# EQUITY ASSET VALUATION WORKBOOK

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**PART II**

  **Solutions**

# EQUITY ASSET VALUATION WORKBOOK

# LEARNING OUTCOMES, SUMMARY OVERVIEW, AND PROBLEMS

# THE EQUITY VALUATION PROCESS

## LEARNING OUTCOMES

*After completing this chapter, you will be able to do the following:*

- Define valuation.
- Discuss the uses of valuation models.
- Discuss the importance of expectations in the use of valuation models.
- Explain the role of valuation in portfolio management.
- Discuss the steps in the valuation process, and the objectives and tasks within each step.
- Discuss the elements of a competitive analysis for a company.
- Contrast top-down and bottom-up approaches to economic forecasting.
- Contrast quantitative and qualitative factors in valuation.
- Discuss the importance of quality of earnings analysis in financial forecasting and identify the sources of information for such analysis.
- Describe quality of earnings indicators and risk factors.
- Define intrinsic value.
- Define and calculate alpha.
- Explain the relationship between alpha and perceived mispricing.
- Discuss the use of valuation models within the context of traditional and modern concepts of market efficiency.
- Contrast the going-concern concept of value to the concept of liquidation value.
- Define fair value.
- Contrast absolute and relative valuation models, and describe examples of each type of model.
- Explain the broad criteria for choosing an appropriate approach for valuing a particular company.
- Discuss the role of ownership perspective in valuation.
- Explain the role of analysts in capital markets.
- Discuss the contents and format of an effective research report.
- Explain the responsibilities of analysts in performing valuations and communicating valuation results.

## SUMMARY OVERVIEW

In this chapter, we have discussed the scope of equity valuation, outlined the valuation process, introduced valuation concepts and models, discussed the analyst's role and responsibilities in conducting valuation, and described the elements of an effective research report in which analysts communicate their valuation analysis.

- Valuation is the estimation of an asset's value based on variables perceived to be related to future investment returns, or based on comparisons with closely similar assets.
- Valuation is used for
  - stock selection,
  - inferring (extracting) market expectations,
  - evaluating corporate events,
  - fairness opinions,
  - evaluating business strategies and models,
  - communication among management, shareholders, and analysts, and
  - appraisal of private businesses.
- The three steps in the portfolio management process are planning, execution, and feedback. Valuation is most closely associated with the planning and execution steps.
  - For active investment managers, plans concerning valuation models and criteria are part of the elaboration of an investment strategy.
  - Skill in valuation plays a key role in the execution step (in selecting a portfolio, in particular).
- The valuation process has five steps:
  1. Understanding the business.
  2. Forecasting company performance.
  3. Selecting the appropriate valuation model.
  4. Converting forecasts to a valuation.
  5. Making the investment decision (recommendation).
- The tasks within "understanding the business" include evaluating industry prospects, competitive position, and corporate strategies. Because similar economic and technological factors typically affect all companies in an industry, and because companies compete with each other for sales, both industry knowledge and competitive analysis help analysts understand a company's economics and its environment. The analyst can then make more accurate forecasts.
- Two approaches to economic forecasting are top-down forecasting and bottom-up forecasting. In top-down forecasting, analysts use macroeconomic forecasts to develop industry forecasts and then make individual company and asset forecasts consistent with the industry forecasts. In bottom-up forecasting, individual company forecasts are aggregated to industry forecasts, which in turn may be aggregated to macroeconomic forecasts.
- Careful scrutiny and interpretation of financial statements, footnotes to financial statements, and other accounting disclosures are essential to a quality of earnings analysis. Quality of earnings analysis concerns the scrutiny of possible earnings management and balance sheet management.
- The intrinsic value of an asset is its value given a hypothetically complete understanding of the asset's investment characteristics.
- Alpha is an asset's excess risk-adjusted return. *Ex ante* alpha is expected holding-period return minus required return given risk. Historical alpha is actual holding-period return minus the contemporaneous required return.
- Active investing is consistent with rational efficient markets and the existence of trading costs and assets whose intrinsic value is difficult to determine.

- The going-concern assumption is the assumption that a company will continue operating for the foreseeable future. A company's going-concern value is its value under the going-concern assumption and is the general objective of most valuation models. In contrast, liquidation value is the company's value if it were dissolved and its assets sold individually.
- Fair value is the price at which an asset would change hands if neither buyer nor seller were under compulsion to buy/sell.
- Absolute valuation models specify an asset's intrinsic value, supplying a point estimate of value that can be compared with market price. Present value models of common stock (also called discounted cash flow models) are the most important type of absolute valuation model.
- Relative valuation models specify an asset's value relative to the value of another asset. As applied to equity valuation, relative valuation is known as the method of comparables: In applying the method of comparables, analysts compare a stock's price multiple to the price multiple of a similar stock or the average or median price multiple of some group of stocks.
- Relative equity valuation models do not address intrinsic value without the further assumption that the price of the comparison value accurately reflects its intrinsic value.
- The broad criteria for selecting a valuation approach are that the valuation approach be
  - consistent with the characteristics of the company being valued;
  - appropriate given the availability and quality of the data; and
  - consistent with the analyst's valuation purpose and perspective.
- Valuation may be affected by control premiums (premiums for a controlling interest in the company), marketability discounts (discounts reflecting the lack of a public market for the company's shares), and liquidity discounts (discounts reflecting the lack of a liquid market for the company's shares).
- Investment analysts play a critical role in collecting, organizing, analyzing, and communicating corporate information, as well as in recommending appropriate investment actions based on their analysis. In fulfilling this role, they help clients achieve their investment objectives and contribute to the efficient functioning of capital markets. Analysts can contribute to the welfare of shareholders through monitoring the actions of management.
- In performing valuations, analysts need to hold themselves accountable to both standards of competence and standards of conduct.
- An effective research report
  - contains timely information;
  - is written in clear, incisive language;
  - is unbiased, objective, and well researched;
  - contains analysis, forecasts, valuation, and a recommendation that are internally consistent;
  - presents sufficient information that the reader can critique the valuation;
  - states the risk factors for an investment in the company; and
  - discloses any potential conflicts of interests faced by the analyst.
- Analysts have an obligation to provide substantive and meaningful content. CFA Institute members have an additional overriding responsibility to adhere to the CFA Institute Code of Ethics and relevant specific Standards of Professional Conduct.

## PROBLEMS

1. A. State four uses or purposes of valuation models.
   B. Which use of valuation models may be the most important to a working equity portfolio manager?
   C. Which uses would be particularly relevant to a corporate officer?

2. In Example 1-1 based on Cornell's (2001) study of Intel Corporation, in which Cornell valued Intel using a present value model of stock value, we wrote:

   "What future revenue growth rates were consistent with Intel's stock price of $61.50 just prior to the release, and $43.31 only five days later? Using a conservatively low discount rate, Cornell estimated that the price of $61.50 was consistent with a growth rate of 20 percent a year for the subsequent 10 years (and then 6 percent per year thereafter)."

   A. If Cornell had assumed a higher discount rate, would the resulting revenue growth rate estimate consistent with a price of $61.50 be higher or lower than 20 percent a year?

   B. Explain your answer to Part A.

3. A. Explain the role of valuation in the planning step of the portfolio management process.

   B. Explain the role of valuation in the execution step of the portfolio management process.

4. Explain why valuation models are important to active investors but not to investors trying to replicate a stock market index.

5. An analyst has been following Kerr-McGee Corporation (NYSE: KMG) for several years. He has consistently felt that the stock is undervalued and has always recommended a strong buy. Another analyst who has been following Nucor Corporation (NYSE: NUE) has been similarly bullish. The tables below summarize the prices, dividends, total returns, and estimates of the contemporaneous required returns for KMG and NUE from 1998 to 2001.

### Data for KMG

| Year | Price at Year-End | Dividends | Total Annual Return | Contemporaneous Required Return |
|------|-------------------|-----------|---------------------|--------------------------------|
| 1997 | $54.22 | | | |
| 1998 | 33.97 | $1.80 | −34.0% | 26.6% |
| 1999 | 54.38 | 1.80 | 65.4 | 19.6 |
| 2000 | 63.96 | 1.80 | 20.9 | −8.5 |
| 2001 | 53.93 | 1.80 | −12.9 | −11.0 |

### Data for NUE

| Year | Price at Year-End | Dividends | Total Annual Return | Contemporaneous Required Return |
|------|-------------------|-----------|---------------------|--------------------------------|
| 1997 | $45.66 | | | |
| 1998 | 41.31 | $0.48 | −8.5% | 29.2% |
| 1999 | 52.93 | 0.52 | 29.4 | 21.5 |
| 2000 | 38.96 | 0.60 | −25.3 | −9.3 |
| 2001 | 52.80 | 0.68 | 37.3 | −12.1 |

The total return is the price appreciation and dividends for the year divided by the price at the end of the previous year. The contemporaneous required return is the average actual return for the year realized by stocks that were of the same risk as KMG or NUE, respectively.

A. Without reference to any numerical data, what can be said about each analyst's *ex ante* alpha for KMG and NUE, respectively?

B. Calculate the *ex post* alphas for each year 1998 through 2001 for KMG and for NUE.

6. On the last trading day of 2000 (29 December 2000), an analyst is reviewing his valuation of Wal-Mart Stores (NYSE: WMT). The analyst has the following information and assumptions:
   - The current price is $53.12.
   - The analyst's estimate of WMT's intrinsic value is $56.00.
   - In addition to the full correction of the difference between WMT's current price and its intrinsic value, the analyst forecasts additional price appreciation of $4.87 and a cash dividend of $0.28 over the next year.
   - The required rate of return for Wal-Mart is 9.2 percent.
   A. What is the analyst's expected holding-period return on WMT?
   B. What is WMT's *ex ante* alpha?
   C. Calculate *ex post* alpha, given the following additional information:
      - Over the next year, 29 December 2000 through 31 December 2001, Wal-Mart's actual rate of return was 8.9 percent.
      - In 2001, the realized rate of return for stocks of similar risk was −10.4 percent.

7. The table below gives information on the expected and required rates of return based on the CAPM for three securities an analyst is valuing:

|  | Expected Rate | CAPM Required Rate |
|---|---|---|
| Security 1 | 0.20 | 0.21 |
| Security 2 | 0.18 | 0.08 |
| Security 3 | 0.11 | 0.10 |

   A. Define *ex ante* alpha.
   B. Calculate the expected alpha of Securities 1, 2, and 3 and rank them from most attractive to least attractive.
   C. Based on your answer to Part B, what risks attach to selecting among Securities 1, 2, and 3?

8. Benjamin Graham (1963) wrote that "[t]here is . . . a double function of the Financial Analyst, related in part to securities and in part to people."
   A. Explain the analyst's function related to people.
   B. How does the analyst's work contribute to the functioning of capital markets?

9. In a research note on the ordinary shares of the Mariella Burani Fashion Group (Milan Stock Exchange: MBFG.MI) dated early July 2001 when a recent price was €7.73 and projected annual dividends were €0.05, an analyst stated a target price of €9.20. The research note did not discuss how the target price was obtained or

how it should be interpreted. Assume the target price represents the expected price of MBFG.MI. What further specific pieces of information would you need to form an opinion on whether MBFG.MI was fairly valued, overvalued, or undervalued?

10. You are researching XMI Corporation (XMI). XMI has shown steady earnings per share growth (18 percent a year during the last seven years) and trades at a very high multiple to earnings (its P/E ratio is currently 40 percent above the average P/E ratio for a group of the most comparable stocks). XMI has generally grown through acquisition, by using XMI stock to purchase other companies. These companies usually trade at lower P/E ratios than XMI.

   In investigating the financial disclosures of these acquired companies and in talking to industry contacts, you conclude that XMI has been forcing the companies it acquires to accelerate the payment of expenses before the acquisition deals are closed. Such acceleration drives down the acquired companies' last reported cash flow and earnings per share numbers. As one example, XMI asks acquired companies to immediately pay all pending accounts payable, whether or not they are due. Subsequent to the acquisition, XMI reinstitutes normal expense payment patterns. After it acquires a company, XMI appears to have a pattern of speeding up revenue recognition as well. For example, one overseas telecommunications subsidiary changed its accounting to recognize up front the expected revenue from sales of network capacity that spanned decades. The above policies and accounting facts do not appear to have been adequately disclosed in XMI's shareholder communications.

   A. Characterize the effect of the XMI expensing policies with respect to acquisitions on XMI's post-acquisition earnings per share growth rate.
   B. Characterize the quality of XMI earnings based on its expensing and revenue-recognition policies with respect to acquisitions.
   C. In discussing the current price of XMI, the question states that XMI's "P/E ratio is currently 40 percent above the average P/E ratio for a group of the most comparable stocks." Characterize the type of valuation model implicit in such a statement.
   D. State two *risk factors* in investing in XMI, in the sense in which that term was used in the discussion of quality of earnings.

# CHAPTER 2

# DISCOUNTED DIVIDEND VALUATION

## LEARNING OUTCOMES

*After completing this chapter, you will be able to do the following:*

- Explain the economic rationale for discounted cash flow (DCF) valuation.
- Give three definitions of expected cash flow that can be used in discounted cash flow valuation, discuss the advantages and disadvantages of each, and identify the investment situations in which each is suitable.
- Determine whether a dividend discount model (DDM) is appropriate for valuing a stock.
- Explain the components of the required rate of return on equity used to discount expected future cash flows.
- Discuss the capital asset pricing model (CAPM), arbitrage pricing theory (APT), and bond yield plus risk premium approaches to determining the required rate of return for an equity investment.
- Calculate the required rate of return for an equity investment using each major approach.
- Calculate the Gordon growth model (GGM) equity risk premium estimate.
- State three limitations to the CAPM and APT approaches to determining the required return on equity.
- Describe and give an example of the build-up approach to determining the required return on equity.
- Calculate the expected holding-period return on a stock given its current price, expected next-period price, and expected next-period dividend.
- Contrast the expected holding-period return with the required rate of return.
- Discuss the effect on expected return of the convergence of price to value, given that price does not equal value.
- Calculate the value of a common stock using the DDM for one-, two-, and multiple-period holding periods.
- State the equation and explain the general form of the DDM.
- Discuss the two major approaches to the dividend-forecasting problem.
- Explain the assumptions of the Gordon growth model.
- Calculate the value of a common stock using the Gordon growth model.
- Discuss the choice of growth rate in the Gordon growth model in relation to the growth rate of the economy.

- Calculate the expected rate of return or implied dividend growth rate in the Gordon growth model, given the market price.
- Explain and calculate the justified leading and trailing price to earnings ratios (P/Es) based on fundamentals, using the Gordon growth model.
- Calculate the value of fixed-rate perpetual preferred stock given the stock's annual dividend and the discount rate.
- Explain and calculate the present value of growth opportunities (PVGO) given current earnings per share, the required rate of return, and the market price of the stock (or value of the stock).
- Explain the strengths and limitations of the Gordon growth model.
- Justify the selection of the Gordon growth model to value a company, given the characteristics of the company being valued.
- Explain the assumptions and justify the selection of the two-stage DDM, the H-model, the three-stage DDM, and spreadsheet modeling.
- Explain the concepts of the growth phase, transitional phase, and maturity phase of a business.
- Explain the concept of terminal value and discuss alternative approaches to determining the terminal value in a discounted dividend model.
- Calculate the value of common stock using the two-stage DDM, the H-model, and the three-stage DDM.
- Justify the selection of a particular multistage dividend discount model given the characteristics of the company being valued.
- Explain how to estimate the implied expected rate of return for any DDM, including the two-stage DDM, the H-model, the three-stage DDM, and the spreadsheet model.
- Calculate the implied expected rate of return for the H-model and a general two-stage model.
- Explain the strengths and limitations of the two-stage DDM, the H-model, the three-stage DDM, and the spreadsheet model.
- Define the concept of sustainable growth rate and explain the underlying assumptions.
- Calculate the sustainable growth rate for a company.
- Explain how the DuPont model can be used to forecast the return on equity for use in estimating the sustainable growth rate.
- Discuss how dividend discount models are used as a discipline for portfolio selection, and explain two risk control methodologies.

## SUMMARY OVERVIEW

This chapter provided an overview of DCF models of valuation, discussed the estimation of a stock's required rate of return, and presented in detail the dividend discount model.

- In DCF models, the value of any asset is the present value of its (expected) future cash flows

$$V_0 = \sum_{t=1}^{\infty} \frac{\text{CF}_t}{(1 + r)^t}$$

where $V_0$ is the value of the asset as of $t = 0$ (today), $\text{CF}_t$ is the (expected) cash flow at time $t$, and $r$ is the discount rate or required rate of return.
- Several alternative streams of expected cash flows can be used to value equities, including dividends, free cash flow, and residual income. A discounted dividend approach is most

suitable for dividend-paying stocks, where the company has a discernible dividend policy that has an understandable relationship to the company's profitability, and the investor has a non-control (minority ownership) perspective.

- The free cash flow approach (FCFF or FCFE) might be appropriate when the company does not pay dividends, dividends differ substantially from FCFE, free cash flows align with profitability, or the investor takes a control (majority ownership) perspective.
- The residual income approach can be useful when the company does not pay dividends (as an alternative to an FCF approach), or free cash flow is negative.
- The required rate of return is the minimum rate of return that an investor would anticipate receiving in order to invest in an asset. The two major approaches to determining the cost of equity are an equilibrium method (CAPM or APT) and the bond yield plus risk premium method.
- The equity risk premium for use in the CAPM approach can be based on historical return data or based explicitly on expectational data.
- The DDM with a single holding period gives stock value as

$$V_0 = \frac{D_1}{(1 + r)^1} + \frac{P_1}{(1 + r)^1} = \frac{D_1 + P_1}{(1 + r)^1}$$

where $D_t$ is the expected dividend at time $t$ (here $t = 1$) and $V_t$ is the stock's (expected) value at time $t$. Assuming that $V_0$ is equal to today's market price, $P_0$, the expected holding-period return is

$$r = \frac{D_1 + P_1}{P_0} - 1 = \frac{D_1}{P_0} + \frac{P_1 - P_0}{P_0}$$

- Expected holding-period returns differ from required rates of return when price does not exactly reflect value. When price does not equal value, there will generally be an additional component to the expected holding-period return reflecting the convergence of price to value.
- The expression for the DDM for any given finite holding period $n$ and the general expression for the DDM are, respectively,

$$V_0 = \sum_{t=1}^{n} \frac{D_t}{(1 + r)^t} + \frac{P_n}{(1 + r)^n} \quad \text{and} \quad V_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1 + r)^t}$$

- There are two main approaches to the problem of forecasting dividends: First, we can assign the entire stream of expected future dividends to one of several stylized growth patterns. Second, we can forecast a finite number of dividends individually up to a terminal point, valuing the remaining dividends by assigning them to a stylized growth pattern, or forecasting share price as of the terminal point of our dividend forecasts. The first forecasting approach leads to the Gordon growth model and multistage dividend discount models; the second forecasting approach lends itself to spreadsheet modeling.
- The Gordon growth model assumes that dividends grow at a constant rate $g$ forever, so that $D_t = D_{t-1}(1 + g)$. The dividend stream in the Gordon growth model has a value of

$$V_0 = \frac{D_0(1 + g)}{r - g}, \quad \text{or} \quad V_0 = \frac{D_1}{(r - g)}$$

where $r > g$.

- The value of fixed rate perpetual preferred stock is $V_0 = D/r$, where $D$ is the stock's (constant) annual dividend.

- Assuming that price equals value, the Gordon growth model estimate of a stock's expected rate of return is

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

- Given an estimate of the next-period dividend and the stock's required rate of return, we can use the Gordon growth model to estimate the dividend growth rate implied by the current market price (making a constant growth rate assumption).
- The present value of growth opportunities (PVGO) is the part of a stock's total value, $V_0$, that comes from profitable future growth opportunities in contrast to the value associated with assets already in place. The relationship is $V_0 = E/r + \text{PVGO}$, where $E/r$ is defined as the no-growth value per share.
- We can express the leading price–earnings ratio ($P_0/E_1$) and the trailing price–earnings ratio ($P_0/E_0$) in terms of the Gordon growth model as, respectively,

$$\frac{P_0}{E_1} = \frac{D_1/E_1}{r - g} = \frac{1 - b}{r - g} \quad \text{and} \quad \frac{P_0}{E_0} = \frac{D_0(1 + g)/E_0}{r - g} = \frac{(1 - b)(1 + g)}{r - g}$$

  The above expressions give a stock's justified price–earnings ratio based on forecasts of fundamentals (given that the Gordon growth model is appropriate).
- The Gordon growth model may be useful for valuing broad-based equity indexes and the stock of businesses with earnings that we expect to grow at a stable rate comparable to or lower than the nominal growth rate of the economy.
- Gordon growth model values are very sensitive to the assumed growth rate and required rate of return.
- For many companies, growth falls into phases. In the growth phase, a company enjoys an abnormally high growth rate in earnings per share, called supernormal growth. In the transition phase, earnings growth slows. In the mature phase, the company reaches an equilibrium in which factors such as earnings growth and the return on equity stabilize at levels that can be sustained long term. Analysts often apply multistage DCF models to value the stock of a firm with multistage growth prospects.
- The two-stage dividend discount model assumes different growth rates in Stage 1 and Stage 2

$$V_0 = \sum_{t=1}^{n} \frac{D_0(1 + g_S)^t}{(1 + r)^t} + \frac{D_0(1 + g_S)^n(1 + g_L)}{(1 + r)^n(r - g_L)}$$

  where $g_S$ is the expected dividend growth rate in the first period and $g_L$ is the expected growth rate in the second period.
- The terminal stock value, $V_n$, is sometimes found with the Gordon growth model or with some other method, such as applying a P/E multiplier to forecasted EPS as of the terminal date.
- The H-model assumes that the dividend growth rate declines linearly from a high supernormal rate to the normal growth rate during Stage 1, and then grows at a constant normal growth rate thereafter:

$$V_0 = \frac{D_0(1 + g_L)}{r - g_L} + \frac{D_0 H(g_S - g_L)}{r - g_L} = \frac{D_0(1 + g_L) + D_0 H(g_S - g_L)}{r - g_L}$$

- There are two basic three-stage models. In one version, the growth rate is constant in each of the three stages. In the second version, the growth rate is constant in Stage 1, declines linearly in Stage 2, and becomes constant and normal in Stage 3.

- Spreadsheet models are very flexible, providing the analyst with the ability to value any pattern of expected dividends.
- In addition to valuing equities, DDMs are used to find expected rates of return. For simpler models (like the one-period model, the Gordon growth model, and the H-model), well-known formulas may be used to calculate these rates of return. For many dividend streams, however, the rate of return must be found by trial and error, producing a discount rate that equates the present value of the forecasted dividend stream to the current market price. Adjustments to the expected return estimates may be needed to reflect the convergence of price to value.
- Multistage DDM models can accommodate a wide variety of patterns of expected dividends. Even though such models may use stylized assumptions about growth, they can provide useful approximations.
- Values from multistage DDMs are generally sensitive to assumptions. The usefulness of such values reflects the quality of the inputs.
- Dividend growth rates can be obtained from analyst forecasts, from statistical forecasting models, or from company fundamentals. The sustainable growth rate depends on the ROE and the earnings retention rate, $b: g = b \times$ ROE. This expression can be expanded further, using the DuPont formula, as

$$g = \frac{\text{Net income} - \text{Dividends}}{\text{Net income}} \times \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Shareholders' equity}}$$

- Dividend discount models can be used as a discipline for portfolio construction. Potential investments can be screened or selected based on their estimated rates of return, along with other portfolio requirements. Often, the discipline involves three steps: sorting stocks into groups according to a risk-control methodology, ranking stocks by expected return within each group, and selecting a portfolio from the highest expected return stocks consistent with the risk-control methodology.

## PROBLEMS

1. The estimated betas for AOL Time Warner (NYSE: AOL), J.P. Morgan Chase & Company (NYSE: JPM), and The Boeing Company (NYSE: BA) are 2.50, 1.50, and 0.80, respectively. The risk-free rate of return is 4.35 percent, and the market risk premium is 8.04 percent. Calculate the required rates of return for these three stocks using the CAPM.

2. The estimated factor sensitivities of Terra Energy to the five macroeconomic factors in the Burmeister, Roll, and Ross (1994) article are given in the table below. The table also gives the market risk premiums to each of these same factors.

|                      | Factor Sensitivity | Risk Premium (%) |
|----------------------|--------------------|------------------|
| Confidence risk      | 0.25               | 2.59             |
| Time horizon risk    | 0.30               | −0.66            |
| Inflation risk       | −0.45              | −4.32            |
| Business-cycle risk  | 1.60               | 1.49             |
| Market-timing risk   | 0.80               | 3.61             |

Use the 5-factor BIRR APT model to calculate the required rate of return for Terra Energy using these estimates. The Treasury bill rate is 4.1 percent.

3. Newmont Mining (NYSE: NEM) has an estimated beta of $-0.2$. The risk-free rate of return is 4.5 percent, and the equity risk premium is estimated to be 7.5 percent. Using the CAPM, calculate the required rate of return for investors in NEM.

4. The expression for the value of a stock given a single-period investment horizon has four variables: $V_0$, $D_1$, $P_1$, and $r$. Solve for the value of the missing variable for each of the four stocks in the table below.

| Stock | Estimated Value ($V_0$) | Expected Dividend ($D_1$) | Expected Price ($P_1$) | Required Rate of Return ($r$) |
|---|---|---|---|---|
| 1 | | $0.30 | $21.00 | 10.0% |
| 2 | $30.00 | | 32.00 | 10.0 |
| 3 | 92.00 | 2.70 | | 12.0 |
| 4 | 16.00 | 0.30 | 17.90 | |

5. General Motors (NYSE: GM) sells for $66.00 per share. The expected dividend for next year is $2.40. Use the single-period DDM to predict GM's stock price one year from today. The risk-free rate of return is 5.3 percent, the market risk premium is 6.0 percent, and GM's beta is 0.90.

6. BP PLC (NYSE: BP) has a current stock price of $50 and current dividend of $1.50. The dividend is expected to grow at 5 percent annually. BP's beta is 0.85. The risk-free interest rate is 4.5 percent, and the market risk premium is 6.0 percent.
   A. What is next year's projected dividend?
   B. What is BP's required rate of return based on the CAPM?
   C. Using the Gordon growth model, what is the value of BP?
   D. Assuming the Gordon growth model is valid, what dividend growth rate would result in a model value of BP equal to its market price?

7. The current market prices of three stocks are given below. The current dividends, dividend growth rates, and required rates of return are also given. The dividend growth rates are perpetual.

| Stock | Current Price | Current Dividend ($t = 0$) | Dividend Growth Rate | Required Rate of Return |
|---|---|---|---|---|
| Que Corp. | $25.00 | $0.50 | 7.0% | 10.0% |
| SHS Company | $40.00 | $1.20 | 6.5 | 10.5 |
| True Corp. | $20.00 | $0.88 | 5.0 | 10.0 |

   A. Find the value of each stock with the Gordon growth model.
   B. Which stock's current market price has the smallest premium or largest discount relative to its DDM valuation?

8. For five utility stocks, the table below provides the expected dividend for next year, the current market price, the expected dividend growth rate, and the beta. The risk-free rate is currently 5.3 percent, and the market risk premium is 6.0 percent.

| Stock | Dividend $(D_1)$ | Price $(P_0)$ | Dividend Growth Rate $(g)$ | Beta $(\beta)$ |
|---|---|---|---|---|
| American Electric (NYSE: AEP) | 2.40 | 46.17 | 5.0% | 0.60 |
| Consolidated Edison (NYSE: ED) | 2.20 | 39.80 | 5.0 | 0.60 |
| Exelon Corp. (NYSE: EXC) | 1.69 | 64.12 | 7.0 | 0.80 |
| Southern Co. (NYSE: SO) | 1.34 | 23.25 | 5.5 | 0.65 |
| Dominion Resources (NYSE: D) | 2.58 | 60.13 | 5.5 | 0.65 |

A.  Calculate the expected rate of return for each stock using the Gordon growth model.
B.  Calculate the required rate of return for each stock using the CAPM.

9. Vicente Garcia is a buy-side analyst for a large pension fund. He frequently uses dividend discount models such as the Gordon growth model for the consumer noncyclical stocks that he covers. The current dividend for Procter & Gamble Co. (NYSE: PG) is $1.46, and the dividend eight years ago was $0.585. The current stock price is $80.00.
A.  What is the historical dividend growth rate for Procter & Gamble?
B.  Garcia assumes that the future dividend growth rate will be exactly half of the historical rate. What is Procter & Gamble's expected rate of return using the Gordon growth model?
C.  Garcia uses a beta of 0.53 (computed versus the S&P 500 index) for Procter & Gamble. The risk-free rate of return is 5.56 percent, and the equity risk premium is 3.71 percent. If Garcia continues to assume that the future dividend growth rate will be exactly half of the historical rate, what is the value of the stock with the Gordon growth model?

10. NiSource Preferred B (NYSE: NI-B) is a fixed-rate perpetual preferred stock paying a $3.88 annual dividend. If the required rate of return is 7.88 percent, what is the value of one share? If the price of this preferred stock were $46.00, what would be the yield?

11. R.A. Nixon put out a "strong buy" on DuPoTex (DPT). This company has a current stock price of $88.00 per share. The company has sales of $210 million, net income of $3 million, and 300 million outstanding shares. DPT is not paying a dividend. Dorothy Josephson has argued with Nixon that DPT's valuation is excessive relative to its sales, profits, and any reasonable assumptions about future possible dividends. Josephson also asserts that DPT has a market value equal to that of many large blue-chip companies, which it does not deserve. Nixon feels that Josephson's concerns reflect an archaic attitude about equity valuation and a lack of understanding about DPT's industry.
A.  What is the total market value of DPT's outstanding shares? What are the price-to-earnings and price-to-sales ratios?
B.  Nixon and Josephson have agreed on a scenario for future earnings and dividends for DPT. Their assumptions are that sales grow at 60 percent annually for four years, and then at 7 percent annually thereafter. In Year 5 and thereafter, earnings will be 10 percent of sales. No dividends will be paid for four years, but in Year 5 and after, dividends will be 40 percent of earnings. Dividends should be discounted at a 12 percent rate. What is the value of a share of DPT using the discounted dividend approach to valuation?

    C. Nixon and Josephson explore another scenario for future earnings and dividends for DPT. They assume that sales will grow at 7 percent in Year 5 and thereafter. Earnings will be 10 percent of sales, and dividends will be 40 percent of earnings. Dividends will be initiated in Year 5, and dividends should be discounted at 12 percent. What level of sales is required in Year 4 to achieve a discounted dividend valuation equal to the current stock price?

12. Dole Food (NYSE: DOL) has a current dividend of $0.40, which is expected to grow at 7 percent forever. Felipe Rodriguez has estimated the required rate of return for Dole using three methods. The methods and the estimates are as follows:

| Bond yield plus risk premium method | $r = 9.6\%$ |
|---|---|
| CAPM method | $r = 11.2\%$ |
| APT method | $r = 10.4\%$ |

Using the assumed dividend pattern, what is the value of Dole Food using each of the three estimated required rates of return?

13. The CFO of B-to-C Inc., a retailer of miscellaneous consumer products, recently announced the objective of paying its first (annual) cash dividend of $0.50 in four years. Thereafter, the dividend is expected to increase by 7 percent per year for the foreseeable future. The company's required rate of return is 15 percent.
    A. Assuming that you have confidence in the CFO's dividend target, what is the value of the stock of B-to-C today?
    B. Suppose that you think that the CFO's outlook is too optimistic. Instead, you believe that the first dividend of $0.50 will not be received until six years from now. What is the value of the stock?

14. FPR is expected to pay a $0.60 dividend next year. The dividend is expected to grow at a 50 percent annual rate for Years 2 and 3, at 20 percent annually for Years 4 and 5, and at 5 percent annually for Year 6 and thereafter. If the required rate of return is 12 percent, what is the value per share?

15. EB Systems is selling for $11.40 and is expected to pay a $0.40 dividend next year. The dividend is expected to grow at 15 percent for the following four years, and then at 7 percent annually after Year 5. If purchased at its current price, what is the expected rate of return on EB Systems? Assume price equals value.

16. Hanson PLC (LSE: HNS) is selling for GBP 472. Hansen has a beta of 0.83 against the FTSE 100 index, and the current dividend is GBP 13.80. The risk-free rate of return is 4.66 percent, and the equity risk premium is 4.92 percent. An analyst covering this stock expects the Hanson dividend to grow initially at 14 percent but to decline linearly to 5 percent over a 10-year period. After that, the analyst expects the dividend to grow at 5 percent.
    A. Compute the value of the Hanson dividend stream using the H-model. According to the H-model valuation, is Hanson overpriced or underpriced?
    B. Assume that Hanson's dividends follow the H-model pattern the analyst predicts. If an investor pays the current GBP 472 price for the stock, what will be the rate of return?

17. (Adapted from 1995 CFA Level II exam) Your supervisor has asked you to evaluate the relative attractiveness of the stocks of two very similar chemical companies: Litchfield

Chemical Corp. (LCC) and Aminochem Company (AOC). AOC and LCC have June 30 fiscal year ends. You have compiled the data in Table 2-1 for this purpose. Use a one-year time horizon and assume the following:
- Real gross domestic product is expected to rise 5 percent;
- S&P 500 expected total return of 20 percent;
- U.S. Treasury bills yield 5 percent; and
- 30-year U.S. Treasury bonds yield 8 percent.

TABLE 2-1    Selected Data for Litchfield and Aminochem

|  | Litchfield Chemical (LCC) | Aminochem (AOC) |
|---|---|---|
| Current stock price | $50 | $30 |
| Shares outstanding (millions) | 10 | 20 |
| Projected earnings per share (FY 1996) | $4.00 | $3.20 |
| Projected dividend per share (FY 1996) | $0.90 | $1.60 |
| Projected dividend growth rate | 8% | 7% |
| Stock beta | 1.2 | 1.4 |
| Investors' required rate of return | 10% | 11% |
| Balance sheet data (millions) | | |
| Long-term debt | $100 | $130 |
| Stockholders' equity | $300 | $320 |

A. Calculate the value of the common stock of LCC and AOC using the constant-growth DDM. Show your work.
B. Calculate the expected return over the next year of the common stock of LCC and AOC using the CAPM. Show your work.
C. Calculate the internal (implied, normalized, or sustainable) growth rate of LCC and AOC. Show your work.
D. Recommend LCC *or* AOC for investment. Justify your choice using your answers to A, B, and C and the information in Table 2-1.

18. (Adapted from 1999 CFA Level II exam) Scott Kelly is reviewing MasterToy's financial statements in order to estimate its sustainable growth rate. Using the information presented in Table 2-2,
    A.  i. Identify the three components of the DuPont formula.
        ii. Calculate the ROE for 1999 using the three components of the DuPont formula.
        iii. Calculate the sustainable growth rate for 1999.
    Kelly has calculated actual and sustainable growth for each of the past four years and finds in each year that its calculated sustainable growth rate substantially exceeds its actual growth rate.
    B. Cite one course of action (other than ignoring the problem) Kelly should encourage MasterToy to take, assuming the calculated sustainable growth rate continues to exceed the actual growth rate.

TABLE 2-2    MasterToy Inc. Actual 1998 and Estimated 1999 Financial Statements for FY Ending
December 31 ($ millions, except per-share data)

|  | 1998 | 1999e | Change (%) |
|---|---|---|---|
| **Income Statement** | | | |
| Revenue | $4,750 | $5,140 | 8.2 |
| Cost of goods sold | $2,400 | $2,540 | |
| Selling, general, and administrative | 1,400 | 1,550 | |
| Depreciation | 180 | 210 | |
| Goodwill amortization | 10 | 10 | |
| Operating income | $760 | $830 | 9.2 |
| Interest expense | 20 | 25 | |
| Income before taxes | $740 | $805 | |
| Income taxes | 265 | 295 | |
| Net income | $475 | $510 | |
| Earnings per share | $1.79 | $1.96 | 9.5 |
| Average shares outstanding (millions) | 265 | 260 | |
| **Balance Sheet** | | | |
| Cash | $400 | $400 | |
| Accounts receivable | 680 | 700 | |
| Inventories | 570 | 600 | |
| Net property, plant, and equipment | 800 | 870 | |
| Intangibles | 500 | 530 | |
| Total assets | $2,950 | $3,100 | |
| Current liabilities | $550 | $600 | |
| Long-term debt | 300 | 300 | |
| Total liabilities | $850 | $900 | |
| Stockholders' equity | 2,100 | 2,200 | |
| Total liabilities and equity | $2,950 | $3,100 | |
| Book value per share | $7.92 | $8.46 | |
| Annual dividend per share | $0.55 | $0.60 | |

19. (Adapted from 2000 CFA Level II exam) The management of Telluride, an international
diversified conglomerate based in the United States, believes that the recent strong
performance of its wholly owned medical supply subsidiary, Sundanci, has gone
unnoticed. In order to realize Sundanci's full value, Telluride has announced that it will
divest Sundanci in a tax-free spin-off.

Sue Carroll, CFA, is Director of Research at Kesson and Associates. In developing
an investment recommendation for Sundanci, Carroll has directed four of her analysts
to determine a valuation of Sundanci using various valuation disciplines. To assist her
analysts, Carroll has gathered the information shown in Tables 2-3 and 2-4.

Prior to determining Sundanci's valuation, Carroll analyzes Sundanci's return on
equity (ROE) and sustainable growth.

A.  i.  Calculate the *three* components of ROE in the DuPont formula for the year 2000.
    ii.  Calculate ROE for the year 2000.
   iii.  Calculate the sustainable rate of growth. Show your work.

Carroll learns that Sundanci's Board of Directors is considering the following policy changes that will affect Sundanci's sustainable growth rate:

- Director A proposes an increase in the quarterly dividend by $0.15 per share.
- Director B proposes a bond issue of $25 million, the proceeds of which will be used to increase production capacity.
- Director C proposes a 2-for-1 stock split.

TABLE 2-3   Sundanci Actual 1999 and 2000 Financial Statements for FY Ending May 31
($ millions, except per-share data)

| Income Statement | 1999 | 2000 |
| --- | --- | --- |
| Revenue | $474 | $598 |
| Depreciation | 20 | 23 |
| Other operating costs | 368 | 460 |
| Income before taxes | 86 | 115 |
| Taxes | 26 | 35 |
| Net income | 60 | 80 |
| Dividends | 18 | 24 |
| Earnings per share | $0.714 | $0.952 |
| Dividends per share | $0.214 | $0.286 |
| Common shares outstanding | 84.0 | 84.0 |

| Balance Sheet | 1999 | 2000 |
| --- | --- | --- |
| Current assets | $201 | $326 |
| Net property, plant, and equipment | 474 | 489 |
| Total assets | 675 | 815 |
| Current liabilities | 57 | 141 |
| Long-term debt | 0 | 0 |
| Total liabilities | 57 | 141 |
| Shareholders' equity | 618 | 674 |
| Total liabilities and equity | 675 | 815 |
| Capital expenditures | 34 | 38 |

TABLE 2-4   Selected Financial Information

| | |
| --- | --- |
| Required rate of return on equity | 14% |
| Growth rate of industry | 13% |
| Industry P/E | 26 |

B. Indicate the effect of each of these proposals on Sundanci's sustainable rate of growth, given that the other factors remain unchanged. Identify which components of the sustainable growth model, if any, are directly affected by each proposal.

Helen Morgan, CFA, has been asked by Carroll to determine the potential valuation for Sundanci using the DDM. Morgan anticipates that Sundanci's earnings and dividends will grow at 32 percent for two years and 13 percent thereafter.

C. Calculate the current value of a share of Sundanci stock using a two-stage dividend discount model and the data from Tables 2-3 and 2-4. Show your work.

20. (Adapted from 2001 CFA Level II exam) Peninsular Research is initiating coverage of a mature manufacturing industry. John Jones, CFA, head of the research department, gathers the information given in Table 2-5 to help in his analysis.

TABLE 2-5    Fundamental Industry and Market Data

| | |
|---|---|
| Forecasted industry earnings retention rate | 40% |
| Forecasted industry return on equity | 25% |
| Industry beta | 1.2 |
| Government bond yield | 6% |
| Equity risk premium | 5% |

A. Compute the price-to-earnings ($P_0/E_1$) ratio for the industry based on the fundamental data in Table 2-5. Show your work.

Jones wants to analyze how fundamental P/Es might differ among countries. He gathers the data given in Table 2-6.

TABLE 2-6    Economic and Market Data

| Fundamental Factors | Country A | Country B |
|---|---|---|
| Forecasted growth in real gross domestic product | 5% | 2% |
| Government bond yield | 10% | 6% |
| Equity risk premium | 5% | 4% |

B. Determine whether each of the fundamental factors in Table 2-6 would cause P/Es to be generally higher for Country A or higher for Country B. Justify each of your conclusions with one reason. *Note:* Consider each fundamental factor in isolation, with all else remaining equal.

21. (Adapted from 1998 CFA Level II exam) Janet Ludlow's company requires all its analysts to use a two-stage DDM and the CAPM to value stocks. Using these models, Ludlow has valued QuickBrush Company at $63 per share. She now must value SmileWhite Corporation.

A. Calculate the required rate of return for SmileWhite using the information in Table 2-7 and the CAPM. Show your work.

TABLE 2-7    Valuation Information: December 1997

|  | QuickBrush | SmileWhite |
|---|---|---|
| Beta | 1.35 | 1.15 |
| Market price | $45.00 | $30.00 |
| Intrinsic value | $63.00 | ? |
| *Notes:* |  |  |
| Risk-free rate | 4.50% |  |
| Expected market return | 14.50% |  |

Ludlow estimates the following EPS and dividend growth rates for SmileWhite:

First three years:              12% per year
Years thereafter:              9% per year

The 1997 dividend per share is $1.72.
B.  Estimate the intrinsic value of SmileWhite using the data above and the two-stage DDM. Show your work.
C.  Recommend QuickBrush or SmileWhite stock for purchase by comparing each company's intrinsic value with its current market price. Show your work.
D.  Describe one strength of the two-stage DDM in comparison with the constant-growth DDM. Describe one weakness inherent in all DDMs.

# FREE CASH FLOW VALUATION

## LEARNING OUTCOMES

*After completing this chapter, you will be able to do the following:*

- Discuss the choice of a free cash flow valuation approach.
- Define and interpret free cash flow to the firm (FCFF) and free cash flow to equity (FCFE).
- Describe the FCFF and FCFE approaches to valuation.
- Explain the strengths and limitations of the FCFE model.
- Contrast the ownership perspective implicit in the FCFE approach to the ownership perspective implicit in the dividend discount approach.
- Contrast the appropriate discount rates for the FCFE and FCFF models.
- Discuss the appropriate adjustments to net income, earnings before interest and taxes (EBIT), earnings before interest, taxes, depreciation, and amortization (EBITDA), and cash flow from operations (CFO) to arrive at FCFF and FCFE.
- Calculate FCFF and FCFE given a company's financial statements, prepared according to U.S. Generally Accepted Accounting Principles (GAAP) or International Accounting Standards (IAS).
- Discuss approaches for forecasting FCFF and FCFE.
- Contrast the recognition of value in the FCFE model with the recognition of value in dividend discount models.
- Explain how dividends, share repurchases, share issues, and changes in leverage may affect FCFF and FCFE.
- Contrast FCFF with EBITDA.
- Critique the use of net income and EBITDA as proxies for cash flow in valuation.
- Describe the stable-growth, two-stage, and three-stage FCFF and FCFE models.
- List and discuss the assumptions of the stable-growth, two-stage, and three-stage FCFF and FCFE models.
- Justify the selection of a stable-growth, two-stage, or three-stage FCFF or FCFE model given characteristics of the company being valued.
- Calculate the value of a company using the stable-growth, two-stage, and three-stage FCFF and FCFE models.
- Explain how sensitivity analysis can be used in FCFF and FCFE valuations.
- Discuss approaches for calculating the terminal value in a multistage valuation model.
- Describe the characteristics of companies for which the FCFF model is preferred to the FCFE model.

## SUMMARY OVERVIEW

Discounted cash flow models are used widely by analysts to value companies.

- Free cash flow to the firm (FCFF) and free cash flow to equity (FCFE) are the cash flows available to all of the investors in the company and to common stockholders, respectively.
- Analysts like to use free cash flow as return (either FCFF or FCFF)
  - if the company is not dividend paying,
  - if the company is dividend paying but dividends differ significantly from the company's capacity to pay dividends,
  - if free cash flows align with profitability within a reasonable forecast period with which the analyst is comfortable, or
  - if the investor takes a control perspective.
- The FCFF valuation approach estimates the value of the firm as the present value of future FCFF discounted at the weighted average cost of capital (WACC):

$$\text{Firm value} = \sum_{t=1}^{\infty} \frac{\text{FCFF}_t}{(1 + \text{WACC})^t}$$

  The value of equity is the value of the firm minus the value of the firm's debt:

$$\text{Equity value} = \text{Firm value} - \text{Market value of debt}$$

  Dividing the total value of equity by the number of outstanding shares gives the value per share. The WACC formula is

$$\text{WACC} = \frac{\text{MV(Debt)}}{\text{MV(Debt)} + \text{MV(Equity)}} r_d (1 - \text{Tax rate}) + \frac{\text{MV(Equity)}}{\text{MV(Debt)} + \text{MV(Equity)}} r$$

- The value of the firm if FCFF is growing at a constant rate is

$$\text{Firm value} = \frac{\text{FCFF}_1}{\text{WACC} - g} = \frac{\text{FCFF}_0 (1 + g)}{\text{WACC} - g}$$

- With the FCFE valuation approach, the value of equity can be found by discounting FCFE at the required rate of return on equity (*r*):

$$\text{Equity value} = \sum_{t=1}^{\infty} \frac{\text{FCFE}_t}{(1 + r)^t}$$

  Dividing the total value of equity by the number of outstanding shares gives the value per share.
- The value of equity if FCFE is growing at a constant rate is

$$\text{Equity value} = \frac{\text{FCFE}_1}{r - g} = \frac{\text{FCFE}_0 (1 + g)}{r - g}$$

- FCFF and FCFE are frequently calculated starting with net income:

$$\text{FCFF} = \text{NI} + \text{NCC} + \text{Int}(1 - \text{Tax rate}) - \text{FCInv} - \text{WCInv}$$
$$\text{FCFE} = \text{NI} + \text{NCC} - \text{FCInv} - \text{WCInv} + \text{Net borrowing}$$

- FCFF and FCFE are related to each other as follows:

$$\text{FCFE} = \text{FCFF} - \text{Int}(1 - \text{Tax rate}) + \text{Net borrowing}$$

- FCFF and FCFE can be calculated starting from cash flow from operations:

$$FCFF = CFO + Int(1 - \text{Tax rate}) - FCInv$$
$$FCFE = CFO - FCInv + \text{Net borrowing}$$

- FCFF can also be calculated from EBIT or EBITDA:

$$FCFF = EBIT(1 - \text{Tax rate}) + Dep - FCInv - WCInv$$
$$FCFF = EBITDA(1 - \text{Tax rate}) + Dep(\text{Tax rate}) - FCInv - WCInv$$

  FCFE can then be found by using $FCFE = FCFF - Int(1 - \text{Tax rate}) + \text{Net borrowing}$.
- Finding CFO, FCFF, and FCFE can require careful interpretation of corporate financial statements. In some cases, the needed information may not be transparent.
- Earnings components such as net income, EBIT, EBITDA, and CFO should not be used as cash flow measures to value a firm. These earnings components either double-count or ignore parts of the cash flow stream.
- More-complicated capital structures, such as those with preferred stock, are easily adapted to find FCFF or FCFE.
- A general expression for the two-stage FCFF valuation model is

$$\text{Firm value} = \sum_{t=1}^{n} \frac{FCFF_t}{(1 + WACC)^t} + \frac{FCFF_{n+1}}{(WACC - g)} \frac{1}{(1 + WACC)^n}$$

- A general expression for the two-stage FCFE valuation model is

$$\text{Equity value} = \sum_{t=1}^{n} \frac{FCFE_t}{(1 + r)^t} + \frac{FCFE_{n+1}}{r - g} \frac{1}{(1 + r)^n}$$

- One common two-stage model assumes a constant growth rate in each stage, and a second common model assumes declining growth in Stage 1 followed by a long-run sustainable growth rate in Stage 2.
- To forecast FCFF and FCFE, analysts build a variety of models of varying complexity. A common approach is to forecast sales, with profitability, investments, and financing derived from changes in sales.
- Three-stage models are often considered to be good approximations for cash flow streams that, in reality, fluctuate from year to year.
- Nonoperating assets such as excess cash and marketable securities, noncurrent investment securities, and nonperforming assets are usually segregated from the company's operating assets. They are valued separately and then added to the value of the company's operating assets to find total firm value.

## PROBLEMS

1. Indicate the effect on this period's FCFF and FCFE of a change in each of the items listed below. Assume a $100 increase in each case and a 40 percent tax rate.
    A. Net income
    B. Cash operating expenses
    C. Depreciation
    D. Interest expense

   E.  EBIT
   F.  Accounts receivable
   G.  Accounts payable
   H.  Property, plant, and equipment
   I.   Notes payable
   J.   Cash dividends paid
   K.  Proceeds from issuing new common shares
   L.  Common stock share repurchases

2. LaForge Systems, Inc., has net income of $285 million for the year 2003. Using information from the company's financial statements below, show the adjustments to net income that would be required to find
   A.  FCFF, and
   B.  FCFE.
   C.  In addition, show the adjustments to FCFF that would result in FCFE.

| **LaForge Systems, Inc.** **Balance Sheet** In millions | December 31, 2002 | 2003 |
|---|---|---|
| **Assets** | | |
| **Current assets** | | |
| Cash and equivalents | $210 | $248 |
| Accounts receivable | 474 | 513 |
| Inventory | 520 | 564 |
| Total current assets | 1,204 | 1,325 |
| Gross fixed assets | 2,501 | 2,850 |
| Accumulated depreciation | (604) | (784) |
| Net fixed assets | 1,897 | 2,066 |
| **Total assets** | $3,101 | $3,391 |
| | | |
| **Liabilities and shareholders' equity** | | |
| **Current liabilities** | | |
| Accounts payable | $295 | $317 |
| Notes payable | 300 | 310 |
| Accrued taxes and expenses | 76 | 99 |
| Total current liabilities | 671 | 726 |
| Long-term debt | 1,010 | 1,050 |
| Common stock | 50 | 50 |
| Additional paid-in capital | 300 | 300 |
| Retained earnings | 1,070 | 1,265 |
| **Total shareholders' equity** | 1,420 | 1,615 |
| **Total liabilities and shareholders' equity** | $3,101 | $3,391 |

**Statement of Income**

| In millions, except per share data | December 31, 2003 |
|---|---|
| Total revenues | $2,215 |
| Operating costs and expenses | 1,430 |
| EBITDA | 785 |
| Depreciation | 180 |
| EBIT | 605 |
| Interest expense | 130 |
| Income before tax | 475 |
| Taxes (at 40 percent) | 190 |
| Net income | 285 |
| Dividends | 90 |
| Addition to retained earnings | 195 |

**Statement of Cash Flows**

| In millions | December 31, 2003 |
|---|---|
| **Operating activities** | |
| Net income | $285 |
| Adjustments | |
| Depreciation | 180 |
| Changes in working capital | |
| Accounts receivable | (39) |
| Inventories | (44) |
| Accounts payable | 22 |
| Accrued taxes and expenses | 23 |
| Cash provided by operating activities | $427 |
| **Investing activities** | |
| Purchases of fixed assets | 349 |
| Cash used for investing activities | $349 |
| **Financing activities** | |
| Notes payable | (10) |
| Long-term financing issuances | (40) |
| Common stock dividends | 90 |
| Cash used for financing activities | $40 |
| Cash and equivalents increase (decrease) | 38 |
| Cash and equivalents at beginning of year | 210 |
| Cash and equivalents at end of year | $248 |
| **Supplemental cash flow disclosures** | |
| Interest paid | $130 |
| Income taxes paid | $190 |

3. For LaForge Systems, whose financial statements are given in Problem 2, show the adjustments from the current levels of CFO (which is 427), EBIT (605), and EBITDA (785) to find
   A.  FCFF, and
   B.  FCFE.

4. The term "free cash flow" is frequently applied to cash flows that differ from the definition for FCFF that should be used to value a firm. Two such definitions of "free cash flow" are given below. Compare the definitions given for FCF to FCFF.
   A.  FCF = Net income + Depreciation and amortization − Cash dividends − Capital expenditures
   B.  FCF = Cash flow from operations (from the statement of cash flows) − Capital expenditures

5. Proust Company has FCFF of $1.7 billion and FCFE of $1.3 billion. Proust's WACC is 11 percent and its required rate of return for equity is 13 percent. FCFF is expected to grow forever at 7 percent and FCFE is expected to grow forever at 7.5 percent. Proust has debt outstanding of $15 billion.
   A.  What is the total value of Proust's equity using the FCFF valuation approach?
   B.  What is the total value of Proust's equity using the FCFE valuation approach?

6. Quinton Johnston is evaluating Taiwan Semiconductor Manufacturing Co., Ltd., (NYSE: TSM) headquartered in Hsinchu, Taiwan. In 2001, when Johnston is performing his analysis, the company—and indeed, the whole industry—is unprofitable. Furthermore, TSM pays no dividends on its common shares. Johnston decides to value TSM using his forecasts of FCFE and makes the following assumptions:
   • The company has 17.0 billion outstanding shares.
   • Sales will be $5.5 billion in 2002, increasing at 28 percent annually for the next four years (through 2006).
   • Net income will be 32 percent of sales.
   • Investment in fixed assets will be 35 percent of sales, investment in working capital will be 6 percent of sales, and depreciation will be 9 percent of sales.
   • 20 percent of the investment in assets will be financed with debt.
   • Interest expenses will be only 2 percent of sales.
   • The tax rate will be 10 percent.
   • TSM's beta is 2.1, the risk-free government bond rate is 6.4 percent, and the equity risk premium is 5.0 percent.
   • At the end of 2006, Johnston projects TSM will sell for 18 times earnings.
   What is the value of one ordinary share of Taiwan Semiconductor Manufacturing Co., Ltd.?

7. Do Pham is evaluating Phaneuf Accelerateur using the FCFF and FCFE valuation approaches. Pham has collected the following information (currency in euro):
   • Phaneuf has net income of 250 million, depreciation of 90 million, capital expenditures of 170 million, and an increase in working capital of 40 million.
   • Phaneuf will finance 40 percent of the increase in net fixed assets (capital expenditures less depreciation) and 40 percent of the increase in working capital with debt financing.
   • Interest expenses are 150 million. The current market value of Phaneuf's outstanding debt is 1,800 million.

- FCFF is expected to grow at 6.0 percent indefinitely, and FCFE is expected to grow at 7.0 percent.
- The tax rate is 30 percent.
- Phaneuf is financed with 40 percent debt and 60 percent equity. The before-tax cost of debt is 9 percent and the before-tax cost of equity is 13 percent.
- Phaneuf has 10 million outstanding shares.
    A. Using the FCFF valuation approach, estimate the total value of the firm, the total market value of equity, and the value per share.
    B. Using the FCFE valuation approach, estimate the total market value of equity and the value per share.

8. PHB Company currently sells for $32.50 per share. In an attempt to determine if PHB is fairly priced, an analyst has assembled the following information:
- The before-tax required rates of return on PHB debt, preferred stock, and common stock are 7.0 percent, 6.8 percent, and 11.0 percent, respectively.
- The company's target capital structure is 30 percent debt, 15 percent preferred stock, and 55 percent common stock.
- The market value of the company's debt is $145 million, and its preferred stock is valued at $65 million.
- PHB's FCFF for the year just ended is $28 million. FCFF is expected to grow at a constant rate of 4 percent for the foreseeable future.
- The tax rate is 35 percent.
- PHB has 8 million outstanding common shares.
What is PHB's estimated value per share? Is PHB's stock underpriced?

9. Watson Dunn is planning to value BHP Billiton Ltd. (NYSE: BHP) using a single-stage FCFF approach. BHP Billiton, headquartered in Melbourne, Australia, provides a variety of industrial metals and minerals. The financial information Dunn has assembled for his valuation is as follows:
- The company has 1,852 million shares outstanding.
- Market value of debt is $3.192 billion.
- FCFF is currently $1.1559 billion.
- Equity beta is 0.90, the equity risk premium is 5.5 percent, and the risk-free rate is 5.5 percent.
- The before-tax cost of debt is 7.0 percent.
- The tax rate is 40 percent.
- To calculate WACC, assume the company is financed 25 percent with debt.
- FCFF growth rate is 4 percent.
Using Dunn's information, calculate the following:
A. WACC
B. Value of the firm
C. Total market value of equity
D. Value per share

10. Kenneth McCoin is valuing McDonald's Corporation and performing a sensitivity analysis on his valuation. He uses a single-stage FCFE growth model. The "base case" values for each of the parameters in the model are given in the following table, along with possible "low" and "high" estimates for each variable.

| Variable | Base Case Value | Low Estimate | High Estimate |
|---|---|---|---|
| Normalized $FCFE_0$ | $0.88 | $0.70 | $1.14 |
| Risk-free rate | 5.08% | 5.00% | 5.20% |
| Equity risk premium | 5.50% | 4.50% | 6.50% |
| Beta | 0.70 | 0.60 | 0.80 |
| FCFE growth rate | 6.40% | 4.00% | 7.00% |

    A.  Use the base case values to estimate the current value of McDonald's Corporation.

    B.  Calculate the range of stock prices that would occur if the base case value for $FCFE_0$ were replaced by the low and high estimates for $FCFE_0$. Similarly, using the base case values for all other variables, calculate the range of stock prices caused by using the low and high values for beta, the risk-free rate, the equity risk premium, and the growth rate. Rank the sensitivity of the stock price to each of the five variables based on these ranges.

11. An aggressive financial planner who claims to have a superior method for picking undervalued stocks is courting one of your clients. The planner claims that the best way to find the value of a stock is to divide EBITDA by the risk-free bond rate. The planner is urging your client to invest in Alcan, Inc. (NYSE: AL). Alcan is the parent of a group of companies engaged in all aspects of the aluminum business. The planner says that Alcan's EBITDA of $1,580 million divided by the long-term government bond rate of 7 percent gives a total value of $22,571 million. With 318 million outstanding shares, Alcan's value per share using this method is $70.98. Shares of Alcan currently trade for $36.50, and the planner wants your client to make a large investment in Alcan through him.

    A.  Provide your client with an alternative valuation of Alcan based on a two-stage FCFE valuation approach. Use the following assumptions:
- Net income is currently $600 million. Net income will grow by 20 percent annually for the next three years.
- The net investment in operating assets (capital expenditures less depreciation plus investment in working capital) will be $1,150 million next year and grow at 15 percent for the following two years.
- Forty percent of the net investment in operating assets will be financed with net new debt financing.
- Alcan's beta is 1.3, the risk-free bond rate is 7 percent, and the equity risk premium is 4 percent.
- After three years, the growth rate of net income will be 8 percent and the net investment in operating assets (capital expenditures minus depreciation plus increase in working capital) each year will drop to 30 percent of net income.
- Debt is, and will continue to be, 40 percent of total assets.
- Alcan has 318 million outstanding shares.

    Find the value per share of Alcan.

    B.  Criticize the valuation approach that the aggressive financial planner used.

12. Bron has earnings per share of $3.00 in 2002 and expects earnings per share to increase by 21 percent in 2003. Earnings per share are expected to grow at a decreasing rate for the following five years, as shown in the following table. In 2008, the growth rate will be

6 percent and is expected to stay at that rate thereafter. Net capital expenditures (capital expenditures minus depreciation) will be $5.00 per share in 2002 and then follow the pattern predicted in the table. In 2008, net capital expenditures are expected to be $1.50 and will then grow at 6 percent annually. The investment in working capital parallels the increase in net capital expenditures and is predicted to equal 25 percent of net capital expenditures each year. In 2008, investment in working capital will be $0.375 and is predicted to grow at 6 percent thereafter. Bron will use debt financing to fund 40 percent of net capital expenditures and 40 percent of the investment in working capital.

| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|
| Growth rate for earnings per share | 21% | 18% | 15% | 12% | 9% | 6% |
| Net capital expenditure per share | $5.00 | $5.00 | $4.50 | $4.00 | $3.50 | $1.50 |

The required rate of return for Bron is 12 percent. Find the value per share using a two-stage FCFE valuation approach.

13. (Adapted from CFA Level II exam, 2000) The management of Telluride, an international diversified conglomerate based in the United States, believes that the recent strong performance of its wholly owned medical supply subsidiary, Sundanci, has gone unnoticed. To realize Sundanci's full value, Telluride announced that it will divest Sundanci in a tax-free spinoff.

Sue Carroll, CFA, is Director of Research at Kesson and Associates. In developing an investment recommendation for Sundanci, Carroll has gathered the information shown in Tables 3-1 and 3-2.

Abbey Naylor, CFA, has been directed by Carroll to determine the value of Sundanci's stock using the FCFE model. Naylor believes that Sundanci's FCFE will grow at 27 percent for two years, and 13 percent thereafter. Capital expenditures, depreciation, and working capital are all expected to increase proportionately with FCFE.
   A. Calculate the amount of FCFE per share for 2000 using the data from Table 3-1. Show your work.
   B. Calculate the current value of a share of Sundanci stock based on the two-stage FCFE model. Show your work.
   C. Describe limitations that the two-stage DDM and FCFE models have in common.

14. (Adapted from CFA Level II exam, 2001) John Jones, CFA, is head of the research department of Peninsular Research. One of the companies he is researching, Mackinac Inc., is a U.S.–based manufacturing company. Mackinac has released its June 2001 financial statements, shown in Tables 3-3, 3-4, and 3-5.

Mackinac has announced that it has finalized an agreement to handle North American production of a successful product currently marketed by a foreign company. Jones decides to value Mackinac using the dividend discount model (DDM) and the free cash flow to equity (FCFE) model. After reviewing Mackinac's financial statements and forecasts related to the new production agreement, Jones concludes the following:
   • Mackinac's earnings and FCFE are expected to grow 17 percent a year over the next three years before stabilizing at an annual growth rate of 9 percent.
   • Mackinac will maintain the current payout ratio.

TABLE 3-1   Sundanci Actual 1999 and 2000 Financial Statements for
Fiscal Years Ending 31 May (in millions, except per-share data)

| Income Statement | 1999 | 2000 |
| --- | --- | --- |
| Revenue | $474 | $598 |
| Depreciation | 20 | 23 |
| Other operating costs | 368 | 460 |
| Income before taxes | 86 | 115 |
| Taxes | 26 | 35 |
| Net income | 60 | 80 |
| Dividends | 18 | 24 |
| Earnings per share | $0.714 | $0.952 |
| Dividends per share | $0.214 | $0.286 |
| Common shares outstanding | 84.0 | 84.0 |

| Balance Sheet | 1999 | 2000 |
| --- | --- | --- |
| Current assets (includes $5 cash in 1999 and 2000) | $201 | $326 |
| Net property, plant, and equipment | 474 | 489 |
| Total assets | 675 | 815 |
| Current liabilities (all non-interest bearing) | 57 | 141 |
| Long-term debt | 0 | 0 |
| Total liabilities | | |
| Shareholders' equity | 618 | 674 |
| Total liabilities and equity | 675 | 815 |
| Capital expenditures | 34 | 38 |

TABLE 3-2   Selected Financial Information

| | |
| --- | --- |
| Required rate of return on equity | 14% |
| Industry growth rate | 13% |
| Industry P/E | 26 |

- Mackinac's beta is 1.25.
- The government bond yield is 6 percent, and the market equity risk premium is 5 percent.
- A. Calculate the value of a share of Mackinac's common stock using the two-stage DDM. Show your calculations.
- B. Calculate the value of a share of Mackinac's common stock using the two-stage FCFE model. Show your calculations.
- C. Jones is discussing with a corporate client the possibility of that client acquiring a 70 percent interest in Mackinac. Discuss whether the DDM or FCFE model is more appropriate for this client's valuation purposes.

TABLE 3-3    Mackinac Inc. Annual Income Statement
June 30, 2001 (in thousands, except per-share data)

| | |
|---|---:|
| Sales | $250,000 |
| Cost of goods sold | 125,000 |
| Gross operating profit | 125,000 |
| Selling, general, and administrative expenses | 50,000 |
| EBITDA | 75,000 |
| Depreciation and amortization | 10,500 |
| EBIT | 64,500 |
| Interest expense | 11,000 |
| Pretax income | 53,500 |
| Income taxes | 16,050 |
| Net income | $37,450 |
| Shares outstanding | 13,000 |
| EPS | $2.88 |

TABLE 3-4    Mackinac Inc. Balance Sheet June 30, 2001 (in thousands)

| | | |
|---|---:|---:|
| **Current Assets** | | |
| Cash and equivalents | $20,000 | |
| Receivables | 40,000 | |
| Inventories | 29,000 | |
| Other current assets | 23,000 | |
| Total current assets | | $112,000 |
| | | |
| **Noncurrent Assets** | | |
| Property, plant, and equipment | $145,000 | |
| Less: Accumulated depreciation | (43,000) | |
| Net property, plant, and equipment | 102,000 | |
| Investments | 70,000 | |
| Other noncurrent assets | 36,000 | |
| Total noncurrent assets | | 208,000 |
| Total assets | | $320,000 |
| | | |
| **Current Liabilities** | | |
| Accounts payable | $41,000 | |
| Short-term debt | 12,000 | |
| Other current liabilities | 17,000 | |
| Total current liabilities | | $70,000 |
| | | |
| **Noncurrent Liabilities** | | |
| Long-term debt | 100,000 | |
| Total noncurrent liabilities | | 100,000 |
| Total liabilities | | 170,000 |
| | | |
| **Shareholders' Equity** | | |
| Common equity | 40,000 | |
| Retained earnings | 110,000 | |
| Total equity | | 150,000 |
| Total liabilities and equity | | $320,000 |

TABLE 3-5   Mackinac Inc. Cash Flow Statement June 30, 2001 (in thousands)

| Cash Flow from Operating Activities | | |
|---|---|---|
| Net income | | $37,450 |
| Depreciation and amortization | | 10,500 |
| **Change in Working Capital** | | |
| (Increase) Decrease in receivables | ($5,000) | |
| (Increase) Decrease in inventories | (8,000) | |
| Increase (Decrease) in payables | 6,000 | |
| Increase (Decrease) in other current liabilities | 1,500 | |
| Net change in working capital | | (5,500) |
| Net cash from operating activities | | $42,450 |
| **Cash Flow from Investing Activities** | | |
| Purchase of property, plant, and equipment | ($15,000) | |
| Net cash from investing activities | | ($15,000) |
| **Cash Flow from Financing Activities** | | |
| Change in debt outstanding | $4,000 | |
| Payment of cash dividends | (22,470) | |
| Net cash from financing activities | | (18,470) |
| Net change in cash and cash equivalents | | $8,980 |
| Cash at beginning of period | | 11,020 |
| Cash at end of period | | $20,000 |

15. SK Telecom Co. is a cellular telephone paging and computer communication services company in Seoul, South Korea. The company is traded on the Korea, New York, and London stock exchanges (NYSE: SKM). Sol Kim has estimated the normalized FCFE for SK Telecom to be 1,300 Korean won (per share) for the year just ended. The real country return for South Korea is 6.50 percent. To estimate the required return for SK Telecom, the adjustments to the real country return are an industry adjustment of +0.60 percent, a size adjustment of −0.10 percent, and a leverage adjustment of +0.25 percent. The long-term real growth rate for South Korea is estimated at 3.5 percent, and Kim expects the real growth rate of SK Telecom to track the country rate.
    A. What is the real required rate of return for SK Telecom?
    B. Using the single-stage FCFE valuation model and real values for the discount rate and FCFE growth rate, estimate the value of one share of SK Telecom.

16. Lawrence McKibben is preparing a valuation of Tele Norte Leste Participacoes SA (NYSE: TNE), a telecom services company headquartered in Rio de Janeiro, Brazil. McKibben has decided to use a three-stage FCFE valuation model and the following estimates. The FCFE per share for the current year is $0.75. FCFE is expected to grow at 10 percent for next year, then at 26 percent annually for the following three years, and then grow at 6 percent in Year 5 and thereafter. TNE's estimated beta is 2.00,

and McKibben feels that current market conditions dictate a 4.5 percent risk-free rate of return and a 5.0 percent equity risk premium. Given McKibben's assumptions and approach, what is the value of Tele Norte Leste Participacoes?

17. Clay Cooperman has valued the operating assets of Johnson Extrusion at $720 million. The company also has short-term cash and securities with a market value of $60 million. The noncurrent investments have a book value of $30 million and a market value of $45 million. The company also has an overfunded pension plan, with plan assets of $210 million and plan liabilities of $170 million. Johnson Extrusion has $215 million of notes and bonds outstanding and 100 million outstanding shares. What is the value per share?

# MARKET-BASED VALUATION: PRICE MULTIPLES

## LEARNING OUTCOMES

*After completing this chapter, you will be able to do the following:*

- Distinguish among types of valuation indicators.
- Distinguish between the method of comparables and the method based on forecasted fundamentals as approaches to using price multiples in valuation.
- Define a justified price multiple.
- Discuss the economic rationales for the method of comparables and the method based on forecasted fundamentals.
- List and discuss rationales for each price multiple and dividend yield in valuation.
- Discuss possible drawbacks to the use of each price multiple and dividend yield.
- Define and calculate each price multiple and dividend yield.
- Define underlying earnings, and calculate underlying earnings given earnings per share (EPS) and nonrecurring items in the income statement.
- Define normalized EPS, discuss the methods of normalizing EPS, and calculate normalized EPS by each method.
- Explain and justify the use of earnings yield (E/P).
- Identify and discuss the fundamental factors that influence each price multiple and dividend yield.
- Calculate the justified price-to-earnings ratio (P/E), price-to-book ratio (P/B), and price-to-sales ratio (P/S) for a stock, based on forecasted fundamentals.
- Calculate a predicted P/E given a cross-sectional regression on fundamentals and explain limitations to the cross-sectional regression methodology.
- Define the benchmark value of a multiple.
- Evaluate a stock using the method of comparables.
- Discuss the importance of fundamentals in using the method of comparables.
- Define and calculate the P/E-to-growth (PEG) ratio and explain its use in relative valuation.
- Calculate and explain the use of price multiples in determining terminal value in a multistage discounted cash flow (DCF) model.

- Discuss alternative definitions of cash flow used in price multiples and explain the limitations of each.
- Discuss the sources of differences in cross-border valuation comparisons.
- Describe the main types of momentum indicators and their use in valuation.
- Explain the use of stock screens in investment management.

## SUMMARY OVERVIEW

In this chapter, we have defined and explained the most important valuation indicators in professional use and illustrated their application to a variety of valuation problems.

- Price multiples are ratios of a stock's price to some measure of value per share.
- Momentum indicators relate either price or a fundamental to the time series of their own past values (or in some cases to their expected value).
- Price multiples are most frequently applied to valuation using the method of comparables. This method involves using a price multiple to evaluate whether an asset is relatively undervalued, fairly valued, or overvalued in relation to a benchmark value of the multiple.
- The benchmark value of the multiple may be the multiple of a similar company or the median or average value of the multiple for a peer group of companies, an industry, an economic sector, an equity index, or the median or average own past values of the multiple.
- The economic rationale for the method of comparables is the law of one price.
- Price multiples may also be applied to valuation using the method based on forecasted fundamentals. Discounted cash flow models provide the basis and rationale for this method. Fundamentals also interest analysts who use the method of comparables, because differences between a price multiple and its benchmark value may be explained by differences in fundamentals.
- The key idea behind the use of P/Es is that earning power is a chief driver of investment value and EPS is probably the primary focus of security analysts' attention. EPS, however, is frequently subject to distortion, often volatile, and sometimes negative.
- The two alternative definitions of P/E are trailing P/E, based on the most recent four quarters of EPS, and leading P/E, based on next year's expected earnings.
- Analysts address the problem of cyclicality by normalizing EPS—that is, calculating the level of EPS that the business could achieve currently under mid-cyclical conditions (normal EPS).
- Two methods to normalize EPS are the method of historical average EPS (over the most recent full cycle) and the method of average ROE (average ROE multiplied by current book value per share).
- Earnings yield (E/P) is the reciprocal of the P/E. When stocks have negative EPS, a ranking by earnings yield is meaningful whereas a ranking by P/E is not.
- Historical trailing P/Es should be calculated with EPS lagged a sufficient amount of time to avoid look-ahead bias. The same principle applies to other multiples calculated on a trailing basis.
- The fundamental drivers of P/E are expected earnings growth rate(s) and the required rate of return. The justified P/E based on fundamentals bears a positive relationship to the first factor and an inverse relationship to the second factor.
- PEG (P/E to growth) is a tool to incorporate the impact of earnings growth on P/E. PEG is calculated as the ratio of the P/E to the consensus growth forecast. Stocks with lower PEGs are more attractive than stocks with higher PEGs, all else equal.

- We can estimate terminal value in multistage DCF models using price multiples based on comparables. The expression for terminal value is (using P/E as an example)

$$V_n = \text{Benchmark value of trailing P/E} \times E_n$$

or

$$V_n = \text{Benchmark value of leading P/E} \times E_{n+1}$$

- Book value per share attempts to represent the investment that common shareholders have made in the company, on a per-share basis. Inflation, technological change, and accounting distortions, however, can impair book value for this purpose.
- Book value is calculated as common shareholders' equity divided by the number of shares outstanding. Analysts adjust book value to more accurately reflect the value of shareholders' investment and to make P/B more useful for comparing different stocks.
- The fundamental drivers of P/B are ROE and the required rate of return. The justified P/B based on fundamentals bears a positive relationship to the first factor and an inverse relationship to the second factor.
- An important rationale for the price-to-sales ratio (P/S) is that sales, as the top line in an income statement, are generally less subject to distortion or manipulation than other fundamentals such as EPS or book value. Sales are also more stable than earnings and never negative.
- P/S fails to take into account differences in cost structure between businesses, may not properly reflect the situation of companies losing money, and can be subject to manipulation through revenue recognition practices.
- The fundamental drivers of P/S are profit margin, growth rate, and the required rate of return. The justified P/S based on fundamentals bears a positive relationship to the first two factors and an inverse relationship to the third factor.
- A key idea behind the use of price-to-cash-flow ratios is that cash flow is less subject to manipulation than are earnings. Price to cash flow are often more stable than P/E. Some common approximations to cash flow from operations have limitations, however, because they ignore items that may be subject to manipulation.
- The major cash flow and related concepts used in multiples are earnings plus noncash charges (CF), cash flow from operations (CFO), free cash flow to equity (FCFE), and earnings before interest, taxes, depreciation, and amortization (EBITDA).
- In calculating price to cash flow, the earnings-plus-noncash-charges concept is traditionally used, although the FCFE has the strongest link to financial theory.
- CF and EBITDA are not strictly cash flow numbers because they do not account for non-cash revenue and net changes in working capital.
- The fundamental drivers of price to cash flow, however defined, are the expected growth rates of future cash flows and the required rate of return. The justified price to cash flow based on fundamentals bears a positive relationship to the first factor and an inverse relationship to the second.
- Enterprise value (EV) is total company value (the market value of debt, common equity, and preferred equity) minus the value of cash and investments.
- EV/EBITDA is preferred to P/EBITDA because EBITDA as a pre-interest number is a flow to all providers of capital.
- EV/EBITDA may be more appropriate than P/E for comparing companies with different amounts of financial leverage (debt).
- EV/EBITDA is frequently used in the valuation of capital-intensive businesses.

- The fundamental drivers of EV/EBITDA are the expected growth rate in free cash flow to the firm and the weighted-average cost of capital. The justified EV/EBITDA based on fundamentals bears a positive relationship to the first factor and an inverse relationship to the second.
- Dividend yield has been used as a valuation indicator because it is a component of total return, and is less risky than capital appreciation. However, investors trade off future earnings growth to receive higher current dividends.
- Trailing dividend yield is calculated as four times the most recent quarterly per-share dividend divided by the current market price.
- The fundamental drivers of dividend yield are the expected growth rate in dividends and the required rate of return.
- Comparing companies across borders frequently involves accounting method differences, cultural differences, economic differences, and resulting differences in risk and growth opportunities.
- Momentum valuation indicators include earnings surprise, standardized unexpected earnings, and relative strength.
- Unexpected earnings (or earnings surprise) equals the difference between reported earnings and expected earnings.
- Standardized unexpected earnings (SUE) are unexpected earnings divided by the standard deviation in past unexpected earnings.
- Relative-strength indicators compare a stock's performance during a period either with its own past performance (first type) or with the performance of some group of stocks (second type). The rationale behind using relative strength is the thesis of patterns of persistence or reversal in returns.
- Screening is the application of a set of criteria to reduce an investment universe to a smaller set of investments and is a part of many stock selection disciplines. In general, limitations of such screens include the lack of control over the calculation of important inputs and the absence of qualitative factors.

## PROBLEMS

1. As of February 2002, you are researching Smith International (NYSE: SII), an oil field services company subject to cyclical demand for its services. You believe the 1997–2000 period reasonably captures average profitability. SII closed at $57.98 on February 2, 2002.

|      | 2001   | 2000   | 1999   | 1998   | 1997   |
|------|--------|--------|--------|--------|--------|
| EPS  | E$3.03 | $1.45  | $0.23  | $2.13  | $2.55  |
| BVPS | E19.20 | 16.21  | 14.52  | 13.17  | 11.84  |
| ROE  | E16%   | 8.9%   | 1.6%   | 16.3%  | 21.8%  |

*Source:* The Value Line Investment Survey.

A. Define normal EPS.
B. Calculate a normal EPS for SII based on the method of historical average EPS, and then calculate the P/E based on that estimate of normal EPS.
C. Calculate a normal EPS for SII based on the method of average ROE and the P/E based on that estimate of normal EPS.

2. An analyst plans to use P/E and the method of comparables as a basis for recommending one of two peer group companies in the personal digital assistant business. Data on the companies' prices, trailing EPS, and expected growth rates in sales (five-year compounded rate) are given in the table below. Neither business has been profitable to date, and neither is anticipated to have positive EPS over the next year.

|  | Price | Trailing EPS | P/E | Expected Growth (Sales) |
|---|---|---|---|---|
| Hand | $22 | −$2.20 | NM | 45% |
| Somersault | $10 | −$1.25 | NM | 40% |

   Unfortunately, because the earnings for both companies were negative, the P/Es were not meaningful. On the basis of the above information, answer the following questions.
   A. State how the analyst might make a relative valuation in this case.
   B. Which stock should the analyst recommend?

3. May Stewart, CFA, a retail analyst, is performing a P/E-based comparison of two jewelry stores as of early 2001. She has the following data for Hallwhite Stores (HS) and Ruffany (RUF).
   - HS is priced at $44. RUF is priced at $22.50.
   - HS has a simple capital structure, earned $2.00 per share in 2000, and is expected to earn $2.20 in 2001.
   - RUF has a complex capital structure as a result of its outstanding stock options. Moreover, it had several unusual items that reduced its basic EPS in 2000 to $0.50 (versus the $0.75 that it earned in 1999).
   - For 2001, Stewart expects RUF to achieve net income of $30 million. RUF has 30 million shares outstanding and options outstanding for an additional 3,333,333 shares.
   A. Which P/E (trailing or leading) should Stewart use to compare the two companies' valuation?
   B. Which of the two stocks is relatively more attractively valued on the basis of P/Es (assuming that all other factors are approximately the same for both stock)?

4. You are researching the valuation of the stock of a company in the food processing industry. Suppose you intend to use the mean value of the leading P/Es for the food processing industry stocks as the benchmark value of the multiple. That mean P/E is 18.0. The leading or expected EPS for the next year for the stock you are studying is $2.00. You calculate 18.0 × $2.00 = $36, which you take to be the intrinsic value of the stock based only on the information given above. Comparing $36 with the stock's current market price of $30, you conclude the stock is undervalued.
   A. Give two reasons why your conclusion that the stock is undervalued may be in error.
   B. What additional information about the stock and the peer group would support your original conclusion?

5. A. Identify two significant differences between Yardeni's model of stock market valuation and the Fed model.
   B. Suppose an analyst uses an equity index as a comparison asset in valuing a stock. Which price multiple(s) would cause concern about the impact of potential overvaluation of the equity index on a decision to recommend purchase of an individual stock?

6. (Adapted from 2000 CFA Level II exam) Christie Johnson, CFA, has been assigned to
   analyze Sundanci. Johnson assumes that Sundanci's earnings and dividends will grow at
   a constant rate of 13 percent. Tables 4-1 and 4-2 provide financial statements and other
   information for Sundanci.
   A. Calculate a justified P/E based on information in Tables 4-1 and 4-2 and on
      Johnson's assumptions for Sundanci. Show your work.
   B. Identify, within the context of the constant dividend growth model, how *each* of the
      fundamental factors shown below would affect the P/E.

TABLE 4-1    Sundanci Actual 1999 and 2000 Financial
Statements For Fiscal Years Ending May 31
(in millions, except per-share data)

| Income Statement | 1999 | 2000 |
|---|---|---|
| Revenue | $474 | $598 |
| Depreciation | 20 | 23 |
| Other operating costs | 368 | 460 |
| Income before taxes | 86 | 115 |
| Taxes | 26 | 35 |
| Net income | 60 | 80 |
| Dividends | 18 | 24 |
| Earnings per share | $0.714 | $0.952 |
| Dividends per share | $0.214 | $0.286 |
| Common shares outstanding | 84.0 | 84.0 |

| Balance Sheet | 1999 | 2000 |
|---|---|---|
| Current assets | $201 | $326 |
| Net property, plant, and equipment | 474 | 489 |
| Total assets | 675 | 815 |
| Current liabilities | 57 | 141 |
| Long-term debt | 0 | 0 |
| Total liabilities | | |
| Shareholders' equity | 618 | 674 |
| Total liabilities and equity | 675 | 815 |
| Capital expenditures | 34 | 38 |

TABLE 4-2    Selected Financial Information

| | |
|---|---|
| Required rate of return on equity | 14% |
| Growth rate of industry | 13% |
| Industry P/E | 26 |

  i. The risk (beta) of Sundanci increases substantially.
  ii. The estimated growth rate of Sundanci's earnings and dividends increases.
  iii. The market risk premium increases.

  *Note:* A change in a fundamental factor is assumed to happen in isolation; inter-active effects between factors are ignored. Every other item of the company is unchanged.

7. At a meeting of your company's investment policy committee, Bill Yu presents a recommendation based on a P/E analysis. He presents the case for Connie's Sporting Goods (CSG), a small chain of retail stores that receives almost no coverage by analysts. Yu begins by noting that CSG appeared to be fairly valued compared with its peers on a P/E basis. CSG's 10-Q filing revealed, however, that an initiative at CSG to offer sports instruction (e.g., golf lessons) along with equipment should immediately raise the earnings growth rate at the company from 5 percent to 6 percent. Yu thus expects the company's trailing P/E to rise from 10.5 to 13.25, a 26 percent increase, as soon as the investment community recognizes this development. The computations supporting his analysis follow.
   Currently the justified P/E based on fundamentals is

$$\frac{P_0}{E_0} = \frac{(1 - b)(1 + g)}{r - g} = \frac{(1 - 0.5)(1.05)}{0.10 - 0.05} = 10.5$$

   He points out that when $g$ rises to 0.06, the trailing P/E should increase to 13.25, providing investors with appreciation in excess of 20 percent. When asked if he expects CSG's ROE to improve with the initiative, Yu indicated that it would likely be flat for the first several years. A colleague argues that because of the flat ROE, CSG's justified P/E will not increase to 13.25 because $b$ must increase to be consistent with the sustainable growth rate expression for $g$. Only companies with at least 20 percent near-term appreciation potential are candidates for inclusion on your company's focus list of stocks.
   A. How would you expect the new initiative to affect the trailing P/E accorded to CSG's stock, assuming Yu's assumptions are correct? (Growth will increase as indicated above and ROE will be steady.)
   B. Is CSG a good candidate for your company's focus list?

8. Tom Smithfield is valuing the stock of a food processing business. He has projected earnings and dividends to four years (to $t = 4$). Other information and estimates are
   • Required rate of return $= 0.09$
   • Average dividend payout rate for mature companies in the market $= 0.45$
   • Industry average ROE $= 0.10$
   • $E_3 = \$3.00$
   • Industry average P/E $= 12$
   On the basis of the above, answer the following questions:
   A. Compute terminal value based on comparables.
   B. Contrast your answer in Part A to an estimate of terminal value using the Gordon growth model.

9. Discuss three types of stocks or investment problems for which an analyst could appropriately use P/B in valuation.

10. Avtech is a multinational distributor of semiconductor chips and related products to businesses. Its leading competitor around the world is Target Electronics. Avtech has a current market price of $10, 20 million shares outstanding, annual sales of $1 billion, and a 5 percent profit margin. Target has a market price of $20, 30 million shares outstanding, annual sales of $1.6 billion, and a profit margin of 4.9 percent. Based on the information given, answer the following questions:

    A. Which of the two companies has a more attractive valuation based on P/S?

    B. Identify and explain one advantage of P/S over P/E as a valuation tool.

11. Wilhelm Müller, CFA, has organized the selected data on four food companies that appear below (TTM stands for trailing 12 months):

|  | Hormel Foods | Tyson Foods | IBP Corp | Smithfield Foods |
| --- | --- | --- | --- | --- |
| Stock price | $25.70 | $11.77 | $23.65 | $24.61 |
| Shares out (1,000s) | 138,923 | 220,662 | 108,170 | 103,803 |
| Market cap ($ mil) | 3,570 | 2,597 | 2,558 | 2,523 |
| Sales ($ mil) | 4,124 | 10,751 | 17,388 | 6,354 |
| Net income ($ mil) | 182 | 88 | 122 | 252 |
| TTM EPS | $1.30 | $0.40 | $1.14 | $2.31 |
| Return on equity | 19.20% | 4.10% | 6.40% | 23.00% |
| Net profit margin | 4.41% | 0.82% | 0.70% | 3.99% |

On the basis of the data given, answer the following questions:

    A. Calculate the trailing P/E and P/S for each company.

    B. Explain on the basis of fundamentals why these stocks have different P/Ss.

12. (Adapted from 2001 CFA Level II exam) John Jones, CFA, is head of the research department at Peninsular Research. Peninsular has a client who has inquired about the valuation method best suited for comparison of companies in an industry with the following characteristics:

    • Principal competitors within the industry are located in the United States, France, Japan, and Brazil.

    • The industry is currently operating at a cyclical low, with many companies reporting losses.

    Jones recommends that the client consider the following valuation ratios:

    1. P/E

    2. P/B

    3. P/S

    Determine which *one* of the three valuation ratios is most appropriate for comparing companies in this industry. Support your answer with *one* reason that makes that ratio superior to either of the other two ratios in this case.

13. General Electric (NYSE: GE) is currently selling for $38.50, with trailing 12-month earnings and dividends of $1.36 and $0.64, respectively. P/E is 28.3, P/B is 7.1, and P/S is 2.9. The return on equity is 27.0 percent, and the profit margin on sales is 10.9 percent. The Treasury bond rate is 4.9 percent, the equity risk premium is 5.5 percent, and GE's beta is 1.2.

    A. What is GE's required rate of return, based on the capital asset pricing model?

    B. Assume that the dividend and earnings growth rates are 9 percent. What P/Es, P/Bs, and P/Ss would be justified given the required rate of return in Part A and current values of the dividend payout ratio, ROE, and profit margin?

    C. Given that the assumptions and constant growth model are appropriate, state whether GE appears to be fairly valued, overvalued, or undervalued based on fundamentals.

14. Jorge Zaldys, CFA, is researching the relative valuation of two companies in the aerospace/defense industry, NCI Heavy Industries (NCI) and Relay Group International (RGI). He has gathered relevant information on the companies in the following table.

<div align="center"><strong>EBITDA Comparisons</strong><br>(in € millions except for per-share)</div>

| Company | RGI | NCI |
|---|---|---|
| Price per share | 150 | 100 |
| Shares outstanding | 5 million | 2 million |
| Market value of debt | 50 | 100 |
| Book value of debt | 52 | 112 |
| Cash and investments | 5 | 2 |
| Net income | 49.5 | 12 |
| Net income from continuing operations | 49.5 | 8 |
| Interest expense | 3 | 5 |
| Depreciation and amortization | 8 | 4 |
| Taxes | 2 | 3 |

Using the information in the above table, answer the following questions:

    A. Calculate P/EBITDA for NCI and RGI.

    B. Calculate EV/EBITDA for NCI and RGI.

    C. Select NCI or RGI for recommendation as relatively undervalued. Justify your selection.

15. Define the major alternative cash flow concepts, and state one limitation of each.

16. Data for two hypothetical companies in the pharmaceutical industry, DriveMed and MAT Technology, are given in the table below. For both companies, expenditures in fixed capital and working capital during the previous year reflected anticipated average expenditures over the foreseeable horizon.

| | DriveMed | MAT Tech. |
|---|---|---|
| Current price | $46.00 | $78.00 |
| Trailing CF per share | $3.60 | $6.00 |
| P/CF | 12.8 | 13.0 |
| Trailing FCFE per share | $1.00 | $5.00 |
| P/FCFE | 46.0 | 15.6 |
| Consensus five-year growth forecast | 15% | 20% |
| Beta | 1.25 | 1.25 |

On the basis of the information supplied, discuss the valuation of MAT Technology relative to DriveMed. Justify your conclusion.

17. Your value-oriented investment management company recently hired a new analyst, Bob Westard, because of his expertise in the life sciences and biotechnology areas. At the company's weekly meeting, during which each analyst proposes a stock idea for inclusion on the company's approved list, Westard recommends Human Cloning International (HCI). He bases his recommendation to the Investment Committee on two considerations. First, HCI has pending patent applications but a P/E that he judges to be low given the potential earnings from the patented products. Second, HCI has had high relative strength versus the S&P 500 over the past month.

   A. Explain the difference between price multiples and relative strength approaches.
   B. State which, if any, of the bases for Westard's recommendation is consistent with the investment orientation of your company.

18. Kirstin Kruse, a portfolio manager, has an important client who wants to alter the composition of her equity portfolio, which is currently a diversified portfolio of 60 global common stocks. The client wants a portfolio that meets the following criteria:

   • Stocks must be in the Dow Jones Industrial Average, Transportation Average, or Utilities Average.
   • Stocks must have a dividend yield of at least 5.0 percent.
   • Stocks must have a P/E no greater than 20.
   • Stocks must have a total market capitalization of at least $2.0 billion.

   The table below shows how many stocks satisfied each screen, which was run in November 2001.

| Screen | Number Satisfying |
|---|---|
| In Dow Jones Industrial Average, Transportation Average, or Utilities Average | 65 |
| Dividend yield of at least 5.0% | 10 |
| P/E less than 20 | 27 |
| Total market cap of at least $2.0 billion | 52 |
| Satisfies all four screens | 6 |

   Other facts are:
   • In total, there are 65 stocks in these three indexes (30 in the Industrial Average, 20 in the Transportation Average, and 15 in the Utilities Average).
   • The stocks meeting all four screens were Southern Co. (utility), TXU Corporation (utility), Eastman Kodak Co. (consumer goods), Public Service Enterprise Group (utility), Reliant Energy (utility), and Consolidated Edison (utility).

   A. Which valuation indicator or fundamental in Kruse's screen is most restrictive?
   B. Critique the construction of the screen.
   C. Do these screens identify an appropriate replacement portfolio for the client?

# CHAPTER 5

# RESIDUAL INCOME VALUATION

## LEARNING OUTCOMES

*After completing this chapter, you will be able to do the following:*

- Define and calculate residual income.
- Describe alternative measures of residual earnings, such as economic value added.
- Discuss the uses of residual income models.
- Calculate future values of residual income given current book value, earnings growth estimates, and an assumed dividend payout ratio.
- Calculate the intrinsic value of a share of common stock using the residual income model.
- Contrast the recognition of value in the residual income model to value recognition in other present value models.
- Discuss the strengths and weaknesses of the residual income model.
- Justify the selection of the residual income model for equity valuation, given characteristics of the company being valued.
- Identify and discuss the fundamental determinants or drivers of residual income.
- Explain the relationship between the justified price-to-book ratio and residual income.
- Explain the relationship of the residual income model to the dividend discount and free cash flow to equity models.
- Discuss the major accounting issues in applying residual income models.
- Calculate an implied growth rate in residual income given the market price-to-book ratio and an estimate of the required rate of return on equity.
- Define continuing residual income and list the common assumptions regarding continuing residual income.
- Justify an estimate of continuing residual income at the earnings forecast horizon given company and industry prospects.
- Calculate the intrinsic value of a share of common stock using a multistage residual income model, given the required rate of return, forecasted earnings per share over a finite horizon, and forecasted continuing residual earnings.

## SUMMARY OVERVIEW

This chapter has discussed the use of residual income models in valuation. Residual income is an appealing economic concept because it attempts to measure economic profit: profits after accounting for all opportunity costs of capital.

- Residual income is calculated as net income minus a deduction for the cost of equity capital. The deduction is called the equity charge, and is equal to equity capital multiplied by the required rate of return on equity (the cost of equity capital in percent).
- Economic value added (EVA) is a commercial implementation of the residual income concept. EVA = NOPAT − (C% × TC), where NOPAT is net operating profit after taxes, C% is the percent cost of equity capital, and TC equals total capital.
- Residual income models (including commercial implementations) are used not only for equity valuation but also to measure internal corporate performance and for determining executive compensation.
- We can forecast per-share residual income as forecasted earnings per share minus the required rate of return on equity multiplied by beginning book value per share. Alternatively, we can forecast per-share residual income as beginning book value per share multiplied by the difference between forecasted ROE and the required rate of return on equity.
- According to the residual income model, the intrinsic value of a share of common stock is the sum of book value per share and the present value of expected future per-share residual income. According to the residual income model, equivalent mathematical expressions for intrinsic value of a common stock are

$$V_0 = B_0 + \sum_{t=1}^{\infty} \frac{RI_t}{(1 + r)^t} = B_0 + \sum_{t=1}^{\infty} \frac{E_t - rB_{t-1}}{(1 + r)^t} = B_0 + \sum_{t=1}^{\infty} \frac{(ROE_t - r) \times B_{t-1}}{(1 + r)^t}$$

where

$V_0$ = value of a share of stock today ($t = 0$)
$B_0$ = current per-share book value of equity
$B_t$ = expected per-share book value of equity at any time $t$
$r$ = required rate of return on equity (cost of equity)
$E_t$ = expected earnings per share for period $t$
$RI_t$ = expected per-share residual income, equal to $E_t - rB_{t-1}$ or to $(ROE - r) \times B_{t-1}$

- In most cases, value is recognized earlier in the residual income model compared with other present value models of stock value such as the dividend discount model.
- Strengths of the residual income model include the following:
  - Terminal values do not make up a large portion of the value relative to other models.
  - The models use readily available accounting data.
  - The models can be used in the absence of dividends and near-term positive free cash flows.
  - The models can be used when cash flows are unpredictable.
- Weaknesses of the residual income model include the following:
  - These models are based on accounting data that can be subject to manipulation by management.

- Accounting data used as inputs may require significant adjustments.
  - The models require that the clean surplus relation holds, or that the analyst makes appropriate adjustments when the clean surplus relation does not hold.
- The residual income model is most appropriate in the following cases:
  - A company is not paying dividends or it exhibits an unpredictable dividend pattern.
  - A company has negative free cash flow many years out but is expected to generate positive cash flow at some point in the future.
  - There is a great deal of uncertainty in forecasting terminal values.
- The fundamental determinants or drivers of residual income are book value of equity and return on equity.
- Residual income valuation is most closely related to P/B. When the present value of expected future residual income is positive (negative), the justified P/B based on fundamentals is greater than (less than) 1.
- When fully consistent assumptions are used to forecast earnings, cash flow, dividends, book value, and residual income through a full set of pro forma (projected) financial statements, and the same required rate of return on equity is used as the discount rate, the same estimate of value should result from a residual income, dividend discount, or free cash flow valuation. In practice, however, analysts may find one model much easier to apply and possibly arrive at different valuations using the different models.
- The residual income model assumes the clean surplus relation $B_t = B_{t-1} + E_t - D_t$. In other terms, the ending book value of equity equals the beginning book value plus earnings less dividends, apart from ownership transactions.
- In practice, to apply the residual income model most accurately, the analyst needs to
  - adjust book value of common equity for off-balance-sheet items; and
  - adjust reported net income to reflect clean surplus accounting, where necessary.
- Continuing residual income is residual income after the forecast horizon. Frequently, one of the following assumptions concerning continuing residual income is made:
  - Residual income continues indefinitely at a positive level.
  - Residual income is zero from the terminal year forward.
  - Residual income declines to zero as ROE reverts to the cost of equity over time.
  - Residual income declines to some mean level.

## PROBLEMS

1. Based on the following information, determine whether Vertically Integrated Manufacturing (VIM) earned any residual income for its shareholders in 2001:
   - VIM had total assets of $3,000,000, financed with twice as much debt capital as equity capital.
   - VIM's pretax cost of debt is 6 percent and cost of equity capital is 10 percent.
   - VIM had EBIT of $300,000 and was taxed at a rate of 40 percent.

2. Using the following information, estimate the intrinsic value of VIM's common stock using the residual income model:
   - VIM had total assets of $3,000,000, financed with twice as much debt capital as equity capital.
   - VIM's pretax cost of debt is 6 percent and cost of equity capital is 10 percent.

- VIM had EBIT of $300,000 and was taxed at a rate of 40 percent. EBIT is expected to continue at $300,000 indefinitely.
- VIM's book value per share is $20.
- VIM has 50,000 shares of common stock outstanding.

3. Palmetto Steel, Inc. (PSI), maintains a dividend payout ratio of 80 percent because of its limited opportunities for expansion. Its return on equity is 15 percent. The required rate of return on PSI equity is 12 percent, and its long-term growth rate is 3 percent. Compute the justified P/B based on forecasted fundamentals, consistent with the residual income model and a constant growth rate assumption.

4. Because New Market Products (NMP) markets consumer staples, it is able to make use of considerable debt in its capital structure; specifically, 90 percent of the company's total assets of $450,000,000 are financed with debt capital. Its cost of debt is 8 percent before taxes, and its cost of equity capital is 12 percent. NMP achieved a pretax income of $5.1 million in 2001 and had a tax rate of 40 percent. What was NMP's residual income for 2001?

5. In 2002, Smithson-Williams Investments (SWI) achieved an operating profit after taxes of €10 million on total assets of €100 million. Half of its assets were financed with debt with a pretax cost of 9 percent. Its cost of equity capital is 12 percent, and its tax rate is 40 percent. Did SWI achieve a positive residual income?

6. Calculate the economic value added (EVA) or residual income, as requested, for each of the following:
    A. NOPAT = $100
       Beginning book value of debt = $200
       Beginning book value of equity = $300
       WACC = 11 percent
       Calculate EVA.
    B. Net income = €5.00
       Dividends = €1.00
       Beginning book value of equity = €30.00
       Required rate of return on equity = 11 percent
       Calculate residual income.
    C. Return on equity = 18 percent
       Required rate of return on equity = 12 percent
       Beginning book value of equity = €30.00
       Calculate residual income.

7. (Adapted from 2000 CFA Level II exam) Jim Martin is using economic value added (EVA) and market value added (MVA) to measure the performance of Sundanci. Martin uses the fiscal 2000 information below for his analysis.
    - Adjusted net operating profit after tax (NOPAT) is $100 million.
    - Total capital is $700 million (no debt).
    - Closing stock price is $26.
    - Sundanci has 84 million shares outstanding.
    - The cost of equity is 14 percent.
    Calculate the following for Sundanci. Show your work.
    A. EVA for fiscal 2000
    B. MVA as of fiscal year-end 2000

8. Protected Steel Corporation (PSC) has a book value of $6 per share. PSC is expected to earn $0.60 per share forever and pays out all of its earnings as dividends. The required rate of return on PSC's equity is 12 percent. Calculate the value of the stock using the following:
   A. Dividend discount model
   B. Residual income model

9. Notable Books (NB) is a family-controlled company that dominates the retail book market. NB has book value of $10 per share, is expected to earn $2.00 forever, and pays out all of its earnings as dividends. Its required return on equity is 12.5 percent. Place a value on the stock of NB using the following:
   A. Dividend discount model
   B. Residual income model

10. Simonson Investment Trust International (SITI) is expected to earn $4.00, $5.00, and $8.00 for the next three years. SITI will pay annual dividends of $2.00, $2.50, and $20.50 in each of these years. The last dividend includes the liquidating payment to shareholders at the end of Year 3 when the trust terminates. SITI's book value is $8 per share and its required return on equity is 10 percent.
    A. What is the current value per share of SITI according to the dividend discount model?
    B. Calculate per-share book value and residual income for SITI for each of the next three years and use those results to find the stock's value using the residual income model.
    C. Calculate return on equity and use it as an input to the residual income model to calculate SITI's value.

11. Foodsco Incorporated (FI), a leading distributor of food products and materials to restaurants and other institutions, has a remarkably steady track record in terms of both return on equity and growth. At year-end 2000, FI had a book value of $30 per share. For the foreseeable future, you expect the company to achieve an ROE of 15 percent (on trailing book value) and to pay out one-third of its earnings in dividends. Your required return is 12 percent. Forecast FI's residual income for the year ending December 31, 2005.

12. Lendex Electronics (LE) has had a great deal of turnover of top management for several years and was not followed by analysts during this period of turmoil. Because the company's performance has been improving steadily for the past three years, technology analyst Steve Kent recently reinitiated coverage of LE. A meeting with management confirmed Kent's positive impression of LE's operations and strategic plan. Kent decides LE merits further analysis.

    Careful examination of LE's financial statements revealed that the company had negative other comprehensive income from changes in the value of available-for-sale securities in each of the past five years. How, if at all, should this observation about LE's other comprehensive income affect the figures that Kent uses for the company's ROE and book value for those years?

13. Retail fund manager Seymour Simms is considering the purchase of shares in upstart retailer Hot Topic Stores (HTS). The current book value of HTS is $20 per share, and its market price is $35. Simms expects long-term ROE to be 18 percent, long-term

growth to be 10 percent, and cost of equity to be 14 percent. What conclusion would you expect Simms to arrive at if he uses a single-stage residual income model to value these shares?

14. Dayton Manufactured Homes (DMH) builds prefabricated homes and mobile homes. Both favorable demographics and the likelihood of slow, steady increases in market share should enable DMH to maintain its ROE of 15 percent and growth rate of 10 percent over time. DMH has a book value of $30 per share and the required rate of return on its equity is 12 percent. Compute the value of its equity using the single-stage residual income model.

15. Use the following inputs and the finite horizon form of the residual income model to compute the value of Southern Trust Bank (STB) shares as of December 31, 2001:
    • ROE will continue at 15 percent for the next five years (and 10 percent thereafter) with all earnings reinvested (no dividends paid).
    • Cost of Equity = 10 percent.
    • $B_0$ = $10 per share (at year-end 2001).
    • Premium over book value at the end of five years will be 20 percent.

*For Problems 16 and 17, use the following data for Taiwan Semiconductor Manufacturing Ltd. (TSM). Refer to Equation 5-8 in the text.*
    • Current price = TWD81.
    • Cost of equity = 14.33 percent.
    • Five-year forecast of growth in book value = 22 percent.
    • Book value per share = TWD16.47.
    • Analyst EPS forecasts are TWD2.07 for 2002 and TWD4.81 for 2003.
    • Analysts expect ROE to stabilize at 25 percent from 2002 through 2011, and then decline to 20 percent through 2022 in Problem 16 and 2023 in Problem 17.
    • As of the beginning of 2002, an analyst estimates the intrinsic value using the residual income model as TWD59.18 with zero premium.

16. In the above analysis, the analyst uses the multistage residual income model and assumes that TSM's ROE will fade toward the cost of equity capital after 2022. How would her conclusion about TSM's valuation change if she believed that the persistence parameter for this company should be 0.90 (rather than 0.60) because of patent protection for some of TSM's technology?

17. Having completed the revised analysis, which gives TSM greater credit for its patented technology, the analyst realizes that the changes warrant an additional adjustment. Although she generally employs a 20-year time frame when implementing the multistage residual income model, she believes that TSM's ROE will remain at 20 percent through 2023 before fading toward the cost of equity capital. (Recall she is now using a persistence parameter of 0.90.) How does this extension of the period with above-normal ROE alter her valuation of TSM?

18. Shunichi Kobayashi is valuing United Parcel Service (NYSE: UPS). Kobayashi has made the following assumptions:
    • Book value per share is estimated at $9.62 on December 31, 2001.
    • EPS will be 22 percent of the beginning book value per share for the next eight years.
    • Cash dividends paid will be 30 percent of EPS.

- At the end of the eight-year period, the market price per share will be three times the book value per share.
- The beta for UPS is 0.60, the risk-free rate is 5.00 percent, and the equity risk premium is 5.50 percent.

The current market price of UPS is $59.38, which indicates a current P/B of 6.2.

   A. Prepare a table showing the beginning and ending book values, net income, and cash dividends annually for the eight-year period.
   B. Estimate the residual income and the present value of residual income for the eight years.
   C. Estimate the value per share of UPS stock using the residual income model.
   D. Estimate the value per share of UPS stock using the dividend discount model. How does this value compare with the estimate from the residual income model?

19. Boeing Company (NYSE: BA) has a current stock price of $49.86. It also has a P/B of 3.57 and book value per share of $13.97. Assume that the single-stage growth model is appropriate for valuing BA. Boeing's beta is 0.80, the risk-free rate is 5.00 percent, and the equity risk premium is 5.50 percent.

   A. If the growth rate is 6 percent and the ROE is 20 percent, what is the justified P/B for Boeing?
   B. If the growth rate is 6 percent, what ROE is required to yield Boeing's current P/B?
   C. If the ROE is 20 percent, what growth rate is required for Boeing to have its current P/B?

# SOLUTIONS

# THE EQUITY VALUATION PROCESS

## SOLUTIONS

1.  A. A satisfactory answer includes any four of the following uses of valuation models: (1) stock selection, (2) inferring market expectations (about variables such as future growth), (3) evaluating corporate events, (4) fairness opinions, (5) evaluating business strategies and models, (6) communication with analysts and shareholders, or (7) appraisal of private businesses.
    B. A portfolio manager's most important use of valuation models is stock selection.
    C. A corporate officer would be most directly concerned with using valuation concepts and models to evaluate corporate events, evaluate business strategies and models, and communicate with analysts and shareholders. To the extent that the corporate officer's company had a program of acquisitions, the use of valuation models in fairness opinions would also be relevant.

2.  A. If Cornell had used a higher discount rate, the revenue growth rate consistent with a price of $61.50 would have been higher than 20 percent a year.
    B. In any present value model, present value is inversely related to the discount rate applied to expected future cash flows. The higher the discount rate applied, the greater the future cash flows needed to equal a given value such as $61.50. To obtain the higher future revenue estimate needed to obtain a present value of $61.50 assuming a higher discount rate, a higher revenue growth rate assumption must be made. Therefore, if Cornell had assumed a higher discount rate, he would have concluded that the market expected Intel's revenue growth rate to be even higher than 20 percent.

3.  A. As part of the planning step (after specification of investment objectives), the investor will generally elaborate on his approach to investment analysis and security selection. An active investor may specify in substantial detail the valuation models and/or criteria that he plans to use.
    B. In the execution step, investment strategies are integrated with expectations to select a portfolio. In selecting a portfolio, the investor is continually put to the test to make accurate valuations of securities. Therefore, skill in valuation plays a key role in this step of the portfolio management process.

4. An investor trying to replicate a stock index does not need to make valuation judgments about securities. For example, the manager of an account indexed to the S&P 500, a type of passive investment strategy, seeks only to replicate the returns on the S&P 500, whether or not the index is fairly valued. In contrast, active investors attempt to identify mispriced securities—in particular, securities expected to earn a positive excess risk-adjusted return.

5. A. The *ex ante* alpha is the expected return minus the required return for a stock. Because the analysts feel their stocks are undervalued, the expected returns should exceed the required rates of return and the *ex ante* alphas should be positive (greater than zero).

   B. The *ex post* alpha is the actual return minus the contemporaneous required return.
   For KMG, the *ex post* alphas are
      1998: $-34.0\% - 26.6\% = -60.6\%$
      1999: $65.4\% - 19.6\% = 45.8\%$
      2000: $20.9\% - (-8.5\%) = 29.4\%$
      2001: $-12.9\% - (-11.0\%) = -1.9\%$
   For NUE, the *ex post* alphas are
      1998: $-8.5\% - 29.2\% = -37.7\%$
      1999: $29.4\% - 21.5\% = 7.9\%$
      2000: $-25.3\% - (-9.3\%) = -16.0\%$
      2001: $37.3\% - (-12.1\%) = 49.4\%$

6. A. Wal-Mart's expected return consists of the following:
   Price correction = 56.00 − 53.12 = $2.88
   Additional price appreciation          4.87
   Cash dividends                         0.28
   Total return                          $8.03

   The expected rate of return is the expected dollar return divided by the price, or $8.03/53.12 = 15.1$ percent.

   B. *Ex ante* alpha = Expected holding-period return − Required return
   *Ex ante* alpha = $15.1 - 9.2 = 5.9$ percent

   C. *Ex post* alpha = Actual holding-period return − Contemporaneous required return
   *Ex post* alpha = $8.9 - (-10.4) = 19.3$ percent

7. A. *Ex ante* alpha is the expected holding-period return on a security minus the security's required return. An asset with a positive (negative) expected alpha is undervalued (overvalued).

   B. Alpha of Security 1 = $0.20 - 0.21 = -0.01$ or $-1$ percent
   Alpha of Security 2 = $0.18 - 0.08 = 0.10$ or 10 percent
   Alpha of Security 3 = $0.11 - 0.10 = 0.01$ or 1 percent
   The ranking is
      Security 2, alpha = 10 percent (most attractive)
      Security 3, alpha = 1 percent
      Security 1, alpha = $-1$ percent (least attractive)

   C. According to Part B, Security 2 and Security 3 offer positive expected alphas. We might thus decide to invest in Security 2 and Security 3. The risks in such a decision include the following:
   • We may have made an incorrect or incomplete adjustment for risk. We may not have accounted for all sources of risk reflected in the prices of the securities.
   • Our own expectations may be biased or otherwise flawed.

- Even if our expectations are more accurate than the expectations reflected in the prices of the securities, there is no assurance that the mispricing will be corrected during our investment horizon, if at all.

   It is also possible to enumerate other risks. For example, Chapter 2 discusses the uncertainty associated with estimating beta, the measure of risk in the CAPM.

8. A. The analyst collects, organizes, analyzes, and communicates corporate information to investors and then recommends appropriate investment actions based on his analysis. When an analyst does his work well, clients are helped in reaching their investment objectives.

   B. When well executed, the work of analysts promotes informed buy and sell decisions. Such informed decisions make asset prices better reflections of underlying value, with the result that capital flows to its highest-valued uses. By monitoring managers' actions, investment analysts can also help prevent managers from exploiting corporate resources for their own benefit.

9. We need to know (1) the time horizon for the price target and (2) the required rate of return on MBFG.MI. The price target of €9.20 represents a rate of return to investing in the stock calculated as (€9.20 + 0.05)/€7.73 − 1.0 = 0.197, or 20 percent. Without a time frame, we cannot evaluate how attractive that rate is. Suppose that the time horizon is one year. To further interpret a 20 percent expected one-year rate of return, we need to adjust it for risk. Subtracting the required rate of return from 20 percent would give the share's expected alpha. This number would allow us to conclude whether the stock was fairly valued.

   Another acceptable answer is that we would need to know the analyst's current estimate of intrinsic value for MBFG.MI. This may or may not be the target price of €9.20.

10. A. XMI's expensing policies with respect to acquisitions inflate its earnings per share growth rate. By pushing down pre-acquisition EPS to an artificially low number, XMI can show unusual post-acquisition earnings growth rates.

    B. Based on both expensing and revenue-recognition policies, earnings clearly do not accurately reflect underlying economics. As noted in Part A, XMI attempts to manipulate the expensing policy of acquisitions to benefit its own earnings growth rate. In speeding up the recognition of revenue in its telecommunications subsidiary, XMI's revenue-recognition policy is aggressive. In summary, the quality of XMI earnings is poor. (Note that the quality of XMI's disclosures is also poor, but disclosure was treated under the rubric of accounting risk factors in the text.)

    C. The statement is a comparison of value, based on XMI's P/E ratio relative to the P/Es of similar stocks. The underlying model is a relative valuation model (or the method of comparables).

    D. Risk factors might include:
       - Possible negative regulatory and legal developments. When and if XMI's accounting and business practices become known, XMI may be subject to legal and regulatory action.
       - Risks in the forecasts. Because of the poor quality of XMI's earnings and the poor quality of its accounting disclosures, there is great uncertainty in any forecasts in a valuation of XMI.
       - With regard to other risk factors, a downward revision to the market price of XMI could occur if the extent of its quality of earnings issues and management's policies were to become known.

CHAPTER $2$

# DISCOUNTED DIVIDEND VALUATION

## SOLUTIONS

1. For AOL Time Warner, the required return is

   $r = R_F + \beta[E(R_M) - R_F] = 4.35\% + 2.50(8.04\%) = 4.35\% + 20.10\% = 24.45\%$

   For J.P. Morgan Chase, the required return is

   $r = R_F + \beta[E(R_M) - R_F] = 4.35\% + 1.50(8.04\%) = 4.35\% + 12.06\% = 16.41\%$

   For Boeing, the required return is

   $r = R_F + \beta[E(R_M) - R_F] = 4.35\% + 0.80(8.04\%) = 4.35\% + 6.43\% = 10.78\%$

2. The five-factor APT model is of the form

   $$E(R_i) = \text{T-bill rate} + (\text{Sensitivity to confidence risk} \times 2.59\%) - \\ (\text{Sensitivity to time horizon risk} \times 0.66\%) - \\ (\text{Sensitivity to inflation risk} \times 4.32\%) + \\ (\text{Sensitivity to business-cycle risk} \times 1.49\%) + \\ (\text{Sensitivity to market-timing risk} \times 3.61\%)$$

   For Terra Energy, the required return is

   $$r = 4.10\% + (0.25 \times 2.59\%) - (0.30 \times 0.66\%) - (-0.45 \times 4.32\%) + \\ (1.60 \times 1.49\%) + (0.80 \times 3.61\%) \\ = 4.10\% + 0.65\% - 0.20\% + 1.94\% + 2.38\% + 2.89\% \\ = 11.76\%$$

3. The required return is given by

   $r = R_F + \beta[E(R_M) - R_F] = 0.045 + (-0.2)(0.075) = 4.5\% - 1.5\% = 3.0\%$

   Newmont Mining has a required return of 3 percent. When beta is negative, an asset has a CAPM required rate of return that is below the risk-free rate.

4. The equation for the single-period DDM is

   $$V_0 = \frac{D_1 + P_1}{1 + r}$$

For Stock 1,    $V_0 = \dfrac{0.30 + 21.00}{1.10} = \$19.36$

For Stock 2, $30.00 = \dfrac{D_1 + 32.00}{1.10}$, $D_1 = 1.10(30.00) - 32.00 = \$1.00$

For Stock 3, $92.00 = \dfrac{2.70 + P_1}{1.12}$, $P_1 = 92.00(1.12) - 2.70 = \$100.34$

For Stock 4, $16.00 = \dfrac{0.30 + 17.90}{1 + r}$, $r = \dfrac{0.30 + 17.90}{16.00} - 1 = 0.1375 = 13.75\%$

5. Using the CAPM, GM's required rate of return is

$$r = R_F + \beta[E(R_M) - R_F] = 5.3\% + 0.90(6.00\%) = 5.3\% + 5.4\% = 10.7\%$$

Substituting the values into the single-period DDM, we obtain

$$V_0 = \frac{D_1 + P_1}{(1 + r)^1}, \quad \text{or} \quad 66.00 = \frac{2.40 + P_1}{(1.107)^1}$$

The expected price is $P_1 = 66.00(1.107) - 2.40 = 73.06 - 2.40 = \$70.66$.

6. A. The projected dividend is $D_1 = D_0(1 + g) = 1.50(1.05) = \$1.575$.
   B. $r = R_F + \beta[E(R_M) - R_F] = 4.5\% + 0.85(6.0\%) = 4.5\% + 5.1\% = 9.6\%$
   C. $V_0 = D_1/(r - g) = 1.575/(0.096 - 0.05) = 1.575/0.046 = \$34.24$
   D. The stock price predicted by the Gordon growth model (\$34.24) is below the market price of \$50. A $g > 5$ percent is required for the value estimated with the model to be \$50. To find the $g$ that would yield a \$50 price, we solve

$$50 = \frac{1.50(1 + g)}{0.096 - g}, \text{which simplifies to}$$
$$4.8 - 50g = 1.5 + 1.5g$$
$$51.5g = 3.3$$
$$g = 0.06408, \quad \text{or} \quad g = 6.408\%$$

   To verify that this growth rate results in a value of \$50, substitute $g = 6.408$ percent into the Gordon growth model equation:

$$V_0 = \frac{D_0(1 + g)}{r - g} = \frac{1.50(1.06408)}{0.096 - 0.06408} = \frac{1.59612}{0.03192} = \$50.00$$

7. A. The value of each stock using the Gordon growth model is

$$V_{Que} = \frac{0.50(1.07)}{0.10 - 0.07} = \frac{0.535}{0.03} = \$17.83$$
$$V_{SHS} = \frac{1.20(1.065)}{0.105 - 0.065} = \frac{1.278}{0.04} = \$31.95$$
$$V_{True} = \frac{0.88(1.05)}{0.10 - 0.05} = \frac{0.924}{0.05} = \$18.48$$

   B. All three stocks are selling at a premium above their DDM estimated values. The percentage premiums are

   Premium (Que) = $(25 - 17.83)/17.83 = 7.17/17.83 = 40.2\%$
   Premium (SHS) = $(40 - 31.95)/31.95 = 8.05/31.95 = 25.2\%$
   Premium (True) = $(20 - 18.48)/18.48 = 1.52/18.48 = 8.2\%$

   True Corporation is selling for the smallest relative premium over its estimated value found with the Gordon growth model.

8. A. In the Gordon growth model, the expected rate of return is $r = D_1/P_0 + g$.

   American Electric        $r = 2.40/46.17 + 5.0\% = 5.20\% + 5.0\% = 10.2\%$

   Consolidated Edison     $r = 2.20/39.80 + 5.0\% = 5.53\% + 5.0\% = 10.53\%$

   Exelon Corp.            $r = 1.69/64.12 + 7.0\% = 2.64\% + 7.0\% = 9.64\%$

   Southern Co.             $r = 1.34/23.25 + 5.5\% = 5.76\% + 5.5\% = 11.26\%$

   Dominion Resources     $r = 2.58/60.13 + 5.5\% = 4.29\% + 5.5\% = 9.79\%$

   B. With the capital asset pricing model, the required return is $r = R_F + \beta[E(R_M) - R_F]$:

   American Electric        $r = 5.3\% + 0.6(6.0\%) = 5.3\% + 3.6\% = 8.9\%$

   Consolidated Edison     $r = 5.3\% + 0.6(6.0\%) = 5.3\% + 3.6\% = 8.9\%$

   Exelon Corp.            $r = 5.3\% + 0.8(6.0\%) = 5.3\% + 4.8\% = 10.1\%$

   Southern Co.             $r = 5.3\% + 0.65(6.0\%) = 5.3\% + 3.9\% = 9.2\%$

   Dominion Resources     $r = 5.3\% + 0.65(6.0\%) = 5.3\% + 3.9\% = 9.2\%$

9. A. Compounded for eight years, $0.585(1 + g)^8 = 1.46$. Solving for $g$, we get $g = 12.11\%$.

   B. For the future dividend growth rate, use $g = 12.11\%/2 = 6.06\%$. The expected rate of return is

$$r = \frac{D_1}{P_0} + g = \frac{1.46(1.0606)}{80.00} + 0.0606 = 0.0800 = 8.00\%$$

   C. The required rate of return for PG using the CAPM is

$$r = R_F + \beta[E(R_M) - R_F] = 5.56\% + 0.53(3.71\%) + 7.53\%$$

$$V_0 = \frac{D_1}{r - g} = \frac{1.46(1.0606)}{0.0753 - 0.0606} = \$105.34$$

10. The value of one share of NiSource Preferred B is $V_0 = D/r = 3.88/0.0788 = \$49.24$. If the price is \$46.00, the yield is $r = D/P_0 = 3.88/46.00 = 0.0843 = 8.43\%$.

11. A. Total market value = (Price/share) × (Number of shares) = 88.00(300,000,000) = \$26.4 billion

   Earnings per share = EPS = \$3,000,000/300,000,000 shares = \$0.01 per share

   P/E = 88.00/0.01 = 8,800

   Sales per share = \$210,000,000/300,000,000 shares = \$0.70

   Price/sales = 88.00/0.70 = 125.7

   B. Sales in Year 0 (the current year) = \$210 million

   Sales in Year 4 = $\text{Sales}_4$ = 210 million × $(1.60)^4$ = \$1,376.26 million

   Sales in Year 5 = $\text{Sales}_5$ = $\text{Sales}_4$ × 1.07 = \$1,376.26 million × 1.07 = \$1,472.59 million

   Earnings in Year 5 = 10% × $\text{Sales}_5$ = 0.10(1,472.59) = \$147.26 million

   Finally, dividends in Year 5 = 0.40 × 147.26 million = \$58.90 million

   The dividend per share is \$58.90 million/300 million = \$0.1963 per share

   Using the Gordon growth model, the value of one share at the end of Year 4 would be $V_4 = D_5/(r - g) = 0.1963/(0.12 - 0.07) = \$3.93$ per share. $V_0$, the present value of $V_4$, is $V_0 = 3.93/(1.12)^4 = \$2.50$, which is far less than the current market value of \$88.00 per share.

   C. We solve this problem by finding the sales and dividend per share in Year 4 that would be required to produce the current \$88.00 price. Then we multiply this sales per share figure by the number of outstanding shares to get the total sales figure.

$$88.00 = \frac{1}{(1.12)^4}V_4 = \frac{1}{(1.12)^4}\left(\frac{D_5}{0.12 - 0.07}\right)$$

Solving this expression, we find that $D_5 = \$6.92$. Because dividends are growing at 7 percent, $D_4 = 6.92/1.07 = \$6.47$. Because dividends are 40 percent of earnings, $EPS_4 = 6.47/0.40 = \$16.175$. Because earnings are 10 percent of sales, sales per share $= 16.175/0.10 = \$161.75$.

Finally, the total sales of the company is $\$161.75 \times 300$ million $= \$48.53$ billion. In this scenario, the current valuation of the stock is justified if sales can increase from $210 million to $48.53 billion in four years!

12. In the Gordon (constant dividend growth) model, $V_0 = D_0(1 + g)/(r - g)$.
With the bond yield plus risk premium method, with $r = 9.6\%$, the value of Dole is

$$V_0 = 0.40(1 + 0.07)/(0.096 - 0.07) = 0.428/0.026 = \$16.46$$

With the CAPM method, $r = 11.2\%$ and the value of Dole is

$$V_0 = 0.40(1 + 0.07)/(0.112 - 0.07) = 0.428/0.042 = \$10.19$$

With the APT method, $r = 10.4\%$ and the value of Dole is

$$V_0 = 0.40(1 + 0.07)/(0.104 - 0.07) = 0.428/0.034 = \$12.59$$

13. A. An analyst accepting the CFO's dividend target would compute the value as follows:

$V_3 = D_4/(r - g)$
$V_3 = 0.50/(0.15 - 0.07) = \$6.25$
$V_0 = V_3/(1 + r)^3$
$V_0 = \$6.25/(1.15)^3 = \$4.11$

B. An analyst extending the dividend target would compute the value as follows:

$V_5 = D_6/(r - g)$
$V_5 = 0.50/(0.15 - 0.07) = \$6.25$
$V_0 = V_5/(1 + r)^5$
$V_0 = \$6.25/(1.15)^5 = \$3.11$

14. The table below calculates the first five dividends and also finds their present values discounted at 12 percent. The value of the dividends for Year 6 and after is found using the Gordon growth model, where the value at time $t = 5$ depends on the dividend at $t = 6$. $D_6$ is found by growing the $D_1$ dividend at 50 percent for two years, at 20 percent for two more years, and at 5 percent for one year:

$$D_6 = 0.60(1.50)^2(1.20)^2(1.05) = \$2.0412$$

$V_5$ is

$$V_5 = \frac{D_6}{r - g} = \frac{2.0412}{0.12 - 0.05} = \frac{2.0412}{0.07} = \$29.16$$

The present values of $V_5$ and the dividends for $t = 1$ through $t = 5$ are in the far right column of the table.

| Time | Value | Calculation | $D_t$ or $V_t$ | Present Values $D_t/(1.12)^t$ or $V_t/(1.12)^t$ |
|---|---|---|---|---|
| 1 | $D_1$ | 0.60 | $ 0.60 | $ 0.536 |
| 2 | $D_2$ | 0.60(1.50) | 0.90 | 0.717 |
| 3 | $D_3$ | $0.60(1.50)^2$ | 1.35 | 0.961 |
| 4 | $D_4$ | $0.60(1.50)^2(1.20)$ | 1.62 | 1.030 |
| 5 | $D_5$ | $0.60(1.50)^2(1.20)^2$ | 1.944 | 1.103 |
| 5 | $V_5$ | $0.60(1.50)^2(1.20)^2(1.05)/(0.12 - 0.05)$ | 29.16 | 16.546 |
| Total | | | | $20.893 |

The dividend for FPR grows at different rates for three time periods. The total present value of the stock's dividends is $20.89.

15. EB Systems dividends are expected to grow in two stages, and the two-stage dividend discount model (DDM) is used to value the stock. The expected rate of return is the discount rate that causes the present value of the future dividend stream to equal the current price of $11.40. If EB Systems' dividend stream were growing at 7 percent (like the Gordon growth model), the rate of return would be $r = D_1/P_0 + g = 0.40/11.40 + 7\% = 3.51\% + 7\% = 10.51\%$. Because the dividend is growing more rapidly during Years 1 through 5, the rate of return will exceed 10.51 percent.

In the table below, we illustrate using trial and error to find the discount rate. The second column shows the dividends for Years 1 through 5. The following columns calculate the present value of these five dividends discounted at 11 percent, 11.5 percent, and 12 percent, respectively. The value of the dividends after Year 5 is $V_5 = D_6/(r - g)$, which is $V_5 = 0.7486/(r - 0.07)$. Notice that $r$ changes, so the terminal values for $r = 11\%$, 11.5%, and 12% also change, as shown in the table. The present value of $V_5$ is calculated and added to the present value of the first five dividends in the bottom row of the table.

| Year | Dividend | PV at 11% | PV at 11.5% | PV at 12% | PV at 11.563% |
|---|---|---|---|---|---|
| 1 | $0.400 | $0.360 | $0.359 | $0.357 | $0.359 |
| 2 | 0.460 | 0.373 | 0.370 | 0.367 | 0.370 |
| 3 | 0.529 | 0.387 | 0.382 | 0.377 | 0.381 |
| 4 | 0.608 | 0.401 | 0.394 | 0.387 | 0.393 |
| 5 | 0.700 | 0.415 | 0.406 | 0.397 | 0.405 |
| Total PV of dividends | | 1.936 | 1.910 | 1.884 | 1.907 |
| Terminal price ($V_5$) | | $18.714 | $16.635 | $14.971 | $16.405 |
| PV of terminal price | | 11.106 | 9.653 | 8.495 | 9.493 |
| Total PV of dividends and $V_5$ | | $13.042 | $11.563 | $10.379 | $11.399 |

The current stock price of $11.40 occurs with a discount rate between 11.5 percent and 12 percent. Further trial and error reveals the discount rate to be 11.563 percent, which gives a total present value of the dividend stream close to $11.40, as shown in the last column of the table.

16. A. The required rate of return for Hanson is $r = R_F + \beta[E(R_M) - R_F] = 4.66\% + 0.83(4.92\%) = 8.74\%$. Using the H-model, the value of Hanson PLC is

$$V_0 = \frac{D_0(1 + g_L)}{r - g_L} + \frac{D_0 H(g_S - g_L)}{r - g_L}$$

$$= \frac{13.80(1 + 0.05)}{0.0874 - 0.05} + \frac{13.80(5)(0.14 - 0.05)}{0.0874 - 0.05}$$

$$V_0 = \frac{14.49}{0.0374} + \frac{6.21}{0.0374} = 387.43 + 166.04 = \text{GBP } 553.47$$

The market price of GBP 472 is below the H-model price of GBP 553.47, so Hanson seems to be underpriced at this time.

B. For the H-model the expected rate of return can be derived as

$$r = \left(\frac{D_0}{P_0}\right)[(1 + g_L) + H(g_S - g_L)] + g_L$$

$$r = \left(\frac{13.80}{472}\right)[(1 + 0.05) + 5(0.14 - 0.05)] + 0.05 = 0.0439 + 0.05$$

$$= 0.0939 = 9.39\%$$

Hanson will return 9.39 percent to the investor if all of these assumptions hold.

17. A. Using the constant-growth dividend discount model, $V_0 = D_1/(r - g)$

   For LCC: $V_0 = \$0.90/(0.10 - 0.08) = \$45.00$
   For AOC: $V_0 = \$1.60/(0.11 - 0.07) = \$40.00$

   B. Using the CAPM, the expected return $r = R_F + \beta[E(R_M) - R_F]$

   For LCC: $r = 8\% + 1.2(20\% - 8\%) = 22.4\%$

   For AOC: $r = 8\% + 1.4(20\% - 8\%) = 24.8\%$

   Alternatively, using the CAPM and using the Treasury bill rate as the risk-free rate

   For LCC: $r = 5\% + 1.2(20\% - 5\%) = 23\%$

   For AOC: $r = 5\% + 1.4(20\% - 5\%) = 26\%$

   C. The internal growth rate is $g = b \times \text{ROE} = [(E - D)/E] \times (E/BV)$

   For LCC: BV = $\$300/10 = \$30$

$$g = [(\$4.00 - \$0.90)/\$4.00] \times (\$4.00/\$30)$$
$$= 0.775 \times 13.33\% = 10.33\%$$

   For AOC: BV = $\$320/20 = \$16$

$$g = [(\$3.20 - \$1.60)/\$3.20] \times (\$3.20/\$16) = 0.50 \times 20\% = 10.00\%$$

   D. *Recommendation:* Aminochem (AOC) is a more attractive investment than Litchfield (LCC) based on the answers to parts A, B, and C and the information provided in Table 2-1.

   *Justification:* Using the constant-growth dividend discount model (DDM), the stock price of AOC is more attractive, at a price of $30 (well below its DDM value of $40), than that of LCC. LCC's internal growth rate (computed in Part C) is higher than that of AOC, but LCC's higher P/E of 12.5 ($50/$4) versus 9.4 ($30/$3.20) for AOC is not justified by the small difference in growth rates.

18. A. i. Return on equity (ROE) = Profit margin × Asset turnover × Financial leverage

   ROE = (Net income/Revenue) × (Revenue/Assets) × (Assets/Equity)

   ii. ROE = (510/5,140) × (5,140/3,100) × (3,100/2,200) = 23.18%

   This calculation used end-of-year (1999e) values. Slightly different and acceptable values would be obtained if balance sheet averages were used for assets and equity or if the beginning value for equity were used.

   iii. Sustainable growth rate = ROE × Retention rate

   Retention rate = 1 − Dividend payout ratio

   Dividend payout ratio = 0.60/1.96 = 0.306

   Retention rate = 1 − 0.306 − 0.694

   Sustainable growth rate = 23.18% × 0.694 = 16.09%

   B. The sustainable growth rate (of 16.09 percent) exceeds MasterToy's actual growth rate. If the problem were temporary, management could simply accumulate resources in anticipation of future growth. Assuming this trend continues for the longer term (as the question states), however, management has at least two alternative courses of action when actual growth is below sustainable growth:

   • Return money to shareholders by increasing the dividend or the dividend payout ratio.

   • Return money to shareholders by buying back stock.

19. A. i. Return on equity is the product of three components: profitability (net profit margin), asset turnover ratio (sales/assets), and financial leverage or equity multiplier (assets-to-equity ratio).

   Net profit margin = Net income/Sales = 80/598 = 13.378%

   Total asset turnover = Sales/Assets = 598/815 = 0.7337

   Financial leverage = Assets/Equity = 815/674 = 1.2092

  ii. Return on equity = Net income/Equity = 80/674 = 11.87%
   Or, ROE = 13.378% × 0.7337 × 1.2092 = 11.87%

  iii. If the company maintains the current capital structure and a stable dividend payout rate, the sustainable rate of growth is defined by the product of ROE, which was calculated above, and the retention rate (1 minus the dividend payout rate), which can be determined from Table 2-3.
    Sustainable growth rate = ROE × Retention rate

$$= 11.87\% \times (1 - 24/80) = 8.31\%$$

B.

| Proposal | Effect on Sustainable Growth Rate | Component Directly Affected (If Any) |
| --- | --- | --- |
| Increase in quarterly dividend | Decrease | Retention rate. An increase in the dividend payout rate lowers the retention rate and thus decreases the sustainable growth rate. |
| Bond issue | Increase | Financial leverage or equity multiplier. An increase in the debt ratio raises financial leverage or the equity multiplier and thus increases sustainable growth. |
| Stock split | No effect | None. A stock split affects none of the components and thus does not affect the sustainable growth rate. |

 C. Using a two-stage dividend discount model, the current value of a share of Sundanci is calculated as

  Year 1 dividend per share ($D_1$) = \$0.286(1.32) = \$0.37752
  Year 2 dividend per share ($D_2$) = \$0.286(1.32)$^2$ = \$0.49833
  Year 3 dividend per share ($D_3$) = \$0.286(1.32)$^2$(1.13) = \$0.56311
  Terminal value ($V_2$) = $D_3/(r - g)$ = 0.56311/(0.14 − 0.13) = \$56.311

  The value of one share is the present value of the first two dividends plus the present value of the terminal share value:

$$V_0 = \frac{0.37752}{1.14} + \frac{0.49833}{(1.14)^2} + \frac{56.311}{(1.14)^2} = 0.331 + 0.383 + 43.329 = \$44.04$$

20. A. The industry's estimated P/E can be computed using the following model:

$$P_0/E_1 = \text{Payout ratio}/(r - g)$$

  Because $r$ and $g$ are not explicitly given, however, they must be computed. The growth rate is

$$g = \text{ROE} \times \text{Retention rate} = 0.25 \times 0.40 = 0.10$$

  The required rate of return is

$$r = R_F + \beta[E(R_M) - R_F] = 0.06 + 1.2(0.05) = 0.06 + 0.06 = 0.12$$

$$P_0/E_1 = 0.60/(0.12 - 0.10) = 30.00$$

B.

| Fundamental Factor | P/Es Higher for Country A or Country B? | Justification |
|---|---|---|
| Forecasted growth in real gross domestic product (GDP) | P/E should be higher for Country A. | Higher expected growth in GDP implies higher earnings growth and a higher P/E. |
| Government bond yield | P/E should be higher for Country B. | A lower government bond yield implies a lower risk-free rate and a higher P/E. |
| Equity risk premium | P/E should be higher for Country B. | A lower equity risk premium implies a lower required return and a higher P/E. |

21. A. The required rate of return is

$$r = \text{Risk-free rate} + \text{Beta} \times (\text{Expected market rate of return} - \text{Risk-free rate})$$

$$r = R_F + \beta[E(R_M) - R_F] = 0.045 + 1.15(0.145 - 0.045) = 16.0\%$$

B. The formula for the two-stage DDM is

$$V_0 = \sum_{t=1}^{3} \frac{D_t}{(1 + r)^t} + \frac{V_3}{(1 + r)^3}$$

The estimated future dividends are
$D_1 = 1.72 \times 1.12 = 1.93$
$D_2 = 1.93 \times 1.12 = 2.16$
$D_3 = 2.16 \times 1.12 = 2.42$
$D_4 = 2.42 \times 1.09 = 2.64$

The terminal stock price at $t = 3$ is

$$V_3 = D_4/(r - g) = 2.64/(0.16 - 0.09) = 37.71$$

The present values of the first three dividends and the terminal value are
$1.93 \times 1/(1.16)^1 = 1.66$
$2.16 \times 1/(1.16)^2 = 1.61$
$2.42 \times 1/(1.16)^3 = 1.55$
$37.71 \times 1/(1.16)^3 = 24.16$
Total present value = 28.98

C. *Recommendation:* Janet Ludlow should recommend QuickBrush for purchase because it is selling below Ludlow's intrinsic value estimate, whereas SmileWhite is selling above Ludlow's intrinsic value estimate. QuickBrush should have an expected return above its required rate of return, whereas SmileWhite should have an expected return below its required return.

QuickBrush has an intrinsic value of $63 versus a current market price of $45, or an intrinsic value of 40 percent above the market price. SmileWhite has an intrinsic value of $28.98 versus a current market price of $30, an intrinsic value of 3.4% below the market price.

D. *Strengths of the two-stage DDM in comparison with the constant-growth DDM:* The DDM is extremely sensitive to the estimated growth rate, $g$. The two-stage model allows for a separate valuation of two distinct periods in a company's future. As a result, a company such as QuickBrush can be evaluated in light of an anticipated change in sustainable growth. Industries have distinct life cycles in which they typically move from a period of rapid growth to a period of normal growth and then to declining growth. The two-stage model has many of the same problems as the constant-growth model, but it is probably a more realistic approach than assuming a constant growth rate for all time. The use of a two-stage model is a key valuation tool in that analysts with superior insight into a potential shift in a company's growth rate at a future date can use that expectation to assess the proper valuation at each stage.

*Weaknesses inherent in all DDMs:* All dividend discount models are extremely sensitive to input values. For example, small changes in the growth rate estimate, $g$, and/or the required rate of return, $r$, lead to large changes in a stock's estimated value. These inputs are difficult to estimate and may be based on unrealistic assumptions.

# FREE CASH FLOW VALUATION

## SOLUTIONS

1.

| $100 Increase In | Change in FCFF | Change in FCFE |
|---|---|---|
| A. Net income | +100 | +100 |
| B. Cash operating expenses | −60 | −60 |
| C. Depreciation | +40 | +40 |
| D. Interest expense | 0 | −60 |
| E. EBIT | +60 | +60 |
| F. Accounts receivable | −100 | −100 |
| G. Accounts payable | +100 | +100 |
| H. Property, plant, and equipment | −100 | −100 |
| I. Notes payable | 0 | +100 |
| J. Cash dividends paid | 0 | 0 |
| K. Shares issued | 0 | 0 |
| L. Share repurchases | 0 | 0 |

2.  A.  Free cash flow to the firm, found with Equation 3-7 from the text, is
$$FCFF = NI + NCC + Int(1 - Tax\ rate) - FCInv - WCInv$$
$$FCFF = 285 + 180 + 130(1 - 0.40) - 349 - (39 + 44 - 22 - 23)$$
$$FCFF = 285 + 180 + 78 - 349 - 38 = \$156\ million$$

  B.  Free cash flow to equity, found with Equation 3-10, is
$$FCFE = NI + NCC - FCInv - WCInv + Net\ borrowing$$
$$FCFE = 285 + 180 - 349 - (39 + 44 - 22 - 23) + (10 + 40)$$
$$FCFE = 285 + 180 - 349 - 38 + 50 = \$128\ million$$

  C.  To find FCFE from FCFF, use the relationship in Equation 3-9:
$$FCFE = FCFF - Int(1 - Tax\ rate) + Net\ borrowing$$
$$FCFE = 156 - 130(1 - 0.40) + (10 + 40)$$
$$FCFE = 156 - 78 + 50 = \$128\ million$$

3.  A.  To find FCFF from cash flow from operations (CFO), EBIT, or EBITDA, the analyst can use Equations 3-8, 3-12, and 3-13.
    To get FCFF from CFO:
    FCFF = CFO + Int(1 − Tax rate) − FCInv
    FCFF = 427 + 130(1 − 0.40) − 349 = 427 + 78 − 349 = $156 million
    To get FCFF from EBIT:
    FCFF = EBIT(1 − Tax rate) + Dep − FCInv − WCInv
    FCFF = 605(1 − 0.40) + 180 − 349 − 38
    FCFF = 363 + 180 − 349 − 38 = $156 million
    Finally, to obtain FCFF from EBITDA:
    FCFF = EBITDA(1 − Tax rate) + Dep(Tax rate) − FCInv − WCInv
    FCFF = 785(1 − 0.40) + 180(0.40) − 349 − 38
    FCFF = 471 + 72 − 349 − 38 = $156 million

    B.  The simplest approach is to calculate FCFF from CFO, EBIT, or EBITDA as was done in Part A above, and then to find FCFE by making the appropriate adjustments to FCFF:
    FCFE = FCFF − Int(1 − Tax rate) + Net borrowing
    FCFE = 156 − 130(1 − 0.40) + 50 = 156 − 78 + 50 = $128 million
    You can also find FCFE using CFO, EBIT, or EBITDA directly. Starting with CFO, using Equation 3-11, FCFE is
    FCFE = CFO − FCInv + Net borrowing
    FCFE = 427 − 349 + 50 = $128 million
    Starting with EBIT, FCFE (found with an equation derived in Footnote 9) is
    FCFE = EBIT(1 − Tax rate) + Dep − Int(1 − Tax rate) − FCInv
            − WCInv + Net borrowing
    FCFE = 605(1 − 0.40) + 180 − 130(1 − 0.40) − 349 − 38 + 50
    FCFE = 363 + 180 − 78 − 349 − 38 + 50 = $128 million
    Finally, starting with EBITDA, FCFE (found with an equation derived in Footnote 9) is
    FCFE = EBITDA(1 − Tax rate) + Dep(Tax rate) − Int(1 − Tax rate)
            − FCInv − WCInv + Net borrowing
    FCFE = 785(1 − 0.40) + 180(0.40) − 130(1 − 0.40) − 349 − 38 + 50
    FCFE = 471 + 72 − 78 − 349 − 38 + 50 = $128 million

4.  A.  FCF = Net income + Depreciation and amortization − Cash dividends − Capital expenditures. This definition of FCF is sometimes used to determine how much "discretionary" cash flow management has at its disposal. Management discretion concerning dividends is limited by investor expectations that dividends will be maintained. Comparing this definition with Equation 3-7,

    FCFF = NI + NCC + Int(1 − Tax rate) − FCInv − WCInv

    FCFF includes a reduction for investments in working capital and the addition of after-tax interest expense. Common stock dividends are not subtracted from FCFF, because doing so represents a distribution of the cash *available* to investors. (If a company pays preferred dividends, they are added back in Equation 3-7 to include them in FCFF if they had previously been taken out when calculating net income available to common stock dividends.)

    B.  FCF = Cash flow from operations (from the statement of cash flows) − Capital expenditures. Comparing this definition of FCF with Equation 3-8 can highlight the relation to FCFF:

    FCFF = CFO + Int(1 − Tax rate) − FCInv

The primary difference is that after-tax interest is added back in order to arrive at the cash flow available to investors. If preferred dividends had been subtracted to obtain net income (in CFO), they would also have to be added back in. This definition is commonly used to approximate FCFF, and it generally understates the actual FCFF by the amount of after-tax interest expense.

5. A. The firm value is the present value of FCFF discounted at the weighted-average cost of capital (WACC), or

$$\text{Firm} = \frac{\text{FCFF}_1}{\text{WACC} - g} = \frac{\text{FCFF}_0(1 + g)}{\text{WACC} - g} = \frac{1.7(1.07)}{0.11 - 0.07} = \frac{1.819}{0.04} = \$45.475$$

The market value of equity is the value of the firm minus the value of debt:

$$\text{Equity} = \$45.475 - 15 = \$30.475 \text{ billion}$$

B. Using the FCFE valuation approach, the present value of FCFE, discounted at the required rate of return on equity, is

$$\text{PV} = \frac{\text{FCFE}_1}{r - g} = \frac{\text{FCFE}_0(1 + g)}{r - g} = \frac{1.3(1.075)}{0.13 - 0.075} = \frac{1.3975}{0.055} = \$25.409$$

The value of equity using this approach is $25.409 billion.

6. The required rate of return found with the CAPM is

$$r = E(R_i) = R_F + \beta_i[E(R_M) - R_F] = 6.4\% + 2.1(5.0\%) = 16.9\%$$

The table below shows the values of sales, net income, capital expenditures less depreciation, and investments in working capital. FCFE equals net income less the investments financed with equity:

$$\text{FCFE} = \text{Net income} - (1 - \text{DR})(\text{Capital expenditures} - \text{Depreciation})$$
$$- (1 - \text{DR})(\text{Investment in working capital})$$

Because 20 percent of new investments are financed with debt, 80 percent of the investments are financed with equity, reducing FCFE by 80 percent of (Capital expenditures − Depreciation) and 80 percent of the investment in working capital.

| (All data in $ billions) Year | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|
| Sales (growing at 28%) | $5.500 | $7.040 | $9.011 | $11.534 | $14.764 |
| Net income = 32% of sales | 1.760 | 2.253 | 2.884 | 3.691 | 4.724 |
| FCInv − Dep = (35% − 9%) × Sales | 1.430 | 1.830 | 2.343 | 2.999 | 3.839 |
| WCInv = (6% of Sales) | 0.330 | 0.422 | 0.541 | 0.692 | 0.886 |
| 0.80 × (FCInv − Dep + WCInv) | 1.408 | 1.802 | 2.307 | 2.953 | 3.780 |
| FCFE = NI − 0.80 × (FCInv − Dep + WCInv) | 0.352 | 0.451 | 0.577 | 0.738 | 0.945 |
| PV of FCFE discounted at 16.9% | 0.301 | 0.330 | 0.361 | 0.395 | 0.433 |

| | |
|---|---|
| Terminal stock value | $85.032 |
| PV of terminal value discounted at 16.9% | 38.950 |
| Total PV of FCFE | 1.820 |
| Total value of firm | 40.770 |

The terminal stock value is 18 times the earnings in 2006, or 18 × $4.724 billion = $85.03 billion. The present value of the terminal value ($38.95 billion) plus the present value of the first five years' FCFE ($1.82 billion) is $40.77 billion. Because there are 17 billion outstanding shares, the value per ordinary share is $2.398.

(Taiwan Semiconductor Manufacturing Co. has ADRs trading on the New York Stock Exchange, where one ADR equals five ordinary shares. So the ADR price would be 5 × $2.398 = $11.99 per ADR.)

7. A. The free cash flow to the firm is

FCFF = NI + NCC + Int(1 − Tax rate) − FCInv − WCInv

FCFF = 250 + 90 + 150(1 − 0.30) − 170 − 40

FCFF = 250 + 90 + 105 − 170 − 40 = 235 million

The weighted-average cost of capital is

$$\text{WACC} = 9\%(1 − 0.30)(0.40) + 13\%(0.60) = 10.32\%$$

The value of the firm is

$$\text{Firm value} = \frac{\text{FCFF}_1}{\text{WACC} − g} = \frac{\text{FCFF}_0(1 + g)}{\text{WACC} − g} = \frac{235(1.06)}{0.1032 − 0.06} = \frac{249.1}{0.0432} = 5{,}766.20$$

The total value of equity is the total firm value minus the value of debt: Equity = 5,766.20 million − 1,800 million = 3,966.20 million. Dividing by the number of shares gives the per share estimate of $V_0$ = 3,966.20 million/10 million = 396.62 per share.

B. The free cash flow to equity is

FCFE = NI + NCC − FCInv − WCInv + Net borrowing

FCFE = 250 + 90 − 170 − 40 + 0.40(170 − 90 + 40)

FCFE = 250 + 90 − 170 − 40 + 48 = 178

Because the company is borrowing 40 percent of the increase in net capital expenditures (170 − 90) and working capital (40), net borrowing is 48.

The total value of equity is the FCFE discounted at the required rate of return of equity:

$$\text{Equity value} = \frac{\text{FCFE}_1}{r − g} = \frac{\text{FCFE}_0(1 + g)}{r − g} = \frac{178(1.07)}{0.13 − 0.07} = \frac{190.46}{0.06} = 3{,}174.33$$

The value per share is $V_0$ = 3,174.33 million/10 million = 317.43 per share.

8. The weighted-average cost of capital for PHB Company is

$$\text{WACC} = 0.30(7.0\%)(1 − 0.35) + 0.15(6.8\%) + 0.55(11.0\%) = 8.435\%$$

The firm value is

Firm value = $\text{FCFF}_0(1 + g)/(\text{WACC} − g)$

Firm value = 28(1.04)/(0.08435 − 0.04) = 29.12/0.04435 = $656.60 million

The value of equity is the firm value minus the value of debt minus the value of preferred stock: Equity = 656.60 − 145 − 65 = $446.60 million. Dividing this by the number of shares gives the estimated value per share of $446.60 million/8 million shares = $55.82. The estimated value for the stock is greater than the market price of $32.50, so the stock appears to be undervalued.

9. A. The required return on equity is

$$r = E(R_i) = R_F + \beta_i[E(R_M) − R_F] = 5.5\% + 0.90(5.5\%) = 10.45\%$$

The weighted-average cost of capital is

$$\text{WACC} = 0.25(7.0\%)(1 - 0.40) + 0.75(10.45\%) = 8.89\%$$

B. Firm value $= \text{FCFF}_0(1 + g)/(\text{WACC} - g)$
   Firm value $= 1.1559(1.04)/(0.0889 - 0.04) = \$24.583$ billion
C. Equity value $=$ Firm value $-$ Market value of debt
   Equity value $= 24.583 - 3.192 = \$21.391$ billion
D. Value per share $=$ Equity value/Number of shares
   Value per share $= 21.391/1.852 = \$11.55$

10. A. The required rate of return for McDonald's found with the CAPM is

$$r = E(R_i) = R_F + \beta_i[E(R_M) - R_F] = 5.08\% + 0.70(5.50\%) = 8.93\%$$

The value per share is

$$V_0 = \frac{\text{FCFE}_0(1 + g)}{r - g} = \frac{0.88(1.064)}{0.0893 - 0.064} = \$37.01$$

B. The table below shows the calculated price for McDonald's using the base case values for all values except for the variable being changed from the base case value.

| Variable | Estimated Price with Low Value | Estimated Price with High Value | Range (Rank) |
|---|---|---|---|
| Normalized FCFE$_0$ | $29.44 | $47.94 | $18.50 (3) |
| Risk-free rate | 38.22 | 35.33 | 2.89 (5) |
| Equity risk premium | 51.17 | 28.99 | 22.18 (2) |
| Beta | 47.29 | 30.40 | 16.89 (4) |
| FCFE perpetual growth rate | 18.56 | 48.79 | 30.23 (1) |

As the table shows, the value of McDonald's is most sensitive to the changes in the FCFE growth rate, with the price moving over a very wide range. The stock price of McDonald's is least sensitive to alternative values of the risk-free rate. Alternative values of beta, the equity risk premium, or the initial FCFE value also have a large impact on the value of the stock, although the impacts of these variables are smaller than that of the growth rate.

11. A. Using the CAPM, the required rate of return for Alcan is

$$r = E(R_i) = R_F + \beta_i[E(R_M) - R_F] = 7\% + 1.3(4\%) = 12.2\%$$

To estimate FCFE, use Equation 3-14:

$$\text{FCFE} = \text{Net income} - (1 - \text{DR})(\text{FCInv} - \text{Depreciation}) - (1 - \text{DR})(\text{WCInv})$$

where DR is the debt ratio—that is, new debt financing as a percentage of the net new investments in fixed capital and the increase in working capital. The following table shows net income, which grows at 20 percent annually for Years 1, 2, and 3, and then at 8 percent for Year 4. Investment (Capital expenditures − Depreciation + Investment

in WC) is $1,150 million in Year 1 and grows at 15 percent annually for Years 2 and 3. Debt financing is 40 percent of this investment. FCFE is NI − Investments + Financing. Finally, the present value of FCFE for Years 1, 2, and 3 is found by discounting at 12.2 percent.

| Year | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Net income | $ 720.00 | $ 864.00 | $1,036.80 | $1,119.74 |
| Investment in operating assets | 1,150.00 | 1,322.50 | 1,520.88 | 335.92 |
| New debt financing | 460.00 | 529.00 | 608.35 | 134.37 |
| Free cash flow to equity | 30.00 | 70.50 | 124.27 | 918.19 |
| PV of FCFE discounted at 12.2% | 26.74 | 56.00 | 87.98 | |

In Year 4, net income is 8 percent larger than in Year 3. In Year 4, the investment in operating assets is 30 percent of net income, and debt financing is 40 percent of this investment. The FCFE in Year 4 is $918.19 million. The value of FCFE after Year 3 is found using the constant-growth model:

$$V_3 = \frac{FCFE_4}{r - g} = \frac{918.19}{0.122 - 0.08} = \$21,861.67 \text{ million}$$

The present value of $V_3$ discounted at 12.2 percent is $15,477.64 million. The total value of equity, the present value of the first three years' FCFE plus the present value of $V_3$, is $15,648.36 million. Dividing this by the number of outstanding shares (318 million) gives a value per share of $49.21. For the first three years, Alcan has a small FCFE because of the large investments it is making during the high-growth phase. In the normal-growth phase, FCFE is much larger because the investments required are much smaller.

B. The planner's estimate of the share value of $70.98 is much higher than the FCFE model estimate of $49.21 for several reasons. First, taxes and interest expenses have a prior claim to the company's cash flow and should be taken out because these cash flows are not available to equity holders. The planner did not do this.

Second, EBITDA does not account for the company's reinvestments in operating assets. So, EBITDA overstates the funds available to stockholders if reinvestment needs exceed depreciation charges, which is the case for growing companies such as Alcan.

Third, EBITDA does not account for the company's capital structure. Using EBITDA to represent a benefit to stockholders (as opposed to stockholders and bondholders combined) is a mistake.

Finally, dividing EBITDA by the bond rate commits major errors as well. The risk-free bond rate is an inappropriate discount rate for risky equity cash flows; the proper measure is the required rate of return on the company's equity. Dividing by a fixed rate also assumes erroneously that the cash flow stream is a fixed perpetuity. EBITDA cannot be a perpetual stream because, if it were distributed, the stream would eventually decline to zero (lacking capital investments). Alcan is actually a growing company, so assuming it to be a nongrowing perpetuity is a mistake.

12. The table below develops the information to calculate FCFE.

| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|
| Growth rate for EPS | 21% | 18% | 15% | 12% | 9% | 6% |
| EPS | $3.630 | $4.283 | $4.926 | $5.517 | $6.014 | $6.374 |
| Capital expenditure per share | 5.000 | 5.000 | 4.500 | 4.000 | 3.500 | 1.500 |
| Investment in WC per share | 1.250 | 1.250 | 1.125 | 1.000 | 0.875 | 0.375 |
| New debt financing = 40% of (Capital expenditure + WCInv) | 2.500 | 2.500 | 2.250 | 2.000 | 1.750 | 0.750 |
| FCFE = NI − Capital expenditure − WCInv + New debt financing | −0.120 | 0.533 | 1.551 | 2.517 | 3.389 | 5.249 |
| PV of FCFE discounted at 12% | −0.107 | 0.425 | 1.104 | 1.600 | 1.923 | |

Earnings for 2002 are $3.00, and the EPS estimates for 2003 through 2008 in the table are found by increasing the previous year's earnings per share by that year's growth rate. The net capital expenditures each year were specified by the analyst. The increase in working capital per share is equal to 25 percent of net capital expenditures. Finally, debt financing is 40 percent of that year's total net capital expenditures and investment in working capital. For example, in 2003, net capital expenditures plus investment in working capital is $5.00 plus $1.25 = $6.25. Debt financing is 40 percent of $6.25, or $2.50. Debt financing for 2004 through 2008 is found in the same way.

FCFE equals net income minus net capital expenditures minus investment in working capital plus new debt financing. Notice that FCFE is initially negative in 2003 because of large capital investments and investments in working capital. As these investments decline relative to net income, FCFE becomes very substantial and positive.

The present values of FCFE from 2003 through 2007 are given in the bottom row of the table. These five present values sum to $4.944. Because the FCFE from 2008 onward will grow at a constant 6 percent, the constant-growth model can be used to value these cash flows.

$$V_{2007} = \frac{FCFE_{2008}}{r - g} = \frac{5.249}{0.12 - 0.06} = \$87.483$$

The present value of this stream is $87.483/(1.12)^5 = \$49.640$. The value per share is the value of the first five FCFE (2003 through 2007) plus the present value of the FCFE after 2007, or $4.944 + $49.640 = $54.58.

13. A. FCFE is defined as the cash flow remaining after the company meets all financial obligations, including debt payment, and covers all capital expenditure and working capital needs. FCFE measures how much a company can afford to pay out as dividends, but in a given year, FCFE may be more or less than the amount actually paid out.

Sundanci's FCFE for the year 2000 is calculated as follows:

| | |
|---|---|
| Net income | = $80 million |
| Plus: Depreciation expense | = 23 |
| Less: Capital expenditures | = 38 |
| Less: Investment in WC | = 41 |
| Equals: FCFE | = $24 million |
| Number of shares | = 84 million |
| FCFE per share | = $ 0.286 |

At the given dividend payout ratio, Sundanci's FCFE equals the dividends paid.

B. The FCFE model requires forecasts of FCFE for the high-growth years (2001 and 2002) plus a forecast for the first year of stable growth (2003) to allow for an estimate of the terminal value in 2002 based on perpetual growth. Because all of the components of FCFE are expected to grow at the same rate, the values can be obtained by projecting the FCFE at the common rate. (Alternatively, the components of FCFE can be projected and aggregated for each year.)

   The following template shows the process for estimating Sundanci's current value on a per share basis.

## Free Cash Flow to Equity

*Base Assumptions*

| | | | | |
|---|---|---|---|---|
| Shares outstanding (millions) | 84 | | | |
| Required return on equity ($r$) | 14% | | | |

| | | Actual 2000 | Projected 2001 27% | Projected 2002 27% | Projected 2003 13% |
|---|---|---|---|---|---|
| Growth Rate ($g$) | | | | | |
| | Total | | Per Share | | |
| Earnings after tax | $80 | $0.952 | $1.2090 | $1.5355 | $1.7351 |
| Plus: Depreciation expense | 23 | 0.274 | 0.3480 | 0.4419 | 0.4994 |
| Less: Capital expenditures | 38 | 0.452 | 0.5740 | 0.7290 | 0.8238 |
| Less: Increase in net working capital | 41 | 0.488 | 0.6198 | 0.7871 | 0.8894 |
| Equals: FCFE | 24 | 0.286 | 0.3632 | 0.4613 | 0.5213 |
| Terminal value[a] | | | | $52.1300 | |
| Total cash flows to equity[b] | | | $0.3632 | 52.5913 | |
| Discounted value[c] | | | 0.3186 | 40.4673 | |
| Current value per share[d] | $40.7859 | | | | |

*Notes:*
[a]Projected 2002 terminal value = Projected 2003 FCFE/$(r - g)$.
[b]Projected 2002 total cash flows to equity = Projected 2002 FCFE + Projected 2002 terminal value.
[c]Discounted values obtained using $r = 14$ percent.
[d]Current value per share = Discounted value 2001 + Discounted value 2002.

C. The following limitations of the DDM *are* addressed by the FCFE model: The DDM uses a strict definition of cash flows to equity—that is, the expected dividends on the common stock. The FCFE model expands the definition of cash flows to include the balance of residual cash flows after all financial obligations and investment needs have been met. Thus the FCFE model explicitly recognizes the company's investment and financing policies as well as its dividend policy. In instances of a change of corporate control, and thus the possibility of changing dividend policy, the FCFE model provides a better estimate of value.

Both two-stage valuation models allow for two distinct phases of growth: an initial finite period where the growth is abnormal, followed by a stable growth period that is expected to last forever. These two-stage models share the same limitations with respect to the growth assumptions.

First, there is the difficulty of defining the duration of the extraordinary growth period. For example, a longer period of high growth will lead to a higher valuation, and analysts may be tempted to assume an unrealistically long period of extraordinary growth.

Second, an assumption of a sudden shift from high growth to lower, stable growth is unrealistic. The transformation more likely will occur gradually over a period of time.

Third, because value is quite sensitive to the steady-state growth assumption, overestimating or underestimating this rate can lead to large errors in value. The two models share other limitations as well, notably difficulties in accurately estimating required rates of return.

14. A. Using a two-stage dividend discount model, the value of a share of Mackinac is calculated as follows:

$DPS_0$ = Cash dividends/Shares outstanding = $22,470/13,000 = $1.7285

$DPS_1 = DPS_0 \times 1.17 = \$2.0223$

$DPS_2 = DPS_0 \times 1.17^2 = \$2.3661$

$DPS_3 = DPS_0 \times 1.17^3 = \$2.7683$

$DPS_4 = DPS_0 \times 1.17^3 \times 1.09 = \$3.0175$

Using the CAPM, the required return on equity is

Cost of equity ($r$) = Government bond rate + (Beta $\times$ Equity risk premium)
$$= 0.06 + (1.25 \times 0.05) = 0.1225 \text{ or } 12.25\%$$

Value per share = $DPS_1/(1 + r) + DPS_2/(1 + r)^2 + DPS_3/(1 + r)^3$
$$+ [DPS_4/(r - g_{stable})]/(1 + r)^3$$

Value per share = $2.0223/1.1225 + $2.3661/1.1225^2 + $2.7683/1.1225^3$
$$+ [\$3.0175/(0.1225 - 0.09)]/1.1225^3$$
$$= \$1.8016 + \$1.8778 + \$1.9573 + \$65.6450 = \$71.28$$

B. Using the two-stage FCFE model, the value of a share of Mackinac is calculated as follows:

Net income = $37,450

Depreciation = $10,500

Capital expenditures = $15,000

Change in working capital = $5,500

New debt issuance − Principal repayments = Change in debt outstanding = $4,000

$FCFE_0$ = Net income + Depreciation − Capital expenditures − Change in working capital − Principal repayments + New debt issues

$FCFE_0$ = $37,450 + $10,500 − $15,000 − $5,500 + $4,000 = $31,450

$FCFE_0$ per share = $31,450/13,000 = $2.4192

$FCFE_1 = FCFE_0 \times 1.17 = \$2.8305$

$FCFE_2 = FCFE_0 \times 1.17^2 = \$3.3117$

$FCFE_3 = FCFE_0 \times 1.17^3 = \$3.8747$

$FCFE_4 = FCFE_0 \times 1.17^3 \times 1.09 = \$4.2234$

Cost of equity ($r$) = Government bond rate + (Beta × Equity risk premium)

= 0.06 + (1.25 × 0.05) = 0.1225 or 12.25%

Value per share = $FCFE_1/(1 + r) + FCFE_2/(1 + r)^2 + FCFE_3/(1 + r)^3$

+ $[FCFE_4/(r - g_{stable})]/(1 + r)^3$

Value per share = $\$2.8305/1.1225 + \$3.3117/1.1225^2 + \$3.8747/1.1225^3$

+ $[\$4.2234/(0.1225 - 0.09)]/1.1225^3$

= $\$2.5216 + \$2.6283 + \$2.7395 + \$91.8798 = \$99.77$

C. The FCFE model is best for valuing firms for takeovers or in situations that have a reasonable chance for a change in corporate control. Because controlling stockholders can change the dividend policy, they are interested in estimating the maximum residual cash flow after meeting all financial obligations and investment needs. The dividend discount model is based on the premise that the only cash flows received by stockholders are dividends. FCFE uses a more expansive definition to measure what a company can afford to pay out as dividends.

15. A. The real required rate of return for SK Telecom Co. is

| | |
|---|---|
| Country return (real) | 6.50% |
| Industry adjustment | +0.60 |
| Size adjustment | −0.10 |
| Leverage adjustment | +0.25 |
| Required rate of return | 7.25% |

B. The real growth rate of FCFE is expected to be the same as the country rate of 3.5 percent. The value of one share is

$$V_0 = \frac{FCFE_0(1 + g_{real})}{r_{real} - g_{real}} = \frac{1,300(1.035)}{0.0725 - 0.035} = 35,880 \text{ Korean won}$$

16. The required return for TNE, found with the CAPM, is $r = E(R_i) = R_F + \beta_i[E(R_M) - R_F] = 4.5\% + 2.0(5.0\%) = 14.5\%$. The estimated future values of FCFE are given in the following table.

| Year $t$ | Variable | Calculation | Value in Year $t$ | Present Value at 14.5% |
|---|---|---|---|---|
| 1 | $FCFE_1$ | 0.75(1.10) | $ 0.825 | $ 0.721 |
| 2 | $FCFE_2$ | 0.75(1.10)(1.26) | 1.040 | 0.793 |
| 3 | $FCFE_3$ | 0.75(1.10)(1.26)² | 1.310 | 0.873 |
| 4 | $FCFE_4$ | 0.75(1.10)(1.26)³ | 1.650 | 0.960 |
| 4 | $TV_4$ | $FCFE_5/(r - g)$ = 0.75(1.10)(1.26)³(1.06)/ (0.145 − 0.06) = 1.749/0.085 | 20.580 | 11.974 |
| 0 | | Total value = PV of FCFE for Years 1−4 + PV of terminal value | | $15.320 |

The FCFE grows at 10 percent for Year 1 and then at 26 percent for Years 2–4. These calculated values for FCFE are shown in the table. The present values of the FCFE for the first four years discounted at the required rate of return are given in the last column of the table. After Year 4, FCFE will grow at 6 percent forever, so the constant-growth FCFE model is used to find the terminal value at Time 4, which is $TV_4 = FCFE_5/(r - g)$.

TV$_4$ is discounted at the required return for four periods to find its present value, as shown in the table. Finally, the total value of the stock, $15.32, is the sum of the present values of the first four years' FCFE plus the present value of the terminal value.

17. The total value of nonoperating assets is

| | |
|---|---|
| Short-term securities | $ 60 million |
| Market value of noncurrent assets | 45 million |
| Pension fund surplus | 40 million |
| Nonoperating assets | $145 million |

The total value of the firm is the value of the operating assets plus the value of the non-operating assets, or $720 million + $145 million = $865 million. The equity value is the value of the firm minus the value of debt, or $865 million − $215 million = $650 million. The value per share is $650 million/100 million shares = $6.50 per share.

# MARKET-BASED VALUATION: PRICE MULTIPLES

## SOLUTIONS

1. A. Normal EPS is the level of earnings per share that the company could currently achieve under midcyclical conditions.
   B. Averaging EPS over the 1997–2000 period, we find that ($2.55 + $2.13 + $0.23 + $1.45)/4 = $1.59. According to the method of historical average EPS, SII's normal EPS is $1.59. The P/E based on this estimate is $57.98/$1.59 = 36.5.
   C. Averaging ROE over the 1997–2000 period, we find that (0.218 + 0.163 + 0.016 + 0.089)/4 = 0.1215. For current BVPS, we use the estimated value of $19.20. According to the method of average ROE, we have 0.1215 × $19.20 = $2.33 as normal EPS. The P/E based on this estimate is $57.98/$2.33 = 24.9.

2. A. The analyst can rank the two stocks by earnings yield (E/P). Whether EPS is positive or negative, a lower E/P reflects a richer valuation and a ranking from high to low E/P has a meaningful interpretation.

   In some cases, an analyst might handle negative EPS by using normal EPS in its place. Neither business, however, has a history of profitability. When year-ahead EPS is expected to be positive, leading P/E is positive. Thus the use of leading P/Es sometimes addresses the problem of trailing negative EPS. Leading P/E is not meaningful in this case, however, because next year's earnings are expected to be negative.
   B. Hand has an E/P of –0.100, and Somersault has an E/P of −0.125. A higher earnings yield has a similar interpretation to a lower P/E, and Hand appears to be relatively undervalued. The difference in earnings yield cannot be explained by differences in sales growth forecasts. In fact, Hand has a higher expected sales growth rate than Somersault. Therefore, the analyst should recommend Hand.

3. A. Because investing looks to the future, analysts often feature leading P/E when earnings forecasts are available, as they are here. But a specific reason to use leading

P/Es based on the facts given is that RUF had some unusual items affecting EPS for 2000. The data to make appropriate adjustments to RUF's 2000 EPS are not given. In summary, Stewart should use leading P/Es.

  B. Because RUF has a complex capital structure, the P/Es of the two companies must be compared on the basis of diluted EPS.

      For HS: leading P/E = $44/2.20 = 20

      For RUF: leading P/E per diluted share = $22.50/(30,000,000/33,333,333) = 25

Therefore, HS has the more attractive valuation at present. The problem illustrates some of the considerations that should be taken into account in using the P/Es and the method of comparables.

4. A. Your conclusion may be in error because of the following:

    • The peer group stocks themselves may be overvalued. Stated another way, the mean P/E of 18 may be too high in terms of intrinsic value. If that is the case, using 18 as a multiplier of the stock's expected EPS will lead to an estimate of stock value in excess of intrinsic value.

    • The stock's fundamentals may differ from those of the mean food processing industry stock. For example, if the stock's expected growth rate is lower than the mean industry growth rate and its risk is higher than the mean, the stock may deserve a lower P/E than the mean.

    In addition, mean P/E may be influenced by outliers.

  B. The following evidence supports the original conclusion:

    • Evidence that stocks in the industry are at least on average fairly valued (that stock prices reflect fundamentals).

    • Evidence that no significant differences exist in the fundamental drivers of P/E for comparing the stock with the average industry stock.

5. A. Yardeni's model uses corporate, rather than U.S. government, bond yields and incorporates an estimate of earnings growth to arrive at an estimate of the fair value of stock market.

  B. In principle, the use of any of this chapter's price multiples for valuation is vulnerable to this problem in comparing a company's characteristics to the overall market. If the stock market is overvalued, an asset that appears to be comparably valued may also be overvalued.

6. A. The formula for calculating P/E for a stable-growth company is the payout ratio divided by the difference between the required rate of return and the growth rate of dividends. If the P/E is being calculated on trailing earnings (Year 0), the payout ratio is increased by the growth rate.

    P/E based on trailing earnings:

$$P/E = [\text{Payout ratio} \times (1 + g)]/(r - g)$$
$$= (0.30 \times 1.13)/(0.14 - 0.13) = 33.9$$

    P/E based on next year's earnings:

$$P/E = \text{Payout ratio}/(r - g)$$
$$= 0.30/(0.14 - 0.13) = 30$$

B.

| Fundamental Factor | Effect on P/E | Explanation (Not Required in Question) |
|---|---|---|
| i. The risk (beta) of Sundanci increases substantially. | Decrease | P/E is a decreasing function of risk—as risk increases, the P/E decreases. Increases in the risk of Sundanci stock would be expected to lower the P/E. |
| ii. The estimated growth rate of Sundanci's earnings and dividends increases. | Increase | P/E is an increasing function of the growth rate of the company—the higher the expected growth, the higher the P/E. Sundanci would command a higher P/E if analysts increase the expected growth rate. |
| iii. The market risk premium increases. | Decrease | P/E is a decreasing function of the market risk premium. An increased market risk premium would increase the required rate of return, lowering the price of a stock relative to its earnings. A higher market risk premium would be expected to lower Sundanci's P/E. |

7.  A. We would expect the trailing P/E accorded to CSG to increase to 13.25 as anticipated by Yu. The colleague is referring to the sustainable growth rate expression $g = b \times$ ROE. The colleague's argument is that if ROE is level over the next several years, $b$ will need to increase (dividend payout will need to decrease) to support a higher (6 percent) growth rate. The idea is that if $b$ increases when growth becomes 6 percent, the P/E does not increase to 13.25. The argument concerning a change in dividend payout is incorrect. Any of the following arguments may be made:
    - Although ROE is expected to be flat only for several years, long-term ROE is the proper value to use in the sustainable growth rate expression.
    - If $b$ actually increases, $g$ will increase above 6 percent, offsetting the effect of $b$.
    - The sustainable growth rate expression assumes no external equity financing and keeping the capital structure constant (see Section 6.1 of Chapter 2). CSG can borrow, either short-term while ROE is flat or even long-term (possibly increasing debt's weight in the capital structure) to fund this growth. The company can also issue new stock. The sustainable growth rate formula cannot realistically serve as a basis to predict a cut in dividends.
    - Dividend payout, which is a discretionary decision of the board of directors, is not an economic fundamental. Investors look to the underlying cash flow of the business in valuation.
    B. Because Yu is correct, CSG should be added to the focus list.
8.  A. $V_n$ = Benchmark value of P/E × $E_n$ = 12 × $3.00 = $36.00
    B. In the sustainable growth rate expression $g = b \times$ ROE, we can use $(1 - 0.45) = 0.55 = b$, and ROE = 0.10 (the industry average), obtaining $0.55 \times 0.10 = 0.055$. Given the required rate of return of 0.09, we obtain the estimate $3.00(0.45)(1.055)/(0.09 - 0.055) = $40.69. In this case, the Gordon growth model estimate of terminal value is higher than the estimate based on multiples. The two estimates may differ

      for a number of reasons, including the sensitivity of the Gordon growth model to the values of inputs.

9. Although the measurement of book value has a number of widely recognized shortcomings, it can still be applied fruitfully in several categories of circumstances:

   • The company is not expected to continue as a going concern. When a company is likely to be liquidated (so that ongoing earnings and cash flow are not relevant) the value of its assets less its liabilities is of utmost importance. Naturally, the analyst must establish the fair value of these assets.

   • The company is composed mainly of liquid assets, such as finance, investment, insurance, and banking institutions.

   • The company's EPS is highly variable or negative.

10. A.     Avtech: P/S = $10 price per share/($1 billion sales/20 million shares)

                   = $10/($1,000,000,000/20,000,000) = 0.2

          Target: P/S = $20 price per share/($1.6 billion sales/30 million shares)

                   = $20/($1,600,000,000/$30,000,000) = 0.375

   Avtech has a more attractive valuation based on its lower P/S but comparable profit margins.

   B. One advantage of P/S over P/E is that companies' accounting decisions can have a much greater impact on reported earnings than they are likely to have on reported sales. Although companies are able to make a number of legitimate business and accounting decisions that affect earnings, their discretion over reported sales (revenue recognition) is more limited.

11. A. The P/Es are

   | | |
   |---|---|
   | Hormel | 25.70/1.30 = 19.8 |
   | Tyson | 11.77/0.40 = 29.4 |
   | IBP | 23.65/1.14 = 20.7 |
   | Smithfield | 24.61/2.31 = 10.7 |

   Sales per share are found by dividing sales by shares outstanding. Dividing this into the share price gives the P/Ss:

   | | |
   |---|---|
   | Hormel | 25.70/(4,124/138.923) = 25.70/29.69 = 0.866 |
   | Tyson | 11.77/(10,751/220.662) = 11.77/48.72 = 0.242 |
   | IBP | 23.65/(17,388/108.170) = 23.65/160.75 = 0.147 |
   | Smithfield | 24.61/(6,354/103.803) = 24.61/61.21 = 0.402 |

   B. If we rank the stocks by P/S from highest to lowest, we have

   | | P/S | Profit Margin |
   |---|---|---|
   | Hormel | 0.866 | 4.41% |
   | Smithfield | 0.402 | 3.99 |
   | Tyson | 0.242 | 0.82 |
   | IBP | 0.147 | 0.70 |

   The differences in P/S appear to be explained, at least in part, by differences in cost structure as measured by profit margin.

12. For companies in the industry described, P/S would be superior to either of the other two ratios. Among other considerations, P/S is
    - more useful in valuing companies with negative earnings;
    - better able to compare companies in different countries that are likely to use different accounting standards (a consequence of the multinational nature of the industry);
    - less subject to manipulation (i.e., managing earnings by management, a frequent consequence when companies are in a cyclical low and likely to report losses); and
    - not as volatile as P/E multiples and hence may be more reliable for use in valuation.
13. A. Using the CAPM, the required rate of return is 4.9% + (1.2 × 5.5%) = 11.5%.
    B. The dividend payout ratio is $0.64/$1.36 = 0.47. The justified values for the three valuation ratios should be

$$\frac{P_0}{E_0} = \frac{(1 - b) \times (1 + g)}{r - g} = \frac{0.47 \times 1.09}{0.115 - 0.09} = \frac{0.5123}{0.025} = 20.5$$

$$\frac{P_0}{B_0} = \frac{\text{ROE} - g}{r - g} = \frac{0.27 - 0.09}{0.115 - 0.09} = \frac{0.18}{0.025} = 7.2$$

$$\frac{P_0}{S_0} = \frac{\text{PM} \times (1 - b) \times (1 + g)}{r - g} = \frac{0.109 \times 0.47 \times 1.09}{0.115 - 0.09} = \frac{0.05584}{0.025} = 2.2$$

    C. The justified P/E is lower than the trailing P/E (20.5 versus 28.3), the justified P/B is higher than actual P/B (7.2 versus 7.1), and the justified P/S is lower than the actual P/S (2.2 versus 2.9). Therefore, based on P/E and P/S, GE appears to be overvalued but, based on P/B, appears to be slightly undervalued.
14. A. EBITDA = Net income (from continuing operations) + Interest expense + Taxes + Depreciation + Amortization

    EBITDA for NCI = €8 million + €5 million + €3 million + €4 million = €20 million
    Per-share EBITDA = (€20 million)/(2 million shares) = €10
    P/EBITDA for NCI = €100/€10 = 10

    EBITDA for RGI = €49.5 million + €3 million + €2 million + €8 million = €62.5 million
    Per-share EBITDA = (€62.5 million)/(5 million shares) = €12.5
    P/EBITDA for RGI = €150/€12.5 = 12

    B. Market value of equity for NCI = €100 × 2 million = €200 million
    Market value of debt for NCI = €100
    Total market value of NCI = €200 million + €100 = €300 million
    Enterprise value (EV) = €300 million − €2 million (cash and investments) = €298 million

    Now we divide EV by total (as opposed to per-share) EBITDA:
    - EV/EBITDA for NCI = (€298 million)/(€20 million) = 14.9

      Market value of equity for RGI = €150 × 5 million = €750 million
      Market value of debt for RGI = €50
      Total market value of RGI = €750 million + €50 = €800 million
      Enterprise value (EV) = €800 million − €5 million (cash and investments) = €795 million

Now we divide EV by total (as opposed to per-share) EBITDA:
- EV/EBITDA for RGI = (€795 million)/(€62.5 million) = 12.72

C. Zaldys should select RGI as relatively undervalued.

First, it is correct that NCI *appears* to be relatively undervalued based on P/EBITDA, because NCI has a lower P/EBITDA multiple:
- P/EBITDA = €150/€12.5 = 12 for RGI
- P/EBITDA = €100/€10 = 10 for NCI

RGI is relatively undervalued based on EV/EBITDA, however, because RGI has the lower EV/EBITDA multiple:
- EV/EBITDA = (€795 million)/(€62.5 million) = 12.72 for RGI
- EV/EBITDA = (€298 million)/(€20 million) = 14.9 for NCI

EBITDA is a pre-interest flow; therefore, it is a flow to both debt and equity and the EV/EBITDA multiple is more appropriate than the P/EBITDA multiple. Zaldys would rely on EV/EBITDA to reach his decision when the two ratios conflict. Note that P/EBITDA does not take into account differences in the use of financial leverage. Substantial differences in leverage exist in this case (NCI uses much more debt), so the preference for EV/EBITDA over P/EBITDA is increased.

15. The major cash flow concepts are:
   - EPS plus per-share depreciation, amortization, and depletion (CF).
     *Limitation:* Ignores changes in working capital and noncash revenue. Not a free cash flow concept.
   - Cash flow from operations (CFO).
     *Limitation:* Not a free cash flow concept, so not directly linked to theory.
   - Free cash flow to equity (FCFE).
     *Limitation:* Often more variable and more frequently negative than other cash flow concepts.
   - Earnings before interest, taxes, depreciation, and amortization (EBITDA).
     *Limitation:* Ignores changes in working capital and noncash revenue. Not a free cash flow concept. Relative to its use in P/EBITDA, EBITDA is mismatched with the numerator because it is a pre-interest concept.

16. MAT Technology is relatively undervalued compared with DriveMed based on a P/FCFE multiple that is 34 percent the size of DriveMed's FCFE multiple (15.6/46 = 0.34, or 34%). The only comparison that is slightly in DriveMed's favor, or approximately equal, is that based on P/CF (12.8 for DriveMed versus 13.0 for MAT Technology). However, FCFE is more strongly grounded in valuation theory than P/CF. Because DriveMed's and MAT Technology's expenditures in fixed capital and working capital during the previous year reflected anticipated average expenditures over the foreseeable horizon, we have additional confidence with the P/FCFE comparison.

17. A. Relative strength is based strictly on price movement (a technical indicator). As used by Westard, the comparison is between the returns on HCI and the returns on the S&P 500. In contrast, the price-multiple approaches are based on the relationship of current price not to past prices, but to some measure of value such as EPS, book value, sales, or cash flow.

   B. Only the reference to the P/E in relation to the pending patent applications in Westard's recommendation is consistent with the company's value orientation, because it addresses HCI's P/E in relation to expected future earnings.

18. A. The most restrictive criterion as judged by the number of stocks meeting it is the dividend yield criterion, which results in only 10 eligible investments. The screen strongly emphasizes dividend yield as a valuation indicator.
    B. The screen may be too narrowly focused on dividend yield. It did not include variables related to expected growth, required rate of return or risk, or financial strength.
    C. The screen results in a very concentrated portfolio. Except for Eastman Kodak, the companies are all utilities, which typically pay high dividends. They belong to a very small segment of the investment universe and would constitute a narrowly focused and nondiversified portfolio.

# RESIDUAL INCOME VALUATION

## SOLUTIONS

1. Yes, VIM earned a positive residual income:

| EBIT | $300,000 |
|---|---|
| Interest | −120,000 (2,000,000 × 6%) |
| Pretax income | $180,000 |
| Tax expense | − 72,000 |
| Net income | $108,000 |

$$\text{Equity charge} = \text{Equity capital} \times \text{Required return on equity}$$
$$= (1/3)(\$3,000,000) \times 0.10$$
$$= \$1,000,000 \times 0.10 = \$100,000$$
$$\text{Residual income} = \text{Net income} - \text{Equity charge}$$
$$= \$108,000 - \$100,000 = \$8,000$$

2. According to the residual income model, intrinsic value for a share of common stock equals book value per share plus the present value of expected future per-share residual income. Book value per share was given as $20. Noting that debt is $(2/3)(\$3,000,000) = \$2,000,000$ so that interest is $\$2,000,000 \times 6\% = \$120,000$, we find that VIM has residual income of $8,000 calculated (as in Problem 1) as follows:

$$\text{Residual income} = \text{Net income} - \text{Equity charge}$$
$$= [(\text{EBIT} - \text{Interest})(1 - \text{Tax rate})] - [(\text{Equity capital})$$
$$\times (\text{Required return on equity})]$$
$$= [(\$300,000 - \$120,000)(1 - 0.40)] - [(\$1,000,000)(0.10)]$$
$$= \$108,000 - \$100,000 = \$8,000$$

Therefore, residual income per share is $8,000/50,000 shares = $0.16 per share. Because EBIT is expected to continue at the current level indefinitely, we treat the expected per-share residual income of $0.16 as a perpetuity. With a required return on equity of 10 percent, we have

$$\text{Intrinsic value} = \$20 + \$0.16/0.10 = \$20 + \$1.60 = \$21.60$$

3. With $g = b \times \text{ROE} = (1 - 0.80)(0.15) = (0.20)(0.15) = 0.03$,

$$\begin{aligned}
\text{P/B} &= (\text{ROE} - g)/(r - g) \\
&= (0.15 - 0.03)/(0.12 - 0.03) \\
&= 0.12/0.09 = 1.33
\end{aligned}$$

or

$$\begin{aligned}
\text{P/B} &= 1 + (\text{ROE} - r)/(r - g) \\
&= 1 + (0.15 - 0.12)/(0.12 - 0.03) = 1.33
\end{aligned}$$

4. In this problem, interest expense has already been deducted in arriving at NMP's pretax income of $5.1 million. Therefore,

$$\begin{aligned}
\text{Net income} \quad &= \text{Pretax income} \times (1 - \text{Tax rate}) \\
&= \$5.1 \text{ million} \times (1 - 0.40) \\
&= \$5.1 \times 0.60 = \$3.06 \text{ million} \\
\text{Equity charge} \quad &= \text{Total equity} \times \text{Cost of equity capital} \\
&= (0.10 \times \$450 \text{ million}) \times 12\% \\
&= \$45 \text{ million} \times 0.12 = \$5,400,000 \\
\text{Residual income} &= \text{Net income} - \text{Equity charge} \\
&= \$3,060,000 - \$5,400,000 = -\$2,340,000
\end{aligned}$$

NMP had negative residual income of $-\$2,340,000$ in 2001.

5. To achieve a positive residual income, a company's net operating profit after taxes (NOPAT) as a percentage of its total assets can be compared with the weighted-average cost of its capital. For SWI:

NOPAT/Assets = €10 million/€100 million = 10%
WACC       = (0.5)(After-tax cost of debt) + (0.5)(Cost of equity)
          = (0.5)(0.09)(0.6) + (0.5)(0.12)
          = (0.5)(0.054) + (0.5)(0.12) = 0.027 + 0.06 = 0.087 = 8.7%

Therefore, SWI's residual income was positive. Specifically, residual income equals $(0.10 - 0.087) \times €100$ million = €1.3 million.

6. A.   EVA = NOPAT − WACC × (Beginning book value of assets)
       = 100 − (11%) × (200 + 300) = 100 − (11%)(500) = \$45

   B.   $\text{RI}_t = E_t - rB_{t-1}$
       = 5.00 − (11%)(30.00) = 5.00 − 3.30 = €1.70

   C.   $\text{RI}_t = (\text{ROE}_t - r) \times B_{t-1}$
       = (18% − 12%) × (30) = €1.80

7. A. Economic value added = Net operating profit after taxes − (Cost of capital × Total capital) = \$100 million − (14% × \$700 million) = \$2 million. In the absence of information that would be required to calculate the weighted average cost of debt and equity, and given that Sundanci has no long-term debt, the only capital cost used is the required rate of return on equity of 14 percent.

   B. Market value added = Market value of capital − Total capital = (\$26 stock price × 84 million shares) − \$700 million = \$1.484 billion.

8. A. Because the dividend is a perpetuity, the no-growth form of the DDM is applied as follows:

$$V_0 = D/r = \$0.60/0.12 = \$5.00 \text{ per share}$$

B. According to the residual income model, $V_0$ = Book value per share + Present value of expected future per-share residual income.

$$RI_t = E - rB_{t-1}$$
$$= \$0.60 - (0.12)(\$6.00) = -\$0.12$$

Present value of perpetual stream of residual income =

$$RI_t/r = -\$0.12/0.12 = -\$1.00.$$
$$V_0 = \$6.00 - \$1.00 = \$5.00 \text{ per share}$$

9. A. According to the DDM, $V_0 = D/r$ for a no-growth company.

$$V_0 = \$2.00/0.125 = \$16 \text{ per share}$$

B. Under the residual income model, $V_0 = B_0$ + Present value of expected future per-share residual income:

$$RI_t = E - rB_{t-1}$$
$$= \$2.00 - (0.125)(\$10) = \$0.75$$

Present value of stream of residual income =

$$RI_t/r = 0.75/0.125 = \$6.00.$$
$$V_0 = \$10 + \$6 = \$16 \text{ per share}$$

10. A.           $V_0$ = Present value of the future dividends
$$= 2/1.10 + 2.50/(1.1)^2 + 20.50/(1.1)^3$$
$$= \$1.818 + \$2.066 + \$15.402 = \$19.286$$

B. The book values and residual incomes for the next three years are:

| Year | 1 | 2 | 3 |
|---|---|---|---|
| Beginning book value | $8.00 | $10.00 | $12.50 |
| Retained earnings (Net income − Dividends) | 2.00 | 2.50 | (12.50) |
| Ending book value | 10.00 | 12.50 | 0.00 |
| Net income | 4.00 | 5.00 | 8.00 |
| Less: Equity charge ($r \times$ Book value) | 0.80 | 1.00 | 1.25 |
| Residual income | 3.20 | 4.00 | 6.75 |

$$V_0 = 8.00 + 3.20/1.1 + 4.00/(1.1)^2 + 6.75/(1.1)^3$$
$$V_0 = 8.00 + 2.909 + 3.306 + 5.071 = \$19.286$$

C.

| Year | 1 | 2 | 3 |
|---|---|---|---|
| Net income | $4.00 | $5.00 | $8.00 |
| Beginning book value | $8.00 | $10.00 | $12.50 |
| Return on equity (ROE) | 50% | 50% | 64% |
| ROE − $r$ | 40% | 40% | 54% |
| Residual income (ROE − $r$) × Book value | $3.20 | $4.00 | $6.75 |

$$V_0 = 8.00 + 3.20/1.1 + 4.00/(1.1)^2 + 6.75/(1.1)^3$$
$$V_0 = 8.00 + 2.909 + 3.306 + 5.071 = \$19.286$$

*Note:* Because the residual incomes for each year are necessarily the same in Parts B and C, the results for stock valuation are identical.

11.

| Year | 2001 | 2002 | 2005 |
|---|---|---|---|
| Beginning book value | $30.00 | $33.00 | $43.92 |
| Net income = ROE × Book value | 4.50 | 4.95 | 6.59 |
| Dividends | 1.50 | 1.65 | 2.20 |
| Equity charge ($r$ × Book value) | 3.60 | 3.96 | 5.27 |
| Residual income | 0.90 | 0.99 | 1.32 |
| Ending book value | 33.00 | 36.30 | 48.32 |

The table shows that residual income in Year 2001 is $0.90: Book value at beginning of year × (ROE − $r$) = $30 × (0.15 − 0.12) = $0.90. By examining the Year 2002 column, one can see that residual income grew by 10 percent to $0.99, which follows from the fact that growth in residual income relates directly to the growth in net income as this company is configured. When both net income and dividends are a function of book value and return on equity is constant, then growth can be predicted from $g$ = (ROE) (1 − Dividend payout ratio). In this case, $g$ = 0.15 × (1 − 0.333) = 0.10 or 10 percent. Net income and residual income will grow by 10 percent annually.

Therefore, residual income in Year 2005 = Residual income in Year 2001 × $(1.1)^4$. Residual income in Year 2005 = 0.90 × 1.4641 = $1.32.

12. When items such as changes in the value of available-for-sale securities bypass the income statement, they are generally assumed to be nonoperating items that will fluctuate from year to year, although averaging to zero over a period of years. The evidence suggests, however, that changes in the value of available-for-sale securities are not averaging to zero but are persistently negative. Furthermore, these losses are bypassing the income statement. It appears that the company is either making an inaccurate assumption or misleading investors in one way or another. Accordingly, Kent might adjust LE's income downward by the amount of loss for other comprehensive income for each of those years. ROE would then decline commensurately. LE's book value would *not* be misstated, because the decline in the value of these securities was already recognized.

13.
$$V_0 = B_0 + [(ROE − r)/(r − g)] × B_0$$
$$= \$20 + [(0.18 − 0.14)/(0.14 − 0.10)] × \$20$$
$$= \$20 + 1.0(\$20) = \$40$$

Simms will probably conclude that the shares are somewhat undervalued.

14.
$$V_0 = B_0 + (ROE − r) × B_0/(r − g)$$
$$= \$30 + (0.15 − 0.12) × \$30/(0.12 − 0.10)$$
$$= \$30 + \$45 = \$75 \text{ per share}$$

15.

| Year | Net Income (Projected) | Ending Book Value | ROE | Equity Charge | Residual Income | PV of RI |
|------|------------------------|-------------------|-----|---------------|-----------------|----------|
| 2001 |        | $10.00 |     |        |        |        |
| 2002 | $1.50  | 11.50  | 15% | $1.00  | $0.50  | $0.45  |
| 2003 | 1.73   | 13.23  | 15  | 1.15   | 0.58   | 0.48   |
| 2004 | 1.99   | 15.22  | 15  | 1.32   | 0.67   | 0.50   |
| 2005 | 2.29   | 17.51  | 15  | 1.52   | 0.77   | 0.53   |
| 2006 | 2.63   | 20.14  | 15  | 1.75   | 0.88   | 0.55   |
|      |        |        |     |        |        | $2.51  |

Using the finite horizon form of residual income valuation,

$$V_0 = B_0 + \text{Sum of discounted RIs} + \text{Premium (also discounted to present)}$$
$$= \$10 + \$2.51 + (0.20)(20.14)/(1.10)^5$$
$$= \$10 + \$2.51 + \$2.50 = \$15.01$$

16. The present value of the terminal value would then be

$$\text{RI}_T/(1 + r - \omega)(1 + r)^{T-1} = 48.86/(1 + 0.1433 - 0.90)(1.1433)^{20} = \text{TWD}13.79$$

Total value is $59.18 + 13.79 = \text{TWD}72.97$. The analyst would again conclude that TSM's shares are overvalued.

17. The value of TSM for the forecast period would be

| Year | Net Income (Projected) | Book Value | Forecast ROE (Beg. Equity) | Cost of Equity | Equity Charge (TWD) | Residual Income | PV of RI | Total |
|------|------------------------|------------|----------------------------|----------------|---------------------|-----------------|----------|-------|
| 2001 |        | 16.47    |        |        |        |       | 16.47  | 62.11 |
| 2002 | 2.07   | 18.54    | 12.57% | 14.33% | 2.36   | −0.29 | (0.25) |       |
| 2003 | 4.81   | 23.35    | 25.94  | 14.33  | 2.66   | 2.15  | 1.65   |       |
| 2004 | 5.84   | 29.19    | 25.00  | 14.33  | 3.35   | 2.49  | 1.67   |       |
| 2005 | 7.30   | 36.48    | 25.00  | 14.33  | 4.18   | 3.11  | 1.82   |       |
| 2006 | 9.12   | 45.61    | 25.00  | 14.33  | 5.23   | 3.89  | 1.99   |       |
| 2007 | 11.40  | 57.01    | 25.00  | 14.33  | 6.54   | 4.87  | 2.18   |       |
| 2008 | 14.25  | 71.26    | 25.00  | 14.33  | 8.17   | 6.08  | 2.38   |       |
| 2009 | 17.81  | 89.07    | 25.00  | 14.33  | 10.21  | 7.60  | 2.60   |       |
| 2010 | 22.27  | 111.34   | 25.00  | 14.33  | 12.76  | 9.50  | 2.85   |       |
| 2011 | 27.84  | 139.18   | 25.00  | 14.33  | 15.96  | 11.88 | 3.11   |       |
| 2012 | 27.84  | 167.01   | 20.00  | 14.33  | 19.94  | 7.89  | 1.81   |       |
| 2013 | 33.40  | 200.41   | 20.00  | 14.33  | 23.93  | 9.47  | 1.90   |       |
| 2014 | 40.08  | 240.50   | 20.00  | 14.33  | 28.72  | 11.36 | 1.99   |       |
| 2015 | 48.10  | 288.60   | 20.00  | 14.33  | 34.46  | 13.64 | 2.09   |       |
| 2016 | 57.72  | 346.32   | 20.00  | 14.33  | 41.36  | 16.36 | 2.20   |       |
| 2017 | 69.26  | 415.58   | 20.00  | 14.33  | 49.63  | 19.64 | 2.30   |       |
| 2018 | 83.12  | 498.70   | 20.00  | 14.33  | 59.55  | 23.56 | 2.42   |       |
| 2019 | 99.74  | 598.43   | 20.00  | 14.33  | 71.46  | 28.28 | 2.54   |       |
| 2020 | 119.69 | 718.12   | 20.00  | 14.33  | 85.76  | 33.93 | 2.66   |       |
| 2021 | 143.62 | 861.75   | 20.00  | 14.33  | 102.91 | 40.72 | 2.80   |       |
| 2022 | 172.35 | 1,034.10 | 20.00  | 14.33  | 123.49 | 48.86 | 2.93   |       |
| 2023 | 206.82 | 1,240.91 | 20.00  | 14.33  | 148.19 | 58.63 |        |       |

The present value of the terminal value would then be

$\text{RI}_T/(1 + r - \omega)(1 + r)^{T-1} = 58.63/(1 + 0.1433 - 0.90)(1.1433)^{21} = \text{TWD}14.47$

Total value is $62.11 + 14.47 = \text{TWD}76.58$. The analyst would again conclude that TSM's shares are overvalued.

18. A. The table below shows calculations for book values, net income, and dividends.

| Year | Beginning Book Value | Net Income | Dividend | Ending Book Value | Residual Income | PV of RI |
|------|---------------------|------------|----------|-------------------|-----------------|----------|
| 1 | $9.620 | $2.116 | $0.635 | $11.101 | $1.318 | $1.217 |
| 2 | 11.101 | 2.442 | 0.733 | 12.811 | 1.521 | 1.297 |
| 3 | 12.811 | 2.818 | 0.846 | 14.784 | 1.755 | 1.382 |
| 4 | 14.784 | 3.252 | 0.976 | 17.061 | 2.025 | 1.472 |
| 5 | 17.061 | 3.753 | 1.126 | 19.688 | 2.337 | 1.569 |
| 6 | 19.688 | 4.331 | 1.299 | 22.720 | 2.697 | 1.672 |
| 7 | 22.720 | 4.998 | 1.500 | 26.219 | 3.113 | 1.781 |
| 8 | 26.219 | 5.768 | 1.730 | 30.257 | 3.592 | 1.898 |

For each year above, net income is 22 percent of beginning book value. Dividends are 30 percent of net income. The ending book value is the beginning book value plus net income minus dividends.

B. Residual income is Net income − Cost of equity (%) × Beginning book value. To find the cost of equity,

$$r = R_F + \beta_i[E(R_M) - R_F] = 5\% + (0.60)(5.5\%) = 8.30\%$$

For Year 1 in the table above,

Residual income $= 2.116 - (8.30\%)(9.62) = 2.116 - 0.798 = \$1.318$

This same calculation is repeated for Years 2 through 8. The final column of the table gives the present value of the calculated residual income, discounted at 8.30 percent.

C. To find the stock value with the residual income method, we use the equation

$$V_0 = B_0 + \sum_{t=1}^{T} \frac{(E_t - rB_{t-1})}{(1 + r)^t} + \frac{P_T - B_T}{(1 + r)^T}$$

In this equation, $B_0$ is the current book value per share of $9.62. The sum of the present values of the eight years' residual income is the sum of the present values of the residual incomes in the table above, $12.288. We need to estimate the final term, the present value of the excess of the terminal stock price over the terminal book value. The terminal stock price is assumed to be three times the terminal book value, or $P_T = 3.0(30.257) = \$90.771$. $P_T - B_T$ is $90.771 - 30.257 = \$60.514$. The present value of this amount discounted at 8.30 percent for eight years is $31.976. Adding these terms together gives a stock price of $V_0 = 9.62 + 12.288 + 31.976 = \$53.884$.

D. The appropriate DDM expression is

$$V_0 = \sum_{t=1}^{T} \frac{D_t}{(1 + r)^t} + \frac{P_T}{(1 + r)^T}$$

We have calculated the dividends and terminal stock price above. Discounting them at 8.30 percent would give the value of the stock:

| Year | Dividend | PV of Dividend |
|------|----------|----------------|
| 1 | $0.635 | $0.586 |
| 2 | 0.733 | 0.625 |
| 3 | 0.846 | 0.666 |
| 4 | 0.976 | 0.709 |
| 5 | 1.126 | 0.756 |
| 6 | 1.299 | 0.805 |
| 7 | 1.500 | 0.858 |
| 8 | 1.730 | 0.914 |
| Total | | $5.919 |

The present value of the eight dividends is $5.92. The terminal stock price is assumed to be $90.771, which is worth $47.964 discounted at 8.30 percent for eight years. The value for the stock, the present value of the dividends plus the present value of the terminal stock price, is $V_0 = \$5.92 + \$47.964 = \$53.884$. The stock values estimated with the residual income model and the dividend discount model are identical. Because they are based on similar financial assumptions, this equivalency is expected. Even though the recognition of income differs between the two models, their final results are the same.

19. A. The justified P/B can be found with the following formula:

$$\frac{P_0}{B_0} = 1 + \frac{\text{ROE} - r}{r - g}$$

ROE is 20%, $g$ is 6%, and $r = R_F + \beta_i[E(R_M) - R_F] = 5\% + (0.80)(5.5\%) = 9.4\%$. Substituting in the values gives a justified P/B of

$$\frac{P_0}{B_0} = 1 + \frac{0.20 - 0.094}{0.094 - 0.06} = 4.12$$

The assumed parameters give a justified P/B of 4.12, slightly above the current value of 3.57.

B. To find the ROE that would result in a P/B of 3.57, we substitute 3.57, $r$, and $g$ into the following equation:

$$\frac{P_0}{B_0} = 1 + \frac{\text{ROE} - r}{r - g}$$

This yields

$$3.57 = 1 + \frac{\text{ROE} - 0.094}{0.094 - 0.06}$$

Solving for ROE, after several steps we finally derive an ROE of 0.18138 or 18.1 percent. This value of ROE is consistent with a P/B of 3.57.

C. To find the growth rate that would result in a P/B of 3.57, we use the expression given in Part B, solving for $g$ instead of ROE:

$$\frac{P_0}{B_0} = 1 + \frac{\text{ROE} - r}{r - g}$$

Substituting in the values, we have

$$3.57 = 1 + \frac{0.20 - 0.094}{0.094 - g}$$

Solving for $g$, after several steps we obtain a growth rate of 0.05275 or 5.3 percent. Assuming that the single-stage growth model is applicable to Boeing, the current P/B and current market price can be justified with values for ROE or $g$ that are not much different from our starting values of 20 percent and 6 percent, respectively.

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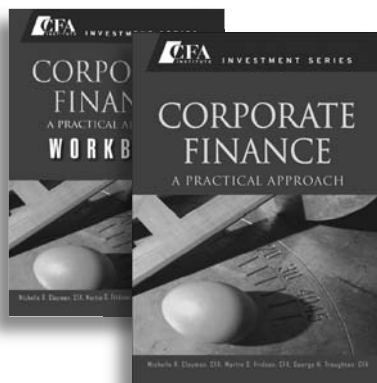
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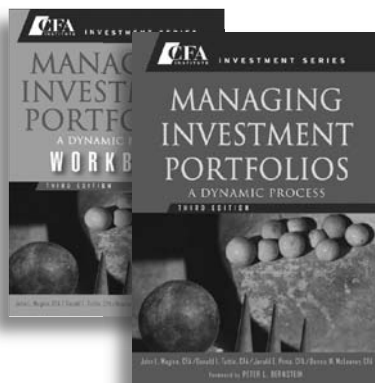
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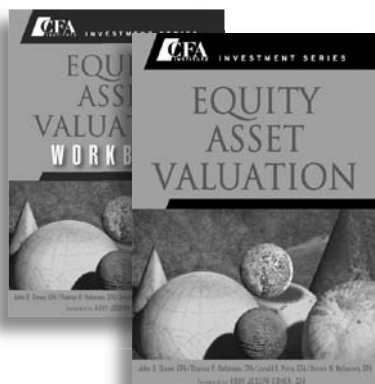Jerald E. Pinto, David E. Runkle
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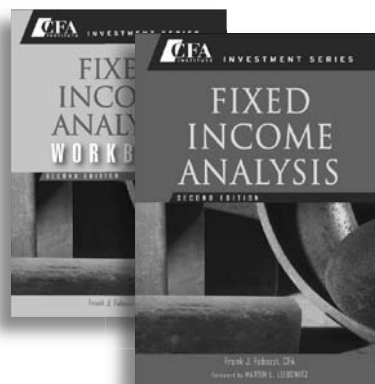Elaine Henry, Michael A. Broihahn
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