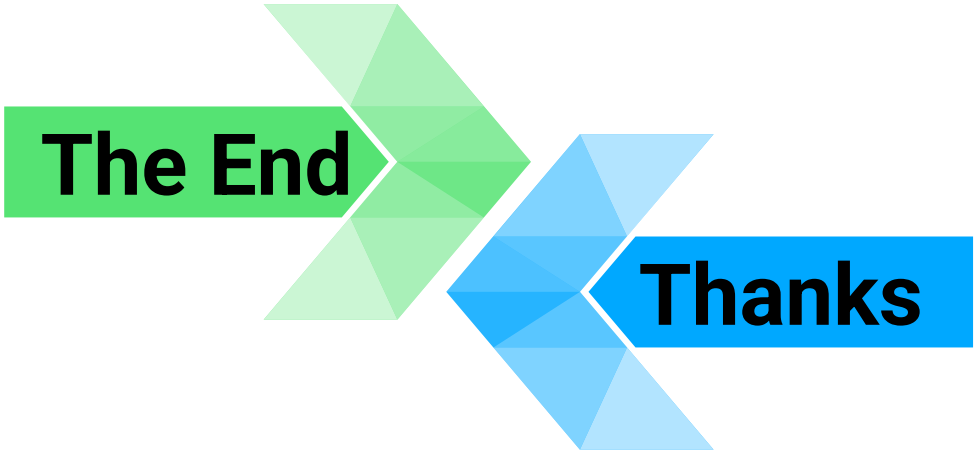
Bond's Value and Required Rate of Return

Relationship Between Bond's Value and Required Rate of Return

There is an inverse relationship between a bond's value and the required rate of return. As the required rate of return decreases, the bond's value increases and as the required rate of return increases, the bond's value decreases.

The following table illustrates how changes in the required rate of return affect the value of Unilever's £100, 20-year, 12 per cent coupon bond with 15 years to maturity:

Coupon Rate (%)	Required Rate of Return (%)	Bond Value (£)	Trade Position
12	14	87.70	Discount
12	12	100.00	Par
12	10	115.17	Premium
12	9	124.23	Premium


The End
Thanks