Chapter 7
Bonds, Bond Valuation, and Interest Rates

Bond Valuation
Valuing the cash flows

1) coupon payment (interest payment) = (coupon rate * principal)
   usually paid every 6 months

2) maturity value = principal or par value = $1000

Example (coupon rate = rd)
Five year corp. bond pay coupons at 10% rate,
market rate (discount rate) (required rate of return) is 10%

Define Terms
- C = coupon payment = coupon rate x $1000 = 10% x $1,000 = $100
- F = face amount or maturity value = $1000
- n = payments to maturity = 5
- rd = required rate of return = 10%
- P₀ = bond value = ?
Example (coupon rate = \( r_d \))

\[ P_0 = PV \text{ of coupon annuity} + PV \text{ of lump sum maturity value} \]

PV of coupon annuity = $379.08
PV of lump sum maturity value = $620.92

\[ P_0 = $379.08 + $620.92 = $1,000.00 \]

Solve with Calculator

\[
\begin{align*}
\text{PMT} &= C = 100 \\
\text{FV} &= F = 1000 \\
\text{I/Y} &= r_d = 10\% \\
N &= 5 \\
\end{align*}
\]

\[ P_0 = PV = 1,000 \]

In this case coupon = \( r_d \) so \( P_0 = F \)
This Bonds sells at PAR

Example (coupon rate > \( r_d \))

Five year corp. bond pay coupons at 10% rate, market rate is 8%

\[
\begin{align*}
\text{PMT} &= C = 100 \\
\text{FV} &= F = 1000 \\
\text{I/Y} &= r_d = 10\% \\
N &= 5 \\
\end{align*}
\]

\[ P_0 = 399.27 + 680.58 = $1,079.85 \]

Calculator:

\[
\begin{align*}
\text{PMT} &= C = 100 \\
\text{FV} &= F = 1000 \\
\text{I/Y} &= rd = 8\% \\
N &= 5 \\
\end{align*}
\]

\[ P_0 = PV = $1,079.85 \]
Example (coupon rate > \( r_d \))

In this case coupon rate > \( r_d \) so \( P_0 > F \), we are getting more in coupon than we demand through required rate of return.

Premium = $79.85

Example (coupon rate < \( r_d \))

Five year corp. bond pay coupons at 10% rate, market rate is 12%

PMT = C = 100
FV = F = 1000
I/Y = \( r_d \) = 12%
N = 5

Example (coupon rate > \( r_d \))

\[
P_0 = 360.47 + 567.43 = $927.90
\]

Calculator:
PMT = C = 100
FV = F = 1000
I/Y = \( r_d \) = 12%
N = 5

\[
P_0 = PV = $927.90
\]

Example (coupon rate < \( r_d \))

In this case coupon rate < \( r_d \) so \( P_0 < F \), we are getting less in coupon than we demand through required rate of return.

Discount = $72.10
<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
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</table>
| A Harrah’s Entertainment Inc 9 7/8 percent bond matures in ten years. Assume that the interest on these bonds is paid and compounded annually. Determine the value of a $1,000 denomination Harrah’s bond as of today if the required rate of return is 7 percent. | PMT = 9.875% x $1,000 = 98.75  
FV = 1000  
I/Y = 7%  
N = 10  
PV = $1,201.93 |

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| A Harrah’s Entertainment Inc 9 7/8 percent bond matures in ten years. Assume that the interest on these bonds is paid and compounded annually. Determine the value of a $1,000 denomination Harrah’s bond as of today if the required rate of return is 9 percent. | PMT = 9.875% x $1,000 = 98.75  
FV = 1000  
I/Y = 9%  
N = 10  
PV = $1,056.15 |
Problem

A Harrah’s Entertainment Inc 9 7/8 percent bond matures in ten years. Assume that the interest on these bonds is paid and compounded annually. Determine the value of a $1,000 denomination Harrah’s bond as of today if the required rate of return is 11 percent.

Solution

\[
PMT = 9.875\% \times $1,000 = 98.75 \\
FV = 1000 \\
I/Y = 11\% \\
N = 10 \\
\]

\[
PV = $933.75 \\
\]

Problem

Assume you purchased a Stations Casino, Inc. bond one year ago for $829.73 when the market rate of interest was 10%. This bond matures in 19 years and is contracted to pay a annual coupons at the rate of 8%. If the current market rate of interest is 13%, what would be the percentage change in bond value from the time you purchased this bond until today?

Problem (cont)

Assume you purchased a Stations Casino, Inc. bond one year ago for $829.73 when the market rate of interest was 10%. This bond matures in 19 years and is contracted to pay a annual coupons at the rate of 8%. If the current market rate of interest is 7%, what would be the percentage change in bond value from the time you purchased this bond until today?
Bond Rules

(1) coupon rate = \( r_d \), Bond sells for PAR
(2) coupon rate < \( r_d \), Bond sells for a discount
(3) coupon rate > \( r_d \), Bond sells for a premium
(4) \( r_d \) increases, Value decreases
(5) \( r_d \) decreases, Value increases

Semi-Annual Coupons

**Example:** What is the price of a 10 year bond with a coupon rate of 10%, if it pays coupons semiannually and the market rate of interest is 8%?

**P_0 = ??**

**Answer:**

\[
PMT = \frac{\text{coupon rate} \times \text{Maturity Value}}{m} = \frac{10\% \times 1,000}{2} = 50
\]

\[
N = \text{years to maturity} \times m = 10 \times 2 = 20
\]

\[
FV = 1,000
\]

\[
I/Y = \frac{\text{rd}}{m} = \frac{8\%}{2} = 4\%
\]

\[
P_0 = 1,135.90
\]

**Problem**

A MGM-Mirage Corporation bond pays a 14.5% coupon on a semi-annual basis. What is the value of this bond if it matures in 16 years and the market rate is 11%?
Answer

\[
PMT = \frac{(14.5\% \times $1,000)}{2} = $72.50
\]
\[
N = 16 \times 2 = 32
\]
\[
FV = $1,000
\]
\[
I/Y = \frac{11\%}{2} = 5.5\%
\]
\[
\text{\textbf{P}}_0 = $1,260.82
\]

Problem

What is the value of a Walt Disney Incorporated 30 year zero coupon bond if the required rate of return is 9% and a similar AA-rated Paychex Incorporated bond pays a 10% coupon?

Answer

\[
PMT = (0.0\% \times $1,000) = $0.00
\]
\[
N = 30
\]
\[
FV = $1,000
\]
\[
I/Y = 9\%
\]
\[
\text{\textbf{P}}_0 = $75.37
\]

Yield-to-Maturity (YTM)

Calculating the return on a Bond.

Consider a bond with a 10% annual coupon rate, 15 years to maturity, and a par value of $1,000. The current price is $928.09. What is the YTM?
Yield -to-Maturity (YTM)

| N     | 15 |
| PV    | -928.09 |
| FV    | 1,000.00 |
| PMT   | 100 |

\[ YTM = i = 11\% \]

YTM = ( Coupon yield ) ± (%ΔP₀)

Coupon Yield = return from the coupon
= annual coupon / P₀
= $100 / $928.09 = 10.77%

%ΔP₀ = ( P₁ - P₀ ) / P₀
= ( $930.18 - $928.09 ) / $928.09
= 0.23%

YTM = 10.77% + 0.23% = 11.00%

Problem

A Microsoft, Incorporated bond has a coupon rate of 8.5%, matures in 12 years, and sells for $835.60 (assume coupons are paid on a semi-annual basis). What is the YTM for this Microsoft, Inc. Corporate Bond?

Yield -to-Maturity (YTM)

| N     | 12 x 2 = 24 |
| PV    | -$835.60 |
| FV    | $1,000.00 |
| PMT   | (8.5% x $1,000) / 2 = $42.50 |

\[ YTM = i = 5.5\% \times 2 = 11\% \]
### Problem
A Microsoft, Incorporated bond has a coupon rate of 8.5%, matures in 12 years, and sells for $835.60 (assume coupons are paid on a semi-annual basis). What is the current yield for the first year on this bond?

### Current Yield
Current or Coupon Yield is the return on a bond from the coupon only.

\[
\text{Current Yield} = \frac{\text{Annual Coupon}}{P_0}
\]

\[
\text{Current Yield} = \frac{85}{835.60} = 10.17\%
\]

### Problem
A Microsoft, Incorporated bond has a coupon rate of 8.5%, matures in 12 years, and sells for $835.60 (assume coupons are paid on a semi-annual basis). What is the expected percentage capital gain or loss for the first year on this bond?

### Capital Gain or Loss
Expected Percentage Capital Gain or Loss

\[
\%\Delta P_0 = \frac{(P_1 - P_0)}{P_0}
\]

\[
= \frac{(842.71 - 835.60)}{835.60}
\]

\[
\%\Delta P_0 \approx 0.85\%
\]
Capital Gain or Loss

\[ \text{YTM} = (\text{Coupon yield}) \pm (\% \Delta P_0) \]

11.0% = 10.17% ± (%\Delta P_0)
11.0% = 10.17% + (%\Delta P_0)
\% \Delta P_0 = 11.00\% - 10.17\%

\% \Delta P_0 = 0.83%%

Corporate Bond Quotes

FINRA Investor Information

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Bond Ratings – Investment Quality

**High Grade**
- Moody’s Aaa and S&P AAA – capacity to pay is extremely strong
- Moody’s Aa and S&P AA – capacity to pay is very strong

**Medium Grade**
- Moody’s A and S&P A – capacity to pay is strong, but more susceptible to changes in circumstances
- Moody’s Baa and S&P BBB – capacity to pay is adequate, adverse conditions will have more impact on the firm’s ability to pay

Bond Ratings – Speculative (Junk)

**Low Grade**
- Moody’s Ba, B, Caa and Ca; S&P BB, B, CCC, CC
  - Considered speculative with respect to capacity to pay

**Very Low Grade**
- Moody’s C and S&P C – income bonds with no interest being paid
- Moody’s D and S&P D – in default with principal and interest in arrears
Bond Evaluation

Use bond rating - yield comparisons

Also, consider maturity, liquidity, call provision, convertibility feature, collateral, other provisions

Major Credit Rating Companies - Moody’s, Standard and Poors (S&P), Fitch