Chapter 8

In many of the solutions, where there is a change in the cost of capital and you are called upon to compute the change in firm value, there is insufficient information to estimate future growth in savings. You have two choices: (1) assume a reasonable perpetual growth rate or (2) a growth rate of zero. While the latter will yield more conservative estimates of value change, I have used it in all of the solutions.

8-1

(a) Book Value Debt/Equity Ratio = 2,500/2,500 = 100%
Market Value of Equity = 50 * 80 = 4,000
Market Value of Debt = .80 * 2500 = 2,000
Debt/Equity Ratio in market value terms = 2,000/4,000 = 50.00%

(b) Book Value Debt/(Debt + Equity) = 2,500/(2,500 + 2,500) = 50%
Market Value Debt/(Debt + Equity) = 2,000/(2,000+4,000) = 33.33%

(c) After-tax Cost of Debt = 12% (1-0.4) = 7.20%

(d) Cost of Equity = 8% + 1.2 (5.5%) = 14.60%

(e) Cost of Capital = 14.60% (4,000/6,000) + 7.20% (2,000/6,000) = 12.13%

8-2

(a) To assess this project from the equity investors' standpoint, we estimate cash flows to equity and the cost of equity.
Initial Equity Investment in Project = 0.6667 (100 million) = $66.67 million
Cash Flows to Equity = Net Income + Depreciation = $9.60 million + $5 million
= $14.60 million
NPV of CF to Equity = 14.60/.1460 - 66.67 = $33.33 million

(b) From the firm's standpoint, the cash flows to the firm have to be estimated.
Initial Investment in Project = $ 100 million
Cash Flows to Firm = EBIT (1 - tax rate) + Depreciation
= $20 million (1-0.4) + $5 million = $17 million
NPV of CF to Firm = $17/.1213 million - $100 million = $40.15 million

(c) The cost of equity should be used as the discount rate if the cash flows being discounted are cash flows to equity.

(d) The cost of capital should be used as the discount rate if the cash flows being discounted are cash flows to the firm.

(e) Even if this project is financed entirely with debt, it should be analyzed using the same costs of equity and capital as the analysis above.

8-3
(a), (b) and (c)
Unlevered Beta = Levered Beta/(1+(1-t)(D/E)) = 1.2/(1+0.6*0.5) = 0.92

	D/E Ratio	Beta	Cost of Equity	Cost of Debt	WACC
Option 1	20.00%	1.03	13.69%	6.60%	12.51%
Option 2	100.00%	1.48	16.12%	7.80%	11.96%
Option 3	500.00%	3.69	28.31%	10.80%	13.72%

(d)

	Δ Firm Value	New Firm Value	Debt	Equity	Stock Price
Option 1	($180)	$5,820	$1,000	$4,820	$76.40
Option 2	$86	$6,086	$3,000	$3,086	$81.72
Option 3	($693)	$5,307	$5,000	$307	$66.14

To compute the change in firm value, this is what we do for option 1:
(.1251-.1213) (6000)/.1251 = -180 (with rounding)
The change in value goes to equity investors:
New value of equity = (4000 + 1000 – 180) = 4820
New value per share = 80 + (-180)/50 = $76.40
We are assuming no growth in the savings, If we did assume growth, the change in value would be greater.)
We repeat the process for options 2 and 3

(e) From a cost of capital standpoint, option 2 is the best one.

(f) If Plastico's income is more volatile, the firm should be more cautious in adding debt.

(g) If the new debt or equity is used to take projects, the analysis would change for three reasons:

(1) the projects may have a different risk profile than the firm's risk profile.
(2) the NPV of the projects has to be added to the value change calculated.
(3) the firm value itself will increase as the new debt and equity is issued.

(h) I would factor in the firm's need for flexibility into the analysis - the greater the need for flexibility the less likely it is that I would add on debt. Further, I would look at how responsive managers are to stockholders; if they are not, I would be more likely to add debt.

(i) The higher rating in option 1 lowers the cost of debt, but it is accomplished by replacing debt with more expensive equity.

8-4

(a) Intuitively, I would expect Plastico to have a higher debt ratio than its competitors because:
(1) its earnings are less volatile than those of its competitors
(2) it has higher cash flows as a percent of firm value than its competitors.
(3) it has a higher tax rate than its competitors
(4) it has a lower need for flexibility; it has lower R& D expenses.

(b) Plugging in the values into the regression,
Predicted Debt/Equity Ratio = .10 -.5 (.2) + 2.0 (.25) + .4 (.4) + 2.5 (.02) = 71.00%

8-5
(a & b) The current D/E ratio = 200/500 = 0.4, and a debt to capital ratio of 0.2857. The cost of capital = (1-0.2857)(8+1.5(5.5)) + (0.2857)(1-0.46)(11) = 13.30%.
The unlevered beta becomes 1.5/(1+(1-0.46)(0.4)) = 1.234.
With the new borrowing, the beta becomes 1.234(1+(1-0.46)(0.6)) = 1.634, and the D/E ratio becomes 0.6; the leverage ratio = 0.375. The new cost of capital becomes (0.625)(8+1.634(5.5)) + (0.375)(1-0.46)(12.5) = 13.15%. Since the cost of capital drops, you should go ahead with the borrowing, assuming that the new funds are invested in similar projects as the existing firm.

(c). At this capital structure, the firm would change in value by
(200+500)(0.0015/0.1315) = $7.984 million
Hence the price per share increases to $50 + $7.984 million/10 million = $50.8.
(I am assuming no growth. If we were able to estimate future growth, the value change would be greater)

(d). If we now assume that these funds can be invested in a new project with before-tax income of $20m. a year (but with similar risk), the after-tax flows are 10.8m per year. The NPV of this investment would be 10.8/.1315 - 100 = -17.17m. Hence the project is not desirable. (This works only if the project is similar in risk to the firm's existing projects)

(e) If the flows in (5) are certain, then we discount them at the riskfree rate of 8%. Hence the NPV of the project = 10.8/.08 - 100 = $35.0. Hence the project would be acceptable.

8-6
(a) First, we calculate the cost of capital at different levels of debt

Add'l Debt	Beta	Cost of Equity	Rating	Cost of Debt	Cost of Capital	
Current	1.15	12.33%	BBB	6.00%	11.06%	
500,000	1.30	13.15%	BB	6.30%	10.87%	Optimal
1,000,000	1.45	13.98%	B	6.90%	10.94%	
1,500,000	1.60	14.80%	B-	8.10%	11.45%	
2,000,000	1.75	15.63%	C	9.00%	11.94%	

Unlevered Beta = 1.15/(1+0.6*(500/2000)) = 1.00
This assumes that the new debt will not be used to buy back stock.

(b) Effect of moving to the optimal on the Stock Price (with 2% growth assumed)
Increase in Firm Value = 2500000 (.1106 - .1087)/(.1087 -.02) = $53,551
Increase in Stock Price = $ 53,551/100000 = $0.54
If there is growth in the savings, the change in value would be greater.

(c) See above.

(d)After-tax Cash Flow to Firm from Project = EBIT (1-t) + Depreciation
= $ 600,000 (1-0.4) + $ 100,000 = $460,000
Note that since we are using the cost of capital as the discount rate, we have to look at pre-debt cash flows. Hence, the use of EBIT rather than net income!
NPV of Project = 460000/.1087 - $ 3,000,000 = $1,231,831

8-7
(a) Optimal Debt Ratio

Debt Ratio	Beta	Cost of Equity	AT Cost of Debt	Cost of Capital	
0%	1.50	17.25%	6.00%	17.25%	
10%	1.60	17.80%	6.30%	16.65%	
20%	1.73	18.49%	6.60%	16.11%	
30%	1.89	19.37%	7.20%	15.72%	
40%	2.10	20.55%	7.80%	15.45%	
50%	2.40	22.20%	8.40%	15.30%	Optimal
60%	2.85	24.68%	9.60%	15.63%	
70%	3.60	28.80%	10.80%	16.20%	
80%	5.10	37.05%	12.00%	17.01%	
90%	9.60	61.80%	15.00%	19.68%	

The optimal debt ratio is 50%.

(b) Change in Firm Value = 20,000,000 (.1725-.1530)/(.1530-.05) = $3,786,407
Increase in Stock Price from going to optimal debt ratio = $3.79
New Stock Price = $ 23.79

8-8
(a) Current Cost of Equity = 8% + 1.06 (5.5%) = 13.83%
Current Cost of Debt = 10% (1-0.4) = 6.00%
Current Cost of Capital = 13.83% (250/275) + 6.00% (25/275) = 13.12%

(b) If the firm borrows $100 million and buys back $100 million of stock
New Debt/Equity Ratio = 125/150 = 0.833333333
Unlevered Beta = 1.06/(1+0.6*.10) = 1.00

New Beta = 1 (1 + 0.6*0.8333) = 1.50
Cost of Equity = 8% + 1.50 (5.5%) = 16.25%
Cost of Capital = 16.25% (150/275) + 13% (1-.4) (125/275) = 12.41%

8-9
(a) Current Cost of Equity = 7% + 1.12 (5.5%) = 13.16%

(b) Current pre-tax Cost of Debt = Interest Expense/Book Debt = 10/100 = 10%
After-tax Cost of Debt = 10% (1-.4) = 6%
[The book interest rate can be used since the bonds are trading at par.]

(c) Current Cost of Capital = 13.16% (500/600) + 6% (100/600) = 11.97%

(d) . With the swap, the value of equity drops to 150. The value of debt rises to 450. The unlevered beta = 1.12/(1 + 0.6(1/5)) = 1; the new levered beta = 1(1+(1-0.2963)(450/150)) = 3.11. (Note that the tax rate used is the effective tax rate of 29.63%). The new cost of equity = .07 + 3.11(0.055) = 24.11%
e. The annual interest payments would be 450(.15) = 67.50. However, the EBIT is only 50. Hence the effective tax rate will have to be adjusted to (50/67.5)(0.4) = 0.2963.
f. The WACC = (150/600)24.11 + (450/600)(1-0.2963)(15) = 13.94%.

8-10
(a) Current Cost of Equity = 6% + 1.25 (5.5%) = 12.88%

(b) Current After-tax Cost of Debt = 11% (1-0.4) = 6.60%

(c) Current Cost of Capital = 12.88% (1800/2700) + 6.60% (900/2700) = 10.79%
[Market Value of Equity = PE * Net Income = 9 * 200 = 1,800;
Market Value of Debt = 0.9* 1,000 = 900]

(d) After the action,
New Equity = 2000
New Debt = 700
Unlevered Beta = 1.25/(1+0.6*(900/1800)) = 0.9615
New Levered Beta = 0.9615 (1+0.6*(700/2000)) = 1.163
New Cost of Equity = 6% + 1.163(5.5%) = 12.40%

(e) New WACC = 12.40% (2000/2700) + 10% (1-.4) (700/2700) = 10.74%

(f) Assuming no growth in savings,
Change in Value of Firm = 2700 (.1079-.1074)/.1074 =12.57 (
New Firm Value = $ 2700 + $12.57 = $2,712.57

8-11
a. Market Value of Equity = 40 million * $ 20 = 800
Cost of Equity = 8% + 1.15 (5.5%) = 14.33%

Cost of Capital = 14.33% (0.8) + 10% (1-.4) (0.2) = 12.66%

b. If the firm borrows $ 200 million and buys back stock, Equity will drop to $ 600 million
New Debt/Equity Ratio = 400/600 = 0.67
Unlevered Beta = 1.15 / (1 + 0.6*0.25) = 1.00
New Beta = 1.00 (1+0.6*0.67) = 1.40
New Cost of Equity = 8% + 1.40 (5.5%) = 15.70%
New Cost of Capital = 15.70% (0.6) + 11% (1-0.4) (0.4) = 12.06%

c. Increase in firm value from moving to optimal = (0.1266-0.1206)(1000)/.1206 = $49.75
Increase in Stock Price = $ 49.75/40 = $1.24

d. The firm currently pays dividends of $1 per share. An increase to $2 per share per year will change equity value to 800(1.1266) - 2(40) = $821.28m., assuming that the required rate of return on equity does not change. This assumes that the market continues to expect a rate of return of 12.66%, although the expected change in leverage may increase it. If the new capital expenditure is financed with debt, the amount of debt will go up to $350m. Hence the debt/equity ratio will equal 350/821.28 = 0.426.

8-12
a. Current Value of Equity = $ 700 million
Current Value of Convertible Debt = $500 million.
To calculate the straight debt portion of this convertible debt, we estimate the market value of a straight bond with a coupon rate of 8% and a maturity of 10 years, using a market interest rate of 10%.
Value of Straight Bond, coupon rate of 8%, maturity of 10 years = $877 million (using annual coupons)
Value of Straight Bond portion of Convertible Debt = $877 * 500,000 = $438.5 million
Value of Equity Portion of Convertible Debt = $500 - $438.5 = $61.5 million
Current Debt/Equity Ratio = 438.5/(700+61.5) = 57.58%

b. Cost of Equity = 6% + 1.2 (5.5%) = 12.60%
Cost of Capital = 12.60% (761.5/12,00) + 10% (1-.4) (438.5/1,200) = 10.19%

c. If $ 250 million is borrowed to buy back stock, pay dividends and take a project
Equity = $ 761.5 - $ 200 + $ 25 = 586.5. (Note the NPV is accrues to equity.)
Debt = 438.5 + 250 = 688.5
New Debt/Equity Ratio = 688.5/586.5 = 117.39%
Unlevered Beta = 1.2/(1+0.6*(.5758)) = 0.89
New Beta = 0.89 (1+0.6*(1.1739)) = 1.52
New Cost of Equity = 6% + 1.52*(5.5%) = 14.36%

d. New Cost of Capital = 14.36% (586.5/1275) + 11% (1-0.4) (688.5/1275) = 10.17%

e. With 0% growth
Change in Firm Value from change in WACC = (.1019-.1017) 1,200/.1017 = $2.36
Increase from taking project with NPV of $ 25 million = $25
Net Effect of Restructuring = 2.36 + 25 = $ 27.36 million.
New Firm Value after the borrowing = 1200 + 50 + 27.36 = $ 1277.36 million
With 2% growth
Change in Firm Value from change in WACC = (.1019-.1017) 1,200/(.1017 -.02)= $2.94
Increase from taking project with NPV of $ 25 million = $25
Net Effect of Restructuring = 2.94 + 25 = $ 27.94 million.
New Firm Value after the borrowing = 1200 + 50 + 27.94 = $ 1277.94 million

8-13
a. Cost of Equity = 6.50% + 1.47 (5.5%) = 14.59%
Cost of Capital = 14.59% (24.27/(24.27+ 2.8)) + 6.8% (1-0.4) (2.8/(24.27+2.8)) = 13.50%

b. If Pfizer moves to a 30% debt ratio,
New debt/equity ratio = 30/70 = 42.86%
Unlevered Beta = 1.47/(1+0.6*(2.8/24.27)) = 1.37
New Beta = 1.37 (1+0.6*0.4286) = 1.72
New Cost of Equity = 6.5% + 1.72 (5.5%) = 15.96%
New Cost of Capital = 15.96% (0.7) + 8.5% (1-.4) (0.3) = 12.70%

c. If the savings grow at 6% a year in perpetuity, the change in firm value can be computed as follows :
Savings each year = (.1350-.1270) (24,270+2800) = $ 216.56 million
PV of Savings with 6% growth = (216.56)/(.127-.06) = $3,232 million
Increase in Stock Price = 3,232/24,270 = 13.32%! Stock Price will increase by 13.32%
I did this problem a little differently from the prior problems to illustrate the alternate approach.

d. The need for R& D increases the need for flexibility; therefore, Pfizer may not go to this higher optimal debt ratio, the cost of capital notwithstanding.

8-14
a. Estimate of Market Value of Debt
Present Value of Interest Expenses ($ 55 million) and book value ($ 664 million) at the cost of debt of 7.5%.
Estimated Market Value of Debt = $700 ! Estimated market value is $ 700 million
Market Value of Equity = 173 * $ 30.75 = $5,320

b. Cost of Equity = 6.50% + 1.17 (5.5%) = 12.94%
Cost of Capital = 12.94% (5320/(5320+700)) + 7.5% (1-.36)(700/(5320+700)) = 11.99%

c. Increase in value per share = $1.25

Total Increase in firm value = 173 * 1.25 = $216
(5320+700) (.1199-x)/x = 216.25
Solving for x,
x = (6020*.1199)/(6020+216.25) = 11.57%
The cost of capital at the optimal is 11.57%.

8-15
a. Unlevered Firm Value = Current Firm Value - Tax Savings + Exp. Bankruptcy Cost @ existing debt = (1760 + 527) - 527*0.36 + 2.3% of 0.30 (2287-527*.36)
X = 2287 - 190 + (.023)(.3)(2287-190) = $2,111

b. At a debt ratio of 50%,
New Levered Firm Value = $ 2,111 + (.36) (.5) (Levered Firm Value) - (.4661) (.30) (2,111)
X = 2,111 + .18 X - (.4661) (.3) (2111)
Solving for X,
X = (2,111 - (.4661)(.3)(2,111))/(0.82) = $2,214.41

8-16
For simplicity, we assume that the debt ratios are computed on the unlevered firm value.
Unlevered Firm Value = Current Firm Value - Tax Savings from Existing Debt + Exp. Bankruptcy Cost
The current levered firm value = 985 + (40)46.25 = 2835m. The debt ratio is about 35%. Hence, we can estimate the probability of default to be about (12.2+32.5)/2 = 22.35%. We can now compute the expected bankruptcy cost as 0.2235(0.25)(2835); the tax savings equal 0.3656(985) = 360.116. The unlevered firm value = 2835 – 0.3656 (985) + 0.2235 (.25) (2835) = $2,634

Debt Ratio	Unlevered Firm Value	Tax Savings on Debt	Expected Cost of Bankruptcy	Levered Firm Value
0%	$2,634	$0	$2	$2,632
10%	$2,634	$96	$2	$2,728
20%	$2,634	$193	$9	$2,817
30%	$2,634	$289	$80	$2,843
40%	$2,634	$385	$214	$2,805
50%	$2,634	$481	$307	$2,809
60%	$2,634	$578	$428	$2,784
70%	$2,634	$674	$527	$2,781
80%	$2,634	$770	$527	$2,878
90%	$2,634	$867	$659	$2,842

8-17
a. The optimal debt ratio is so high because Reebok has a high EBIT relative to firm value.
EBIT/Firm Value = 420/3343 = 12.56%

If one adds back depreciation to this return, it is quite clear that at existing levels, Reebok has substantial cash flows to meet any debt payments, which in turn is pushing up the optimal debt ratio.

b. My primary concern with moving towards this optimal would lie in whether these operating cash flows are sustainable, given the volatility of the product market that Reebok serves.

8-

8-18
a. Current market value of equity = 12.2(210) = 2562. If we capitalize lease payments at the same rate as the debt, we get a present value of 150.0/0.1012 = 1482. This is a high estimate, since the actual life of the lease payments is probably lower. The market value of the debt itself is 3000m. Hence, the debt/equity ratio = (1482+3000)/2562 = 1.75, or a debt ratio of 0.6364.
b. The cost of equity = .0612 + 1.26(0.055) = 0.1305. The WACC = (0.6364)(1-0.35)10.12% + (0.3636)13.05% = 8.93%
c. The current beta = 1.26; the unlevered beta = $\frac{1.26}{1+(1-0.35)1.75} = 0.5895$. Hence the levered beta at a debt ratio of 30% = 0.5895(1+(1-0.35)(0.3/0.7) = 0.753; the cost of equity = .0612 + 0.753(.055) = 0.1026. The WACC = (0.3)(1-0.35)(.0812) + (0.7)(.1026) = 8.77%. The firm value at this optimum = (2562+1482+3000)[1+(.0893-.0877)/0.0877] = 7172,51 million. (which includes the capitalized value of lease payments).
d. Yes, if 1995 operating income was depressed, the estimated bond rating is probably biased downwards. Hence, the true firm value is probably higher.

8-19
a. The market value of equity = 51b; the market value of debt = 1.5b. Hence the D/E ratio = 0.029;
The current beta = 1.35; hence the cost of equity = 0.06 + 1.35(0.055) = 0.13425;
The WACC = (.029/1.029)(1-.365)6.8% + (1/1.029)13.425% = 13.168%

b. If all debt is refinanced at the new rate, the interest expenses can be estimated as 0.16(0.7)(51+1.5) = 5.88b. Since EBIT is only 3.4b, it would not be possible to get the entire amount of the tax advantage to debt, because there is not enough income to deduct these interest payments. Hence we would use a marginal tax rate of (3.4/5.88)(36.5%) = 21.1%
c. The unlevered beta = $\frac{1.35}{1+(1-0.365)0.029} = 1.326$. Using the conventional method, the levered beta at 70% debt = 1.326(1+(1-0.365)(.7/0.3)) = 3.29.
If the debt had a beta of 0.60, then we have a levered beta estimate of
Levered Beta = Unlevered Beta (1+ (1-tax rate) (D/E)) – Beta of debt (1-t) (D/E)
= 1.326 (1+(1-.365) (.7/3)) – 0.6 (1-.365) (.7/.3) = 2.40
(If you use the effective tax rate of 21.1%, both estimates would be higher.

The second estimate is better, because it takes the actual riskiness of the debt into account.

d. The cost of equity capital = 0.06 + 2.40(0.055) = 19.20%
The after tax cost of debt = (1-.211)(16) = 12.624%
The WACC = (0.7)(12.624) + (0.3)(19.20) = 14.60%

e. Firm value will drop to (52.5)[1-(.1460-.13168)/.146] = 47.35 billion

f. It is not desirable to increase debt too much, if you are a growth firm and have volatile income.

8-20
a. The expected bankruptcy cost = .0141(.30)(12.14+20.55) = 0.1383b. The tax advantage to debt = 12.14(0.36) = 4.37b. Hence the unlevered firm value = 12.14 + 20.55 + 0.1383 - 4.37 = 28.46b.
b. To estimate the firm value at a 50% debt ratio, we first compute the dollar debt at a 50% debt ratio using the current market values of debt and equity as the base.
Dollar debt at 50% debt ratio = 0.5 (12.14+20.55) = $16.345 billion
Tax benefits at 50% debt ratio = 16.345*.36 = $5.88 billion
Expected bankruptcy cost = .023*(28.46+5.88)*0.30 = $0.24Value of the firm = 28.46+5.88 – 0.24 = $34.1 billion

c. Since the earnings will be more volatile, you'd expect the leverage ratio to be lower.

8-21
a. Estimated Market Value of Debt:
Calculate present value of $ 80,000 for 5 years and $ 1 million at end of fifth year at 8.25%.
PV of Debt = $990,084
Debt/Equity Ratio = 990,084/6,000,000 = 16.50%
Unlevered Beta for comparable firms = 1.05/(1+0.6*.25) = 0.91
Beta based upon D/E ratio of 16.50% = 0.91(1+0.6*.165) = 1.00
Cost of Equity = 7% + 5.5% = 12.5%
Cost of Capital = 12.5% (6000/6990) + 8.25% (1-.4)(990/6990) = 11.43%

b. New D/E Ratio = 1,990,084/6000000 = 0.331666667! Assumes debt is used to take projects
New Beta = 0.91 (1+0.6*.33) = 1.09
New Cost of Equity = 7% + 1.09*(5.5%) = 13.00%
New Cost of Capital = 13% (6000/7990) + 9% (1-.4)(1990/7990) = 11.11%
Change in Firm Value = (0.1143-0.1111)(6990)/0.1111 = $201
New Firm Value = 6990 + 1000 + 201 = $8,191

c. Estimated Debt Ratio = 0.15+ 1.05 (500/6990) - 0.10 (1.00) = 12.51%

d. These analyses are based upon the assumption that the only risk is market risk. For a private firm, all risk matters, since the owners of these firms may not be well diversified.

8-22
It is true that the return on equity can be increased by borrowing money, since the after-tax cost of debt is likely to be lower than the return on assets (which is currently equal to the return on equity) of 12.75%. Borrowing money will also increase the cost of equity, however. The net effect will determine whether leverage will increase firm value. If the business risk of the firm is high (a high unlevered beta), then the increase in the cost of equity may exceed the increase in return on equity.