

# Chapter 8

## Stocks, Stock Valuation, and Stock Market Equilibrium

### ANSWERS TO END-OF-CHAPTER QUESTIONS

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- 8-1 a. A proxy is a document giving one person the authority to act for another, typically the power to vote shares of common stock. If earnings are poor and shareholders are dissatisfied, an outside group may solicit the proxies in an effort to overthrow management and take control of the business, known as a proxy fight. A takeover is an action whereby a person or group succeeds in ousting a firm's management and taking control of the company. The preemptive right gives the current shareholders the right to purchase any new shares issued in proportion to their current holdings. When granted, the preemptive right enables current owners to maintain their proportionate share of ownership and control of the business. Dual-class stock is sometimes created by a firm to give greater voting rights to existing owners. Generally, when special classifications of stock are used, one type is designated "Class A", another as "Class B", and so on. Class A might be entitled to multiple votes for every share held. Class B might have limited voting rights.
- b. Some companies are so small that their common shares are not actively traded; they are owned by only a few people, usually the companies' managers. The stock in such firms is said to be closely held. In contrast, the shares of larger companies are owned by many investors, most of whom are not active in management. Such shares are said to be publicly owned stock.
- c. Intrinsic value ( $\hat{P}_0$ ) is the present value of the expected future cash flows. The market price ( $P_0$ ) is the price at which an asset can be sold.
- d. The required rate of return on common stock, denoted by  $r_s$ , is the minimum acceptable rate of return considering both its riskiness and the returns available on other investments. The expected rate of return, denoted by  $\hat{r}_s$ , is the rate of return expected on a stock given its current price and expected future cash flows. If the stock is in equilibrium, the required rate of return will equal the expected rate of return. The realized (actual) rate of return, denoted by  $\bar{r}_s$ , is the rate of return that was actually realized at the end of some holding period. Although expected and required rates of return must always be positive, realized rates of return over some periods may be negative.

- e. The capital gains yield results from changing prices and is calculated as  $(P_1 - P_0)/P_0$ , where  $P_0$  is the beginning-of-period price and  $P_1$  is the end-of-period price. For a constant growth stock, the capital gains yield is  $g$ , the constant growth rate. The dividend yield on a stock can be defined as either the end-of-period dividend divided by the beginning-of-period price, or the ratio of the current dividend to the current price. Valuation formulas use the former definition. The expected total return, or expected rate of return, is the expected capital gains yield plus the expected dividend yield on a stock. The expected total return on a bond is the yield to maturity.
- f. Normal, or constant, growth occurs when a firm's earnings and dividends grow at some constant rate forever. One category of nonconstant growth stock is a "supernormal" growth stock that has one or more years of growth above that of the economy as a whole, but at some point the growth rate will fall to the "normal" rate. This occurs, generally, as part of a firm's normal life cycle. A zero growth stock has constant earnings and dividends; thus, the expected dividend payment is fixed, just as a bond's coupon payment. Since the company is presumed to continue operations indefinitely, the dividend stream is a perpetuity. A perpetuity is a security on which the principal never has to be repaid.
- g. Preferred stock is a hybrid—it is similar to bonds in some respects and to common stock in other respects. Preferred dividends are similar to interest payments on bonds in that they are fixed in amount and generally must be paid before common stock dividends can be paid. If the preferred dividend is not earned, the directors can omit it without throwing the company into bankruptcy. So, although preferred stock has a fixed payment like bonds, a failure to make this payment will not lead to bankruptcy. Most preferred stocks entitle their owners to regular fixed dividend payments.

- h. Equilibrium is the condition under which the expected return on a security is just equal to its required return,  $\hat{r} = r$ , and the price is stable. The Efficient Markets Hypothesis (EMH) states (1) that stocks are always in equilibrium and (2) that it is impossible for an investor to consistently “beat the market.” In essence, the theory holds that the price of a stock will adjust almost immediately in response to any new developments. In other words, the EMH assumes that all important information regarding a stock is reflected in the price of that stock. Financial theorists generally define three forms of market efficiency: weak-form, semistrong-form, and strong-form.

Weak-form efficiency assumes that all information contained in past price movements is fully reflected in current market prices. Thus, information about recent trends in a stock’s price is of no use in selecting a stock. Semistrong-form efficiency states that current market prices reflect all publicly available information. Therefore, the only way to gain abnormal returns on a stock is to possess inside information about the company’s stock. Strong-form efficiency assumes that all information pertaining to a stock, whether public or inside information, is reflected in current market prices. Thus, no investors would be able to earn abnormal returns in the stock market.

- 8-2 True. The value of a share of stock is the PV of its expected future dividends. If the two investors expect the same future dividend stream, and they agree on the stock’s riskiness, then they should reach similar conclusions as to the stock’s value.
- 8-3 A perpetual bond is similar to a no-growth common stock and to a share of preferred stock in the following ways:
1. All three derive their values from a series of cash inflows—coupon payments from the perpetual bond, and dividends from both types of stock.
  2. All three are assumed to have indefinite lives with no maturity value (M) for the perpetual bond and no capital gains yield for the stocks.

## SOLUTIONS TO END-OF-CHAPTER PROBLEMS

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8-1  $D_0 = \$2.25$ ;  $g_{1-3} = 8\%$ ;  $g_n = 10\%$ ;  $D_1$  through  $D_5 = ?$

$$D_1 = D_0(1 + g_1) = \$2.25(1.08) = \$2.43.$$

$$D_2 = D_0(1 + g_1)(1 + g_2) = \$2.25(1.08)^2 = \$2.62.$$

$$D_3 = D_0(1 + g_1)(1 + g_2)(1 + g_3) = \$2.25(1.08)^3 = \$2.83.$$

$$D_4 = D_0(1 + g_1)(1 + g_2)(1 + g_3)(1 + g_n) = \$2.25(1.08)^3(1.10) = \$3.11.$$

$$D_5 = D_0(1 + g_1)(1 + g_2)(1 + g_3)(1 + g_n)^2 = \$2.25(1.08)^3(1.10)^2 = \$3.42.$$

8-2  $D_1 = \$1.50$ ;  $g = 7\%$ ;  $r_s = 15\%$ ;  $\hat{P}_0 = ?$

$$\hat{P}_0 = \frac{D_1}{r_s - g} = \frac{\$1.50}{0.15 - 0.07} = \$18.75.$$

8-3  $P_0 = \$20$ ;  $D_0 = \$1.00$ ;  $g = 10\%$ ;  $\hat{P}_1 = ?$ ;  $\hat{r}_s = ?$

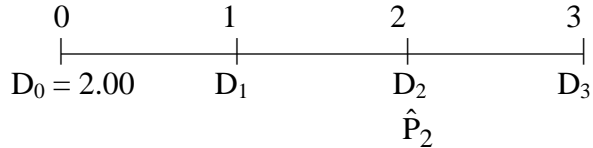
$$\hat{P}_1 = P_0(1 + g) = \$20(1.10) = \$22.$$

$$\begin{aligned}\hat{r}_s &= \frac{D_1}{P_0} + g = \frac{\$1.00(1.10)}{\$20} + 0.10 \\ &= \frac{\$1.10}{\$20} + 0.10 = 15.50\%. \quad \hat{r}_s = 15.50\%.\end{aligned}$$

8-4  $D_{ps} = \$5.00$ ;  $V_{ps} = \$50$ ;  $r_{ps} = ?$

$$r_{ps} = \frac{D_{ps}}{V_{ps}} = \frac{\$5.00}{\$50.00} = 10\%.$$

8-5



Step 1: Calculate the required rate of return on the stock:

$$r_s = r_{RF} + (r_M - r_{RF})b = 4.5\% + (4\%)1.8 = 11.7\%.$$

Step 2: Calculate the expected dividends:

$$\begin{aligned} D_0 &= \$2.00 \\ D_1 &= \$2.00(1.14) = \$2.28 \\ D_2 &= \$2.00(1.14)^2 = \$2.60 \\ D_3 &= \$2.60(1.07) = \$2.78 \end{aligned}$$

Step 3: Calculate the PV of the expected dividends:

$$PV_{Div} = \$2.28/(1.117) + \$2.60/(1.117)^2 = \$2.04 + \$2.08 = \$4.12.$$

Step 4: Calculate  $\hat{P}_2$ :

$$\hat{P}_2 = D_3/(r_s - g) = \$2.78/(0.117 - 0.07) = \$59.15.$$

Step 5: Calculate the PV of  $\hat{P}_2$ :

$$PV = \$59.15/(1.117)^2 = \$47.41.$$

Step 6: Sum the PVs to obtain the stock's price:

$$\hat{P}_0 = \$4.12 + \$47.41 = \$51.53.$$

Alternatively, using a financial calculator, input the following:

$CF_0 = 0$ ,  $CF_1 = 2.28$ , and  $CF_2 = 61.75$  ( $2.60 + 59.15$ ) and then enter  $I = 11.7$  to solve for  $NPV = \$51.53$ .

- 8-6 The problem asks you to determine the constant growth rate, given the following facts:  $P_0 = \$80$ ,  $D_1 = \$4$ , and  $r_s = 14\%$ . Use the constant growth rate formula to calculate  $g$ :

$$\begin{aligned}\hat{r}_s &= \frac{D_1}{P_0} + g \\ 0.14 &= \frac{\$4}{\$80} + g \\ g &= 0.09 = 9\%.\end{aligned}$$

- 8-7 The problem asks you to determine the value of  $\hat{P}_3$ , given the following facts:  $D_1 = \$2$ ,  $b = 0.9$ ,  $r_{RF} = 5.6\%$ ,  $RP_M = 6\%$ , and  $P_0 = \$25$ . Proceed as follows:

Step 1: Calculate the required rate of return:

$$r_s = r_{RF} + (r_M - r_{RF})b = 5.6\% + (6\%)0.9 = 11\%.$$

Step 2: Use the constant growth rate formula to calculate  $g$ :

$$\begin{aligned}\hat{r}_s &= \frac{D_1}{P_0} + g \\ 0.11 &= \frac{\$2}{\$25} + g \\ g &= 0.03 = 3\%.\end{aligned}$$

Step 3: Calculate  $\hat{P}_3$ :

$$\hat{P}_3 = P_0(1 + g)^3 = \$25(1.03)^3 = \$27.3182 \approx \$27.32.$$

Alternatively, you could calculate  $D_4$  and then use the constant growth rate formula to solve for  $\hat{P}_3$ :

$$\begin{aligned}D_4 &= D_1(1 + g)^3 = \$2.00(1.03)^3 = \$2.1855. \\ \hat{P}_3 &= \$2.1855 / (0.11 - 0.03) = \$27.3188 \approx \$27.32.\end{aligned}$$

8-8  $V_{ps} = D_{ps}/r_{ps}$ ; therefore,  $r_{ps} = D_{ps}/V_{ps}$ .

- a.  $r_{ps} = \$1.75/\$16 = 10.94\%$ .
- b.  $r_{ps} = \$1.75/\$21 = 8.33\%$ .
- c.  $r_{ps} = \$1.75/\$25 = 7\%$
- d.  $r_{ps} = \$1.75/\$37 = 4.73\%$ .

8-9  $\hat{P}_0 = \frac{D_1}{r_s - g} = \frac{D_0(1+g)}{r_s - g} = \frac{\$5[1+(-0.04)]}{0.15 - (-0.04)} = \frac{\$4.80}{0.19} = \$25.26$ .

8-10 a.  $r_i = r_{RF} + (r_M - r_{RF})b_i$ .  
 $r_C = 4\% + (13\% - 4\%)0.4 = 7.6\%$ .  $r_D = 4\% + (13\% - 4\%)(-0.3) = 1.3\%$ .

Note that  $r_D$  is below the risk-free rate. But since this stock is like an insurance policy because it “pays off” when something bad happens (the market falls), the low return is not unreasonable.

b. In this situation, the expected rate of return is as follows:

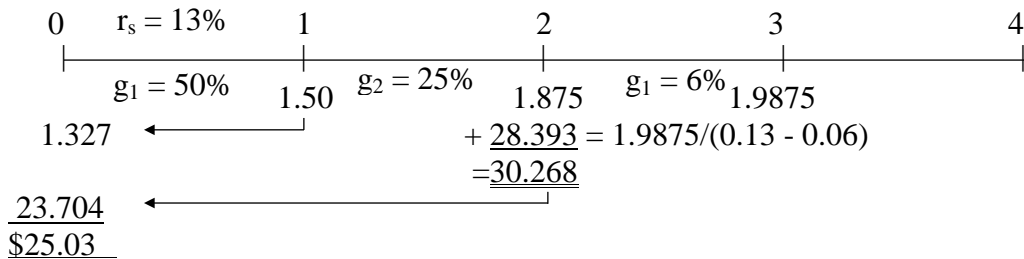
$$\hat{r}_c = D_1/P_0 + g = \$1/\$30 + 4\% = 7.3\%$$

However, the required rate of return is 7.6 percent. Investors will seek to sell the stock, dropping its price to the following:

$$\hat{P}_C = \frac{\$1}{0.076 - 0.04} = \$27.78$$

At this point,  $\hat{r}_c = \frac{\$1}{\$27.78} + 4\% = 7.6\%$ , and the stock will be in equilibrium.

8-11  $D_0 = \$1, r_s = 7\% + 6\% = 13\%, g_1 = 50\%, g_2 = 25\%, g_n = 6\%$ .

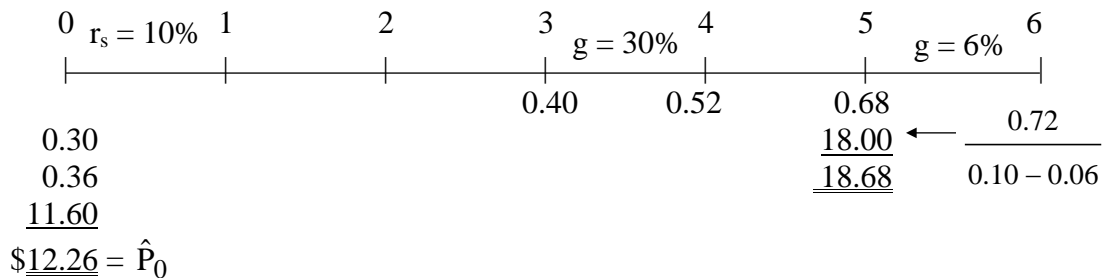


8-12 Calculate the dividend stream and place them on a time line. Also, calculate the price of the stock at the end of the supernormal growth period, and include it, along with the dividend to be paid at  $t = 5$ , as  $CF_5$ . Then, enter the cash flows as shown on the time line into the cash flow register, enter the required rate of return as  $I = 10$ , and then find the value of the stock using the NPV calculation. Be sure to enter  $CF_0 = 0$ , or else your answer will be incorrect.

$$D_0 = 0; D_1 = 0, D_2 = 0, D_3 = 0.40$$

$$D_4 = 0.40(1.3) = 0.52; D_5 = 0.40(1.3)^2 = 0.68; D_6 = 0.40(1.3)^2(1.06) = \$0.72$$

$$\hat{P}_0 = ?$$



$$\hat{P}_5 = D_6 / (r_s - g) = 0.72 / (0.10 - 0.06) = 18. \text{ This is the stock price at the end of Year 5.}$$

or using the calculator:

$$CF_0 = 0; CF_{1-2} = 0; CF_3 = 0.4; CF_4 = 0.52; CF_5 = 18.68; I = 10\%.$$

With these cash flows in the cash flow register, press NPV to get the value of the stock today:  $NPV = \$12.25$ . (The \$0.01 difference is due to rounding.)

8-13 a.  $V_{ps} = \frac{6\% \times \$25}{0.07} = \$21.43.$

b.  $V_{ps} = \frac{6\% \times \$25}{0.09} = \$16.67.$

8-14 a. Calculator solution: Input  $N = 2$ ,  $PV = -3.01$ ,  $PMT = 0$ ,  $FV = 3.6421$ ,  $I = ?$   $I = 10\%$ .

b.  $\$3.01 / \$33.44 = 9\%$ .

c.  $\hat{r}_s = D_1 / P_0 + g = \$3.01 / \$33.44 + 10\% = 9\% + 10\% = 19\%$ .

8-15 a. 1.  $\hat{P}_0 = \frac{\$2(1-0.05)}{0.15+0.05} = \frac{\$1.90}{0.20} = \$9.50.$

2.  $\hat{P}_0 = \$2/0.15 = \$13.33.$

3.  $\hat{P}_0 = \frac{\$2(1.05)}{0.15-0.05} = \frac{\$2.10}{0.10} = \$21.00.$

4.  $\hat{P}_0 = \frac{\$2(1.10)}{0.15-0.10} = \frac{\$2.20}{0.05} = \$44.00.$

b. 1.  $\hat{P}_0 = \$2.30/0 = \text{Undefined}.$

2.  $\hat{P}_0 = \$2.40/(-0.05) = -\$48,$  which is nonsense.

These results show that the formula does not make sense if the required rate of return is equal to or less than the expected growth rate.

c. No.

8-16 a.  $r_s = r_{RF} + (r_M - r_{RF})b = 5\% + (8\% - 5\%)1.5 = 9.5\%.$   
 $\hat{P}_0 = D_1/(r_s - g) = \$2.25/(0.095 - 0.05) = \$50.00.$

b.  $r_s = 4\% + (7\% - 4\%)1.5 = 8.5\%.$   $\hat{P}_0 = \$2.25/(0.085 - 0.05) = \$64.29.$

c.  $r_s = 4\% + (6.5\% - 4\%)1.5 = 7.75\%.$   $\hat{P}_0 = \$2.25/(0.0775 - 0.05) = \$81.82.$

d. New data given:  $r_{RF} = 4\%; r_M = 6.5\%; g = 5.5\%, b = 1.3.$

$r_s = r_{RF} + (r_M - r_{RF})b = 4\% + (6.5\% - 4\%)1.3 = 7.25\%.$

$\hat{P}_0 = D_1/(r_s - g) = \$2.26/(0.0725 - 0.055) = \$129.14.$

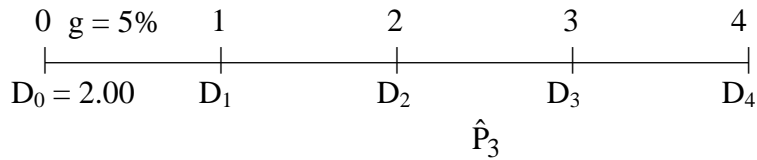
8-17 The value of any asset is the present value of all future cash flows expected to be generated from the asset. Hence, if we can find the present value of the dividends during the period preceding long-run constant growth and subtract that total from the current stock price, the remaining value would be the present value of the cash flows to be received during the period of long-run constant growth.

$$\begin{array}{rcl}
 D_1 = \$2.00 \times (1.25)^1 = \$2.50 & PV(D_1) = \$2.50/(1.12)^1 & = \$2.2321 \\
 D_2 = \$2.00 \times (1.25)^2 = \$3.125 & PV(D_2) = \$3.125/(1.12)^2 & = \$2.4912 \\
 D_3 = \$2.00 \times (1.25)^3 = \$3.90625 & PV(D_3) = \$3.90625/(1.12)^3 & = \$2.7804 \\
 & \Sigma PV(D_1 \text{ to } D_3) & = \$7.5037
 \end{array}$$

Therefore, the PV of the remaining dividends is:  $\$58.8800 - \$7.5037 = \$51.3763$ . Compounding this value forward to Year 3, we find that the value of all dividends received during constant growth is \$72.18. [ $\$51.3763(1.12)^3 = \$72.18$ ] Applying the constant growth formula, we can solve for the constant growth rate:

$$\begin{aligned}
 \hat{P}_3 &= D_3(1 + g)/(r_s - g) \\
 \$72.18 &= \$3.90625(1 + g)/(0.12 - g) \\
 \$8.6616 - \$72.18g &= \$3.90625 + \$3.90625g \\
 \$4.75535 &= \$76.08625g \\
 0.0625 &= g \\
 6.25\% &= g.
 \end{aligned}$$

8-18



a.  $D_1 = \$2(1.05) = \$2.10$ .  $D_2 = \$2(1.05)^2 = \$2.21$ .  $D_3 = \$2(1.05)^3 = \$2.32$ .

b.  $PV = \$2.10(0.8929) + \$2.21(0.7972) + \$2.32(0.7118) = \$5.29$ .

Calculator solution: Input 0, 2.10, 2.21, and 2.32 into the cash flow register, input  $I = 12$ ,  $PV = ?$   $PV = \$5.29$ .

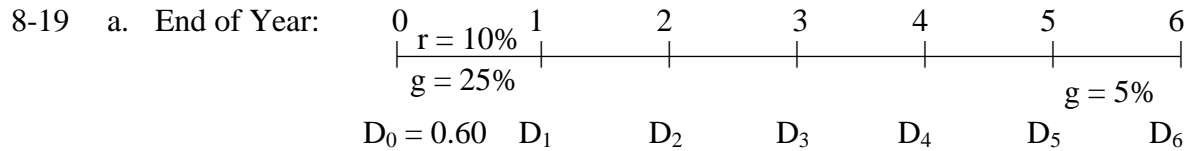
c.  $\$34.73(0.7118) = \$24.72$ .

Calculator solution: Input 0, 0, 0, and 34.73 into the cash flow register,  $I = 12$ ,  $PV = ?$   $PV = \$24.72$ .

d.  $\$24.72 + \$5.29 = \$30.01 =$  Maximum price you should pay for the stock.

e.  $\hat{P}_0 = \frac{D_0(1+g)}{r_s - g} = \frac{D_1}{r_s - g} = \frac{\$2.10}{0.12 - 0.05} = \$30.00$ .

f. The value of the stock is *not* dependent upon the holding period. The value calculated in Parts a through d is the value for a 3-year holding period. It is equal to the value calculated in Part e except for a small rounding error. Any other holding period would produce the same value of  $\hat{P}_0$ ; that is,  $\hat{P}_0 = \$30.00$ .



$$D_t = D_0(1 + g)^t$$

$$D_1 = \$0.60(1.25)^1 = \$0.75.$$

$$D_2 = \$0.60(1.25)^2 = \$0.60(1.5625) = \$0.94.$$

$$D_3 = \$0.60(1.25)^3 = \$0.60(1.9531) = \$1.17.$$

$$D_4 = \$0.60(1.25)^4 = \$0.60(2.4414) = \$1.46.$$

$$D_5 = \$0.60(1.25)^5 = \$0.60(3.0518) = \$1.83.$$

b. Step 1

$$\text{PV of dividends} = \sum_{t=1}^5 \frac{D_t}{(1 + r_s)^t}.$$

$$\text{PV } D_1 = \$0.75(\text{PVIF}_{10\%,1}) = \$0.75(0.9091) = \$0.68$$

$$\text{PV } D_2 = \$0.94(\text{PVIF}_{10\%,2}) = \$0.94(0.8264) = \$0.78$$

$$\text{PV } D_3 = \$1.17(\text{PVIF}_{10\%,3}) = \$1.17(0.7513) = \$0.88$$

$$\text{PV } D_4 = \$1.46(\text{PVIF}_{10\%,4}) = \$1.46(0.6830) = \$1.00$$

$$\text{PV } D_5 = \$1.83(\text{PVIF}_{10\%,5}) = \$1.83(0.6209) = \underline{\$1.14}$$

$$\text{PV of dividends} = \underline{\underline{\$4.48}}$$

Step 2

$$\hat{P}_5 = \frac{D_6}{r_s - g_n} = \frac{D_5(1 + g_n)}{r_s - g_n} = \frac{\$1.83(1.05)}{0.10 - 0.05} = \frac{\$1.92}{0.05} = \$38.40.$$

This is the price of the stock 5 years from now. The PV of this price, discounted back 5 years, is as follows:

$$\text{PV of } \hat{P}_5 = \$38.40(\text{PVIF}_{10\%,5}) = \$38.40(0.6209) = \$23.84.$$

Step 3

The price of the stock today is as follows:

$$\begin{aligned} \hat{P}_0 &= \text{PV dividends Years 1 through 5} + \text{PV of } \hat{P}_5 \\ &= \$4.48 + \$23.84 = \$28.32 \end{aligned}$$

This problem could also be solved by substituting the proper values into the following equation:

$$\hat{P}_0 = \sum_{t=1}^5 \frac{D_0(1+g_s)^t}{(1+r_s)^t} + \left( \frac{D_6}{r_s - g_n} \right) \left( \frac{1}{1+r_s} \right)^5.$$

Calculator solution: Input 0, .75, .94, 1.17, 1.46, 40.23 (1.83 + 38.40) into the cash flow register, input I = 10, PV = ? PV = \$28.31.

c. First Year (t=0)

$D_1/P_0 = \$0.75/\$28.32$	= 2.65%
Capital gains yield	= <u>7.35%</u>
Expected total return	= <u>10.00%</u>

Sixth Year (t=5)

$D_6/P_5 = \$1.92/\$38.40$	= 5.00%
Capital gains yield	= <u>5.00</u>
Expected total return	= <u>10.00%</u>

\*We know that r is 10%, and the dividend yield is 2.65%; therefore, the capital gains yield must be 7.35%.

The main points to note here are as follows:

1. The total yield is always 10% (except for rounding errors).
2. The capital gains yield starts relatively high, then declines as the supernormal growth period approaches its end. The dividend yield rises.
3. After t=5, the stock will grow at a 5 percent rate. The dividend yield will equal 5%, the capital gains yield will equal 5%, and the total return will be 10%.



Part 2:

Expected dividend yield:  $D_1/P_0 = \$1.92/\$54.11 = 3.55\%$ .

Capital gains yield: First, find  $\hat{P}_1$  which equals the sum of the present values of  $D_2$  and  $\hat{P}_2$ , discounted for one year.

$$\hat{P}_1 = D_2/(1.10) + \hat{P}_2/(1.10) = \frac{\$2.304 + \$61.06}{(1.10)^1} = \$57.60.$$

Calculator solution: Input 0, 63.364 (2.304 + 61.06) into the cash flow register, input I = 10, PV = ? PV = \$57.60.

Second, find the capital gains yield:

$$\frac{\hat{P}_1 - P_0}{P_0} = \frac{\$57.60 - \$54.11}{\$54.11} = 6.45\%.$$

$$\begin{aligned} \text{Dividend yield} &= 3.55\% \\ \text{Capital gains yield} &= \frac{6.45}{10.00}\% = r_s. \end{aligned}$$

- b. Due to the longer period of supernormal growth, the value of the stock will be higher for each year. Although the total return will remain the same,  $r_s = 10\%$ , the distribution between dividend yield and capital gains yield will differ: The dividend yield will start off lower and the capital gains yield will start off higher for the 5-year supernormal growth condition, relative to the 2-year supernormal growth state. The dividend yield will increase and the capital gains yield will decline over the 5-year period until dividend yield = 4% and capital gains yield = 6%.
- c. Throughout the supernormal growth period, the total yield will be 10 percent, but the dividend yield is relatively low during the early years of the supernormal growth period and the capital gains yield is relatively high. As we near the end of the supernormal growth period, the capital gains yield declines and the dividend yield rises. After the supernormal growth period has ended, the capital gains yield will equal  $g_n = 6\%$ . The total yield must equal  $r_s = 10\%$ , so the dividend yield must equal  $10\% - 6\% = 4\%$ .
- d. Some investors need cash dividends (retired people) while others would prefer growth. Also, investors must pay taxes each year on the dividends received during the year, while taxes on capital gains can be delayed until the gain is actually realized.

$$\begin{aligned}
8-21 \quad \text{FCF} &= \text{NOPAT} - \text{Net investment in operating capital} \\
&= \$500,000,000 - \$100,000,000 \\
&= \$400,000,000
\end{aligned}$$

$$\begin{aligned}
\text{Firm value} &= \frac{\text{FCF}}{\text{WACC} - g} \\
&= \frac{\$400,000,000}{0.10 - 0.06} \\
&= \frac{\$400,000,000}{0.04} \\
&= \$10,000,000,000.
\end{aligned}$$

This is the total firm value. Now find the market value of its equity.

$$\begin{aligned}
\text{Market Value}_{\text{Total}} &= \text{Market Value}_{\text{Equity}} + \text{Market Value}_{\text{Debt}} \\
\$10,000,000,000 &= \text{Market Value}_{\text{Equity}} + \$3,000,000,000 \\
\text{Market Value}_{\text{Equity}} &= \$7,000,000,000.
\end{aligned}$$

This is the market value of all the equity. Divide by the number of shares to find the price per share.  $\$7,000,000,000 / 200,000,000 = \$35.00$ .

## SOLUTION TO SPREADSHEET PROBLEM

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8-22 The detailed solution for the spreadsheet problem is in the file *Ch 08 Build a Model Solution.xlsx* and is available in the textbook's website.

## MINI CASE

**Strother and Shawna Tibbs are senior vice presidents of First Strategies Investment Counsel (FSIC). They are co-directors of the company's pension fund management division, with Strother having responsibility for fixed income securities (primarily bonds) and Tibbs responsible for equity investments. A major new client has requested that FSIC present an investment seminar to its Executive Committee, and Strother and Tibbs, who will make the actual presentation, have asked you to help them.**

**To illustrate the common stock valuation process, Strother and Tibbs have asked you to analyze the Temp Force Company, an employment agency that supplies word processor operators and computer programmers to businesses with temporarily heavy workloads. You are to answer the following questions.**

**a. Describe briefly the legal rights and privileges of common shareholders.**

**Answer:** The common shareholders are the owners of a corporation, and as such, they have certain rights and privileges as described below.

1. Ownership implies control. Thus, a firm's common shareholders have the right to elect its firm's directors, who in turn elect the officers who manage the business.
2. Common shareholders may have the right, called the preemptive right, to purchase any additional shares sold by the firm.

**b. 1. Write out a formula that can be used to value any stock, regardless of its dividend pattern.**

**Answer:** The value of any stock is the present value of its expected dividend stream:

$$\hat{P}_0 = \frac{D_1}{(1+r_s)^1} + \frac{D_2}{(1+r_s)^2} + \frac{D_3}{(1+r_s)^3} + \dots + \frac{D_\infty}{(1+r_s)^\infty}.$$

However, some stocks have dividend growth patterns that allow them to be valued using short-cut formulas.

**b. 2. What is a constant growth stock? How are constant growth stocks valued?**

**Answer:** A constant growth stock is one whose dividends are expected to grow at a constant rate forever. “Constant growth” means that the best estimate of the future growth rate is some constant number, not that we really expect growth to be the same each and every year. Many companies have dividends that are expected to grow steadily into the foreseeable future, and such companies are valued as constant growth stocks.

For a constant growth stock:

$$D_1 = D_0(1 + g), D_2 = D_1(1 + g) = D_0(1 + g)^2, \text{ and so on.}$$

With this regular dividend pattern, the general stock valuation model can be simplified to the following very important equation:

$$\hat{P}_0 = \frac{D_1}{r_s - g} = \frac{D_0(1 + g)}{r_s - g}.$$

This is the well-known “Gordon,” or “constant-growth” model for valuing stocks. Here  $D_1$  is the next expected dividend, which is assumed to be paid 1 year from now,  $r_s$  is the required rate of return on the stock, and  $g$  is the constant growth rate.

**b. 3. What happens if a company has a constant  $g$  which exceeds its  $r_s$ ? Will many stocks have expected  $g > r_s$  in the short run (i.e., for the next few years)? In the long run (i.e., forever)?**

**Answer:** The model is derived mathematically, and the derivation requires that  $r_s > g$ . If  $g$  is greater than  $r_s$ , the model gives a negative stock price, which is nonsensical. The model simply cannot be used unless (1)  $r_s > g$ , (2)  $g$  is expected to be constant, and (3)  $g$  can reasonably be expected to continue indefinitely.

Stocks may have periods of supernormal growth, where  $g_s > r_s$ ; however, this growth rate cannot be sustained indefinitely. In the long-run,  $g < r_s$ .

**c. Assume that Temp Force has a beta coefficient of 1.2, that the risk-free rate (the yield on government bonds) is 5.0%, and that the market risk premium is 4%. What is the required rate of return on the firm’s stock?**

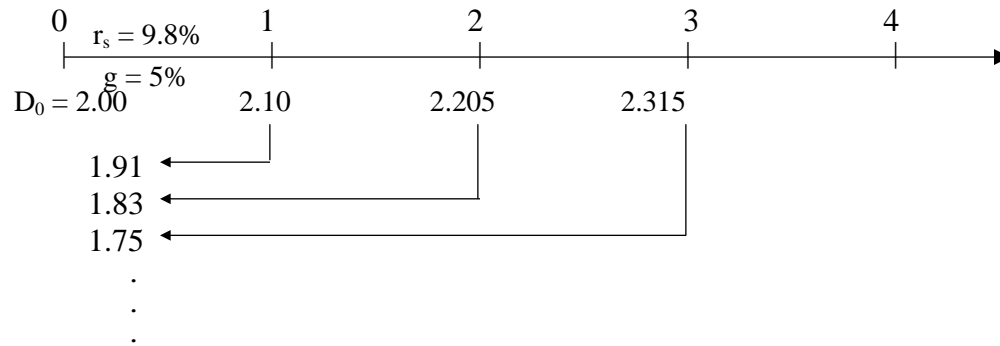
**Answer:** Here we use the SML to calculate Temp Force’s required rate of return:

$$\begin{aligned} r_s &= r_{RF} + (r_M - r_{RF})b_{\text{Temp Force}} = 5\% + (9\% - 5\%)(1.2) \\ &= 5\% + (4\%)(1.2) = 5\% + 4.8\% = 9.8\%. \end{aligned}$$

**d. Assume that Temp Force is a constant growth company whose last dividend was \$2.00 and whose dividend is expected to grow indefinitely at a 5% rate.**

**d. 1. What is the firm's expected dividend stream over the next 3 years?**

**Answer:** Temp Force is a constant growth stock, and its dividend is expected to grow at a constant rate of 5 percent per year. Expressed as a time line, we have the following setup. Just enter 2 in your calculator; then keep multiplying by  $1 + g = 1.05$  to get  $D_1$ ,  $D_2$ , and  $D_3$ :



**d. 2. What is the firm's current stock price?**

**Answer:** We could extend the time line on out forever, find the value of Temp Force's dividends for every year on out into the future, and then the PV of each dividend, discounted at  $r = 9.8\%$ . For example, the PV of  $D_1$  is \$1.91; the PV of  $D_2$  is \$1.83; and so forth. Note that the dividend payments increase with time, but as long as  $r_s > g$ , the present values decrease with time. If we extended the graph on out forever and then summed the PVs of the dividends, we would have the value of the stock. However, since the stock is growing at a constant rate, its value can be estimated using the constant growth model:

$$\hat{P}_0 = \frac{D_1}{(r_s - g)} = \frac{\$2.10}{(0.098 - 0.05)} = \frac{\$2.10}{0.048} = \$43.75.$$

**d. 3. What is the stock's expected value 1 year from now?**

**Answer:** After one year,  $D_1$  will have been paid, so the expected dividend stream will then be  $D_2$ ,  $D_3$ ,  $D_4$ , and so on. Thus, the expected value one year from now is \$45.94:

$$\hat{P}_1 = \frac{D_2}{(r_s - g)} = \frac{\$2.205}{(0.098 - 0.05)} = \frac{\$2.205}{0.048} = \$45.94.$$

**d. 4. What are the expected dividend yield, the capital gains yield, and the total return during the first year?**

**Answer:** The expected dividend yield in any year n is

$$\text{Dividend Yield} = \frac{D_n}{\hat{P}_{n-1}},$$

While the expected capital gains yield is

$$\text{Capital Gains Yield} = \frac{(\hat{P}_n - \hat{P}_{n-1})}{\hat{P}_{n-1}} = r - \frac{D_n}{P_{n-1}}.$$

Thus, the dividend yield in the first year is 4.8 percent, while the capital gains yield is 5 percent:

Total return	= 9.8%
Dividend yield = \$2.10/\$43.75	= <u>4.8%</u>
Capital gains yield	= <u>5.0%</u>

**e. Now assume that the stock is currently selling at \$43.75. What is the expected rate of return on the stock?**

**Answer:** The constant growth model can be rearranged to this form:

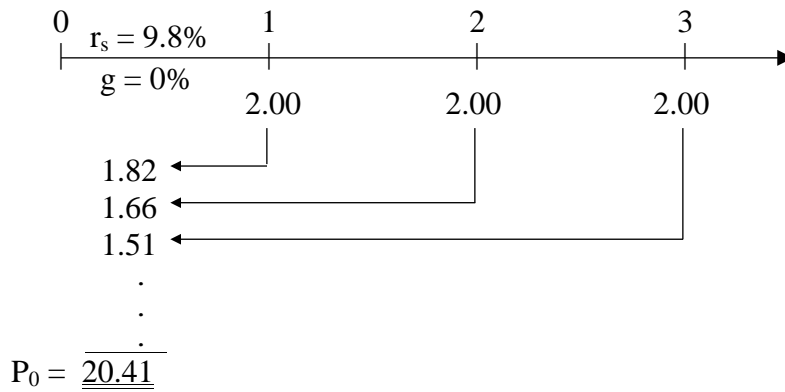
$$\hat{r}_s = \frac{D_1}{P_0} + g.$$

Here the current price of the stock is known, and we solve for the expected return. For Temp Force:

$$\hat{r}_s = \$2.10/\$43.75 + 0.05 = 0.048 + 0.05 = 9.8\%.$$

**f. What would the stock price be if its dividends were expected to have zero growth?**

**Answer:** If Temp Force's dividends were not expected to grow at all, then its dividend stream would be a perpetuity. Perpetuities are valued as shown below:

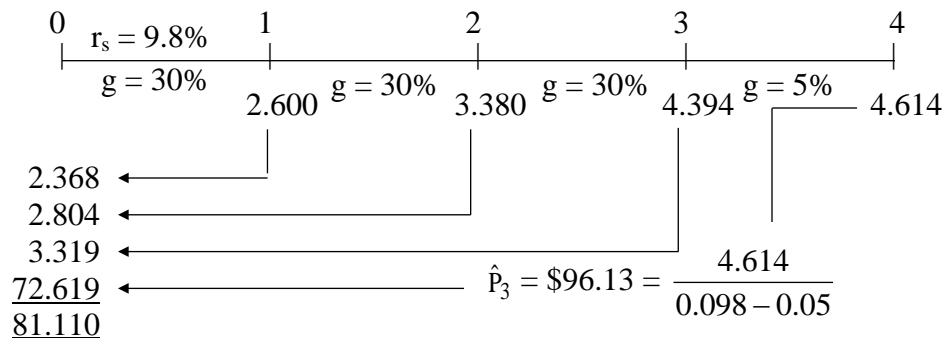


$$P_0 = \text{PMT}/r = \$2.00/0.098 = \$20.41.$$

Note that if a preferred stock is a perpetuity, it may be valued with this formula.

**g. Now assume that Temp Force is expected to experience supernormal growth of 30% for the next 3 years, then to return to its long-run constant growth rate of 5%. What is the stock's value under these conditions? What is its expected dividend yield and capital gains yield be in Year 1? In Year 4?**

**Answer:** Temp Force is no longer a constant growth stock, so the constant growth model is not applicable. Note, however, that the stock is expected to become a constant growth stock in 3 years. Thus, it has a nonconstant growth period followed by constant growth. The easiest way to value such nonconstant growth stocks is to set the situation up on a time line as shown below:



Simply enter \$2 and multiply by (1.30) to get  $D_1 = \$2.60$ ; multiply that result by 1.3 to get  $D_2 = \$3.38$ , and so forth. Then recognize that after Year 3, Temp Force becomes a constant growth stock, and at that point  $\hat{P}_3$  can be found using the constant growth model.  $\hat{P}_3$  is the present value as of  $t = 3$  of the dividends in year 4 and beyond.

With the cash flows for  $D_1$ ,  $D_2$ ,  $D_3$ , and  $\hat{P}_3$  shown on the time line, we discount each value back to year 0, and the sum of these four PVs is the value of the stock today,  $P_0 = \$81.11$ .

The dividend yield in year 1 is 3.2 percent, and the capital gains yield is 6.6 percent:

$$\text{Dividend yield} = \frac{\$2.600}{\$81.11} = 0.032 = 3.2\%.$$

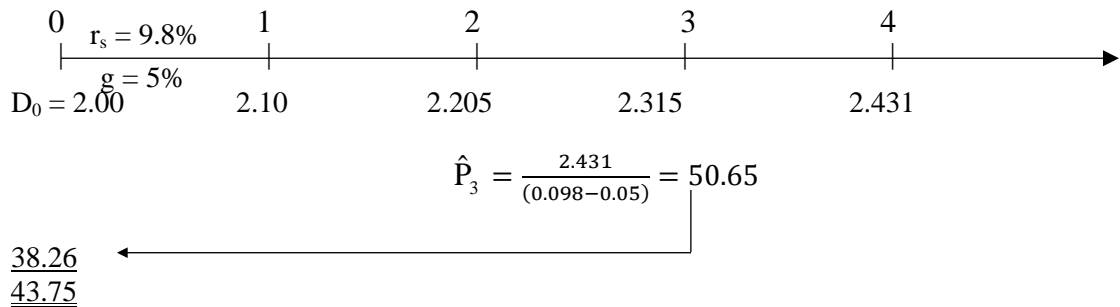
$$\text{Capital gains yield} = 9.8\% - 3.2\% = 6.6\%.$$

During the nonconstant growth period, the dividend yields and capital gains yields are not constant, and the capital gains yield does not equal  $g$ . However, after Year 3, the stock becomes a constant growth stock, with  $g = \text{capital gains yield} = 5.0\%$  and  $\text{dividend yield} = 9.8\% - 5.0\% = 4.8\%$ .

**h. Is the stock price based more on long-term or short-term expectations? Answer this by finding the percentage of Temp Force current stock price based on dividends expected more than 3 years in the future (using the original assumptions).**

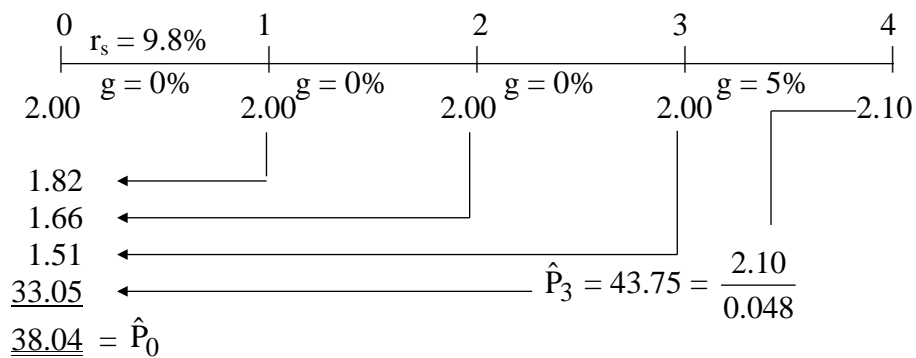
**Answer:**  $\frac{\$38.26}{\$43.75} = 87\%$

Stock price is based more on long-term expectations, as is evident by the fact that 87% of Temp Force's stock price is determined by dividends expected more than three years from now.



**i. Suppose Temp Force is expected to experience zero growth during the first 3 years and then to resume its steady-state growth of 5% in the fourth year. What is the stock's value now? What is its expected dividend yield and its capital gains yield in Year 1? In Year 4?**

**Answer:** Now we have this situation:



During year 1:

$$\text{Dividend Yield} = \frac{\$2.00}{\$38.04} = 0.0526 = 5.26\%$$

$$\text{Capital Gains Yield} = 9.8\% - 5.26\% = 4.54\%$$

Again, in Year 4 Temp Force becomes a constant growth stock; hence  $g =$  capital gains yield  $= 5.0\%$  and dividend yield  $= 4.8\%$ .

**j. Finally, assume that Temp Force's earnings and dividends are expected to decline by a constant 5% per year, that is,  $g = -5\%$ . Why would anyone be willing to buy such a stock, and at what price should it sell? What would be the dividend yield and capital gains yield in each year?**

**Answer:** The company is earning something and paying some dividends, so it clearly has a value greater than zero. That value can be found with the constant growth formula, but where  $g$  is negative:

$$P_0 = \frac{D_1}{r_S - g} = \frac{D_0(1+g)}{r_S - g} = \frac{\$2.00(0.95)}{0.098 - (-0.05)} = \frac{\$1.90}{0.148} = \$12.84.$$

Since it is a constant growth stock:

$$g = \text{Capital Gains Yield} = -5.0\%,$$

hence:

$$\text{Dividend Yield} = 9.8\% - (-5.0\%) = 14.8\%.$$

As a check:

$$\text{Dividend Yield} = \frac{\$1.90}{\$12.84} = 0.148 = 14.8\%.$$

The dividend and capital gains yields are constant over time, but a high (14.8 percent) dividend yield is needed to offset the negative capital gains yield.

**k. What is market multiple analysis?**

**Answer:** Analysts often use the P/E multiple (the price per share divided by the earnings per share) or the P/CF multiple (price per share divided by cash flow per share, which is the earnings per share plus the dividends per share) to value stocks. For example, estimate the average P/E ratio of comparable firms. This is the P/E multiple. Multiply this average P/E ratio by the expected earnings of the company to estimate its stock price. The entity value (V) is the market value of equity (# shares of stock multiplied by the price per share) plus the value of debt. Pick a measure, such as EBITDA, sales, customers, eyeballs, etc. Calculate the average entity ratio for a sample of comparable firms. For example, V/EBITDA, V/customers. Then find the entity value of the firm in question. For example, multiply the firm's sales by the V/sales multiple, or multiply the firm's # of customers by the V/customers ratio. The result is the total value of the firm. Subtract the firm's debt to get the total value of equity. Divide by the number of shares to get the price per share. There are problems with market multiple analysis. (1) It is often hard to find comparable firms. (2) The average ratio for the sample of comparable firms often has a wide range. For example, the average P/E ratio might be 20, but the range could be from 10 to 50. How do you know whether your firm should be compared to the low, average, or high performers?

**l. Temp Force recently issued preferred stock. It pays an annual dividend of \$1.60, and the issue price was \$25 per share. What is the expected return to an investor on this preferred stock?**

**Answer:**

$$\begin{aligned} r_{ps} &= \frac{D_{ps}}{V_{ps}} \\ &= \frac{\$1.60}{\$25} \\ &= 6.4\% \end{aligned}$$

**m. Why do stock prices change? Suppose the expected  $D_1$  is \$2, the growth rate is 4%, and  $r_s$  is 12%. Using the constant growth model, what is the price? What is the impact on the stock price if  $g$  is 5% or 6%? If  $r_s$  is 11% or 13%?**

**Answer:** Using the constant growth model, the price of a stock is  $P_0 = D_1 / (r_s - g)$ . If estimates of  $g$  change, then the price will change. If estimates of the required return on stock change, then the stock price will change. Notice that  $r_s = r_{RF} + (r_{PM})b_i$ , so  $r_s$  will change if there are changes in inflation expectations, risk aversion, or company risk. The following table shows the stock price for various levels of  $g$  and  $r_s$ .

$r_s$	$g$ 4%	$g$ 5%	$g$ 6%
11%	28.57	33.33	40.00
12%	25.00	28.57	33.33
13%	22.22	25.00	28.57

**n. What does market equilibrium mean?**

**Answer:** Equilibrium means stable, no tendency to change. Market equilibrium means that prices are stable—at its current price, there is no general tendency for people to want to buy or to sell a security that is in equilibrium. Also, when equilibrium exists, the expected rate of return will be equal to the required rate of return:

$$\hat{r} = D_1/P_0 + g = r = r_{RF} + (r_M - r_{RF})b.$$

**o. If equilibrium does not exist, how will it be established?**

**Answer:** Securities will be bought and sold until the equilibrium price is established.

**p. What is the Efficient Markets Hypothesis, what are its three forms, and what are its implications?**

**Answer:** The EMH in general is the hypothesis that securities are normally in equilibrium, and are “priced fairly,” making it impossible to “beat the market” over the long term.

Weak-form efficiency says that investors cannot profit from looking at past movements in stock prices—the fact that stocks went down for the past few days is no reason to think that they will go up (or down) in the future. This form has been proven pretty well by empirical tests, even though people still employ “technical analysis.”

Semistrong-form efficiency says that all publicly available information is reflected in stock prices, hence that it won’t do much good to pore over annual reports trying to find undervalued stocks.

Strong-form efficiency says that all information, even inside information, is embedded in stock prices. This form does not hold—insiders know more, and could take advantage of that information to make abnormal profits in the markets. Trading on the basis of insider information is illegal.