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-tobook 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.

1 INTRODUCTION

Residual income models of equity value have become widely recognized tools in both investment practice and research. Conceptually, residual income is net income less a charge (deduction) for common shareholders' opportunity cost in generating net income. As an economic concept, residual income has a long history. As far back as the 1920s, General Motors employed the concept in evaluating business segments.¹ More recently, residual income has received renewed attention and interest, sometimes under names such as economic profit, abnormal earnings, or economic value added.

The appeal of residual income models stems from a shortcoming of traditional accounting. Specifically, although a company's income statement includes a charge for the cost of debt capital in the form of interest expense, it does not include a charge for the cost of equity capital. A company can have positive net income but may still not be adding value for shareholders if it does not earn more than the cost of equity capital. Residual income concepts have been used in a variety of contexts, including the measurement of internal corporate performance. This chapter, however, will focus on the residual income model for estimating the intrinsic value of common stock. Among the questions we will study to help us use residual income models professionally are the following:

- How is residual income measured, and how can an analyst use residual income in valuation?
- How does residual income relate to fundamentals, such as return on equity and earnings growth rates?
- How is residual income linked to other valuation methods, such as a price-multiple approach?
- What challenges arise in applying residual income valuation internationally?

The chapter is organized as follows: In Section 2, we develop the concept of residual income and present alternative measures used in practice. In Section 3, we derive the residual income valuation model and illustrate its use in valuing common stock. Section 4 addresses accounting and international issues in the use of residual income valuation. In subsequent sections, we present practical applications of residual income models: Section 5 presents the single-stage (constant-growth) residual income model, and Section 6 presents multistage residual income models. We summarize the chapter in Section 7.

2 RESIDUAL INCOME

Traditional financial statements, particularly the income statement, are prepared to reflect earnings available to owners. As a result, net income includes an expense to represent the cost of debt capital in the form of interest expense. Dividends or other charges for equity capital, however, are not deducted. Traditional accounting lets the owners decide whether earnings cover their opportunity costs. The economic concept of residual income, on the other hand, explicitly deducts the estimated cost of equity capital, the finance concept that measures shareholders' opportunity costs. Residual income models have been used to value

¹ See, for example, Young (1999) and Lo and Lys (2000).

both individual stocks² and the Dow Jones Industrial Average³ and have been proposed as a solution to measuring goodwill impairment by accounting standard setters.⁴ Residual income models have been found more useful than some other major present value models of equity value in explaining stock prices (American Accounting Association, 2001). Example 5-1 illustrates, in a stylized setting, the calculation and interpretation of residual income.⁵

EXAMPLE 5-1. The Calculation of Residual Income.

Axis Manufacturing Company, Inc. (AXCI), a very small company in terms of market capitalization, has total assets of $\notin 2,000,000$ financed 50 percent with debt and 50 percent with equity capital. The cost of debt capital is 7 percent before taxes (4.9 percent after taxes) and the cost of equity capital is 12 percent.⁶ The company has earnings before interest and taxes (EBIT) of $\notin 200,000$ and a tax rate of 30 percent. Net income for AXCI can be determined as follows:

EBIT	€200,000
Less: Interest Expense	70,000
Pretax Income	€130,000
Less: Income Tax Expense	39,000
Net Income	€91,000

With earnings of €91,000, AXCI is clearly profitable in an accounting sense. But was the company profitable enough to satisfy its owners? Unfortunately, it was not. To incorporate the cost of equity capital, we compute residual income. One approach to calculating residual income is to deduct an **equity charge** (the estimated cost of equity capital in money terms) from net income. We compute the equity charge as follows:

Equity charge = Equity capital × Cost of equity capital in percent = $\notin 1,000,000 \times 12\% = \notin 120,000.$

As stated, residual income is equal to net income minus the equity charge:

Net Income	€91,000
Equity Charge	120,000
Residual Income	€(29,000)

AXCI did not earn enough to cover the cost of equity capital. As a result, it has negative residual income. Although AXCI is profitable in an accounting sense, it is not profitable in an economic sense.

² See Fleck, Craig, Bodenstab, Harris, and Huh (2001).

³ See Lee and Swaminathan (1999) and Lee, Myers, and Swaminathan (1999).

⁴ See American Accounting Association Financial Accounting Standards Committee (2001). **Impairment** in an accounting context means downward adjustment. **Goodwill**, in this context, is an intangible asset that may appear on a company's balance sheet as a result of its purchase of another company.

⁵ To simplify the following introduction, we assume here that net income accurately reflects *clean surplus accounting*, which we will explain later in this chapter. Our discussions in this chapter assume that companies' financing consists of common equity and debt only. In the case of a company that also has preferred stock financing, the calculation of residual income would reflect the deduction of preferred stock dividends from net income.

⁶ See Chapter 2 for a discussion of estimating required rates of return for equity.

In Example 5-1, we calculated residual income based on net income and a charge for the cost of equity capital. Analysts will also encounter another approach to calculating residual income that yields the same results. In this second approach, which takes the perspective of all providers of capital (both debt and equity), we subtract a capital charge (the company's total cost of capital in money terms) from the company's after-tax operating profit. In the case of AXCI in Example 5-1, net operating profit after taxes (NOPAT) is €140,000 (€200,000 less 30 percent taxes). AXCI's after-tax weighted-average cost of capital (WACC) is 8.45 percent, computed as 50 percent (capital structure weight of equity) times the cost of equity of 12 percent plus 50 percent (capital structure weight of debt) times the after-tax cost of debt, 4.9 percent.⁷ The capital charge is $\notin 169,000 (= 8.45\% \times 10^{-7})$ \pounds 2,000,000), which is higher than its after-tax operating profit of \pounds 140,000 by \pounds 29,000, the same figure obtained in Example 5-1. That the company is not profitable in an economic sense can also be seen by comparing the company's WACC, 8.45 percent, with after-tax operating profits as a percent of total assets (the after-tax net operating return on total assets or capital). The after-tax net operating return on total assets is €140,000/€2,000,000 = 7 percent, which is less than WACC by 1.45 percentage points.⁸

We can illustrate the impact of residual income on equity valuation using the case of AXCI presented in Example 5-1. Assume the following:

- Initially, AXCI equity is selling for book value or €1,000,000, with 100,000 shares outstanding. Thus, AXCI's book value per share and initial share price are both €10.
- Earnings per share (EPS) are €91,000/100,000 = €0.91.
- Earnings will continue at the current level indefinitely.
- All net income is distributed as dividends.

Because AXCI is not earning its cost of equity, as shown in Example 5-1, the company's share price should fall. In Chapter 2, we explained that for a no-growth company, as here, the earnings yield (E/P) is an estimate of the expected rate of return. Therefore, when price reaches the point at which E/P equals the required rate of return on equity, an investment in the stock is expected to just cover the stock's required rate of return. With EPS of €0.91, the earnings yield is exactly 12 percent (AXCI's cost of equity) when share price is €7.58333. At a share price of €7.58333, the total market value of AXCI equity is €758,333. At this level, the equity charge is €91,000 ($€758,333 \times 12\%$) and residual income is zero. When a company has negative residual income, we expect shares to sell at a discount to book value. In this example, AXCI's price-to-book ratio (P/B) would be 0.7583. Conversely, if we changed the data in Example 5-1 so that AXCI earned positive residual income, we would conclude that its shares would sell at a premium to book value. In summary, we expect higher residual income to be associated with higher market prices (and higher P/Bs), all else equal.

Residual income and residual income valuation models have been referred to by a variety of names. Residual income has sometimes been called **economic profit** because it represents the economic profit of the company after deducting the cost of all capital, debt, and

⁷ This example of the weighted-average cost of capital assumes that interest is tax deductible. In countries where corporate interest is not tax deductible, the after-tax cost of debt would equal the pretax cost of debt. In the rest of the chapter, we will refer to *after-tax cost of capital* or *after-tax WACC* as *cost of capital* and *WACC*, respectively, for brevity.

⁸ After-tax net operating profits as a percent of total assets or capital has been called **return on invested capital** (ROIC). Residual income can also be calculated as (ROIC – WACC) × (Beginning capital).

265

equity. In forecasting future residual income, the term **abnormal earnings** is also used. Assuming that in the long term the company is expected to earn its cost of capital (from all sources), any earnings in excess of the cost of capital can be termed abnormal earnings. The residual income valuation model has also been called the **discounted abnormal earnings model** (DAE model) and the **Edwards-Bell-Ohlson model** (EBO model) after the names of researchers in the field.⁹ This chapter focuses on a presentation of a general residual income valuation model that can be used by analysts using publicly available data and nonproprietary accounting adjustments. A number of commercial implementations of the approach are also very well known, however. Before returning to the general residual income valuation model in Section 3, we briefly discuss one such commercial implementation.

2.1 COMMERCIAL IMPLEMENTATIONS One example of several competing commercial implementations of the residual income concept is **economic value added** (EVA[®]), trademarked by Stern Stewart & Company.¹⁰ In the previous section, we illustrated the calculation of residual income starting from net operating profit after taxes, and EVA takes the same broad approach. Specifically, EVA is computed as

$$EVA = NOPAT - (C\% \times TC)$$
(5-1)

where NOPAT is the company's net operating profit after taxes, C% is the cost of capital and TC is total capital. In this model, both NOPAT and TC determined under generally accepted accounting principles are adjusted for a number of items.¹¹ Some of the more common adjustments follow:

- Research and development expenses are capitalized and amortized rather than expensed (R&D expense is added back to earnings to compute NOPAT).
- In the case of strategic investments that are not expected to generate a return immediately, a charge for capital is suspended until a later date.
- Goodwill is capitalized and not amortized (amortization expense is added back in arriving at NOPAT, and accumulated amortization is added back to capital).
- Deferred taxes are eliminated such that only cash taxes are treated as an expense.
- Any inventory LIFO reserve is added back to capital and any increase in the LIFO reserve is added in arriving at NOPAT.
- Operating leases are treated as capital leases, and nonrecurring items are adjusted.

Because of the adjustments made under EVA, a different numerical result will be obtained, in general, than that resulting from the use of the simple computation presented in Example 5-1. In practice, general (nonbranded) residual income (RI) valuation also considers the impact of accounting methods on reported results. However, analysts' adjustments to reported accounting results in estimating residual income will generally reflect some differences from the set specified for EVA. Section 4 of this chapter will explore accounting considerations in more detail.

⁹ More information on the background of the model is given later.

¹⁰ For a complete discussion, see Stern (1991) and Peterson and Peterson (1996).

¹¹ See, for example, Ehrbar (1998).

Over time, a company must generate EVA in order for its market value to increase. A related concept is market value added (MVA):

$$MVA = Market value of the company - Total capital$$
 (5-2)

A company that generates positive EVA should have a market value in excess of the accounting book value of its capital.

Research on the ability of value-added concepts to explain equity value and stock returns has reached mixed conclusions. Peterson and Peterson (1996) found that value-added measures are slightly more highly correlated with stock returns than traditional measures such as return on assets and return on equity. Bernstein and Pigler (1997) and Bernstein, Bayer, and Pigler (1998) found that value-added measures are no better at predicting stock performance than are measures such as earnings growth.

A variety of commercial models related to the residual income concept have been marketed by other major accounting and consulting firms. Interestingly, the application focus of these models is not, in general, equity valuation. Rather, these implementations of the residual income concept are marketed primarily for measuring internal corporate performance and determining executive compensation.

3 THE RESIDUAL INCOME VALUATION MODEL

In Section 2, we discussed the concept of residual income and briefly introduced the relationship of residual income to equity value. In the long term, companies that earn more than the cost of capital should sell for more than book value and companies that earn less than the cost of capital should sell for less than book value. The **residual income model** (RIM) of valuation analyzes the intrinsic value of equity into two components:

- the current book value of equity, plus
- the present value of expected future residual income.

Note that when we turn from valuing total shareholders' equity to directly valuing an individual common share, we work with earnings per share rather than net income. According to the residual income model, the intrinsic value of common stock can be expressed as follows:

$$V_0 = B_0 + \sum_{t=1}^{\infty} \frac{\mathrm{RI}_t}{(1+r)^t} = B_0 + \sum_{t=1}^{\infty} \frac{E_t - rB_{t-1}}{(1+r)^t}$$
(5-3)

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 EPS for period t
- RI_t = expected per-share residual income, equal to $E_t rB_{t-1}$

The per-share residual income in period t, RI_p is the EPS for the period, E_p minus the per-share equity charge for the period, which is the required rate of return on equity times the book value per share at the beginning of the period, or rB_{t-1} . Whenever earnings per share exceed the per-share cost of equity, per-share residual income is positive; and whenever earnings are less, per-share residual income is negative. Example 5-2 illustrates the calculation of per-share residual income.

EXAMPLE 5-2. Per-Share Residual Income Forecasts.

David Smith is evaluating the expected residual income for ScottishPower (London Stock Exchange: SPW). Smith determines that SPW has a required rate of return of 8 percent. He obtains the following data from Thomson Financial as of 4 March 2002:

Current market price:	GBP4.00
Book value per share:	GBP3.41
Consensus annual earnings estimates	
March 2002:	GBP0.33
March 2003:	GBP0.39
Annualized dividend per share:	GBP0.26

What is the forecast residual income for fiscal years ended March 2002 and March 2003?

Solution:

TABLE 5-1

Year	2002	2003
Beginning book value (BV ₀)	3.41	3.48
Earnings per share forecast (E)	0.33	0.39
Dividend forecast (D)	0.26	0.26
Forecast book value per share $(BV_0 + E - D)$	3.48	3.61
Per-share equity charge $(BV_0 \times r)$	0.27	0.28
Per-share residual income (EPS forecast – Equity charge)	0.06	0.11

We illustrate the use of Equation 5-3, the expression for the estimated intrinsic value of common stock, in Example 5-3.

EXAMPLE 5-3. Using the Residual Income Model (1).

Bugg Properties' expected EPS is \$2.00, \$2.50, and \$4.00 for the next three years, respectively. Analysts expect that Bugg will pay dividends of \$1.00, \$1.25, and \$12.25 for the three years. The last dividend is anticipated to be a liquidating dividend; analysts expect Bugg will cease operations after Year 3. Bugg's current book value is \$6.00 per share, and its required rate of return on equity is 10 percent.

- 1. Calculate per-share book value and residual income for the next three years.
- 2. Estimate the stock's value using the residual income model given in Equation 5-3:

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

Solution to 1. The book values and residual incomes for the next three years are as follows:

TABLE 5-2

Year	1	2	3
Beginning book value per share	6.00	7.00	8.25
Retained earnings $(E - D)$	1.00	1.25	-8.25
Ending book value	7.00	8.25	0
Net income	2.00	2.50	4.00
Less equity charge ($r \times Beginning BV$)	0.60	0.70	0.825
Residual income	1.40	1.80	3.175

Solution to 2. The value using the residual income model is

 $V_0 = 6.00 + \frac{1.40}{(1.10)} + \frac{1.80}{(1.10)^2} + \frac{3.175}{(1.10)^3}$ = 6.00 + 1.2727 + 1.4876 + 2.3854 = \$11.15

Example 5-4 illustrates an important point that the recognition of value in residual income models typically occurs earlier than in dividend discount models.

EXAMPLE 5-4. Valuing a Perpetuity with the Residual Income Model.

Assume the following data:

- A company will earn \$1.00 per share forever.
- The company pays out all earnings as dividends.
- Book value per share is \$6.00.
- The required rate of return on equity (or the percent cost of equity) is 10 percent.
- 1. Calculate the value of this stock using the dividend discount model (DDM).
- 2. Calculate the level amount of per-share residual income that will be earned each year.
- 3. Calculate the value of the stock using a residual income valuation model.
- 4. Create a table summarizing the recognition of value in the dividend discount model and the residual income model.

Solution to 1. Because the dividend is a perpetuity, $V_0 = D/r = 1.00/0.10 =$ \$10.00 per share.

Solution to 2. Because each year all net income is paid out as dividends, book value per share will be constant at \$6.00. Therefore, with a required rate of

return on equity of 10 percent, for all future years per share residual income will be as follows:

$$RI_t = E_t - rB_{t-1} = 1.00 - 0.10(6.00) = 1.00 - 0.60 = $0.40$$

Solution to 3. Using a residual income model, the estimated value equals the current book value per share plus the present value of future expected residual income (which here can be valued as a perpetuity):

 V_0 = Book value + PV of expected future per-share residual income = 6.00 + 0.40/0.10 = 6.00 + 4.00 = \$10.00

Solution to 4. Table 5-3 below summarizes when values are recognized in the DDM and the RI valuation models.

Dividend Discount Model		Residual Income Model		
Year	D_t	PV of D_t	B_0 or RI_t	PV of B_0 or RI
0			6.00	6.000
1	1.00	0.909	0.40	0.364
2	1.00	0.826	0.40	0.331
3	1.00	0.751	0.40	0.301
4	1.00	0.683	0.40	0.273
5	1.00	0.621	0.40	0.248
6	1.00	0.564	0.40	0.226
7	1.00	0.513	0.40	0.205
8	1.00	0.467	0.40	0.187
:	:	:	:	:
Total		\$10.00		\$10.00

TABLE 5-3 Value Recognition in DDM and RIM Valuation

Table 5-3 shows that in the residual income valuation, current book value of \$6.00 represents 60 percent of the stock's total present value of \$10. Most of the total value is recognized now (today) for this stock. The DDM valuation also estimates the value of the stock as \$10. As an exercise, suppose we add up the present values of the first five years' dividends. This sum of \$3.79 (0.909 + 0.826 + 0.751 + 0.683 + 0.621) represents approximately 38 percent of the total present value of \$10. In the DDM, value is recognized with the receipt of dividends; typically the recognition of value occurs earlier in a residual income model than in a dividend discount model.

As illustrated in Example 5-4, the dividend discount and residual income models are in theory mutually consistent. Because of the real-world uncertainty in forecasting distant cash flows, however, we may find that the earlier recognition of value in a residual income approach relative to other present value approaches is a practical advantage. In the dividend discount and free cash flow models (discussed in Chapters 2 and 3, respectively), we often model a stock's value as the sum of the present values of individually forecasted dividends or free cash flows up to some terminal point plus the present value of the expected terminal value of the stock. In practice, analysts often find that a large fraction of a stock's total present value, using either the dividend discount or free cash flow to equity model, is represented by the present value of the expected terminal value. However, substantial uncertainty often surrounds the terminal value. In contrast, residual income valuations typically are relatively less sensitive to terminal value estimates. (In some residual income valuation contexts the terminal value may actually be set equal to zero, as we will discuss in a later section.) The early recognition of value is one reason residual income valuation can be a useful analytical tool.

Before we discuss the implementation of the residual income model in detail, it is helpful to have an overview of the strengths and weaknesses of the residual income approach. The strengths of the residual income models include the following:

- Terminal values do not make up a large portion of the total present value, relative to other models.
- The RI models use readily available accounting data.
- The models can be readily applied to companies that do not pay dividends or to companies that do not have positive expected near-term free cash flows.
- The models can be used when cash flows are unpredictable.
- The models have an appealing focus on economic profitability.

The potential weaknesses of residual income models include the following:

- The 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. In the next section we will present the clean surplus relation (or clean surplus accounting), previously mentioned in Chapter 2.

The above list of potential weaknesses helps explain the chapter's focus in Section 4 on accounting considerations. In light of its strengths and weaknesses, we state the following broad guidelines for using a residual income model in common stock valuation. A residual income model is most appropriate when

- a company does not pay dividends, or its dividends are not predictable;
- a company's expected free cash flows are negative within the analyst's comfortable forecast horizon; or
- there is great uncertainty in forecasting terminal values using an alternative present value approach.

Residual income models are least appropriate when

- there are significant departures from clean surplus accounting; or
- significant determinants of residual income, such as book value and ROE, are not predictable.

The balance of Section 3 develops the most familiar general expression for the residual income model and illustrates the model's application.

3.1 THE GENERAL RESIDUAL INCOME MODEL
 The residual income model is conceptually sound and hence will have a clear relationship to other sound models, such as the dividend discount model. In fact, the residual income model given in Equation 5-3 can be derived from the dividend discount model. The general expression for the dividend discount model is

$$V_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \cdots$$

The **clean surplus relation** states the relationship among earnings, dividends, and book value as follows:

$$B_t = B_{t-1} + E_t - D_t$$

In other terms, the ending book value of equity equals the beginning book value plus earnings less dividends, apart from ownership transactions. The condition that income (earnings) reflect all changes in the book value of equity other than ownership transactions is known as clean surplus accounting. Rearranging the clean surplus relation, the dividend for each period can be viewed as the net income minus the earnings retained for the period, or net income minus the increase in book value:

$$D_t = E_t - (B_t - B_{t-1}) = E_t + B_{t-1} - B_t$$

Substituting $E_t + B_{t-1} - B_t$ for D_t in the expression for V_0 results in

$$V_0 = \frac{E_1 + B_0 - B_1}{(1+r)^1} + \frac{E_2 + B_1 - B_2}{(1+r)^2} + \frac{E_3 + B_2 - B_3}{(1+r)^3} + \cdots$$

This equation can be re-written as follows:

$$V_0 = B_0 + \frac{E_1 - rB_0}{(1+r)^1} + \frac{E_2 - rB_1}{(1+r)^2} + \frac{E_3 - rB_2}{(1+r)^3} + \cdots$$

Expressed with summation notation, the following equation restates the residual income model that we gave in Equation 5-3 above:

$$V_0 = B_0 + \sum_{t=1}^{\infty} \frac{\mathrm{RI}_t}{(1+r)^t} = B_0 + \sum_{t=1}^{\infty} \frac{E_t - rB_{t-1}}{(1+r)^t}$$

According to the above expression, the value of a stock equals its book value per share plus the present value of expected future per-share residual income. Note that when the present value of expected future per-share residual income is positive (negative), intrinsic value V_0 is greater (smaller) than book value per share, B_0 .

The residual income model used in practice today has largely developed from the recent academic work of Ohlson (1995) and Feltham and Ohlson (1995) and the earlier work of Edwards and Bell (1961), although in the United States this method has been used to value small businesses in tax cases since the 1920s.¹² The general expression for the residual income model based on this work¹³ can also be stated as

$$V_0 = B_0 + \sum_{t=1}^{\infty} \frac{(\text{ROE}_t - r) \times B_{t-1}}{(1+r)^t}$$
(5-4)

Equation 5-4 is equivalent to the expressions for V_0 given earlier because in any year *t*, $RI_t = (ROE_t - r) \times B_{t-1}$. Other than the required rate of return on common stock, the inputs to the residual income model come from accounting data. Example 5-5 illustrates the estimation of value using Equation 5-4.

EXAMPLE 5-5. Using the Residual Income Model (2).

To recap the data from Example 5-3, Bugg Properties has expected earnings per share of \$2.00, \$2.50, and \$4.00, and expected dividends per share of \$1.00, \$1.25, and \$12.25 over next three years. Analysts expect that the last dividend will be a liquidating dividend and that Bugg will cease operating after Year 3. Bugg's current book value per share is \$6.00, and its estimated required rate of return on equity is 10 percent.

Using the above data, estimate the value of Bugg Properties stock using a residual income model of the form $V_0 = B_0 + \sum_{t=1}^{\infty} \frac{(\text{ROE}_t - r) \times B_{t-1}}{(1+r)^t}$.

Solution. To value the stock, we need to forecast residual income. Table 5-4 illustrates the calculation of residual income. (Note that Table 5-4 arrives at the same estimates of residual income as did Table 5-2 in Example 5-3.)

Year	1	2	3
Earnings per share	2.00	2.50	4.00
Beginning book value per share	6.00	7.00	8.25
ROE	0.3333	0.3571	0.4848
Abnormal rate of return (ROE $- r$)	0.2333	0.2571	0.3848
Residual income (ROE $- r$) × Beginning BV	1.40	1.80	3.175



We estimate the stock value as follows:

$$V_0 = 6.00 + \frac{1.40}{(1.10)} + \frac{1.80}{(1.10)^2} + \frac{3.175}{(1.10)^3}$$

= 6.00 + 1.2727 + 1.4876 + 2.3854
= \$11.15

¹² In tax valuation, the method is known as the excess earnings method. For example, see Hawkins and Paschall (2001) and U.S. IRS Revenue Ruling 68-609.

¹³ See, for example, Hirst and Hopkins (2000).

Note that the value is identical to the estimate obtained using Equation 5-3, as illustrated in Example 5-3, because the assumptions are the same and Equations 5-3 and 5-4 are equivalent expressions.

Example 5-5 showed that residual income value can be estimated using current book value, forecasts of earnings, forecasts of book value, and an estimate of the required rate of return on equity. The forecasts of earnings and book value translate into ROE forecasts.

EXAMPLE 5-6. Valuing a Company Using the General Residual Income Model.

Robert Sumargo, an equity analyst, is considering the valuation of Dell Computer (NYSE: DELL), which closed on 19 April 2002 at \$27.34. Sumargo notes that DELL has had very high ROE in the past 10 years and that consensus analyst forecasts for EPS for fiscal years ending in January 2003 and 2004 reflect expected ROEs of 50 percent and 48 percent, respectively. Sumargo expects that high ROEs may not be sustainable in the future. Sumargo often takes a present value approach to valuation. As of the date of the valuation, DELL does not pay dividends; although a discounted dividend valuation is possible, Sumargo does not feel confident about predicting the date of dividend initiation. He decides to apply the residual income model to value DELL, using the following data and assumptions:

- According to the capital asset pricing model (CAPM), DELL has a required rate of return of 14 percent.
- DELL's book value per share at 1 February 2002 was \$1.78.
- ROE is expected to be 50 percent for fiscal year-end January 2003. Because of competitive pressures, Sumargo expects ROE to decline by 2 percent each year thereafter until it reaches the CAPM required rate of return.
- DELL does not currently pay a dividend. Sumargo does not expect one to be paid in the foreseeable future, so that all earnings will be reinvested.
- 1. Compute the value of DELL using the residual income model (Equation 5-4).
- 2. After reviewing Sumargo's valuation, a colleague points out that DELL has been issuing stock options to employees, which are not recorded as an expense, and repurchasing shares on the market to offset the dilutive impact of the stock options. These activities have resulted in a large decline in book value per share in recent years. At the same time, the colleague expects that the diminution of book value per share from the use of employee stock options will continue into the future. Discuss the potential impact on Sumargo's estimate of value if the colleague is correct.

Solution to 1. Book value per share is initially \$1.78. Based on a ROE forecast of 50 percent in the first year, the forecast EPS would be \$0.89. Because no dividends are paid and the clean surplus relation is assumed to hold, book value at the end of the period is forecast at \$2.67. For 2003, residual income is measured as the beginning book value per share times the difference between ROE and r or \$0.64. The present value of \$0.64 at 14 percent for one year is \$0.56. This process

is continued year by year as presented in Table 5-5. The value of DELL under this residual income model would be the present value of each year's residual income plus the current book value per share. Because residual income is zero starting in 2021, no forecast is required beyond that period. The estimated value under this model is \$27.01, as shown in Table 5-5.

TABLE 5-5 Valuation of DELL Using the Residual Income Model

FYE January	Book Value per Share (beginning)	Forecast EPS	Forecast DPS	Forecast ROE (on beg. BV, %)	Required Return (%)	ROE – r (%)	$(\text{ROE} - r) \times \text{BV}$	$PV of (ROE - r) \times BV$
2003	1.78	0.89	0	50	14	36	0.64	0.56
2004	2.67	1.28	0	48	14	34	0.91	0.70
2005	3.95	1.82	0	46	14	32	1.26	0.85
2006	5.77	2.54	0	44	14	30	1.73	1.02
2007	8.31	3.49	0	42	14	28	2.33	1.21
2008	11.80	4.72	0	40	14	26	3.07	1.40
2009	16.52	6.28	0	38	14	24	3.96	1.58
2010	22.79	8.21	0	36	14	22	5.01	1.76
2011	31.00	10.54	0	34	14	20	6.20	1.91
2012	41.54	13.29	0	32	14	18	7.48	2.02
2013	54.83	16.45	0	30	14	16	8.77	2.08
2014	71.28	19.96	0	28	14	14	9.98	2.07
2015	91.23	23.72	0	26	14	12	10.95	1.99
2016	114.95	27.59	0	24	14	10	11.50	1.84
2017	142.54	31.36	0	22	14	8	11.40	1.60
2018	173.90	34.78	0	20	14	6	10.43	1.28
2019	208.68	37.56	0	18	14	4	8.35	0.90
2020	246.25	39.40	0	16	14	2	4.92	0.47
2021	285.65	39.99	0	14	14	0	0.00	0.00
							Total PV	25.23
							Initial Book value	1.78
							Total value	27.01

Solution to 2. Unless the inputs are corrected to reflect clean surplus accounting, the residual income valuation will probably overstate intrinsic value because forecasted book value growth will not be realized. The clean surplus relation assumes that all changes to book value other than ownership transactions flow through earnings. If that relation is violated, estimated share value can be overstated (or understated). In the case of DELL, in recent years (relative to the date of Sumargo's analysis) many transactions have affected book value per share without flowing through the income statement. DELL has made wide use of employee stock options, which have not been recorded as an expense on the income statement. DELL

has issued shares under these stock option plans and has aggressively repurchased shares to manage the resulting dilution of employee stock options. These transactions have greatly reduced book value per share in recent years. If this trend continues, DELL is not likely to see the increases in book value forecast in the model above, and the residual income model will likely overstate the value of DELL.

Example 5-6, Part 2, touched on the issue of violations of clean surplus accounting. The residual income model, as stated earlier, assumes clean surplus accounting. **Comprehensive income** is income under clean surplus accounting; as such, comprehensive income reflects all changes in equity other than contributions by, and distributions to, owners. Comprehensive income often includes several items that bypass the current income statement such as the impact of changes in the market value of certain securities.¹⁴ Strictly speaking, in using residual income models we are concerned with comprehensive income (income under clean surplus accounting); analysts thus adjust net income for material differences from clean surplus accounting. Section 4.1 explores violations of the clean surplus accounting in more detail.

3.2 FUNDAMENTAL DETERMINANTS OF RESIDUAL INCOME

The residual income model in general makes no assumptions about future earnings and dividend growth. If we assume constant earnings and dividend growth (at *g*), we can derive a version of the residual income model that is useful for illustrating the fundamental drivers of residual income. In Chapter 4, we developed the following expression for justified P/B based on forecasted fundamentals, assuming the Gordon (constant growth) DDM and the sustainable growth rate equation, $g = b \times \text{ROE}$:¹⁵

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

which is mathematically equivalent to

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

The justified price is the stock's intrinsic value ($P_0 = V_0$). Therefore, using the previous equation, we can express a stock's intrinsic value under the residual income model, assuming constant growth, as

$$V_0 = B_0 + \frac{\text{ROE} - r}{r - g} B_0$$
(5-5)

Under this model, the estimated value of a share is thus the book value per share (B_0) plus the present value of the expected level stream of residual income, $(ROE - r) \times B_0$. In the case of a company for which ROE exactly equals the cost of equity, the intrinsic value should equal the book value per share. We call Equation 5-5 the single-stage (or constantgrowth) residual income model.

In an ideal world, where the book value of equity represents the fair value of net assets and clean surplus accounting prevails, the term B_0 reflects the value of assets owned by

¹⁴ In U.S. financial statements, items that bypass the income statement (**dirty surplus items**) are entered into **other comprehensive income**. The relationship is Comprehensive income = Net income + Other comprehensive income.

¹⁵ Interestingly, the sustainable growth rate formula itself can be derived from the clean surplus relation.

the company less its liabilities. The second term, $(ROE - r) \times B_0/(r - g)$, represents additional value expected because of the company's ability to generate returns in excess of its cost of equity; the second term is the present value of the company's expected economic profits. Unfortunately, both U.S. and international accounting rules enable companies to exclude some liabilities from their balance sheets, and neither set of rules reflects the fair value of many corporate assets. There is, however, a move internationally toward fair value accounting, particularly for financial assets. Controversies, such as the failure of Enron Corporation in the United States, have highlighted the importance of identifying off-balance-sheet financing techniques.

The single-stage residual income model also assumes that the company's positive residual income continues indefinitely and that book value grows at a constant rate. More likely, a company's ROE will revert to a mean value of ROE over time and at some point, the company's residual income will be zero. In light of these considerations, the residual income model has been adapted in practice to handle declining residual income and deficiencies in the current accounting model. For example, Lee and Swaminathan (1999) and Lee, Myers, and Swaminathan (1999) used a residual income model to value the Dow 30 assuming that ROE fades (reverts) to the industry mean over time. Lee and Swaminathan found that the residual income model had more ability to predict future returns than traditional price multiples. Bauman (1999) demonstrated how accounting data could be useful in equity valuation using a residual income model.

Before proceeding to the next section, which addresses both domestic and international issues in using accounting data in the residual income model, we should briefly summarize the relationships of the residual income model to other valuation models.

Valuation models based on discounting dividends or on discounting free cash flow to equity (FCFE) are theoretically sound models, as is the residual income model. Unlike the residual income model, however, DDM and FCFE models forecast future cash flows and find the value of stock by discounting them back to the present using the required return on equity. The RI model approaches this process differently. It starts with a value based on the balance sheet, the book value of equity, and adjusts this value by adding the present values of expected future residual income. Thus, the recognition of value is different, but the total present value, whether using expected dividends, expected free cash flow, or book value plus expected residual income, should be consistent, in theory.¹⁶

In fact, because each model can be derived from the same underlying theoretical model, 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 using each model. Practically speaking, however, it may not be possible to forecast each of these items with the same degree of certainty.¹⁷ For example, if a company has near-term negative free cash flow and forecasts for the terminal value are uncertain, a residual income model may be more appropriate. On the other hand, a company with positive, predictable cash flow that does not pay a dividend would be well suited for a discounted free cash flow valuation.

A residual income model can also be used in conjunction with other models to assess the consistency of results. If a wide variation of estimates is found and the models appear appropriate, the inconsistency may lie with the assumptions used in the models. The ana-

3.3 RESIDUAL INCOME VALUATION IN RELATION TO OTHER APPROACHES

¹⁶ See, for example, Shrieves and Wachowicz (2001).

¹⁷ For a lively debate on this issue, see Penman and Sougiannis (1998), Penman (2001), Lundholm and O'Keefe (2001a), and Lundholm and O'Keefe (2001b).

lyst would need to perform additional work to determine whether the assumptions are mutually consistent and which model is most appropriate for the subject company. Residual income models, just like the DDM and FCFE models, can also be used to establish justified market multiples, such as P/E or P/B. For example, the value can be determined using a residual income model and divided by earnings to arrive at a justified P/E in conjunction with a relative valuation approach. The residual income model is most closely related to the P/B ratio. A stock's justified P/B ratio is directly related to expected future residual income. Another closely related concept is **Tobin's** *q*, the ratio of the market value of debt and equity to the replacement cost of total assets:¹⁸

Tobin's $q = \frac{\text{Market value of debt and equity}}{\text{Replacement cost of total assets}}$

Although similar to P/B, Tobin's q also has some obvious differences: The numerator includes the market value of total capital (debt as well as equity). The denominator uses total assets rather than equity. Further, assets are valued at replacement cost rather than a historical accounting cost; replacement costs take account of the effects of inflation. All else equal, we expect Tobin's q to be higher, the greater the productivity of a company's assets.¹⁹ One difficulty in computing Tobin's q is the lack of information on assets' replacement costs. If available, market values of assets or replacement costs can be more useful in a valuation than historical costs.

4 ACCOUNTING AND INTERNATIONAL CONSIDERATIONS

In practice, to most accurately apply the residual income model, the analyst needs to adjust book value of common equity for off-balance-sheet items and adjust reported net income to obtain comprehensive income. In this section, we will discuss issues relating to these tasks.

Bauman (1999) has noted that the strength of the residual income valuation model is that the two components (book value and future earnings) of the model have a balancing effect on each other, provided that the clean surplus relationship is followed:

All other things held constant, companies making aggressive (conservative) accounting choices will report higher (lower) book values and lower (higher) future earnings. In the model, the present value of differences in future income is exactly offset by the initial differences in book value. (Baumann 1999, page 31)

Unfortunately, this argument has several problems in practice. The clean surplus relationship does not prevail, and analysts often use past earnings to predict future earnings. International Accounting Standards (IAS) and U.S. GAAP permit a variety of items to bypass the income statement and be reported directly in stockholders' equity. Further, companies have managed to keep some liabilities off the balance sheet and to obscure financial results with nonoperating and nonrecurring items. The analyst must thus watch for such practices in evaluating the book value of equity and return on equity to be used as inputs into a residual income model.

¹⁸ See Tobin (1969) or more recent work such as Landsman and Shapiro (1995).

¹⁹ Tobin theorized that q would average to 1 over all companies, as the economic rents or profits earned by assets would average to zero.

With regard to the contention that aggressive accounting choices will lead to lower reported future earnings, take an example in which a company chooses to capitalize an expenditure in the current year rather than to expense it. Doing so overstates current-year earnings as well as current book value. If an analyst uses current earnings (or ROE) naively in predicting future residual earnings, the residual income model will overestimate the value of the company. Take, for example, a company with \$1,000,000 of book value and \$200,000 of earnings before taxes, after expensing an expenditure of \$50,000. Ignoring taxes, this company has a ROE of 20 percent. If the company capitalized the expenditure rather than expensing it immediately, it would have a ROE of 23.81 percent (\$250,000/\$1,050,000).

Although at some time in the future this capitalized item will likely be amortized or written off, thus reducing realized future earnings, analysts' expectations often rely on historical data. If capitalization persists over time for a stable company, ROE can decline because net income will normalize over the long term, but book value will be overstated. For a growing company, for which the expenditure in question is increasing, ROE can continue at high levels over time. We suggest that because the residual income model uses primarily accounting data as inputs, the model can be sensitive to accounting choices and aggressive accounting methods (e.g., accelerating revenues or deferring expenses) can result in errors in valuation. The analyst must be particularly careful, therefore, in analyzing a company's reported data for use in a residual income model.

As we have seen, two principal drivers of residual earnings are ROE and book value. The analyst must understand how to use historical reported accounting data for these items to the extent he uses historical data in forecasting future ROE and book value. Chapter 2 explained the DuPont analysis of ROE, which can be used as a tool in forecasting. Chapter 4 discussed the calculation of book value. We extend these previous discussions below with specific application to residual income valuation, particularly in addressing the following accounting considerations:

- violations of the clean surplus relationship,
- balance sheet adjustments for fair value,
- intangible assets,
- nonrecurring items,
- · aggressive accounting practices, and
- international considerations.

In any valuation, we must pay close attention to the accounting practices of the company being valued. In the following sections, we address the above issues as they particularly affect residual income valuation.

4.1 VIOLATIONS OF THE CLEAN SURPLUS RELATIONSHIP

One potential accounting issue in applying a residual income model is a violation of clean surplus accounting. Violations may occur when accounting standards permit charges directly to stockholders' equity, bypassing the income statement. An example is the case of changes in the market value of long-term investments. IAS provide that the change in market value can be reported in current profits or can bypass the income statement and be reported in shareholders' equity. Under U.S. GAAP, the balance sheet includes, at market value, investments considered to be "available for sale"; however, any change in their market value is reflected in stockholders' equity as other comprehensive income rather than as income on the income statement.

Earlier, we defined comprehensive income as all changes in equity other than contributions by and distributions to owners. Comprehensive income includes net income reported on the income statement. *Other comprehensive income* (also previously defined) is the result of other events and transactions that result in a change to equity but are not reported on the income statement. Items that commonly bypass the income statement include²⁰

- foreign currency translation adjustments,
- certain pension adjustments, and
- fair value changes of some financial instruments.

In all of these cases, the book value of equity is stated accurately, but net income is not from the perspective of residual income valuation. The analyst should be most concerned with the impact of these items on forecasts of net income and ROE (which has net income in the numerator), and hence also residual income.²¹ Because some items (including those listed above) bypass the income statement, they are excluded from historical ROE data. As noted by Frankel and Lee (1999), bias will be introduced into the valuation only if the present expected value of the clean surplus violations do not net to zero. In other words, reductions in income from some periods may be offset by increases from other periods. The analyst must examine the equity section of the balance sheet and the related statements of shareholders' equity and comprehensive income carefully for items that have bypassed the income statement; the analyst can then assess whether amounts are likely to be offsetting and can assess the impact on future ROE.

EXAMPLE 5-7. Evaluating Clean Surplus Violations.

The statement of changes in stockholders' equity for Nokia Corporation (NYSE: NOK), prepared under IAS as of 31 December 1999, is partially replicated below:

	Share Capital	Share Issue Premium	Treasury Share	Translation Differences	Retained Earnings	Total
					0	
Balance at 31 December 1998	255	909	(110)	182	3,873	5,109
Share issue	3	191				194
Bonus issue	36	(36)				0
Cancellation of Treasury shares	(15)	15	110		(110)	0
Acquisition of Treasury shares			(24)		24	0
Dividend					(586)	(586)
Dividend on Treasury shares					31	31
Translation differences				61		61
Other increase/decrease, net					(8)	(8)
Net profit					2,577	2,577
Balance at 31 December 1999	279	1,079	(24)	243	5,801	7,378

TABLE 5-6 Nokia Corporation Statement of Changes in Stockholders' Equity (€ millions)

²⁰ See Frankel and Lee (1999).

²¹ The analyst should most precisely calculate historical ROE at the aggregate level (e.g., as net income divided by shareholders' equity) rather than as earnings per share divided by book value per share, because actions such as share issuance and share repurchases can distort ROE calculated on a per-share basis.

The column "Translation Differences" reflects the cumulative amount of translation adjustments on equity that have bypassed the income statement. Because there is a positive adjustment to stockholders' equity, this item would have increased income if it had been reported on the income statement. Because the balance is accumulating, it does not appear to be reversing (netting to zero) in the long term. If the analyst expects this trend to continue, an increase in expected ROE might be warranted. It is possible, however, that future exchange rates will reverse this impact. Additionally, the decision to forgo making an adjustment to ROE would result in a conservative valuation in this case.

4.2 BALANCE SHEET ADJUSTMENTS FOR FAIR VALUE

In order to have a reliable measure of book value of equity, an analyst must identify and scrutinize significant off-balance-sheet assets and liabilities. Additionally, reported assets and liabilities should be adjusted to fair value when possible. Off-balance-sheet assets and liabilities may become apparent by an examination of the financial statement footnotes. Examples include pension liabilities, the use of operating leases, and the use of special purpose entities to remove both debt and assets from the balance sheet. Some items such as the pension liability often result in an understatement of liabilities and overstatement of equity. Others, such as leases, may not affect the amount of equity (for example off-balance-sheet assets offset off-balance-sheet liabilities) but can impact an assessment of future earnings for the residual income component of value. Other assets and liabilities may be stated at other than fair value. For example, inventory may be stated at LIFO and require adjustment to restate to current value. Presented below are some common items to review for balance sheet adjustments. Note, however, that this list is not all-inclusive:²²

- inventory,
- · deferred tax assets and liabilities,
- pension plan assets and liabilities,
- operating leases,
- special-purpose entities,
- reserves and allowances (for example, bad debts), and
- intangible assets.

Additionally, the analyst should examine the financial statements and footnotes for items unique to the subject company.

4.3 INTANGIBLE Intangible assets can have a significant impact on book value. In the case of specifically identifiable intangibles that can be separated from the entity (e.g., sold), it is appropriate to include these in the determination of book value of equity. If these assets are wasting (declining in value over time), they will be amortized over time as an expense. Goodwill, on the other hand, requires special consideration, particularly in light of recent changes in accounting for goodwill. Goodwill represents the excess of the purchase price of an acquisition over the value of the net assets acquired. Goodwill is generally not recognized as an asset unless it results from an acquisition (most international accounting standards do not allow the recognition of internally generated goodwill on the balance sheet). To

²² See also Chapter 17 of White, Sondhi, and Fried (1998).

	Alpha	Beta
Cash	€1,600	€100
Property, plant, and equipment	€3,400	€900
Total assets	€5,000	€1,000
Equity	€5,000	€1,000
Net income	€600	€150

demonstrate this, consider two companies, Alpha and Beta, with the following summary financial information (all amounts in thousands, except per-share data):

Each company pays out all net income as dividends (no growth), and the clean surplus relation holds. Alpha has a 12 percent ROE and Beta has a 15 percent ROE, both expected to continue indefinitely. Each has a 10 percent required rate of return. The fair market value of each company's property, plant, and equipment is the same as its book value. What is the value of each company in a residual income framework?

Using total book value rather than per-share data, the value of Alpha would be $\notin 6,000$, determined as follows:²³

$$V_0 = B_0 + \frac{\text{ROE} - r}{r - g}B_0 = 5,000 + \frac{0.12 - 0.10}{0.10 - 0.00}5,000 = 6,000$$

Similarly, the value of Beta would be $\in 1,500$:

$$V_0 = B_0 + \frac{\text{ROE} - r}{r - g}B_0 = 1,000 + \frac{0.15 - 0.10}{0.10 - 0.00}1,000 = 1,500$$

The value of the companies on a combined basis would be \notin 7,500. Note that both companies are valued more highly than the book value of equity because they have ROEs in excess of the required rate of return. Absent an acquisition transaction, the financial statements of Alpha and Beta do not reflect this value. If either is acquired, however, goodwill would appear as an asset and result in higher book value of equity. For instance, suppose Alpha acquires Beta by paying Beta's former shareholders \notin 1,500 in cash. Alpha has just paid \notin 500 in excess of the value of Beta's total assets (\notin 1,000), which is recorded as good-will. The balance sheet of Alpha immediately after the acquisition would be²⁴

	Alpha
Cash	€200
Property, plant, and equipment	€4,300
Goodwill	€500
Total assets	€5,000
Equity	€5,000

Note that the total book value of equity did not change, because cash was used in the transaction. Assuming that goodwill is amortized over a 10-year period, the combined

²³ Results would be the same if done on a per-share basis.

²⁴ For example, cash at €200 is calculated as €1,600 (cash of Alpha) + €100 (cash of Beta) - €1,500 (purchase price of Beta).

company's expected net income would be $\notin 700$ ($\notin 600 + \notin 150 - \notin 50$ amortization). Expected ROE would be 14 percent. Under a residual income model with no adjustment for goodwill amortization, the value of the combined company would be

$$V_0 = B_0 + \frac{\text{ROE} - r}{r - g}B_0 = 5,000 + \frac{0.14 - 0.10}{0.10 - 0.00}5,000 = 7,000$$

Why should the combined company be worth less than the two separate companies? Assuming that a fair price was paid to the former shareholders, the combined value should not be lower. The lower value results from a reduction in ROE due to the amortization of goodwill. If goodwill were not amortized (or we added back the amortization expense before computing ROE), net income would be €750 and ROE would be 15 percent. The value of the combined entity would be

$$V_0 = B_0 + \frac{\text{ROE} - r}{r - g}B_0 = 5,000 + \frac{0.15 - 0.10}{0.10 - 0.00}5,000 = 7,500$$

This amount is the same as the sum of the values of the companies on a separate basis.

Recently, U.S. GAAP has altered the treatment of goodwill amortization. Goodwill is still listed as an asset when purchased but is no longer amortized.²⁵ Under IAS, goodwill is currently required to be amortized over a period not to exceed 20 years. To ensure international comparability and to avoid the adverse impact of amortization noted above, we recommend adjusting earnings to remove any amortization of goodwill.

Would the answer be different if the acquiring company used newly issued stock rather than cash in the acquisition? The form of currency used to pay for the transaction should not impact the total value. If Alpha used \notin 1,500 of newly issued stock to acquire Beta, its balance sheet would be

	Alpha
Cash	€1,700
Property, plant, and equipment	€4,300
Goodwill	€500
Total assets	€6,500
Equity	€6,500

Projected earnings, excluding the amortization of goodwill, would be €750, and projected ROE would be 11.538 percent. Value under the residual income model would be

$$V_0 = B_0 + \frac{\text{ROE} - r}{r - g}B_0 = 6,500 + \frac{0.11538 - 0.10}{0.10 - 0.00}6,500 = 7,500$$

The overall value remains unchanged. The book value of equity is higher but offset by the impact on ROE. Once again, this assumes that the buyer paid a fair value for the acquisition. If an acquirer overpays for an acquisition, this should become evident in a reduction in future residual income and write-off of previously recorded goodwill.

Research and development costs provide another example of an intangible asset that must be given careful consideration. Under U.S. GAAP, R&D is expensed to the income statement directly. Under IAS, some R&D costs can be capitalized and amortized over

²⁵ If goodwill is later deemed to be impaired, a write-off or loss is taken.

time. R&D expenditures are reflected in a company's ROE, and hence residual income, over time. If a company engages in unproductive R&D expenditures, these will lower residual income through the expenditures made. If a company engages in productive R&D expenditures, these should result in higher revenues to offset the expenditures over time. In summary, on an ongoing basis for a mature company, ROE should reflect the productivity of R&D expenditures.

Bauman (1999) applied a residual income model to Cisco Systems, Inc. by capitalizing and amortizing purchased in-process R&D that was expensed under U.S. GAAP rather than becoming part of goodwill. He found that when purchased in-process R&D is capitalized and then amortized over a short period, there is no impact on overall value compared with immediate expensing of R&D in a residual income framework. White, Sondhi, and Fried (1998), however, noted that expensing of R&D in the long term results in higher ROEs over the long term. The analyst should carefully consider the company's R&D expenditures and their impact on long-term ROE.

4.4 In applying a residual income model, it is important to develop a forecast of future residual income based on recurring items. Often, companies report nonrecurring charges as part of earnings or classify nonoperating income (e.g., sale of assets) as part of operating income. These misclassifications can lead to overestimates and underestimates of future residual earnings if no adjustments are made. No adjustments to book value are necessary for these items, however, because nonrecurring gains and losses are reflected in the value of assets in place. Hirst and Hopkins (2000) noted that nonrecurring items sometimes result from accounting rules and at other times result from "strategic" management decisions. Regardless, they highlighted the importance of examining the financial statement notes and other sources for items that may warrant adjustment in determining recurring earnings, such as

- unusual items,
- extraordinary items,
- restructuring charges,
- · discontinued operations, and
- accounting changes.

In some cases, management may record restructuring or unusual charges in every period. In these cases, the item may be considered an ordinary operating expense and may not require adjustment.

Companies sometimes inappropriately classify nonoperating gains as a reduction in operating expenses (such as selling, general, and administrative expenses). If material, this inappropriate classification can usually be uncovered by a careful reading of financial statement footnotes and press releases. Analysts should consider whether these items are likely to continue and contribute to residual income over time. More likely, they should be removed from operating earnings when forecasting residual income.

4.5 OTHER AGGRESSIVE ACCOUNTING PRACTICES

Companies may engage in accounting practices that result in the overstatement of assets (book value) and/or overstatement of earnings. We discussed many of these practices in the preceding sections.²⁶ Other activities that a company may engage in include accelerating revenues to the current period or deferring expenses to a later period.²⁷ Both activities simultaneously increase earnings and book value. For example, a company might ship

²⁶ Also see Chapter 1.

²⁷ See, for example, Schilit (1993).

unordered goods to customers at year-end, recording revenues and a receivable. Conversely, a company could capitalize rather than expense a cash payment, resulting in lower expenses and an increase in assets. The analyst must evaluate a company's accounting policies carefully and consider the integrity of management in assessing the inputs in a residual income model. Companies have also been criticized recently for the use of "cookie jar" reserves (reserves saved for future use), in which excess losses or expenses are recorded in an earlier period (for example, in conjunction with an acquisition or restructuring) and then used to reduce expense and increase income in future periods. The analyst should carefully examine the use of reserves when assessing residual earnings.

4.6 International Considerations

Accounting standards differ internationally. These differences result in different measures of book value and earnings internationally and suggest that valuation models based on accrual accounting data might not perform as well as other present value models in international contexts. It is interesting to note, however, that Frankel and Lee (1999) found that the residual income model works well in valuing companies on an international basis. Using a simple residual income model without any of the adjustments discussed in this chapter, they found that their residual income valuation model accounted for 70 percent of the cross-sectional variation of stock prices across 20 countries. Table 5-7 shows the model's explanatory power by country.

Explanatory Power	Country
40-50 percent	Germany
	Japan (Parent company reporting)
60-70 percent	Australia
	Canada
	Japan (Consolidated reporting)
	United Kingdom
More than 70 percent	France
	United States

TABLE 5-7 International Application of Residual Income Models

Source: Frankel and Lee (1999).

Germany had the lowest explanatory power. Japan had low explanatory power for companies reporting only parent company results; the explanatory power for Japanese companies reporting on a consolidated basis was considerably higher. Explanatory power was highest in France, the United Kingdom, and the United States. Frankel and Lee concluded that there are three primary considerations in applying a residual income model internationally:

- the availability of reliable earnings forecasts,
- systematic violations of the clean surplus assumption, and
- "poor quality" accounting rules that result in delayed recognition of value changes.

Analysts should expect the model to work best in situations in which earnings forecasts are available, clean surplus violations are limited, and accounting rules do not result in delayed recognition. Because Frankel and Lee found good explanatory power for a residual income model using unadjusted accounting data, it should be expected that if adjustments are made to the reported data to correct for clean surplus and other violations, international comparisons should result in comparable valuations. For circumstances in which clean surplus violations exist, accounting choices result in delayed recognition, or accounting disclosures do not permit adjustment, the residual income model would not be appropriate and the analyst should consider a model less dependent on accounting data, such as a FCFE model.

5 SINGLE-STAGE RESIDUAL INCOME VALUATION

The single-stage (constant-growth) residual income model assumes that a company has a constant return on equity and constant earnings growth rate over time. This model was given in Equation 5-5, repeated below:

$$V_0 = B_0 + \frac{\text{ROE} - r}{r - g} B_0$$

EXAMPLE 5-8. Single-Stage Residual Income Model (1).

Joseph Yoh is evaluating a purchase of Canon, Inc. (NYSE: CAJ). Current book value per share is \$12.90, and the current price per share is \$32.41 (from Value Line, 8 February 2002). Yoh expects long-term ROE to be 10 percent and long-term growth to be 8 percent. Assuming a cost of equity of 9 percent, what is the intrinsic value of Canon stock using a residual income model?

$$V_0 = 12.90 + \frac{0.10 - 0.09}{0.09 - 0.08} 12.90 = $25.80$$

Similar to the Gordon growth DDM, the single-stage residual income model can be used to assess the market expectations of residual income growth by inputting the current price into the model and solving for g.

EXAMPLE 5-9. Single-Stage Residual Income Model (2).

Joseph Yoh is curious about the market-perceived growth rate, given that he is comfortable with his other inputs. Using the current price per share of \$32.41 for Canon, Yoh solves for g:

$$32.41 = 12.90 + \frac{0.10 - 0.09}{0.09 - g} 12.90$$

He finds an implied growth rate of 8.34 percent.

In the above example, the company was valued at twice its book value because its ROE exceeded its cost of equity. If ROE were equal to the cost of equity, the company would be valued at book value. If ROE were lower than the cost of equity, the company would have negative residual income and be valued at less than book value. In the case in which a company cannot cover its cost of capital, a liquidation of the company and redeployment of assets may be appropriate. Assuming the market appropriately values the company below book value, this case may also be an opportunity for an acquisition or other restructuring in which new management may be able to improve residual income and add value to the company.

Year	Projected Income	Ending Book Value	Forecast ROE (beg. equity, %)	Cost of Equity (%)	Cost of Equity (TWD)	Residual Income	PV of RI	Total PV of RI
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	
Termin	al Premium =	0.00						

TABLE 5-8 Taiwan Semiconductor (Continued)

The market price of TWD81 exceeds the estimated value of TWD59.18. Rosato concludes that the company is overvalued in the current marketplace.

Lee and Swaminathan (1999) and Lee, Myers and Swaminathan (1999) have presented a residual income model based on explicit forecasts of residual income for three years. Thereafter, ROE is forecast to fade to the industry mean value of ROE. The terminal value at the end of the forecast horizon (T) is estimated as the terminal-year residual income discounted as a perpetuity. Lee and Swaminathan stated that this assumes that any growth in earnings after T is value neutral. Table 5-8 presents some recent industry ROE data from Baseline. In forecasting a fading ROE, the analyst should also consider any trends in industry ROE.

Industry	ROE	Industry	ROE
Advertising	32.00%	Insurance-Multiline	14.00%
Aerospace/Defense	18.00	Insurance-Prop/Casualty	10.00
Agricultural Product	5.00	IT Consulting & Svc	20.00
Air Freight & Couriers	14.00	Internet Software & Svc	4.00
Aluminum	18.00	Leisure Facilities	9.00
Apparel & Accessory	17.00	Leisure Products	9.00
Application Software	19.00	Machinery Industrial	19.00
Airlines	13.00	Meat Poultry & Fish	11.00
Auto Parts & Equip	20.00	Broadcasting & Cable	2.00
Automobile Mfrs	23.00	Diverse Metal/Mining	6.00
Banks	34.00	Motorcycle Mfrs	27.00
Soft Drinks	30.00	Multi–Utilities	12.00
Biotechnology	24.00	Networking Equipment	21.00
Building Products	18.00	Office Electronics	20.00
Brewers	37.00	Services-Office/Supp	37.00
Chemicals-Commodity	45.00	Oil & Gas–Drilling	6.00

TABLE 5-9 U.S. Industry ROEs, 2000

Industry	ROE	Industry	ROE
Consumer Electronics	15.00	Oil & Gas–Equip/Svc	7.00
Computer Hardware	29.00	Oil & Gas–Explor/Prod	27.00
Industrial Conglomerates	28.00	Oil & Gas–Integrated	30.00
Construction Materials	16.00	Oil & Gas–Refng/Mktg	21.00
Contain Metal/Glass	9.00	Services-Environmental	18.00
Casinos & Gaming	12.00	Integrated Telecom Svc	24.00
Personal Products	53.00	Photographic Prods	38.00
Chemicals-Diverse	17.00	Packaged Foods	55.00
Services-Div/Comm'l	29.00	Paper Packaging	12.00
Computer Storage/Peripherals	27.00	Paper Products	7.00
Distributors	18.00	Precious Metal & Mineral	19.00
Diverse Financial Svc	24.00	Commercial Printing	22.00
Services–Data Proc	24.00	Publishing & Printing	18.00
Pharmaceuticals	34.00	Railroads	8.00
Distiller & Vintners	22.00	Reinsurance	8.00
Electrical Component	18.00	Restaurants	24.00
Electronic Equip/Inst	17.00	Retail-Apparel	36.00
Construction & Engineer	5.00	Retail-Catalog	18.00
Movies & Entertainment	11.00	Retail-Comp/Electronic	21.00
Electric Utilities	15.00	Department Stores	12.00
Chemicals-Agri/Fertilizer	11.00	Retail–Drugs	19.00
Consumer Finance	25.00	General Merchandise	23.00
Food Distributors	27.00	Retail–Home Improve	18.00
Retail–Food	23.00	Specialty Stores	19.00
Forest Products	11.00	Chemicals-Specialty	15.00
Gold	6.00	Semiconductors	27.00
Gas Utilities	14.00	Semiconductor Equip	32.00
Healthcare-Dist/Svc	14.00	Marine	12.00
Healthcare-Equipment	27.00	Footwear	18.00
Healthcare–Facility	6.00	Services-Employment	29.00
Healthcare–Managed Care	17.00	Steel	10.00
Healthcare–Supplies	7.00	Systems Software	37.00
Homebuilding	23.00	Tobacco	55.00
Home Furnishings	15.00	Telecom Equipment	11.00
Hotels	16.00	Tires & Rubber	3.00
Household Appliances	36.00	Wireless Telecom Svc	5.00
Household Products	36.00	Trade Cos & Distr	15.00
Housewares & Specs	16.00	Machinery Const/Farm	16.00
Industrial Gases	9.00	Trucking	9.00
Insurance-Brokers	21.00	Textiles	5.00
Insurance-Life/Health	12.00	Water Utilities	10.00

TABLE 5-9 U.S. Industry ROEs, 2000 (Continued)

EXAMPLE 5-11. Multistage Residual Income Model (2).

Rosato's supervisor questions her assumption that Taiwan Semiconductor will have no premium at the end of her forecast period. Rosato amends her model to use a terminal value based on a perpetuity of Year 2021 residual income. She computes the following terminal value:

TV = 40.72/0.1433 = 284.16

The present value of this terminal value is as follows:

 $PV = 284.16/(1.1433)^{20} = 19.51$

Adding this number to the previous value of 58.91 (for which the terminal value was zero) yields a total value of TWD78.69. Because the current market price of TWD81 is greater than TWD78.69, Rosato concludes that market participants expect a positive continuing residual income after her forecast period.

Another multistage model assumes that ROE fades over time to the cost of equity. In this approach, ROE can be explicitly forecast each period until reaching the cost of equity. The forecast would then end and the terminal value would be zero. Example 5-6 presented such a model using Dell Computer Corporation.

Dechow, Hutton, and Sloan (1998) presented an analysis of a residual income model in which residual income fades over time:²⁹

$$V_0 = B_0 + \sum_{t=1}^{T-1} \frac{(E_t - rB_{t-1})}{(1+r)^t} + \frac{E_T - rB_{T-1}}{(1+r-\omega)(1+r)^{T-1}}$$
(5-8)

This model adds a persistence factor, ω , which is between 0 and 1. A persistence factor of 1.0 implies that residual income will continue indefinitely (a perpetuity). A persistence factor of 0 implies that residual income will not continue after the initial forecast horizon. The higher the value of the persistence factor, the higher the valuation. Dechow et al. found that in a large sample of company data from 1976 to 1995, the persistence factor equaled 0.62. This persistence factor considers the long-run mean-reverting nature of ROE, assuming that over time ROE regresses towards *r* and that resulting residual income fades toward zero. Bauman (1999) noted that the above results imply that residual income decays at a rate of 38 percent a year on average. Bauman uses the Dechow et al. model to demonstrate residual income valuation for Cisco. Bauman uses a persistence factor of 0.80 for Cisco, stating that Cisco's market leadership implies a lower rate of decay (20 percent). Clearly, the persistence factor varies from company to company. Dechow et al. provided insight into some characteristics that can indicate a lower or higher level of persistence, listed in Table 5-10.

²⁹ See Dechow, Hutton, and Sloan (1998) and Bauman (1999).

Lower Residual Income Persistence	Higher Residual Income Persistence
Extreme accounting rates of return (ROE)	Low dividend payout
Extreme levels of special items (e.g., nonrecurring items)	High historical persistence in the industry
Extreme levels of accounting accruals	

TABLE 5-10	Final-Stage	Residual	Income	Persistence
------------	-------------	----------	--------	-------------

Example 5-12 illustrates the assumption that continuing residual income will decline to zero as ROE approaches the required rate of return on equity.

EXAMPLE 5-12. Multistage Residual Income Model (3).

Rosato extends her analysis to consider the possibility that ROE will slowly decay after 2022 toward *r*, rather than using a perpetuity of Year 2021 residual income. Rosato estimates a persistence parameter of 0.60. The present value of the terminal value is determined as

$$\frac{E_T - rB_{T-1}}{(1 + r - \omega)(1 + r)^{T-1}}$$

with T = 21 and 2022 residual income equal to $40.72 \times 1.20 = 48.86$.

 $\frac{48.86}{\left(1+0.1433-0.60\right)\left(1.1433\right)^{20}}=6.18$

Total value is TWD65.36 calculated by adding 6.18 to 59.18. Rosato concludes that if Taiwan Semiconductor's residual income does not persist at a stable level past 2022 and deteriorates over time, the shares are overvalued.

7 SUMMARY

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 $\% \times$ 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 pershare residual income. According to the residual income model, equivalent mathematical expressions for intrinsic value of a common stock are

$$V_0 = B_0 + \sum_{t=1}^{\infty} \frac{\mathrm{RI}_t}{(1+r)^t} = B_0 + \sum_{t=1}^{\infty} \frac{E_t - rB_{t-1}}{(1+r)^t} = B_0 + \sum_{t=1}^{\infty} \frac{(\mathrm{ROE}_t - r) \times B_{t-1}}{(1+r)^t}$$

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 if 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 NewMarket 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.

- (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 3 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 a 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 31 December 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 31 December 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 = $10 \text{ per share (at year-end 2001).}$
 - 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 the zero premium shown in Example 5-10.
- **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 the 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 31 December 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?

SO	LU	TI	0	NS

1. Yes, VIM earned a positive residual income:

EBIT Interest Pretax income	$\frac{300,000}{120,000} (2,000,000 \times 6\%)$ 180,000
Tax expense Net income	$\frac{72,000}{108,000}$
Equity charge	= Equity capital × Required return on equity = $(1/3)(3,000,000) \times 0.10$ = $1,000,000 \times 0.10 = 100,000$
Residual income	e = Net income - 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 × 6% = \$120,000, we find that VIM has residual income of \$8,000 calculated (as in Problem 1) as follows:

Residual income = Net income - Equity charge
=
$$[(EBIT - Interest)(1 - Tax rate)]$$

- $[(Equity capital)(Required return on equity)]$
= $[(\$300,000 - \$120,000)(1 - 0.40)] - [(\$1,000,000)(0.10)]$
= $\$108,000 - \$100,000$
= $\$8,000$

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

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

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

P/B = (ROE - g)/(r - g)= (0.15 - 0.03)/(0.12 - 0.03) = 0.12/0.09 = 1.33 or P/B = 1 + (ROE - r)/(r - g)= 1 + (0.15 - 0.12)/(0.12 - 0.03) = 1.33

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

Net income = Pretax income
$$\times$$
 (1 - Tax rate)
= \$5.1 million \times (1 - 0.4)
= \$5.1 \times 0.6 = \$3.06 million

Equity charge: Total equity \times Cost of equity capital = $(0.1 \times \$450 \text{ million}) \times 12\%$ = $\$45 \text{ million} \times 0.12 = \$5,400,000$ Residual income = Net income - Equity charge

= \$3,060,000 - \$5,400,000 = -\$2,340,000

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 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 percent 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 $(0.10 - 0.087) \times \text{}{\in}100 \text{ million} = \text{}{\in}1.3 \text{ million}.$

6. A. $EVA = NOPAT - WACC \times (Beginning book value of assets)$

$$= 100 - (11\%) \times (200 + 300) = 100 - (11\%)(500) = $45$$

B. RI_t = $E_t - rB_{t-1}$ = 5.00 - (11%)(30.00) = 5.00 - 3.30 = €1.70 C. RI_t = (ROE_t - r) × B_t

$$a_t = (ROE_t - r) \land B_{t-1}$$

= (18% - 12%) × (30) = €1.80

- 7. A. Economic value added = Net operating profit after taxes (Cost of capital \times Total capital) = \$100 million (14% \times \$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 = \$1.48 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 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) = -\$0.12

Present value of perpetual stream of residual income equals

 $RI_t/r = -\$0.12/0.12 = -\1.00 $V_0 = \$6.00 - \$1.00 = \$5.00$ per share

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

 $V_0 =$ \$2.00/0.125 = \$16 per share

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

> $RI_t = E - rB_{t-1}$ = \$2 - (0.125)(\$10) = \$0.75

Present value of stream of residual income = RI_t/r

= 0.75/0.125 = \$6V₀ = \$10 + \$6 = \$16 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
$V_0 = 8.00 + 3.20/1.1 + 4.00/(1.1)^2 + V_0 = 8.00 + 2.909 + 3.306 + 5.071 =$	• •		
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
$V_0 = 8.00 + 3.20/1.1 + 4.00/(1.1)^2 +$	$6.75/(1.1)^3$		

 $V_0 = 8.00 + 3.20/1.1 + 4.00/(1.1)^2 + 6.75/(1.1)$ $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 = $ROE \times Book$ value	4.50	4.95	6.59
	Dividends	1.50	1.65	2.20
	Equity charge ($r \times Book$ 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, which equals Book value (beginning of year) \times (ROE - r) = \$30 \times (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 func-

tion of book value and return on equity is constant, then growth can be predicted from g = (ROE)(1 - Dividend payout ratio). In this case, $g = 0.15 \times (1 - 0.333) = 0.10$ 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) \times (1.1)⁴. Residual income in Year 2005 = $0.90 \times 1.4641 =$ \$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. $V_0 = B_0 + [(\text{ROE} r)/(r g)] \times B_0$ = \$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.
$$V_0 = B_0 + (\text{ROE} - r) \times B_0/(r - g)$$

= 30 + (0.15 - 0.12) × 30/(0.12 - 0.10)
= 30 + 45 = \$75 per share

15.

Year	Net Income (Projected)	Ending Book Value	ROE (%)	Equity Charge (in currency)	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	<u>0.55</u>
						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

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

Total value is 59.18 + 13.79 = TWD72.97. The analyst would again conclude that TSM's shares are overvalued.

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	1034.10	20.00	14.33	123.49	48.86	2.93	
2023	206.82	1240.91	20.00	14.33	148.19	58.63		

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

The present value of the terminal value would then be

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

Total value is 62.11 + 14.47 = TWD76.58. 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	Dividends	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 $(\%) \times$ 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 3.0 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	
All		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 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.