Chapter 9

Stock Valuation

Key Concepts and Skills

- Understand how stock prices depend on future dividends and dividend growth

- Be able to compute stock prices using the dividend growth model

- Understand how growth opportunities affect stock values

- Understand the PE ratio

Chapter Outline

9.1   The Present Value of Common Stocks

9.2   Estimates of Parameters in the Dividend Discount Model

9.3   Growth Opportunities

9.4   Price-Earnings Ratio

Cash Flows for Stockholders

- If you own a share of stock, you can receive cash in two ways
  - The company pays dividends
  - You sell your shares, either to another investor in the market or back to the company
- As with bonds, the price of the stock is the present value of these expected cash flows
  - Dividends → cash income
  - Selling → capital gains

One Period Example

- Suppose you are thinking of purchasing the stock of Moore Oil, Inc.
    - You expect it to pay a $2 dividend in one year
    - You believe you can sell the stock for $14 at that time.
    - You require a return of 20% on investments of this risk
    - What is the maximum you would be willing to pay?

One Period Example

- $D_1 = \$2$ dividend expected in one year
- $R = 20\%$
- $P_1 = \$14$
- $CF_1 = \$2 + \$14 = \$16$
- Compute the PV of the expected cash flows

$$P_0 = \frac{(2+14)}{1.20} = \$13.33$$

Two Period Example

- What if you decide to hold the stock for two years?
  - $D_1 = \$2.00$ $CF_1 = \$2.00$
  - $D_2 = \$2.10$
  - $P_2 = \$14.70$ } $CF_2 = \$2.10 + \$14.70 = \$16.80$

- Now how much would you be willing to pay?

$$P_0 = \frac{2}{1.20} + \frac{(2.10 + 14.70)}{(1.20)^2} = \$13.33$$

Three Period Example

- What if you decide to hold the stock for three years?
  - $D_1 = \$2.00 \quad CF_1 = \$2.00$
  - $D_2 = \$2.10 \quad CF_2 = \$2.10$
  - $D_3 = \$2.205$
  - $P_3 = \$15.435$ $\Bigg\}$ $CF_3 = \$2.205 + \$15.435 = \$17.640$

- Now how much would you be willing to pay?

$$P_0 = \frac{2}{1.20} + \frac{2.10}{(1.20)^2} + \frac{(2.205 + 15.435)}{(1.20)^3} = \$13.33$$

Developing The Model

- You could continue to push back when you would sell the stock

- You would find that the price of the stock is really just the *present value of <u>all</u> expected future dividends*

Stock Value = PV of Dividends

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

$$\boxed{\hat{P}_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+R)^t}}$$

How can we estimate all future dividend payments?

Estimating Dividends: 3 Special Cases

- Zero Growth
  - Firm will pay a constant dividend forever
  - Like preferred stock
  - Price is computed using the perpetuity formula

- Constant dividend growth
  - Firm will increase the dividend by a constant *percent* every period

- Nonconstant growth
  - Dividend growth is not consistent initially, but settles down to constant growth eventually

Case 1: Zero Growth

- Assume that dividends will remain at the same level forever

$$\text{Div}_1 = \text{Div}_2 = \text{Div}_3 = \cdots$$

- Since future cash flows are constant, the value of a zero growth stock is the present value of a perpetuity:

$$P_0 = \frac{\text{Div}_1}{(1+R)^1} + \frac{\text{Div}_2}{(1+R)^2} + \frac{\text{Div}_3}{(1+R)^3} + \cdots$$

$$P_0 = \frac{\text{Div}}{R}$$

Zero Growth

- Dividends expected at regular intervals forever = perpetuity

  $P_0 = D / R$

- Suppose stock is expected to pay a $0.50 dividend every quarter and the required return is 10% with quarterly compounding. What is the price?

$$P_0 = \frac{0.50}{.10 / 4} = \$20$$

Practice Problems Ch. 9

The Pancake House pays a constant annual dividend of $1.25 per share. How much are you willing to pay for one share if you require a 15 percent rate of return?

Case 2: Constant Growth

Assume that dividends will grow at a constant rate, g, forever, *i.e.*,

$$\text{Div}_1 = \text{Div}_0 (1 + g)$$

$$\text{Div}_2 = \text{Div}_1 (1 + g) = \text{Div}_0 (1 + g)^2$$

$$\text{Div}_3 = \text{Div}_2 (1 + g) = \text{Div}_0 (1 + g)^3$$

$$\vdots$$

Since future cash flows grow at a constant rate forever, the value of a constant growth stock is the present value of a growing perpetuity:

$$P_0 = \frac{\text{Div}_1}{R - g}$$

DGM – Example 1

- Suppose Big D, Inc. <u>just paid</u> a dividend of $.50. It is expected to increase its dividend by 2% per year. If the market requires a return of 15% on assets of this risk, how much should the stock be selling for?

- D_0 = $0.50

- g = 2%

- R = 15%

$$P_0 = \frac{D_0(1+g)}{R-g}$$

$$P_0 = \frac{0.50(1+.02)}{.15-.02} = \$3.92$$

DGM – Example 2

- Suppose TB Pirates, Inc. is expected to pay a $2 dividend in one year. If the dividend is expected to grow at 5% per year and the required return is 20%, what is the price?

  - D_1 = $2.00

  - g = 5%

  - r = 20%

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

$$P_0 = \frac{2.00}{.20 - .05} = \$13.33$$

Practice Problems Ch. 9

- Healthy Foods just paid its annual dividend of $1.45 a share. The firm recently announced that all future dividends will be increased by 2.8 percent annually. What is one share of this stock worth to you if you require a 14 percent rate of return?

Gordon Growth Company - I

- Gordon Growth Company is <u>expected</u> to pay a dividend of $4 next period and dividends are expected to grow at 6% per year. The required return is 16%.

- What is the current price?

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

$$P_0 = \frac{4.00}{.16 - .06} = \$40$$
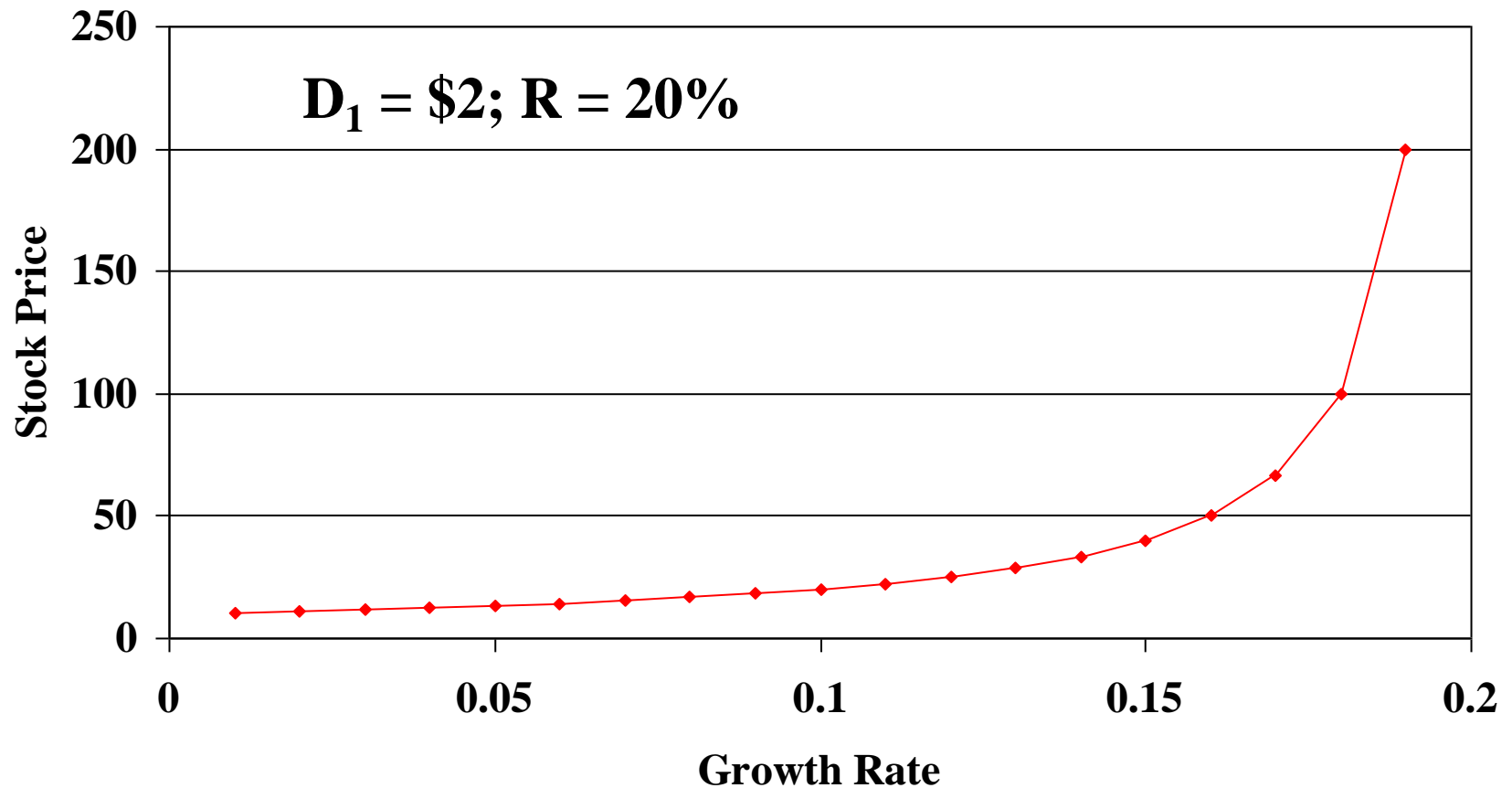
Gordon Growth Company - II

- What is the price expected to be in year 4?

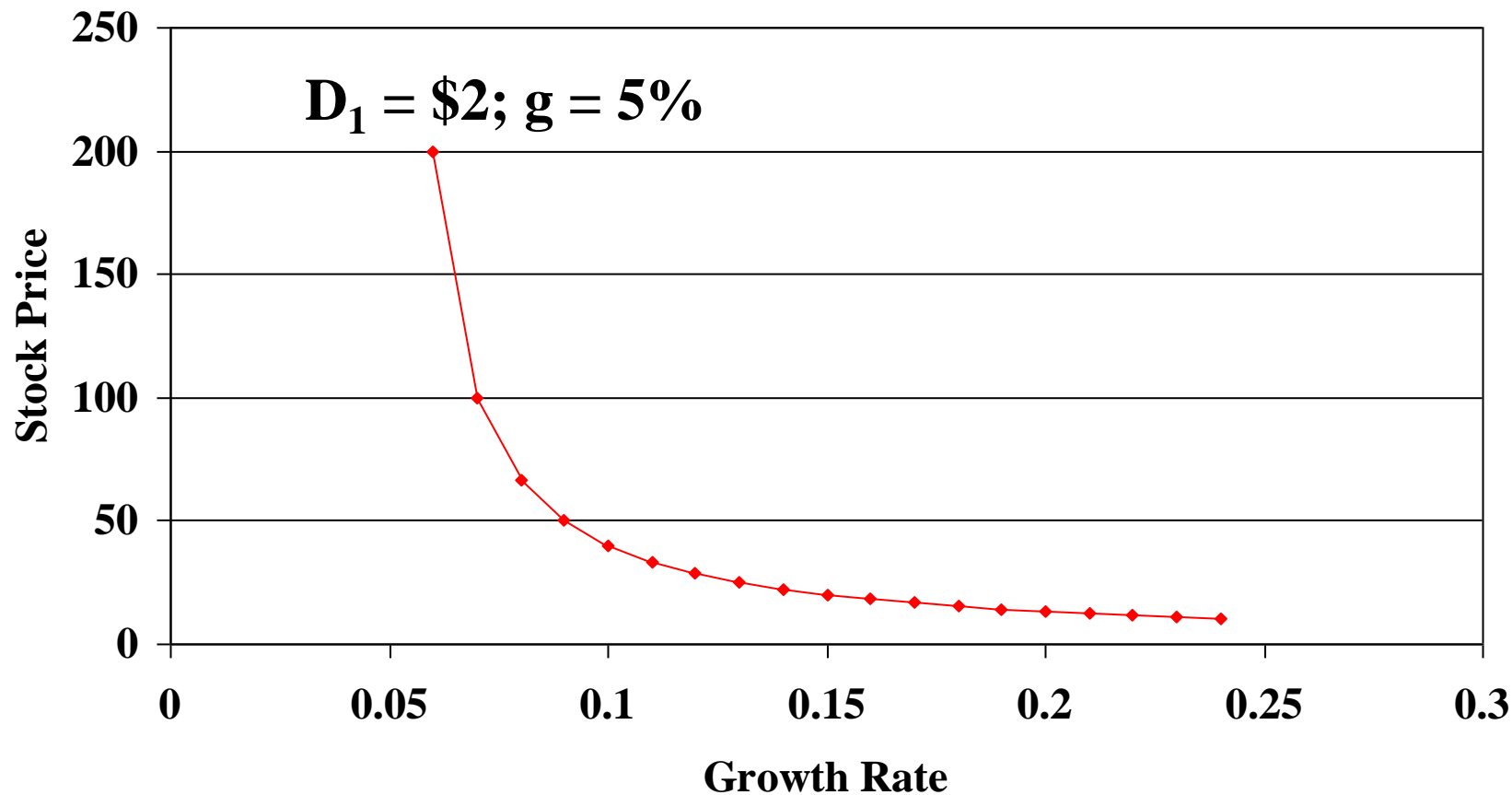$$P_4 = \frac{D_4(1+g)}{R-g} = \frac{D_5}{R-g}$$

$$D_5 = D_1(1+g)^4$$

$$P_4 = \frac{4.00(1+.06)^4}{.16-.06} = \$50.50$$

Stock Price Sensitivity to Dividend Growth, g

$D_1 = \$2; R = 20\%$

Stock Price (y-axis): 0 to 250

Growth Rate (x-axis): 0 to 0.2

Stock Price Sensitivity to Required Return, R

$D_1 = \$2$; $g = 5\%$

Case 3: Differential Growth

- Assume that dividends will grow at different rates in the foreseeable future and then will grow at a constant rate thereafter.

- To value a Differential Growth Stock, we need to:
  - Estimate future dividends in the foreseeable future.
  - Estimate the future stock price when the stock becomes a Constant Growth Stock.
  - Compute the total present value of the estimated future dividends and future stock price at the appropriate discount rate.

Case 3: Differential Growth

- Assume that dividends will grow at rate g_1 for N years and grow at rate g_2 thereafter.

$$\text{Div}_1 = \text{Div}_0(1 + g_1)$$

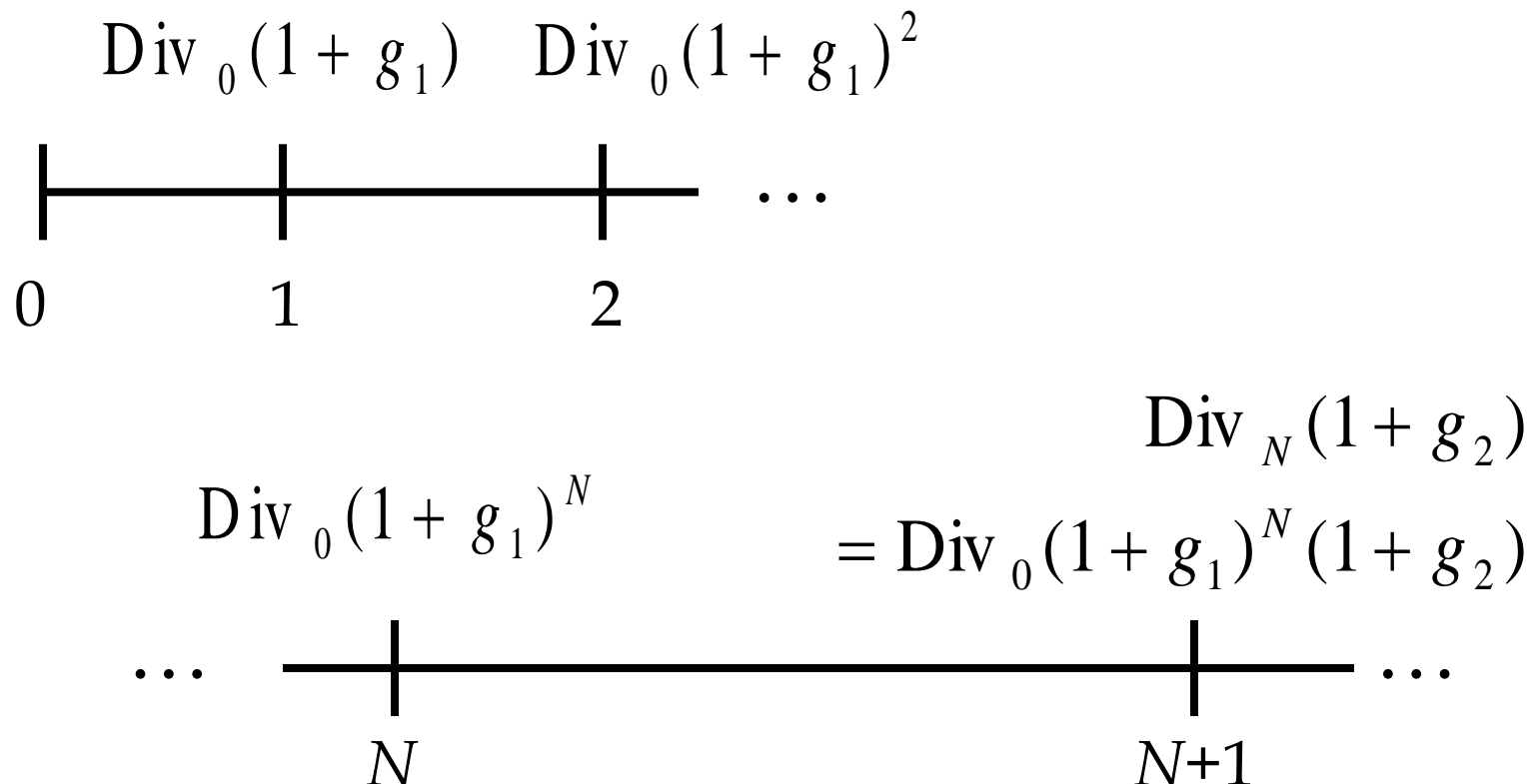$$\text{Div}_2 = \text{Div}_1(1 + g_1) = \text{Div}_0(1 + g_1)^2$$

$$\vdots$$

$$\text{Div}_N = \text{Div}_{N-1}(1 + g_1) = \text{Div}_0(1 + g_1)^N$$

$$\text{Div}_{N+1} = \text{Div}_N(1 + g_2) = \text{Div}_0(1 + g_1)^N(1 + g_2)$$

$$\vdots$$

Case 3: Differential Growth

Dividends will grow at rate g_1 for N years and grow at rate g_2 thereafter

$$\text{Div}_0(1+g_1) \qquad \text{Div}_0(1+g_1)^2$$

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├────────┼────────┼──────  …
0        1        2
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$$\text{Div}_N(1+g_2)$$

$$\text{Div}_0(1+g_1)^N \qquad = \text{Div}_0(1+g_1)^N(1+g_2)$$

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…  ─────┼────────────────┼──  …
        N                N+1
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Case 3: Differential Growth

We can value this as the sum of:

- a *T*-year annuity growing at rate g_1

$$P_A = \frac{C}{R - g_1}\left[1 - \frac{(1 + g_1)^T}{(1 + R)^T}\right]$$

- plus the discounted value of a perpetuity growing at rate g_2 that starts in year *T*+1

$$P_B = \frac{\left(\dfrac{\mathrm{Div}_{T+1}}{R - g_2}\right)}{(1 + R)^T}$$

Case 3: Differential Growth

Consolidating gives:

$$P = \frac{C}{R - g_1}\left[1 - \frac{(1 + g_1)^T}{(1 + R)^T}\right] + \frac{\left(\dfrac{\text{Div}_{T+1}}{R - g_2}\right)}{(1 + R)^T}$$

Or, we can "cash flow" it out.

A Differential Growth Example

A common stock just paid a dividend of $2. The dividend is expected to grow at 8% for 3 years, then it will grow at 4% in perpetuity.

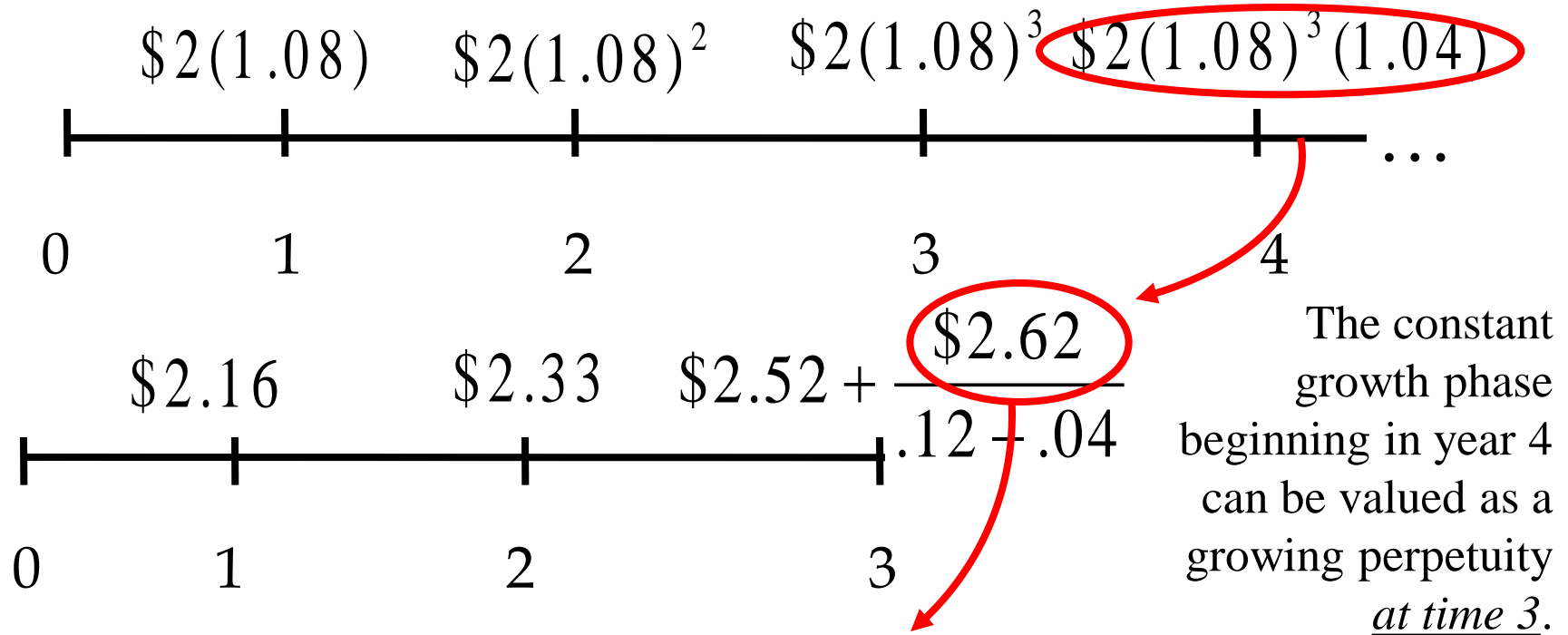What is the stock worth? The discount rate is 12%.

With the Formula

$$P = \frac{\$2 \times (1.08)}{.12 - .08}\left[1 - \frac{(1.08)^3}{(1.12)^3}\right] + \frac{\left(\dfrac{\$2(1.08)^3(1.04)}{.12 - .04}\right)}{(1.12)^3}$$

$$P = \$54 \times [1 - .8966] + \frac{(\$32.75)}{(1.12)^3}$$

$$P = \$5.58 + \$23.31 \qquad\qquad P = \$28.89$$

With Cash Flows

$$\$2(1.08) \qquad \$2(1.08)^2 \qquad \$2(1.08)^3 \qquad \$2(1.08)^3(1.04)$$

0   1   2   3   4   …

$$\$2.16 \qquad \$2.33 \qquad \$2.52 + \dfrac{\$2.62}{.12 - .04}$$

0   1   2   3

The constant growth phase beginning in year 4 can be valued as a growing perpetuity *at time 3*.
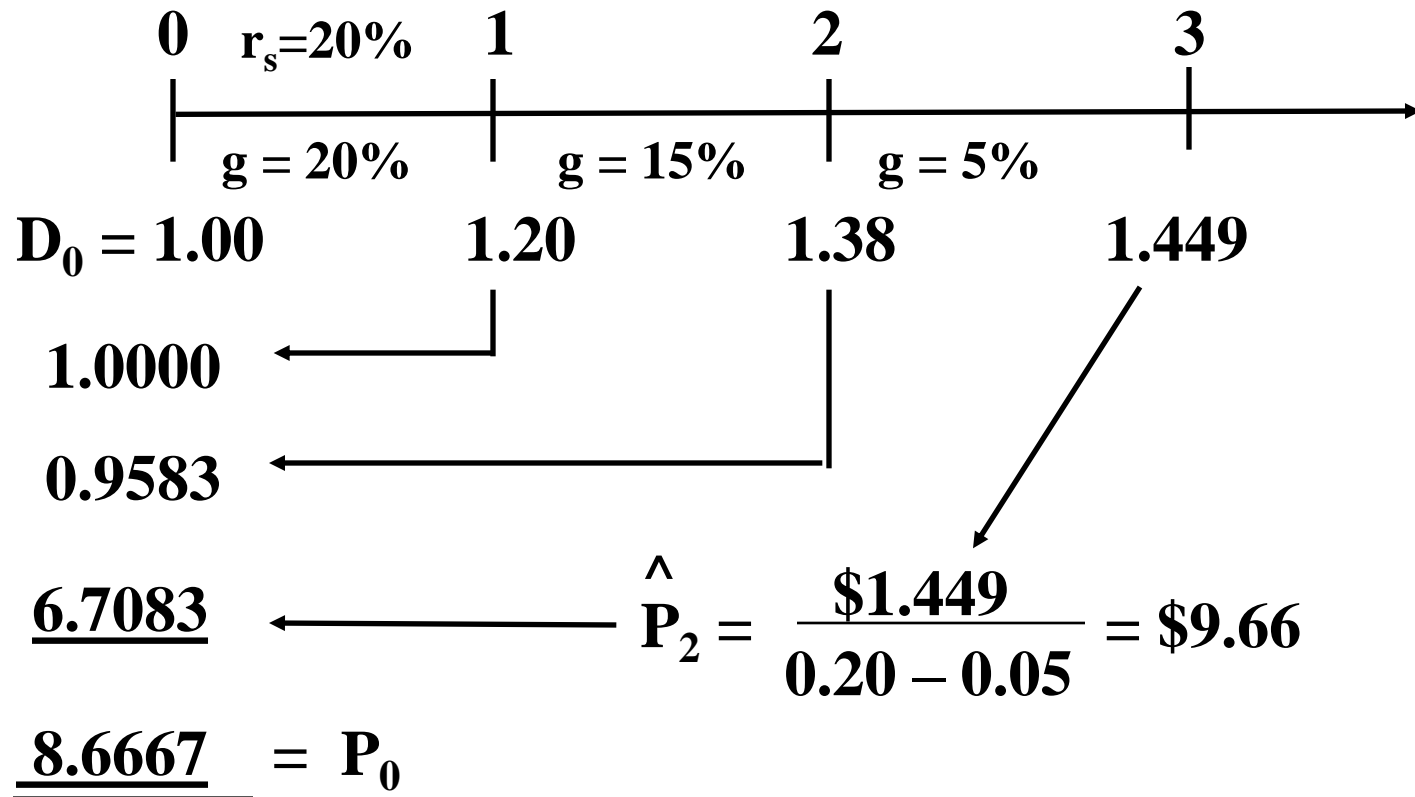
$$P_0 = \frac{\$2.16}{1.12} + \frac{\$2.33}{(1.12)^2} + \frac{\$2.52 + \$32.75}{(1.12)^3} = \$28.89$$

$$P_3 = \frac{\$2.62}{.08} = \$32.75$$

Nonconstant growth followed by constant growth:

$$r_s = 20\%$$

0	1	2	3

$g = 20\%$ $g = 15\%$ $g = 5\%$

$D_0 = 1.00$ 1.20   1.38   1.449

1.0000

0.9583

$\underline{6.7083} \longleftarrow \hat{P}_2 = \dfrac{\$1.449}{0.20 - 0.05} = \$9.66$

$\underline{8.6667} = P_0$

Practice Problems Ch. 9

Atlas Home Supply has paid a constant annual dividend of $2.40 a share for the past 15 years. Yesterday, the firm announced the dividend will increase next year by 10 percent and will stay at the level through year three, after which time the dividends will increase by 2 percent annually. The required return on this stock is 12 percent. What is the current value per share?

9.2 Estimates of Parameters

- The value of a firm depends upon its growth rate, g, and its discount rate, R.
  - Where does g come from?

    g = Retention ratio × Return on retained earnings

$$\begin{array}{ccc} \text{Earnings} & & \text{Earnings} & & \text{Retained} & & \text{Return on} \\ \text{next} & = & \text{this} & + & \text{earnings} & \times & \text{retained} \\ \text{year} & & \text{year} & & \text{this year} & & \text{earnings} \end{array}$$

$$\underbrace{\qquad\qquad\qquad\qquad\qquad\qquad\qquad}_{\text{Increase in earnings}}$$

$$\frac{\text{Earnings next year}}{\text{Earnings this year}} = \frac{\text{Earnings this year}}{\text{Earnings this year}} + \left(\frac{\text{Retained earnings this year}}{\text{Earnings this year}} \right)$$
$$\times \text{ Return on retained earnings}$$

$$1 + g = 1 + \text{Retention ratio} \times \text{Return on retained earnings}$$

Estimating the Dividend Growth Rate

Another method for estimating the growth rate is to use the historical average:

Year	Dividend	Percent Change
2005	1.23	
2006	1.3	(1.30 − 1.23) / 1.23 = 5.7%
2007	1.36	(1.36 − 1.30) / 1.30 = 4.6%
2008	1.43	(1.43 − 1.36) / 1.36 = 5.1%
2009	1.5	(1.50 − 1.43) / 1.43 = 4.9%

Average = (5.7 + 4.6 + 5.1 + 4.9) / 4 = 5.1%

Where Does *R* Come From?

- The discount rate can be broken into two parts.
  - The dividend yield
  - The growth rate (in dividends)
- In practice, there is a great deal of estimation error involved in estimating *R*.

$$P_0 = \frac{\text{Div}_1}{R - g}$$

Using the DGM to Find R

- Start with the DGM:

$$P_0 = \frac{D_0(1+g)}{R-g} = \frac{D_1}{R-g}$$

Rearrange and solve for R:

$$R = \frac{D_0(1+g)}{P_0} + g = \frac{D_1}{P_0} + g$$

Advantages and Disadvantages of Dividend Growth Model

Advantage:

- Easy to understand and use

Disadvantages:

• Only applicable to companies currently paying dividends

• Not applicable if dividends aren't growing at a reasonably constant rate

• Extremely sensitive to the estimated growth rate – an increase in g of 1% increases the cost of equity by 1%

• Does not <u>explicitly</u> consider risk

9.3 Growth Opportunities

- Growth opportunities are opportunities to invest in positive NPV projects.

- The value of a firm can be conceptualized as the sum of the value of a firm that pays out 100% of its earnings as dividends plus the net present value of the growth opportunities.

$$P = \frac{EPS}{R} + NPVGO$$

NPVGO Model: Example

Consider a firm that has forecasted EPS of $5, a discount rate of 16%, and is currently priced at $75 per share.

- We can calculate the value of the firm as a cash cow.

- So, NPVGO must be: $75 - $31.25 = $43.75

$$P_0 = \frac{\text{EPS}}{R} = \frac{\$5}{.16} = \$31.25$$

Retention Rate and Firm Value

- An increase in the retention rate will:
  - Reduce the dividend paid to shareholders
  - Increase the firm's growth rate
- These have offsetting influences on stock price
- Which one dominates?
  - If ROE>R, then increased retention increases firm value since reinvested capital earns more than the cost of capital.

Retention Rate and Firm Value

The Stambaugh Corporation currently has earnings per share of $9.40. The company has no growth and pays out all earnings as dividends. It has a new project that will require an investment of $1.95 per share in one year. The project is only a two-year project, and it will increase earnings in the two years following the investment by $2.75 and $3.05, respectively. Investors require a return of 12 percent on Stambaugh stock.

- What is the value per share of the company's stock assuming the firm does not undertake the investment opportunity?
- If the company does undertake the investment, what is the value per share now?
- Again, assume the company undertakes the investment. What will the price per share be four years from today?

- P = Dividend / R = \$9.40 / .12 = \$78.33

- NPVGO = C_1 / $(1 + R)$ + C_2 / $(1 + R)^2$ + C_3 / $(1 + R)^3$

  NPVGO = –\$1.95 / 1.12 + \$2.75 / 1.12^2 + \$3.05 / 1.12^3

  NPVGO = \$2.62

  So, the price of the stock if the company undertakes the investment opportunity will be:

  P = \$78.33 + 2.62

- After the project is over, and the earnings increase no longer exists, the price of the stock will revert back to \$78.33

9.4 Price-Earnings Ratio

- Many analysts frequently relate earnings per share to price.
- The price-earnings ratio is calculated as the current stock price divided by annual EPS.

$$P/E \text{ ratio } = \frac{Price \ per \ share}{EPS}$$

PE and NPVGO

- Recall, $$P = \frac{EPS}{R} + NPVGO$$

- Dividing every term by EPS provides the following description of the PE ratio:

$$PE = \frac{1}{R} + \frac{NPVGO}{EPS}$$

- So, a firm's PE ratio is positively related to growth opportunities and negatively related to risk (R)