

FREE CASH FLOW VALUATION

Study Session 12

EXAM FOCUS

This topic review introduces the concept of free cash flow. The value of a firm's stock is calculated by forecasting free cash flow to the firm (FCFF) or free cash flow to equity (FCFE) and discounting these cash flows back to the present at the appropriate required rate of return. FCFF or FCFE are the appropriate models to use when (1) the firm doesn't pay dividends at all or pays out fewer dividends than dictated by its cash flow, (2) free cash flow tracks profitability,

or (3) the analyst takes a corporate control perspective. Make sure you see the parallels between the free cash flow framework and the discounted dividend framework (i.e., the basic free cash flow model is analogous to the Gordon growth model). Memorize the formulas for FCFF and FCFE. This is a very popular test topic at Level 2, as many analysts prefer free cash flow models to dividend discount models.

FREE CASH FLOW VALUATION

LOS 42.a: Define and interpret free cash flow to the firm (FCFF) and free cash flow to equity (FCFE).

Forget about all the complicated financial statement relationships for a minute and simply picture the firm as a cash "processor." Cash flows into the firm in the form of revenues as it sells its product, and cash flows out as it pays its cash operating expenses (e.g., salaries and taxes, but not interest expense, which is a financing and not an operating expense). The firm takes the cash that's left over and makes short-term net investments in working capital (e.g., inventory and receivables) and long-term investments in property, plant, and equipment. The cash that remains is available to pay out to the firm's investors: bondholders and common shareholders (let's assume for the moment that the firm has not issued preferred stock). That pile of remaining cash is called **free cash flow to the firm** (FCFF) because it's "free" to pay out to the firm's investors (see Figure 1). The formal definition of FCFF is the cash available to all of the firm's investors, including stockholders and bondholders, after the firm buys and sells products, provides services, pays its cash operating expenses, and makes short- and long-term investments.



Professor's Note: Taxes paid are included in the definition of cash operating expenses for purposes of defining free cash flow, even though taxes aren't generally considered a part of operating income.

What does the firm do with its FCFF? First, it takes care of its bondholders because common shareholders are last in line at the money store. So it makes interest payments

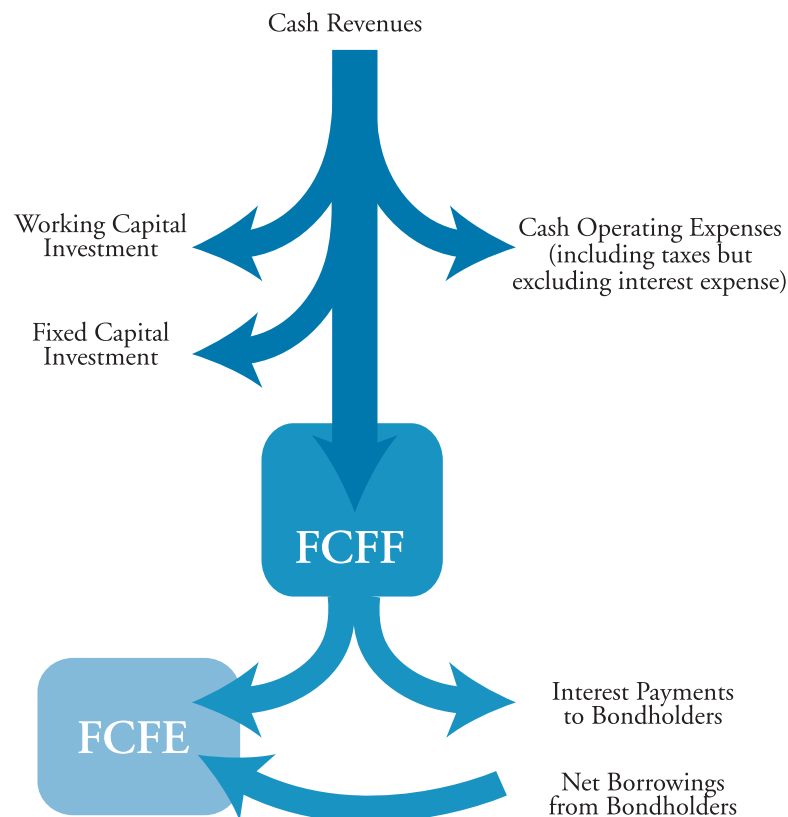
to bondholders and borrows more money from them or pays some of it back. However, making interest payments to bondholders has one advantage for common shareholders: it reduces the tax bill.

The amount that's left after the firm has met all its obligations to its other investors is called **free cash flow to equity** (FCFE), as can be seen in Figure 1. However, the board of directors still has discretion over what to do with that money. It could pay it all out in dividends to its common shareholders, but it might decide to only pay out some of it and put the rest in the bank to save for next year. That way, if FCFE is low the next year, it won't have to cut the dividend payment. So FCFE is the cash available to common shareholders after funding capital requirements, working capital needs, and debt financing requirements.



Professor's Note: You need to know these general definitions! We will explore how these two cash flow measures are estimated using accounting data, and in the process we'll throw a lot of formulas at you. It's much easier to remember these formulas and repeat them on the exam if you have a conceptual understanding of what FCFF and FCFE represent. That way if, for example, you happen to forget the FCFE formula in the heat of the moment on exam day, you still have a chance to reconstruct it by thinking through what FCFE really is.

Figure 1: FCFF and FCFE



LOS 42.b: Describe, compare, and contrast the FCFF and FCFE approaches to valuation.

LOS 42.n: Describe the characteristics of companies for which the FCFF model is preferred to the FCFE model.

We're going to use the typical discounted cash flow technique for free cash flow valuation, in which we estimate value today by discounting expected future cash flows at the appropriate required return. What makes this complicated is that we'll end up with two values we want to estimate (firm value and equity value), two cash flow definitions (FCFF and FCFE), and two required returns [weighted average cost of capital (WACC) and required return on equity]. The key to nailing this question on the exam is knowing which *cash flows* to discount at which *rate* to estimate which *value*.

The value of the *firm* is the present value of the expected future *FCFF* discounted at the *WACC* (this is so important we're going to repeat it as a formula):

firm value = FCFF discounted at the WACC

The weighted average cost of capital is the required return on the firm's assets. It's a weighted average of the required return on common equity and the after-tax required return on debt. We'll show you the formula later in this topic review.



Professor's Note: Technically, what we've called firm value is actually the value of the operating assets (the assets that generate cash flow). Significant nonoperating assets, such as excess cash (not total cash on the balance sheet), excess marketable securities, or land held for investment should be added to this estimate to calculate total firm value. Most of the time the value of these assets is small in relation to the present value of the FCFFs, so we don't lose much by ignoring it. If you are asked to calculate the value of the firm using the FCFF approach, calculate the present value of the FCFFs and then look for any additional information in the problem that specifically says "excess cash and marketable securities" or "land held for investment."

The value of the firm's *equity* is the present value of the expected future *FCFE* discounted at the *required return on equity*:

equity value = FCFE discounted at the required return on equity

Given the value of the firm, we can also calculate equity value by simply subtracting out the market value of the debt:

equity value = firm value – market value of debt

We'll get to the details of the calculations later in this topic review. However, this is an extremely important concept, so memorize it now.



Professor's Note: A very common mistake is to use the wrong discount rate or the wrong cash flow definition. Remember, always discount FCFF at the WACC to find firm value and FCFE at the required return on equity to estimate equity value!

The differences between FCFF and FCFE account for differences in capital structure and consequently reflect the perspectives of different capital suppliers. FCFE is easier and more straightforward to use in cases where the company's capital structure is not particularly volatile. On the other hand, if a company has negative FCFE and significant debt outstanding, FCFF is generally the best choice. We can always estimate equity value indirectly by discounting FCFF to find firm value and then subtracting out the market value of debt to arrive at equity value.

LOS 42.c: Contrast the ownership perspective implicit in the FCFE approach to the ownership perspective implicit in the dividend discount approach.

LOS 42.g: Contrast the recognition of value in the FCFE model with the recognition of value in dividend discount models.

The ownership perspective in the free cash flow approach is that of an acquirer who can change the firm's dividend policy, which is a control perspective, or for minority shareholders of a company that is "in-play" (i.e., it is a takeover target with potential bidders). The ownership perspective implicit in the dividend discount approach is that of a minority owner who has no direct control over the firm's dividend policy. If investors are willing to pay a premium for control of the firm, there may be a difference between the values of the same firm derived using the two models.

Analysts often prefer to use free cash flow rather than dividend-based valuation for the following reasons:

- Many firms pay no, or low, cash dividends.
- Dividends are paid at the discretion of the board of directors. It may, consequently, poorly reflect the firm's long-run profitability.
- If a company is viewed as an acquisition target, free cash flow is a more appropriate measure because the new owners will have discretion over its distribution.

FCFF AND FCFE CALCULATIONS

LOS 42.d: Discuss the appropriate adjustments to net income, earnings before interest and taxes (EBIT), earnings before interest, taxes, depreciation, and amortization (EBITDA), and cash flow from operations (CFO) to calculate FCFF and FCFE.

You are in danger of being buried alive by formulas in this topic review. We'll show you the ones you need to know for this LOS without showing you the derivations (you're welcome!). The basic idea is that we can arrive at FCFF by starting with one of four different financial statement items (net income, EBIT, EBITDA, or cash flow from

operations [CFO]) and then making the appropriate adjustments. Then we can calculate FCFE from FCFF or by starting with net income or CFO.

Calculating FCFF from net income. FCFF is calculated from net income as:

$$\text{FCFF} = \text{NI} + \text{NCC} + [\text{Int} \times (1 - \text{tax rate})] - \text{FCInv} - \text{WCInv}$$

where :

NI	=	net income
NCC	=	noncash charges
Int	=	interest expense
FCInv	=	fixed capital investment (capital expenditures)
WCInv	=	working capital investment

Notice that net income does not represent free cash flows defined as FCFF, so we have to make four important adjustments to net income to get to FCFF: noncash charges, fixed capital investment, working capital investment, and interest expense.

Noncash charges. Noncash charges are added back to net income to arrive at FCFF because they represent expenses that reduced reported net income but didn't actually result in an outflow of cash. The most significant noncash charge is usually depreciation. Here are some other examples of noncash charges that often appear on the cash flow statement:

- Amortization of intangibles should be added back to net income, much like depreciation.
- Restructuring charges and other noncash losses (such as the loss on sale of long-term assets) should be added back to net income. However, if the firm is accruing these costs to cover future cash outflows, then the forecast of future free cash flow should be reduced accordingly.
- Income from restructuring charge reversals and other noncash gains should be subtracted from net income.
- The amortization of a bond discount should be added back to net income, and the accretion of the bond premium should be subtracted from net income to calculate FCFF.
- Deferred taxes, which result from differences in the timing of reporting income and expenses for accounting versus tax purposes, must be carefully analyzed. Over time, differences between book and taxable income should offset each other and have no significant effect on overall cash flows. If, however, the analyst expects deferred tax liabilities to continue to increase (i.e., not reverse), increases in deferred tax liabilities should be added back to net income. Increases in deferred tax assets that are not expected to reverse should be subtracted from net income.

Fixed capital investment. Investments in fixed capital do not appear on the income statement, but they do represent cash leaving the firm. That means we have to subtract them from net income to estimate FCFF. Fixed capital investment is a net amount: it is equal to the difference between capital expenditures (investments in long-term fixed assets) and the proceeds from the sale of long-term assets:

$$\text{FCInv} = \text{capital expenditures} - \text{proceeds from sales of long-term assets}$$

Both capital expenditures and proceeds from long-term asset sales (if any) are likely to be reported on the firm's statement of cash flows. If no long-term assets were sold during the year, then capital expenditures will also equal the change in the gross PP&E account from the balance sheet. Note that if long-term assets were sold during the year, any gain or loss on the sale is handled as a non-cash item as previously discussed.

So what is the Level 2 candidate supposed to do on exam day to calculate FCInv? Let's examine two cases: first, if no long term assets were sold during the year, and second, if the company did sell long term assets.

If no long term assets were sold during the year, then FCInv is simply equal to the change in the gross PP&E account:

$$\text{FCInv} = \text{capital expenditures} = \text{ending gross PP\&E} - \text{beginning gross PP\&E}$$

If long term assets were sold during the year, then:

- Determine capital expenditures from either (1) an item in the statement of cash flows called something like "purchase of fixed assets" or "purchases of PP&E", or (2) data provided in the vignette.
- Determine proceeds from sales of fixed assets from either (1) an item in the statement of cash flows called something like "proceeds from disposal of fixed assets", or (2) data provided in the vignette.
- Calculate FCInv = capital expenditures – proceeds from sale of long-term assets

Example: Calculating FCInv with no long-term asset sales

Airbrush Inc. financial statements for 2007 include the following information:

Selected Financial Data

	2007	2006
Gross PP&E	\$5,000	\$4,150
Accumulated depreciation	<u>\$1,500</u>	<u>\$1,200</u>
Net PP&E	\$3,500	\$2,950

There were no sales of PP&E during the year; depreciation expense was \$300. Calculate Airbrush's FCInv for 2007.

Answer:

$$\begin{aligned} \text{FCInv} &= \text{capital expenditures} = \text{ending gross PP\&E} - \text{beginning gross PP\&E} \\ &= (\$5,000 - \$4,150) = \$850 \end{aligned}$$

Example: Calculating FCInv with long-term asset sales

Use the same information for Airbrush Inc. as in the previous example, but now also suppose that the company reports capital expenditures of \$1,400, long-term asset sales of \$600, and depreciation expense of \$850. The long-term assets sold were fully depreciated. Calculate Airbrush's revised FCInv for 2007.

Answer:

$$\begin{aligned}\text{Revised FCInv} &= \text{capital expenditures} - \text{proceeds from sales of long-term assets} \\ &= \$1,400 - \$600 = \$800\end{aligned}$$

Working capital investment. The investment in net working capital is equal to the change in working capital, *excluding cash, cash equivalents, notes payable, and the current portion of long-term debt.* Note that there would be a + sign in front of a *reduction* in working capital; we would add it back because it represents a cash inflow.

Interest expense. Interest was expensed on the income statement, but it represents a financing cash flow to bondholders that is available to the firm *before* it makes any payments to its capital suppliers. Therefore we have to add it back. However, we don't add back the entire interest expense, only the after-tax interest cost because paying interest reduces our tax bill. For example, if the marginal tax rate is 30%, every dollar of interest paid reduces the tax bill by thirty cents. The net effect on free cash flow is an increase in the after-tax interest cost of 70 cents.

Unfortunately, you have to memorize a number of free cash flow formulas to be fully prepared for the exam. However, we can use the statement of cash flows (as it is required to be reported under U.S. GAAP) as a framework to provide some intuition concerning the free cash flow formulas and perhaps make it a little easier to remember these formulas.

Given our conceptual discussion of FCFF and FCFE, it would make sense to define them as shown in the first column of Figure 2.

Figure 2: Calculating FCFF and FCFE Using the Statement of Cash Flows

<i>Statement of Cash Flows</i>	<i>FCFF and FCFE</i>	
Net income (NI)	Net income (NI)	
+ Noncash charges (NCC)	+ Noncash charges (NCC)	
<u>- WCInv</u>	<u>- WCInv</u>	
Cash flow from operations (CFO)	Cash flow from operations (CFO)	
<u>- FCInv</u>	+ Int (1 - tax rate) <u>- FCInv</u>	After-tax interest expense is classified as financing outflow rather than operating outflow
(Almost) FCFF	(Actual) FCFF	
+ Net borrowing	+ Net borrowing <u>- Int (1 - tax rate)</u>	
FCFE	FCFE	
- Dividends	- Dividends	
+/- Common stock issues (repurchases)	+/- Common stock issues (repurchases)	
Net change in cash	Net change in cash	

Free cash flow to the firm is the operating cash flow left after the firm makes working capital and fixed capital investment. Therefore, we can get close to the actual calculation by using the first column in Figure 2:

$$\begin{aligned} \text{(Almost) FCFF} &= [\text{NI} + \text{NCC} - \text{WCInv}] - \text{FCInv} \\ &= \text{CFO} - \text{FCInv} \end{aligned}$$

We're not quite there, however, because of one unique feature of the statement of cash flows: interest expense is considered an operating cash flow, whereas we'd like to call it a financing cash flow. Because interest is tax deductible, the after-tax interest expense [interest × (1 - tax rate)] reduces net income, but we want to add it back to net income and then subtract it out as a financing cash outflow. By doing that we go from our (almost) definition to the actual formula for FCFF (as shown in the second column in Figure 2):

$$\begin{aligned} \text{(Actual) FCFF} &= [\text{NI} + \text{NCC} - \text{WCInv}] + \text{Int}(1 - \text{tax rate}) - \text{FCInv} \\ &= \text{CFO} + \text{Int}(1 - \text{tax rate}) - \text{FCInv} \end{aligned}$$

We can also use the second column format to calculate FCFE directly from FCFF:

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

Notice that any financial decisions that affect cash flows below FCFE (e.g., dividends, share repurchases, and share issues) do not affect FCFF or FCFE (see LOS 42.h for more detail).

Calculating FCFF from EBIT. FCFF can also be calculated from earnings before interest and taxes (EBIT):

$$\text{FCFF} = [\text{EBIT} \times (1 - \text{tax rate})] + \text{Dep} - \text{FCInv} - \text{WCInv}$$

where :

EBIT = earnings before interest and taxes

Dep = depreciation

If we start with earnings before interest and taxes (EBIT), we have to add back depreciation because it was subtracted out to get to EBIT. However, because EBIT is “before interest and taxes” we don’t have to take out interest (remember that it’s a financing cash flow). We do have to adjust for taxes, though, by computing after-tax EBIT, which is EBIT times one minus the tax rate. We also make the same adjustments as we did before by subtracting out fixed capital and working capital investment.



Professor’s Note: Because many noncash adjustments occur on the income statement below EBIT, we don’t need to adjust for them when calculating free cash flow if we start with EBIT. We assume that the only noncash charge that appears above EBIT is depreciation in the equation “FCFF from EBIT.” In general, however, the rule is to adjust for any noncash charge that appears on the income statement above the income statement item you’re starting with.

Calculating FCFF from EBITDA. We can also start with earnings before interest, taxes, depreciation, and amortization (EBITDA) to arrive at FCFF:

$$\text{FCFF} = [\text{EBITDA} \times (1 - \text{tax rate})] + (\text{Dep} \times \text{tax rate}) - \text{FCInv} - \text{WCInv}$$

where :

EBITDA = earnings before interest, taxes, depreciation, and amortization

Remember that EBITDA is “before depreciation,” so we only have to add back the depreciation tax shield, which is depreciation times the tax rate. Even though depreciation is a noncash expense, the firm reduces its tax bill by expensing it, so the free cash flow available is increased by the taxes saved.

Calculating FCFF from CFO. Finally, FCFF can also be estimated by starting with cash flow from operations (CFO) from the statement of cash flows:

$$\text{FCFF} = \text{CFO} + [\text{Int} \times (1 - \text{tax rate})] - \text{FCInv}$$

where :

CFO = cash flow from operations

Cash flow from operations is equal to net income plus noncash charges less working capital investment. We have to add back to CFO the after-tax interest expense to get to FCFF because interest expense (and the resulting tax shield) was reflected on the income statement to arrive at net income. We also have to subtract out fixed capital investment since CFO only includes changes in working capital investment.



Professor's Note: Which formula should you use on the exam? I suggest that, at a minimum, you memorize the first one (that starts with net income) and the last one (that starts with cash flow from operations). That way, given either an income statement or a cash flow statement, you can calculate FCFF. However, don't be surprised if you're required to know the other two as well.

Calculating FCFE from FCFF. Calculating FCFE is easy once we have FCFF:

$$\text{FCFE} = \text{FCFF} - [\text{Int} \times (1 - \text{tax rate})] + \text{net borrowing}$$

where :

net borrowing = long- and short-term new debt issues – long- and short-term debt repayments

If we start with FCFF, we have to adjust for the two cash flows to bondholders to calculate FCFE: the after-tax interest expense and any new long- or short-term borrowings. We only subtract the after-tax interest expense because paying interest reduces the firm's tax bill and reduces the cash available to the shareholders by the interest paid minus the taxes saved.

Calculating FCFE from net income. We can also calculate FCFE from net income by making some of the usual adjustments. The two differences between this "FCFE from net income" formula and the "FCFF from net income formula" are (1) after-tax interest expense is NOT added back and (2) net borrowing is added back.

$$\text{FCFE} = \text{NI} + \text{NCC} - \text{FCInv} - \text{WCInv} + \text{net borrowing}$$

Calculating FCFE from CFO. Finally, we can calculate FCFE from CFO by subtracting out fixed capital investment (which reduces cash available to shareholders) and adding back net borrowing (which increases the cash available to shareholders).

$$\text{FCFE} = \text{CFO} - \text{FCInv} + \text{net borrowing}$$

Free Cash Flow With Preferred Stock

The FCFF and FCFE formulas assume that the company uses only debt and common equity to raise funds. The use of preferred stock requires the analyst to revise the FCFF and FCFE formulas to reflect the payment of preferred dividends and any issuance or repurchase of such shares. *The thing to remember is to treat preferred stock just like debt, except preferred dividends are not tax-deductible.*

Specifically, any preferred dividends should be added back to the FCFE, just as after-tax interest charges are in the net income approach to generating FCFE. This approach assumes that “net income” is net income to common shareholders after preferred dividends have been subtracted out. The WACC should also be revised to reflect the percent of total capital raised by preferred stock and the cost of that capital source. The only adjustment to FCFE would be to modify net borrowing to reflect new debt borrowing and net issuances by the amount of the preferred stock. Keep in mind that relatively few firms issue preferred stock.



Professor's Note: See Questions 6 through 10 in the Concept Checkers at the end of this topic review for specific examples in which we calculate free cash flow for a firm with preferred stock.

LOS 42.e: Calculate FCFE and FCFE given a company's financial statements, prepared according to U.S. generally accepted accounting principles (GAAP) or International Financial Reporting Standards (IFRS).

Let's try an example to see if all these formulas really work.

Example: Calculating FCFE and FCFE

Anson Ford, CFA, is analyzing the financial statements of Sting's Delicatessen. He has a 2007 income statement and balance sheet, as well as 2008 income statement, balance sheet, and cash flow from operations forecasts (as shown in the tables below). Assume there will be no sales of long-term assets in 2008. Calculate forecasted free cash flow to the firm (FCFF) and free cash flow to equity (FCFE) for 2008.

Sting's Income Statement

<i>Income Statement</i>		
	2008 Forecast	2007 Actual
Sales	\$300	\$250
Cost of goods sold	120	100
Gross profit	180	150
SG&A	35	30
Depreciation	50	40
EBIT	95	80
Interest expense	15	10
Pre-tax earnings	80	70
Taxes (at 30%)	24	21
Net income	\$56	\$49

Sting's Balance Sheet

<i>Balance Sheet</i>		
	2008 Forecast	2007 Actual
Cash	\$10	\$5
Accounts receivable	30	15
Inventory	40	30
Current assets	\$80	\$50
Gross property, plant, and equipment	400	300
Accumulated depreciation	(190)	(140)
Total assets	\$290	\$210
Accounts payable	\$20	\$20
Short-term debt	20	10
Current liabilities	\$40	\$30
Long-term debt	114	100
Common stock	50	50
Retained earnings	86	30
Total liabilities and owners' equity	\$290	\$210

Sting's Cash Flow From Operations Forecast

<i>Cash Flow From Operations Forecast for 2008</i>	
Net income	\$56
+ depreciation	50
– WCInv	25
Cash flow from operations	\$81

Answer:

Fixed capital investment is equal to capital expenditures (because there are no asset sales), which is equal to the change in gross PP&E:

$$\begin{aligned} \text{FCInv} &= 400 - 300 \\ &= 100 \end{aligned}$$

Working capital investment is the change in the working capital accounts, excluding cash and short-term borrowings:

$$\begin{aligned} \text{WCInv} &= (\text{AcctsRec}_{2008} + \text{Inv}_{2008} - \text{AcctsPay}_{2008}) - \\ &\quad (\text{AcctsRec}_{2007} + \text{Inv}_{2007} - \text{AcctsPay}_{2007}) \\ \text{WCInv} &= (30 + 40 - 20) - (15 + 30 - 20) = 50 - 25 = 25 \end{aligned}$$

Given that depreciation is the only noncash charge, we can calculate FCFF from net income:

$$\begin{aligned} \text{FCC} &= \text{NI} + \text{NCC} + [\text{Int} \times (1 - \text{tax rate})] - \text{FCInv} - \text{WCInv} \\ &= 56 + 50 + [15 \times (1 - 0.3)] - 100 - 25 = -8.5 \\ &= 56 + 50 + 10.5 - 100 - 25 = -8.5 \end{aligned}$$

It's entirely possible that FCFF can be negative in the short term. We'll talk more later about how to value firms with negative FCFF.

Net borrowing is the difference between the long-term and short-term debt accounts:

$$\begin{aligned} \text{net borrowing} &= (114 + 20) - (100 + 10) = 24 \\ \text{FCFE} &= \text{FCFF} - [\text{Int}(1 - \text{tax rate})] + \text{net borrowing} \\ &= -8.5 - 10.5 + 24 = 5 \end{aligned}$$

Example: Calculating FCFF and FCFE with the other formulas

Calculate FCFF starting with EBIT, EBITDA, and CFO, and calculate FCFE starting with NI and CFO.

Answer:

$$\begin{aligned}\text{FCFF} &= [\text{EBIT} \times (1 - \text{tax rate})] + \text{Dep} - \text{FCInv} - \text{WCInv} \\ &= [95 \times (1 - 0.3)] + 50 - 100 - 25 = -8.5\end{aligned}$$

$$\begin{aligned}\text{FCFF} &= [\text{EBITDA} \times (1 - \text{tax rate})] + (\text{Dep} \times \text{tax rate}) - \text{FCInv} - \text{WCInv} \\ &= [145 \times (1 - 0.3)] + (50 \times 0.3) - 100 - 25 = -8.5\end{aligned}$$

$$\begin{aligned}\text{FCFF} &= \text{CFO} + [\text{Int} \times (1 - \text{tax rate})] - \text{FCInv} \\ &= 81 + [15 \times (1 - 0.3)] - 100 = -8.5\end{aligned}$$

$$\begin{aligned}\text{FCFE} &= \text{NI} + \text{Dep} - \text{FCInv} - \text{WCInv} + \text{net borrowing} \\ &= 56 + 50 - 100 - 25 + 24 = 5\end{aligned}$$

$$\begin{aligned}\text{FCFE} &= \text{CFO} - \text{FCInv} + \text{net borrowing} \\ &= 81 - 100 + 24 = 5\end{aligned}$$

Example: Calculating FCFF and FCFE using the statement of cash flows

In order to see how all these formulas fit together, reconstruct the framework from Figure 2 using the actual numbers from the previous example.

Answer:

Net income	\$56.0	
+ noncash charges	+ 50.0	
<u>- WCInv</u>	<u>- 25.0</u>	
Cash flow from operations		\$81.0
+ Int (1 - tax rate)	+ 10.5	
<u>- FCInv</u>	<u>- 100.0</u>	
FCFF		-\$8.5
+ net borrowing	+ 24.0	
<u>- Int (1 - tax rate)</u>	<u>- 10.5</u>	
FCFE		+\$5.0



Professor's Note: For a more complicated problem that requires a calculation of FCFE with an unusual gain on the sale of equipment, see Challenge Problem 22.

LOS 42.f: Discuss approaches for forecasting FCFF and FCFE.

Two approaches are commonly used to forecast future FCFF and FCFE.

The first method is to calculate *historical free cash flow* and apply a growth rate under the assumptions that growth will be constant and fundamental factors will be maintained. For example, we could calculate free cash flow in the most recent year and then forecast it to grow at 8% for four years and 4% forever after that. This is the same method we used for dividend discount models. Note that the growth rate for FCFF is usually different than the growth rate for FCFE.

The second method is to forecast the underlying *components of free cash flow* and calculate each year separately. This is a more realistic, more flexible, and more complicated method because we can assume that each component of free cash flow is growing at a different rate over some short-term horizon. This often ties sales forecasts to future capital expenditures, depreciation expenses, and changes in working capital. Importantly, capital expenditures have two dimensions: outlays that are needed to maintain *existing capacity* and marginal outlays that are needed to support *growth*. Thus, the first type of outlay is related to the current level of sales, and the second type depends on the predicted sales growth.

In forecasting FCFE with the second method, it is common to assume that the firm maintains a *target debt to asset ratio* for net new investment in fixed capital and working capital. For example, if the target debt ratio is 40% and fixed capital investment is \$60 million, \$24 million (0.40 times \$60 million) is assumed to be financed with debt and \$36 million with equity. Thus, net borrowing may be expressed without having to specifically forecast underlying debt issuance or repayment. This implies that we can forecast FCFE with the following formula:

$$\text{FCFE} = \text{NI} - [(1 - \text{DR}) \times (\text{FCInv} - \text{Dep})] - [(1 - \text{DR}) \times \text{WCInv}]$$

where:

DR = target debt-to-asset ratio

LOS 42.h: Explain how dividends, share repurchases, share issues, and changes in leverage may affect FCFF and FCFE.

This is a deceptively simple LOS. The short answer is that dividends, share repurchases, and share issues have *no effect* on FCFF and FCFE; changes in leverage have only a minor effect on FCFE and no effect on FCFF.

The reason is very straightforward. FCFF and FCFE represent cash flows available to investors and shareholders, respectively, before any financing decisions. Dividends, share repurchases, and share issues, on the other hand, represent *uses* of those cash flows; as such, these financing decisions don't affect the level of cash flow *available*. Changes in leverage will have a small effect on FCFE. For example, a decrease in leverage through a repayment of debt will decrease FCFE in the current year and increase forecasted FCFE in future years as interest expense is reduced.

LOS 42.i: Critique the use of net income and EBITDA as proxies for cash flow in valuation.

Net income is a poor proxy for FCFE. We can see that by simply examining the formula for FCFE in terms of NI.

Once again, we have not burdened you with the derivation:

$$\text{FCFE} = \text{NI} + \text{NCC} - \text{FCInv} - \text{WCInv} + \text{net borrowing}$$

Net income includes noncash charges like depreciation that have to be added back to arrive at FCFE. In addition, it ignores cash flows that don't appear on the income statement, such as investments in working capital and fixed assets as well as net borrowings.

EBITDA is a poor proxy for FCFF. We can also see this from the formula relating FCFF to EBITDA (which you've already seen):

$$\text{FCFF} = [\text{EBITDA} \times (1 - \text{tax rate})] + (\text{Dep} \times \text{tax rate}) - \text{FCInv} - \text{WCInv}$$

EBITDA doesn't reflect the cash taxes paid by the firm, and it ignores the cash flow effects of the investments in working capital and fixed capital.

IMPLEMENTING THE FREE CASH FLOW VALUATION APPROACH

LOS 42.j: Discuss the single-stage (stable-growth), two-stage, and three-stage FCFF and FCFE models (including assumptions) and explain the company characteristics that would justify the use of each model.

Single-Stage FCFF Model

The single-stage FCFF model is analogous to the Gordon growth model discussed in the previous topic review on dividend valuation models. The single-stage FCFF model is useful for stable firms in mature industries. The model assumes that (1) FCFF grows at a constant rate g forever, and (2) the growth rate is less than the weighted average cost of capital (WACC).

The formula should look familiar; it's the Gordon growth model, with FCFF replacing dividends and WACC replacing required return on equity.

$$\text{value of the firm} = \frac{\text{FCFF}_1}{\text{WACC} - g} = \frac{\text{FCFF}_0 \times (1 + g)}{\text{WACC} - g}$$

where:

FCFF_1 = expected free cash flow to the firm in one year

FCFF_0 = starting level of FCFF

g = constant expected growth rate in FCFF

WACC = weighted average cost of capital

The WACC is the weighted average of the rates of return required by each of the capital suppliers (usually just equity and debt) where the weights are the proportions of the firm's total market value from each capital source:

$$\text{WACC} = (w_e \times r_e) + [w_d \times r_d \times (1 - \text{tax rate})]$$

where :

$$w_e = \frac{\text{market value of equity}}{\text{market value of equity} + \text{market value of debt}}$$

$$w_d = \frac{\text{market value of debt}}{\text{market value of equity} + \text{market value of debt}}$$

It is assumed that payments to stockholders are *not* tax-deductible, and payments to debtholders are tax-deductible. Thus, the after-tax cost of debt is the before-tax rate of return on debt times one minus the firm's marginal tax rate. WACC will change over time as the firm's capital structure changes. Therefore analysts usually use target capital structure weights rather than actual weights. On the exam, use target weights if they are given in the problem; otherwise use actual market-value weights.

Single-Stage FCFE Model

The single-stage constant-growth FCFE valuation model is analogous to the single-stage FCFF model, with FCFE instead of FCFF and required return on equity instead of WACC:

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

where:

FCFE_1 = expected free cash flow to equity in one year

FCFE_0 = starting level of FCFE

g = constant expected growth rate in FCFE

r = required return on equity



Professor's Note: It's quite likely that a firm's growth rate in FCFF will be different than its FCFE growth rate.

The single-stage FCFE model is often used in international valuation, especially for companies in countries with high inflationary expectations when estimation of nominal growth rates and required returns is difficult. In those cases, real (i.e., inflation-adjusted) values are estimated for the inputs to the single-stage FCFE model: FCFE, the growth rate, and the required return.



Professor's Note: Please see Topic Review 40 for details on how to adjust for inflation in international valuations.

Multistage Models: How Many Variations Are There?

This is where things get a little complicated, but don't worry; we're here to help you. If we analyze every possible permutation of multistage free cash flow models that might appear on the exam, you'd be carrying this book around in a wheelbarrow. There are at least three important ways that these models can differ. Let's take them one at a time, but keep in mind the basic valuation principle at work here: *value is always estimated as the present value of the expected future cash flows discounted at the appropriate discount rate.*

FCFF versus FCFE: Remember that the value of the firm is the present value of the FCFF discounted at the WACC; the value of equity is the present value of the FCFE discounted at the required return on equity.

Two-stage versus three-stage models: We can model the future growth pattern in two stages or three. There are several variations of each approach depending on how we model growth within the stages.

Forecasting growth in total free cash flow (FCFF or FCFE) versus forecasting the growth rates in the components of free cash flow: The simple free cash flow model, in which we forecast total FCFE or FCFF, looks a lot like the multistage dividend discount models. The benefit of using free cash flow models, however, is when we refine our approach by forecasting the values and/or growth rates in the components of free cash flow over the first stage and then calculate free cash flow in each year using one of our trusty formulas. There are even variations of this approach in which we start with earnings per share instead of sales.

Model Assumptions and Firm Characteristics

The assumptions for the two- and three-stage free cash flow models are simply the assumptions we make about the projected pattern of growth in free cash flow. We would use a two-stage model for a firm with two stages of growth: a short-term supernormal growth phase and a long-term stable growth phase. For example, a firm with a valuable patent that expires in seven years might experience a high growth rate for seven years and then immediately drop to a long-term, lower growth rate beginning in the eighth year. We would use a three-stage model for a firm that we expect to have three distinct stages of growth (e.g., a growth phase, a mature phase, and a transition phase).

Examples of Two-Stage Models

Let's talk about some examples of two-stage models. We're going to wait until the next LOS, however, to start doing the number-crunching. For now, concentrate on the differences in the assumptions: FCFF versus FCFE, growth pattern in the first stage, and forecasting total free cash flow versus forecasting its components.

We could analyze a:

- Two-stage FCFF model in which FCFF is projected to grow at 20% for the first four years and then 4% every year thereafter.
- Two-stage FCFE model in which FCFE declines from 20% to 4% over four years and then stays at 4% forever.
- Two-stage FCFE model in which sales grow at 20% for four years, the net profit margin is constant at 8%, fixed capital investment is equal to 60% of the dollar increase in sales, working capital investment is equal to 25% of the dollar increase in sales, and the debt ratio is 50%. Given a starting value for sales, we have all we need to forecast FCFE for the first four years.

Remember that we also need a terminal value at the end of the first growth stage for each of these examples. The most common method for estimating terminal value is to apply a single-stage free cash flow model at the point in time when growth settles down to its long-run level. This is the same way we did it in the last topic review with dividend discount models. We'll talk more about how to estimate terminal value in LOS 42.m.

Examples of Three-Stage Models

Three-stage models have all the complications of the two-stage models, with an additional growth stage to worry about. Keep in mind, however, that what we're trying to do is forecast FCFF or FCFE over some interim period with three distinct stages of growth, estimate the terminal value, and then estimate the value of the firm or the value of the equity today as the present value of those cash flows discounted at the appropriate required return (have you heard that already?). For example, we could analyze a:

- Three-stage FCFE model in which FCFE grows at 30% for two years (stage 1), 15% for four years (stage 2), and then 5% forever (stage 3).
- Three-stage FCFF model in which FCFF grows at 25% for three years (stage 1), declines to 4% over next the five years (stage 2), then stays at 4% forever (stage 3).
- Three-stage FCFE model in which we forecast the components of FCFE over three different stages.

LOS 42.k: Calculate the value of a company using the stable-growth, two-stage, and three-stage FCFF and FCFE models.

I think we've talked about free cash flow models enough, so now let's get to the hard work: actually calculating value using these models. We won't go through every different possible example, but we will give you a range of examples that cover just about every important concept.

Single-Stage FCFF Model

The first example is a basic single-stage FCFF model, where we first calculate WACC as the appropriate required return.

Example: Calculating firm value with a single-stage FCFF model

Knappa Valley Winery's (KVW) most recent FCFF is \$5,000,000. KVW's target debt-to-equity ratio is 0.25. The market value of the firm's debt is \$10,000,000, and KVW has 2,000,000 shares of common stock outstanding. The firm's tax rate is 40%, the shareholders require a return of 16% on their investment, the firm's before-tax cost of debt is 8%, and the expected long-term growth rate in FCFF is 5%. Calculate the value of the firm and the value per share of the equity.

Answer:

Note that the problem gives the FCFF in the most recent year ($FCFF_0$). Therefore, you need to increase $FCFF_0$ at the growth rate by one year (at the 5% rate) to get $FCFF_1$.

Let's calculate the WACC. The target debt-to-equity ratio is 0.25. This implies that for every \$1 of debt, there is \$4 of equity, for total capital of \$5. Since total assets equals total capital, it follows that the target debt-to-asset ratio is 1/5, or 20%, and the target equity-to-asset ratio is 4/5, or 80%. The WACC is:

$$WACC = (0.8 \times 0.16) + [0.20 \times 0.08(1 - 0.40)] = 0.1376 = 13.76\%$$

We can now calculate the value of the firm as:

$$\text{value of firm} = \frac{\$5,000,000 \times 1.050}{0.1376 - 0.050} = \$59,931,507$$

Given that debt is worth \$10,000,000, the implied total value of the equity is:

$$\text{value of equity} = \$59,931,507 - \$10,000,000 = \$49,931,507$$

With 2,000,000 shares outstanding, the value of the equity per share is:

$$\frac{\$49,931,507}{2,000,000} = \$24.97$$

Notice that the actual debt-to-equity ratio ($10,000,000 / 49,931,507 = 0.20$) does not equal the target ratio of 0.25. There is nothing inconsistent in this example. WACC is usually calculated using target capital weights.

Single-Stage FCFE Model

Example: Calculating value with a single-stage FCFE model

Ridgeway Construction has an FCFE of 2.50 Canadian dollars (C\$) per share and is currently operating at a target debt-to-equity ratio of 0.4. The expected return on the market is 9%, the risk free rate is 4%, and Ridgeway has a beta of 1.5. The expected growth rate of FCFE is 4.5%. Calculate the value of Ridgeway stock.

Answer:

Begin by computing the required return on equity with the CAPM:

$$r = 0.04 + [1.50 \times (0.09 - 0.04)] = 0.115 = 11.5\%$$

Note that the problem gives FCFE in the most recent year ($FCFE_0$). The model calls for the FCFE *next* year, which is $FCFE_1$. Therefore, you need to multiply $FCFE_0$ by one plus the growth rate to get $FCFE_1$. The equity value per share is:

$$\text{equity value per share} = \frac{\text{C}\$2.50 \times 1.045}{0.115 - 0.045} = \text{C}\$37.32$$



Professor's Note: In the first example we calculated total value and then equity value per share by dividing total value by the number of shares. In the second example we were given FCFE per share, so we could calculate value per share directly. Read the questions on the exam carefully to make sure you use the correct approach given the information in the problem.

Two-Stage FCFF Model

The first two-stage example requires the FCFF model and a forecast of the components of FCFF during the high-growth stage.

Example: Calculating value with a two-stage FCFF model

The Prentice Paint Company earned a net profit margin of 20% on revenues of \$20 million this year. Fixed capital investment was \$2 million, and depreciation was \$3 million. Working capital investment equals 7.5% of the sales level in that year. Net income, fixed capital investment, depreciation, interest expense, and sales are expected to grow at 10% per year for the next five years. After five years, the growth in sales, net income, depreciation and interest expense will decline to a stable 5% per year, and fixed capital investment and depreciation will offset each other. The tax rate is 40%, and Prentice has 1 million shares of common stock outstanding and long-term debt paying 12.5% interest trading at its par value of \$32 million. Calculate the value of the firm and its equity using the FCFF model if the WACC is 17% during the high growth stage and 15% during the stable stage.

Answer:

The components of FCFF are calculated in the following table.

FCFF for Years 0 Through 6 (in per-share amounts of \$)

	0	1	2	3	4	5	6
Sales (\$)	20.00	22.00	24.20	26.62	29.28	32.21	33.82
Net Income	4.00	4.40	4.84	5.32	5.86	6.44	6.76
Interest (1-T)	2.40	2.64	2.90	3.19	3.51	3.87	4.06
Depreciation	3.00	3.30	3.63	3.99	4.39	4.83	5.07
FCInv	2.00	2.20	2.42	2.66	2.93	3.22	5.07
WCInv	1.50	1.65	1.82	2.00	2.20	2.42	2.54
FCFF	\$5.90	\$6.49	\$7.13	\$7.84	\$8.63	\$9.50	\$8.28

Let's demonstrate the calculation of the FCFF in year 0:

$$\begin{aligned}
 \text{net income} &= \$20.00 \times 0.20 = \$4.00 \\
 \text{interest} &= \$32 \times 0.125 = \$4.00 \\
 \text{interest}(1 - T) &= \$4.00 \times (1 - 0.40) = \$2.40 \\
 \text{WCInv} &= \$20.00 \times 0.075 = \$1.50 \\
 \text{FCFF} &= \$4.00 + \$2.40 + \$3.00 - \$2.00 - \$1.50 = \$5.90
 \end{aligned}$$

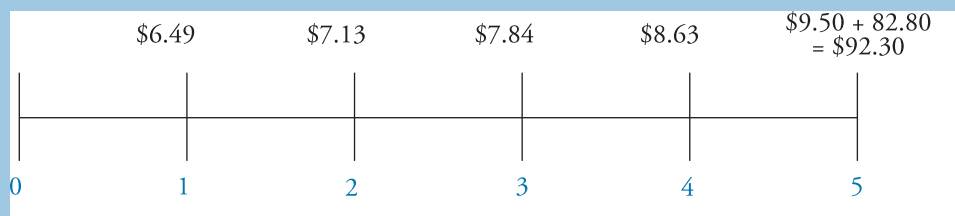
In year 1, sales grow by 10% to \$22.00 per share. Following five years of 10% growth, the growth of each component falls to 5%, and FCIInv is exactly offset by depreciation.

The terminal value (as of year 5, discounted at the stable WACC of 15%) is:

$$\text{terminal value} = \frac{\text{FCFF}_6}{\text{WACC} - g} = \frac{\$8.28}{0.15 - 0.05} = \$82.80$$

We can place the cash flows to be evaluated on a time line, such as the one in the following figure, to get a clearer picture of what we need to evaluate.

FCFF Timeline



Notice that the WACC in the high-growth stage (17%) is different than the stable stage (15%).

We calculated terminal value in year 5 using 15%, but we'll calculate the present value today of the high-growth cash flows and the terminal value at 17%. The total of the firm today is:

$$\text{value of firm} = \frac{\$6.49}{1.17^1} + \frac{\$7.13}{1.17^2} + \frac{\$7.84}{1.17^3} + \frac{\$8.63}{1.17^4} + \frac{\$92.30}{1.17^5} = \$62.36$$

Since, in all likelihood, we would want to use our financial calculators to perform this calculation more quickly and accurately, the appropriate keystrokes are:

$$\text{CF}_0 = 0; \text{C01} = 6.49; \text{C02} = 7.13; \text{C03} = 7.84; \text{C04} = 8.63; \text{C05} = 92.30 \\ \text{I} = 17; \text{CPT} \rightarrow \text{NPV } 62.36$$

Thus, given that the value of the firm's debt is \$32 per share, the value of equity per share is $\$62.36 - \$32.00 = \$30.36$.

It is uncommon for growth rates to drop as drastically and quickly from stage 1 to stage 2 as shown in the previous example. It is more likely to find a gradual decline in the growth rate as a company matures and attracts more competition that will decrease its profit margin and its sustainable growth rate. This next two-stage example is an FCFE model with declining growth rates in stage 1 and constant growth in stage 2.

Example: Two-stage FCFE model with declining growth in stage 1

Consider a rival to the Prentice Paint Company presented in the previous example. Assume that Sioux Falls Decor also has revenues of \$20 million this year. However, we assume that its future performance will be tracked relative to sales as follows:

- Sales growth and the net profit margin are projected by year as shown in the following table:

Sales and Net Margin Forecasts

Year	1	2	3	4	5	6
Sales growth	30%	25%	20%	15%	10%	5%
Net profit margin	8.0%	7.5%	7.0%	6.0%	5.5%	5.0%

- Fixed capital investment *net of depreciation* is projected to be 30% of the sales increase in each year.
- Working capital requirements are 7.0% of the projected dollar increase sales in each year.
- Debt will finance 40% of the investments in net capital and working capital.
- The company has a 12% required rate of return on equity.
- The firm has 1 million shares of common stock outstanding.

Calculate the value of the equity of Sioux Falls using the two-stage FCFE model.

Answer:

Recognize that the target debt-to-asset ratio (DR) is 0.40. The following table shows the FCFE for years 1 through 6 (\$ amounts are per share).

Calculating FCFE for Years 1 Through 6:

	1	2	3	4	5	6
Sales growth	30%	25%	20%	15%	10%	5%
Net profit margin	8.0%	7.5%	7.0%	6.0%	5.5%	5.0%
Sales	\$26.00	\$32.50	\$39.00	\$44.85	\$49.335	\$51.802
Net income	2.08	2.44	2.73	2.691	2.71	2.59
FCInv – Dep	1.80	1.95	1.95	1.755	1.346	0.74
WCInv	0.42	0.455	0.455	0.4095	0.314	0.171
Debt financing	0.888	0.962	0.962	0.864	0.664	0.364
FCFE	\$0.748	\$0.997	\$1.287	\$1.391	\$1.714	\$2.043

Let's demonstrate the calculation of the cash flow components in year 1:

$$\begin{aligned}
 \text{sales} &= \$20.00 \times 1.30 = \$26.00 \\
 \text{net income} &= \$26.00 \times 0.08 = \$2.08 \\
 \text{net FCInv} &= (\$26.00 - \$20.00) \times 0.30 = \$1.80 \\
 \text{WCInv} &= (\$26.00 - \$20.00) \times 0.07 = \$0.42 \\
 \text{FCFE} &= \text{NI} - [(1 - \text{DR}) \times (\text{FCInv} - \text{Dep})] - [(1 - \text{DR}) \times \text{WCInv}] \\
 &= \$2.08 - [(1 - 0.4) \times \$1.80] - [(1 - 0.4) \times \$0.42] = \$0.748
 \end{aligned}$$

Terminal value (as of year 5 assuming 5% stable long-term growth) is equal to:

$$\text{terminal value} = \frac{\$2.043}{0.12 - 0.05} = \$29.186$$

Total current value of equity:

$$\text{value of equity} = \frac{\$0.748}{1.12^1} + \frac{\$0.997}{1.12^2} + \frac{\$1.287}{1.12^3} + \frac{\$1.391}{1.12^4} + \frac{\$1.714 + \$29.186}{1.12^5} = \$20.80$$

As usual, we would rely on the cash flow keys of our financial calculator to perform the above calculation:

$$\text{CF}_0 = 0; \text{C01} = 0.748; \text{C02} = 0.997; \text{C03} = 1.287; \text{C04} = 1.391; \text{C05} = 30.90$$

$$\text{I} = 12; \text{CPT} \rightarrow \text{NPV} = 20.80$$

Three-Stage FCFE Model

The following example of a three-stage FCFE model is a little different than the last two examples because we're given growth in total FCFE in each of three stages, rather than the growth rates in the components. Growth in the first and third stage is constant, while growth in the second stage is declining. There is one tricky feature to this problem, however—the required return in each of the three growth stages is different.

Example: Three-stage FCFE model with forecast growth in total FCFE

Medina Classic Furniture Inc. is expected to experience growth in three distinct stages in the future. Its most recent FCFE is 0.90 Canadian dollars (C\$) per share. The following information has been compiled:

High-growth period:

- Duration = 3 years.
- FCFE growth rate = 30%.
- Shareholders' required return = 20%.

Transitional period:

- Duration = 3 years.
- FCFE growth will decline by 9% per year down to the indicated stable growth rate.
- Shareholders' required return = 15%.

Stable-growth period:

- FCFE growth rate = 3%.
- Shareholders' required return = 10%.

Calculate the value of the firm's equity using the three-stage FCFE model.

Answer:

The annual FCFE and the associated present value are presented in the table:

FCFE and PV

<i>High-Growth Period</i>	<i>Year 1</i>	<i>Year 2</i>	<i>Year 3</i>
Growth rate	30%	30%	30%
FCFE	C\$1.170	C\$1.521	C\$1.977
PV (@ 20%)	C\$0.975	C\$1.056	C\$1.144
<i>Transitional Period</i>	<i>Year 4</i>	<i>Year 5</i>	<i>Year 6</i>
Growth rate	21%	12%	3%
FCFE	C\$2.393	C\$2.680	C\$2.760
PV	C\$1.204	C\$1.173	C\$1.050

The transitional present values are computed using a combination of the 20% initial discount rate and the transitional 15% rate. For example, the present value of $FCFE_5$ is computed as:

$$C\$1.173 = \frac{C\$2.680}{1.20^3 \times 1.15^2}$$

We can calculate the terminal value of the stock as of year 6 using the FCFE projected for year 7. Notice that we use the stage 3 required return of 10%.

$$\text{terminal value} = \frac{\$2.760 \times 1.03}{0.10 - 0.03} = \$40.611$$

The value of Medina stock is:

$$\begin{aligned} \text{value per share} &= 0.975 + 1.056 + 1.144 + 1.204 + 1.173 + 1.050 + \left(\frac{40.611}{1.20^3 \times 1.15^3} \right) \\ &= C\$22.055 \end{aligned}$$

The changing discount rates were important here for a couple of reasons. First, the terminal value in year 6 had to be discounted for three years at 20% and for three years at 15%. Second, due to the changing discount rates, our financial calculator was not as helpful as it was in other multiple cash flow calculations. It simply cannot handle the changing discount rates in one easy set of calculations.

LOS 42.1: Explain how sensitivity analysis can be used in FCFF and FCFE valuations.

Sensitivity analysis shows how sensitive an analyst's valuation results are to changes in each of a model's inputs. Some variables have a greater impact on valuation results than others. The importance of various forecasting errors can be assessed through comprehensive sensitivity analysis.



Professor's Note: On the exam, you are unlikely to be asked to conduct a comprehensive sensitivity analysis that includes numerous calculations. However, a few key calculations and/or an interpretation of a sensitivity analysis are quite possible.

There are two major sources of error in valuation analysis:

- Estimating the future *growth* in FCFF and FCFE. Growth forecasts depend on a firm's future profitability, which in turn depends on sales growth, changes in profit margin, position in the life cycle, its competitive strategy, and the overall profitability of the industry.

- The chosen *base years* for the FCFF or FCFE growth forecasts. A representative base year must be chosen, or all of the subsequent analysis and valuation will be flawed.

For example, suppose an analyst is conducting a sensitivity analysis on the value of a beverage stock using the FCFE approach. She provides high and low estimates of the following variables consistent with their forecasted ranges in her model: FCFE, beta, risk-free rate of return, equity risk premium, and the FCFE growth rate. This produces a series of value estimates that reveal the sensitivity of her valuation estimate to variations in her underlying inputs.

LOS 42.m: Discuss approaches for calculating the terminal value in a multistage valuation model.

There are two basic approaches for calculating terminal value: using a single-stage model or a multiple approach. All of our examples used the first approach, in which we forecasted an FCFF or FCFE at the point in time at which cash flows begin to grow at the long-term, stable growth rate, and then we estimated terminal value using a single-stage model.

The other way to do this is to use valuation multiples (like P/E ratios) to estimate terminal value. The terminal value in year n in terms of P/E, for example, would be expressed as:

$$\begin{aligned} \text{terminal value in year } n &= (\text{trailing P/E}) \times (\text{earning in year } n) \\ \text{terminal value in year } n &= (\text{leading P/E}) \times (\text{forecasted earnings in year } n+1) \end{aligned}$$

Example: Estimating terminal value with a P/E multiple

An analyst estimates the EPS of Polar Technology in five years to be \$2.10, the EPS in six years to be \$2.32, and the median trailing industry P/E to be 35. Calculate the terminal value in year 5.

Answer:

$$\text{terminal value in year 5} = \text{year 35} \times \$2.10 = \$73.50$$

KEY CONCEPTS

LOS 42.a

FCFF is the cash available to all of the firm's investors, including stockholders and bondholders, after the firm buys and sells products, provides services, pays its cash operating expenses, and makes short- and long-term investments. FCFE is the cash available to common shareholders after funding capital requirements, working capital needs, and debt financing requirements.

LOS 42.b

The value of the firm is the present value of the expected future FCFF discounted at the WACC. The value of the firm's equity is the present value of the expected future FCFE discounted at the required return on equity.

FCFE is easier and more straightforward to use in cases where the company's capital structure is not particularly volatile. On the other hand, if a company has negative FCFE and significant debt outstanding, FCFF is generally the best choice.

LOS 42.c

Analysts prefer to use either FCFF or FCFE as a measure of value if:

- The firm does not pay dividends.
- The firm pays dividends, but the dividends do not reflect the company's long-run profitability.
- The analyst takes a control perspective.

Thus, in valuation the use of free cash flows reflects a control perspective while the use of dividends reflects a minority common stockholder's perspective. The ownership perspective in the free cash flow approach is that of an acquirer who can change the firm's dividend policy, which is a control perspective.

LOS 42.d,e

FCFF and FCFE may be calculated starting either from net income, cash flows from operations, EBIT, or EBITDA. You need to know how to calculate the following measures using financial data:

$$\text{FCFF} = \text{NI} + \text{NCC} + [\text{Int} \times (1 - \text{tax rate})] - \text{FCInv} - \text{WCInv}$$

$$\text{FCFF} = [\text{EBIT} \times (1 - \text{tax rate})] + \text{Dep} - \text{FCInv} - \text{WCInv}$$

$$\text{FCFF} = [\text{EBITDA} \times (1 - \text{tax rate})] + (\text{Dep} \times \text{tax rate}) - \text{FCInv} - \text{WCInv}$$

$$\text{FCFF} = \text{CFO} + [\text{Int} \times (1 - \text{tax rate})] - \text{FCInv}$$

$$\text{FCFE} = \text{FCFF} - [\text{Int} \times (1 - \text{tax rate})] + \text{net borrowing}$$

$$\text{FCFE} = \text{NI} + \text{NCC} - \text{FCInv} - \text{WCInv} + \text{net borrowing}$$

$$\text{FCFE} = \text{CFO} - \text{FCInv} + \text{net borrowing}$$

LOS 42.f

For forecasting FCFE, use:

$$\text{FCFE} = \text{NI} - [(1 - \text{DR}) \times (\text{FCInv} - \text{Dep})] - [(1 - \text{DR}) \times \text{WCInv}]$$

LOS 42.g

The free cash flow to equity approach takes a control perspective which assumes that recognition of value should be immediate. Dividend discount models take a minority perspective, under which value may not be realized until the dividend policy accurately reflects the firm's long-run profitability.

LOS 42.h

Dividends, share repurchases, and share issues have no effect on FCFF and FCFE; changes in leverage have only a minor effect on FCFE and no effect on FCFF.

LOS 42.i

Net income is a poor proxy for FCFE, and EBITDA is a poor proxy for FCFF.

LOS 42.j,k

The single-stage free cash flow models are useful for stable firms in mature industries. The models assume free cash flows grow at a constant rate, g , forever and that the growth rate is less than the required return (WACC for FCFF models and required return on equity for FCFE models).

$$\text{value of the firm} = \frac{\text{FCFF}_1}{\text{WACC} - g}$$

$$\text{value of equity} = \frac{\text{FCFE}_1}{r - g}$$

The assumptions for the two- and three-stage free cash flow models are simply the assumptions we make about the projected pattern of growth in free cash flow. We'd use a two-stage model for a firm with two stages of growth: a short-term supernormal growth phase and a long-term stable growth phase. We'd use a three-stage model for a firm that we expect to have three distinct stages of growth (e.g., a growth phase, a mature phase, and a transition phase).

LOS 42.l

Sensitivity analysis shows how sensitive an analyst's valuation results are to changes in each of a model's inputs. Some variables have a greater impact on valuation results than others. The importance of various forecasting errors can be assessed through comprehensive sensitivity analysis.

LOS 42.m

There are two basic approaches for calculating terminal value: using a single-stage model or a multiple approach. The multiple approach uses valuation multiples (like P/E ratios) to estimate terminal value.

LOS 42.n

Choosing whether to use FCFE or FCFF for valuation depends on the perspective of the capital suppliers and the nature of the capital structure. FCFE makes more sense when the company's capital structure is not unusual. FCFF makes sense when the firm has a relatively large amount of debt and/or the equity value is negative.

CONCEPT CHECKERS

1. The Gray Furniture Co. earned £3.50 per share last year. Investment in fixed capital was £2.00 per share, depreciation was £1.60, and the investment in working capital was £0.50 per share. Gray is currently operating at its target debt-to-asset ratio of 40%. Thus, 40% of annual investments in working capital and fixed capital will be financed with new borrowings. Shareholders require a return of 14% on their investment, and the expected growth rate is 4%. The value of Gray's stock is *closest* to:
 - A. £27.04.
 - B. £29.90.
 - C. £30.78.

2. The Anderson Door Co. earned C\$30 million before interest and taxes on revenues of C\$80 million last year. Capital expenditures were C\$20 million, and depreciation was C\$15 million. The additions to working capital were C\$6 million. The firm's weighted average cost of capital is 12.45%, the marginal tax rate is 40% and the expected cash flow growth is 5%. The market value of debt is C\$25 million. The value of the firm's equity is *closest* to:
 - A. C\$73.70.
 - B. C\$93.96.
 - C. C\$98.70.

Use the following information to answer Questions 3 through 5.

The Sanford Software Co. earned \$20 million before interest and taxes on revenues of \$60 million last year. Investment in fixed capital was \$12 million, and depreciation was \$8 million. Working capital investment was \$3 million. Sanford expects earnings before interest and taxes (EBIT), investment in fixed and working capital, depreciation, and sales to grow at 12% per year for the next five years. After five years, the growth in sales, EBIT, and working capital investment will decline to a stable 4% per year, and investments in fixed capital and depreciation will offset each other. Sanford's tax rate is 40%. Assume the weighted average cost of capital (WACC) is 11% during the high growth stage and 8% during the stable stage. The calculation of FCFF in years 1 through 5 is shown in the following table:

	0	1	2	3	4	5
Sales	60.00	67.20	75.26	84.30	94.41	105.74
EBIT	20.00	22.40	25.09	28.10	31.47	35.25
EBIT(1-T)	12.00	13.44	15.05	16.86	18.88	21.15
Dep	8.00	8.96	10.04	11.24	12.59	14.10
FCInv	12.00	13.44	15.05	16.86	18.88	21.15
WCInv	3.00	3.36	3.76	4.21	4.72	5.29
FCFF	5.00	5.60	6.28	7.03	7.87	8.81

3. Free cash flow to the firm (FCFF) in year 6 is *closest* to:
 - A. \$14.14.
 - B. \$16.49.
 - C. \$18.26.
4. The terminal value in year 5 is *closest* to:
 - A. \$206.12.
 - B. \$220.25.
 - C. \$412.25.
5. The value of the firm using a FCFF model is *closest* to:
 - A. \$149.04.
 - B. \$265.17.
 - C. \$270.35.

Use the following information to answer Questions 6 through 10.

An analyst following Barlow Energy has compiled the following information in preparation for additional analysis she has to include in a report she has been asked to produce (data is in hundreds of millions of \$):

<i>Security Type</i>	<i>Market Value</i>	<i>Before-Tax Required Return</i>
Preferred stock	\$200	7.0%
Bonds	\$600	7.5%
Common stock	\$700	14.0%
Total	\$1,500	

- Bonds are trading at par
 - Preferred share dividends: \$14
 - Net income available to common: \$125
 - Investment in working capital: \$30
 - Investment in fixed capital: \$100
 - Net new borrowing: \$40
 - Depreciation: \$50
 - Tax rate: 40%
 - Long-term growth rate of FCFF: 4%
 - Long-term growth rate of FCFE: 4%
 - WACC 9.27%
6. The current FCFF for Barlow Energy is *closest* to:
 - A. \$36.
 - B. \$62.
 - C. \$86.

7. The total value of Barlow Energy using a single-stage FCFF model is *closest* to:
- A. \$894.40.
 - B. \$1,631.88.
 - C. \$1,697.15.
8. The value of Barlow Energy's equity using a single-stage FCFF model is *closest* to:
- A. \$897.15.
 - B. \$1,097.15.
 - C. \$1,497.15.
9. The current FCFE using the information for Barlow Energy is *closest* to:
- A. \$45.
 - B. \$85.
 - C. \$99.
10. The value of Barlow Energy's equity using a single-stage model and the current FCFE is *closest* to:
- A. \$468.
 - B. \$850.
 - C. \$884.
11. Which of the following is the *best estimate* of the cash flows available to the firm's investors before any financing decisions?
- A. $EBITDA \times (1 - \text{tax rate})$.
 - B. $EBITDA \times (1 - \text{tax rate}) + (\text{Dep} \times \text{tax rate}) - \text{FCInv} - \text{WCInv}$.
 - C. $EBITDA \times (1 - \text{tax rate}) + (\text{Dep} \times \text{tax rate}) - \text{FCInv} - \text{WCInv} + \text{Int} \times (1 - \text{tax rate})$.
12. The adjustments to cash flow from operations necessary to obtain free cash flow to the firm (FCFF) are:
- A. add noncash charges, subtract fixed capital investment, and subtract working capital investment.
 - B. add after-tax interest expense and subtract fixed capital investment.
 - C. add net borrowing and subtract fixed capital investment.

Use the following information to answer Questions 13 and 14.

Rachel Keimmel, CFA, is researching the MWC Corporation, a U.S.-based automobile parts manufacturing firm. MWC has recently entered into a long-term agreement with a German automobile company to be the sole supplier of an innovative suspension system that will be used with a newly designed, moderately priced sports car. Keimmel believes that this new agreement will favorably impact MWC's stock price. To support her belief, Keimmel reviewed MWC's financial statements and sales forecasts and reached the following conclusions:

- MWC's earnings and FCFE growth will be 15% per year for two years, then stabilize at 8% per year.
- MWC will maintain its current dividend payout ratio.
- MWC has a beta of 1.2.
- Government bonds yield 6.4%, and the market equity risk premium is 5.5%.
- The most recent dividend paid to MWC shareholders was \$2.30.

Keimmel also has MWC's current cash flow statement, which follows.

MWC Incorporated
Statement of Cash Flows, December 31, 2007
(\$ Thousands)

Cash Flow From Operating Activities		
Net income	29,960	
Depreciation	8,400	
Changes in Working Capital		
(Increase) Decrease in receivables	(4,000)	
(Increase) Decrease in inventories	(6,400)	
Increase (Decrease) in payables	4,800	
Increase (Decrease) in other current liabilities	1,200	
Net change in working capital	(4,400)	
Net cash from operating activities	33,960	
Cash Flow From Investing Activities		
Purchase of fixed assets (PP&E)	(12,000)	
Net cash from investing activities	(12,000)	
Cash Flow From Financing Activities		
Change in debt outstanding	3,200	
Payment of cash dividends	(23,920)	
Net cash from financing activities	(20,720)	
Net change in cash and cash equivalents	1,240	
Beginning-of-period cash	8,760	
End-of-period cash	10,000	

13. The value of MWC's common stock using the two-stage dividend discount model is *closest* to:
- A. \$56.33.
 - B. \$61.55.
 - C. \$65.88.
14. The value of MWC's common stock using the two-stage FCFE approach is *closest* to:
- A. \$55.09.
 - B. \$59.10.
 - C. \$68.24.

15. The Hoffman Card Co. earned £1.50 per share last year. Investment in fixed capital was £0.80 per share, and depreciation was £0.30. Investment in working capital was £0.20 per share. Hoffman expects earnings to grow at 15% per year for the next five years and that investment in fixed capital, depreciation, and investment in working capital will grow at the same rate. After five years, the growth in earnings and working capital requirements will decline to a stable 5% per year, and investment in fixed capital and depreciation will offset each other (i.e., they will be equal). Hoffman's target debt ratio is 30%. The shareholders require a return of 17% on their investment during the high-growth stage and a return of 10% on their investment during the stable stage. The FCFE in year 6 and the value per share of Hoffman's common stock are *closest* to:
- | | <u>FCFE in year 6</u> | <u>Share value</u> |
|----|-----------------------|--------------------|
| A. | £2.03 | £31.08 |
| B. | £2.88 | £31.08 |
| C. | £2.88 | £57.60 |

CHALLENGE PROBLEMS

16. Suppose an analyst estimates equity value by discounting free cash flow to equity (FCFE) at the weighted average cost of capital (WACC) in the FCFE model and estimates firm and equity value by discounting free cash flow to the firm (FCFF) at the required return on equity in the FCFF model. The analyst would *most likely*:
- overestimate equity value with the FCFE model and underestimate firm value and equity value with the FCFF model.
 - underestimate equity value with the FCFE model and overestimate firm value and equity value with the FCFF model.
 - underestimate equity value with the FCFE model and underestimate firm value and equity value with the FCFF model.

Use the following information to answer Questions 17 through 19.

Meyer Henderson, CFA, is analyzing the financials of Roth Department Stores. He intends to use a free cash flow to the firm (FCFF) model to value Roth's common stock. In the 2007 financial statements and footnotes he has identified the following items:

- Item #1: Roth reported depreciation and software amortization of \$23 million in 2007.
- Item #2: The deferred tax liability increased by \$17 million in 2007.
- Item #3: Roth reported income of \$6 million in 2007 from the reversal of previous restructuring charges related to store closings in 2006.
- Item #4: Net income totaled \$173 million in 2007.
- Item #5: The net increase in noncash net working capital accounts was \$47 million in 2007.
- Item #6: Net capital spending totaled \$86 million in 2007.
- Item #7: Roth reported interest expense of \$19 million.

Henderson estimated Roth's marginal tax rate to be 35%. He also expects Roth to be profitable for the foreseeable future, so he does not expect the deferred tax liability to reverse. As the base-year projection for his FCFF valuation, Henderson calculates FCFF for 2007 as:

$$\text{FCFF}_{2007} = \$173 + \$23 + \$6 + \$17 + [\$19(1 - 0.35)] - \$86 - \$47 = \$98.35 \text{ million}$$

17. In implementing the FCFF model to value Roth, did Henderson correctly treat Items #1 and #2?
 - A. Both items treated correctly.
 - B. One correct, one incorrect.
 - C. Neither item treated correctly.
18. In implementing the FCFF model to value Roth, did Henderson correctly treat Items #3 and #4?
 - A. Both items treated correctly.
 - B. One correct, one incorrect.
 - C. Neither item treated correctly.
19. In implementing the FCFF model to value Roth, did Henderson correctly treat Items #5 and #7?
 - A. Both items treated correctly.
 - B. One correct, one incorrect.
 - C. Neither item treated correctly.

Use the following information to answer Questions 20 and 21.

At the end of 2007, Meyer Henderson, CFA, also prepared a 10-year forecast of free cash flow to equity (FCFE) and free cash flow to the firm (FCFF) from 2008 to 2017 for Trammel Medical Supplies. In early 2008 Trammel unexpectedly announced a new 15-year issue of senior debt. The proceeds are expected to be used to repurchase common stock in the open market during 2008.

20. As a result of the unexpected debt issue, Henderson should *most likely*:
 - A. increase his FCFE forecast for 2008 and decrease his FCFE forecast for 2009 through 2017.
 - B. decrease his FCFE forecast for 2008 and increase his FCFE forecast for 2009 through 2017.
 - C. increase his FCFE forecast for 2008 and not change his FCFE forecast for 2009 through 2017.

21. As a result of the unexpected debt issue, Henderson should *most likely*:
- increase his FCFF forecast for 2008 and decrease his FCFF forecast for 2009 through 2017.
 - decrease his FCFF forecast for 2008 and increase his FCFF forecast for 2009 through 2017.
 - not change his FCFF forecast for 2008 and also not change his FCFF forecast for 2009 through 2017.
22. Given the following information, calculate free cash flow to equity:
- Net income = \$50.
 - Working capital investment = \$4.
 - Beginning gross fixed assets = \$90; ending gross fixed assets = \$136.
 - Beginning accumulated depreciation = \$30; ending accumulated depreciation = \$40.
 - Depreciation expense = \$27.
 - Capital expenditures = \$65.
 - Net borrowing = \$0.

In addition, a piece of equipment with an original book value of \$19 was sold for \$10. The equipment had a book value at the time of the sale of \$2. The gain was classified as unusual. Free cash flow to equity is *closest* to:

- \$6.
 - \$10.
 - \$18.
23. Chamber Group is analyzing the potential takeover of Outmenu Inc. Chamber has gathered the following data on Outmenu. All figures are in millions of dollars.

	2007	2006	2005	2004
Net income	-\$26	\$34	\$18	\$26
FCFE	-\$1	-\$23	\$14	-\$15
FCFF	\$3	\$4	\$6	\$8
Dividends	\$5	\$5	\$4	\$4
Debt-to-equity	93%	91%	78%	84%

The *most appropriate* model for valuing Outmenu is the:

- free cash flow to equity model.
- dividend discount H-model.
- free cash flow to the firm model.

24. Suppose an analyst uses the statement of cash flows to calculate free cash flow to the firm (FCFF) as cash flow from operations less fixed capital investment, and free cash flow to equity (FCFE) as FCFF plus net borrowing. The firm has short- and long-term debt on its balance sheet. Has the analyst correctly stated, overstated, or understated FCFF and FCFE?

- | | <u>FCFF</u> | <u>FCFE</u> |
|----|-------------|-------------|
| A. | Overstated | Correct |
| B. | Understated | Understated |
| C. | Understated | Correct |

25. An analyst calculates firm value using a single-stage model on December 31, 2007 as:

$$\text{value of the firm} = \frac{\text{FCFE}_{2008}}{r - g} + \text{MVD}$$

where :

FCFE_{2008} = free cash flow to equity forecast for 2008

r = required return on equity

g = growth rate in FCFE

MVD = market value of debt on 12/31/2007

Assuming there are no nonoperating assets on the balance sheet, the analyst has *most likely*:

- correctly calculated firm value.
- incorrectly calculated firm value. The weighted average cost of capital should be substituted for the required return on equity.
- incorrectly calculated firm value. The weighted average cost of capital should be substituted for the required return on equity, and $\text{FCFE}_{2007}(1 + g)$ should be substituted for FCFE_{2008} .

ANSWERS – CONCEPT CHECKERS

1. C $FCFE = NI - (1 - DR)(FCInv - Dep) - (1 - DR)(WCInv) =$
 $£3.50 - [(1 - 0.4)(£2.00 - £1.60)] - [(1 - 0.4)(£0.50)] = £2.96$

$$\text{equity value per share} = \frac{£2.96 \times 1.04}{0.14 - 0.04} = £30.78$$

2. A $FCFF_0 = [EBIT \times (1 - \text{tax rate})] + Dep - FCInv - WCInv$

$$FCFF_0 (\text{in millions}) = [C\$30 \times (1 - 0.40)] + C\$15 - C\$20 - C\$6 = C\$7.0$$

$$\text{value of firm (in millions)} = \frac{C\$7.0 \times 1.05}{0.1245 - 0.05} = C\$98.7$$

$$\text{value of equity (in millions)} = C\$98.7 - C\$25.0 = C\$73.7$$

3. C The following table shows FCFF for years 0 through 6 (in \$):

	0	1	2	3	4	5	6
Sales	60.00	67.20	75.26	84.30	94.41	105.74	109.97
EBIT	20.00	22.40	25.09	28.10	31.47	35.25	36.66
EBIT(1 - T)	12.00	13.44	15.05	16.86	18.88	21.15	21.99
Dep	8.00	8.96	10.04	11.24	12.59	14.10	—
FCInv	12.00	13.44	15.05	16.86	18.88	21.15	—
WCInv	3.00	3.36	3.76	4.21	4.72	5.29	5.50
FCFF	5.00	5.60	6.28	7.03	7.87	8.81	16.49

$$FCFF = [EBIT \times (1 - \text{tax rate})] + Dep - FCInv - WCInv$$

$$FCFF_6 = 21.99 + 0 + 0 - 5.50 = 16.49$$

4. C The terminal value (as of year 5) is found by using the FCFF in year 6 and WACC of 8% and growth rate of 4% in the stable growth stage:

$$\text{terminal value}_5 = \frac{\$16.49}{0.08 - 0.04} = \$412.25$$

5. C The value of the firm today is the present value of the forecasted cash flows, discounted at the WACC during the high-growth stage of 11%:

$$\text{value of firm} = \frac{\$5.60}{1.11} + \frac{\$6.28}{1.11^2} + \frac{\$7.03}{1.11^3} + \frac{\$7.87}{1.11^4} + \frac{\$8.81 + \$412.25}{1.11^5} = \$270.35$$

Using the calculator, enter $CF_0 = 0.00$; $C01 = 5.60$; $C02 = 6.28$; $C03 = 7.03$; $C04 = 7.87$; $C05 = 8.81 + 412.25 = 421.06$; $I = 11$; Compute \rightarrow NPV = 270.35

6. C With the bonds trading at par, the interest expense is based on the before-tax yield:

$$\text{interest} = \$600 \times 0.075 = \$45$$

Add back preferred dividends to net income available to common to get FCFF:

$$\text{FCFF} = \text{NI (available to common)} + \text{NCC} + [\text{Int} \times (1 - \text{tax rate})] + \text{preferred dividends} \\ - \text{FCInv} - \text{WCInv}$$

$$\text{FCFF} = 125 + 50 + [45 \times (1 - 0.40)] + 14 - 100 - 30 = \$86$$

7. C The value of the firm is the present value of the constantly growing FCFF. Using single-stage FCFF model we get:

$$\text{value of firm} = \frac{\text{FCFF}_0 \times (1 + g)}{\text{WACC} - g} = \frac{\$86 \times 1.04}{0.0927 - 0.04} = \$1,697.15$$

8. A The value of the equity is equal to firm value less the market value of debt and preferred stock:

$$\text{value of equity} = \$1697.15 - \$600 - \$200 = \$897.15$$

9. B Find the FCFE from the current value of the FCFF in Answer 6:

$$\text{FCFE} = \text{FCFF} - [\text{Int} \times (1 - \text{tax rate})] - \text{preferred dividends} + \text{net borrowing} \\ = 86 - [45 \times (1 - 0.4)] - 14 + 40 = \$85$$

10. C $\text{value of equity} = \frac{\$85 \times 1.04}{0.14 - 0.04} = \884

11. B Free cash flow to the firm (FCFF) is the estimate of the cash flows available to the firm's investors after the firm buys and sells products, provides services, pays its cash operating expenses, and makes short- and long-term investment decisions but before the firm makes any financing decisions. EBITDA is a poor proxy for free cash flow. FCFF is calculated as:

$$\text{FCFF} = [\text{EBITDA} \times (1 - \text{tax rate})] + (\text{Dep} \times \text{tax rate}) - \text{FCInv} - \text{WCInv}$$

12. B Free cash flow to the firm is equal to cash flow from operations plus after-tax interest expense [interest(1 - tax rate)] minus fixed capital investment.

13. **A** Based on the CAPM, the required return on MWC's common equity can be computed as follows:

$$r = 6.4\% + (1.2 \times 5.5\%) = 13\%$$

The current value of MWC common stock can be estimated using the two-stage DDM approach as follows:

$$g = 15\%$$

$$D_{2007} = \$2.30$$

$$D_{2008} = \$2.30 \times 1.15 = \$2.65$$

$$D_{2009} = \$2.65 \times 1.15 = \$3.05$$

$$\text{terminal value} = \frac{\$3.05 \times 1.08}{(0.13 - 0.08)} = \$65.88$$

$$\text{equity value} = \frac{\$2.65}{1.13} + \frac{\$3.05 + \$65.88}{1.13^2} = \$56.33$$

14. **B** The current value of MWC common stock can be estimated using the two-stage FCFE approach as follows:

$$\text{FCFE}_{2007} = \text{CFO} - \text{FCInv} + \text{net borrowing} = 33,960 - 12,000 + 3,200 = \$25,160$$

$$\text{shares outstanding} = \text{dividends paid} / \text{dividends per share} = \frac{\$23,920}{\$2.30} = 10,400$$

$$\text{FCFE}_{2007} \text{ per share} = \frac{\text{FCFE}_{2007}}{10,400} = \frac{\$25,160}{10,400} = \$2.42$$

$$g = 15\%$$

$$\text{FCFE}_{2007} = \$2.42$$

$$\text{FCFE}_{2008} = \$2.42 \times 1.15 = \$2.78$$

$$\text{FCFE}_{2009} = \$2.78 \times 1.15 = \$3.20$$

$$\text{terminal value} = \frac{\$3.20 \times 1.08}{(0.13 - 0.08)} = \$69.12$$

$$\text{equity value} = \frac{\$2.78}{1.13} + \frac{\$3.20 + \$69.12}{1.13^2} = \$59.10$$

15. **B** The following table shows FCFE for years 0 through 6 (in £).

	<i>Year 0</i>	<i>Year 1</i>	<i>Year 2</i>	<i>Year 3</i>	<i>Year 4</i>	<i>Year 5</i>	<i>Year 6</i>
EPS	1.50	1.73	1.98	2.28	2.62	3.02	3.17
FCInv	0.80	0.92	1.06	1.22	1.40	1.61	–
Depreciation	0.30	0.35	0.40	0.46	0.52	0.60	–
WCInv	0.20	0.23	0.26	0.30	0.35	0.40	0.42
FCFE	1.01	1.17	1.34	1.54	1.76	2.03	2.88

Example of FCFE calculation (year 1):

$$\text{FCFE}_1 = 1.73 - [(1 - 0.3)(0.92 - 0.35)] - [(1 - 0.3)(0.23)] = \text{£}1.17$$

Calculate terminal value in year five using FCFE estimate for year 6, discounted at required return of 10% in the stable growth period.

$$\text{terminal value}_5 = \frac{\text{£}2.88}{0.10 - 0.05} = \text{£}57.60$$

Use the short-term discount rate of 17% to discount the cash flows back to the present:

$$\text{equity value per share} = \frac{1.17}{1.17^1} + \frac{1.34}{1.17^2} + \frac{1.54}{1.17^3} + \frac{1.76}{1.17^4} + \frac{2.03 + 57.60}{1.17^5} = \text{£}31.08$$

Using the calculator, enter the following: $\text{CF}_0 = 0.00$; $\text{C01} = 1.17$; $\text{C02} = 1.34$; $\text{C03} = 1.54$; $\text{C04} = 1.76$; $\text{C05} = 2.03 + 57.60 = 59.63$; $\text{I} = 17$; Compute \rightarrow NPV = 31.08

ANSWERS – CHALLENGE PROBLEMS

16. **A** WACC is less than required return on equity. Incorrectly using the WACC (which is too low) in the FCFE model will overestimate equity value. Incorrectly using required return on equity (which is too high) in the FCFF model will underestimate firm value and equity value.

For Questions 17 through 19, items #1, 2, 4, 5, 6, and 7 were applied correctly. Only item #3 related to the reversal of restructuring charges was applied incorrectly: income from restructuring charge reversals is a noncash gain that should be subtracted from net income to calculate FCFE. Depreciation and software amortization should be added back to net income, after-tax interest should be added back, and the increase in deferred taxes should be added back (because it is not expected to reverse in the foreseeable future). Net working capital and fixed capital investments should be subtracted from net income to arrive at FCFF. The correct calculation of FCFF is:

$$\text{FCFF}_{2007} = \$173 + \$23 - \$6 + \$17 + [\$19(1 - 0.35)] - \$86 - \$47 = \$86.35 \text{ million}$$

17. **A**
18. **B**
19. **A**
20. **A** The increased net borrowing for 2008 will cause the forecasted free cash flow to EQUITY (FCFE) to increase in 2008. However, in future years, the higher interest expense associated with the debt issue will cause the FCFE forecast to decrease.
21. **C** Free cash flow to the FIRM (FCFF) represents cash flow available to all investors before any financing cash flows, including interest payments. Changes in leverage are uses of cash (i.e., financing decisions) that do not affect FCFF.

22. **B** Recognize that the firm generated \$10 in cash and a noncash \$8 gain on the sale of the equipment. Then calculate FCFE as NI plus depreciation minus the noncash gain minus FCInv minus WCInv + net borrowing:

$$\text{FCFE} = \$50 + \$27 - \$8 - (\$65 - \$10) - \$4 + \$0 = \$10$$

23. **C** Dividend discount models like the Gordon growth model and the dividend discount H-model are not appropriate in this case for two reasons: (1) dividends are not related to the firm's earnings stream, and (2) this is a takeover situation in which a free cash flow model is more appropriate.

The FCFF model is preferred to the FCFE model because (1) FCFE is negative and volatile and (2) leverage is relatively high.

24. **C** The firm must have interest expense on its income statement because of the debt on its balance sheet. By ignoring the after-tax interest cash flow, the analyst has understated FCFE, which is actually equal to CFO plus after-tax interest cash flow less fixed capital investment. He has, however, calculated FCFE correctly because FCFE is equal to CFO less fixed capital investment (his incorrect FCFF calculation) plus net borrowing.
25. **A** Although the calculation is a bit unusual (we usually calculate firm value as the present value of FCFF discounted at the weighted average cost of capital), the analyst has correctly calculated firm value. The first term is equal to the market value of equity on 12/31/2007; firm value is equal to the market value of equity plus the market value of debt.