

Chapter 5 – Interest Rates and Bond Valuation

Price

Par (face) value

Coupon rate (semiannual unless stated otherwise)

Maturity

Market rate (Yield to Maturity – TYM)

Bond pricing

Suppose we have the following bond:

Par = \$1,000

Coupon rate = 8%

Maturity = 6 years

YTM = 10%

What is the price of the bond?

What if the YTM is 6%?

Bond fact #1:

If the YTM is greater than the coupon rate, the bond will sell at a discount (below par.) If the YTM is less than the coupon rate, the bond will sell at a premium (above par.)

Bond fact #2:

There is an inverse relationship between interest rates and bond prices. If interest rates increase, bond prices decrease. If interest rates decrease, bond prices increase.

Bond fact #3:

Interest rate risk is the risk that if interest rates increase, bond prices will decrease. All else the same, a longer term bond will have more interest rate risk than a shorter term bond.

Bond pricing

Suppose we have the following two bonds:

Par = \$1,000
Coupon rate = 7%
Maturity = 3 years
YTM = 7%

Par = \$1,000
Coupon rate = 7%
Maturity = 25 years
YTM = 7%

What is the price of each bond?

Suppose interest rates fall to 6%. What will happen to the price of each bond? What is the new price of each bond?

Suppose interest rates increase to 8%. What will happen to the price of each bond? What is the new price of each bond?

Bond fact #4:

All else the same, there is an inverse relationship between the coupon rate and interest rate risk. A bond with a lower coupon has more interest rate risk than a bond with a higher coupon.

Suppose we have the following two bonds:

Par = \$1,000
 Coupon rate = 3%
 Maturity = 25 years
 YTM = 8%

Par = \$1,000
 Coupon rate = 12%
 Maturity = 25 years
 YTM = 8%

What is the price of each bond?

1,000 FV
 15 PMT
 50 N
 4 I/Y
 CPT PV
 \$462.95

1,000 FV
 60 PMT
 50 N
 4 I/Y
 CPT PV
 \$1,429.64

Suppose the YTM changes to 6 percent. What is the price of each bond now?

1,000 FV
 15 PMT
 50 N
 3 I/Y
 CPT PV
 \$614.05

1,000 FV
 60 PMT
 50 N
 3 I/Y
 CPT PV
 \$1,771.89

$\% \Delta = 32.64\%$

$\% \Delta = 23.94\%$

Suppose the YTM changes to 10 percent. What is the price of each bond now?

1,000 FV
 15 PMT
 50 N
 5 I/Y
 CPT PV
 \$361.04

1,000 FV
 60 PMT
 50 N
 5 I/Y
 CPT PV
 \$1,182.56

$\% \Delta = 22.01\%$

$\% \Delta = 17.28\%$

Finding the YTM

Suppose we see a 7.5 percent coupon bond with 10 years to maturity selling for \$934. Is the YTM above or below 7.5 percent? What is the YTM of the bond?

Zero coupon bonds

Suppose we have the following bond:

Par = \$1,000
Coupon rate = 0%
Maturity = 15 years
YTM = 9%

What is the price of the bond?

| | |
|----------|----------|
| 1,000 FV | 1,000 FV |
| 30 N | 28 N |
| 4.5 I/Y | 4.5 I/Y |
| CPT PV | CPT PV |
| \$267.00 | \$291.57 |

Interest = \$24.57

Bond Basics

The bond indenture is a *three-party contract* between the bond issuer, the bondholders, and the trustee. The trustee is hired by the issuer to protect the bondholders' interests.

The indenture includes

- ◆ The basic terms of the bond issue
- ◆ The total amount of bonds issued
- ◆ A description of the security
- ◆ The repayment arrangements
- ◆ The call provisions
- ◆ Details of the protective covenants

Credit ratings:

| | Investment-Quality Bond Ratings | | | | Low-Quality, Speculative, and/or "Junk" Bond Ratings | | | | | |
|-------------------|---------------------------------|----|--------------|-----|--|---|----------------|----|---|---|
| | High Grade | | Medium Grade | | Low Grade | | Very Low Grade | | | |
| Standard & Poor's | AAA | AA | A | BBB | BB | B | CCC | CC | C | D |
| Moody's | Aaa | Aa | A | Baa | Ba | B | Caa | Ca | C | D |

The Yield Spread

- A bond's credit rating helps determine its *yield spread*.
- The yield spread is the extra return (increased yield to maturity) that investors demand for buying a bond with a lower credit rating (and higher risk).
- Yield spreads are often quoted in basis points over Treasury notes and bonds. That is,
 - ◆ Suppose we see a 5-year Aaa/AAA yield spread equal to 59.
 - ◆ This means the YTM on this bond is 59 basis points (0.59%) greater than 5-year U.S. Treasury notes.

Factors Affecting a Bond's Coupon Rate (or YTM)

Bond Rating - Moody's and Standard & Poor's

Maturity

Seniority – who gets paid first

Sinking fund – fund managed by a trustee for repayment (at maturity) or repurchase (on the open market or call) of bonds

Call Provision – ability of the firm to buy back debt early

- Deferred call – cannot be called for a specific time
- Call premium – carries a price premium if called

Make Whole Call

Protective covenants – list of permissible actions of the firm

- Positive covenants – what a firm must do
 - maintain collateral in good condition
 - keep minimum level of working capital
 - keep audited financial statements
- Negative covenants – what a firm cannot do
 - raise dividends
 - issue more debt
 - merge with another company

Convertibility

Other Types of Bonds

CAT bonds

Floating rate bonds

Collateralized bonds

Death bonds

Bond Quotes

Corporate bonds:

| Corporate Bonds | | | | | | | |
|--|--------|--------------|------------|------------|-------------|------|--------------------|
| Thursday, April 27, 2006 | | | | | | | |
| Forty most active fixed-coupon corporate bonds | | | | | | | |
| COMPANY (TICKER) | COUPON | MATURITY | LAST PRICE | LAST YIELD | %EST SPREAD | UST† | EST \$ VOL (000's) |
| Comcast Corp (CMCSA) | 6.450 | Mar 15, 2037 | 95.170 | 6.826 | 156 | 30 | 178,032 |
| Wachovia Capital Trust III (WB) | 5.800 | Mar 15, 2011 | 97.976 | 5.930 | 97 | 5 | 121,500 |
| Sprint Capital Corp (S) | 8.375 | Mar 15, 2012 | 112.281 | 5.869 | 92 | 5 | 84,227 |
| Sprint Capital Corp (S) | 6.875 | Nov 15, 2028 | 102.428 | 6.665 | 140 | 30 | 81,530 |
| CenturyTel Inc (CTL) | 7.875 | Aug 15, 2012 | 108.797 | 6.163 | 109 | 5 | 80,100 |
| Omnicom Group Inc (OMC) | 5.900 | Apr 15, 2016 | 97.489 | 6.241 | 117 | 10 | 76,065 |
| USB Capital IX (USB) | 6.189 | Apr 15, 2011 | 98.824 | 6.250 | 131 | 5 | 69,610 |
| ArvinMeritor Inc (ARM) | 8.125 | Sep 15, 2015 | 97.375 | 8.535 | 347 | 10 | 68,600 |
| Goldman Sachs Group Inc (GS) | 5.350 | Jan 15, 2016 | 95.481 | 5.969 | 89 | 10 | 66,057 |

Treasury Bonds, Notes and Bills

Explanatory Notes

Representative Over-the-Counter quotation based on transactions of \$1 million or more. Treasury bond, note and bill quotes are as of mid-afternoon. Colons in bid-and-asked quotes represent 32nds; 101:01 means 101 1/32. Net changes in 32nds. n-Treasury note. i-Inflation-Indexed issue. Treasury bill quotes in hundredths, quoted on terms of a rate of discount. Days to maturity calculated from settlement date. All yields are to maturity and based on the asked quote. Latest 13-week and 26-week bills are boldfaced. For bonds callable prior to maturity, yields are computed to the earliest call date for issues quoted above par and to the maturity date for issues below par. *When issued.

Source: eSpeed/Cantor Fitzgerald

U.S. Treasury strips as of 3 p.m. Eastern time, also based on transactions of \$1 million or more. Colons in bid and asked quotes represent 32nds; 99:01 means 99 1/32. Net changes in 32nds. Yields calculated on the asked quotation. ci-stripped coupon interest. bp-Treasury bond, stripped principal. np-Treasury note, stripped principal. For bonds callable prior to maturity, yields are computed to the earliest call date for issues quoted above par and to the maturity date for issues below par.

Source: Bear, Stearns & Co. via Street Software Technology Inc.

| RATE | MATURITY MO/YR | BID | ASKED | CHG | ASK YLD | RATE | MATURITY MO/YR | BID | ASKED | CHG | ASK YLD |
|-------------------------------------|----------------|--------|--------|-----|---------|--------|----------------|--------|--------|-----|---------|
| Government Bonds & Notes | | | | | | | | | | | |
| 2.250 | Apr 06n | 99:30 | 99:31 | ... | 5.02 | 1.875 | Jul 13i | 96:25 | 96:26 | 15 | 2.36 |
| 2.000 | May 06n | 99:27 | 99:28 | ... | 4.29 | 4.250 | Aug 13n | 95:07 | 95:08 | 9 | 5.03 |
| 4.625 | May 06n | 100:00 | 100:00 | ... | 4.20 | 12.000 | Aug 13 | 115:09 | 115:10 | 3 | 4.88 |
| 6.875 | May 06n | 100:03 | 100:04 | ... | 4.08 | 4.250 | Nov 13n | 95:01 | 95:02 | 8 | 5.04 |
| 2.500 | May 06n | 99:25 | 99:26 | 1 | 4.53 | 2.000 | Jan 14i | 97:06 | 97:07 | 13 | 2.39 |
| 2.750 | Jun 06n | 99:20 | 99:21 | ... | 4.61 | 4.000 | Feb 14n | 93:09 | 93:10 | 8 | 5.05 |
| 7.000 | Jul 06n | 100:13 | 100:14 | ... | 4.78 | 4.750 | May 14n | 98:00 | 98:00 | 7 | 5.05 |
| 2.750 | Jul 06n | 99:14 | 99:15 | ... | 4.73 | 13.250 | May 14 | 123:11 | 123:12 | 5 | 4.89 |
| 2.375 | Aug 06n | 99:07 | 99:08 | ... | 4.83 | 2.000 | Jul 14i | 97:02 | 97:03 | 14 | 2.39 |
| 2.375 | Aug 06n | 99:04 | 99:05 | 1 | 4.83 | 4.250 | Aug 14n | 94:18 | 94:19 | 8 | 5.05 |
| 2.500 | Sep 06n | 98:30 | 98:31 | ... | 4.94 | 12.500 | Aug 14 | 122:27 | 122:28 | 5 | 4.90 |
| 6.500 | Oct 06n | 100:21 | 100:22 | ... | 4.94 | 11.750 | Nov 14 | 121:27 | 121:28 | 5 | 4.94 |
| 2.500 | Oct 06n | 98:24 | 98:25 | 1 | 4.94 | 4.250 | Nov 14n | 94:13 | 94:14 | 9 | 5.06 |
| 2.625 | Nov 06n | 98:23 | 98:24 | 1 | 4.94 | 1.625 | Jan 15i | 93:27 | 93:28 | 14 | 2.41 |
| 3.500 | Nov 06n | 99:06 | 99:07 | 1 | 4.96 | 4.000 | Feb 15n | 92:17 | 92:18 | 7 | 5.05 |
| 2.875 | Nov 06n | 98:24 | 98:25 | 1 | 4.96 | 11.250 | Feb 15 | 143:08 | 143:09 | 8 | 5.08 |
| 3.000 | Dec 06n | 98:21 | 98:22 | 2 | 4.97 | 4.125 | May 15n | 93:07 | 93:08 | 7 | 5.06 |
| 3.375 | Jan 07i | 101:05 | 101:06 | 1 | 1.70 | 1.875 | Jul 15i | 95:18 | 95:19 | 15 | 2.41 |
| 3.125 | Jan 07n | 98:19 | 98:20 | 2 | 4.96 | 4.250 | Aug 15n | 93:29 | 93:30 | 7 | 5.07 |
| 2.250 | Feb 07n | 97:27 | 97:28 | 2 | 4.96 | 10.625 | Aug 15 | 140:17 | 140:18 | 8 | 5.09 |
| 6.250 | Feb 07n | 100:30 | 100:31 | 2 | 4.97 | 4.500 | Nov 15n | 95:19 | 95:20 | 7 | 5.08 |
| 3.375 | Feb 07n | 98:21 | 98:22 | 2 | 4.97 | 9.875 | Nov 15 | 135:23 | 135:24 | 8 | 5.10 |
| 3.750 | Mar 07n | 98:28 | 98:29 | 2 | 4.97 | 2.000 | Jan 16i | 96:07 | 96:08 | 15 | 2.44 |
| 3.625 | Apr 07n | 98:22 | 98:23 | 2 | 4.93 | 4.500 | Feb 16n | 95:16 | 95:17 | 6 | 5.08 |
| 6.625 | May 07n | 101:22 | 101:23 | 3 | 4.92 | 9.250 | Feb 16 | 131:18 | 131:19 | 8 | 5.11 |
| 4.375 | May 07n | 99:13 | 99:14 | 2 | 4.92 | 7.250 | May 16 | 116:15 | 116:16 | 7 | 5.13 |
| 3.125 | May 07n | 98:04 | 98:05 | 2 | 4.94 | 7.500 | Nov 16 | 118:30 | 118:31 | 8 | 5.15 |
| 3.500 | May 07n | 98:15 | 98:16 | 3 | 4.93 | 8.750 | May 17 | 129:25 | 129:26 | 8 | 5.17 |
| 3.625 | Jun 07n | 98:15 | 98:16 | 2 | 4.94 | 8.875 | Aug 17 | 131:07 | 131:08 | 8 | 5.18 |
| 3.875 | Jul 07n | 98:22 | 98:23 | 3 | 4.93 | 9.125 | May 18 | 134:21 | 134:22 | 9 | 5.21 |
| 2.750 | Aug 07n | 97:08 | 97:09 | 3 | 4.93 | 9.000 | Nov 18 | 134:10 | 134:11 | 8 | 5.23 |
| 3.250 | Aug 07n | 97:28 | 97:29 | 3 | 4.93 | 8.875 | Feb 19 | 133:15 | 133:16 | 8 | 5.25 |
| 6.125 | Aug 07n | 101:14 | 101:15 | 3 | 4.93 | 8.125 | Aug 19 | 127:03 | 127:04 | 8 | 5.26 |
| 4.000 | Aug 07n | 98:25 | 98:26 | 3 | 4.92 | 8.500 | Feb 20 | 131:09 | 131:10 | 7 | 5.27 |
| 4.000 | Sep 07n | 98:23 | 98:24 | 4 | 4.92 | 8.750 | May 20 | 134:04 | 134:05 | 8 | 5.28 |
| 4.250 | Oct 07n | 99:01 | 99:02 | 4 | 4.90 | 8.750 | Aug 20 | 134:13 | 134:14 | 7 | 5.29 |
| | | | | | | 7.875 | Feb 21 | 126:06 | 126:07 | 8 | 5.30 |
| | | | | | | 8.125 | May 21 | 129:00 | 129:01 | 6 | 5.30 |

Feb 2021 bond:

Term Structure of Interest Rates

