SOURCE: Damodaran, Ch. 14

CHAPTER 14

Free Cash Flow to Equity Discount Models

The dividend discount model is based on the premise that the only cash flows received by stockholders are dividends. Even if we use the modified version of the model and treat stock buybacks as dividends, we may misvalue firms that consistently fail to return what they can afford to their stockholders.

This chapter uses a more expansive definition of cash flows to equity as the cash flows left over after meeting all financial obligations, including debt payments, and after covering capital expenditure and working capital needs. It discusses the reasons for differences between dividends and free cash flows to equity, and presents the discounted free cash flow to equity model for valuation.

MEASURING WHAT FIRMS CAN RETURN TO THEIR STOCKHOLDERS

Given what firms are returning to their stockholders in the form of dividends or stock buybacks, how do we decide whether they are returning too much or too little? We measure how much cash is available to be paid out to stockholders after meeting reinvestment needs and compare this amount to the amount actually returned to stockholders.

Free Cash Flows to Equity

To estimate how much cash a firm can afford to return to its stockholders, we begin with the net income—the accounting measure of the stockholders' earnings during the period—and convert it to a cash flow by subtracting out a firm's reinvestment needs. First, any capital expenditures, defined broadly to include acquisitions, are subtracted from the net income, since they represent cash outflows. Depreciation and amortization, on the other hand, are added back in because they are noncash charges. The difference between capital expenditures and depreciation (net capital expenditures) is usually a function of the growth characteristics of the firm. High-growth firms tend to have high net capital expenditures relative to earnings, whereas low-growth firms may have low, and sometimes even negative, net capital expenditures.

Second, increases in working capital drain a firm's cash flows, while decreases in working capital increase the cash flows available to equity investors. Firms that are growing fast, in industries with high working capital requirements (retailing, for

instance), typically have large increases in working capital. Since we are interested in the cash flow effects, we consider only changes in noncash working capital in this analysis.

Finally, equity investors also have to consider the effect of changes in the levels of debt on their cash flows. Repaying the principal on existing debt represents a cash outflow, but the debt repayment may be fully or partially financed by the issue of new debt, which is a cash inflow. Again, netting the repayment of old debt against the new debt issues provides a measure of the cash flow effects of changes in debt.

Allowing for the cash flow effects of net capital expenditures, changes in working capital, and net changes in debt on equity investors, we can define the cash flows left over after these changes as the free cash flow to equity (FCFE):

$$\begin{aligned}\text{Free cash flow to equity} = {} & \text{Net income} - (\text{Capital expenditures} - \text{Depreciation}) \\ & - (\text{Change in noncash working capital}) \\ & + (\text{New debt issued} - \text{Debt repayments})\end{aligned}$$

This is the cash flow available to be paid out as dividends.

This calculation can be simplified if we assume that the net capital expenditures and working capital changes are financed using a fixed mix[1] of debt and equity. If δ is the proportion of the net capital expenditures and working capital changes that is raised from debt financing, the effect on cash flows to equity of these items can be represented as follows:

$$\begin{aligned}&\text{Equity cash flows associated with meeting capital expenditure needs} \\ &\qquad = -(\text{Capital expenditures} - \text{Depreciation})(1 - \delta)\end{aligned}$$

$$\begin{aligned}&\text{Equity cash flows associated with meeting working capital needs} \\ &\qquad = -(\Delta \text{ Working capital})(1 - \delta)\end{aligned}$$

Accordingly, the cash flow available for equity investors after meeting capital expenditure and working capital needs is:

$$\begin{aligned}\text{Free cash flow to equity} = {} & \text{Net income} - (\text{Capital expenditures} - \text{Depreciation}) \\ & \times (1 - \delta) - (\Delta \text{ Working capital})(1 - \delta)\end{aligned}$$

Note that the net debt payment item is eliminated, because debt repayments are financed with new debt issues to keep the debt ratio fixed. It is particularly useful to assume that a specified proportion of net capital expenditures and working capital needs will be financed with debt if the target or optimal debt ratio of the firm is used to forecast the free cash flow to equity that will be available in future periods. Alternatively, in examining past periods, we can use the firm's average debt ratio over the period to arrive at approximate free cash flows to equity.

[1]The mix has to be fixed in book value terms. It can be varying in market value terms.

WHAT ABOUT PREFERRED DIVIDENDS?

In both the long and short formulations of free cash flows to equity described in the preceding section, we have assumed that there are no preferred dividends paid. Since the equity that we value is only common equity, you would need to modify the formulas slightly for the existence of preferred stock and dividends. In particular, you would subtract the preferred dividends to arrive at the free cash flow to equity:

Free cash flow to equity = Net income – (Capital expenditures
– Depreciation) – (Change in noncash WC)
– (Preferred dividends + New preferred stock issued)
+ (New debt issued – Debt repayments)

In the short form, you would obtain the following:

Free cash flow to equity = Net income – Preferred dividend
– (Capital expenditures – Depreciation)
$\times (1 - \delta)$ – (Δ Working capital)$(1 - \delta)$

The debt ratio (δ) would then have to include the expected financing from new preferred stock issues.

ILLUSTRATION 14.1: Estimating Free Cash Flows to Equity: The Home Depot and Boeing

In this illustration, we estimate the free cash flows to equity for the Home Depot, the home improvement retail giant, and Boeing. We begin by estimating the free cash flow to equity for the Home Depot each year from 1989 to 1998 in the table, using the full calculation described in the last section.

Year	Net Income	Depreciation	Capital Spending	Change in Noncash Working Capital	Net Debt Issued	FCFE
1989	$ 111.95	$ 21.12	$ 190.24	$ 6.20	$181.88	$118.51
1990	$ 163.43	$ 34.36	$ 398.11	$ 10.41	$228.43	$ 17.70
1991	$ 249.15	$ 52.28	$ 431.66	$ 47.14	-$ 1.94	($179.31)
1992	$ 362.86	$ 69.54	$ 432.51	$ 93.08	$802.87	$709.68
1993	$ 457.40	$ 89.84	$ 864.16	$153.19	-$ 2.01	($472.12)
1994	$ 604.50	$129.61	$1,100.65	$205.29	$ 97.83	($474.00)
1995	$ 731.52	$181.21	$1,278.10	$247.38	$497.18	($115.57)
1996	$ 937.74	$232.34	$1,194.42	$124.25	$470.24	$321.65
1997	$1,160.00	$283.00	$1,481.00	$391.00	-$ 25.00	($454.00)
1998	$1,615.00	$373.00	$2,059.00	$131.00	$238.00	$ 36.00
Average	$ 639.36	$146.63	$ 942.99	$140.89	$248.75	($ 49.15)

As the table indicates, the Home Depot had negative free cash flows to equity in 5 of the 10 years, largely as a consequence of significant capital expenditures. The average net debt issued during the period was $248.75 million, and the average net capital expenditure and working capital needs amounted to $937.25 million ($942.99 – 146.63 + 140.89), resulting in a debt ratio of 26.54%. Using the approximate formulation for FCFE yields the following results for FCFE for the same period:

Year	Net Income	Net Capital Expenditures (1 – DR)	Change in Noncash Working Capital (1 – DR)	FCFE
1989	$ 111.95	$ 124.24	$ 4.55	($ 16.84)
1990	$ 163.43	$ 267.21	$ 7.65	($111.43)
1991	$ 249.15	$ 278.69	$ 34.63	($ 64.17)
1992	$ 362.86	$ 266.64	$ 68.38	$ 27.85
1993	$ 457.40	$ 568.81	$112.53	($223.95)
1994	$ 604.50	$ 713.32	$150.81	($259.63)
1995	$ 731.52	$ 805.77	$181.72	($255.98)
1996	$ 937.74	$ 706.74	$ 91.27	$139.72
1997	$1,160.00	$ 880.05	$287.23	($ 7.28)
1998	$1,615.00	$1,238.53	$ 96.23	$280.24
Average	$ 639.36	$ 585.00	$103.50	($ 49.15)

DR = Average debt ratio during the period = 26.54%

Note that the approximate formulation yields the same average FCFE for the period. Since new debt issues are averaged out over the 10 years in the approach, it also smooths out the annual FCFE, since actual debt issues are much more unevenly spread over time.

A similar estimation of FCFE was done for Boeing from 1989 to 1998 in the following table:

Year	Net Income	Net Capital Expenditures (1 – DR)	Change in Noncash Working Capital (1 – DR)	FCFE
1989	$ 973.00	$423.80	$333.27	$ 215.93
1990	$1,385.00	$523.55	$113.59	$ 747.86
1991	$1,567.00	$590.44	($ 55.35)	$1,031.92
1992	$ 552.00	$691.34	($555.26)	$ 415.92
1993	$1,244.00	$209.88	$268.12	$ 766.00
1993	$ 856.00	($200.08)	$ 6.34	$1,049.74
1995	$ 393.00	($232.95)	($340.77)	$ 966.72
1996	$1,818.00	($155.68)	($ 21.91)	$1,995.59
1997	($ 178.00)	$516.63	($650.98)	($ 43.65)
1998	$1,120.00	$754.77	$107.25	$ 257.98
Average	$ 973.00	$312.17	($ 79.57)	$ 740.40

DR = Average debt ratio during the period = 42.34%

During the period, Boeing financed a high proportion of its reinvestment needs with debt, and its market debt ratio increased from about 1% to approximately 20%. The average free cash flow to equity during the period was $740.40 million. Note that the 1997 and 1998 capital expenditures include the amount spent by Boeing to acquire McDonnell Douglas.

Comparing Dividends to Free Cash Flows to Equity

The conventional measure of dividend policy—the dividend payout ratio—gives us the value of dividends as a proportion of earnings. Our approach measures the total cash returned to stockholders as a proportion of the free cash flow to equity:

$$\text{Dividend payout ratio} = \text{Dividends/Earnings}$$

$$\text{Cash to stockholders to FCFE ratio} = (\text{Dividends} + \text{Equity repurchases})/\text{FCFE}$$

The ratio of cash to stockholders to FCFE shows how much of the cash available to be paid out to stockholders is actually returned to them in the form of dividends and stock buybacks. If this ratio, over time, is equal or close to 1, the firm is paying out all that it can to its stockholders. If it is significantly less than 1, the firm is paying out less than it can afford to and is using the difference to increase its cash balance or to invest in marketable securities. If it is significantly over 1, the firm is paying out more than it can afford and is either drawing on an existing cash balance or issuing new securities (stocks or bonds).

We can observe the tendency of firms to pay out less to stockholders than they have available in free cash flows to equity by examining cash returned to stockholders paid as a percentage of free cash flow to equity. In 1998, for instance, the average dividend to free cash flow to equity ratio across all firms on the New York Stock Exchange was 51.55%. Figure 14.1 shows the distribution of cash returned as a percent of FCFE across all firms.

A percentage less than 100 percent means that the firm is paying out less in dividends than it has available in free cash flows and that it is generating surplus cash. For those firms, this cash surplus appears as an increase in the cash balance. A percentage greater than 100 percent indicates that the firm is paying out more in dividends than it has available in cash flow. These firms have to finance these dividend payments either out of existing cash balances or by making new stock issues.

The implications for valuation are simple. If we use the dividend discount model and do not allow for the buildup of cash that occurs when firms pay out less than they can afford, we will underestimate the value of equity in firms. If we use the model to value firms that pay out more dividends than they have available, we will overvalue the firm. The rest of this chapter is designed to correct for this limitation.

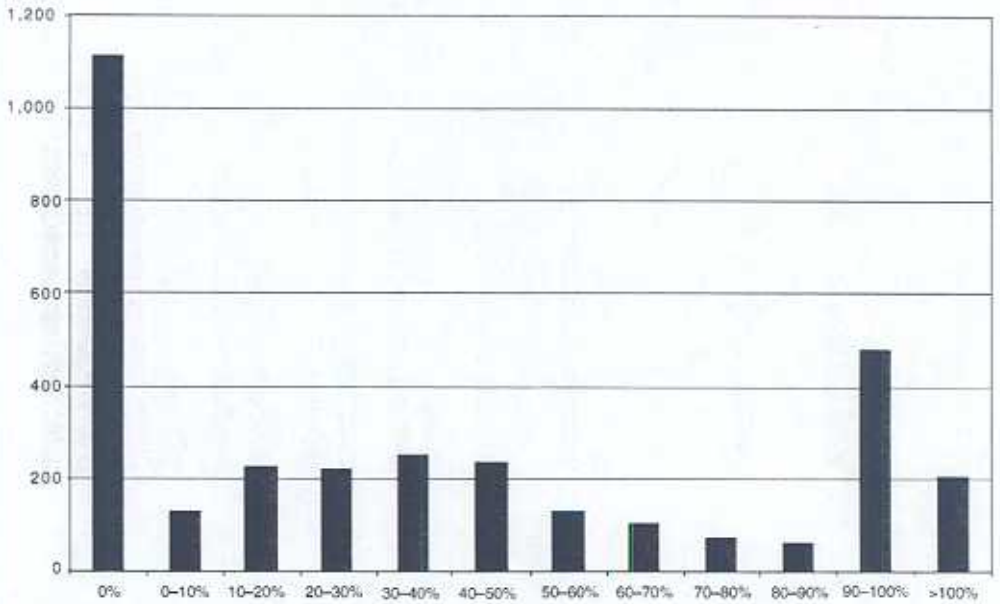

FIGURE 14.1 Cash Returned as Percent of FCFE
Source: Compustat database 1998.

dividends.xls: **This spreadsheet allows you to estimate the free cash flow to equity and the cash returned to stockholders for a period of up to 10 years.**

divfcfe.xls: **This dataset on the Web summarizes dividends, cash returned to stockholders, and free cash flows to equity, by sector, in the United States.**

Why Firms May Pay Out Less than Is Available

Many firms pay out less to stockholders, in the form of dividends and stock buybacks, than they have available in free cash flows to equity. The reasons vary from firm to firm.

Desire for Stability Firms are generally reluctant to change dividends, and dividends are considered "sticky" because the variability in dividends is significantly lower than the variability in earnings or cash flows. The unwillingness to change dividends is accentuated when firms have to reduce dividends, and empirically, increases in dividends outnumber cuts in dividends by at least a five-to-one margin in most periods. As a consequence of this reluctance to cut dividends, firms will often refuse to increase dividends even when earnings and FCFE go up, because they are uncertain about their capacity to maintain these higher dividends. This leads to a lag between earnings increases and dividend increases. Similarly, firms frequently keep dividends unchanged in the face of declining earnings and FCFE. Figure 14.2 reports the number of dividend changes (increases, decreases, no changes) between 1989 and 1998.

The number of firms increasing dividends outnumbers those decreasing dividends seven to one. The number of firms, however, that do not change dividends

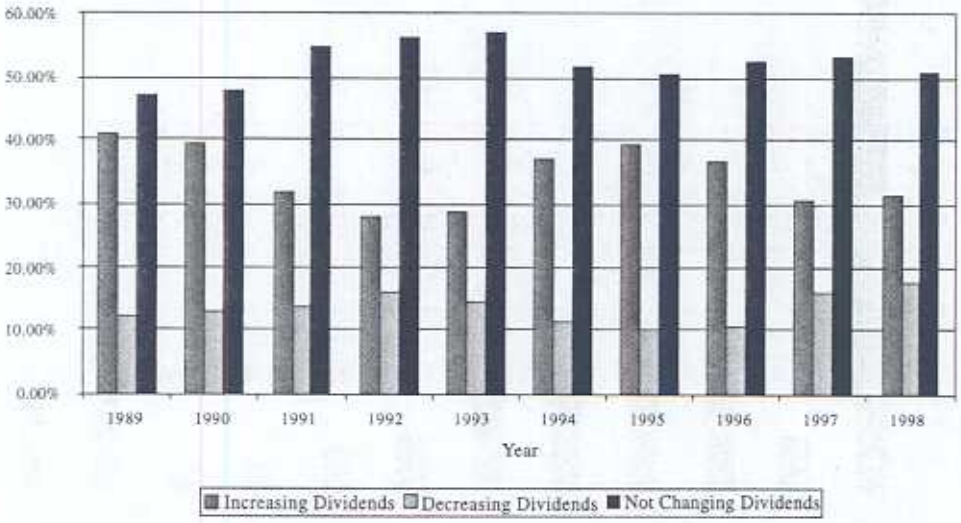

FIGURE 14.2 Dividend Changes, 1989–1998
Source: Compustat.

outnumbers firms that do about four to one. Dividends are also less variable than either FCFE or earnings, but this reduced volatility is a result of keeping dividends significantly below the FCFE.

Future Investment Needs A firm might hold back on paying its entire FCFE as dividends if it expects substantial increases in capital expenditure needs in the future. Since issuing stocks is expensive (from a flotation cost standpoint), it may choose to keep the excess cash to finance these future needs. Thus, to the degree that a firm may be unsure about its future financing needs, it may retain some cash to take on unexpected investments or meet unanticipated needs.

Tax Factors If dividends are taxed at a higher tax rate than capital gains, a firm may choose to retain the excess cash and pay out much less in dividends than it has available. This is likely to be accentuated if the stockholders in the firm are in high tax brackets, as is the case with many family-controlled firms. If, however, investors in the firm like dividends or tax laws favor dividends, the firm may pay more out in dividends than it has available in FCFE, often borrowing or issuing new stock to do so.

Signaling Prerogatives Firms often use dividends as signals of future prospects, with increases in dividends being viewed as positive signals and decreases as negative signals. The empirical evidence is consistent with this signaling story, since stock prices generally go up on dividend increases and down on dividend decreases. The use of dividends as signals may lead to differences between dividends and FCFE.

Managerial Self-Interest The managers of a firm may gain by retaining cash rather than paying it out as a dividend. The desire for empire building may make increasing the size of the firm an objective on its own. Or management may feel the need to build up a cash cushion to tide over periods when earnings may dip; in such periods, the cash cushion may reduce or obscure the earnings drop and may allow managers to remain in control.

FCFE VALUATION MODELS

The free cash flow to equity model does not represent a radical departure from the traditional dividend discount model. In fact, one way to describe a free cash flow to equity model is that it represents a model where we discount potential dividends rather than actual dividends. Consequently, the three versions of the FCFE valuation model presented in this section are simple variants on the dividend discount model, with one significant change—free cash flows to equity replace dividends in the models.

Underlying Principle

When we replace the dividends with FCFE to value equity, we are doing more than substituting one cash flow for another. We are implicitly assuming that the FCFE will be paid out to stockholders. There are two consequences:

1. There will be no future cash buildup in the firm, since the cash that is available after debt payments and reinvestment needs is paid out to stockholders each period.
2. The expected growth in FCFE will include growth in income from operating assets and not growth in income from increases in marketable securities. This follows directly from the last point.

How does discounting free cash flows to equity compare with the modified dividend discount model, where stock buybacks are added back to dividends and discounted? You can consider stock buybacks to be the return of excess cash accumulated largely as a consequence of not paying out their FCFE as dividends. Thus, FCFE represents a smoothed-out measure of what companies can return to their stockholders over time in the form of dividends and stock buybacks.

Estimating Growth in FCFE

Free cash flows to equity, like dividends, are cash flows to equity investors and you could use the same approach that you used to estimate the fundamental growth rate in dividends per share:

$$\text{Expected growth rate} = \text{Retention ratio} \times \text{Return on equity}$$

The use of the retention ratio in this equation implies that whatever is not paid out as dividends is reinvested back into the firm. There is a strong argument to be made, though, that this is not consistent with the assumption that free cash flows to equity are paid out to stockholders, which underlies FCFE models. It is far more consistent to replace the retention ratio with the equity reinvestment rate, which measures the percent of net income that is invested back into the firm.

$$\text{Equity reinvestment rate} = 1 - (\text{Net cap ex} + \text{Change in working capital} - \text{Net debt issues})/\text{Net income}$$

The return on equity may also have to be modified to reflect the fact that the conventional measure of the return includes interest income from cash and marketable securities in the numerator and the book value of equity also includes the value of the cash and marketable securities. In the FCFE model, there is no excess cash left in the firm and the return on equity should measure the return on noncash investments. You could construct a modified version of the return on equity that measures this:

$$\text{Noncash ROE} = \frac{\text{Net income} - \text{After-tax income from cash and marketable securities}}{\text{Book value of equity} - \text{Cash and marketable securities}}$$

The product of the equity reinvestment rate and the modified ROE will yield the expected growth rate in FCFE:

$$\text{Expected growth in FCFE} = \text{Equity reinvestment rate} \times \text{Noncash ROE}$$

Constant Growth FCFE Model

The constant growth FCFE model is designed to value firms that are growing at a stable growth rate and are hence in steady state.

The Model The value of equity, under the constant growth model, is a function of the expected FCFE in the next period, the stable growth rate, and the required rate of return.

$$\text{Value} = \frac{\text{FCFE}_1}{k_e - g_n}$$

where Value = Value of stock today
FCFE_1 = Expected FCFE next year
k_e = Cost of equity of the firm
g_n = Growth rate in FCFE for the firm forever

Caveats The model is very similar to the Gordon growth model in its underlying assumptions and works under some of the same constraints. The growth rate used in the model has to be reasonable, relative to the nominal growth rate in the economy in which the firm operates. As a general rule, a stable growth rate cannot exceed the growth rate of the economy in which the firm operates.

The assumption that a firm is in steady state also implies that it possesses other characteristics shared by stable firms. This would mean, for instance, that capital expenditures are not disproportionately large, relative to depreciation, and the firm is of average risk. (If the capital asset pricing model is used, the beta of the equity should be close to 1.) To estimate the reinvestment for a stable growth firm, you can use one of two approaches:

You can use the typical reinvestment rates for firms in the industry to which the firm belongs. A simple way to do this is to use the average capital expenditure to depreciation ratio for the industry (or better still, just stable firms in the industry) to estimate a normalized capital expenditure for the firm.

Alternatively, you can use the relationship between growth and fundamentals to estimate the required reinvestment. The expected growth in net income can be written as:

Expected growth rate in net income = Equity reinvestment rate × Return on equity

This allows us to estimate the equity reinvestment rate:

Equity reinvestment rate = Expected growth rate/Return on equity

To illustrate, a firm with a stable growth rate of 4 percent and a return on equity of 12 percent would need to reinvest about one-third of its net income back into net capital expenditures and working capital needs. Put another way, the free cash flows to equity should be two-thirds of net income.

Best Suited for Firms This model, like the stable growth dividend discount model, is best suited for firms growing at a rate comparable to or lower than the nominal growth in the economy. It is, however, the better model to use than the dividend

discount model for stable firms that pay out dividends that are unsustainably high (because they exceed FCFE by a significant amount) or are significantly lower than the FCFE. Note, though, that if the firm is stable, and pays out its FCFE as dividend, the value obtained from this model will be the same as the one obtained from the Gordon growth model.

ILLUSTRATION 14.2: FCFE Stable Growth Model: Singapore Airlines

Rationale for Using the Model

- Singapore Airlines is a large firm in a mature industry. Given the competition for air passengers and the limited potential for growth, it seems reasonable to assume stable growth for the future. Singapore Airline's revenues have grown about 3% a year for the past five years.
- Singapore Airlines has maintained a low book debt ratio historically, and its management seems inclined to keep leverage low.

Background Information

In the financial year ended March 2001, Singapore Airlines reported net income of S$1,164 million on revenues of S$7,816 million, and earned a noncash return on equity of 10% for the year. The capital expenditures during the year amounted to S$2,214 million, but the average capital expenditures between 1997 and 2000 were S$1,520 million. The depreciation in 2000 was S$1,205 million. The noncash working capital increased by $303 million in 2000. The book value debt to capital ratio at the end of 2000 was 5.44%.

Estimation

We begin by estimating a normalized free cash flow to equity for the current year. We will assume that earnings will grow 5% over the next year. To estimate net capital expenditures, we will use the average capital expenditures between 1997 and 2000 (to smooth out the year-to-year jumps) and the depreciation from the most recent year. Finally, we will assume that the 5.44% of future reinvestment needs will come from debt, reflecting the firm's current book debt ratio:[2]

Net income next year	$1,164 million
Net cap ex (1 – Debt ratio) = (1,520 – 1,205)(1 – .0544)	$298 million
Change in working capital (1 – Debt ratio) = 303 (1 – .0544)	$287 million
Normalized FCFE for current year	$579 million

As a check, we also computed the equity reinvestment rate that Singapore Airlines would need to maintain to earn a growth of 5%, based on its return on equity of 10%:

$$\text{Equity reinvestment rate} = g/\text{ROE} = 50\%$$

With this reinvestment rate, the free cash flows to equity would have been half the net income. The reinvestment we used in the calculation above is very close to this value:

$$\text{Equity reinvestment rate used} = (289 + 287)/1{,}164 = 50.2\%$$

[2]In making estimates for the future, you can go with either book or market debt ratios, depending on what you think about the firm's financing policy.

To estimate the cost of equity, we used the bottom-up unlevered beta for airlines (0.81), Singapore Airlines' market debt to equity ratio of 3.63% and tax rate of 38%.

$$\text{Levered beta} = 0.81[1 + (1 - .38)(.0363)] = 0.83$$

Using a riskless rate of 6% based on a 10-year S$-denominated bond issued by the Singapore government, and using a risk premium of 5% (4% for mature market risk plus 1% for additional country risk), we estimate a cost of equity:

$$\text{Cost of equity} = 6\% + 0.83 \times (5\%) = 10.14\%$$

VALUATION

With the normalized FCFE estimated above, a perpetual growth rate of 5%, and a cost of equity of 10.14%, we can estimate the value of equity:

$$\text{Value of equity} = \text{Expected FCFE next year}/(\text{Cost of equity} - \text{Expected growth})$$
$$= 579(1.05)/(.1014 - .05) = \text{S\$11,833 million}$$

The equity in the firm had a market value of S$14,627 million in May 2001.

FCFEst.xls: **This spreadsheet allows you to value the equity in a firm in stable growth, with all of the inputs of a stable growth firm.**

LEVERAGE, FCFE, AND EQUITY VALUE

Embedded in the FCFE computation seems to be the makings of a free lunch. Increasing the debt ratio increases free cash flow to equity because more of a firm's reinvestment needs will come from borrowing and less is needed from equity investors. The released cash can be paid out as additional dividends or used for stock buybacks. In the case for Singapore Airlines, for instance, the free cash flow to equity is shown as a function of the debt to capital ratio in Figure 14.3.

If the free cash flow to equity increases as the leverage increases, does it follow that the value of equity will also increase with leverage? Not necessarily. The discount rate used is the cost of equity, which is estimated based on a beta or betas. As leverage increases, the beta will also increase, pushing up the cost of equity. In fact, in the levered beta equation that we introduced in Chapter 8 the levered beta is:

$$\text{Levered beta} = \text{Unlevered beta}\,[1 + (1 - \text{Tax rate})(\text{Debt/Equity})]$$

This, in turn, will have a negative effect on equity value. The net effect on value will then depend on which effect—the increase in cash flows or the increase in betas—dominates. Figure 14.4 graphs out the value of Singapore Airlines as a function of the debt-to-capital ratio. The value of equity is maximized at a debt ratio of 30 percent, but beyond that level debt's costs outweigh its benefits.

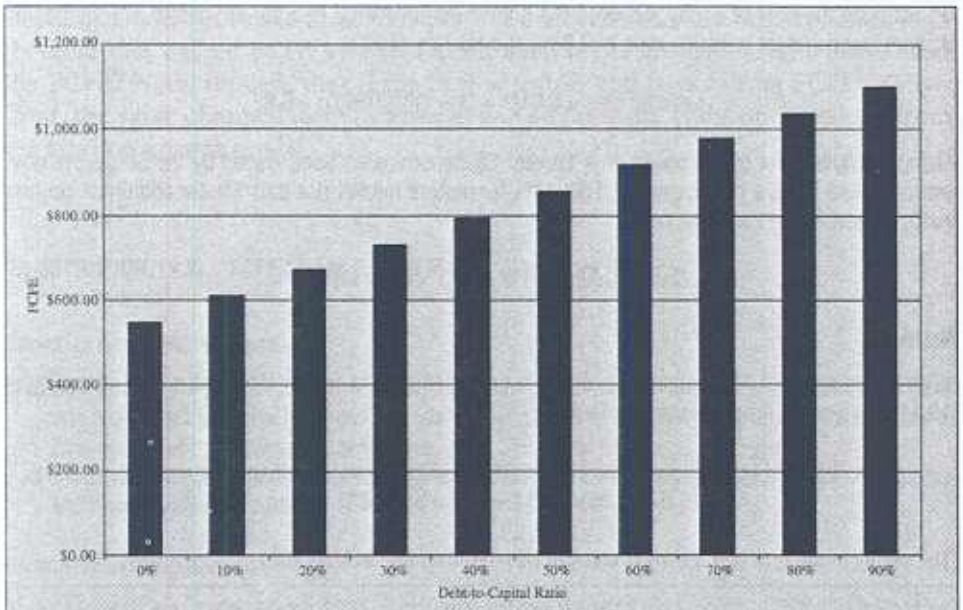

FIGURE 14.3 FCFE and Leverage—Singapore Airlines

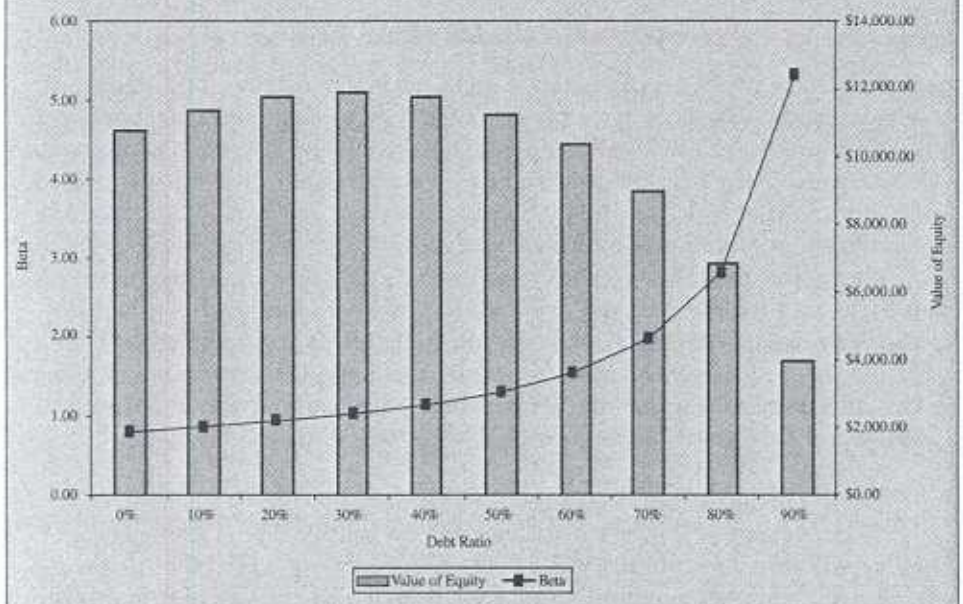

FIGURE 14.4 Singapore Air—Leverage and Value of Equity

A TROUBLESHOOTING GUIDE: WHAT IS WRONG WITH THIS VALUATION? (CONSTANT GROWTH FCFE MODEL)

If This Is Your Problem	*This May Be the Solution*
• If you get a low value from this model, it may be because:	
Capital expenditures are too high relative to depreciation.	Use a smaller cap ex or use the two-stage model.
Working capital as a percent of revenues is too high.	Normalize this ratio, using historical averages.
The beta is high for a stable firm.	Use a beta closer to 1.
• If you get too high a value, it is because:	
Capital expenditures are lower than depreciation.	Estimate an appropriate reinvestment rate = g/ROE.
Working capital ratio as percent of revenue is negative.	Set equal to zero.
The expected growth rate is too high for a stable firm.	Use a growth rate less than or equal to GNP growth.

Two-Stage FCFE Model

The two-stage FCFE model is designed to value a firm that is expected to grow much faster than a stable firm in the initial period and at a stable rate after that.

The Model The value of any stock is the present value of the FCFE per year for the extraordinary growth period plus the present value of the terminal price at the end of the period.

$$\text{Value} = \text{PV of FCFE} + \text{PV of terminal price}$$
$$= \sum_{t=1}^{t=n} \text{FCFE}_t/(1+k_{e,hg})^t + P_n/(1+k_{e,hg})^n$$

where FCFE_t = Free cash flow to equity in year t
P_n = Price at the end of the extraordinary growth period
k_e = Cost of equity in high growth (hg) and stable growth (st) periods

The terminal price is generally calculated using the infinite growth rate model:

$$P_n = \text{FCFE}_{n+1}/(k_{e,st} - g_n)$$

where g_n = Growth rate after the terminal year forever

Calculating the Terminal Price The same caveats that apply to the growth rate for the stable growth rate model, described in the previous section, apply here as well. In addition, the assumptions made to derive the free cash flow to equity after the terminal year have to be consistent with this assumption of stability. For instance, while capital spending may be much greater than depreciation in the initial high-

growth phase, the difference should narrow as the firm enters its stable growth phase. We can use the two approaches described for the stable growth model—industry average capital expenditure requirements or the fundamental growth equation (equity reinvestment rate = g/ROE) to make this estimate.

The beta and debt ratio may also need to be adjusted in stable growth to reflect the fact that stable growth firms tend to have average risk (betas closer to 1) and use more debt than high-growth firms.

ILLUSTRATION 14.3: Capital Expenditure, Depreciation, and Growth Rates

Assume you have a firm that is expected to have earnings growth of 20% for the next five years and 5% thereafter. The current earnings per share is $2.50. Current capital spending is $2.00, and current depreciation is $1.00. If we assume that capital spending and depreciation grow at the same rate as earnings and there are no working capital requirements or debt:

Earnings in year 5 = $2.50 \times (1.20)^5$	$6.22
Capital spending in year 5 = $2.00 \times (1.20)^5$	$4.98
Depreciation in year 5 = $1.00 \times (1.20)^5$	$2.49
Free cash flow to equity in year 5 = $6.22 + $2.49 – $4.98	$3.73

If we use the infinite growth rate model, but fail to adjust the imbalance between capital expenditures and depreciation, the free cash flow to equity in the terminal year is:

$$\text{Free cash flow to equity in year 6} = 3.73 \times 1.05 = \$3.92$$

This free cash flow to equity can then be used to compute the value per share at the end of year 5, but it will understate the true value. There are two ways in which you can adjust for this:

1. Adjust capital expenditures in year 6 to reflect industry average capital expenditure needs: Assume, for instance, that capital expenditures are 150% of depreciation for the industry in which the firm operates. You could compute the capital expenditures in year 6 as follows:

$$\text{Depreciation in year 6} = 2.49(1.05) = \$2.61$$

$$\begin{aligned}\text{Capital expenditures in year 6} &= \text{Depreciation in year 6} \\ &\quad \times \text{Industry average capital expenditures as \% of depreciation} \\ &= \$2.61 \times 1.50 = \$3.92\end{aligned}$$

$$\text{FCFE in year 6} = \$6.53 + \$2.61 - \$3.92 = \$5.23$$

2. Estimate the equity reinvestment rate in year 6, based on expected growth and the firm's return on equity. For instance, if we assume that this firm's return on equity will be 15% in stable growth, the equity reinvestment rate would need to be:

$$\text{Equity reinvestment rate} = g/ROE = 5\%/15\% = 33.33\%$$

$$\begin{aligned}\text{Net capital expenditures in year 6} &= \text{Equity reinvestment rate} \times \text{Earnings per share} \\ &= .3333 \times \$6.53 = \$2.18\end{aligned}$$

$$\begin{aligned}\text{Capital expenditures in year 6} &= \text{Net capital expenditures} + \text{Depreciation} \\ &= \$2.18 + \$2.61 = \$4.79\end{aligned}$$

$$\text{FCFE in year 6} = \$6.53 + \$2.61 - \$4.79 = \$4.35$$

Firms Model Works Best For This model makes the same assumptions about growth as the two-stage dividend discount model (i.e., that growth will be high and constant in the initial period and drop abruptly to stable growth after that). It is

different because of its emphasis on FCFE rather than dividends. Consequently, it provides much better results than the dividend discount model when valuing firms which either have dividends which are unsustainable (because they are higher than FCFE) or which pay less in dividends than they can afford to (i.e., dividends are less than FCFE).

ILLUSTRATION 14.4: Two-Stage FCFE Model: Nestlé

Nestlé has operations all over the world, with 97% of its revenues coming from markets outside Switzerland, where it is headquartered. The firm, like many large European corporations, has a weak corporate governance system, and stockholders have little power over managers.

Rationale for Using the Model

- *Why two-stage?* Nestlé has a long and impressive history of growth, and while we believe that its growth will be moderate, we assume that it will be able to maintain high growth for 10 years.
- *Why FCFE?* Given its weak corporate governance structure and a history of accumulating cash, the dividends paid by Nestlé bear little resemblance to what the firm could have paid out.

Background Information

Current net income = Sfr 5,763 million
Current capital spending = Sfr 5,058 million
Current depreciation = Sfr 3,330 million
Current revenues = Sfr 81,422 million
Noncash working capital= Sfr 5,818 million
Change in working capital = Sfr 368 million
Net debt issues = Sfr 272 million

Earnings per share = Sfr 148.33
Capital expenditures/share = Sfr 130.18
Depreciation/share = Sfr 85.71
Revenue/share = Sfr 2,095.64
Working capital/share = Sfr 149.74
Change in working capital/share = Sfr 9.47

Estimates

We will begin by estimating the cost of equity for Nestlé during the high growth period in Swiss francs. We will use the 10-year Swiss government Sfr bond rate of 4% as the risk-free rate. To estimate the risk premium, we used the breakdown of Nestlé's revenues by region:

Region	*Revenues (in Billions Sfr)*	*Weight*	*Risk Premium*
North America	20.21	24.82%	4.00%
South America	4.97	6.10%	12.00%
Switzerland	1.27	1.56%	4.00%
Germany/France/United Kingdom	21.25	26.10%	4.00%
Italy/Spain	7.39	9.08%	5.50%
Asia	6.70	8.23%	9.00%
Rest of Western Europe	15.01	18.44%	4.00%
Eastern Europe	4.62	5.67%	8.00%
Total	81.42	100.00%	5.26%

The risk premiums for each region represent an average of the risk premiums of the countries in the region. Using a bottom-up beta of 0.85 for Nestlé, we estimated a cost of equity of:

$$\text{Cost of equity} = 4\% + 0.85(5.26\%) = 8.47\%$$

To estimate the expected growth rate in free cash flows to equity, we first computed the free cash flows to equity in the current year:

FCFE = Net income – (Cap ex – Depreciation) – Change in working capital + Net debt issues
= 5,763 – (5,058 – 3,330) – 368 + 272 = Sfr 3,939 million

The equity reinvestment rate can be estimated from this value:

Equity reinvestment rate = 1 – FCFE/Net income = 1 – 3,939/5,763 = 31.65%

The return on equity in 2000 was estimated using the net income from 2000 and the book value of equity from the end of the previous year:

Return on equity = 5,763/25,078 = 22.98%

The expected growth rate in FCFE is a product of the equity reinvestment rate and the return on equity:

Expected growth in FCFE = Equity reinvestment rate × Return on equity = .3165 × .2298 = 7.27%

We will assume that net capital expenditures and working capital will grow at the same rate as earnings and that the firm will raise 33.92% of its reinvestment needs from debt (which is its current book value debt-to-capital ratio).

In stable growth, we assume a growth rate of 4%. We also assume that the cost of equity remains unchanged but that the return on equity drops to 15%. The equity reinvestment rate in stable growth can be estimated as follows:

Equity reinvestment in stable growth = g/ROE = 4%/15% = 26.67%

Valuation

The first component of value is the present value of the expected FCFE during the high-growth period, (see table) assuming earnings, net capital expenditures, and working capital grow at 7.27% and 33.92% of reinvestment needs come from debt:

Year	*Earnings per Share*	*Net Cap Ex per Share*	*Change in Working Capital per Share*	*Reinvestment per Share*	*Equity Reinvestment per Share*	*FCFE per Share*	*Present Value*
1	159.12	47.71	10.89	58.60	38.72	120.39	110.99
2	170.69	51.18	11.68	62.86	41.54	129.15	109.76
3	183.10	54.90	12.53	67.44	44.56	138.54	108.55
4	196.42	58.90	13.44	72.34	47.80	148.62	107.35
5	210.71	63.18	14.42	77.60	51.28	159.43	106.17
6	226.03	67.77	15.47	83.25	55.01	171.02	105.00
7	242.47	72.70	16.60	89.30	59.01	183.46	103.84
8	260.11	77.99	17.80	95.80	63.30	196.81	102.69
9	279.03	83.67	19.10	102.76	67.91	211.12	101.56
10	299.32	89.75	20.49	110.24	72.85	226.48	100.44
			Sum of present value of FCFE				1,056.34

Note that the change in working capital each year is computed based on the existing working capital of Sfr 149.74 per share, and that the present value is computed using the cost of equity of 8.47%.

To estimate the terminal value, we first estimate the free cash flows to equity in year 11:

Expected earnings per share in year 11 = $EPS_{10}(1 + g) = 299.32(1.04) = 311.30$
Equity reinvestment in year 11 = $EPS_{11} \times$ Stable equity reinvestment rate = $311.30 \times .2667 = 83.02$
Expected FCFE in year 11 = EPS_{11} – Equity reinvestment$_{11}$ = 311.30 – 83.02 = 228.28
Terminal value of equity per share = $FCFE_{11}$/(Cost of equity$_{11}$ – g) = 228.28/(.0847 – .04) = 5,105.88

The value per share can be estimated as the sum of the present value of FCFE during the high growth phase and the present value of the terminal value of equity:

Value per share = PV of dividend during high-growth phase + Terminal price/$(1 + k_e)^n$
= $1,056.34 + 5,105.88/1.0847^{10} = 3,320.65$ Sfr

The stock was trading at 3,390 Sfr per share in May 2001 at the time of this valuation.

FCFE2st.xls: **This spreadsheet allows you to value a firm with a temporary period of high growth in FCFE, followed by stable growth.**

REINVESTMENT ASSUMPTIONS, TERMINAL VALUE, AND EQUITY VALUE

We have repeatedly emphasized the importance of linking growth assumptions to assumptions about reinvestment, and especially so in stable growth. A very common assumption in many discounted cash flow valuations is that capital expenditures offset depreciation in stable growth. When combined with the assumption of no working capital changes, this translates into zero reinvestment. While this may be a reasonable assumption for a year or two, it is not consistent with the assumption that operating income will grow in perpetuity. How much of a difference can one assumption make? In the Nestlé valuation, we reestimated terminal value of equity per share assuming no reinvestment:

Estimated terminal value of equity per share = 311.30/(.0847 – .04) = 6,962.57

Keeping all of our other assumptions intact, this results in a value of equity per share of 4,144 Sfr per share—an increase in value of approximately 22 percent.

E Model—A Three-Stage FCFE Model

The E model is designed to value firms that are expected to go through three stages of growth—an initial phase of high growth rates, a transitional period where the growth rate declines, and a steady-state period where growth is stable.

The Model The E model calculates the present value of expected free cash flow to equity over all three stages of growth:

$$P_0 = \sum_{t=1}^{t=n1} \frac{FCFE_t}{(1+k_e)^t} + \sum_{t=n1+1}^{t=n2} \frac{FCFE_t}{(1+k_e)^t} + \frac{P_{n2}}{(1+k_e)^{n2}}$$

where P_0 = Value of the stock today
$FCFE_t$ = FCFE in year t
k_e = Cost of equity
P_{n2} = Terminal price at the end of transitional period = $FCFE_{n2+1}/(k_e - g_n)$
n1 = End of initial high-growth period
n2 = End of transition period

Caveats in Using Model Since the model assumes that the growth rate goes through three distinct phases—high growth, transitional growth, and stable growth—it is important that assumptions about other variables are consistent with these assumptions about growth.

Capital Spending versus Depreciation It is reasonable to assume that as the firm goes from high growth to stable growth, the relationship between capital

A TROUBLESHOOTING GUIDE: WHAT IS WRONG WITH THIS VALUATION? (TWO-STAGE FCFE MODEL)

If This Is Your Problem	*This May Be the Solution*
• If you get a extremely low value from the two-stage FCFE, the likely culprits are:	
Earnings are depressed due to some reason (economy, etc.).	Use normalized earnings.
Capital expenditures are significantly higher than depreciation in stable growth phase.	Reduce the difference for stable growth period. (Compute the appropriate reinvestment rate—you might need a higher ROE.)
The beta in the stable period is too high for a stable firm.	Use a beta closer to 1.
Working capital as percent of revenue is too high to sustain.	Use a working capital ratio closer to industry.
The use of the two-stage model when the three-stage model is more appropriate.	Use a three-stage model.
• If you get an extremely high value:	
Earnings are inflated above normal levels.	Use normalized earnings.
Capital expenditures offset or lag depreciation during high-growth period.	Compute the appropriate reinvestment rate = g/ROE.
The growth rate in the stable growth period is too high for stable firm.	Use a growth rate closer to GNP growth.

spending and depreciation will change. In the high-growth phase, capital spending is likely to much larger than depreciation. In the transitional phase, the difference is likely to narrow and the difference between capital spending and depreciation will be lower still in stable growth, reflecting the lower expected growth rate. (See Figure 14.5.)

Risk As the growth characteristics of a firm change, so do its risk characteristics. In the context of the CAPM, as the growth rate declines the beta of the firm can be expected to change. The tendency of betas to converge toward one in the long term has been confirmed by empirical observation of portfolios of firms with high betas. Over time, as these firms get larger and more diversified, the average betas of these portfolios move toward 1.

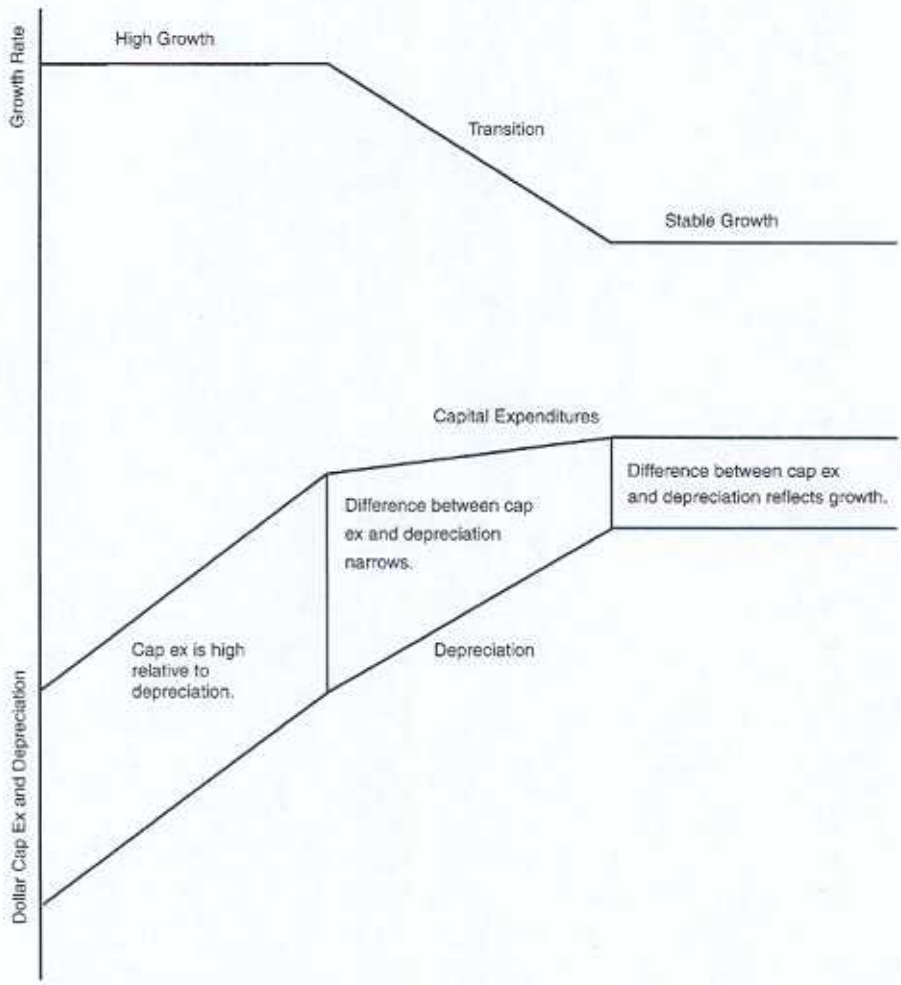

FIGURE 14.5 Three-Stage FCFE Model: Reinvestment Needs

Firms Model Works Best For Since the model allows for three stages of growth and for a gradual decline from high to stable growth, it is the appropriate model to use to value firms with very high growth rates currently. The assumptions about growth are similar to the ones made by the three-stage dividend discount model, but the focus is on FCFE instead of dividends, making it more suited to value firms whose dividends are significantly higher or lower than the FCFE.

ILLUSTRATION 14.5: Three-Stage FCFE Model: Tsingtao Breweries (China)

Tsingtao Breweries produces and distributes beer and other alcoholic beverages in China and around the world under the Tsingtao brand name. The firm has 653.15 million shares listed on the Shanghai and Hong Kong exchanges.

Rationale for Using the Three-Stage FCFE Model

- *Why three-stage?* Tsingtao is a small firm serving a huge and growing market—China, in particular, and the rest of Asia in general. The firm's current return on equity is low, and we anticipate that it will improve over the next five years. As it increases, earnings growth will be pushed up.
- *Why FCFE?* Corporate governance in China tends to be weak and dividends are unlikely to reflect free cash flow to equity. In addition, the firm consistently funds a portion of its reinvestment needs with new debt issues.

Background Information

In 2000, Tsingtao Breweries earned 72.36 million CY (Chinese yuan) in net income on a book value of equity of 2,588 million CY, giving it a return on equity of 2.80%. The firm had capital expenditures of 335 million CY and depreciation of 204 million CY during the year, and noncash working capital dropped by 1.2 million CY during the year. The total reinvestment in 2000 was therefore:

$$\begin{aligned}\text{Total reinvestment} &= \text{Capital expenditures} - \text{Depreciation} + \text{Change in noncash working capital}\\ &= 335 - 204 - 1.2 = 129.8 \text{ million}\end{aligned}$$

The working capital changes over the past four years have been volatile, and we normalize the change using noncash working capital as a percent of revenues in 2000:

$$\begin{aligned}\text{Normalized change in noncash working capital} &= (\text{Noncash working capital}_{2000}/\text{Revenues}_{2000})\\ &\quad \times (\text{Revenues}_{2000} - \text{Revenues}_{1999})\\ &= (180/2{,}253) \times (2{,}253 - 1{,}598) = 52.3 \text{ million CY}\end{aligned}$$

The normalized reinvestment in 2000 can then be estimated as follows:

$$\begin{aligned}\text{Normalized reinvestment} &= \text{Capital expenditures} - \text{Depreciation}\\ &\quad + \text{Normalized change in noncash working capital}\\ &= 335 - 204 + 52.3 = 183.3 \text{ million CY}\end{aligned}$$

As with working capital, debt issues have been volatile. We estimate the firm's book debt to capital ratio of 40.94% at the end of 2000 and use it to estimate the normalized equity reinvestment in 2000:

$$\text{Equity reinvestment in 2000} = \text{Reinvestment}(1 - \text{Debt ratio}) = 183.3(1 - .4094) = 108.27 \text{ million CY}$$

As a percent of net income,

$$\text{Equity reinvestment rate in 2000} = 108.27/72.36 = 149.97\%$$

ESTIMATION

To estimate free cash flows to equity for the high-growth period, we make the assumption that the return on equity, which is 2.80% today, will drift up to 12% by the fifth year. In addition, we will assume that new investments from now on will earn a return on equity of 12%. Finally, we will assume that the equity reinvestment rate will remain at its current level (149.97%) each year for the next five years. The expected growth rate over the next five years can then be estimated as follows:

$$\begin{aligned}\text{Expected growth rate—next five years} &= \text{Equity reinvestment rate} \times ROE_{new} \\ &\quad + [(ROE_{new} - ROE_{today})/ROE_{today}]^{1/5} - 1 \\ &= 1.4997 \times .12 + ([(.12 - .028)/.028]^{1/5} - 1) = 44.91\%\end{aligned}$$

After year 5, we will assume that the expected growth rate declines linearly each year from years 6 through 10 to reach a stable growth rate of 10% in year 10. (Note that the growth rate is in nominal CY; the higher stable growth rate reflects the higher expected inflation in that currency.) As the growth rate declines, the equity reinvestment rate also drops off to a stable period equity reinvestment rate of 50%, estimated using the 10% stable growth rate and an assumed return on equity in stable growth of 20%.

$$\text{Stable period equity reinvestment rate} = g/ROE = 10\%/20\% = 50\%$$

To estimate the cost of equity, we used a risk-free rate of 10% (in nominal CY), a risk premium of 6.28% (4% for mature market risk and 2.28% as the country risk premium for China) and a beta of 0.75 (reflecting the bottom-up beta for breweries):

$$\text{Cost of equity} = 10\% + 0.75(6.28\%) = 14.71\%$$

In stable growth, we assume that the beta will drift up to 0.80 and that the country risk premium will drop to 0.95%:

$$\text{Cost of equity} = 10\% + 0.80(4.95\%) = 13.96\%$$

The cost of equity adjusts in linear increments from 14.71% in year 5 to 13.96% in year 10.

VALUATION To value Tsingtao, we will begin by projecting the free cash flows to equity during the high growth and transition phases, using an expected growth rate of 44.91% in net income and an equity reinvestment rate of 149.97% for the first five years. The next five years represent a transition period, where the growth drops in linear increments from 44.91% to 10% and the equity reinvestment rate drops from 149.97% to 50%. The resulting free cash flows to equity are shown in the following table:

Year	*Expected Growth*	*Net Income*	*Equity Reinvestment Rate*	*FCFE*	*Cost of Equity*	*Present Value*
Current		CY72.36	149.97%			
1	44.91%	CY104.85	149.97%	(CY52.40)	14.71%	(CY45.68)
2	44.91%	CY151.93	149.97%	(CY75.92)	14.71%	(CY57.70)
3	44.91%	CY220.16	149.97%	(CY110.02)	14.71%	(CY72.89)
4	44.91%	CY319.03	149.97%	(CY159.43)	14.71%	(CY92.08)
5	44.91%	CY462.29	149.97%	(CY231.02)	14.71%	(CY116.32)
6	37.93%	CY637.61	129.98%	(CY191.14)	14.56%	(CY84.01)
7	30.94%	CY834.92	109.98%	(CY83.35)	14.41%	(CY32.02)
8	23.96%	CY1,034.98	89.99%	CY103.61	14.26%	CY34.83
9	16.98%	CY1,210.74	69.99%	CY363.29	14.11%	CY107.04
10	10.00%	CY1,331.81	50.00%	CY665.91	13.96%	CY172.16

Sum of the present values of FCFE during high growth = (CY186.65)

To estimate the terminal value of equity, we use the net income in the year 11, reduce it by the equity reinvestment needs in that year, and then assume a perpetual growth rate to get to a value.

Expected stable growth rate =10%
Equity reinvestment rate in stable growth = 50%
Cost of equity in stable growth = 13.96%
Expected FCFE in year 11 = Net income$_{11}$ × (1 − Stable period equity reinvestment rate)
= CY1,331.81(1.10)(1 − .5) = CY732.50 million
Terminal value of equity in Tsingtao Breweries = FCFE$_{11}$/(Stable period cost of equity − Stable growth rate) = 732.5/(.1396 − .10)
= CY18,497 million

To estimate the value of equity today, we sum up the present value of the FCFE over the high-growth period and add to it the present value of the terminal value of equity:

$$\text{Value of equity} = \text{PV of FCFE during the high-growth period} + \text{PV of terminal value}$$
$$= -\text{CY186.65} + \text{CY18,497}/(1.1471^5 \times 1.1456 \times 1.1441 \times 1.1426 \times 1.1411 \times 1.1396) = \text{CY4,596 million}$$

Value of equity per share = Value of equity/Number of shares = CY4,596/653.15 = CY7.04 per share

The stock was trading at 10.10 yuan per share, which would make it overvalued based on this valuation.

NEGATIVE FCFE, EQUITY DILUTION, AND VALUE PER SHARE

Unlike dividends, free cash flows to equity can be negative. This can occur either because net income is negative or because a firm's reinvestment needs are significant; this is the case with Tsingtao in Illustration 14.5. The resulting net capital expenditure and working capital needs may be much larger than the net income. In fact, this is likely to occur fairly frequently with high-growth firms.

The FCFE model is flexible enough to deal with this issue. The free cash flows to equity will be negative as the firm reinvests substantial amounts to generate high growth. As the growth declines, the reinvestment needs also drop off and free cash flows to equity turn positive.

Intuitively, though, consider what a negative free cash flow to equity implies. It indicates that the firm does not generate enough cash flows from current operations to meet its reinvestment needs. Since the free cash flow to equity is after net debt issues, the firm will have to issue new equity in years where the cash flow is negative. This expected dilution in future years will reduce the value of equity per share today. In the FCFE model, the negative free cash flows to equity in the earlier years will reduce the estimated value of equity today. Thus the dilution effect is captured in the present value, and no additional consideration is needed of new stock issues in future years and the effect on value per share today.

A TROUBLESHOOTING GUIDE: WHAT IS WRONG WITH THIS VALUATION? (THREE-STAGE FCFE MODEL)

If This Is Your Problem	*This May Be the Solution*
• If you get a extremely low value from the three-stage FCFE, the likely culprits are:	
Capital expenditures are significantly higher than depreciation in stable growth phase.	Reduce net cap ex in stable growth. Cap ex grows slower than depreciation during transition period.
The beta in the stable period is too high for a stable firm.	Use a beta closer to 1.
Working capital as percent of revenue is too high to sustain.	Use working capital ratio closer to industry average.
• If you get an extremely high value:	
Capital expenditures offset depreciation during high-growth period.	Capital expenditures should be set higher.
Capital expenditures are less than depreciation.	(Calculate reinvestment rate = g/ROC)
Growth period (high growth and transition) is too long.	Use a shorter growth period.
The growth rate in the stable growth period is too high for stable firm.	Use a growth rate closer to GNP growth.

FCFE3st.xls: **This spreadsheet allows you to value a firm with a temporary period of high growth in FCFE, followed by a transition period, followed by stable growth.**

FCFE VALUATION VERSUS DIVIDEND DISCOUNT MODEL VALUATION

The discounted cash flow model that uses FCFE can be viewed as an alternative to the dividend discount model. Since the two approaches sometimes provide different estimates of value, it is worth examining when they provide similar estimates of value, when they provide different estimates of value, and what the difference tells us about the firm.

When They Are Similar

There are two conditions under which the value from using the FCFE in discounted cash flow valuation will be the same as the value obtained from using the dividend

discount model. The first is the obvious one, where the dividends are equal to the FCFE. The second condition is more subtle, where the FCFE is greater than dividends, but the excess cash (FCFE minus dividends) is invested in projects with net present value of zero. (For instance, investing in financial assets that are fairly priced should yield a net present value of zero.)

When They Are Different

There are several cases where the two models will provide different estimates of value. First, when the FCFE is greater than the dividend and the excess cash either earns below-market interest rates or is invested in negative net present value projects, the value from the FCFE model will be greater than the value from the dividend discount model. There is reason to believe that this is not as unusual as it would seem at the outset. There are numerous case studies of firms, which having accumulated large cash balances, by paying out low dividends relative to FCFE, have chosen to use this cash to finance unwise takeovers (where the price paid is greater than the value received from the takeover). Second, the payment of smaller dividends than can be afforded to be paid out by a firm lowers debt-to-equity ratios and may lead the firm to become underleveraged, causing a loss in value.

In the cases where dividends are greater than FCFE, the firm will have to issue either new stock or new debt to pay these dividends leading to at least three negative consequences for value. One is the flotation cost on these security issues, which can be substantial for equity issues, creates an unnecessary expenditure that decreases value. Second, if the firm borrows the money to pay the dividends, the firm may become overlevered (relative to the optimal) leading to a loss in value. Finally, paying too much in dividends can lead to capital rationing constraints where good projects are rejected, resulting in a loss of wealth.

There is a third possibility and it reflects different assumptions about reinvestment and growth in the two models. If the same growth rate is used in the dividend discount and FCFE models, the FCFE model will give a higher value than the dividend discount model whenever FCFE are higher than dividends and a lower value when dividends exceed FCFE. In reality, the growth rate in FCFE should be different from the growth rate in dividends, because the free cash flow to equity is assumed to be paid out to stockholders. This will affect the reinvestment rate of the firm. In addition, the return on equity used in the FCFE model should reflect the return on equity on noncash investments, whereas the return on equity used in the dividend discount model should be the overall return on equity. Table 14.1 summarizes the differences in assumptions between the two models.

In general, when firms pay out much less in dividends than they have available in FCFE, the expected growth rate and terminal value will be higher in the dividend discount model, but the year-to-year cash flows will be higher in the FCFE model. The net effect on value will vary from company to company.

TABLE 14.1 Differences between DDM and FCFE Models

	Dividend Discount Model	FCFE Model
Implicit assumption	Only dividends are paid. Remaining portions of earnings are invested back into the firm, some in operating assets and some in cash and marketable securities.	The FCFE is paid out to stockholders. The remaining earnings are invested only in operating assets.
Expected growth	Measures growth in income from both operating and cash assets. In terms of fundamentals, it is the product of the retention ratio and the return on equity.	Measures growth only in income from operating assets. In terms of fundamentals, it is the product of the equity reinvestment rate and the noncash return on equity.
Dealing with cash and marketable securities	The income from cash and marketable securities is built into earnings and ultimately into dividends. Therefore, cash and marketable securities do not need to be added in.	You have two choices: 1. Build in income from cash and marketable securities into projections of income, and estimate the value of equity. 2. Ignore income from cash and marketable securities, and add their value to equity value in model.

What Does It Mean When They Are Different?

When the value using the FCFE model is different from the value using the dividend discount model, with consistent growth assumptions, there are two questions that need to be addressed: What does the difference between the two models tell us? Which of the two models is the appropriate one to use in evaluating the market price?

The more common occurrence is for the value from the FCFE model to exceed the value from the dividend discount model. The difference between the value from the FCFE model and the value using the dividend discount model can be considered one component of the value of controlling a firm—it measures the value of controlling dividend policy. In a hostile takeover, the bidder can expect to control the firm and change the dividend policy (to reflect FCFE), thus capturing the higher FCFE value.

As for which of the two values is the more appropriate one for use in evaluating the market price, the answer lies in the openness of the market for corporate control. If there is a sizable probability that a firm can be taken over or its management changed, the market price will reflect that likelihood, and the appropriate benchmark to use is the value from the FCFE model. As changes in corporate control become more difficult because of a firm's size and/or legal or market restrictions on takeovers, the value from the dividend discount model will provide the appropriate benchmark for comparison.

ILLUSTRATION 14.6: Comparing the DDM and FCFE Models: Coca-Cola

In Chapter 13, we valued Coca-Cola using a three-stage dividend discount model at $42.72 a share. Here, we will value Coca-Cola using a three-stage free cash flow to equity model.

Rationale for Using Three-Stage FCFE Model

- *Why three-stage?* Coca-Cola's strong brand name will allow it to overcome some of the constraints that may exist on its high growth rate—the saturation of its domestic market and its high market share in these markets. However, we believe that this growth will come under assault from competition in future years, leading us to allow for a transition to stable growth.
- *Why FCFE?* While the firm does have a history of returning cash to stockholders, we wanted to examine the differences in value, if any, estimated with the dividend and FCFE models.
- The firm has used debt a little more liberally in the past few years, but it remains a firm that uses equity for much of its reinvestment needs.

Background Information

Net income = $3,879.77
Number of shares outstanding = 2,487.03
Current capital expenditures = $992.00
Current depreciation = $773.00
Increase in noncash working capital in most recent year = $852.00
Net debt issued (paid) during the year = ($585.00)

Based on these values, we can estimate the free cash flows to equity in the most recent year as follows:

$$\begin{aligned}\text{Free cash flow to equity} &= \text{Net income} - (\text{Cap expenditures} - \text{Depreciation}) \\ &\quad - \text{Change in noncash working capital} + \text{Net debt issued} \\ &= 3{,}878 - (992 - 773) - 852 + (-585) = \$2{,}222 \text{ million}\end{aligned}$$

The return on equity in the most recent year was estimated to be 23.37% in the dividend discount model. We reestimated the return on equity excluding the income from cash and marketable securities from net income[3] and the value of the cash and marketable securities from book equity:

$$\begin{aligned}\text{Modified return on equity} &= (\text{Net income} - \text{After-tax interest income from cash}) \\ &\quad /(\text{Book value of equity} - \text{Cash and marketable securities}) \\ &= (2{,}177 - 91)/(9{,}317 - 1{,}822) = 27.83\%\end{aligned}$$

Estimation

We assume that the cost of equity for Coca-Cola will be 9.99% for the five-year high-growth period, declining in linear increments to 9.40% in year 10 and stable growth beyond. The slightly higher cost of equity results from the use of beta of 0.82 in the high-growth period. (In the DDM we used a beta of 0.80.)

The capital expenditures, working capital requirements and the debt ratio for Coca-Cola have been volatile over the past five years. To normalize changes over time, we decided to do the following:

First, we computed the net capital expenditures as a percent of earnings before interest and taxes each year for the past five years:

[3]As in the dividend discount model, we used a normalized net income ($2,177 million) just for this computation. The rest of the valuation is based on the actual net income prior to extraordinary items.

	–5	*–4*	*–3*	*–2*	*Current*	*Average*
Net cap ex	$1,391.00	$1,485.00	$1,996.00	$2,332.00	$ 219.00	$1,484.60
EBIT	$4,833.00	$5,001.00	$4,967.00	$3,982.00	$5,134.00	$4,783.40
Average net cap ex/EBIT =						31.04%

Normalized net capital expenditure = Average net cap ex as % of EBIT over past five years
× EBIT in most recent year = .3104 × 5,134 = $1,593 million

Then we estimated noncash working capital as a percent of revenues in the most recent year and used this to estimate the change in noncash working capital over the last year:

Noncash working capital in current year = $223 million
Revenues in current year = $20,458 million
Revenues last year = $19,805 million
Normalized change in noncash working capital last year = (223/20,458)(20,458 – 19,805)
= $7.12 million

Finally, we normalized the net debt issued by assuming that Coca-Cola would continue to fund its reinvestment needs with its market debt-to-capital ratio. To estimate the market debt-to-capital ratio, we used the total interest bearing debt outstanding at the end of 2000 and the current market value of equity:

Debt ratio = Interest-bearing debt/(Interest-bearing debt + Market value of equity)
= 5,651/(5,651 + 115,125) = 4.68%

Normalized debt issued in current year = (Normalized net capital expenditures
+ Normalized change in noncash working capital)
× Debt ratio = (1,593 + 7.12) × (.0468) = $74.89 million

The normalized free cash flow to equity can then be computed:

Normalized FCFE = Net income – Normalized net cap ex – Normalized change in working capital
+ Normalized net debt issued = 3,878 – 1,593 – 7.12 + 74.89 = $2,353 million

This normalized FCFE also lets us compute the equity reinvestment rate for the firm:

Equity reinvestment rate = 1 – FCFE/Net income = 1 – 2,353/3,878 = 39.3%

With the current return on equity of 27.83%, this yields an expected growth rate in noncash net income at Coca-Cola of 10.94%.

Expected growth = Equity reinvestment rate × Return on equity = .393 × .2783 = .1094

In stable growth, we assume that the return on equity drops to 20% and that the growth rate in perpetuity in net income is 5.5%. The equity reinvestment rate can then be estimated as follows:

Equity reinvestment rate in stable growth = g/ROE = 5.5%/20% = 27.5%

Valuation

To value Coca-Cola, we will begin by projecting the free cash flows to equity during the high growth and transition phases, using an expected growth rate of 10.94% in noncash net income and an equity reinvestment rate of 39.3% for the first five years.

Noncash net income = Net income – After-tax interest income from cash and marketable securities
= $3,878 million – $91 million = $3,789 million

The next five years represent a transition period, where the growth drops in linear increments from 10.94% to 5% and the equity reinvestment rate drops from 39.3% to 25%. The resulting free cash flows to equity are shown in the following table:

Year	Expected Growth	Net Income	Equity Reinvestment Rate	FCFE	Cost of Equity	Present Value
1	10.94%	$4,203.28	39.32%	$2,550.42	9.99%	$ 2,318.73
2	10.94%	$4,663.28	39.32%	$2,829.53	9.99%	$ 2,338.80
3	10.94%	$5,173.61	39.32%	$3,139.18	9.99%	$ 2,359.03
4	10.94%	$5,739.79	39.32%	$3,482.72	9.99%	$ 2,379.44
5	10.94%	$6,367.93	39.32%	$3,863.86	9.99%	$ 2,400.03
6	9.85%	$6,995.48	36.96%	$4,410.06	9.87%	$ 2,493.13
7	8.77%	$7,608.71	34.59%	$4,976.57	9.76%	$ 2,563.34
8	7.68%	$8,192.87	32.23%	$5,552.37	9.64%	$ 2,608.54
9	6.59%	$8,732.68	29.86%	$6,124.69	9.52%	$ 2,627.34
10	5.50%	$9,212.97	27.50%	$6,679.40	9.40%	$ 2,619.11
	Sum of the present values of FCFE during high growth					$24,707.49

To estimate the terminal value of equity, we use the net income in the terminal year (year 11), reduce it by the equity reinvestment needs in that year, and then assume a perpetual growth rate to get to a value.

Expected stable growth rate = 5.5%
Equity reinvestment rate in stable growth = 27.5%
Cost of equity in stable growth = 9.40%
Expected FCFE in year 11 = Net income$_{11}$ × (1 – Stable period equity reinvestment rate)
= $9,213(1.055)(1 – .275) = $7,047 million
Value of equity in Coca-Cola = FCFE$_{11}$/(Stable period cost of equity – Stable growth rate)
= 7,047/(.094 – .055) = $180,686

To estimate the value of equity today, we sum up the present value of the FCFE over the high-growth period and add to it the present value of the terminal value of equity:

Value of equity = PV of FCFE during the high-growth period + PV of terminal value
= $24,707 + $180,686/$(1.0999^5 \times 1.0987 \times 1.0976 \times 1.0964 \times 1.0952 \times 1.094)$
= $95,558 million

Adding in the value of the cash and marketable securities that Coca-Cola had on hand at the end of 2001, we obtain the total value of equity:

Value of equity including cash = $95,588 + $1,892 = $97,447 million

Value of equity per share = Value of equity/Number of shares = $97,447/2,487.03 = $39.19

The FCFE model yields a slightly lower value than the dividend discount model value of $42.72 a share. This may seem surprising since the FCFE each year for the high-growth period are greater than the dividends, but this effect is more than offset by the decline in the expected growth rate, which is generated by the equity reinvestment rate being lower than the retention ratio. This valuation is probably more realistic than the dividend discount model because it keeps investments in cash and marketable securities separate from investments in operating assets. The dividend discount model overstates the expected growth rate because it does not consider the fact that the low return earned by cash investments will bring the return on equity down over time (and growth down with it).

CONCLUSION

The primary difference between the dividend discount models described in the previous chapter and the free cash flow to equity models described in this one lies in the definition of cash flows; the dividend discount model uses a strict definition of cashflow to equity (i.e., the expected dividends on the stock), while the FCFE model uses an expansive definition of cash flow to equity as the residual cash flow after meeting all financial obligations and investment needs. When firms have dividends that are different from the FCFE, the values from the two models will be different. In valuing firms for takeovers or in valuing firms where there is a reasonable chance of changing corporate control, the value from the FCFE model provides the better estimate of value.

QUESTIONS AND SHORT PROBLEMS

1. Respond true or false to the following statements relating to the calculation and use of FCFE:
   a. The free cash flow to equity will generally be more volatile than dividends.
      True ____ False ____
   b. The free cash flow to equity will always be higher than dividends.
      True ____ False ____
   c. The free cash flow to equity will always be higher than net income.
      True ____ False ____
   d. The free cash flow to equity can never be negative.
      True ____ False ____
2. Kimberly-Clark, a household product manufacturer, reported earnings per share of $3.20 in 1993 and paid dividends per share of $1.70 in that year. The firm reported depreciation of $315 million in 1993, and capital expenditures of $475 million. (There were 160 million shares outstanding, trading at $51 per share.) This ratio of capital expenditures to depreciation is expected to be maintained in the long term. The working capital needs are negligible. Kimberly-Clark had debt outstanding of $1.6 billion, and intended to maintain its current financing mix (of debt and equity) to finance future investment needs. The firm was in steady state and earnings were expected to grow 7% a year. The stock had a beta of 1.05. (The Treasury bond rate was 6.25%, and the risk premium was 5.5%.)
   a. Estimate the value per share, using the dividend discount model.
   b. Estimate the value per share, using the FCFE model.
   c. How would you explain the difference between the two models, and which one would you use as your benchmark for comparison to the market price?
3. Ecolab Inc. sells chemicals and systems for cleaning, sanitizing, and maintenance. It reported earnings per share of $2.35 in 1993, and expected earnings growth of 15.5% a year from 1994 to 1998, and 6% a year after that. The capital expenditure per share was $2.25, and depreciation was $1.125 per share in 1993. Both were expected to grow at the same rate as earnings from 1994 to 1998. Working capital was expected to remain at 5% of revenues, and revenues, which were $1 billion in 1993, were expected to increase 6% a year from 1994 to 1998, and 4% a year after that. The firm had has a debt ratio [D/(D + E)] of 5%, but planned to finance future investment needs (including working capital investments) using a debt ratio of 20%. The stock was expected to have a beta of 1 for the period of

the analysis, and the Treasury bond rate was 6.50%. (There were 63 million shares outstanding, and the market risk premium was 5.5%.)

a. Assuming that capital expenditures and depreciation offset each other after 1998, estimate the value per share. Is this a realistic estimate?
b. Assuming that capital expenditures continue to be 200% of depreciation even after 1998, estimate the value per share.
c. What would the value per share have been, if the firm had continued to finance new investments with its old financing mix (5%)? Is it fair to use the same beta for this analysis?

4. Dionex Corporation, a leader in the development and manufacture of ion chromography systems (used to identify contaminants in electronic devices), reported earnings per share of $2.02 in 1993, and paid no dividends. These earnings were expected to grow 14% a year for five years (1994 to 1998) and 7% a year after that. The firm reported depreciation of $2 million in 1993 and capital spending of $4.20 million, and had 7 million shares outstanding. The working capital was expected to remain at 50% of revenues, which were $106 million in 1993, and were expected to grow 6% a year from 1994 to 1998 and 4% a year after that. The firm was expected to finance 10% of its capital expenditures and working capital needs with debt. Dionex had a beta of 1.20 in 1993, and this beta was expected to drop to 1.10 after 1998. (The Treasury bond rate was 7%, and the market risk premium was 5.5%.)
   a. Estimate the expected free cash flow to equity from 1994 to 1998, assuming that capital expenditures and depreciation grow at the same rate as earnings.
   b. Estimate the terminal price per share (at the end of 1998). Stable firms in this industry have capital expenditures which are 150% of revenues, and maintain working capital at 25% of revenues.
   c. Estimate the value per share today, based on the FCFE model.
5. Biomet Inc., which designs, manufactures, and markets reconstructive and trauma devices, reported earnings per share of $0.56 in 1993, on which it paid no dividends (it had revenues per share in 1993 of $2.91). It had capital expenditures of $0.13 per share in 1993, and depreciation in the same year of $0.08 per share. The working capital was 60% of revenues in 1993 and were expected to remain at that level from 1994 to 1998, while earnings and revenues were expected to grow 17% a year. The earnings growth rate was expected to decline linearly over the following five years to a rate of 5% in 2003. During the high-growth and transition periods, capital spending and depreciation were expected to grow at the same rate as earnings, but capital spending would be 120% of depreciation when the firm reaches steady state. Working capital was expected to drop from 60% of revenues during the 1994–1998 period to 30% of revenues after 2003. The firm had no debt currently, but planned to finance 10% of its net capital investment and working capital requirements with debt.

   The stock was expected to have a beta of 1.45 for the high-growth period (1994–1998), and it was expected to decline to 1.10 by the time the firm goes into steady state (in 2003). The Treasury bond rate is 7%, and the market risk premium is 5.5%.
   a. Estimate the value per share, using the FCFE model.
   b. Estimate the value per share, assuming that working capital stays at 60% of revenues forever.

c. Estimate the value per share, assuming that the beta remains unchanged at 1.45 forever.

6. Will the following firms be likely to have a higher value from the dividend discount model, a higher value from the FCFE model, or the same value from both models?
   a. A firm that pays out less in dividends than it has available in FCFE, but which invests the balance in treasury bonds.
   b. A firm that pays out more in dividends than it has available in FCFE, and then issues stock to cover the difference.
   c. A firm that pays out, on average, its FCFE as dividends.
   d. A firm that pays out less in dividends that it has available in FCFE, but which uses the cash at regular intervals to acquire other firms with the intent of diversifying.
   e. A firm that pays out more in dividends than it has available in FCFE, but borrows money to cover the difference. (The firm is overlevered to begin with.)
7. You have been asked to value Oneida Steel, a midsize steel company. The firm reported $80 million in net income, $50 million in capital expenditures, and $20 million in depreciation in the just-completed financial year. The firm reported that its noncash working capital increased by $20 million during the year and that total debt outstanding increased by $10 million during the year. The book value of equity at Oneida Steel at the beginning of the last financial year was $400 million. The cost of equity is 10%.
   a. Estimate the equity reinvestment rate, return on equity, and expected growth rate for Oneida Steel. (You can assume that the firm will continue to maintain the same debt ratio that it used last year to finance its reinvestment needs.)
   b. If this growth rate is expected to last five years and then drop to a 4% stable growth rate after that and the return on equity after year 5 is expected to be 12%, estimate the value of equity today, using the projected free cash flows to equity.
8. Luminos Corporation, a manufacturer of lightbulbs, is a firm in stable growth. The firm reported net income of $100 million on a book value of equity of $1 billion. However, the firm also had a cash balance of $200 million on which it earned after-tax interest income of $10 million last year. (This interest income is included in the net income, and the cash is part of the book value of equity.) The cost of equity for the firm is 9%.
   a. Estimate the noncash return on equity at Luminos Corporation.
   b. If you expect the cash flows from the operating assets of Luminos to increase 3% a year in perpetuity, estimate the value of equity at Luminos.