REVIEW EXERCISE 1.1

The Market Value Company Economic Balance Sheet

Prepare an economic balance sheet for The Market Value Company as of Year 0 using the following information and the financial statements provided. The company's share price is $12.08 and it has 1,200 shares outstanding. Its debt is trading at a premium, indicating that its market value is equal to 102% of its book value. The company has land valued at $3,000 that is not necessary to operate the business. Based on the amount and type of debt financing, the company creates $3,800 in value from financing.

THE MARKET VALUE COMPANY
Income Statement and Balance Sheet Forecasts

	Year –1	Year 0
Balance Sheet—Assets		
Cash balance	$ 171.4	$ 188.5
Accounts receivable	571.2	628.3
Inventory	286.5	315.2
Total current assets	$1,029.1	$1,132.0
Net property, plant and equipment	7,539.4	8,567.5
Total assets	$8,568.5	$9,699.5
Income Statement		
Revenue	$3,427.0	$3,769.7
Cost of goods sold	–1,473.6	–1,621.0
Gross margin	$1,953.4	$2,148.7
Selling, general and administrative	–479.8	–527.8
Operating income	$1,473.6	$1,621.0
Interest expense	–307.0	–384.0
Income before taxes	$1,166.6	$1,237.0
Income tax expense	–443.3	–470.0
Net income	$ 723.3	$ 766.9

	Year –1	Year 0
Balance Sheet—Liabilities & Equity		
Accounts payable	$ 122.8	$ 135.1
Other current operating liabilities	119.9	131.9
Total current liabilities	$ 242.7	$ 267.0
Debt	4,800.0	5,200.0
Total liabilities	$5,042.7	$5,467.0
Common stock	$1,802.4	$1,802.4
Retained earnings	1,723.3	2,430.0
Total shareholders' equity	$3,525.7	$4,232.4
Total liabilities and equities	$8,568.5	$9,699.5

Exhibit may contain small rounding errors

Solution on pages 34–35.

1.3 VALUATION PRINCIPLES

LO2 Understand the principles underpinning the commonly used valuation methods

An asset has value to an investor because the investor believes the asset will generate cash flows in the future. The value of an asset depends on the magnitude, timing, and risk of the cash flows the investor expects it to generate. Holding everything else constant, the value of an asset increases if the magnitude of its expected cash flows increases, if its expected cash flows arrive sooner, or if its risk (risk-adjusted discount rate) decreases. As we discuss below, the **discounted cash flow (DCF) valuation model** directly results from these valuation principles.

Valuation Key 1.2

The value of an asset depends on the magnitude, timing, and risk of the cash flows (called free cash flows) the investor expects it to generate. The discounted cash flow (DCF) valuation model directly results from these valuation principles.

Introduction to Measuring Free Cash Flows

The DCF model measures the value of an asset as the sum of the expected cash flows the asset generates after adjusting each expected cash flow for its timing and risk. In the context of the valuation of

continued from previous page

The adjustments to the rate of return on assets calculation include deducting the after-tax income on those investments from the numerator ($2.1 billion) and deducting the average balance of its long-term marketable securities from the denominator ($167.2 billion). The adjustments to the rate of return on equity are to again deduct the after-tax income on those investments from the numerator ($2.1 billion) but, instead of deducting the average balance of its long-term marketable securities from the denominator, we minimize the effect on the denominator by assuming Apple first redeems all of its debt and then deduct only the average balance of its long-term marketable securities net of its debt from the denominator ($99.9 billion). Given that we eliminated Apple's debt, we also add back after-tax interest to the numerator ($0.9 billion). This results in a net adjustment to the numerator of $1.2 billion ($1.2 = $2.1 − $0.9). Measured in this way, Apple's return on assets increases to 32% and its return on equity increases to 186%.

($ in millions)	2016 Reported		ROR	Adjustments	2016 Adjusted		ROR
Return on Assets							
Unlevered Income	$ 46,561	=	15.2%	–$ 2,136	$ 44,425	=	32.0%
Average total assets	$306,016			–$167,248	$138,768		
Return on Equity							
Net income	$ 45,687	=	36.9%	–$ 1,262	$ 44,425	=	185.6%
Average common equity	$123,802			–$ 99,870	$ 23,933		

Source: Apple Inc. 2016 10-K Report.

Alternative Ways to Measure Financial Ratio Inputs

Instead of using a measure of accounting income in the numerator, some analysts use some type of cash flow to measure rates of return. For example, we can use unlevered cash flow from operations or free cash flow as the numerator in the return on assets and return on investment equations, and use operating cash flow (adjusted for preferred stock dividends) or equity free cash flow as the numerator in the return on common equity calculation.

Cash flow rate of return measures have become more popular since the standardization of cash flow statements in 1987. Many analysts utilize cash flows from operations for the numerator in equity rate of return measures. One note of caution regarding cash flows from operations is that it does not contain any provision for the replacement of assets, whereas income numbers at least include a depreciation charge. One measure of cash return on assets that captures capital expenditures is free cash flow of the unlevered firm divided by total assets. The limitation of using free cash flow of the unlevered firm in the numerator, however, is that capital expenditures can be "lumpy," that is, large in some years and small in others. Some type of averaging or normalization of capital expenditures can be used to address this issue.

Limitations of Accounting Rates of Return as Measures of Performance

Accounting rates of return have widely recognized limitations as measures of performance.[8] Accounting rates of return focus on the ratio of a measure of earnings in a single year to a measure of investment calculated using financial statement numbers. The percentage change in the value of an investment depends on changes in all expected future cash flows and risk. Thus, accounting earnings, which generally focus on a single period, cannot measure changes in the value of an investment exactly. In addition, historical cost accounting measures of the value of an investment do not reflect market values. Alternative measures that attempt to address some of these limitations involve some sort of longer-term forecast of expected performance and risk.

[8] See, for example, Solomon, E., and J. Lays, "Measurement of Company Profitability: Some Systematic Errors in the Accounting Rate of Return,", in A. Robichek, ed., *Financial Research and Management Decisions*, Wiley (2003), pp. 152–283; and Fisher, F., and J. McGowan, "On the Misuse of Accounting Rates of Return to Infer Monopoly Profits," *American Economic Review* 73 (1983), pp. 82–97.

SOLUTIONS FOR REVIEW EXERCISES

Solution for Review Exercise 2.1: The Gap, Inc. Return on Assets Year +1 and Beyond

Return on Assets	Year 0	Year +1	Year +2	Year +3	Year +4	Year +5	Year +6
Return on assets	16.0%	18.4%	19.9%	20.9%	21.7%	21.8%	21.9%
Unlevered profit margin	8.2%	8.4%	8.5%	8.5%	8.5%	8.5%	8.5%
Total asset utilization (turnover)	1.95	2.19	2.33	2.45	2.54	2.56	2.57
Return on assets (check)	16.0%	18.4%	19.9%	20.9%	21.7%	21.8%	21.9%

Solution for Review Exercise 2.2: The Gap, Inc. Expense Ratio Forecasts for Year +1 and Beyond

Expense Ratios (to Revenue)	Year 0	Year +1	Year +2	Year +3	Year +4	Year +5	Year +6
Cost of goods sold	55.4%	54.7%	54.6%	54.6%	54.6%	54.6%	54.6%
Gross margin	44.6%	45.3%	45.4%	45.4%	45.4%	45.4%	45.4%
Depreciation and amortization	4.4%	4.4%	4.4%	4.4%	4.4%	4.4%	4.4%
Operating expense	26.7%	27.1%	27.0%	27.0%	27.0%	27.0%	27.0%
Operating income	13.4%	13.7%	13.9%	13.9%	13.9%	13.9%	13.9%
Interest expense	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other income (expense), net	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Income before income tax expense	13.5%	13.8%	14.0%	14.0%	14.0%	14.0%	14.0%
Income tax expense (benefit)	5.3%	5.4%	5.5%	5.5%	5.5%	5.5%	5.5%
Net income	8.2%	8.4%	8.5%	8.5%	8.5%	8.5%	8.5%

Solution for Review Exercise 2.3: The Gap, Inc. Asset Utilization Ratios for Year +1 and Beyond

Asset Utilization (Turnover) Ratios	Year 0	Year +1	Year +2	Year +3	Year +4	Year +5	Year +6
Cash—required (total revenues)	6.93	9.00	9.04	9.04	9.04	8.94	8.94
Accounts receivable, gross (total revenues)							
Inventories (total revenues)	9.47	9.29	9.40	9.40	9.40	9.29	9.29
Other current assets (total revenues)	23.29	23.18	23.29	23.29	23.29	23.02	23.02
Total current assets (total revenues)	3.41	3.82	3.85	3.85	3.85	3.80	3.80
Property, plant, and equipment, net (total revenues)	5.65	6.37	7.67	9.10	10.50	11.19	11.47
Other assets (total revenues)	23.11	25.96	26.08	26.08	26.08	25.77	25.77
Total assets w/o excess assets (total revenues)	1.95	2.19	2.33	2.45	2.54	2.56	2.57
Property, plant, and equipment, gross (total revenues)	1.96	1.97	1.97	1.95	1.92	1.82	1.73
Total assets (total revenues)	1.95	2.19	2.33	2.45	2.54	2.56	2.57

continued

Solution for Review Exercise 2.3 continued

1 / Asset Utilization (Turnover) Ratios	A2010	F2011	F2012	F2013	F2014	F2015	F2016
Cash - Required (Total Revenues)	0.144	0.111	0.111	0.111	0.111	0.112	0.112
Accounts Receivable, Gross (Total Revenues)							
Inventories (Total Revenues)	0.106	0.108	0.106	0.106	0.106	0.108	0.108
Other Current Assets (Total Revenues)	0.043	0.043	0.043	0.043	0.043	0.043	0.043
Sum of above = Total Current Assets	**0.293**	**0.262**	**0.260**	**0.260**	**0.260**	**0.263**	**0.263**
Total Current Assets (Total Revenues)	0.293	0.262	0.260	0.260	0.260	0.263	0.263
Property, Plant, and Equipment, Net (Total Rev	0.177	0.157	0.130	0.110	0.095	0.089	0.087
Other Assets (Total Revenues)	0.043	0.039	0.038	0.038	0.038	0.039	0.039
Sum of Above = Total Assets	**0.513**	**0.457**	**0.429**	**0.408**	**0.393**	**0.391**	**0.389**
Total Assets w/o Excess Assets (Total Revenues	0.513	0.457	0.429	0.408	0.393	0.391	0.389
Property, Plant, and Equipment, Gross (Total R	0.511	0.508	0.507	0.512	0.521	0.549	0.579
Total Assets (Total Revenues)	0.513	0.457	0.429	0.408	0.393	0.391	0.389

Assume a company has taxable income equal to $100,000, but it also has $10,000 in interest income from non-taxable municipal bonds. Assume further that the company has a 40% tax rate on all types of taxable income. For financial accounting purposes, the company has income before tax equal to $110,000. For income tax purposes, the company has income equal to $100,000 and an income tax liability equal to $40,000 ($40,000 = 0.4 × $100,000). Since the municipal bond interest is a permanent difference, the financial accounting records also reflect the $40,000 income tax liability. The correct calculation and presentation of the company's income taxes is as follows:

	Tax (40%)	Book
Income before interest expense and interest income	$120,000	$120,000
Interest expense	−20,000	−20,000
Municipal bond interest		10,000
Taxable income or income before taxes	$100,000	$110,000
Income tax payable or expense (provision)	−40,000	−40,000
Net income	$ 60,000	$ 70,000
Effective income tax rate	40.0%	36.4%

A permanent difference in net income—between the income tax records and financial statements—causes the effective tax rate implied in the financial statements to differ from the statutory tax rate. The effective tax rate implied in the financial statements is simply calculated as the provision for income taxes (income tax expense) divided by income before tax. In our example, the effective income tax rate is 36.4% (0.364 = $40,000/$110,000) rather than 40.0%. This difference is important because the effective tax rate implied in the financial statements does not represent the tax rate used in the calculation of interest tax shields, or the income tax rate that the company pays on its taxable income, or the income tax rate used for EBIT in the free cash flow schedule. U.S. companies are required to reconcile the difference between the U.S. federal statutory rate and the effective income tax rate. The reconciliation is useful because it provides us with information relevant to determining the tax rate the company faces. In this case, the reconciliation would indicate that the company is paying at the 40% tax rate on its taxable income. The reconciliation for the company in our example is as follows:

Reconciliation to the Statutory Rate	
Statutory rate	40.0%
Non-taxable municipal bond interest*	–3.6%
Effective income tax rate	36.4%

*Calculated as 0.4 × $10,000/$110,000

The income tax rate for interest, T_{INT}, is an input to measure free cash flows. Given the assumptions in this example, we know the income tax rate for interest is 40%. While in this case it is easy to determine the income tax rate on interest that is not always the case. We illustrate the steps in performing this calculation. First, we measure the interest tax shield, which is equal to the difference between the income taxes paid by the company with and without the interest deduction. In other words, the difference between the income taxes paid if the company did not have debt and its actual income taxes. In the above example, if the company did not have any interest expense, its taxable income would equal its operating income, $120,000. The income tax on taxable income of $120,000 is $48,000 ($48,000 = 0.4 × $120,000). As shown in the above table, the income tax on taxable income after deducting interest is $40,000. The income tax reduction from the interest deduction, that is, the interest tax shield, is $8,000 ($8,000 = $48,000 − $40,000). Based on the interest tax shield, we measure the income tax rate for interest, T_{INT}, as the interest tax shield divided by the interest deduction, 40% (0.4 = $8,000/$20,000). We note that in cases where the company has net operating losses (NOLs) or has interest expense that exceeds the limitation on tax deductible interest, measuring the interest tax shield and the income tax rate for interest is more complicated. We discuss these issues later in the chapter.

In this example, EBIT is equal to the company's income, $70,000, plus its interest expense, $20,000, plus its income taxes, $40,000, or $130,000 (assuming we include the municipal bond interest in EBIT). The accounting-based income tax on EBIT is equal to actual income tax paid plus the interest tax shield, $48,000 ($48,000 = $40,000 + $8,000). In this example, the accounting-based income tax on EBIT is also equal to the income taxes

paid because the company only has a permanent difference (no temporary difference), and thus, the accounting-based income tax (income tax expense) is equal to the income tax that would be paid on EBIT. The accounting-based income tax rate for EBIT is equal to 36.9%, (0.369 = $48,000/$130,000), which is not equal to either the effective tax rate, 36.4%, or the income tax rate for interest, 40%. Although we can calculate the income tax rate on EBIT in this way, we typically do not need this income tax rate because we can calculate the amount of the accounting-based income taxes on EBIT as the actual provision for income taxes (income tax expense) plus the interest tax shield, which does not require knowing this rate. Again, it is important to remember that here we assume that the only difference between book income and tax income is a permanent difference; with temporary differences this calculation is more complex.

REVIEW EXERCISE 3.3

Effect of Permanent Difference on Income Tax Rates

A company has $200,000 of income before interest expense and interest income on both its income statement (book) and tax forms (tax). The company also has $80,000 of interest expense that is also tax deductible and $60,000 of municipal bond interest income that is not taxable. The company has a 40% tax rate on all types of income. Calculate the company's effective tax rate and prepare a reconciliation between its 40% statutory rate and its effective tax rate. Also calculate the company's interest tax shield and the income tax rate for interest. Assume the company's EBIT is $260,000 ($260,000 = $200,000 + $60,000), what is the income tax the company would pay on EBIT? Assume that all interest expense is tax deductible in each year and is not subject to any limitation.

Solution on page 149.

Temporary Differences Between Book and Tax Accounting

A company's income tax expense shown on the income statement usually does not equal the income taxes on its tax forms that are currently payable to various governments. In the past, some countries had close uniformity between book and tax accounting, however in the U.S., and in many other countries now, a company's financial statements are not identical to its income tax records (filed with various tax authorities), and the differences are not just permanent differences.

Temporary differences arise when the revenues and/or expenses on the tax records are temporarily different from the revenues and/or expenses in the financial statements. These temporary differences between the book and tax records eventually reverse themselves so that the cumulative expenses or revenues are the same over the life of the firm. Temporary differences result in the creation of either **deferred income tax asset** or **deferred income tax liability** accounts (or both). Deferred income tax asset or liability accounts arise when the values of the assets and liabilities on a company's financial statements (the **book value** of its assets and liabilities) do not equal the values in its income tax records (the **tax basis** of the assets and liabilities) because of temporary differences. Permanent differences do not create deferred income tax assets or liabilities. If it is more likely than not that the company will not be able to capture the benefit of a deferred tax asset, accounting rules require companies to offset (reduce) the balance of a deferred tax asset using a separate **valuation allowance** account. In other words, if management does not expect to be able to capture the benefits of a deferred tax asset, the company reduces the value of its deferred tax asset for the amount of the asset that it may not be able to capture. A valuation allowance is a contra-asset account and essentially records the reduction in the deferred tax assets in such circumstances.

Deferred tax asset and liability accounts do not represent cash flows. Why do we care about them when valuing a company? We care about deferred income taxes because we typically do not have access to a company's income tax records. Therefore, we use the deferred income tax assets and liabilities in order to measure the company's income tax payable to the tax authorities, which we use to calculate free cash flows. While deferred tax asset and liability accounts are not cash flows in themselves, we use them to calculate income taxes paid by adjusting the provision for income taxes (income tax expense on the income statement).

Conceptually, the balance of a company's net deferred income taxes (that is, the net of the company's deferred tax assets and deferred tax liabilities) is equal to the difference between the book value and tax basis of the company's assets and liabilities, multiplied by the appropriate tax rate. The provision for income taxes reported on the company's income statement is equal to the sum of the income tax on the

Administration (FDA), and the efficacy tests indicate that the drug has great benefits with little side effects—turning it into a blockbuster drug with strong demand and excellent pricing. Another scenario is that the drug is approved, but the tests indicate frequent side effects and positive results in a smaller number of patients. Thus, while the drug will be marketable to patients with little hope from any alternative treatments, its sales will not be as impressive. Finally, we could develop a scenario where the FDA does not approve the drug due to serious side effects and poor clinical results at an early stage of testing and further development is abandoned.[6]

A Monte Carlo simulation is more complex than either a sensitivity or scenario analysis. In a **Monte Carlo simulation**, we incorporate a financial model into a simulation software package (for example an Excel add-on). In addition, we input distributional parameters for each forecast driver in the model (for example, assume that the company's ratio of cost of goods sold to revenue is normally distributed with a mean of 55% and a variance of 1.5%) and the correlation among all of the forecast drivers. The simulation software package allows the user to choose from a wide variety of statistical distributions as well as allowing the user to customize the distribution. The simulation then generates distributions of the forecasts by repeatedly sampling across the forecast drivers, based on the distributional assumptions provided. Assuming the financial model calculates the present value of the future cash flows, the simulation will provide a distribution of firm values obtained from the distributional assumptions provided. The mean of the distribution will represent the value of the company at the expected value of the cash flows.

Valuation Key 4.4

Sensitivity analyses, scenario analyses, and simulations can be useful tools to understand the impact that various assumptions have on forecasts and valuations. In addition, these tools can provide a distribution of possible forecasts and valuations based on the distributions of the assumptions in the financial model. One advantage of uncovering which assumptions have the biggest impact on value is that we can then try to refine our information with respect to the most critical drivers of value.

4.8 FORECASTING REQUIRED CASH AND VALUING EXCESS CASH

LO4 Forecast required cash and measure excess cash

As we discussed in all of the earlier chapters, companies require some amount of cash or securities that can be converted into cash to operate their businesses, which we call **required cash**. Some companies require more cash than others, and generally, the amount of cash required to operate the business increases with the scale of the business. Some companies, however, hold more cash (and liquid investments also referred to as cash) than they need to operate the company, called **excess cash**. Recalling the discussion in Chapter 3, excess cash flow results whenever managers do not distribute all of the company's (positive) equity free cash flows to its common equityholders.

Economic research suggests that companies hold excess cash for a variety of reasons.[7] Some multinational companies hold more cash than they need because of repatriation taxes that result from upstreaming cash to the parent company. This depends on the home country's tax system. For example, prior to 2018, U.S. multinational firms paid U.S. taxes on cash they repatriated back to the U.S. parent, whereas those earnings escaped U.S. taxes if the funds were not repatriated back. This is called a worldwide tax system, meaning the home country taxes the earnings of the company from all over the world when it is repatriated back to the parent (more on this in Chapter 17). Of course with the passage of the Tax Cuts and Jobs Act of 2017, companies must now pay taxes on those previously unrepatriated earnings (15.5% on liquid assets and 8% on illiquid assets) and they have eight years in which to do so (8% in each of first five years, 15% in year 6, 20% in year 7 and 25% in year 8, starting in 2018). Thus, U.S. companies can now use those liquid

[6] According to the 2013 Association for Financial Professionals survey, 72% of the respondents use multiple scenarios to evaluate projects and other investment opportunities. See, 2013 AFP Estimating and Applying Cost of Capital: Report of Survey Results, October 2013, Association for Financial Professionals.

[7] See, for example, Bates, T. W., K. M. Kahle, and R. M. Stulz, "Why Do U.S. Firms Hold So Much More Cash than They Used To?," *Journal of Finance* vol. LXIV, no. 5 (October 2009), pp. 1985–2021; Opler, T., et al. "The Determinants and Implications of Corporate Cash," *Journal of Financial Economics* vol. 52 (1999), pp. 3–46; Foleya, C. F., et al., "Why Do Firms Hold so Much Cash? A Tax-Based Explanation," *Journal of Financial Economics* vol. 86, no. 3 (December 2007), pp. 579–607; Simutin, Mikhail, "Excess Cash and Stock Returns," *Financial Management* vol. 39, no. 3 (Autumn 2010), pp. 1197–1222; and Liu, Yixin and David C. Mauer, "Corporate Cash Holdings and CEO Compensation Incentives," *Journal of Financial Economics* vol. 39, no. 3 (Autumn 2010), pp. 83–198.

REVIEW EXERCISE 6.3

Estimating Growth Rates from Comparable Companies

A comparable company has a 10% weighted average cost of capital. Its equity value is currently $12,000, and the value of its debt—the only other financing it uses—is $6,000. It has unlevered free cash flow forecasts for the next three years equal to $1,000, $1,200, and $1,500, respectively. The company is anticipated to maintain a constant proportionate capital structure. Measure the present value weighted average growth rate for the company's continuing value for Year 4 and beyond.

Solution on page 287.

6.3 ESTIMATING THE BASE-YEAR FREE CASH FLOW

LO3 Measure the base-year free cash flow for the constant-growth perpetuity model

In this section, we discuss some of the factors to consider when estimating the base-year free cash flow for the constant-growth perpetuity model. First, we consider the growth rates of the components of the free cash flow forecasts, which may require extending the year-by-year forecast horizon so that the free cash flow growth rate in the year-by-year forecasts approaches the long-term growth rate. Second, we consider the "lumpy" nature of some types of capital expenditures. Third, we consider a related issue, when depreciable useful life differs from economic useful life. While these issues are not uncommon for individual assets, we typically assume they are less important at the company level. Lastly, we discuss the relation between capital expenditures and depreciation.

Preparing the Base-Year Free Cash Flow Forecast for the Financial Model

Valuations are often based on financial models that grow the scale of the company and free cash flows at a rate that is substantially higher than the long-term growth rate even in the last year of the year-by-year forecast horizon and then, as of the continuing value date, assume the free cash flows grow at a substantially lower long-term growth rate in perpetuity. The degree to which this assumption is correct depends on the required growth in the balance sheet to support the assumed growth in the free cash flows. Consider two extreme example companies.

Company A requires no investments in assets and has no liabilities, and it has all cash revenues and cash expenses, which are proportional to its revenues. For this company, free cash flows equal revenues minus expenses. Since expenses grow at the same rate as revenues, free cash flows grow at the same rate as revenues. For this company, a change in the revenue growth rate results in the same change in the free cash flow growth rate because it has no required growth in the balance sheet to support the assumed growth in the free cash flows.

Company B requires substantial investments in fixed assets (for example, land) and has no liabilities, and it has all cash revenues and no expenses (land is not depreciated). For this company, free cash flows equal revenues minus capital expenditures. While this company's balance sheet (total investment in fixed assets) always grows at the same growth rate as revenues, its capital expenditures (investment in additional fixed assets—that is the change in the balance sheet account) do not if the growth rate in a year is different from the growth rate in the previous year. In a year that the revenue growth rate increases, the growth rate for land (more generally, the growth rate for capital expenditures and the change in working capital) is higher than the revenue growth rate, and free cash flows grow at a rate lower than the revenue growth rate in that year. In a year that the revenue growth rate decreases, the growth rate for land is lower than the revenue growth rate, and free cash flows grow at a rate higher than the revenue growth rate in that period.

In Exhibit 6.8, we provide a simple illustration of the effect of changing revenue growth rates on free cash flow growth rates for a company with required investments in working capital. This company has no capital expenditures and finances itself with 100% equity. Its only expense is an operating expense that is equal to 60% of revenues, and it has a constant income tax rate equal to 30%. The company has only one asset—accounts receivable—that is equal to 40% of revenues. The company's revenues grow

EXHIBIT 6.14 Value Created or Destroyed (Real Cost of Capital = 12%, Initial Free Cash Flow Without New Investment = $120, and Inflation = 2.5%)

I%	FCFROI	Inflation (i)	FCF_1	g_{FCF}	$[r - g_{FCF}]^{-1}$	V_0	% Change in V_0
0%		2.5%	$123	2.5%	8.1	$1,000	
20%	10.0%	2.5%	98	4.0%	9.3	911	–8.9%
20%	14.8%	2.5%	98	5.0%	10.2	1,000	0.0%
20%	18.0%	2.5%	98	5.6%	10.9	1,070	7.0%
40%	10.0%	2.5%	74	5.5%	10.8	794	–20.6%
40%	14.8%	2.5%	74	7.4%	13.6	1,000	0.0%
40%	18.0%	2.5%	74	8.7%	16.4	1,210	21.0%

date. In order to assess the reasonableness of those forecasts, we use tools such as the financial analysis discussed in Chapter 2 to analyze financial statement forecasts as of the continuing value date. We discuss this in more detail in Section 6.5.

Yahoo! with New Investments as of the Continuing Value Date

To illustrate how new investment opportunities affect continuing value, we assume that Yahoo's management believes that in Year 11, and thereafter, it will have additional opportunities to invest a certain percentage of its free cash flow in new investments (a certain percentage of $5.678 billion in Year 11 and of each subsequent free cash flow before new investments). Should Yahoo make this additional investment each year? The answer, of course, depends on the economic rate of return that Yahoo expects to earn on these new investments.

In Exhibit 6.15, we illustrate the effect resulting from three alternative assumptions regarding Yahoo's new investment opportunities as of the continuing value date. We use the same free cash flow, discount rate, and inflation rate that we used in the continuing value calculation of $59.8 billion (Appendix Exhibit A6.3), which we show in the first column of this exhibit. In the second column of the exhibit, we assume that Yahoo invests 20% of its free cash flow of $5.7 billion and that the nominal return on the new investment is 12% as a result of a real rate of return on new investment of 9.27% and inflation of 2.5% (12% nominal, $0.12 = 1.0927 \times 1.025 - 1$). Applying Equation 6.7, we see that this investment strategy is value neutral; even though Yahoo's growth rate increases to 4.4%, which is 1.9% above inflation, its value is unchanged by this investment regardless of the percentage invested in the new investment, for the return on new investment is equal to the required rate of return. In other words, these new investments are zero NPV investments that do not create value.

EXHIBIT 6.15 Yahoo! Inc.—Alternative New Investment Opportunities

	No New Investment	Value Neutral New Investment	Value Creating New Investment	Value Destroying New Investment
Free cash flow (Before investment), Year CV+1	$5.678	$5.678	$5.678	$5.678
Nominal required rate of return	12.00%	12.00%	12.00%	12.00%
Inflation	2.50%	2.50%	2.50%	2.50%
Return on new investment (Real)		9.27%	11.00%	8.00%
Return on new investment (Nominal)		12.000%	13.775%	10.700%
% New investment		20.00%	20.00%	20.00%
Growth rate	2.50%	4.40%	4.76%	4.14%
Continuing value	$ 59.8	$ 59.8	$ 62.7	$ 57.8
% Change in value		0.00%	4.90%	–3.31%

In the third column of the exhibit, we increase the real return on the new investment to 11% (13.8% nominal) but maintain all other assumptions. Since the inflation-adjusted return on new investment is larger

replaced every three years and depreciation on fixed assets purchased begins the year after they are purchased. The replacement cost of all fixed assets is expected to remain constant in perpetuity. The company will have to invest $1.2 million in fixed assets at the end of Years 1 and 2 to support its revenue growth in Years 2 and 3. The company is all-equity financed, will hold no cash, and has no working capital requirements. The company's cost of capital is 12%. Measure the company's free cash flow for Years 1 through 4. Measure the value of the company as of the end of Year 0.

P6.7 **Growth and Value Creation:** Assume a company has expected free cash flows equal to $12,000 in Year 0, before making any new investments. It has a discount rate of 15%, and the inflation rate is 3%. If the company does not invest any of its free cash flows without new investment in Year 0, its cash flows will grow at the inflation rate. The company believes it could invest 20% of its free cash flows before new investment in perpetuity. Measure the value of the company under four scenarios: no new investment is made; the company makes a new investment each year and earns a 10%, 15%, and 20% nominal return on its investment annually and in perpetuity. What if the company invested 40% of its free cash flows before new investment and earned a 10%, 15%, or 20% nominal return?

P6.8 **Growth Rates and Continuing Value—Ed Kaplan, Inc.:** A young analyst is valuing Ed Kaplan, Inc. as of the end of Year 0. The forecast drivers underpinning the financial statement and free cash flow forecasts for four years appear in Exhibit P6.2, and the resulting income statement, balance sheet, and free cash flow forecasts for three years appear in Exhibits P6.3 and P6.4. The company's unlevered cost of capital is 13% and interest tax shields are valued using the unlevered cost of capital. The company's revenue growth rate is expected to equal 3% in perpetuity beginning in Year 4. The company intends to increase the amount of debt outstanding every year beginning at the end of Year 4 by 3%. To measure the company's continuing value at the end of Year 3, the analyst assumed the Year 3 free cash flow grew at 3% in Year 4 and then continued at that growth rate in perpetuity. The analyst calculated the company's continuing value at the end of Year 3 (CV_3) using the following formula:

$$CV_3 = \frac{FCF_3 \times (1+g)}{r_{UA} - g} + \frac{ITS_3}{r_{UA}}$$

$$CV_3 = \frac{\$852.5(1.03)}{0.13-0.03} + \frac{\$320.0}{0.13} = \$8{,}780.75 + \$2{,}461.5 = \$11{,}242.3$$

NOTE TO INSTRUCTOR:
p6.8
Number of days used for solution was 360, not 365 per the formula in the book for Days Sales in Inventory, Days in A/P, and Days Sales in A/R.
Instruct students as to which to use in their calculations.

a. Identify the errors the analyst made in the continuing value calculation.
b. Forecast the company's unlevered free cash flow in Year 4 using the information in the exhibits for this problem.
c. Discuss the difference between the Year 4 growth rates for revenue and the unlevered free cash flow.
d. Calculate the correct value of the firm as of the end of Year 0 and the continuing value of the firm as of the end of Year 3 using the perpetuity valuation.
e. Forecast the company's equity free cash flow in Year 4 using the information in the exhibits for this problem.
f. Calculate the correct value of the equity as of the end of Year 0 and the continuing value of the equity as of the end of Year 3 using the perpetuity valuation.

EXHIBIT P6.2 Ed Kaplan, Inc.—Forecast Drivers

Ed Kaplan, Inc.—Foreast Drivers	Actual	Forecast			
	Year 0	Year 1	Year 2	Year 3	Year 4
Expected inflation	3.0%	3.0%	3.0%	3.0%	3.0%
Revenue growth rate	10.0%	20.0%	20.0%	20.0%	3.0%
Cost of goods sold (% revenue)	20.0%	20.0%	20.0%	20.0%	20.0%
Selling, general and administrative (% revenue)	12.0%	12.0%	12.0%	12.0%	12.0%
Constant income tax rate	40.0%	40.0%	40.0%	40.0%	40.0%
Required cash balance (% revenue)	2.5%	2.5%	2.5%	2.5%	2.5%
Accounts receivable (days to collect)	60.0	60.0	60.0	60.0	60.0
Inventory (days to sell)	70.0	70.0	70.0	70.0	70.0
Accounts payable (days to pay)	30.0	30.0	30.0	30.0	30.0
Other current operating liabilities (% revenue)	3.5%	3.5%	3.5%	3.5%	3.5%
Land based on revenue to land	0.50	0.50	0.50	0.50	0.50
Interest rate on debt	8.0%	8.0%	8.0%	8.0%	8.0%

If we plug our unlevered beta estimate into the CAPM equation with a 4% risk-free rate and 6% market risk premium, we find the unlevered cost of capital is equal to 10.05% (0.1005 = 0.04 + 1.008 × 0.06) which is the same result we obtained when we unlevered the equity cost of capital previously when using the annual refinancing assumption.

When the Cost of Debt Is the Discount Rate for Some but Not All Interest Tax Shields

The unlevering formulas in Equations 10.15 (to unlever the equity cost of capital) and 10.19 (to unlever the equity beta), are useful when the cost of debt is the discount rate for some, but not all of a company's interest tax shields. The most likely situation in which these formulas will be used is when a company has existing debt and plans to refinance that debt based on a debt-to-value ratio when the debt matures. Given that lenders naturally have a limit on how much debt the company can borrow relative to the value of the underlying assets, this situation is common for companies with high leverage-based capital structures. This assumes that the company will not retire the existing debt early to maintain a target debt-to-value capital structure if the value of the firm falls below the amount necessary to maintain the target debt-to-value ratio.

In such situations, it may be reasonable to use the cost of debt for the discount rate for the interest tax shields from the existing debt and the unlevered cost of capital for the discount rate for the interest tax shields from the refinanced debt based on the debt-to-value ratio. For example, assume the debt outstanding for the Bakwin Company matures in ten years and the Bakwin Company intends to refinance that debt when it matures based on a specific debt-to-value ratio. The specific debt-to-value ratio is irrelevant to our calculations because the only debt that directly affects the calculation of the unlevered cost of capital or unlevered beta is the debt for which the cost of debt is the discount rate for the resulting interest tax shields.

The Bakwin Company has $10,000 of debt outstanding, which has a 6% interest rate. Since Bakwin has a 40% income tax rate on all income, its interest tax shield based on this debt is $240 ($240 = $10,000 × 0.06 × 0.4). The present value of ten years of interest tax shields of $240 is $1,766

$$\$1{,}766 = \$240 \times \left(\frac{1}{0.06} - \frac{1}{0.06} \times \frac{1}{1.06^{10}} \right)$$

Once we measure the present value of the interest tax shields discounted at the cost of debt, we can measure the unlevered cost of capital using Equation 10.15 as follows

$$r_{UA} = 0.18667 \times \frac{\$6{,}000}{\$20{,}000 - \$1{,}766} + 0.06 \times \frac{\$10{,}000 - \$1{,}766}{\$20{,}000 - \$1{,}766} + 0.07 \times \frac{\$4{,}000}{\$20{,}000 - \$1{,}766} = 0.1039$$

Finally, we can measure the unlevered beta using Equation 10.19 as follows

$$\beta_{UA} = 2.445 \times \frac{\$6{,}000}{\$20{,}000 - \$1{,}766} + 0.333 \times \frac{\$10{,}000 - \$1{,}766}{\$20{,}000 - \$1{,}766} + 0.5 \times \frac{\$4{,}000}{\$20{,}000 - \$1{,}766} = 1.065$$

If we plug our unlevered beta estimate into the CAPM equation with a 4% risk-free rate and 6% market risk premium, we find the unlevered cost of capital is equal to 10.39% (0.1039 = 0.04 + 1.065 × 0.06) which is the same result we obtained when we unlevered the equity cost of capital.

Again, this assumes that Bakwin would not retire the existing debt early if the value of the firm fell below the amount necessary to be consistent with its debt-to-value target capital structure. For example, let us assume that their target debt-to-value ratio is 40%. Therefore, we are assuming that if the value of the firm fell below $25,000 (which would support $10,000 of debt at a 40% debt-to-value ratio), Bakwin would not retire any of the existing debt.

P10.5 **Unlevering the Equity Beta—Low Leverage & High Leverage Companies:** Use the information from P10.4 and assume that the risk-free rate is 4% and that the market risk premium is 6%. Respond to each part of P10.4 but calculate the unlevered beta instead of the unlevered cost of capital.

P10.6 **Unlevering the Equity Cost of Capital:** For each comparable company below, choose an unlevering method and measure the company's unlevered cost of capital. Explain why you chose the unlevering method you chose. Summary information appears below.

	Company A	Company B	Company C
Income tax rate for interest (T_{INT})	30.0%	40.0%	30.0%
Value of debt	$ 3,000	$28,000	$45,000
Value of preferred stock	$ 1,000	$ 4,000	
Value of equity	$16,000	$ 8,000	$ 5,000
Maturity of debt (years)	1	50	5
Debt cost of capital	5.0%	8.0%	8.0%
Preferred stock cost of capital	8.0%	8.5%	
Equity cost of capital	11.8%	16.2%	28.0%

Company A is a company that has had a stable capital structure strategy; it generally adjusts its financing to its target capital structure on a regular basis. Company B is a company that had issued a very long-term bond to finance an expansion. This is the only debt the company ever issued. The company has a very low growth rate, it funds its investments internally, and has no plans to issue additional debt. Company C has had very little debt historically. About five years ago, the company went through a debt recapitalization. The company issued debt and repurchased some of its shares, and it announced a new capital structure strategy which was to repay all of the debt by the end of its ten-year maturity. Over the last five years, the company has repaid its debt as per its capital structure strategy. The company's current debt has a five-year maturity, and the company plans to repay 20% of this balance at the end of each of the next five years. The company plans to operate with no debt after it repays its current debt. The company's equity cost of capital reflects its current capital structure strategy and debt outstanding.

P10.7 **Assuming Zero Non-Equity Betas:** For each part of the problem, measure the equity beta, equity cost of capital, and weighted average cost of capital under the assumptions that interest is tax deductible and that (i) the discount rate for interest tax shields is the unlevered cost of capital, (ii) the discount rate for interest tax shields is the debt cost of capital, and (iii) the company refinances itself annually to a target capital structure (use the debt cost of capital for the first year and the unlevered cost of capital for subsequent years).

a. Assume non-equity betas are equal to the betas implied by the cost of capital stated for each security.
b. Assume non-equity betas are equal to zero and use the debt and preferred stock costs of capital stated in the problem to measure the weighted average cost of capital. What violations of standard corporate finance theory do you observe?

Risk-free cost of capital	4.0%
Market risk premium	6.0%

	Company 1	Company 2	Company 3
Debt to firm value	10.0%	20.0%	60.0%
Preferred stock to firm value	40.0%	20.0%	20.0%
Unlevered CAPM beta	1.000	1.000	1.000
Debt cost of capital	6.0%	6.0%	7.0%
Preferred stock cost of capital	7.0%	6.5%	7.5%
Equity cost of capital	???	???	???
Income tax rate for interest (T_{INT})	40.0%	40.0%	40.0%

P10.8 **Incorrect Valuation Assumptions:** A privately held company finances itself with long-term debt and preferred stock using the capital structure shown below. The company's current free cash flow is $1,000, and it expects to generate a series of cash flows that will grow at 3% per year in perpetuity. The company plans to maintain its current capital structure strategy of 50% debt and 20% preferred stock in perpetuity, refinancing the company on an ongoing basis.

This table shows that the cost of capital for the convertible debt, 11.44%, is greater than the cost of capital for straight debt. This back-of-the-envelope example illustrates why convertible debt is not cheap debt.

Dates of payments	IRR of Interest and Principal	IRR of Interest and Conversion
Initial loan	−$641.000	−$641.000
September 15, 2009	$ 15.094	$ 15.094
March 15, 2010	$ 15.094	$ 15.094
September 15, 2010	$ 15.094	$ 15.094
March 15, 2011	$ 15.094	$ 15.094
September 15, 2011	$ 15.094	$ 15.094
March 15, 2012	$ 15.094	$ 15.094
September 15, 2012	$ 15.094	$ 15.094
March 15, 2013	$ 15.094	$ 15.094
September 15, 2013	$ 15.094	$ 15.094
March 15, 2014	$ 590.094	$ 921.679
Internal rate of return (semi-annual)	1.39%	5.56%
Internal rate of return (annual)	2.79%	11.44%

Using the above and some additional information about Alcoa in conjunction with the warrant pricing model, we first measure the cost of capital for the conversion feature of its convertible debt. In the following table we summarize Alcoa's inputs for the warrant pricing model.

Risk-free rate of return	2.1%
Equity cost of capital	12.000%
Annual volatility of equity	34.0%
Dividend yield continuously compounded	3.000%
Expiration of warrants (in years)	5.0
Face value per note	$1,000.00
Conversion ratio per $1,000 note	155.4908
Exercise price of conversion feature	$ 6.4312
Current stock price	$ 6.700
Common shares outstanding	974,372,426
Marginal tax rate for interest	40.0%

In the following table we summarize the output from the warrant pricing model. The cost of capital for the conversion feature is 23.8%,[25] which is, as expected, higher than Alcoa's equity cost of capital of 12%.

Stock price/Warrant price	$6.700	$1.690
Volatility, σ_E/Risk-free rate	34.00%	2.10%
d_1 and d_2	0.4192	−0.3616
σ_Q	0.3492	
ω_E	0.5531	
Equity and warrant costs of capital	12.00%	23.80%
Combined total equity cost of capital	12.27%	

[25] The cost of debt for the conversion feature is equal to the following (Equation 12.16).

$$r_w = r_F + (r_E - r_F) \times \frac{P_E}{P_W} \times \omega_E = 0.021 + (0.12 - 0.021) \times \frac{6.70}{1.690} \times 0.5531 = 0.238$$

From equation 12.1', the total equity cost of capital is as follows:

$$r_{TE} = 0.12 \times \frac{\$6.70 \times 974.372426}{\$6.70 \times 974.372426 + \$1.69 \times 89.407210} + 0.2380 \times \frac{\$1.69 \times 89.407210}{\$6.70 \times 974.372426 + \$1.69 \times 89.407210} = 0.12267$$

We use the risk factors and forecast drivers in Exhibit 13.9 as the basis of our Pepsi simulation. In Exhibit 13.10, we summarize the results of the Pepsi simulation for the firm value-based multiples. This exhibit is organized in the following way. We present a set of rows for each of the risk factors and forecast drivers. Each set of rows illustrates the effect of a change in a risk factor or one of the forecast drivers on the different multiples shown in the columns. For a set of rows, the first row presents the original values from the Pepsi financial model and valuation (see Exhibit 13.8); the second row presents the revised value for the risk factor or forecast driver and the resulting multiples; the third row presents the percentage change in firm value and the percentage change in the denominators of each of the multiples; and the last row presents the percentage change in the multiple.

EXHIBIT 13.10 PepsiCo Inc.—Illustration of the Effects of Changes in Risk and Forecast Drivers on Firm Value-Based Market Multiples

	Financial Model Assumption	% Change in Firm Value	Free Cash Flow Multiple	Unlevered Earnings Multiple	EBIT Multiple	EBITDA Multiple	Revenue Multiple	Total Invested Capital Multiple
Risk (discount rate)	8.00%		24.9	24.2	18.1	14.2	2.6	3.8
New assumption and multiples	9.00%		19.9	19.4	14.5	11.4	2.1	3.0
% Change in underlying variable		−19.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
% Change in multiples			−19.9%	−19.9%	−19.9%	−19.9%	−19.9%	−19.9%
Financial leverage	24.00%		24.9	24.2	18.1	14.2	2.6	3.8
New assumption and multiples	0.00%		23.6	23.0	17.2	13.5	2.5	3.6
% Change in underlying variable		−5.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
% Change in multiples			−5.0%	−5.0%	−5.0%	−5.0%	−5.0%	−5.0%
Growth rate	3.98%		24.9	24.2	18.1	14.2	2.6	3.8
New assumption and multiples	3.48%		22.1	21.6	16.2	12.7	2.3	3.4
% Change in underlying variable		−11.2%	−0.1%	−0.5%	−0.5%	−0.5%	−0.5%	0.0%
% Change in multiples			−11.1%	−10.8%	−10.8%	−10.8%	−10.8%	−11.2%
Capital expenditures growth to revenue	5.00%		24.9	24.2	18.1	14.2	2.6	3.8
New assumption and multiples	15.00%		24.9	23.3	17.5	13.7	2.5	2.1
% Change in underlying variable		−3.6%	−3.6%	0.0%	0.0%	0.0%	0.0%	71.4%
% Change in multiples			0.0%	−3.6%	−3.6%	−3.6%	−3.6%	−43.8%
Operating working capital	3.00%		24.9	24.2	18.1	14.2	2.6	3.8
New assumption and multiples	0.00%		24.9	24.5	18.3	14.4	2.7	4.0
% Change in underlying variable		1.1%	1.1%	0.0%	0.0%	0.0%	0.0%	−4.1%
% Change in multiples			0.0%	1.1%	1.1%	1.1%	1.1%	5.5%
Income tax rate	25.00%		24.9	24.2	18.1	14.2	2.6	3.8
New assumption and multiples	30.00%		24.9	24.1	16.6	13.0	2.4	3.5
% Change in underlying variable		−8.6%	−8.6%	−8.3%	0.0%	0.0%	0.0%	0.0%
% Change in multiples			0.0%	−0.3%	−8.6%	−8.6%	−8.6%	−8.6%
Depreciation expense %	4.00%		24.9	24.5	18.3	14.4	2.7	4.0
New assumption and multiples	5.00%		24.9	24.2	18.2	15.2	2.8	4.0
% Change in underlying variable		−9.5%	−9.5%	−9.2%	−9.2%	0.0%	0.0%	0.0%
% Change in multiples			0.0%	−0.3%	−0.3%	−9.5%	−9.5%	−9.5%
Operating expense %	81.50%		24.9	24.2	18.1	14.2	2.6	3.8
New assumption and multiples	82.50%		24.9	24.1	18.1	14.0	2.4	3.5
% Change in underlying variable		−7.2%	−7.2%	−7.0%	−7.0%	−5.5%	0.0%	0.0%
% Change in multiples			0.0%	−0.2%	−0.2%	−1.8%	−7.2%	−7.2%

The percentage change in the multiple is equal to one plus the percentage change in the numerator value divided by one plus the percentage change in the denominator minus 1. The more sensitive the multiple is to a change in a value driver or risk factor, the more important that value driver or risk factor is for assessing comparability.