Chapter 10
Stocks and Their Valuation

Learning Objectives

After reading this chapter, students should be able to:

- Discuss the legal rights of stockholders.
- Explain the distinction between a stock's price and its intrinsic value.
- Identify the two models that can be used to estimate a stock's intrinsic value: the discounted dividend model and the corporate valuation model.
- List the key characteristics of preferred stock, and describe how to estimate the value of preferred stock.

Lecture Suggestions

This chapter provides important and useful information on common and preferred stocks. Moreover, the valuation of stocks reinforces the concepts covered in Chapters 5, 8, and 9, so Chapter 10 extends and reinforces concepts discussed in those chapters.

We begin our lecture with a discussion of the characteristics of common stocks and how stocks are valued in the market. Models are presented for valuing constant growth stocks, zero growth stocks, and nonconstant growth stocks. We then present the corporation valuation model, which can be used to value divisions and firms that do not pay dividends. We conclude the lecture with a discussion of preferred stocks.

What we cover, and the way we cover it, can be seen by scanning the slides and Integrated Case solution for Chapter 10, which appears at the end of this chapter's solutions. For other suggestions about the lecture, please see the "Lecture Suggestions" in Chapter 2, where we describe how we conduct our classes.

DAYS ON CHAPTER: 3 OF 56 DAYS (50-minute periods)

Answers to End-of-Chapter Questions

10-1 **a.** The average investor of a firm traded on the NYSE is not really interested in maintaining his or her proportionate share of ownership and control. If the investor wanted to increase his or her ownership, the investor could simply buy more stock on the open market. Consequently, most investors are not concerned with whether new shares are sold directly (at about market prices) or through rights offerings. However, if a rights offering is being used to effect a stock split, or if it is being used to reduce the underwriting cost of an issue (by substantial underpricing), the preemptive right may well be beneficial to the firm and to its stockholders.

b. The preemptive right is clearly important to the stockholders of closely held (private) firms whose owners are interested in maintaining their relative control positions.

10-2 No. The correct equation has D_1 in the numerator and a minus sign in the denominator.

10-3 Yes. If a company decides to increase its payout ratio, then the dividend yield component will rise, but the expected long-term capital gains yield will decline.

10-4 Yes. 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.

10-5 A perpetual bond is similar to a no-growth stock and to a share of perpetual 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.
   However, there are preferreds that have a stated maturity. In this situation, the preferred would be valued much like a bond with a stated maturity. Both derive their values from a series of cash inflows—coupon payments and a maturity value for the bond and dividends and a stock price for the preferred.

10-6 The discounted dividend model uses the firm's cost of equity as the discount rate to discount future dividends per share an investor expects to receive starting at t = 1 to calculate the firm's intrinsic value, $\hat{P}_0$, today. The corporate valuation model uses the firm's weighted average cost of capital as the discount rate to discount the firm's future free cash flows starting at t = 1 to arrive at the firm's corporate value. (Free cash flows represent cash generated from current operations less the cash that must be spent on investments and working capital to support future growth. Free cash flows are funds available to *all* capital investors and thus are discounted at the firm's WACC.) Once the corporate value is determined, the current market value of debt and preferred is subtracted to arrive at the firm's equity value. The firm's equity value is divided by the number of shares outstanding to calculate the firm's intrinsic value, $\hat{P}_0$. The corporate valuation model can be used to value divisions and firms that do not pay dividends. The discounted dividend model could not be used in those situations.

10-7 The P/E approach can be used as a starting point in stock valuation. If a stock's P/E ratio is well above its industry average and if the stock's growth potential and risk are similar to other firms in the industry, the stock's price may be too high. To estimate a ball-park value multiply the firm's EPS by the industry-average P/E ratio.

An alternative approach is based on the concept of Economic Value Added (EVA). Remember, EVA = Equity(ROE – r_s). Companies increase their EVA by investing in projects that provide shareholders with returns greater than the cost of capital. When you purchase a firm's stock, you receive more than just the book value of equity—you also receive a claim on all future value that is created by the firm's managers. So, it follows that a company's market value of equity = book value plus the present value of all future EVAs. This value is then divided by the number of shares outstanding to arrive at an estimate of the stock's intrinsic value.

10-8 If a company decides to increase its payout ratio, then the dividend yield component will rise, but the expected long-term capital gains yield will decline.

10-9 The value of a constant growth stock can be calculated by dividing dividend at the next period with the difference between required rate of return and growth rate, which is shown in the following formula:

$$\hat{P}_0 = \frac{D_0(1+g)^1}{(1+r_s)^1} + \frac{D_0(1+g)^2}{(1+r_s)^2} + \cdots + \frac{D_0(1+g)^\infty}{(1+r_s)^\infty}$$
$$= \frac{D_0(1+g)}{r_s - g} = \frac{D_1}{r_s - g}$$

Solutions to End-of-Chapter Problems

10-1 D_0 = \$2; $g_{1\text{-}4}$ = 6%; g_n = 4%; D_1 through D_5 = ?

$D_1 = D_0(1 + g_1) = \$2(1.06) = \$2.12.$

$D_2 = D_0(1 + g_1)(1 + g_2) = \$2(1.06)^2 = \$2.2472.$

$D_3 = D_0(1 + g_1)(1 + g_2)(1 + g_3) = \$2(1.06)^3 = \$2.3820.$

$D_4 = D_0(1 + g_1)(1 + g_2)(1 + g_3)(1 + g_4) = \$2(1.06)^4 = \$2.5250.$

$D_5 = D_0(1 + g_1)(1 + g_2)(1 + g_3)\,(1 + g_4)\,(1 + g_n) = \$2(1.06)^4(1.04) = \$2.6260.$

10-2 D_1 = \$0.80; g = 5%; r_s = 10%; $\hat{P}_0$ = ?

$$\hat{P}_0 = \frac{D_1}{r_s - g} = \frac{\$0.80}{0.10 - 0.05} = \$16.00$$

10-3 P_0 = \$30.00; D_0 = \$1.50; g = 7%; $\hat{P}_1$ = ?; r_s = ?

$\hat{P}_1 = P_0(1 + g) = \$30(1.07) = \$32.10$

$$\hat{r}_s = \frac{D_1}{P_0} + g$$
$$= \frac{\$1.50(1.07)}{\$30} + 0.07$$
$$= 12.35\%$$

$r_s = 12.35\%$

10-4 **a.** The horizon date is the date when the growth rate becomes constant. This occurs at the end of Year 2.

b.

0		1		2		3
	r_s = 10%					
1.25	g_s = 20%	1.50	g_s = 20%	1.80	g_n = 5%	1.89

$$37.80 = \frac{1.89}{0.10 - 0.05}$$

The horizon, or continuing, value is the value at the horizon date of all dividends expected thereafter. In this problem it is calculated as follows:

$$\frac{\$1.80(1.05)}{0.10 - 0.05} = \$37.80.$$

c. The firm's intrinsic value is calculated as the sum of the present value of all dividends during the supernormal growth period plus the present value of the terminal value. Using your financial calculator, enter the following inputs: CF_0 = 0, CF_1 = 1.50, CF_2 = 1.80 + 37.80 = 39.60, I/YR = 10, and then solve for NPV = $34.09.

10-5 The firm's free cash flow is expected to grow at a constant rate, hence we can apply a constant growth formula to determine the total value of the firm.

$$\begin{aligned}\text{Firm value} &= FCF_1/(WACC - g_{FCF}) \\ &= \$150{,}000{,}000/(0.10 - 0.05) \\ &= \$3{,}000{,}000{,}000.\end{aligned}$$

To find the value of an equity claim upon the company (share of stock), we must subtract out the market value of debt and preferred stock. This firm happens to be entirely equity funded, and this step is unnecessary. Hence, to find the value of a share of stock, we divide equity value (or in this case, firm value) by the number of shares outstanding.

$$\begin{aligned}\text{Equity value per share} &= \text{Equity value/Shares outstanding} \\ &= \$3{,}000{,}000{,}000/50{,}000{,}000 \\ &= \$60.\end{aligned}$$

Each share of common stock is worth $60, according to the corporate valuation model.

10-6 D_p = \$5.00; V_p = \$60; r_p = ?

$$r_p = \frac{D_p}{V_p} = \frac{\$5.00}{\$60.00} = 8.33\%.$$

10-7 $V_p = D_p/r_p$; therefore, $r_p = D_p/V_p$.

a. r_p = \$120(0.06)/\$70 = \$7.20/\$70 = 10.29%.

b. r_p = \$7.20/\$90 = 8%.

c. r_p = \$7.20/\$110 = 6.55%.

d. r_p = \$7.20/\$130 = 5.54%.

10-8 **a.** $V_p = \frac{D_p}{r_p} = \frac{\$120(0.05)}{0.1} = \frac{\$6}{0.1} = \$60$

b. $V_p = \frac{\$6}{0.14} = \$42.86$

10-9 **a.** The preferred stock pays \$12 annually (\$3 per quarter) in dividends. Therefore, its nominal rate of return would be:

Nominal rate of return = \$12/\$90 = 13.33%.

Or alternatively, you could determine the security's periodic return and multiply by 4.

Periodic rate of return = \$3/\$90 = 3.333%.

Nominal rate of return = 3.333% $\times$ 4 = 13.33%.

b. EAR $= (1 + r_{NOM}/4)^4 - 1$
$= (1 + 0.1333/4)^4 - 1$
$= 0.14 = 14\%$.

10-10 $$\hat{P}_0 = \frac{D_1}{r_s - g} = \frac{D_0(1+g)}{r_s - g} = \frac{\$5[1+(-0.05)]}{0.15-(-0.05)} = \frac{\$5(0.95)}{0.15+0.05} = \frac{\$4.75}{0.20} = \$23.75.$$

10-11 First, solve for the current price.

$\hat{P}_0 = D_1/(r_s - g)$
$= \$0.50/(0.12 - 0.07)$
$= \$10.00$.

If the stock is in a constant growth state, the constant dividend growth rate is also the capital gains yield for the stock and the stock price growth rate. Hence, to find the price of the stock four years from today:

$\hat{P}_4 = P_0(1 + g)^4$
$= \$10.00(1.07)^4$
$= \$13.10796 \approx \$13.11$.

10-12 **a.** 1. $\hat{P}_0 = \dfrac{\$2(1-0.05)}{0.15+0.05} = \dfrac{\$1.90}{0.20} = \$9.50.$

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

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

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

b. 1. $\hat{P}_0 = \$2.30/0 =$ 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, the results of Part b show this. It is not reasonable for a firm to grow indefinitely at a rate higher than its required return. Such a stock, in theory, would become so large that it would eventually overtake the whole economy.

10-13 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:

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

$$0.11 = \frac{\$2}{\$25} + g$$

$$g = 0.03 = 3\%.$$

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

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

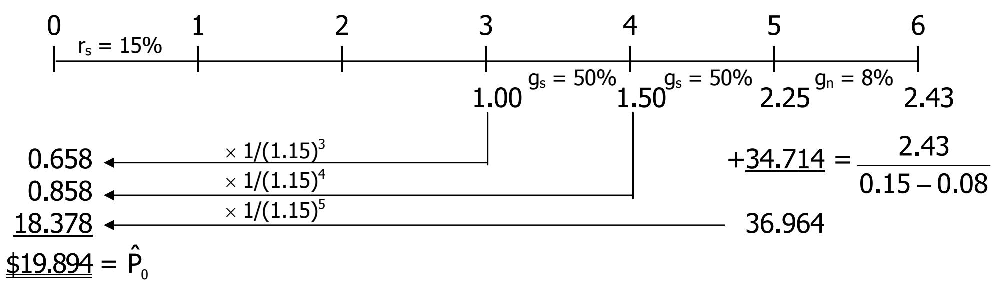
Alternatively, you could calculate D_4 and then use the constant growth rate formula to solve for $\hat{P}_3$:

$D_4 = D_1(1 + g)^3 = \$2.00(1.03)^3 = \$2.1855.$

$\hat{P}_3 = \$2.1855/(0.11 - 0.03) = \$27.3182 \approx \$27.32.$

10-14 Calculate the dividend cash flows and place them on a time line. Also, calculate the stock price 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/YR = 15, 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.

$D_0 = 0$; $D_1 = 0$; $D_2 = 0$; $D_3 = 1.00$; $D_4 = 1.00(1.5) = 1.5$; $D_5 = 1.00(1.5)^2 = 2.25$; $D_6 = 1.00(1.5)^2(1.08) = \$2.43$. $\hat{P}_0$ = ?



$\hat{P}_5 = D_6/(r_s - g) = \$2.43/(0.15 - 0.08) = \$34.714$. This is the stock price at the end of Year 5.

CF_0 = 0; $CF_{1\text{-}2}$ = 0; CF_3 = 1.0; CF_4 = 1.5; CF_5 = 36.964; I/YR = 15. With these cash flows in the CFLO register, press NPV to calculate the value of the stock today: NPV = \$19.89.

10-15 **a.** Horizon value = $\dfrac{\$40(1.07)}{0.13 - 0.07} = \dfrac{\$42.80}{0.06}$ = \$713.33 million.

b.

0	1	2	3	4
WACC = 13%				g_n = 7%
	-20	30	40	42.80

(\$ 17.70) ← × 1/1.13 (from -20)
23.49 ← × $1/(1.13)^2$ (from 30)
522.10 ← × $1/(1.13)^3$ (from 753.33)
\$527.89

V_{op_3} = 713.33
753.33

Using a financial calculator, enter the following inputs: CF_0 = 0; CF_1 = -20; CF_2 = 30; CF_3 = 753.33; I/YR = 13; and then solve for NPV = \$527.89 million.

c. Total value$_{t=0}$ = \$527.89 million.

Value of common equity = \$527.89 – \$100 = \$427.89 million.

Price per share = $\dfrac{\$427.89}{10.00}$ = \$42.79.

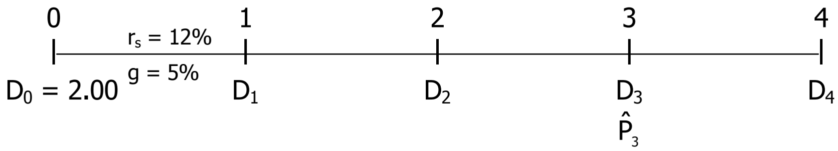
10-16 The value of any asset is the present value of all future cash flows expected to be generated from the asset. Hence, if we can find the present value of the dividends during the period preceding long-run constant growth and subtract that total from the current stock price, the remaining value would be the present value of the cash flows to be received during the period of long-run constant growth.

$D_1 = \$3.00 \times (1.2)^1 = \$3.60$	$PV(D_1) = \$3.60/(1.10)^1$	= \$3.2727
$D_2 = \$3.00 \times (1.2)^2 = \$4.32$	$PV(D_2) = \$4.32/(1.10)^2$	= \$3.5702
$D_3 = \$3.00 \times (1.2)^3 = \$5.184$	$PV(D_3) = \$5.184/(1.10)^3$	= \$3.8948
$D_4 = \$3.00 \times (1.2)^4 = \$6.2208$	$PV(D_4) = \$6.2208/(1.10)^4$	= \$4.2489
	Σ PV(D_1 to D_4)	= \$14.9866

Therefore, the PV of the remaining dividends is: \$60.00 – \$14.9866 = \$45.0134. Compounding this value forward to Year 4, we find that the value of all dividends received during constant growth is \$65.90. [$\$45.0134(1.1)^4 = \$65.9041 \approx \$65.90$.] Applying the constant growth formula, we can solve for the constant growth rate:

$$
\begin{aligned}
\hat{P}_4 &= D_4(1 + g)/(r_s - g) \\
\$65.90 &= \$6.2208(1 + g)/(0.10 - g) \\
\$6.59 - \$65.9g &= \$6.2208 + \$6.2208g \\
\$0.3692 &= \$72.1208g \\
0.005119 &= g \\
g &= 0.512\%.
\end{aligned}
$$

10-17



a. $D_1 = \$2(1.05) = \$2.10$; $D_2 = \$2(1.05)^2 = \$2.2050$; $D_3 = \$2(1.05)^3 = \$2.31525$.

b. Financial calculator solution: Input 0, 2.10, 2.2050, and 2.31525 into the cash flow register, input I/YR = 12, and solve for NPV = PV = \$5.28.

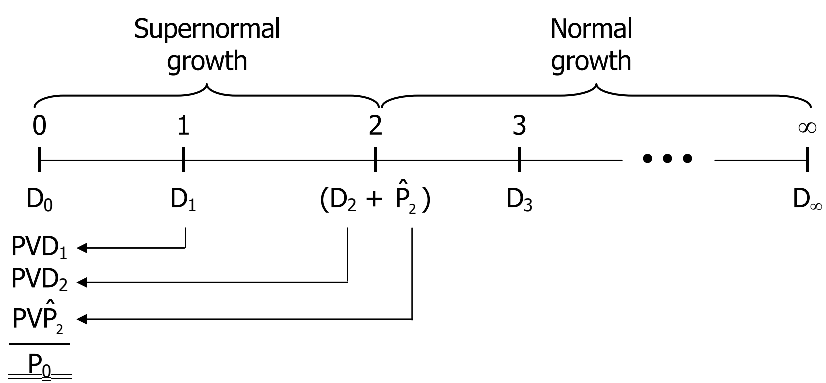
c. Financial calculator solution: Input 0, 0, 0, and 34.73 into the cash flow register, I/YR = 12, and solve for NPV = PV = \$24.72.

d. \$24.72 + \$5.28 = \$30.00 = Maximum price you should pay for the stock.

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

f. No. 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. Any other holding period would produce the same value of $\hat{P}_0$; that is, $\hat{P}_0$ = \$30.00.

10-18 a. Part 1: Graphical representation of the problem:



$D_1 = D_0(1 + g_s) = \$1.6(1.20) = \$1.92.$

$D_2 = D_0(1 + g_s)^2 = \$1.60(1.20)^2 = \$2.304.$

$$\hat{P}_2 = \frac{D_3}{r_s - g_n} = \frac{D_2(1+g_n)}{r_s - g_n} = \frac{\$2.304(1.06)}{0.10 - 0.06} = \$61.06.$$

$$\begin{aligned}\hat{P}_0 &= PV(D_1) + PV(D_2) + PV(\hat{P}_2)\\ &= \frac{D_1}{(1+r_s)} + \frac{D_2}{(1+r_s)^2} + \frac{\hat{P}_2}{(1+r_s)^2}\\ &= \$1.92/1.10 + \$2.304/(1.10)^2 + \$61.06/(1.10)^2 = \$54.11.\end{aligned}$$

Financial calculator solution: Input 0, 1.92, 63.364(2.304 + 61.06) into the cash flow register, input I/YR = 10, and solve for NPV = PV = \$54.11.

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.

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

Financial calculator solution: Input 0, 63.364(2.304 + 61.06) into the cash flow register, input I/YR = 10, and solve for NPV = PV = \$57.60.

Second, find the capital gains yield:

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

Dividend yield =	3.55%
Capital gains yield =	6.45
	10.00% = r_s.

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, r_s, will be 10%, 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 the capital gain can be delayed until the gain is actually realized. Currently (2011), dividends to individuals are now taxed at the lower capital gains rate of 15%; however, as we work on these solutions, this is set to expire at the end of 2012 and taxation of dividends is set to increase to pre-2003 levels.

10-19 a.

0	WACC = 12%	1	2	3	4
		3,000,000	6,000,000	10,000,000	15,000,000

Using a financial calculator, enter the following inputs: CF_0 = 0; CF_1 = 3000000; CF_2 = 6000000; CF_3 = 10000000; CF_4 = 15000000; I/YR = 12; and then solve for NPV = \$24,112,308.

b. The firm's horizon value is calculated as follows:

$$\frac{\$15{,}000{,}000(1.07)}{0.12-0.07}=\$321{,}000{,}000.$$

c. The firm's total value is calculated as follows:

0	1	2	3	4	5
WACC = 12%					g_n = 7%
	3,000,000	6,000,000	10,000,000	15,000,000	16,050,000

PV = ?

$$321{,}000{,}000=\frac{16{,}050{,}000}{0.12-0.07}$$

Using your financial calculator, enter the following inputs: CF_0 = 0; CF_1 = 3000000; CF_2 = 6000000; CF_3 = 10000000; CF_4 = 15000000 + 321000000 = 336000000; I/YR = 12; and then solve for NPV = $228,113,612.

d. To find Barrett's stock price, you need to first find the value of its equity. The value of Barrett's equity is equal to the value of the total firm less the market value of its debt and preferred stock.

Total firm value	$228,113,612	
Market value, debt + preferred	60,000,000	(given in problem)
Market value of equity	$168,113,612	

Barrett's price per share is calculated as:

$$\frac{\$168{,}113{,}612}{10{,}000{,}000}=\$16.81.$$

10-20 $FCF_1 = EBIT(1 - T) + \text{Depreciation} - \begin{matrix}\text{Capital}\\ \text{expenditures}\end{matrix} - \Delta\begin{pmatrix}\text{Net operating}\\ \text{working capital}\end{pmatrix}$

$= \$500{,}000{,}000 + \$100{,}000{,}000 - \$200{,}000{,}000 - \$0$
$= \$400{,}000{,}000.$

$$\begin{aligned}\text{Firm value} &= \frac{FCF_1}{WACC - g_{FCF}}\\ &= \frac{\$400{,}000{,}000}{0.10-0.06}\\ &= \frac{\$400{,}000{,}000}{0.04}\\ &= \$10{,}000{,}000{,}000.\end{aligned}$$

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

$$\begin{aligned}MV_{Total} &= MV_{Equity} + MV_{Debt}\\ \$10{,}000{,}000{,}000 &= MV_{Equity} + \$3{,}000{,}000{,}000\\ MV_{Equity} &= \$7{,}000{,}000{,}000.\end{aligned}$$

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.

10-21 a. End of Year:

12	13	14	15	16	17	18
$r_s = 12\%$, $g_s = 15\%$					$g_n = 5\%$	
$D_0 = 1.75$	D_1	D_2	D_3	D_4	D_5	D_6

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

$D_{2013} = \$1.75(1.15)^1 = \$2.01$.

$D_{2014} = \$1.75(1.15)^2 = \$1.75(1.3225) = \$2.31$.

$D_{2015} = \$1.75(1.15)^3 = \$1.75(1.5209) = \$2.66$.

$D_{2016} = \$1.75(1.15)^4 = \$1.75(1.7490) = \$3.06$.

$D_{2017} = \$1.75(1.15)^5 = \$1.75(2.0114) = \$3.52$.

b. Step 1:

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

PV D_{2013} = $2.01/(1.12) = $1.79
PV D_{2014} = $2.31/$(1.12)^2$ = $1.84
PV D_{2015} = $2.66/$(1.12)^3$ = $1.89
PV D_{2016} = $3.06/$(1.12)^4$ = $1.94
PV D_{2017} = $3.52/$(1.12)^5$ = <u>$2.00</u>
PV of dividends = <u>$9.46</u>

Step 2:

$$\hat{P}_{2017} = \frac{D_{2018}}{r_s - g_n} = \frac{D_{2017}(1+g)}{r_s - g_n} = \frac{\$3.52(1.05)}{0.12 - 0.05} = \frac{\$3.70}{0.07} = \$52.80.$$

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

PV of $\hat{P}_{2017}$ = $52.80/$(1.12)^5$ = $29.96

Step 3:

The price of the stock today is as follows:

$\hat{P}_0$ = PV dividends Years 2013-2017 + PV of $\hat{P}_{2017}$
= $9.46 + $29.96 = $39.42.

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, 2.01, 2.31, 2.66, 3.06, 56.32 (3.52 + 52.80) into the cash flow register, input I/YR = 12, and solve for NPV = PV = $39.43.

c. 2013

D_1/P_0 = $2.01/$39.43	=	5.10%
Capital gains yield	=	6.90*
Expected total return	=	12.00%

*We know that r_s is 12%, and the dividend yield is 5.10%; therefore, the capital gains yield must be 6.90%.

2018

D_6/P_5 = $3.70/$52.80	=	7.00%
Capital gains yield	=	5.00
Expected total return	=	12.00%

The main points to note here are as follows:

1. The total yield is always 12% (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 12/31/17, the stock will grow at a 5% rate. The dividend yield will equal 7%, the capital gains yield will equal 5%, and the total return will be 12%.

d. People in high-income tax brackets will be more inclined to purchase "growth" stocks to take the capital gains and thus delay the payment of taxes until a later date. The firm's stock is "mature" at the end of 2017.

e. Since the firm's supernormal and normal growth rates are lower, the dividends and, hence, the present value of the stock price will be lower. The total return from the stock will still be 12%, but the dividend yield will be larger and the capital gains yield will be smaller than they were with the original growth rates. This result occurs because we assume the same last dividend but a much lower current stock price.

f. As the required return increases, the price of the stock declines, but both the capital gains and dividend yields increase initially. Of course, the long-term capital gains yield is still 4%, so the long-term dividend yield is 10%.

Comprehensive/Spreadsheet Problem

Note to Instructors:
The solutions for Parts a through c of this problem are provided at the back of the text; however, the solution to Part d is not. Instructors can access the *Excel* file on the textbook's website.

10-22 **a.** 1. Find the price today.

D_0	$1.60	
r_s	10.0%	
g_s	20%	Short-run g; for Years 1-2 only.
g_n	6%	Long-run g; for Year 3 and all following years.

	20%			6%
Year	0	1	2	3
Dividend	$1.6000	$1.9200	$2.3040	$2.4422

PV of dividends
$1.7455
$1.9041
$50.4595

$61.0560 = Horizon value = P_2 = $\dfrac{\$2.4422}{4.0\%}$ = $r_s - g_n$

$54.1091 = P_0

2. Find the expected dividend yield.

Recall that the expected dividend yield is equal to the next expected annual dividend divided by the price at the beginning of the period.

Dividend yield =	D_1	/	P_0
Dividend yield =	$1.9200	/	$54.1091
Dividend yield =	3.55%		

3. Find the expected capital gains yield.

The capital gains yield can be calculated by simply subtracting the dividend yield from the expected total return.

Cap. gain yield =	Expected total return	–	Dividend yield
Cap. gain yield =	10.0%	–	3.55%
Cap. gain yield =	6.45%		

Alternatively, we can recognize that the capital gains yield measures capital appreciation, hence solve for the price in one year, then divide the change in price from today to one year from now by the current price. To find the price one year from now, we will have to find the present values of the horizon value and second year dividend to time period one.

$$P_1 = \frac{P_2 + D_2}{(1 + r_s)}$$

$$P_1 = \frac{\$61.0560 + \$2.3040}{1.10}$$

$$P_1 = \$57.60$$

Cap. gain yield =	$(P_1 - P_0)$	/	P_0
Cap. gain yield =	\$3.49	/	\$54.1091
Cap. gain yield =	**6.45%**		

b. 1. Find the price today.

D_0	\$1.60	
r_s	10.0%	
g_s	20%	Short-run g; for Years 1-5 only.
g_n	6%	Long-run g; for Year 6 and all following years.

	20%					6%	
Year	0	1	2	3	4	5	6
Dividend	\$1.6000	\$1.9200	\$2.3040	\$2.7648	\$3.3178	\$3.9813	\$4.2202

PV of dividends
\$1.7455
\$1.9041
\$2.0772
\$2.2661
\$2.4721
\$65.5102
\$75.9751 = P_0

$$\$105.5048 = \text{Horizon value} = P_5 = \frac{\$4.2202}{4.0\%} \quad = r_s - g_n$$

2. Find the expected dividend yield.

Dividend yield =	D_1	/	0
Dividend yield =	\$1.9200	/	\$75.9751
Dividend yield =	**2.53%**		

3. Find the expected capital gains yield.

Cap. gain yield =	Expected total return	–	Dividend yield
Cap. gain yield =	10.0%	–	2.53%
Cap. gain yield =	**7.47%**		

c. We used the 5 year supernormal growth scenario for this calculation, but ultimately it does not matter which example you use, as they both yield the same result.

Dividend yield =	D_{N+1}	/	P_N
Dividend yield =	$4.2202	/	$105.5048
Dividend yield =	**4.0%**		

Cap. gain yield =	Expected total return	–	Dividend yield
Cap. gain yield =	10.0%	–	4.0%
Cap. gain yield =	**6.0%**		

Upon reflection, we see that these calculations were unnecessary because the constant growth assumption holds that the long-term growth rate is the dividend growth rate and the capital gains yield, hence we could have simply subtracted the long-run growth rate from the required return to find the dividend yield.

d. INPUT DATA

WACC	9%
g_n	6%
Millions of shares	20
MV of debt	$1,200

Year (9%)	0	1	2	3	4	5	6	7	8	9	10	11
FCF's		$5.5	$12.1	$23.8	$44.1	$69.0	$88.8	$107.5	$128.9	$147.1	$161.3	$171.0
PV of FCF's		$5.05	$10.18	$18.38	$31.24	$44.85	$52.95	$58.81	$64.69	$67.73	$68.13	

PV of FCF_{1-10} =	$422.00	
HV at Year 10 of FCF after Year 10 = $FCF_{11}/(WACC - g_n)$:		$\frac{\$171.0}{3\%}$ = $5,699.27
PV of HV at Year 0 = $HV/(1+WACC)^{10}$:	$2,407.43	
Sum = Value of the Total Corporation	$2,829.44	
Less: MV of Debt and Preferred	$1,200.00	
Value of Common Equity	$1,629.44	
Number of Shares (in Millions) to Divide By:	20	
Value per Share = Value of Common Equity/No. Shares:	$81.47	versus $75.98 using the discounted dividend model

The price as estimated by the corporate valuation method differs from the discounted dividends method because different assumptions are built into the two situations. If we had projected financial statements, found both dividends and free cash flow from those projected statements, and applied the two methods, then the prices produced would have been identical. As it stands, though, the two prices were based on somewhat different assumptions, hence different prices were obtained. Note especially that in the FCF model we assumed a WACC of 9% versus a cost of equity of 10% for the discounted dividend model. That would obviously tend to raise the price.

Integrated Case

10-23
Ping An Insurance (Group) Company of China Ltd.
Stock Valuation

Robert Su and Carol Tso are senior vice presidents of Ping An Insurance (Group) Company of China Ltd. Su's main responsibility is fixed-income securities (primarily bonds) and Tso being responsible for equity investments. A major new client, Synergis Holdings Ltd., has requested that Ping An Insurance present an investment seminar to their shareholders and directors; and Su and Tso, who will make the actual presentation, have asked you to help them.

To illustrate the common stock valuation process, Su and Tso have asked you to analyze the Bau Bau 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 stockholders.**

Answer: **[Show S10-1 and S10-2 here.] The common stockholders are the <u>owners</u> of a corporation, and as such they have certain rights and privileges as described below.**

1. **Ownership implies control. Thus, a firm's common stockholders have the right to elect its firm's directors, who in turn elect the officers who manage the business.**

2. **Common stockholders often have the right, called the preemptive right, to purchase any additional shares sold by the firm. In some states, the preemptive right is automatically**

included in every corporate charter; in others, it is necessary to insert it specifically into the charter.

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

Answer: **[Show S10-3 through S10-6 here.] The value of any stock is the present value of its expected dividend stream:**

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

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: **[Show S10-7 and S10-8 here.] A <u>constant growth stock</u> 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:

$D_1 = D_0(1 + g)$, $D_2 = D_1(1 + g) = D_0(1 + g)^2$, 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 are the implications if a company forecasts a constant g that exceeds its r_s? Will many stocks have expected g > r_s in the short run (that is, for the next few years)? In the long run (that is, forever)?

Answer: [Show S10-9 here.] 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.

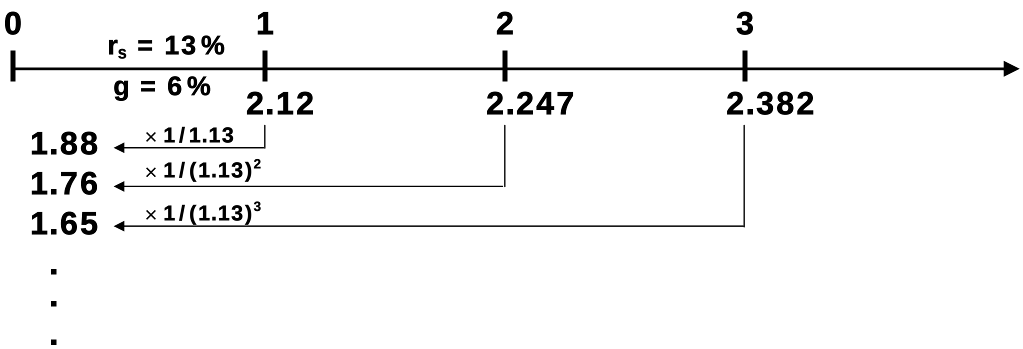
C. Assume that Bau Bau Company has a beta coefficient of 1.2, that the risk-free rate (the yield on T-bonds) is 7%, and that the required rate of return on the market is 12%. What is Bau Bau Company's required rate of return?

Answer: [Show S10-10 here.] Here we use the SML to calculate Bau Bau Company's required rate of return:

$$\begin{aligned} r_s &= r_{RF} + (r_M - r_{RF})b_{\text{Bau Bau Company}} \\ &= 7\% + (12\% - 7\%)(1.2) \\ &= 7\% + (5\%)(1.2) \\ &= 7\% + 6\% = 13\%. \end{aligned}$$

D.		**Assume that Bau Bau Company is a constant growth company whose last dividend (D_0, which was paid *yesterday*) was \$2.00 and whose dividend is expected to grow indefinitely at a 6% rate.**
	(1)	**What is the firm's expected dividend stream over the next 3 years?**

Answer: [Show S10-11 here.] Bau Bau Company is a constant growth stock, and its dividend is expected to grow at a constant rate of 6% per year. Expressed as a time line, we have the following setup. Just enter 2 in your calculator; then keep multiplying by $1 + g = 1.06$ to get D_1, D_2, and D_3:



D.	**(2)**	**What is its current stock price?**

Answer: [Show S10-12 here.] We could extend the time line on out forever, find the value of Bau Bau Company's dividends for every year on out into the future, and then the PV of each dividend discounted at $r_s = 13\%$. For example, the PV of D_1 is \$1.8761; the PV of D_2 is \$1.7599; 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:

$$\hat{P}_0 = \frac{D_1}{r_s - g} = \frac{\$2.12}{0.13 - 0.06} = \frac{\$2.12}{0.07} = \$30.29.$$

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

Answer: **[Show S10-13 here.] 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 \$32.10:**

$$\hat{P}_1 = \frac{D_2}{r_s - g} = \frac{\$2.247}{0.13 - 0.06} = \frac{\$2.247}{0.07} = \$32.10.$$

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

Answer: **[Show S10-14 here.] 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

$$\text{Capital gains yield} = \frac{(\hat{P}_N - \hat{P}_{N-1})}{\hat{P}_{N-1}} = r_s - \frac{D_N}{P_{N-1}}.$$

Thus, the dividend yield in the first year is 7%, while the capital gains yield is 6%:

$$\begin{aligned}
&\text{Total return} && = 13.0\% \\
&\text{Dividend yield} = \$2.12/\$30.29 && = \underline{\ 7.0}\% \\
&\text{Capital gains yield} && = \underline{\underline{\ 6.0}}\%
\end{aligned}$$

E.	**Now assume that the stock is currently selling at \$30.29. What is its expected rate of return?**

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

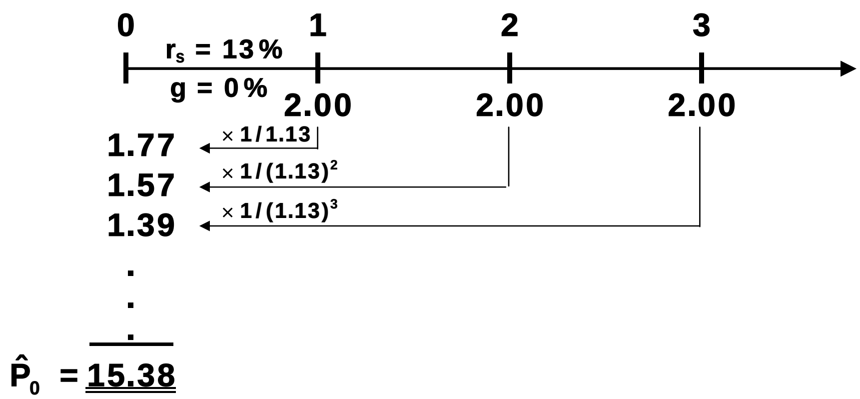
$$\hat{r}_s = \frac{D_1}{P_0} + g.$$

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

$$\hat{r}_s = \$2.12/\$30.29 + 0.060 = 0.070 + 0.060 = 13\%.$$

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

Answer: **[Show S10-15 here.] If Bau Bau Company's dividends were not expected to grow at all, then its dividend stream would be a perpetuity. Perpetuities are valued as shown below:**

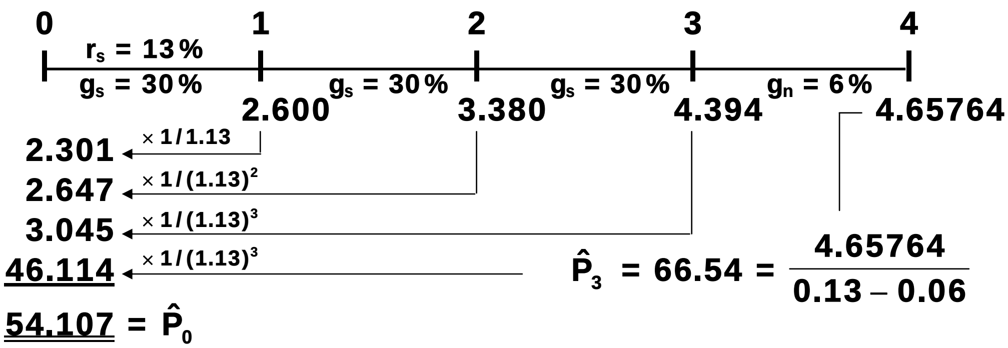


$$\hat{P}_0 = D/r_s = \$2.00/0.13 = \$15.38.$$

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

G.	**Now assume that Bau Bau Company is expected to experience nonconstant growth of 30% for the next 3 years, then return to its long-run constant growth rate of 6%. What is the stock's value under these conditions? What are its expected dividend and capital gains yields in Year 1? Year 4?**

Answer: **[Show S10-16 through S10-18 here.] Bau Bau Company 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, Bau Bau Company 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 and is also called the horizon, or continuing, value.

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 = \$54.107.

The dividend yield in Year 1 is 4.80%, and the capital gains yield is 8.2%:

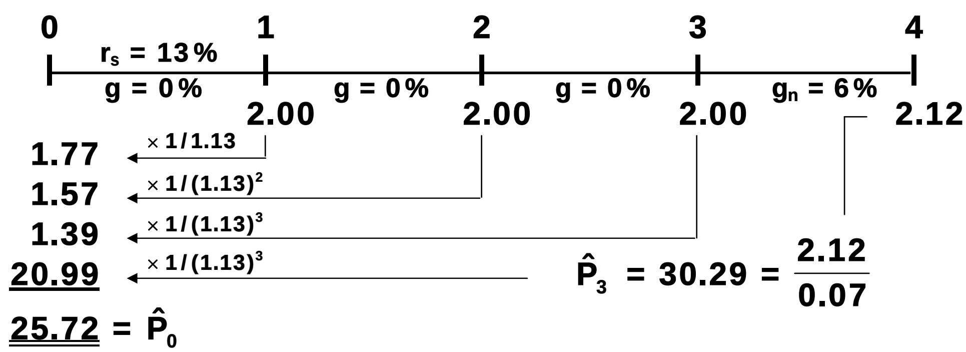
$$\text{Dividend yield} = \frac{\$2.600}{\$54.107} = 0.0480 = 4.8\%.$$

$$\text{Capital gains yield} = 13.00\% - 4.8\% = 8.2\%.$$

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 = capital gains yield = 6.0% and dividend yield = 13.0% – 6.0% = 7.0%.

H.	Suppose Bau Bau Company is expected to experience zero growth during the first 3 years and then resume its steady-state growth of 6% in the fourth year. What would be its value then? What would be its expected dividend and capital gains yields in Year 1? In Year 4?

Answer: [Show S10-19 and S10-20 here.] Now we have this situation:



During Year 1:

$$\text{Dividend yield} = \frac{\$2.00}{\$25.72} = 0.0778 = 7.78\%.$$

$$\text{Capital gains yield} = 13.00\% - 7.78\% = 5.22\%.$$

Again, in Year 4 Bau Bau Company becomes a constant growth stock; hence g = capital gains yield = 6.0% and dividend yield = 7.0%.

I.	**Finally, assume that Bau Bau Company's earnings and dividends are expected to decline at a constant rate of 6% per year, that is, g = -6%. Why would anyone be willing to buy such a stock, and at what price should it sell? What would be its dividend and capital gains yields in each year?**

Answer: **[Show S10-21 and S10-22 here.] 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:**

$$P_0 = \frac{D_1}{r_S - g} = \frac{D_0(1+g)}{r_S - g} = \frac{\$2.00(0.94)}{0.13-(-0.06)} = \frac{\$1.88}{0.19} = \$9.89.$$

Since it is a constant growth stock:

g = Capital gains yield = -6.0%,

Hence:

Dividend yield = 13.0% – (-6.0%) = 19.0%.

As a check:

$$\text{Dividend yield} = \frac{\$1.88}{\$9.89} = 0.190 = 19.0\%.$$

The dividend and capital gains yields are constant over time, but a high (19.0%) dividend yield is needed to offset the negative capital gains yield.

J.	**Suppose Bau Bau Company embarked on an aggressive expansion that requires additional capital. Management decided to finance the expansion by borrowing \$40 million and by halting dividend payments to increase retained earnings. Its WACC is now 10%, and the projected free cash flows for the next 3 years are -\$5 million, \$10 million, and \$20 million. After Year 3, free cash flow is projected to grow at a constant 6%. What is Bau Bau Company's total value? If it has 10 million shares of stock and \$40 million of debt and preferred stock combined, what is the price per share?**

Answer: **[Show S10-23 through S10-29 here.]**

0	1	2	3	4
WACC = 10%			g_n = 6%	
	-5	10	20	21.20

-4.545 ← × 1/1.10 (−5)

8.264 ← × 1/(1.10)^2 (10)

15.026 ← × 1/(1.10)^3 (20)

398.197 ← × 1/(1.10)^3 ← $530 = \dfrac{21.20}{0.10 - 0.06}$

416.942 = Total value

Value of equity = Total value – Debt

= \$416.94 – \$40 = \$376.94 million.

Price per share = \$376.94/10 = \$37.69.

K.	**Suppose Bau Bau Company decided to issue preferred stock that would pay an annual dividend of \$5.00 and that the issue price was \$50.00 per share. What would be the stock's expected return? Would the expected rate of return be the same if the preferred was a perpetual issue or if it had a 20-year maturity?**

Answer: **[Show S10-30 and S10-31 here.]**

$$\hat{r}_p = \frac{D_p}{V_p} = \frac{\$5}{\$50} = 10\%.$$

If the preferred has a 20-year maturity its value would be calculated as follows:

Enter the following inputs into your financial calculator: N = 20; I/YR = 10; PMT = 5; FV = 50; and then solve for PV = $50.

However, to find the value of the perpetual preferred's dividends after Year 20 we can enter the following data: N = 20; I/YR = 10; PMT = 5; FV = 0; and then solve for PV = $42.57. Thus, dividends in Years 21 to infinity account for $50.00 – $42.57 = $7.43 of the perpetual preferred's value.

Appendix 10A
Stock Market Equilibrium

Answers to End-of-Chapter Questions

10A-1 For a stock to be in equilibrium, two related conditions must hold:

1. A stock's expected rate of return as seen by the marginal investor must equal its required rate of return: $\hat{r}_i = r_i$.

2. The actual market price of the stock must equal its intrinsic value as estimated by the marginal investor: $P_0 = \hat{P}_0$.

10A-2 Some individual investors may believe that $\hat{r}_i > r_i$ and $\hat{P}_0 > P_0$ (hence they would invest most of their funds in the stock), while other investors might have an opposite view and sell all of their shares. However, investors at the margin establish the actual market price; and for these investors, we must have $\hat{r}_i = r_i$ and $\hat{P}_0 = P_0$. If these conditions do not hold, trading will occur until they do.

Solutions to End-of-Chapter Problems

10A-1 a. $r_i = r_{RF} + (r_M - r_{RF})b_i$.

$r_C = 7\% + (11\% - 7\%)0.4 = 8.6\%$.

$r_D = 7\% + (11\% - 7\%)(-0.5) = 5\%$.

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 reasonable.

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

$$\hat{r}_C = D_1/P_0 + g = \$1.50/\$25 + 4\% = 10\%.$$

However, the required rate of return is 8.6%. Investors will seek to buy the stock, raising its price to the following:

$$\hat{P}_C = \frac{\$1.50}{0.086 - 0.04} = \$32.61.$$

At this point, $\hat{r}_C = \frac{\$1.50}{\$32.61} + 4\% = 8.6\%$, and the stock will be in equilibrium.

10A-2 a. $r_s = r_{RF} + (r_M - r_{RF})b = 6\% + (10\% - 6\%)1.5 = 12.0\%$.

$\hat{P}_0 = D_1/(r_s - g) = \$2.25/(0.12 - 0.05) = \$32.14$.

b. $r_s = 5\% + (9\% - 5\%)1.5 = 11.0\%$. $\hat{P}_0 = \$2.25/(0.110 - 0.05) = \$37.50$.

c. $r_s = 5\% + (8\% - 5\%)1.5 = 9.5\%$. $\hat{P}_0 = \$2.25/(0.095 - 0.05) = \$50.00$.

d. New data given: $r_{RF} = 5\%$; $r_M = 8\%$; $g = 6\%$, $b = 1.3$.

$r_s = r_{RF} + (r_M - r_{RF})b = 5\% + (8\% - 5\%)1.3 = 8.9\%$.

$\hat{P}_0 = D_1/(r_s - g) = \$2.27/(0.089 - 0.06) = \$78.28$.

10A-3 a. Old $r_s = r_{RF} + (r_M - r_{RF})b = 6\% + (3\%)1.2 = 9.6\%.$

New $r_s = 6\% + (3\%)0.9 = 8.7\%.$

Old price: $\hat{P}_0 = \frac{D_1}{r_s - g} = \frac{D_0(1+g)}{r_s - g} = \frac{\$2(1.06)}{0.096 - 0.06} = \$58.89.$

New price: $\hat{P}_0 = \frac{\$2(1.04)}{0.087 - 0.04} = \$44.26.$

Since the new price is lower than the old price, the expansion in consumer products should be rejected. The decrease in risk is not sufficient to offset the decline in profitability and the reduced growth rate.

b. $P_{Old} = \$58.89$. $P_{New} = \frac{\$2(1.04)}{r_s - 0.04}.$

Solving for r_s we have the following:

$$\begin{aligned} \$58.89 &= \frac{\$2.08}{r_s - 0.04} \\ \$2.08 &= \$58.89(r_s) - \$2.3556 \\ \$4.4356 &= \$58.89(r_s) \\ r_s &= 0.07532. \end{aligned}$$

Solving for b:

$$\begin{aligned} 7.532\% &= 6\% + 3\%(b) \\ 1.532\% &= 3\%(b) \\ b &= 0.5107. \end{aligned}$$

Check: $r_s = 6\% + (3\%)0.5107 = 7.532\%.$

$$\hat{P}_0 = \frac{\$2.08}{0.07532 - 0.04} = \$58.89.$$

Therefore, only if management's analysis concludes that risk can be lowered to b = 0.5107, should the new policy be put into effect.