Lecture 17

Vocabulary – read the textbook Glossary to learn more about these words!

asset-backed security
bearer bond
bond
bond rating
capital gain
catastrophe bond
consol
coupon rate
debenture
Federal National Mortgage Association
high yield
indenture
industrial revenue bond
junk bond
mortgage-backed security
municipal bond
nominal rate
par value
rating service
revenue bond
securitization
sinking fund
yield-to-maturity
zero-coupon bond

Daily problems – after this lecture the problems you should master include:

Exercises 7.2, p. 232, #2 – 11
Exercises 7.3, p. 239, #2 – 5

Preliminaries

Trading game: today only review timing of submissions & printouts

Street-Bite

Table 7.1, average daily trading volume
Visit www.nasdbondinfo.com and obtain price quotes
Asset-backed securities (from Chapter 9, Section 9.3.A1 p. 294 - 296)

- tremendous growth, from $35 billion in 1985 to more than $2,000 billion today
- ABS are the liabilities (securities) on right-hand-side balance sheet that receives the cash flows submitted by the financial assets on the left-hand-side; see *securitization*
- major assets with ABS include mortgages, consumer credit, manufactured homes, student loans, business accounts receivables

Discussion

Chapter 7: Time Value Application 2, Bond Valuation
Section 1. Bond basics: Notation, quotation, and cash flow

- obtain the cash flow stream from the description
  - formulas 7.1, 7.2, and 7.3

Section 2. Relation between price and yield-to-maturity

- The *YTM:* formula 7.4
  - Rule 7.1: the *promised yield*
- Components of the total rate of return
  - formula 7.5

Section 3. Bond price movements

- Rule 7.2: Discount versus premium bond prices

3A. Constant interest rates and scientific amortization

- Figure 7.1

Handouts

Trading game
Practice Problems for Exam 3

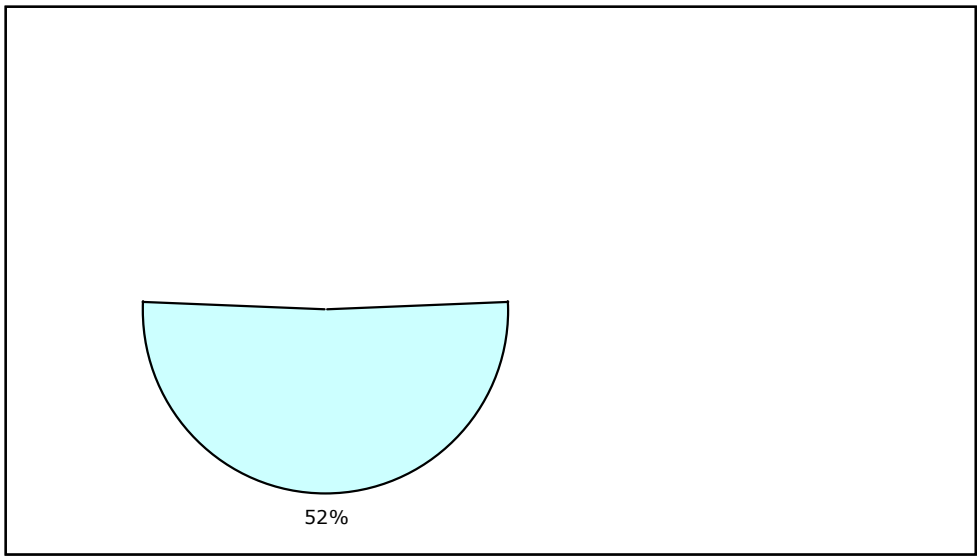
	Average Daily Trading Volume ($ billions)				
	U.S. Treasury Securities - 1 -	U.S. Agency Securities - 2 -	Municipal Securities - 3 -	Long-Term Corporate Securities - 4 -	NYSE Stocks - 5 -
1991	$128	$6	not available	not available	$6
1992	152	6			7
1993	174	9			9
1994	191	16			10
1995	193	24			12
1996	204	31			16
1997	212	40			23
1998	227	48			29
1999	187	55			35
2000	207	73			43
2001	298	90	9		41
2002	366	82	9	19	40
2003	434	82	11	21	36
2004	501	77	12	21	46

TABLE 7.1 Average daily trading volume of selected financial securities

Asset-backed securities (from Chapter 9, Section 9.3.A1 p. 294 - 296)

All "open market" securities mature in less than 270 days, and most mature in less than 60 days. Recall that according to one of the categorization schemes for financial markets in chapter 1 (table 1.2), the "money market" contains all securities with original maturity of 1-year or less. Securities with longer maturities are in the "capital markets." All open market paper is in the money market.

Companies that issue open market securities realize an increase in a liability on the balance sheet. For issuing companies, open market securities are a financing source. The companies borrow cash for this very short-term because their intended use of the cash also is short-term. Generally speaking, companies obtain short-term financing for short-term uses, long-term financing for long-term uses. Figure 9.1 shows the types of companies that issue open market paper.



"ABS" in figure 9.1 stands for short-term asset-backed securities and at year-end 2001 they represent 52% ($745 billion) of all commercial paper outstanding in the U.S.A. The balance sheet for the company creating the ABS provides key insight about this important security. The company issues (that is, sells) the asset backed security, the sale represents a source of financing, and there is an increase on the liability side for the line item "ABS". Investors purchasing the ABS includes institutional players on the buy-side (pension funds, etc.). Companies creating open market ABS use the money to purchase *Receivables* from hundreds of different companies. The balance sheet's asset side lists all the different *Receivables* on which the ABS have a claim. Ownership of an asset-backed security represents indirect ownership of revenues from a large pool of financial assets.

FORMULA 7.1 Semiannual coupon

The interest payment for a bond is paid semiannually and is called a coupon. The semiannual coupon is computed as

coupon = face value x annual coupon rate ÷ 2

FORMULA 7.2 Bond price

Bond prices in the U.S.A. typically are quoted as a percent of par. The dollar price of the bond is computed as

bond price = face value x quoted percentage price

FORMULA 7.3 Current yield

current yield = face value x annual coupon rate ÷ bond price

FORMULA 7.4 Yield-to-maturity and bond cash flows

$$bond\ \ price = \frac{coupon_1}{\left(1+YTM/2\right)^1} + \frac{coupon_2}{\left(1+YTM/2\right)^2} + \ldots + \frac{coupon_N}{\left(1+YTM/2\right)^N} + \frac{face\ \ value}{\left(1+YTM/2\right)^N}$$

$$= \ coupon\left\{\frac{1-\left(1+YTM/2\right)^{-N}}{YTM/2}\right\} \ + \ \frac{face\ \ value}{\left(1+YTM/2\right)^N}$$

N is the number of expected coupons. The right-hand-side sums $N + 1$ terms. The first N terms equal the present value of N expected coupons. They sum to the coupon multiplied by $PVIFA_{YTM/2\,,\,N}$. The last term is the present value of the principal repayment (i.e., the face value). The investor receives the face value at the same time that the final coupon is paid so the two last terms on the right-hand-side are both discounted N periods. The yield-to-maturity is an annual percentage rate. The formula divides the yield-to-maturity by two because interest compounds semiannually.

EXERCISES 7.2

5. A 10-year bond with a 4.40% coupon rate was issued with a 5.37% yield to maturity. Find the bond price at time of issue. ©BD7a

6. A 20-year bond with a 7.80% coupon rate was issued at a price of $1,130. Find the bond yield to maturity at time of issue. ©BD7b

7. Today is a day in June 2525 and a bond with annual coupon rate of 12.40% just yesterday paid a coupon. The bond matures in June 2545 and its annual yield-to-maturity equals 8.80% (semiannual compounding). Find the bond price. ©BD11a .

10. Today is a day in November 2525 and a bond with annual coupon rate of 5.40% just yesterday paid a coupon. The bond matures in May 2537 and its quoted bond price is 74.53 percent of par (semiannual compounding). You wish to make a bid such that your promised rate of return is 30 basis points greater than the quoted annual yield-to-maturity. Find the price as percent of par that you offer for the bond. ©BD13a

11. A bond with a coupon rate of 7.30% has a price that today equals $868.92 . The $1,000 bond pays coupons every 6 months, 30 coupons remain, and a coupon was paid yesterday. Suppose you buy this bond at today's price and hold it so that you receive 20 coupons. You sell the bond upon receiving that last coupon. Find the selling price if the bond's yield-to-maturity remains constant. ©BD14

FORMULA 7.5 Components for bonds of the promised yield-to-maturity

$$yield-to-maturity = \frac{coupon}{bond\ \ price} \quad + \quad \%\Delta(bond\ \ price)$$

$$= \begin{pmatrix} current \\ yield \end{pmatrix} + \begin{pmatrix} capital \\ gains \\ yield \end{pmatrix}$$

The total return from a bond investment has two sources. A current income component provides immediate cash flow in the form of coupons while a changing price component causes capital gains or losses. Table 7.2 contrasts characteristics for these two components.

Current yield (*coupon / price*)	Capital gains yield (*%Δprice*)
realized cash flow	accrued cash flow
immediately taxable	taxes are deferred
relatively predictable & more certain	very unpredictable & more uncertain
relatively large and usually the main reason for buying the bond	relatively small and not a significant decision variable (except for zero coupon bonds)

TABLE 7.2 Component characteristics for the total rate of return

RULE 7.1 Determination of premium and discount bonds

The bond price is 100 percent of face value, and the bond is said to sell at *par*, when the coupon rate equals the yield to maturity

The bond price is less than face value, and the bond is said to sell at a *discount*, when the coupon rate is less than the yield to maturity

The bond price exceeds face value, and the bond is said to sell at a *premium*, when the coupon rate is greater than the yield to maturity

RULE 7.2 Relation between yield-to-maturity, coupon rate, and bond price

$$\textit{Bond price} \left\{ \begin{matrix} > \\ = \\ < \end{matrix} \right\} \textit{\$1,000 when coupon rate} \left\{ \begin{matrix} > \\ = \\ < \end{matrix} \right\} \textit{YTM}.$$

The bond price exceeds face value and the bond is said to sell at a *premium* when coupon rate > yield-to-maturity. Conversely, bond price is less than face value and the bond is said to sell at a *discount* when the coupon rate < *YTM*. When coupon rate and yield to maturity are equal the bond price equals face value and the bond is said to sell at *par*.

Borrowers usually set coupon rates so that the bonds sell in the primary market at a price near face value. The coupon rate is printed on the bond and is unchanging. The overall level of interest rates, on the other hand, rises and falls with economic factors such as inflation. Yield-to-maturity for any particular bond correlates highly with the overall level of rates.

RULE 7.3 Inverse relation between bond price and interest rate movements

$$\textit{Existing bond prices} \left\{ \begin{matrix} \textit{rise} \\ \textit{fall} \end{matrix} \right\} \textit{when subsequent interest rates} \left\{ \begin{matrix} \textit{fall} \\ \textit{rise} \end{matrix} \right\}.$$

Rule 7.3 is strictly true for exclusively the relation between a particular bond's price and yield-to-maturity. Because a particular *YTM* generally rises or falls with the overall level of interest rates, though, the rule is generally true.

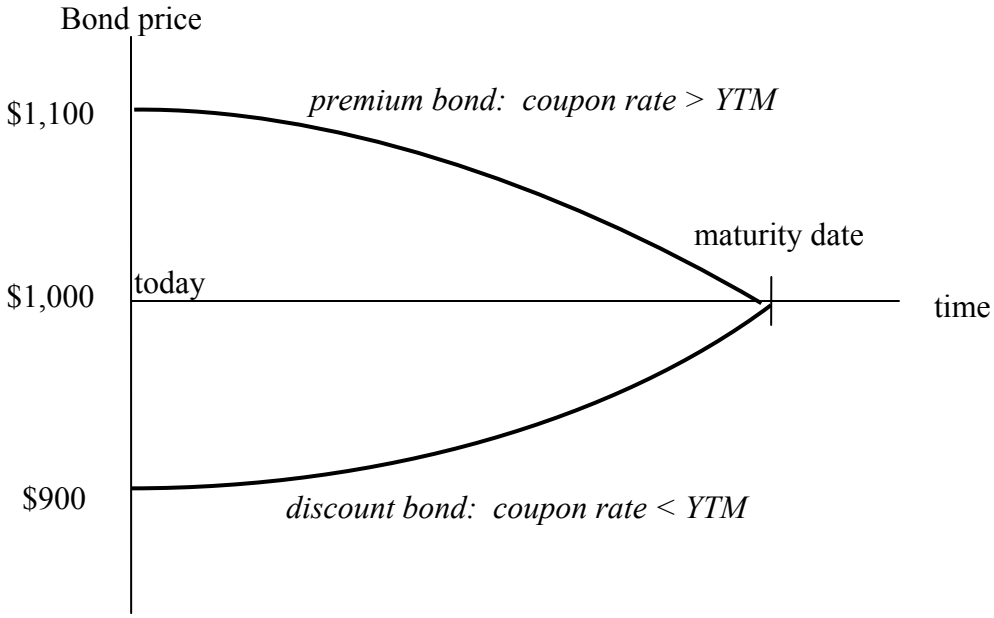


FIGURE 7.1 Evolution of bond price over time given constant yield-to-maturity
Notes The premium bond with $1,100 price today converges by the maturity date to its face value of $1,000. The discount bond with price of $900 also converges to face value.

Scientific amortization refers to the evolutionary path of bond price from its current price toward face value given yield-to-maturity remains constant.

EXERCISES 7.3B

5. Today is a day in June 2525 and a bond with annual yield-to-maturity of 11.20% just yesterday paid a coupon. The bond matures in June 2540 and its quoted bond price today is 77.72 percent of par (semiannual compounding). Contrast the annual capital gains yield today with the annual capital gains yield for the six months that conclude with June 2540 (assume scientific amortization and constant *YTM*). ©BD17b .