CHAPTER 14

FREE CASH FLOW TO EQUITY DISCOUNT MODELS

The dividend discount model is based upon the premise that the only cashflows received by stockholders is dividends. Even if we use the modified version of the model and treat stock buybacks as dividends, we may misvalue firms that consistently return less or more than they can afford to their stockholders.

This chapter uses a more expansive definition of cashflows to equity as the cashflows 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 cashflow 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 non-cash charges. The difference between capital expenditures and depreciation is referred to as *net capital expenditures* and 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 *non-cash 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).

Free Cash Flow to Equity (FCFE) = Net Income
- (Capital Expenditures - Depreciation)
- (Change in Non-cash Working Capital)
+ (New Debt Issued - Debt Repayments)

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

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:

Equity Cash Flows associated with Capital Expenditure Needs = – (Capital Expenditures - Depreciation)$(1 - \delta)$

Equity Cash Flows associated with Working Capital Needs = - (Δ Working Capital)$(1-\delta)$

Accordingly, the cash flow available for equity investors after meeting capital expenditure and working capital needs, assuming the book value of debt and equity mixture is constant, is:

Free Cash Flow to Equity = Net Income
- (Capital Expenditures - Depreciation)(1 - δ)
- (Δ Working Capital)(1-δ)

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.

What about preferred dividends?

In both the long and short formulations of free cashflows to equity described in the section above, 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 formulae slightly for the existence of preferred stock and dividends. In particular, you would subtract out the preferred dividends to arrive at the free cashflow to equity:

Free Cash Flow to Equity (FCFE) = Net Income - (Capital Expenditures - Depreciation) - (Change in Non-cash Working Capital) – (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)(1 - δ) - (Δ Working Capital)(1-δ)

The non-equity financial 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

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

to equity for the Home Depot each year from 1989 to 1998 in Table 14.1, using the full calculation described in the last section.

Table 14.1: Estimates of Free Cashflow to Equity for The Home Depot: 1989 – 1998

Year	*Net Income*	*Depreciation*	*Capital Spending*	*Change in Non-cash Working Capital*	*Net Debt Issued*	*FCFE*
1	$111.95	$21.12	$190.24	$6.20	$181.88	$118.51
2	$163.43	$34.36	$398.11	$10.41	$228.43	$17.70
3	$249.15	$52.28	$431.66	$47.14	-$1.94	($179.31)
4	$362.86	$69.54	$432.51	$93.08	$802.87	$709.68
5	$457.40	$89.84	$864.16	$153.19	-$2.01	($472.12)
6	$604.50	$129.61	$1,100.65	$205.29	$97.83	($474.00)
7	$731.52	$181.21	$1,278.10	$247.38	$497.18	($115.57)
8	$937.74	$232.34	$1,194.42	$124.25	$470.24	$321.65
9	$1,160.00	$283.00	$1,481.00	$391.00	-$25.00	($454.00)
10	$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 Table 14.1 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 the constant debt and equity financing mixture for FCFE, Table 14.2 yields the following results for FCFE for the same period.

Table 14.2: Approximate FCFE Using Average Debt Ratio

Year	*Net Income*	*Net Capital Expenditures (1-DR)*	*Change in Non-Cash WC (1-DR)*	*FCFE*
1	$111.95	$124.24	$4.55	($16.84)
2	$163.43	$267.21	$7.65	($111.43)

3	$249.15	$278.69	$34.63	($64.17)
4	$362.86	$266.64	$68.38	$27.85
5	$457.40	$568.81	$112.53	($223.95)
6	$604.50	$713.32	$150.81	($259.63)
7	$731.52	$805.77	$181.72	($255.98)
8	$937.74	$706.74	$91.27	$139.72
9	$1,160.00	$880.05	$287.23	($7.28)
10	$1,615.00	$1,238.53	$96.23	$280.24
Average	$639.36	$585.00	$103.50	($49.15)

∂ = 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 smoothes 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 Table 14.3

Table 14.3: Approximate FCFE on Boeing from 1989 to 1998

Year	*Net Income*	*Net Capital Expenditures (1-DR)*	*Change in Non-Cash WC (1-DR)*	*FCFE*
1	$973.00	$423.80	$333.27	$215.93
2	$1,385.00	$523.55	$113.59	$747.86
3	$1,567.00	$590.44	($55.35)	$1,031.92
4	$552.00	$691.34	($555.26)	$415.92
5	$1,244.00	$209.88	$268.12	$766.00
6	$856.00	($200.08)	$6.34	$1,049.74
7	$393.00	($232.95)	($340.77)	$966.72
8	$1,818.00	($155.68)	($21.91)	$1,995.59
9	($178.00)	$516.63	($650.98)	($43.65)
10	$1,120.00	$754.77	$107.25	$257.98
Average	$973.00	$312.17	($79.57)	$740.40

∂ = 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. In contrast, our approach measures the total cash returned to stockholders as a proportion of the free cash flow to equity.

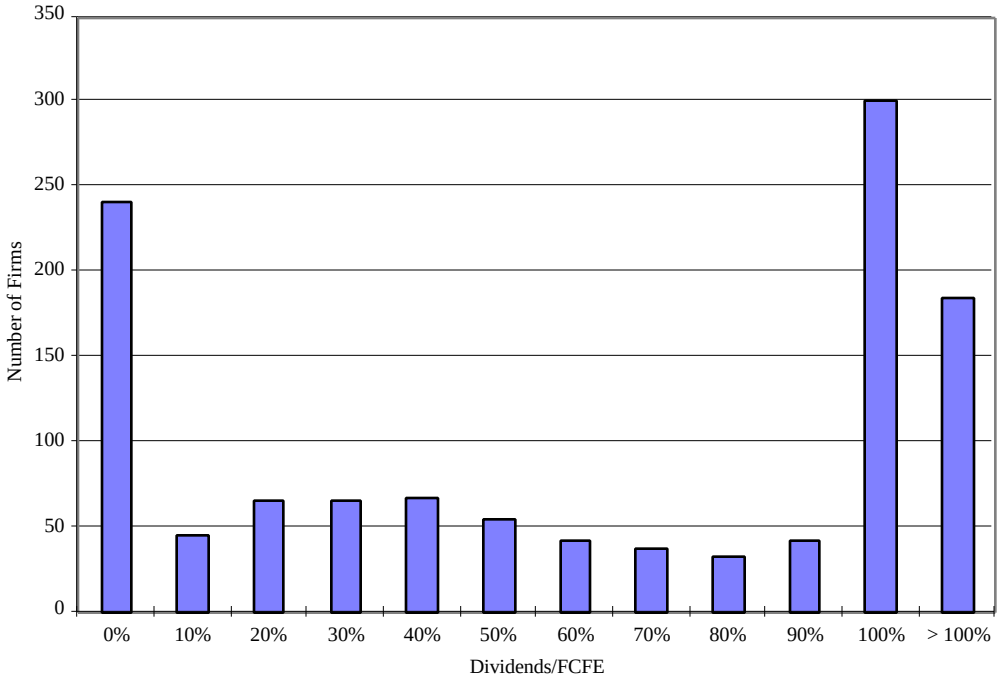
$$\text{Dividend Payout Ratio} = \frac{\text{Dividends}}{\text{Earnings}}$$

$$\text{Cash to Stockholders to FCFE Ratio} = \frac{\text{Dividends} + \text{Equity Repurchases}}{\text{FCFE}}$$

The ratio of cash to FCFE to the stockholders 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 NYSE was 51.55%. Figure 14.1 shows the distribution of cash returned as a percent of FCFE across all firms.

Figure 14.1: Dividends/FCFE: US firms in 2000



Source: Compustat database 1998

A percentage less than 100% 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 that did not make net debt payments (debt payments in excess of new debt issues) during the period, this cash surplus appears as an increase in the cash balance. A percentage greater than 100% 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 and debt issues.

The implications for valuation are simple. If we use the dividend discount model and do not allow for the build-up of cash that occurs when firms pay out less than they can afford, we will under estimate the value of equity in firms. The rest of this chapter is designed to correct for this limitation.

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*: There is a dataset on the web that summarizes dividends, cash returned to stockholders and free cash flows to equity, by sector, in the United States.

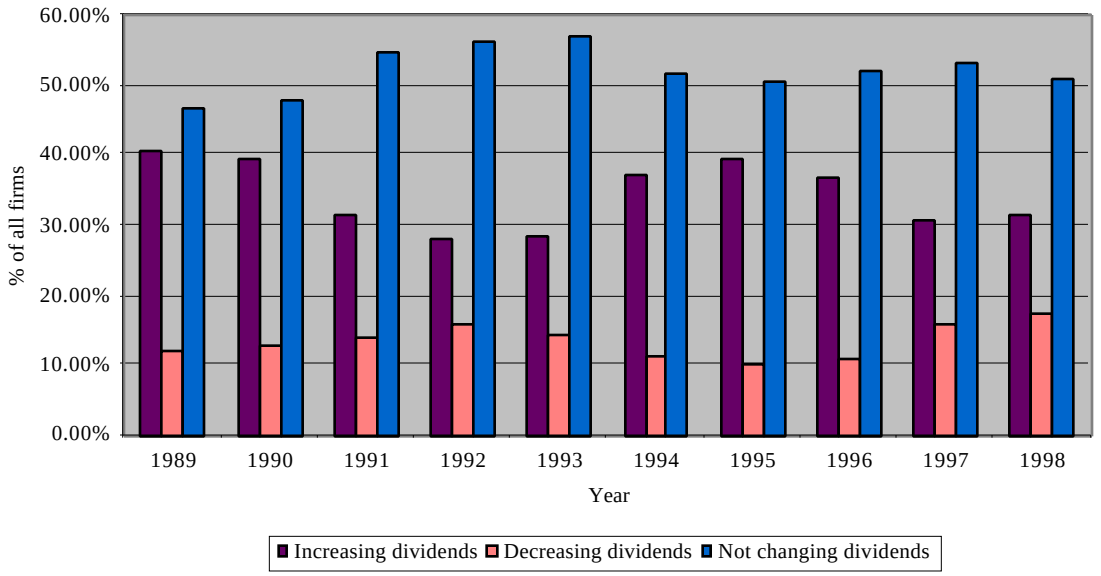
Why Firms may pay out less than is available

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 and we list some below.

1. 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 cashflows. 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:

Figure 14.2: Dividend Changes : 1989-1998



Source: Compustat

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

2. 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 securities 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 choose to retain some cash to take on unexpected investments or meet unanticipated needs.

3. 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 on the other hand, 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.

4. 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.

5. 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 cashflows 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 build-up 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 cashflows 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 represent 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.

Expected Growth rate = Retention Ratio * 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.

Equity Reinvestment Rate =

$$1 - \frac{\text{Net Cap Ex} + \text{Change in Working Capital} - \text{Net Debt Issues}}{\text{Net Income}}$$

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 non-cash investments. You could construct a modified version of the return on equity that measures the non-cash aspects.

$$\text{Non-cash ROE} = \frac{\text{Net Income - After tax income from cash and marketable securities}}{\text{Book Value of Equity - Cash and Marketable Securities}}$$

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

Expected Growth in FCFE = Equity Reinvestment Rate * Non-cash ROE

I. The constant growth FCFE model

The constant growth FCFE model is designed to value firms that are growing at a stable 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.

$$P_0 = \frac{FCFE_1}{k_e - g_n}$$

where,

P_0 = 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 by more than one or two percent.

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, relative to depreciation, are not disproportionately large and the firm is of 'average' risk. (If the capital asset pricing model is used, the beta of the equity should not

significantly different from one.) 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 developed in Chapter 12 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:

$$\text{Equity reinvestment rate} = \frac{\text{Expected growth rate}}{\text{Return on Equity}}$$

To illustrate, a firm with a stable growth rate of 4% and a return on equity of 12% would need to reinvest about a 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 Gordon growth 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 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 outs 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 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 Air's revenues have grown about 3% a year for the last 5 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, representing a non-cash 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 firm has no working capital requirements. 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 this year		= $1,164 m
Net Cap Ex (1- Debt Ratio)	= (1520-1205)(1-.0544)	= $ 298 m
Change in Working Capital (1- Debt Ratio)	= 303 (1-.0544)	= $ 287 m
Normalized FCFE for current year		= $ 580 m

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

$$\text{Equity reinvestment rate} = \frac{g}{ROE} = \frac{5\%}{10\%} = 50\%$$

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:

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

Equity reinvestment rate used = $\frac{298 + 287}{1164} = 50.20\%$

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%.

Levered Beta = 0.81 (1 + (1-0.38) (.0363)) = 0.83

Using a riskless rate of 6% based upon 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:

Cost of equity = 6% + 0.83*(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 below:

$$\text{Value of equity} = \frac{\text{Expected FCFE next year}}{\text{Cost of equity - expected growth}}$$

$$= \frac{580(1.05)}{0.1014 - 0.05} = \text{S\$11,838}$$

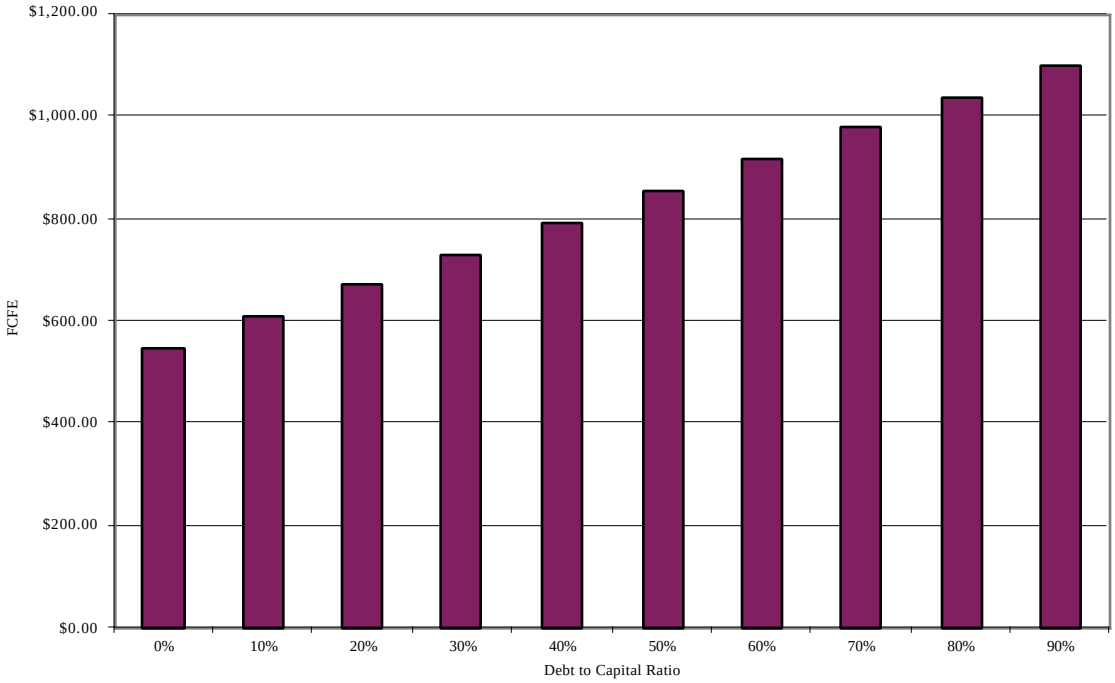
The equity in the firm had a market value of S$14,627 million in May 2001.

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:

Figure 14.3: FCFE and Leverage- Singapore Airlines



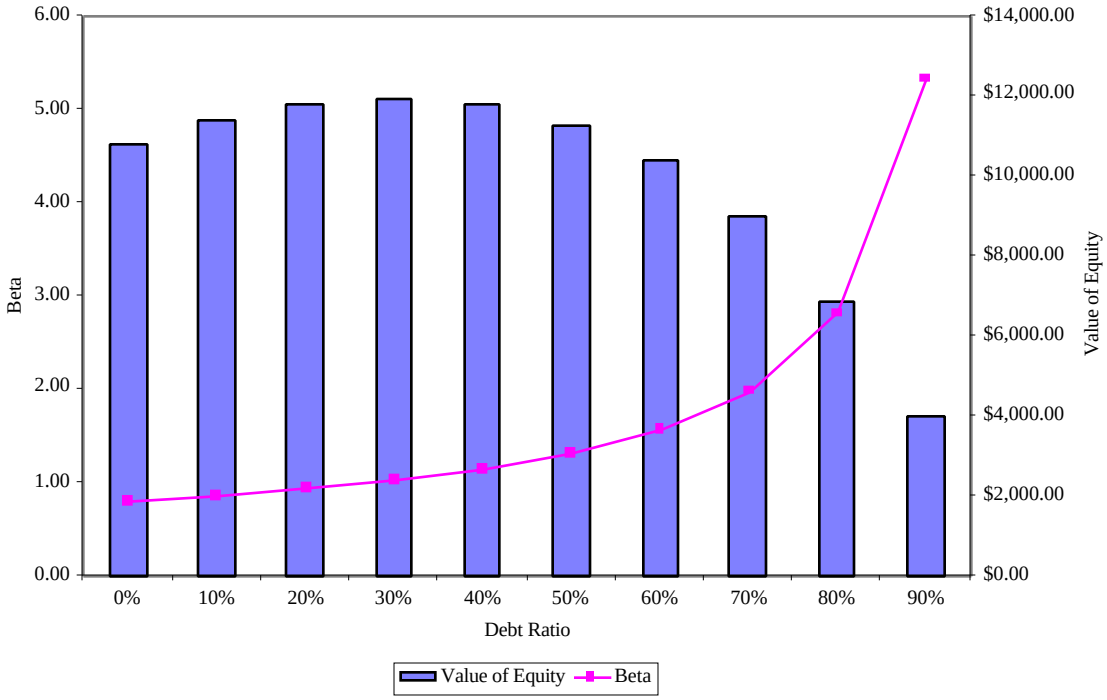
If the free cash flow to equity increases as the leverage increases, does it follow that the value of equity will also increase with leverage? Not necessarily. The discount rate used is the cost of equity, which is estimated based upon a beta or betas. As leverage increases, the beta will also increase,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

Levered beta = Unlevered beta (1 + (1- tax rate) (Debt/Equity))

This, in turn, will have a negative effect on equity value. The net effect on value will then depend upon which effect – the increase in cash flows or the increase in betas –

dominates. Figure 14.4 graphs out the value of Singapore as a function of the debt to capital ratio

Figure 14.4: Singapore Air- Leverage and Value of Equity



The value of equity is maximized at a debt ratio of 30%, but beyond that level, debt's costs outweigh its benefits.

What is wrong with this valuation? FCFE Stable	
· If you get a low value from this model, it may be because	*Solution*
- capital expenditures are too high relative to depreciation	Use a smaller Cap Ex or use the 2-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 one
· If you get too high a value, it is because	
- Capital expenditures are lower than depreciation	Estimate a reinvestment rate, given growth
- Working capital ratio as % 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.

II. The Two-stage FCFE Model

The two stage FCFE model is designed to value a firm which 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.

$$= \text{PV of FCFE} + \text{PV of terminal price}$$

$$\text{Value} = \sum \frac{\text{FCFE}_t}{(1+k_e)^t} + \frac{P_n}{(1+k_e)^n}$$

where,

$FCFE_t$ = Free Cashflow 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,

$$P_n = \frac{\text{FCFE}_{n+1}}{r - g_n}$$

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 cashflow to equity after the terminal year have to be consistent with the 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 one) 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. 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 * $(1.20)^5$ =	$ 6.22
Capital spending in year 5	= 2.00 * $(1.20)^5$ =	$ 4.98
Depreciation in year 5	= 1.00 * $(1.20)^5$ =	$ 2.49

Free cashflow 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 cashflow to equity in the terminal year is --

Free cashflow to equity in year 6 = 3.73* 1.05 = $ 3.92

This free cashflow 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:

   Depreciation in year 6 = 2.49 (1.05) = $2.61

   Capital expenditures in year 6 = Depreciation in year 6* Industry average capital expenditures as percent of depreciation = $2.61 *1.50 = $3.92

   FCFE in year 6 = $6.53 + $2.61 - $3.92 = $5.23
2. Estimate the equity reinvestment rate in year 6, based upon 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:

Equity reinvestment rate = g/ ROE = 5%/15% = 33.33%

Net Capital expenditures in year 6 = Equity reinvestment rate * Earnings per share

= 0.3333* $ 6.53 = $2.18

FCFE in year 6 = $6.53 - $2.18 = $4.35

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: Nestle

Nestle 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.

A Rationale for using the Model

- *Why two-stage?* Nestle 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 Nestle bear little resemblance to what the firm could have paid out.

Background Information

Current Net Income =Sfr 5,763 million	Earnings per share =Sfr 148.33
Current Capital Spending= Sfr 5,058 million	Capital Expenditures/sh = Sfr 130.18

Current Depreciation = Sfr 3,330 million
Depreciation / share = Sfr 85.71
Current Revenues = Sfr 81,422 million
Revenue/ share = Sfr 2,095.64
Non-cash Working Capital= Sfr 5,818 million
Working Capital/share = Sfr 149.74
Change in Working capital = Sfr 368 million
Chg. Working Capital/share Sfr 9.47

Estimates

We will begin by estimating the cost of equity for Nestle during the high growth period in Swiss francs. We will use the 10-year Swiss Government Sfr bond rate of 4% as the riskfree rate. To estimate the risk premium, we used the breakdown of Nestle's revenues by region in Table 14.4.

Table 14.4: Risk Premium for Nestle: Regional Breakdown

Region	*Revenues*	*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/UK	21.25	26.10%	4.00%
Italy/Spain	7.39	9.08%	5.50%
Asia	6.70	8.23%	9.00%
Rest of W. 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 Nestle, 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

= 5763 – (5058 –3330) –368 + 272 = Sfr 3,939 million

The equity reinvestment rate can be estimated from this value:

$$\text{Equity reinvestment rate} = 1 - \frac{\text{FCFE}}{\text{Net Income}} = 1 - \frac{3939}{5763} = 31.65\%$$

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

$$\text{Return on equity} = \frac{5763}{25078} = 22.98\%$$

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

= 0.3165 * 0.2298 = 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 stable 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:

$$\text{Equity reinvestment in stable growth} = \frac{g}{\text{ROE}} = \frac{4\%}{15\%} = 26.67\%$$

Valuation

The first component of value is the present value of the expected FCFE during the high growth period, assuming earnings, net capital expenditures and working capital grow at 7.27% and33.92 % of reinvestment needs come from debt:

Table 14.5: Estimated Free Cash Flows to Equity: Nestle

Year	*Earnings per Share*	*Net Cap Ex/Share*	*Change in Working Capital/share*	*Reinvestment/share*	*Equity Reinvestment Share*	*FCFE/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 =							1056.34

Note that the change in working capital each year is computed based upon the current working capital of Sfr 149.74 per share. The present value of FCFE 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}*Stable Equity reinvestment rate

$= 311.30 * 0.2667 = 83.02$

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)

$$= \frac{228.28}{0.0847 - 0.04} = 5{,}105.88$$

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:

$$\text{Value per share} = \text{PV of dividend during high growth phase} + \frac{\text{Terminal Price}}{(1+k_e)^n}$$

$$= 1056.34 + \frac{5105.88}{1.0847^{10}} = 3320.65 \text{ Sfr}$$

The stock was trading 3390 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 Nestle valuation above, we re-estimated terminal value of equity per share assuming no reinvestment.

$$\text{Estimated terminal value of equity per share} = \frac{311.30}{0.0847 - 0.04} = 6962.57$$

Keeping all of our other assumptions intact, this results in an increase in the estimated value of equity per share to 4144 Sfr per share.

What is wrong with this valuation? FCFE 2 Stage

· If you get a extremely low value from the 2-stage FCFE, the likely culprits are	
- earnings are depressed due to some reason (economy...)	Use normalized earnings
- capital expenditures are significantly higher than depreciation in stable growth phase	Reduce the difference for stable growth period
- the beta in the stable period is too high for a stable firm	Use a beta closer to one.
- working capital as % of revenue is too high to sustain	Use a working capital ratio closer to industry
- the use of the 2-stage model when the 3-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	Capital expenditures should be set higher
- the growth rate in the stable growth period is too high for stable firm	Use a growth rate closer to GNP growth

What is wrong with this valuation? FCFE 3 Stage

· If you get a extremely low value from the 3-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 one.
- working capital as % 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	Set capital expenditures equal to depreciation.
- Growth Period (High growth + 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

III. The 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:

$$P_0 = \sum_{t=1}^{t=n1} \frac{FCFE_t}{(1+k_{e,hg})^t} + \sum_{t=n1+1}^{t=n2} \frac{FCFE_t}{(1+k_{e,t})^t} + \frac{P_{n2}}{(1+k_{e,st})^n}$$

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 = $\frac{FCFE_{n2+1}}{r - g_n}$

n1 = End of initial high growth period

n2 = End of transition period

Caveats in using model

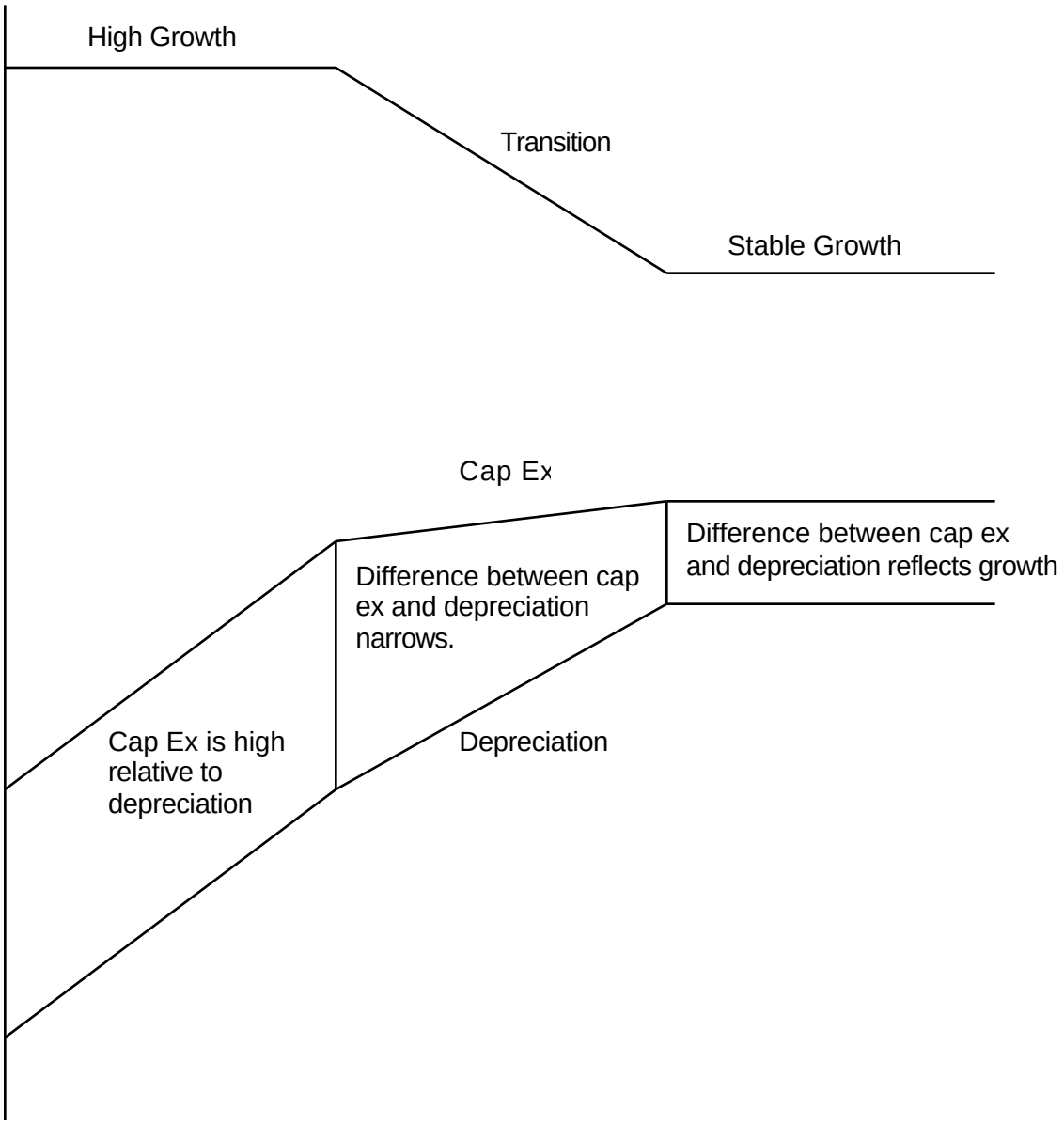
Since the model assumes that the growth rate goes through three distinct phases - high growth, transitional growth and stable growth - it is important that assumptions about other variables are consistent with these assumptions about growth.

1. Capital Spending versus Depreciation

It is reasonable to assume that as the firm goes from high growth to stable growth, the relationship between capital spending and depreciation will change. In the high growth phase, capital spending is likely to be much larger than depreciation. In the transitional phase, the difference is likely to narrow. Finally, the difference between capital spending

and depreciation will be lower still in stable growth, reflecting the lower expected growth rate.

Figure 14.5: Three Stage FCFE Model: Reinvestment Needs



2. 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 towards 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 towards one.

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 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 5 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 non-cash working capital dropped by 1.2 million CY during the year. The total reinvestment in 2000 was therefore:

Total Reinvestment

= Capital expenditures – Depreciation + Change in non-cash working capital

= 335 - 204 - 1.2 = 129.8 million

The working capital changes over the last 4 years have been volatile and we normalize the change using non-cash working capital as a percent of revenues in 1999.

Normalized change in non-cash working capital

$$= \left(\frac{\text{Non - cash working capital}_{1999}}{\text{Revenues}_{1999}}\right)\left(\text{Revenuess}_{1999} - \text{Revenues}_{1998}\right)$$

$$= \left(\frac{180}{2253}\right)(2253 - 1598) = 52.3 \text{ million CY}$$

The normalized reinvestment in 1999 can then be estimated.

Normalized Reinvestment

= Capital expenditures – Depreciation + Normalized Change in non-cash working capital

= 335 - 204 + 52.3 = 183.3 million CY

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 1999 and use it to estimate the normalized equity reinvestment in 1999.

Equity Reinvestment in 2000 = Reinvestment (1- Debt ratio)

= 183.3 (1-0.4094) = 108.27million CY

As a percent of net income,

$$\text{Equity Reinvestment rate in 2000} = \frac{108.27}{72.36} = 149.97\%$$

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 5 years. The expected growth rate over the next 5 years can then be estimated.

Expected growth rate- next 5 years

$$= (\text{Equity reinvestment rate})(\text{ROE}_{\text{New}}) + \left(\frac{\text{ROE}_5 - \text{ROE}_{\text{today}}}{\text{ROE}_{\text{today}}}\right)^{\frac{1}{5}} - 1$$

$$= (1.4997)(0.12) + \left(\frac{0.12 - 0.0280}{0.0280}\right)^{\frac{1}{5}} - 1 = 44.91\%$$

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%.

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

To estimate the cost of equity, we used a riskfree 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):

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%.

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 5 years. The next 5 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 Table 14.6.

Table 14.6: Estimated FCFE for Tsingtao Breweries

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 =						($186.65)

To estimate the terminal value of equity, we used 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

$= (\text{Net Income}_{11})(\text{1-Stable period equity reinvestment rate})$

$= (1331.81)(1.10)(1-0.5) = 732.50 \text{ million}$

Terminal Value of equity in Tsingtao Breweries:

$$= \frac{\text{FCFE}_{11}}{\text{Stable period cost of equity} \quad \text{Stable growth rate}}$$

$$= \frac{732.50}{0.1396-0.10} = 18{,}497 \text{ million}$$

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

$$= \text{PV of FCFE during the high growth period} + \text{PV of terminal value}$$

$$\text{Value of Equity} = -186.65 + \frac{18{,}497}{(1.1471)^5(1.1456)(1.1441)(1.1426)(1.1411)(1.1396)}$$

$$= 4{,}596 \text{ million}$$

$$\text{Value of Equity per share} = \frac{\text{Value of Equity}}{\text{Number of Shares}} = \frac{4{,}596}{653.15} = CY\,7.04 \text{ per share}$$

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

 .*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.

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 the illustration above. 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 model that we have described above 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.

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.

a. When they are similar

There are two conditions under which the value from using the FCFE in discounted cashflow 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 - Dividends) is invested in projects with net present value of zero. (For instance, investing in financial assets which are fairly priced should yield a net present value of zero.)

b. 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 dividends less than FCFE lowers debt-equity ratios and may lead the firm to become underlevered, causing a loss in value.

In the cases where dividends are greater than FCFE, the firm will have to issue either new stock 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 and 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 value.

There is a third possibility and it reflects different assumptions about reinvestment and growth in the two models. If the same growth rate 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 non-cash investments, whereas the return on equity used in the dividend discount model should be the overall return on equity. Table 14.7 summarizes the differences in assumptions between the two models.

Table 14.7: Differences between DDM and FCFE Model

	Dividend Discount Model	*FCFE Model*
Implicit Assumption	Only dividends are paid. Remaining portion of earnings are invested back into the firm, some in operating assets and some in cash & 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 non-cash return on equity.
Dealing with cash and marketable securities	The income from cash and marketable securities is built into earnings and ultimately	You have two choices: 1. Build in income from cash and marketable securities

	into dividends. Therefore, cash and marketable securities do not need to be added in	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

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.

3. 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, either 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 the market. 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 last few years, but it remains a firm that uses equity for much of its reinvestment needs.

Background Information

Net Income =$3,878

Number of shares outstanding =2487.03

Current Capital Expenditures =$992.00

Current Depreciation =$773.00

Increase in non-cash Working capital in most recent year =$852.00

Net Debt Issued (Paid) during the year =($585.00)

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

Free Cash flow to equity = Net Income – (Cap Expenditures – Depreciation) – Change in non-cash working capital + Net Debt Issued = 3878 – (992- 773) – 852 + (-585) = $2,222 million

The return on equity in the most recent year was estimated to be 23.37% in the dividend discount model. We re-estimated 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:

Modified return on equity = (Net Income – After-tax Interest income from cash)/ (Book Value of Equity – Cash and Marketable Securities) = $\frac{2177 - 91}{9317 - 1822} = 27.83\%$

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. This cost of equity is slightly higher than the cost of equity used in the dividend discount model to reflect the fact that we are valuing operating assets (not including cash) – the beta used was 0.82, slightly higher than the beta of 0.80 used in the dividend discount model.

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

- We computed the net capital expenditures as a percent of earnings before interest and taxes each year for the last 5 years.

	-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
						31.04%

Normalized net capital expenditure = Average as % of EBIT over last 5 years * EBIT in most recent year = 0.3104* 5134 = $1,593 million

- We estimated non-cash working capital as a percent of revenues in the most recent year and used it to estimate the change in non-cash working capital over the last year.

Non-cash working capital in current year = $223 million

Revenues in current year = $20,458 million

[3] As in the dividend discount model, we used a normalized net income ($2177 million) just for this computation. The rest of the valuation is based upon the actual net income prior to extraordinary items.

Revenues last year = $19,805 million

Normalized change in non-cash working capital last year =

$$\left(\frac{223}{20458}\right)(20458 - 19805) = \$7.12 \text{ million}$$

- 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.

$$\text{Debt Ratio} = \frac{\text{Interest bearing debt}}{\text{Interest bearing debt} + \text{Market value of equity}}$$
$$= \frac{5651}{5651 + 115125} = 4.68\%$$

Normalized debt issued in current year = (Normalized net capital expenditures + Normalized change in non-cash working capital) * Debt Ratio

= (1593+7.12)*(0.0468) =$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 = 3878 – 1593 – 7.12 + 74.89 = $2,353 million

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

$$\text{Equity reinvestment rate} = 1 - \frac{\text{FCFE}}{\text{Net Income}} = 1 - \frac{2353}{3878} = 39.3\%$$

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

Expected Growth = Equity reinvestment rate * Return on Equity = 0.393*0.2783 = 0.1094

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:

$$\text{Equity Reinvestment rate in stable growth} = \frac{g}{\text{ROE}} = \frac{5.5\%}{20\%} = 27.5\%$$

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 non-cash net income and an equity reinvestment rate of 39.3% for the first 5 years.

Non-cash Net Income = Net Income – After-tax Interest income from cash and marketable securities = $3,878 million – 89 million = $3,789 million

The next 5 years represent a transition period, where the growth drops in linear increments from 10.94% to 5.5% and the equity reinvestment rate drops from 39.3% to 27.5%. The resulting free cash flows to equity are shown in Table 14.8.

Table 14.8: Estimated FCFE for Coca Cola

Year	Expected Growth	Net Income	Equity Reinvestment Rate	FCFE	Cost of Equity	Present Value
High Growth Stage						
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
Steady Growth Stage						
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 used 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

$$= (\text{Net Income}_{11})(1 - \text{Stable period equity reinvestment rate})$$
$$= (9212.97)(1.055)(1 - 0.275) = 7{,}047 \text{ million}$$

$$\text{Value of equity in Coca Cola} = \frac{\text{FCFE}_{11}}{\text{Stable period cost of equity} - \text{Stable growth rate}}$$
$$= \frac{7{,}047}{0.094 - 0.055} = 180{,}686$$

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.

$$\text{Value of Equity} = \text{PV of FCFE during the high growth period} + \text{PV of terminal value}$$
$$= 24{,}707 + \frac{180{,}686}{(1.0988)^5(1.0987)(1.0976)(1.0964)(1.0952)(1.0940)}$$
$$= 95{,}558 \text{ million}$$

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 = $95,558 + $1,892 = $97,447 million

$$\text{Value of Equity per share} = \frac{\text{Value of Equity}}{\text{Number of Shares}}$$
$$= \frac{97{,}447}{2{,}487.03} = \$39.19$$

The FCFE model yields a 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. We would argue that 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 the growth rate down with it).

Conclusion

The primary difference between the dividend discount models described in the previous chapter and the free cashflow 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 cashflow to equity as the residual cashflow 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 provides the better estimate of value.

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.

B. The free cash flow to equity will always be higher than the dividends.

C. The free cash flow to equity will always be higher than net income.

D. The free cash flow to equity can never be negative.

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 intends to maintain its current financing mix (of debt and equity) to finance future investment needs. The firm is in steady state and earnings are expected to grow 7% a year. The stock had a beta of 1.05. (The treasury bond rate is 6.25%.)

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 are expected to grow at the same rate as earnings from 1994 to 1998. Working capital is expected to remain at 5% of revenues and revenues, which were $1,000 million in 1993, are expected to increase 6% a year from 1994 to 1998, and 4% a year after that. The firm currently has a debt ratio (D/(D+E)) of 5%, but plans to finance future investment needs (including working capital investments) using a debt ratio of 20%. The stock is expected to have a beta of 1.00 for the period of the analysis and the treasury bond rate is 6.50%. (There are 63 million shares outstanding)

a. Assuming that capital expenditures and depreciation offset each other after 1998, estimate the value per share.

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 are 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 is expected to remain at 50% of revenues, which were $106 million in 1993, and are expected to grow 6% a year from 1994 to 1998 and 4% a year after that. The firm is 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 is expected to drop to 1.10 after 1998. (The treasury bond rate is 7%)

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 upon the FCFE model.

5. Biomet Inc. designs, manufactures and markets reconstructive and trauma devices and 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 will remain at that level from 1994 to 1998, while earnings and revenues are expected to grow 17% a year. The earnings growth rate is 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 are expected to grow at the same rate as earnings, but are expected to offset each other when the firm reaches steady state. Working capital is expected to drop from 60% of revenues during the 1994-1998 period to 30% of revenues after 2003. The firm has no debt currently, but plans to finance 10% of its net capital investment and working capital requirements with debt.

The stock is expected to have a beta of 1.45 for the high growth period (1994-1998) and it is expected to decline to 1.10 by the time the firm goes into steady state (in 2003). The treasury bond rate is 7%.

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. Which of the following firms is 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 which pays out more in dividends than it has available in FCFE, and then issues stock to cover the difference.

(c) A firm which pays out, on average, its FCFE as dividends.

(d) A firm which 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 which pays out more in dividends than it has available in FCFE, but borrows money to cover the difference. (The firm is over-levered to begin with.)