Chapter 6
Valuing Bonds

Bond Valuation - value 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: Five year corp. bond pay coupons at 10% rate, market rate (discount rate) (required rate of return) is 10%

Define Terms

PMT = coupon payment
   = coupon rate * $1000

FV = face amount or maturity value = $1000

N = payments to maturity = 5

i\[d\] = required rate of return = 10%

PV\[0\] = bond value = ?

```
0 1  2  3  4  5
PV\[0\] $100 $100 $100 $100 $100 $1,000
```

\[PV\[0\] = PV \text{ of coupon annuity} + PV \text{ of lump sum maturity value}\]

CALCULATOR:

PMT = 100

FV = 10000

i\[d\] = 10%

N = 5

PV\[0\] = 1,000

In this case coupon = i\[d\] so PV\[0\] = FV

This Bonds sells at PAR
coupon rate > $i_d$

ex.

\[
\begin{align*}
&PMT = 100 \text{ (coupon rate } = 10\%) \\
&N = 5 \\
&i_d = 8\%
\end{align*}
\]

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

Calculator:

\[
\begin{align*}
PMT &= 100 \\
FV &= 1000 \\
&i_d = 8\% \\
N &= 5
\end{align*}
\]

\[PV_0 = $1,079.85\]

In this case coupon rate > $i_d$ so $PV_0 > FV$, we are getting more in coupon than we demand through required rate of return.

Premium = $79.85

---

coupon rate < $i_d$

ex.

\[
\begin{align*}
PMT &= 100 \text{ (coupon rate } = 10\%) \\
N &= 5 \\
&i_d = 12\%
\end{align*}
\]

\[PV_0 = 360.47 + 567.43 = $927.90\]

In this case coupon rate < $i_d$ so $PV_0 < FV$, we are getting less in coupon than we demand through required rate of return.

Discount = $72.10
A Harrah’s Entertainment Incorporated 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

a. 7 percent
b. 9 percent
c. 11 percent

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 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?

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?

**RULES:**

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

\[
PV_0 = ??
\]

\[
PMT = \frac{(coupon \ rate \times Maturity \ Value)}{m} = \$50
\]
\[
N = \text{years to maturity} \times m = 10 \times 2 = 20
\]
\[
FV = \$1,000
\]
\[
i = \frac{i_d}{m} = 8\% / 2 = 4\%
\]
\[
PV_0 = \$1,135.90
\]
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%?

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?

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?

\[
\begin{align*}
N &= 15 \\
PV_0 &= -928.09 \\
FV &= 1,000.00 \\
PMT &= 100 \\
YTM &= i_d = 11\% \\
\end{align*}
\]

\[
YTM = (\text{Coupon yield}) \pm (\frac{\%_\Delta PV_0}{PV_0})
\]

Coupon Yield = return from the coupon
\[
= \text{annual PMT} / PV_0
= \frac{100}{928.09} = 10.77\%
\]

\[
\%_\Delta PV_0 = \frac{(PV_f - PV_0)}{PV_0}
= \frac{($930.18 - $928.09)}{928.09}
= 0.23\%
\]

\[
YTM = 10.77\% + 0.23\% = 11.00\%
\]

Note: These are expected values, assumes interest rates do not change.

Yield to Call (YTC)

Consider a bond with a 10% annual coupon rate, 15 years to maturity, 5 years to call, a par value of $1,000, and a call price of $1,100. The current price is $1,003.28. What is the YTC?

\[
\begin{align*}
N &= 5 \\
PV &= -1,003.28 \\
FV &= 1,100.00 \\
PMT &= 100 \\
YTC &= i_d = 11.50\%
\end{align*}
\]
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?

What is the current yield for the first year on this bond?

What is the expected percentage capital gain or loss for the first year on this bond?

If this Microsoft bond is callable in 7 years at the price of $1,085, what is its YTC

### Wall Street Journal - Corporate Bond Quotes

<table>
<thead>
<tr>
<th>Company (Ticker)</th>
<th>Coupon</th>
<th>Maturity</th>
<th>Last Price</th>
<th>Last Yield</th>
<th>*Est Spread</th>
<th>UST†</th>
<th>Est $ Vol (000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ford Motor Credit (F)</td>
<td>7.375</td>
<td>Mar 1, 2020</td>
<td>109.632</td>
<td>6.076</td>
<td>181</td>
<td>10</td>
<td>63,070</td>
</tr>
<tr>
<td>Ford Motor Credit (F)</td>
<td>8.375</td>
<td>Mar 1, 2044</td>
<td>106.008</td>
<td>7.866</td>
<td>294</td>
<td>30</td>
<td>119,517</td>
</tr>
<tr>
<td>Kraft Foods (KFT) - c</td>
<td>1.500</td>
<td>Mar 1, 2034</td>
<td>102.813</td>
<td>1.362</td>
<td>n.a.</td>
<td>n.a.</td>
<td>32,610</td>
</tr>
</tbody>
</table>

* Estimated spreads over the comparable Treasury note / bond.
† Comparable United States Treasury issue.

### 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. The “B” ratings are the lowest degree of speculation.

**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
Treasury Quotes

<table>
<thead>
<tr>
<th>RATE</th>
<th>MATURITY MO/YR</th>
<th>BID</th>
<th>ASKED</th>
<th>CHG</th>
<th>ASK YLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.000</td>
<td>Sep 27</td>
<td>133:27</td>
<td>133:28</td>
<td>24</td>
<td>5.88</td>
</tr>
</tbody>
</table>

Coupon rate = 9.00%
Maturity = September of 2027
Bid Price = 133 27/32 = 133.84375% = $1,338.4375
Asked Price = 133 28/32 = 133.8750% = $1,338.75
Change in Price = 24/32 = 0.75% = $7.50
Yield = 5.88%

Yield Calculation:

\[
\begin{align*}
PV &= -$1,338.75 \\
PMT &= $45.00 \\
FV &= $1,000.00 \\
n &= 17 \text{ years, } 181 \text{ days } = 17.4959 \text{ yrs } \times 2 = 35 \text{ periods} \\
i &\approx 5.88% 
\end{align*}
\]

Answer the following questions based on the WSJ treasury bond quote (assume coupons are paid on a semi-annual basis).

What is the premium or discount for this bond?
What is the current yield?
What is the yield-to-maturity?
What is the bid-ask spread (in dollar terms)?

Treasury Inflation-protected securities (TIPS)

TIPS are US Treasury Bonds that are indexed to inflation

Features:
Fixed percentage coupon
Par Value is adjusted with changes in inflation [as measured by the Consumer Price Index (CPI)]
TIPS example

Look at example 6-2 on page 183

TIPS issued on July 15, 2006 to pay $2\frac{1}{2}$% coupon. Reference CPI was 201.95

What is the par value and interest payment at these dates?

1) January 2007 with a CPI of 201.66
Par Value = $1,000 \times 201.66 \div 201.95 = $998.564
Interest Payment = $998.564 \times 2\frac{1}{2}\% \div 2 = $24.964 \div 2 = $12.48

2) July 2007 with a CPI of 207.26
Par Value = $1,000 \times 207.26 \div 201.95 = $1,026.294
Interest Payment = $1,026.294 \times 2\frac{1}{2}\% \div 2 = $25.657 \div 2 = $12.83

3) January 2008 with a CPI of 209.50
Par Value = $1,000 \times 209.50 \div 201.95 = $1,037.386
Interest Payment = $1,037.386 \times 2\frac{1}{2}\% \div 2 = $25.935 \div 2 = $12.97