Overview and Learning Objectives

Overview

In this chapter, we learn how shareholders value their claims on the firm, i.e., the valuation of stocks. Investors determine the value of, and make investment decisions on, stocks using the first principle of Finance, the same principle that financial managers use to determine the value of corporate investment opportunities, i.e. the Net Present Value (NPV) rule in Chapter 4A. Therefore, we will apply the TVM formulas introduced in Chapter 4 here in stock valuation. This chapter also discusses factors that determine stock price.

Learning Objectives

After reading course materials on this chapter, students should be able to:

- Compute the values of different types of stocks.
- Estimate the key variables in computing the value of a stock.
- Explain how each key variable affects the value of a stock.
- Decompose the stock price into the income and growth components.
- Explain the relation between the Price-Earnings (PE) ratio and the growth potential of a company.
- Interpret stock market information presented in the financial press.

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Stock Market Basics and Reporting (Ref: Section 9.6)

Brokers and Dealers

- Broker □ one who arranges security transactions among investors; major player in secondary market transactions.
- Dealer □ one who buys and sells securities from inventory.
- Bid price □ the price at which a dealer is willing to buy a security; i.e., investors' selling price.
- Ask price □ the price at which a dealer is willing to sell a security, i.e., investors' purchase price.
- Spread □ the difference between the bid and ask prices; the major source of income for dealers.

Organization of the NYSE

Historically, the right to trade on the NYSE was held by 1,366 □members□ who owned seats on the exchange, with seats trading for as much as $4 million each. After the reorganization of the NYSE as a public company in 2006, this structure was replaced by 1,500 licenses that, as of 2008, cost approximately $44,000 per year.

- Commission brokers □ those who execute customer orders to buy and sell stock on the floor of the exchange.
- Specialist □ NYSE member who acts as a dealer on the exchange floor, often called a market maker.
- Floor brokers □ NYSE members who execute orders for commission brokers on a fee basis.
- Floor Traders □ those who trade for their own accounts, trying to anticipate and profit from temporary price fluctuations.

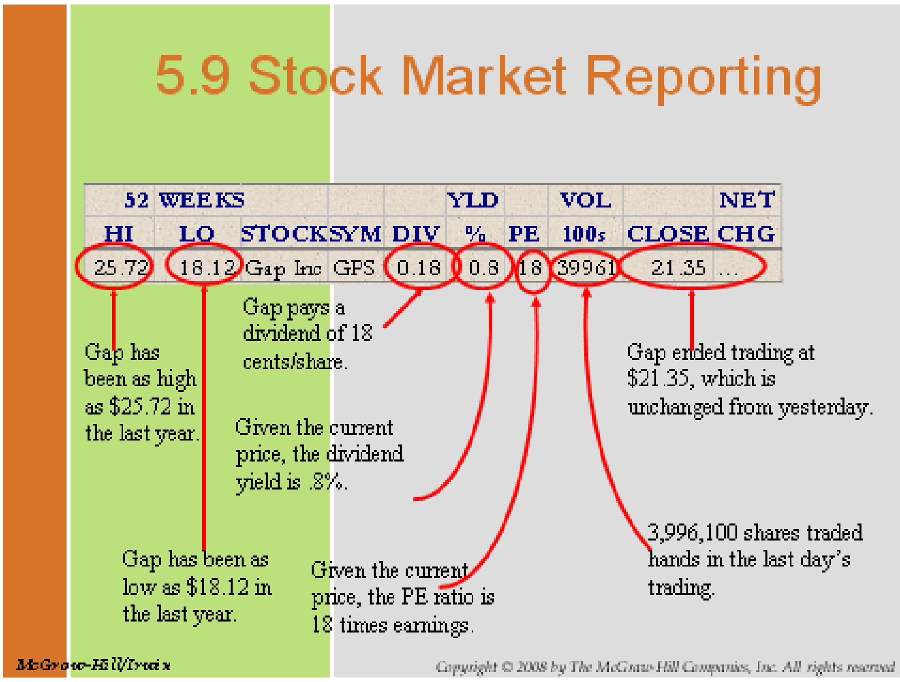
NASDAQ Operations

NYSE operations represent a premier example of the trading of □listed□ securities. NASDAQ operations, on the other hand, represent the evolution of □over-the-counter□ trading of securities that do not rely on a physical market place.

- NASDAQ □ National Association of Securities Dealers Automated Quotation system □ computer network of securities dealers who disseminate timely security price quotes to NASDAQ subscribers.
- Electronic Communication Networks (ECNs) allow individual investors to transact directly with one another rather than with a dealer. ECN orders are displayed with market maker orders, thereby □opening□ up the market.

Stock Market Reporting

If you are unfamiliar with the reporting of stock market information in the financial press, please reference the text for further information.



Valuation of Financial Securities

The intrinsic value, V, of a financial security, which is defined as the present value of the financial security's expected future cash flows over its life, discounted at the appropriate discount rate, serves as the benchmark in identifying mispriced securities.

When applying the **Intrinsic Value Analysis**, we compare the market price, P, of the security to its intrinsic value, V.

- If **P > V**, the security is **overpriced** → a SELL recommendation.
- If **P < V**, the security is **underpriced** → a BUY recommendation.
- If P = V, the security is fairly priced.

In valuating a financial security, we need to estimate both the size and timing of its future cash flows. We also consider the riskiness of its future cash flows in determining the appropriate discount rate according to the Opportunity Cost Principle (discussed in Chapter 4). Note that we consider all three aspects of cash flows that affect value (Ref: Chapter 1) in the valuation of financial securities.

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The Intrinsic Value of Stocks (Ref: Section 9.1)

The valuation principles are the same for stocks and bonds. The intrinsic value of a stock is the present value of all its expected future cash flows: the expected dividend plus expected price at the end of the holding period. For a single holding period,

$$\mathbf{V_0 = (Div_1 + P_1) / (l+r)}$$

But what determines P_1?

An investor valuing the stock in the next period (t = 1) will apply the same principles:

Expected $P_1 = V_1 = (Div_2 + P_2) / (l+r)$

Therefore, $V_0 = Div_1 / (l+r) + Div_2 / (l+r)^2 + P_2 / (l+r)^2$

Since common stock has no expiration date, applying the same principles to P_2, P_3, and so on eventually results in:

$$V_0 = Div_1 / (l+r) + Div_2 / (l+r)^2 + Div_3 / (l+r)^3 + \ldots$$

$$= \sum_{t=1}^{\infty} \frac{Div_t}{(1+r)^t}$$

Thus, the value of common stock depends only on the timing, size, and riskiness of its expected future dividends. In other words, the intrinsic value of a stock, V, is defined as the present value of all its future expected dividends over its infinite life, discounted at the appropriate discount rate, r. This is the essence of the dividend valuation model. How do we estimate future dividends?

Obviously, it is not feasible to estimate dividends for each period individually. To make the above valuation formula operational, we introduce three models for estimating future dividends of a stock:- zero growth, constant dividend growth, and differential (multi-stage) growth.

The three dividend growth models apply to firms in different stages of the life cycle. Young companies usually have a high growth rate. After a while their growth slows down to a normal rate. Finally, they may shrink or go out of business entirely.

We need to note that there are a few caveats with the dividend growth models:

- Growth is hard to forecast precisely and the growth rate has a large impact on estimated firm value.
- It is dividends, not earnings, which should be used in the valuation.

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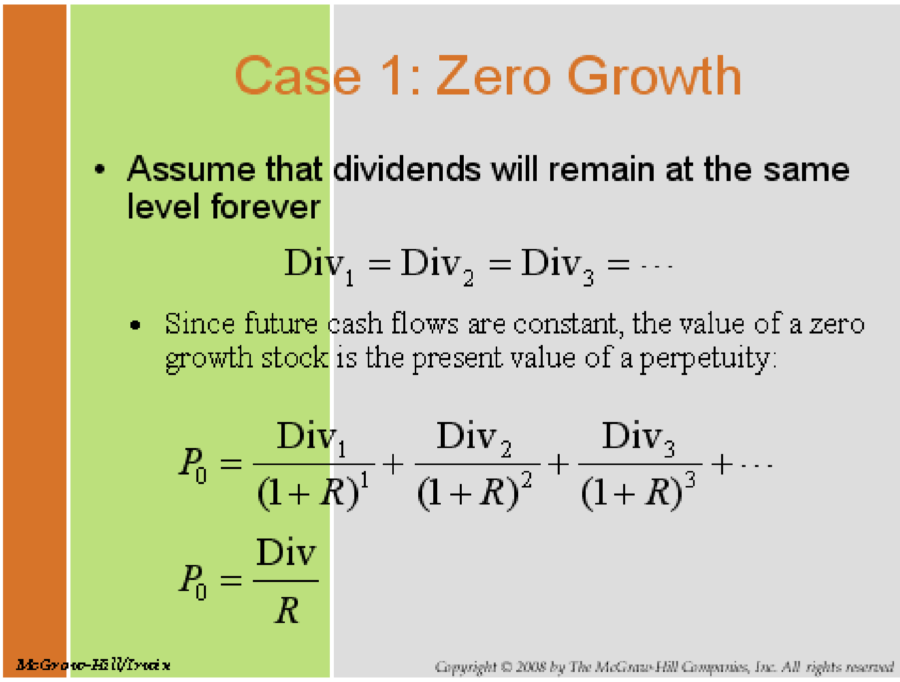
Case 1: Zero Growth



This model assumes that dividends will remain at the same level forever

$D_1 = D_2 = \ldots = D_t$.

Since future cash flows are constant, the intrinsic value of a zero growth stock is an application of the present value of a perpetuity (that we learned from Chapter 4):

$\mathbf{V_t = D_{t+1} / r}$

Example of a zero growth stock:
Suppose a firm's earnings and dividends are expected to remain constant at $1 per share forever. The discount rate appropriate for the risk of the dividends is 10%. The value of the firm is then

V = $1/(0.10) = $10 per share.

The zero growth model fits many mature companies surprisingly well if cash flows and the discount rate are estimated in real terms. It fits exactly in real terms when nominal cash flows are expected to increase at the rate of inflation. For the case of nominal cash flows and discount rate, preferred stocks are good examples of zero growth stocks.

The expected rate of return, E(r), on a zero growth stock is -

- $\mathbf{E(r_t) = DPS / Price = D / P_t}$

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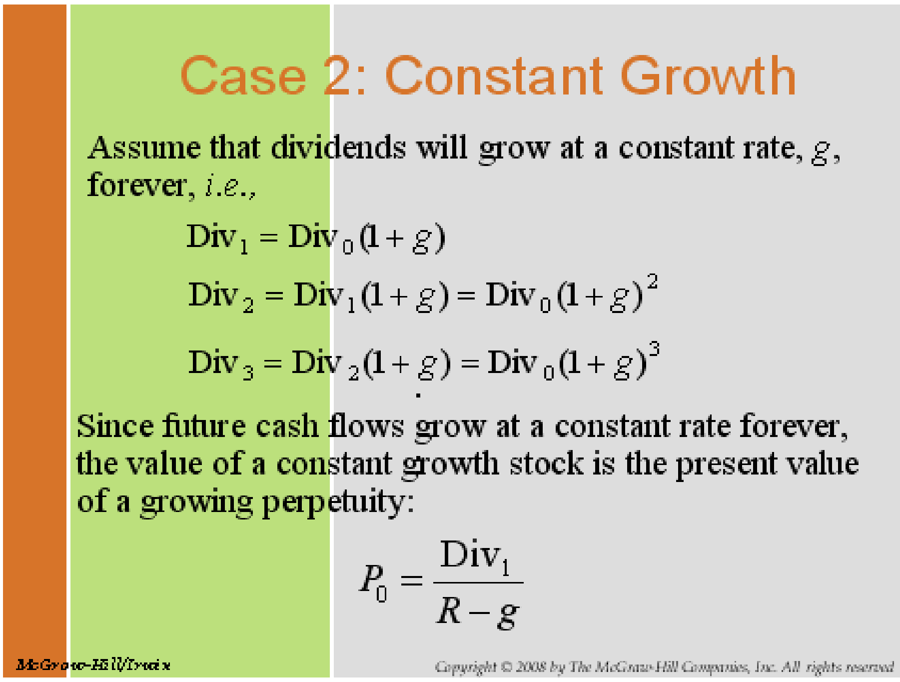
Case 2: Constant Dividend Growth



This model assumes that dividends will grow at a constant rate, g, **forever**

$D_1 = D_0 \times (1+g)$
$D_2 = D_1 \times (1+g)$, etc., etc.. and
In general, $D_t = D_0 \times (1+g)^t$ for constant growth stocks.

Since future cash flows grow at a constant rate forever, the value of a constant growth stock is an application of the present value of a growing perpetuity (that we learned in Chapter 4) :

$$\mathbf{V_t = D_{t+1} / (r - g)}$$

Note that for a meaningful V_t, i.e., $V_t > 0$, we need $r > g$. Why?

Here are two possible explanations - First, r may be less than g in the short-run. The differential growth model (discussed in the next page) is an example of this situation. Second, in the long-run equilibrium, high returns on investment will attract capital, which, in the absence of technological change, will ensure that in succeeding periods, higher returns cannot be earned without taking greater risk. But, taking greater risk will increase r, so g cannot be increased without raising r.

Example of a constant growth stock:

Suppose a firm just paid a dividend of $10 per share. Future dividends are expected to increase at a 5% annual rate. The required return is 25% per year. The value of the firm is estimated as:

$\text{Div}_1 = \text{Div}_0 (1 + g) = \$10*(1.05) = \$10.50$
$V_0 = \text{Div}_1 / (r - g) = \$10.50 / (0.25-0.05) = \mathbf{\$52.50}$

Expected rate of return, E(r), of a constant growth stock -

- $\mathbf{E(r_t) = D_{t+1} / P_t + g}$
- where D_{t+1} / P_t is the dividend yield; and g is the capital gain yield for the case of a constant growth stock.

- Note that we always use stock price, P, NOT intrinsic value, V, in calculating E(r)!

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Case 3: Differential (Multi-Stage) Growth

This model assumes that dividends will grow at different rates in the foreseeable future, i.e., a finite horizon, and then will grow at a constant rate thereafter, i.e., an infinite horizon, when the company becomes a mature firm and its stock becomes a constant growth stock. This general type of model is especially useful for valuing firms in the growth stage of their life cycle.

To value a Differential (Multi-Stage) Growth Stock, we need to follow these steps:

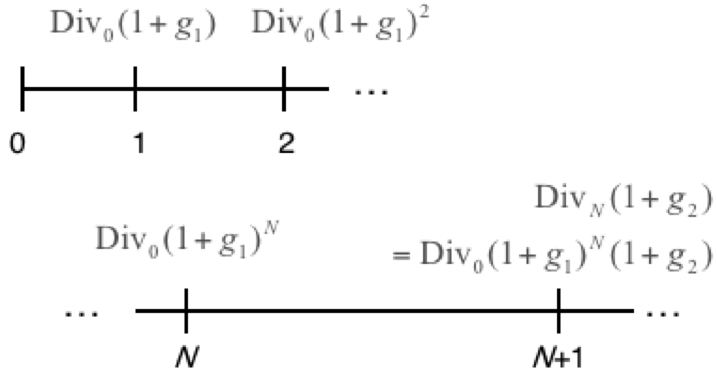
> **Step 1: Estimate future dividends in the foreseeable future**, D_1, D_2, …, D_n, i.e., during the FINITE supernormal growth stage that ends with period N.
>
> **Step 2: Estimate the future stock price when the stock becomes a Constant Growth stock , V_N, i.e., the value of all expected future dividends during the INFINITE normal growth stage.**
>
> **Step 3: Compute the total present value of the estimated future dividends and future stock price at the appropriate discount rate, i.e., the sum of PV of step 1 and PV of step 2**.

If we assume that dividends are growing at the same rate, g_1, during the FINITE supernormal growth stage, then the dividends during this growth stage will follow the cash flow pattern of a growing annuity. As such, the procedures of valuing this special case of multi-stage growth stocks are presented as follows:

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

$$\mathrm{Div}_1 = \mathrm{Div}_0(1+g_1)$$
$$\mathrm{Div}_2 = \mathrm{Div}_1(1+g_1) = \mathrm{Div}_0(1+g_1)^2$$
$$\vdots$$
$$\mathrm{Div}_N = \mathrm{Div}_{N-1}(1+g_1) = \mathrm{Div}_0(1+g_1)^N$$
$$\mathrm{Div}_{N+1} = \mathrm{Div}_N(1+g_2) = \mathrm{Div}_0(1+g_1)^N(1+g_2)$$
$$\vdots$$

Dividends will grow at rate g_1 for N years and grow at rate g2 thereafter



We can value this as the sum of:
an N-year annuity growing at rate g_1

PV of Step 1:

$$V_A = \frac{DIV_1}{r - g_1}\left[1 - \frac{(1+g_1)^N}{(1+r)^N}\right]$$

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

PV of Step 2:

$$V_B = \frac{\left(\frac{\text{Div}_{N+1}}{r - g_2}\right)}{(1+r)^N}$$

To value a Differential (Multi-Stage) Growth Stock, we can use (i.e., Step 3),

$$V_0 = \frac{DIV_1}{r - g_1}\left[1 - \frac{(1+g_1)^N}{(1+r)^N}\right] + \frac{\left(\frac{\text{Div}_{N+1}}{r - g_2}\right)}{(1+r)^N}$$

Or we can cash flow it out

Example of a differential (multi-stage) growth stock:
A common stock pays a current dividend of \$2. The dividend is expected to grow at an 8% annual rate for the next three years; then it will grow at 4% in perpetuity. The appropriate discount rate is 12%. What is the value of this stock today?

r = 12% (required return)
$g_1 = g_2 = g_3 = 8\%$
$D_0 = \$2$

Step 1:

$D_1 = \$2 \times 1.08 = \$2.16$; $D_2 = \$2.16 \times 1.08 = \$2.33$;
$D_3 = \$2.33 \times 1.08 = \$2.52$

Step 2:

$g_4 = g_n = 4\%$ $D_4 = \$2.52 \times 1.04 = \$2.62$
$\rightarrow V_3 = \$2.62 / (0.12 - 0.04) = \$32.75$

Expected future cash flows of this stock:

0	1	2	3	
	D_1	D_2	$D_3 + P_3$	(r = 12%)
	2.16	2.33	2.52 + 32.75	

Step 3:

$$V_0 = \$2.16/1.12 + \$2.33/(1.12)^2 + \$(2.52+32.75)/(1.12)^3 = \$28.89$$

Say, if the market price of this stock is $35, then this stock is overpriced according to the Intrinsic Value Analysis and a **Sell** recommendation follows. On the other hand, if the market price is $25, then the stock is considered to be underpriced and a **Buy** recommendation follows.

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Estimation and Properties of Stock Value (Ref: Section 9.2)

Using the constant growth stock as the reference, we can identify three variables needed in estimating the intrinsic value of a stock.

$$V_0 = D_0 * (1+g) / (r - g)$$

They are the current dividend per share, D_0, the dividend growth rate, g, and the required return or discount rate, r, -

- The current dividend per share is observable.
- The growth rate can be estimated with the historical data, i.e., the historical growth rate in dividends and/or earnings, and more recent data such as the sustainable growth rate approach, i.e., g = retention ratio * ROE (Slide). Intuitively, we can interpret the (earnings) retention ratio as a proxy for the level of reinvestment activities of the firm, and the ROE as a proxy for the profitability of the reinvestment. In Finance, a firm grows through investment. If the firm invests in positive NPV projects, its value will increase, and vice versa.
- The required return or discount rate should be a function of the riskiness of the stock according to the opportunity cost principle. We will learn the asset pricing models that help us estimate the discount rate in later chapters (Slide).

Recognizing that these are the three variables that affect stock value, we are interested in knowing how each of them affects the stock value. Holding other factors constant,

- The higher the current dividends per share (D_0), the **higher** the stock value.
- The higher the discount rate (r), the **lower** the stock value.
- The higher the growth rate (g), the **higher** the stock value.
  - The higher the ROE, the **higher** the stock value.
  - However, the impact of the (earnings) retention ratio on the stock value is **NOT** unidirectional. The impact will be
    - **positive** if earnings are reinvested in **NPV > 0** projects.
    - **negative** if earnings are reinvested in **NPV < 0** projects.
    - **neutral** if earnings are reinvested in **NPV = 0** projects.

Another look at the relation between earnings retention ratio and stock value - If a firm increases its retention rate, it will be able to grow at a faster rate. However, this increased retention rate reduces the current payout (i.e., dividend) to shareholders. These impacts have offsetting influences on stock price. Which effect dominates depends on the relation between ROE and the discount rate (r). If ROE > r, then reinvestment creates value because reinvested earnings return more than the cost of capital. More specific, if ROE is greater than r, then NPVGO is positive and would increase with the retention rate that leads to higher valuation.

An observation - In his book, A Random Walk Down Wall Street, pp. 82-89, (1985, W.W. Norton & Company, New York), Burton Malkiel gives four fundamental rules of stock prices. Loosely paraphrased, the rules are as follows. Other things equal:

- Investors pay a higher price, the larger the dividend growth rate
- Investors pay a higher price, the larger the proportion of earnings paid out as dividends
- Investors pay a higher price, the less risky the company's stock
- Investors pay a higher price, the lower the level of interest rates

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Growth Opportunities & the NPVGO Model (Ref: Section 9.3)

Suppose a firm has no positive NPV opportunities and hence does not need to retain earnings for reinvestment purpose. The firm generates a constant stream of earnings per share which is paid out as dividend, so that g = 0 and EPS = D. The value of this no-growth firm is:

$$\mathbf{V_0 = EPS / r = D / r}$$

Suppose our no-growth firm takes its earnings in period 1 and, instead of paying a dividend, invests in a new project at time 1. The discount rate on this new project is r, the same as on the old assets. (Since we haven't discussed risk as yet, we'll assume certainty. It could just as well represent a risk-adjusted discount rate.) The project will produce a change in EPS in period 2 and thereafter due to the new project, but otherwise the firm is the same. All earnings are still paid out as dividends, except in period 1.

$$V_0 = \left[\sum_{t=1}^{\infty} \frac{EPS}{(1+r)^t}\right] - \left[\frac{EPS_1}{1+r}\right] + \left[\sum_{t=2}^{\infty} \frac{\Delta EPS}{(1+r)^t}\right]$$

= [PV of firm without new project] – [Cost of new project] + [PV of new project]
= PV of firm without growth + NPV of growth opportunities

$$\mathbf{V_0 = EPS / r + NPVGO}$$

Where the EPS/r is the INCOME (or 'CASH COW') component, and the NPVGO is the GROWTH component, of stock price.

Decomposing firm value into these two components helps relate the valuation principles to the goal of the firm. Accepting projects with positive NPV will increase firm value and is consistent with the goal of the firm and the goal of stockholders. Negative NPV projects should be rejected because they reduce firm value.

Example of decomposing stock price into the INCOME and GROWTH components:
Consider a firm that has EPS of $5 at the end of the first year, a dividend-payout ratio of 30%, a discount rate of 16-percent, and a return on retained earnings (ROE) of 20-percent.

- The dividend at year one will be $5 × .30 = $1.50 per share.
  - The retention ratio is 0.70 (= 1 − 0.30) implying a sustainable growth rate in dividends of 14% = 0.70 × 20% (Recall that g = retention ratio * ROE)

From the dividend growth model, the value of a share is:

$1.50 / (0.16 − 0.14) = $75.0

The INCOME component in the stock value is:

EPS/r = $5.0/0.16 = $31.25

The GROWTH component in the stock value is:

NPVGO = V − EPS/r

NPVGO = $75.0 − $31.25 = **$43.75**.
OR NPVGO = $0.875 / (0.16-0.14) = $43.75.

Computing NPVGO - Direct Approach

- Yr. 1, $NPV_1 = -\$3.50 + \frac{\$3.50 \times .20}{.16} = \$0.8750$
- Yr. 2, $NPV_2 = -\$3.99 + \frac{\$3.99 \times .20}{.16} = \$0.9975$
- Yr. 3, $NPV_3 = -\$4.55 + \frac{\$4.55 \times .20}{.16} = \$1.13715$
- And so forth …..

$$NPVGO = \frac{\$0.875}{1.16} + \frac{\$0.9975}{(1.16)^2} + \frac{\$1.13715}{(1.16)^3} + ...$$

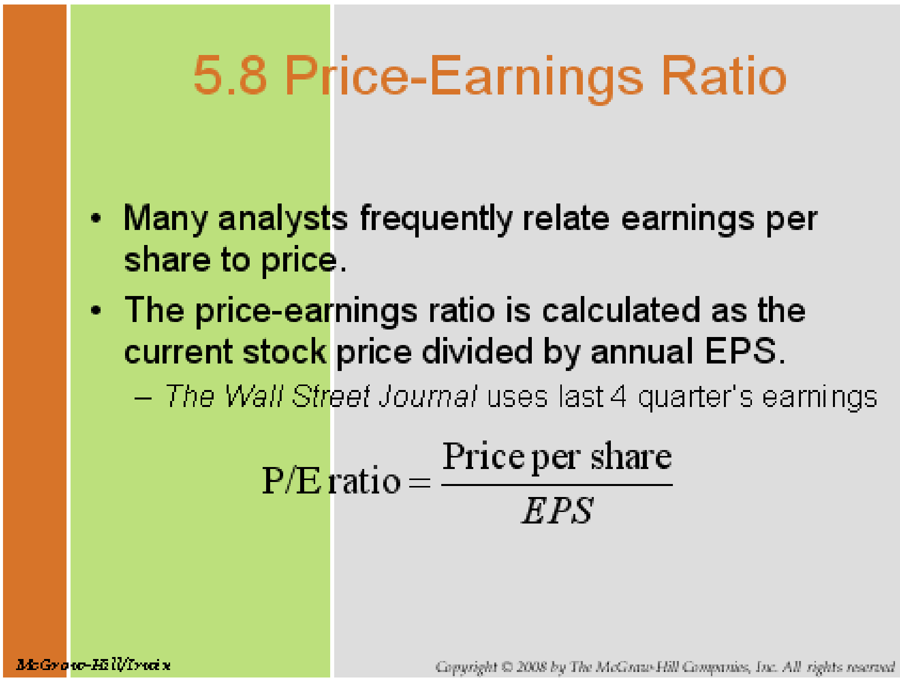
$$NPVGO = \frac{\$0.875}{1.16} + \frac{\$0.875(1.14)}{(1.16)^2} + \frac{\$0.875(1.14)^2}{(1.16)^3} + ...$$

- As a growing perpetuity, $NPVGO = \frac{NPV_1}{r-g} = \frac{\$0.875}{.16-.14} = \$43.75$

Price Earnings and Other Price Ratios (Ref: Section 9.4)

The P/E ratio is a commonly cited statistic in the financial press. Most of the P/E ratios reported in the financial press are computed using historic EPS and current stock price, rather than the "no-growth" EPS and the intrinsic value in the text. The economic intuition that applies to the P/E ratio in the text will apply to historic P/E ratio if:

1. the historic EPS = the "no-growth" EPS.
2. current price = intrinsic value.



The NPVGO valuation model can be restated as:

V_0/EPS= 1/r + NPVGO/EPS

Therefore, P/E ratio is positively related to the net present value of growth opportunities (NPVGO) and negatively related to the discount rate r. High growth firms typically have high P/E ratios. According to this relationship, a risky firm with no growth opportunities and a high required return will have a low P/E. In fact, many high growth firms are riskier than average. For these firms, the P/E ratio will depend upon which effect, NPVGO or r, dominates.

Thus, a stock's PE ratio is likely the function of three factors:

- 1. Growth opportunities (positive relation); the likely dominating factor in practice
- 2. Risk (negative relation)
- 3. Accounting practices (conservative accounting practices are likely related to higher PE ratios)

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