# 3. VALUATION OF BONDS AND STOCK

**Objectives:** After reading this chapter, you should be able to:
1. Understand the role of stocks and bonds in the financial markets.
2. Calculate value of a bond and a share of stock using proper formulas.

## 3.1 Acquisition of Capital

Corporations, big and small, need capital to do their business. The investors provide the capital to a corporation. A company may need a new factory to manufacture its products, or an airline a few more planes to expand into new territory. The firm acquires the money needed to build the factory or to buy the new planes from investors. The investors, of course, want a return on their investment. Therefore, we may visualize the relationship between the corporation and the investors as follows:
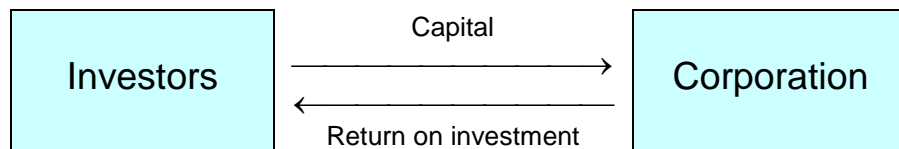


Fig. 3.1: The relationship between the investors and a corporation.

Capital comes in two forms: *debt* capital and *equity* capital. To raise debt capital the companies sell bonds to the public, and to raise equity capital the corporation sells the stock of the company. Both stock and bonds are financial instruments and they have a certain intrinsic value.

Instead of selling directly to the public, a corporation usually sells its stock and bonds through an intermediary. An investment bank acts as an agent between the corporation and the public. Also known as underwriters, they raise the capital for a firm and charge a fee for their services. The underwriters may sell $100 million worth of bonds to the public, but deliver only $95 million to the issuing corporation. A corporation that is selling its bonds, or stock, for the first time may have to pay a higher percentage of the total value as underwriters' fees. Well-established companies with strong financial record can sell their stock or bonds with relative ease and so the underwriters' fees are lower. When a corporation issues its stock for the first time, it is known as an IPO, or an initial public offering. Later, the investors buy and sell the stock in the secondary markets, such as the New York Stock Exchange.

## 3.2 Valuation of Bonds

Corporations sell bonds to borrow money from the investors. As a financial instrument, a bond represents a contractual agreement between the corporation and the bondholders. Eventually the corporation has to repay the principal to the investors and pay interest to them in the meantime.

_____

Typically, a bond has the following features:

1. *The face value*, *F*. The face value of a bond, or its principal, is usually $1,000, which means that the investment in bonds is a multiple of $1,000. The total value of the bonds issued by a company at a certain time could be millions of dollars.

2. *The market value, B*. Although a bond may have a face value of $1000, it may not sell at $1000 in the bond market. If the issuing company is not doing well financially, its bonds may sell for less than $1000, perhaps at $950. If you look up their price on the Internet, or some financial newspaper, it is listed as 95. This means that the bond is selling at 95% of its face value, or $950. The bond is selling at a discount. If the market value of the bond is more than $1,000, and then it is selling at a *premium*. A bond with a market value less than $1,000 is selling at a *discount*, and a bond, which is priced at its face value, is selling at *par*.

3. *The time to maturity*, *n*. There is a definite date when a bond matures. At that time, the corporation must pay the face value of the bonds to the bondholders. This could be from as little as 5 years to as long as 100 years. The short-term bonds are also called *notes*. The companies that are starting out, do not want to carry a long-term debt burden and so they issue relatively short-term bonds. Well established companies prefer to use long-term debt in their capital, especially when the interest rates are low.

4. *The coupon rate*, *c*. This is the stated rate of interest of the bonds. For example, a bond may be paying 8% interest to the bondholders. The dollar amount of interest *C*, is the product of the face amount of the bond and the coupon rate. We may write this as

$$C = cF$$

The 8% bond is paying .08*1000 = $80 per year to the investors. The corporations generally pay the interest semiannually, so the 8% bond really pays $40 every six months. For example, a bond may pay interest on February 15 and August 15 in a calendar year. If an investor buys a bond between the interest payments dates, let us say on May 1, then he has to pay the *accrued interest*, the interest for the period February 16 to May 1, to the seller of the bond.

The interest rate on a bond depends primarily on two factors. First, it depends on the general level of interest rates in the economy. At the time of this writing, the interest rates are at their historical lows due to the easy-credit policy of the Federal Reserve Board. This allows companies to borrow money at lower rates enabling them to expand their business easily. At other times, the interest rates may be quite high, partly because of Fed's tight money policy. This forces all companies to borrow at a higher rate of interest.

Second, the company, which is issuing bonds, may not be in a strong financial condition. The sales are down, the cash flow is small, and the future prospects of the company are not too bright. It must borrow new money at a higher rate. On the other hand, well-

_____

managed companies in a strong financial position can borrow at relatively low interest rates.

5. *The indenture*. The indenture is the formal contract between the bondholders and the corporation. Written in legal language, the fine print spells out the rights and responsibilities of both parties.

In particular, the indenture requires the company to pay interest to the bondholders whenever it is due. The companies have to pay interest before they pay taxes or dividends on the common stock. This makes the position of the bondholders quite secure. The indenture also spells out the timetable for bond refunding.

Another clause in the indenture further strengthens the position of the bondholders. This allows them to force the company into liquidation if the company fails to meet its interest obligations on time.

Figure 3.2 shows an advertisement that appeared in the *Wall Street Journal*. Dynex Capital, Inc. issued bonds with a total face value of $100 million in July 1997. The bonds had a coupon of $7^7/_8\%$, meaning that each bond paid $78.75 in interest every year. Actually, half of this interest was paid every six months. The bonds were to mature after 5 years, which is a relatively short time for bonds. They were senior notes in the sense that the interest on these bonds would be paid ahead of some other junior notes. This made the bonds relatively safer.

$$
\begin{array}{c}
\$100{,}000{,}000 \\[4pt]
\textbf{\Large DYNEX} \\[4pt]
\text{Dynex Capital, Inc.} \\
7^7/_8\% \text{ Senior Notes Due July 15, 2002} \\
\text{Interest Payable January 15 and July 15} \\
\rule{3cm}{0.4pt} \\
\text{Price 99.900\%} \\
\text{plus accrued interest from July 15, 1997} \\
\rule{3cm}{0.4pt} \\
\text{Paine Webber Incorporated}\quad\text{Smith Barney Incorporated}
\end{array}
$$

Fig. 3.2: A bond advertisement in Wall Street Journal.

The price of these bonds is $999 for each $1,000 bond. Occasionally, the corporations may reduce the price of a bond and sell them at a discount from their face value. This is true if the coupon is less than the prevailing interest rates, or if the financial condition of the company is not too strong. The buyer must also pay the accrued interest on the bond. If an investor buys the bond on July 25, 2002, he must pay accrued interest for 10 days.

The two companies listed at the bottom of the advertisement, Paine Webber Incorporated and Smith Barney Incorporated, are the *underwriters* for this issue. Underwriters, or

_____

investment banking firms, such as Merrill Lynch, will take a certain commission for selling the entire issue to the public.

Since the appearance of this advertisement, several changes have occurred. On November 3, 2000, Paine Webber merged with UBS AG, a Swiss banking conglomerate. Smith Barney is now part of Citigroup. Corporations no longer use fractions in identifying the coupon rates; instead, they all use decimals.

Table 3.2 shows the yields of corporate bonds on January 5, 2007. Rated by Fitch or other agencies, the letters AAA, AA, and A represent the quality of bonds. The highest quality, or least risky, bonds are designated by AAA, and so on. We notice two things. First, the longer maturity bonds of the same quality rating have a higher yield. For instance, for bonds with A rating, the yield for 2-year maturity is 5.13%; and for 20 years, it is 5.82%. Second, the yield is higher for riskier bonds. Consider 5-year bonds. The yield rises from 5.06% to 5.20% when the rating drops from AAA to A.

| Corporate Bonds, January 5, 2007 | | | | |
|---|---|---|---|---|
| **Maturity** | **Yield** | **Yesterday** | **Last Week** | **Last Month** |
| 2yr AA | 5.04 | 4.98 | 5.11 | 4.86 |
| 2yr A | 5.13 | 5.08 | 5.20 | 4.92 |
| 5yr AAA | 5.06 | 5.03 | 5.11 | 5.19 |
| 5yr AA | 5.13 | 5.09 | 5.17 | 4.93 |
| 5yr A | 5.20 | 5.16 | 5.23 | 4.99 |
| 10yr AAA | 5.18 | 5.07 | 5.30 | 5.08 |
| 10yr AA | 5.32 | 5.33 | 5.42 | 5.19 |
| 10yr A | 5.43 | 5.37 | 5.47 | 5.26 |
| 20yr AAA | 5.68 | 5.71 | 5.76 | 5.06 |
| 20yr AA | 5.76 | 5.79 | 5.84 | 5.68 |
| 20yr A | 5.82 | 5.85 | 5.90 | 5.71 |

Table 3.2: The yield of bonds as a function of quality and time to maturity.
Source: http://finance.yahoo.com/bonds January 5, 2007

Table 3.3 shows a sampling of bonds available in the market in January 2007. They appear in terms of their quality rating, the least risky bonds are at the top and the riskiest ones at the bottom.

| *Issue* | *Price* | *Coupon %* | *Maturity date* | *YTM %* | *Current Yield* | *Fitch Ratings* | *Callable* |
|---|---|---|---|---|---|---|---|
| Federal Home Ln Mtg | 99.00 | 5.000 | 27-Jan-2017 | 5.128 | 5.051 | AAA | Yes |
| Goldman Sachs | 104.40 | 5.750 | 1-Oct-2016 | 5.168 | 5.508 | AA | No |
| Emerson Electric | 100.53 | 5.125 | 1-Dec-2016 | 5.056 | 5.098 | A | No |
| Clear Channel Comm. | 90.90 | 7.250 | 15-Oct-2027 | 8.165 | 7.976 | BBB | No |
| Scotia Pacific | 81.50 | 7.710 | 20-Jan-2014 | 11.634 | 9.460 | BB | No |
| Brookstone | 99.88 | 12.000 | 15-Oct-2012 | 12.020 | 12.015 | B | Yes |
| Fedders No Am | 72.50 | 9.875 | 1-Mar-2014 | 16.575 | 13.621 | CCC | Yes |
| Wise Metals | 90.74 | 10.250 | 15-May-2012 | 12.678 | 11.296 | CC | Yes |

Table 3.3: The yield of bonds as a function of quality and time to maturity. [Yahoo Finance, 1/5/2007]

_____

Normally, when an investor buys a bond he has to pay the accrued interest on the bond. This is the interest earned by the bond since the last interest payment date. Occasionally some bonds trade without the accrued interest and they are thus dealt in flat. Due to poor financial condition of the company, such bonds sell at a deep discount from their face value.

An investor buys a bond for its future cash flows. To evaluate a bond, therefore, we have to find the present value of the cash flows. We use a very fundamental concept in finance:

> The present value of a bond is simply the present value of all future cash flows from the bond, discounted at the risk-adjusted discount rate.

We may use this concept to find the value of any financial instrument, whether it is a stock, a bond, or a call option. For a bond, we need to find the present value of all the interest payments and the present value of the final payment, namely, the face amount of the bond. We may write it mathematically as

$$B = \sum_{i=1}^{n} \frac{C}{(1+r)^i} + \frac{F}{(1+r)^n}$$

In the above equation, we define

$B$ = the present value, or the market value of the bond
$C$ = cash flow from the interest of the bond, and for semiannual interest payments, it
     should be one-half of the annual interest paid by the bond
$n$ = the number of semiannual payments received
$F$ = face amount of the bond
$r$ = risk-adjusted discount rate for the bond. For riskier bonds, the discount rate is higher.

We can do the summation by using (2.5),

$$\sum_{i=1}^{n} \frac{C}{(1+r)^i} = \frac{C\left[1-(1+r)^{-n}\right]}{r} \tag{2.5}$$

Thus, we can find the value of a bond by

Bond value, $$B = \frac{C\left[1-(1+r)^{-n}\right]}{r} + \frac{F}{(1+r)^n} \tag{3.1}$$

Consider a bond that is never going to mature, that is, it is a perpetual bond. An investor will buy such a bond and earn interest on it. The bond will pay a steady income forever. If he no longer needs an income, he can simply sell the bond to another investor. The bond represents a perpetual income stream and we can evaluate it by using (1.6),

_____

$$\sum_{i=1}^{\infty} \frac{C}{(1+r)^i} = \frac{C}{r} \qquad (1.6)$$

For perpetual bonds, $$B = \frac{C}{r} \qquad (3.2)$$

It is also possible to get (3.2) by setting $n = \infty$ in (3.1).

Another type of a bond is a zero-coupon bond. Such a bond does not pay any interest but it does pay the principal at maturity. An investor who does not need a steady income, but requires $1000 at a future time, may buy such a bond. The value of a zero-coupon bond is found by letting $C = 0$ in (3.1). The result is

For zero-coupon bonds, $$B = \frac{F}{(1+r)^n} \qquad (3.3)$$

Suppose you have the option of keeping your money in a savings account that pays interest at the rate of 6% per year, compounding it every year. You plan to keep this money for the next 10 years and then withdraw it. You would like to have $1000 after ten years. How much money should you deposit right now?

The answer is, the present value of $1000 discounted at the rate of 6% per year. That is, $1000/1.06^{10} = \$558.48$.

Suppose a zero-coupon bond with face value $1000 is also available, which matures after 10 years. If you can buy this bond for $558.48, it will serve your purpose perfectly. It will also give you $1000 at maturity, after 10 years. Zero-coupon bonds are sold at a discount; occasionally well below their face value.

Those investors who do not need steady income from bond investments will buy zero-coupon bonds. They are perhaps saving for retirement, or for children's education. Those corporations that do not have enough money to pay the interest payments due to cash-flow problems may issue zero-coupon bonds.

US Treasury bills are zero-coupon bonds. You buy them at a discount and when they mature, you get their face amount.

The holder of a convertible bond is entitled to convert it into a fixed number of shares of the stock of the issuing corporation at any time before maturity. As the stock price rises, the value of the bond also rises. Occasionally, convertible bonds sell well above the par value. The convertible bonds are quite difficult to evaluate.

An investor buys a bond for its *yield*, which is the annual return on the investment. We may define the current yield, *y*, of a bond as the annual interest *C* in dollars, divided by the market price of the bond *B* in dollars. In symbols,

_____

$$y = C/B \qquad (3.4)$$

This represents the return on investment provided one holds the bond for a short time. For instance, you buy a 5% coupon bond at 60. Then the annual interest received is $50, and the market price of the bond $600. Dividing one by the other, we get the current yield as

$$y = \frac{50}{600} = 8.33\%$$

Suppose a bondholder wants to hold the bond all the way to its maturity. Then he may be interested to find its yield-to-maturity, $Y$. By definition,

> The yield-to-maturity of a bond is that particular value of $r$ that will equate the market value of a bond to its calculated value by using (3.1)

In practice, one can calculate the yield to maturity accurately by using Excel, WolframAlpha, or Maple.

When you hold a bond to maturity, you receive money in the form of interest payments, plus there is a change in the value of the bond. If you have bought the bond at a discount, it will rise in value reaching its face value at maturity. On the other hand, the bond may drop in price if you have bought it at a premium. In any case, it should be selling for its face value at maturity. The total price change for the bond is $(F - B)$ which may be positive or negative depending upon whether $F$ is more or less than $B$. On the average, the price change per year is $(F - B)/n$. The average price of the bond for the holding period is $(F + B)/2$. We may calculate the *yield to maturity* of a bond, approximately, by dividing the average annual return by the average price. We write it as follows.

$$Y \approx \frac{\text{annual interest received} + \text{annual price change}}{\text{average price of the bond for the entire holding period}}$$

Or,
$$Y \approx \frac{C + (F - B)/n}{(F + B)/2} \qquad (3.5)$$

Consider a bond with coupon rate 8% and 10 years to maturity. If the discount rate is 8%, then the bond is selling at par. Its value will remain $1000 with the passage of time. This is shown as the straight horizontal line in the middle of Fig. 3.3.

If the discount rate is 6%, the bondholders' required rate of return is 6%. Since the bond is providing 8% coupon, it is more than the required rate of return. This will make the market value of the bond more than its face value and the bond will be selling at a premium. Calculations indicate that it should sell for $1148.77. As the time passes, the time to maturity gets shorter, and the value of the bond slides along the top curve until it becomes $1000 at maturity. Note that the curve is not a straight line.
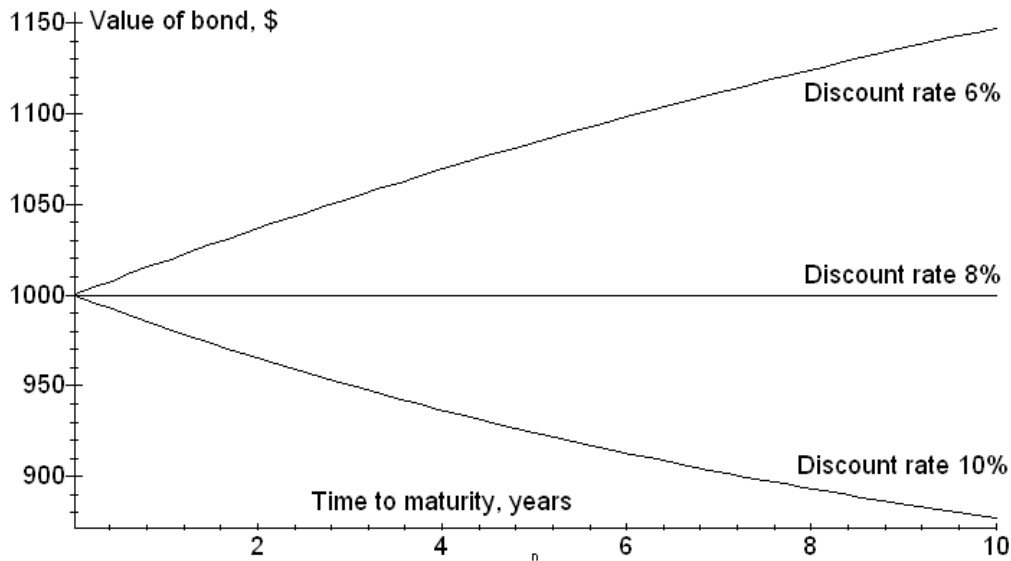
_____



Figure 3.3: The value of a bond with coupon rate 8%, discounted at different discount rates. As the bond approaches maturity, time to maturity becomes zero, and its value approaches $1000. Before maturity, its value is more than $1000 if the discount rate is less than 8%. Similarly, the value is less than $1000 for a discount rate higher than 8%.

If the discount rate is 10%, the bond will sell at a price less than $1000. Its calculated value is $875.38. This is shown as the bottom curve in Fig. 3.3. With the passage of time the bond actually rises in value, and at maturity, it becomes $1000. Assuming that the company is financially strong, it will redeem the bonds at $1000 at maturity.

## Examples

**3.1.** Wall Street Journal lists a bond as Apex 9s14 and shows the price as 88.875. If your required rate of return is 10%, would you buy one of these bonds in 2001?

The price of the bond is 88.875. This means it is selling for 88.875% of its face value. For a $1000 bond, it is $888.75. The term 9s14, pronounced as "nines of fourteen" means that the coupon rate of the bond is 9% and that it will mature in 2014. The bond matures after 13 years and makes 26 semiannual interest payments. The annual interest paid is $90. Each semiannual interest payment is $45. The semiannual required rate of return is 5%.

Using the bond pricing formula,

$$B = \frac{C\left[1 - (1 + r)^{-n}\right]}{r} + \frac{F}{(1 + r)^n} \qquad (3.1)$$

we find the theoretical bond price by letting $C = \$45$, $r = .05$, $F = \$1000$, and $n = 26$.

_____

$$B = \sum_{i=1}^{26} \frac{45}{1.05^i} + \frac{1000}{1.06^{26}} = \frac{45[1 - 1.05^{-26}]}{.05} + \frac{1000}{1.05^{26}} = \$928.12$$

The intrinsic value, or the theoretical value, of the bond is \$928.12, whereas it is available in the market for \$888.75. You should buy it. ♥

In Excel, you can do it as follows.

|   | A | B |
|---|---|---|
| 1 | Semiannual interest payment, $C$ | 45 |
| 2 | Semiannual discount rate, $r$ | .05 |
| 3 | No. of semiannual payments, $n$ | 26 |
| 4 | Face value of the bond, $F$ | 1000 |
| 5 | Market value of the bond, $B$ | =B1*(1-1/(1+B2)^B3)/B2+B4/(1+B2)^B3 |

If you copy the above table in a blank Excel sheet, you should get the answer as \$928.12 in cell B5.

WRA `Sum[45/1.05^i,{i,1,26}]+1000/1.05^26`

**3.2.** The ARA Corporation bonds have a coupon of 14%, pay interest semiannually, and they will mature in 7 years. Your required rate of return for such an investment is 10% annually. How much should you pay for a \$1,000 ARA Corporation bond?
For a 14% bond, the annual interest is \$140 and its semiannual value is \$70. The number of semiannual periods before maturity is 14 and the semiannual discount rate is 5% or .05. The face amount of the bond is \$1000. Using (3.1), we get,

$$B = \frac{C\,[1 - (1 + r)^{-n}]}{r} + \frac{F}{(1 + r)^n} \tag{3.1}$$

$$B = \sum_{i=1}^{14} \frac{70}{1.05^i} + \frac{1000}{1.05^{14}} = \frac{70(1 - 1.05^{-14})}{0.05} + \frac{1000}{1.05^{14}} = \$1,197.97 \; ♥$$

WRA `Sum[70/1.05^i,{i,1,14}]+1000/1.05^14`

**3.3.** A bond has a coupon of 6.5% and it pays interest semiannually. With a face value of \$1000, it will mature after 10 years. If you require a return of 12% from this bond, how much should you pay for it?

We have, number of semiannual periods, $n = 20$; semiannual interest, $C = \$32.50$; and the semiannual required rate of return, $r = 0.06$. Using (3.1), we have

$$B = \sum_{i=1}^{20} \frac{32.50}{1.06^i} + \frac{1000}{1.06^{20}} = \frac{32.50(1 - 1.06^{-20})}{0.06} + \frac{1000}{1.06^{20}} = 684.58$$

Therefore, you should pay at most \$684.58 for it. ♥

_____

**3.4.** In 2001, a newspaper listed a bond as Slimline Corp 6s13 and showed its price as a two-digit number with a fraction. The bondholders had a required rate of return of 12% for these bonds. Find the (approximate) price of the bond as shown in the newspaper.

The numbers 6s13 mean that the bond pays interest at the rate of 6% per year, and it will mature in the year 2013. In 2001, the bond still has 12 years before it matures. There are 24 semiannual periods, and the semiannual interest is $30. Using (3.1),

$$B = \sum_{i=1}^{24} \frac{30}{1.06^i} + \frac{1000}{1.06^{24}} = \frac{30(1 - 1.06^{-24})}{.06} + \frac{1000}{1.06^{24}} = \$623.49$$

The price of the bond is $623.49. The newspaper listed it as $62^3/_8$. ♥

**3.5.** The British Government issued perpetual bonds in 1821 with a coupon rate of 3% and face value of £100. Calculate the price of such a bond in 2008 when the riskless interest rate in London is 4.85%.

With a 3% coupon, the £100 bond will pay £3 in interest annually forever. Put $C = 3$ and $r = .0485$ in (3.2) to get

$$B = C/r = 3/.0485 = £61.86 ♥$$

The bond should be selling for £61.86. ♥

**3.6.** In 2001, a newspaper lists a bond as AT&T 10s05 and its price as 105. Find the approximate yield to maturity for this bond.

The bond will mature in 2005 and it has another 4 years before maturity. Its price is $1050 and its face value is $1000. Using (3.5), we have

$$YTM \approx \frac{\text{annual interest received} + \text{annual price change}}{\text{average price of the bond for the entire holding period}}$$

Or,
$$YTM \approx \frac{100 + (1000 - 1050)/4}{(1000 + 1050)/2} = 0.0854 \approx 8.54\% ♥$$

The reason for the yield to be less than 10% is that an investor has paid too much money for it, $1050, and he will get back only $1000 at maturity.

**3.7.** Berks Corp bonds pay interest semiannually and they will mature in 10 years. Currently a $1000 bond sells for $800 and the bondholders require annual return of 9%. Calculate the coupon rate of these bonds.

The number of payments that investors will receive, $n = 20$. The face amount $F = \$1000$ and the current price of the bond $B = \$800$. The required rate of return $r = 9\%$ annually, or 4.5% semiannually. Suppose the coupon rate is $c$. The annual interest payment is

_____

found by multiplying the coupon rate by the face amount of bond, or $c(1000)$. The semiannual interest payment is half as much, or $500c$. Substituting all this in (3.1), we get

$$800 = \sum_{i=1}^{20} \frac{500c}{1.045^i} + \frac{1000}{1.045^{20}} = \frac{500c(1 - 1.045^{-20})}{.045} + \frac{1000}{1.045^{20}}$$

Moving things around, we get

$$800 - \frac{1000}{1.045^{20}} = \frac{500c(1 - 1.045^{-20})}{.045}$$

Or,

$$\left(800 - \frac{1000}{1.045^{20}}\right)\left(\frac{.045}{500(1 - 1.045^{-20})}\right) = c$$

This gives $c = .0592495 \approx 5.925\%$ ♥

The following instruction gets the answer on WolframAlpha as $c = .0592495$.

WRA **`800=Sum[500*c/1.045^i,{i,1,20}]+1000/1.045^20`**

To do the problem on an Excel sheet, proceed as follows. The calculation assumes that the bonds pay interest semiannually. The answer in cell B5 is .05925, or 5.925%.

| | A | B |
|---|---|---|
| 1 | Face value, $ | 1000 |
| 2 | Time to maturity, years | 10 |
| 3 | Market price, $ | 800 |
| 4 | Required rate of return | .09 |
| 5 | Unknown coupon rate, $c$ | =B4*(B3-(1+B4+1/4*B4^2)^(-B2)*B1)/B1/(1-4^B2*(1/(2+B4)^2)^B2) |

**3.8.** In 2001, Milhous Co 12s09 bonds are listed as 97, and they pay interest semiannually. If your required rate of return is 13%, how much should you pay for one of these bonds? Would you buy them at the market price?

The term "12s09" means that the coupon rate of the bonds is 12% and that they will mature in the year 2009. If the bond is listed as 97, it is selling at 97% of its face value. A $1000 bond is selling for $970. The bonds will mature after 8 years, meaning there are 16 semiannual periods. The interest per period is $60, and the required rate of return is 6.5% per period. The intrinsic value $B$ of the bond is

$$B = \sum_{i=1}^{16} \frac{60}{1.065^i} + \frac{1000}{1.065^{16}} = \frac{60(1 - 1.06^{-16})}{.065} + \frac{1000}{1.065^{16}} = \$951.16$$

The intrinsic value of the bonds is $951.16 each and, therefore, one should not buy the bond at the market price of $970. ♥

_____

**3.9.** You have bought a zero-coupon bond for $300. It will mature in 6 years and pay the face value of $1,000. Assuming annual compounding, what is the implied rate of return for the bond?

A zero-coupon bond pays no interest. However, one can buy the bond at a deep discount from its face value. When the bond matures, the holder is entitled to receive the face amount of the bond, which is generally $1,000. The present value of the bond is $300, and its future value $1000. This is a single payment problem, thus

$$1000 = 300(1 + r)^6$$

Or,                         $$1 + r = (1000/300)^{1/6} = 1.2222$$

Or,                         $$r = 22.22\% \; \heartsuit$$

**3.10.** Albert Company bonds, with current yield 12%, will mature after 10 years. The coupon rate of these bonds is 10%. Calculate their market price and the yield to maturity.

By definition, the current yield of the bond is equal to the annual interest payment from the bond, divided by the market value of the bond. Write it as

$$\text{Current yield} = \frac{\text{Annual interest payment from the bond}}{\text{Market price of the bond}}$$

With 10% coupon, the annual interest from the bond is $100. Putting numbers,

$$.12 = \frac{100}{B}$$

Or,                         $$B = 100/.12 = \$833.33 \; \heartsuit$$

To find their yield to maturity, we use (3.5), which gives

$$Y = \frac{100 + (1000 - 833.33)/10}{\frac{1}{2}(1000 + 833.33)} = 12.73\% \; \heartsuit$$

## Problems

**3.11.** The WSJ lists a bond as Acme 9s13 and the price as 89.875. If your required rate of return is 10%, would you buy one of these bonds in 2001?         $B = \$931.00$, yes. $\heartsuit$

**3.12.** Bakersfield Company 8.5s26 bonds pay interest semiannually, and they are quoted in the WSJ as 90. If your required rate of return is 10%, would you buy these bonds in 2011?         $B = \$884.71$, no. $\heartsuit$

_____

**3.13.** You are thinking of buying IBM 6.25s20 bonds, priced at 92. The bonds pay interest semiannually. If your required rate of return is 8%, would you buy these bonds in 2011?                                                              *B* = $889.23, no. ♥

**3.14.** Napier Company has zero-coupon bonds maturing in 2018. The yield to maturity for these bonds is 9%. Find the price of one of these bonds in 2001.                $231.07 ♥

**3.15.** Checking the *Wall Street Journal* in 2001, you find that the Babbitt Co. 6s21 bonds show the price as 68. The bonds pay interest semiannually. If your required rate of return for such bonds is 10%, would you buy Babbitt bonds?                *B* = $656.81, no. ♥

**3.16.** The investors require 8% return on Keitel Corporation 5s2024 bonds that pay interest semiannually. Find the price of one of these bonds in 2011.                $760.26 ♥

**3.17.** Adapazari Company 7% coupon bonds pay interest semiannually. When you bought one of these bonds, it had 11 years to maturity, and the appropriate discount rate was 9%. After one year, the discount rate on such bonds is 8% because of the improved financial health of the company. If you sell the bond today, what would be your capital gain or loss?                                                              $69.89 gain ♥

**3.18.** Zeller Co bonds are selling at $602.50 each because the bondholders' required rate of return is 15%. The bonds pay interest semiannually and they will mature after 10 years. Find the coupon rate of these bonds.                                              7.2% ♥

**3.19.** Armstrong Company bonds have 7% coupon rate, they pay interest semiannually, and they will mature after 12 years. In the bond market, these bonds are selling at $900 each. If your required rate of return is 8%, would you buy one of these bonds?
*B* = $923.77, yes. ♥

**3.20.** Suppose you want to buy a PP&L bond with coupon 18.75% that matures in 5 years, and pays interest semiannually. If the face value of this bond is $1,000, and your required rate of return is 12%, how much should you pay for this bond?        $1,248.40 ♥

**3.21.** Athens Corporation bonds pay interest semiannually. The bonds have a coupon of 11% and they will mature after 11 years. If the investors' required rate of is return of 14%, find the market value of a $1000 bond.                                $834.08 ♥

**3.22.** Allen Corp bonds have a face value of $1,000 and coupon rate of 13.5%. They make semiannual interest payments. How much should you pay for an Allen bond if your required rate of return is 8.5% and the bond will mature after 8 years?        $1,286 ♥

**3.23.** IBM bonds have a coupon rate of 8%, pay interest semiannually, and will mature in 8 years. What is the price of a $1,000 IBM bond if the investors have a required rate of return of 7%?                                                              $1060.47 ♥

_____

**3.24.** Edwards Corp 9s2018 bonds pay interest semiannually. If your required rate of return for such a bond is 11% annually, how much should you pay for a $1,000 bond in 2001?                                                                                      $847.63 ♥

**3.25.** Butler Corp 6s06 bonds pay interest semiannually and will mature on October 8, 2006. If your required rate of return is 9% per year, how much should you pay for a $1,000 bond on April 9, 2001?                                                              $872.06 ♥

**3.26.** Find the price of a $1000 Forster Corp bond which is going to mature in six and a half years. It pays interest semiannually; has coupon of 11%; and the bondholders have a required rate of return of 12% annually on their investment.                      $955.74 ♥

**3.27.** Aquarius Waterworks bonds have 9 years until maturity and they pay interest annually. The investors require a return of 14% on these bonds and are willing to buy them at 80% of their face value. Find the coupon rate on these bonds.              9.96% ♥

**3.28.** A perpetual bond has face value $1,000, and coupon 8%. You bought this bond when the interest rates were 10%, and sold it when the interest rates were 12%. Find your capital gain or loss in dollars.                                            Loss $133.33 ♥

**3.29.** Meitner Corp issued zero coupon bonds in 1980 that mature in 2010. If your required rate of return is 13% on such bonds, how much would you pay for one in 1997?
$204.16 ♥

**3.30.** Doenitz Corp issued $1000 face value, perpetual bonds in 1980 with a coupon of 8%. Find the price of one of these bonds in 1999 when the interest rate is 7%. $1142.86 ♥

**3.31.** The Northern Airlines 5s03 bonds will mature on January 15, 2003. Due to financial difficulties of the firm, the bondholders have a required rate of return of 25% on their investment. Find the price of one of these bonds on July 15, 1999.          $550.77 ♥

**3.32.** Baines Corp bonds have 6½ years until maturity. The bonds have a 9% coupon, and they sell at $1075 apiece. Calculate their yield to maturity.                      7.56% ♥

**3.33.** Compton Company bonds pay interest semiannually, and they will mature after 10 years. Their current yield is 8%, whereas their yield to maturity is 10%. Find the coupon rate and the market value of these bonds. Hint: use (3.1) and (3.4).      6.012%, $751.51 ♥

**3.34.** Port Elizabeth Corporation bondholders require a return of 12% on their investment. The bonds carry a coupon of 7½% and they will mature after 7.5 years. Find the market price of one of these bonds.                                            $781.47 ♥

**3.35.** Johannesburg Corporation issued zero-coupon bonds in 1976, which will mature in 2006. The initial price of the bonds gave 9.5% return to the investors. Find the issue price of these bonds.                                                              65.70 ♥

_____

**3.36.** A bond pays interest semiannually and it will mature after six years. The required rate of return by the bondholders is 14% per year, and the face amount of the bond is $1000. If the market price of the bond is $920.60, find its coupon rate.                    12% ♥
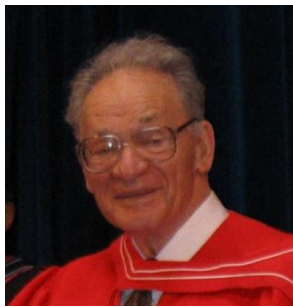
**3.37.** Bennett Company bonds will mature after 5 years and they are selling at 80.175% of their face value. The bonds pay interest annually. The required rate of return by the bondholders is 12%. Find the coupon rate of these bonds.                    6.5% ♥

**3.38.** Cleveland Company bonds have current yield 8% and yield to maturity 9%. They are selling at $725.50 per $1000 bond. Find the time to maturity for these bonds.

14 years ♥

**3.39.** You are planning to buy Ford 6¼s10 bonds in 2001 with the price at 79. The bonds pay interest semiannually. If your required rate of return is 11%, would you buy these bonds?                    $B = \$732.91$, no. ♥

**3.40.** Checking *The Wall Street Journal*, you find that the Burns Co. 7s21 bonds are quoted as 66. The bonds pay interest semiannually. If in 2001 your required rate of return for such bonds is 12%, would you buy Burns bonds?                    $B = \$623.84$, no. ♥

## 3.3    Valuation of Stock

There are two types of investors, the stockholders, and the bondholders, who provide the financial capital of a company. The stockholders are the real owners of the corporation. They have an equity stake in the business. The bondholders merely lend the money to the company. They receive a set rate of return determined by the coupon rate on the bonds.

Myron J. Gordon, 1920-2010

The stockholders receive dividends. However, the company does not guarantee dividends, and some companies do not pay any dividends at all. The bondholders receive regular, guaranteed interest payments. If the bondholders do not receive the interest payments on time, they have a right to sue the company and seize the assets of the firm. The bondholders also receive the face value of the bonds at maturity.

The stockholders are taking on more *risk* because their dividends are dependent on uncertain cash flows. To conserve cash a company may resort to eliminating cash dividends. The bondholders' position is much safer. The company must pay the interest before it pays the income tax or dividends.

The stockholders participate in the growth of the company. They also bear the losses when the times are tough. The bondholders cannot participate in the growth of the company. At the most, they can receive the interest payments and the face value of the bonds.

_____

The stockholders have the right to elect the board of directors of the corporation. The board is responsible for the implementation of major decisions at the company, such as the appointment of the president. In this way, the stockholders can participate in the management of the firm. The bondholders cannot participate in the running of the company.

The cash flows for a stock are quite random. The firm faces economic uncertainties. There is the possibility of labor strife, or shortage of raw materials, or unexpected action by the competitors. Each turn of events can make the earnings of the company unpredictable. The sudden changes in the stock price are essentially due to the changes in the financial condition of a firm. A look at the stock pages in a newspaper, with up and down movements of the stock prices, makes this idea quite clear. The stockholders are sharing this risk of the company.

The valuation of the equity of a firm is a much more difficult process due to the inherent uncertainty of the cash flows. Equation (3.6) gives a general formula for the stock valuation. However, we derive this formula under severe restrictions:

(1) The growth of the company is uniform from year to year, that is, the growth rate $g$ is constant. This is not true for actual firms. The company may grow by 10% and it may drop in value by 5% the following year.

(2) The growth will continue forever. This assumption is also unrealistic, because the companies go through a supernormal growth period for a while. Then the competition gets in and slows the growth. Mature companies show little growth, and they may even shrink in value.

(3) The dividends paid out by the firms will also grow at the same rate as the overall growth of the company. In real life, the companies set their dividend policy based on their investment needs, their cash flow projections, and their capital structure.

(4) The required rate of return of the stockholders is greater than the growth rate of the company. This is strictly a mathematical requirement to make sure that the formula will work properly.

Since no firm can meet all these conditions, the formula is only approximately true.

To develop the formula, let us suppose that the dividend paid during the current year has been $D_0$. If the dividends are growing uniformly, the dividend next year is $(1 + g)$ times the dividend this year, that is,

$$D_1 = D_0(1 + g)$$

The dividend available two years from now will be

$$D_2 = D_1(1 + g)$$

_____

and so on. The dividend available after three years should be

$$D_3 = D_2(1 + g) = D_1(1 + g)^2$$

When we buy the stock we expect to receive dividends $D_1$, $D_2$, $D_3$, ... after one, two, three, ... years. The sum of the future dividends, properly discounted, is just equal to the current price of the stock. Thus

$$P_0 = \frac{D_1}{1 + R} + \frac{D_1(1 + g)}{(1 + R)^2} + \frac{D_1(1 + g)^2}{(1 + R)^3} + ... \infty$$

We can find the summation using WolframAlpha.

WRA  `P0=Sum[D1*(1+g)^(i-1)/(1+R)^i,{i,1,infinity}]`

This is an infinite geometric series with first term $a = \dfrac{D_1}{1 + R}$, and ratio between the terms, $x = \dfrac{1 + g}{1 + R}$. Using (3.2) for the summation of such series, we get

$$P_0 = \frac{\dfrac{D_1}{1 + R}}{1 - \dfrac{1 + g}{1 + R}}$$

After some simplification, we get the final result as

$$P_0 = \frac{D_1}{R - g} \tag{3.6}$$

In the above equation, $R$ is the risk-adjusted discount rate. The stocks are much riskier and thus we must use a much higher discount rate. This discount rate is the *required rate of return*, required by the investor who is putting his money at risk. Usually called Gordon's growth model, after Myron J. Gordon who initially developed the above equation in 1959 at University of Toronto.

Besides common stock, a firm may also issue *preferred* shares of stock. The preferred stock lies somewhere between the common stock and the bonds of a company in terms of priority of claims on the assets of the firm. The preferred stockholders get constant dividends and they are not entitled to participate in the growth of the company. Thus substituting $g = 0$ in (3.5), we get the value of a preferred share as

$$P_0 = \frac{D}{R} \tag{3.7}$$

Comparing (3.7) and (3.2), we may think of preferred stock to be like a perpetual bond with dividends $D$ annually, and discount rate $R$. Sometimes the preferred stock is

_____

*callable*, that is, the company has the right to buy it back at a certain future date for a certain price. In this case, the preferred stock is similar to an ordinary bond.

We may write the main result, (3.6), as

$$R = \frac{D_1}{P_0} + g \tag{3.8}$$

The interpretation of this equation is quite simple: the required rate of return from a stock $R$ is the sum of its two components, the dividend yield $D_1/P_0$, and the growth rate of the dividends, $g$.

The Internet has become one of the best sources of financial information. The information is available easily. It is accurate, thorough, and timely. It is also possible to trade stocks or pay bills on-line. A direct consequence of this information explosion is that the investors are much better informed. The trading costs have become very reasonable. Further, it is possible to trade in your account from anywhere in the world if you have access to the Internet.

Some of the Internet sites for financial information are:

| | |
|---|---|
| http://marketwatch.com | Financial news, quotes, options, market data |
| http://www.yahoo.com | Financial news, market data |
| http://www.cboe.com | Options |

Table 3.2 gives the information about the stocks of some well-known companies. The information was available over the Internet at www.yahoo.com on June 7, 2006. The first two columns show the high and the low price of the stock for the last 52 weeks. The prices are all in dollars.

The next two columns show the name of the company and its ticker-tape symbol. The next column shows the annual dividend of the stock. For example, the dividend for Boeing is $1.20. Thus, its dividend yield is $1.20/81.46 = 1.47\%$.

| 52 Week Range | Stock | Symbol | Close | Div | Yld % | PE | Volume 100s | Net Chg | β |
|---|---|---|---|---|---|---|---|---|---|
| 59.70-89.58 | Boeing | BA | 81.46 | 1.20 | 1.50 | 23.82 | 49,949 | +0.81 | 1.09 |
| 42.91-50.72 | Citigroup | C | 49.95 | 1.96 | 4.00 | 10.32 | 148,152 | +0.19 | 0.41 |
| 32.21-37.05 | Gen Electric | GE | 34.40 | 1.00 | 2.90 | 21.79 | 278,693 | -0.15 | 0.44 |
| 36.60-43.98 | Home Depot | HD | 36.71 | 0.60 | 1.60 | 12.90 | 116,570 | -0.35 | 1.24 |
| 21.98-28.38 | Microsoft | MSFT | 22.04 | 0.36 | 1.60 | 17.46 | 737,784 | -0.09 | 0.35 |
| 27.83-33.68 | PP&L | PPL | 30.35 | 1.10 | 3.60 | 14.78 | 12,574 | +0.23 | 0.20 |

Table 3.2: Source: Yahoo.Finance, June 7, 2006

The next column shows the price-earnings ratio of the stock. This ratio shows how many times is the stock selling relative to its most recent annual earnings after taxes, per share.

_____

For instance, if Boeing is selling 23.82 times its earnings, its latest annual earnings must be 81.46/23.82 = \$3.42 per share.

## Examples

**3.42.** The current annual dividend of General Electric is \$0.20 while its stock is selling at 30.90. The required rate of return for the stockholders is 10%. Find the expected rate of growth for the company.

Write the given information in symbols as, $P_0 = \$30.90$, $R = .1$, $D_0 = \$0.20$. The dividend next year will grow by a factor $(1 + g)$ and it will become $D_1 = 0.20(1 + g)$. Substituting in Gordon's growth model, we get

$$30.90 = \frac{.20(1 + g)}{.1 - g}$$

Or,         $30.90(.1 - g) = .20(1 + g)$

Or,         $3.09 - 30.9\,g = .2 + .2\,g$
Or,         $3.09 - .2 = 30.9g + .2g$

Or,         $2.89 = 31.1\,g$

Or,         $g = 2.89/31.1 = .09292604502$

which gives       $g = 9.29\%$ ♥

Enter the following to get the result at WolframAlpha, $x \approx .092926$.

WRA **`30.90=.20*(1+x)/(.1-x)`**

**3.43.** Calculate the fair market price of a stock that just gave a dividend of \$1.50, and the long-term annual growth rate of the company is 3%. Investors require a return of 16% from such a stock.
Since the stock just paid the dividend for this year, its dividend for next year will be 3% higher, namely 1.50(1.03). Using equation (3.6), we get,

$$P_0 = \frac{D_1}{R - g} = \frac{(1.50)(1.03)}{.16 - .03} = \$11.88 \ ♥$$

**3.44.** You believe that there is a 30% probability that the dividend paid by IBM next year is going to be \$4.50, and a 70% probability that the dividend will increase to \$5.00. You also feel that IBM will grow at the rate of 8% for the long term. Your required rate of return for IBM stock is 12%. How much should you pay for a share of IBM?

The expected dividend equals the sum of the products of different outcomes and their corresponding probabilities. The expected dividend for next year is thus

_____

$$E(D_1) = 0.3(4.50) + 0.7(5.00) = \$4.85.$$

Using
$$P_0 = \frac{D_1}{R - g}$$
(3.6)

we get,
$$P_0 = \frac{4.85}{.12 - .08} = \$121.25 \; \heartsuit$$

**3.45.** Wilson Corp preferred stock pays annual dividend of \$4. The preferred stockholders have a required rate of return of 11%. Find the price of a Wilson preferred share.

The preferred stock does not participate in the growth opportunities of a company. Its dividend remains fixed. We can evaluate a preferred stock by using (3.7) with the understanding that $g = 0$. Further, $R = .11$, and $D = 4$. Thus

$$P_0 = 4/0.11 = \$36.36 \; \heartsuit$$

**3.46.** You bought a stock at \$45 last year. After one year, you received a dividend of \$2.50, and then sold the stock for \$49.00. Calculate the rate of return on your investment.

The total return of a stock is, by definition

$$\text{Total return on a stock} = \frac{\text{dividend received} + \text{capital gain}}{\text{purchase price}}$$

Thus
$$R = \frac{2.50 + 4}{45} = .1444 = 14.44\% \; \heartsuit$$

**3.47.** Rudolph Co stock has just paid its annual dividend of \$2.25. The expected growth rate of Rudolph is 7% in the long run. If your required rate of return is 16%, how much should you pay for a share of Rudolph stock?

$$P_0 = \frac{D_1}{R - g} = \frac{D_0(1 + g)}{R - g} = \frac{2.25(1.07)}{0.16 - 0.07} = \$26.75 \; \heartsuit$$

## Problems

**3.48.** Invercargill Company stock has paid a \$6.00 annual dividend in 2003 and a \$6.50 dividend in 2004. This growth in dividends will continue in the future. The stockholders of Invercargill require a 17% return on their investment. Calculate the price of one share of Invercargill stock in 2005.                                              \$88.02 $\heartsuit$

**3.49.** Boston Corporation stock currently pays \$6 annual dividend and sells at \$62 per share. The company expects to show continued growth at the rate of 4% per year. Find the required rate of return by the stockholders.                                    14.06% $\heartsuit$

_____

**3.50.** A stock sells at $54 a share. Its current dividend is $2.00 a share, and the stockholders require a return of 16% on their investment. Find the expected growth rate of the dividends of this stock.                                    11.86% ♥

**3.51.** Cape Town Company stock paid a dividend of $4.00 in 1999 and $3.75 in 1998. These dividends reflect the long-term growth rate of the company. If your required rate of return is 16% for Cape Town stock, how much should you pay for a share in 1999?
$45.71 ♥

**3.52.** Adams Company stock paid a dividend of $3.00 last year, and $3.25 this year. The increase in the dividend is similar to the long-term growth of the company. Considering the risk, your required rate of return from this stock is 14%. Find the price of the stock.
$62.13 ♥

**3.53.** The expected dividend of Arnold Co for next year has the following probability distribution: 20% $2.00, 30% $2.25, 40% $2.50, and 10% $2.75. The growth rate of Arnold is almost zero. If your required rate of return is 12%, find the price of an Arnold share in your estimation.                                    $19.58 ♥

**3.54.** You feel that Exxon has a long-term growth rate of 5%. Its dividend next year has the following probability distribution: 30% $4.50, 30% $4.75, and 40% $5.00. What should you pay for Exxon stock if your required rate of return is 12%?          $68.21 ♥

**3.55.** The current price of Ford stock is $50 a share and it has paid a dividend of $4 this year. The required rate of return for Ford shareholders is 16%. What is the expected growth rate of Ford?                                    7.407% ♥

**3.56.** Bradford Corp preferred stock pays a quarterly dividend of $1.25 and the stockholders have a required rate of return of 12% annually on their investments. Assuming quarterly compounding, find the price of a Bradford preferred share.  $41.67 ♥

**3.57.** The estimates of long-term growth for Glenn Co are: 5% (probability 50%), 6% (probability 30%), or 7% (probability 20%). Its current dividend is $2 and the investors' required rate of return is 12%. Find the price of one share of Glenn stock.          $34.16 ♥

**3.58.** Ekberg Mining Co is winding down its business in 1997. It will pay dividend of $7 per share in 1998, $6 in 2000, $5 in 2001, $15 in 2003, and then it will go out of business. Suppose you pay 28% tax on dividend income and your after-tax required rate of return is 11%, how much should you pay for a share of Ekberg? Also, assume that the loss of the stock cannot offset your other income.                                    $15.84 ♥

**3.59.** Reno Corporation stock has just paid its annual dividend of $2.00. This dividend will become $2.10 next year, in line with the long-term growth record of the company. Considering the risk of the company, the stockholders have a 15% required rate of return. Find the price of one share of Reno stock.                                    $21.00 ♥

_____

**3.60.** The long-term growth rate of Jackson Corp is 6%. The stockholders have a required rate of return of 13%. The dividend of Jackson this year was $4.40. Find the price of a share of Jackson.                                               $66.63 ♥

**3.61.** Moscow Company has paid a constant dividend of $3 per share every year, and it expects to do so in the future. If your required rate of return for this investment is 17%, what should you pay for a share of Moscow stock?                        $17.65 ♥

**3.62.** Dexter Company stock sells at $53 a share. The annual dividend on this stock is $2 per share this year and it should be $2.25 per share next year, which is in line with its long-term growth rate. Find the required rate of return on this stock.        16.75% ♥

## Multiple Choice Questions

1. For a bond selling at its face value, 5 years before maturity,
   - A. the yield to maturity equals its current yield
   - B. the bond should have zero coupon
   - C. the coupon rate is more than its current yield
   - D. the coupon rate must be equal to the prime rate

2. For the yield-to-maturity of a bond to be equal to its current yield,
   - A. the bond must be selling at a discount
   - B. the bond should have zero coupon
   - C. the bond must sell at its face value
   - D. coupon rate must be equal to the prime rate

3. A bond is listed in WSJ as Ford 8.5s17 and priced as 85. This means
   - A. Its semiannual interest payment is $85
   - B. Its maturity date is unknown
   - C. Its price is $85
   - D. Its current yield is 10%.

4. For a perpetual bond,
   - A. It is not possible to calculate its current yield
   - B. The face amount is unknown
   - C. The market price is inversely proportional to the interest rates
   - D. The coupon rate is not known

5. Gordon's growth model does not assume that
   - A. the rate of growth of dividends is constant
   - B. the growth will continue forever
   - C. the company must pay all its earnings in dividends
   - D. the required rate of return by the stockholders is greater than the rate of growth of the company

6. For a zero-coupon bond,
    A. It is possible to calculate its current yield
    B. The face amount is not known
    C. The market price is directly proportional to the interest rates
    D. The coupon rate is not known.

7. For a bond that is selling at par
    A. The face value is not equal to its market value
    B. The current yield is less than its yield to maturity
    C. The coupon rate is equal to its current yield
    D. The coupon rate is more than its yield to maturity

8. For a zero-coupon bond
    A. The market price is more than its face value
    B. The current yield is zero
    C. The yield to maturity is zero
    D. The risk of the bond is zero

9. The prime rate is the rate used by
    A. Stock brokers for loans to their customers
    B. Federal Reserve for loans to member banks
    C. Banks as a benchmark rate for commercial lending
    D. Treasury Department for short-term borrowing

## Key terms

_____

## Money Market Rates

### Tuesday, July 31, 2007, Wall Street Journal

PRIME RATE: 8.25% (effective 6/29/06). This is a benchmark rate used by banks in making loans to their commercial customers. The best customers pay close to the prime rate, less creditworthy customers pay more.

DISCOUNT RATE: 6.25% (Primary) (effective 6/29/06). This is the rate charged by the Federal Reserve for the loans made to the member banks.

FEDERAL FUNDS: 5.4375%, high, 4.500% low, 4.250% near closing bid, 5.00% offered. Effective rate 5.32%. Reserves traded by the member banks for overnight use in amounts of $1 million or more.

CALL MONEY: 7.00% (effective 6/29/06). This is the rate of interest used by stockbrokers for making loans to their customers for the purchase of common stocks.

COMMERCIAL PAPER: placed directly by General Electric Capital Corporation, 5.24% 30 to 44 days, 5.25% 45 to 61 days, 5.28% 62 to 89 days, 5.29% 90 to 119 days, 5.30% 120 to 190 days, 5.29% 191 to 219 days, 5.28% 220 to 249 days, 5.27% 250 to 270 days.

CERTIFICATES OF DEPOSIT: 5.28% one month, 5.36% three months, 5.46% six months.

LONDON INTERBANK OFFERED RATE (LIBOR): 5.3300% one month, 5.42625% three months, 5.5150% six months, 5.5675% one year. The rate is set by the British Banker's Association, and is used by one bank making loan to another bank. This is a key rate used in international transactions, especially interest rate swaps.

FOREIGN PRIME RATES: Canada 6.25%, European Central Bank 4.00%, Japan 1.875%, Switzerland 4.42%, Britain 5.75%, Australia 6.25%, Hong Kong 8.00%.

TREASURY BILLS: Results of the Monday, August 31, 2007, auction of the short-term T-bills sold at a discount in units of $1,000 to $1 million. 5.055% 4 weeks, 4.825% 13 weeks, 4.800% 26 weeks.

MERRILL LYNCH READY ASSETS TRUST: 4.70%, average rate of return, after expenses, for the past 30 days; not a forecast of future returns.

CONSUMER PRICE INDEX: June 208.4, up 2.7% from a year ago. Bureau of Labor Statistics.

Financial markets rates