Chapter 4

(In many of these solutions, you need an equity risk premium. I have used 5.5% as the premium over long term rates and 8.76% as the premium for stocks over short term rates, where none is specified but you can use the current premiums from the book instead. The answer will be different but it is not wrong)

4-1

a. We use the CAPM:

The Expected Return on the stock = 0.058 + 0.95(0.0876) = 0.1 = 14.12%.

Since the investor is a short-term investor, we use the T-bill rate, and the arithmetic mean. Since the focus is short-term, we don't need to take compounding into account.

(I used the arithmetic average historical; premium for stocks over T.Bills at the time of the analysis. This number will be different in the updated tables)

b. For a long-term investor, we would use 5.5% as our estimate of the market premium, the expected return would be 0.064 + 0.95(0.055) = 0.1163 or 11.63%.

c. The cost of equity for the company is more appropriately the long-term required rate of return, since most projects for the company would be long-term.

4-2

a. The levered beta of the company is given by formula: .

Solving, we get $\beta_{unlevered}$ = 0.95/(1+(1-0.36)(1.7/1.5)) = 0.55

b. The proportion of the risk of the firm's equity that can be attributed to business risk is 0.55/0.95 = 58%, while the remainder is due to financial leverage risk.

4-3

a.The cost of equity equals 0.064 + 1.70(0.055) = 15.75%

b. If long term bond rates rise to 7.5%, the cost of equity will rise by a like amount to 16.85%.

c. Since Biogen had no debt, all of its risk is due to business risk.

4-4

a. The expected return on the stock, assuming that the marginal investor is a Malaysian with primarily domestic holdings is 0.115 + 1.15(0.12) = 25.30%, using the risk premium based on country risk provided by ratings agencies.

(I am assuming that the Malaysian government is default free and using the Malaysian government borrowing rate as the riskfree rate)

b. For an international investor, who has the ability to diversify globally, some of the risk might be diversifiable, and hence the true beta might be lower. To take care of this possible overstatement, it would be appropriate to compute a beta relative to a more global index, such as the Morgan Stanley Capital Index.

4-5

a. Using the CAPM, we compute the expected return as 0.03 + 1.2(0.0876) = 13.51%.

(Again, I am using the arithmetic average historical risk premium for stocks over T.Bills as my risk premium, but that number is different now. We use a T-bill rate, because the focus is on the short-term expected return (the next year). For the same reason, we use the market premium over bills.

b. The cum-dividend price, one year from now, would be $50 (1.1351) = 56.75. The ex-dividend price, assuming that the stock price goes down by the amount of the dividend is 56.75 – 2.50 = $54.25.

c. Over last year, the market return was -5% (-8% price appreciation + 3% dividend). Plugging this value back into an ex-post CAPM

Expected return = 5% + 1.2 (-5% -5%) = -7%

I would have expected a stock with a beta of 1.2 to have -7% as returns in the last year

d. The actual returns were (-4+2)/54 = -3.70%

Stock did badly but not as badly as expected.

e. The unlevered beta based on the current capital structure would be 1.2/(1+(1-0.4)(50/100)) = 0.92. There is no debt in the new capital structure. Hence the new beta would be 0.92.

4-6

It's current levered beta is 1.2. Using the formula for leveraging a beta
, we find the unlevered beta = 1.2/(1+(1-0.4)(50/100)) = 0.92. If the D/E ratio is increased to 8, we have the new levered beta equal to 0.92(1+(1-0.4)8) = 5.35.

4-7

a. The combined beta for Novell after the acquisition equals

$$\left(\frac{2}{1+2}\right)1.5 + \left(\frac{1}{1+2}\right)1.3 = 1.43$$

b. If Novell borrowed the $1billion., we would lever this beta to get 1.43(1+(1-0.4)(1/2)) = 1.86

4-8

In this problem, I have used a 36% tax rate all the way through the problem.

a. The easy way out is to take the weighted average of the betas (assuming that they are equity betas), using the estimated value of equity in each business:

Equity beta for HP = 1.1 (2/8) + 1.50 (2/8) + 2.00 (1/8) + 1 (3/8) = 1.275

The more difficult way is to assume that the betas are unlevered betas and to compute the unlevered beta for the business firm. To do this, you need to use the debt value that is given in the problem to estimate the firm value

Firm Value = Value of equity + Value of debt = $ 8 billion + $ 1 billion = $ 9 billion

We will assume that the debt is allocated to the divisions in proportion to the market value of equity of the divisions. The unlevered for Hewlett Packard as a company can be computed as

Unlev beta for HP= 1.10 (2.25/9) + 1.50 (2.25/9) + 2.00 (1.125/9) + 1.00 (3.375/9) = 1.275

(I am assuming that the betas for the divisions are unlevered betas)

Using the debt to equity ratio of 1/8, we can estimate HP's levered beta to be

Levered Beta = 1.275 (1 + (1-.36) (1/8)) = 1.377

Since the divisional structure and leverage of Hewlett Packard has probably changed over the years, the beta obtained by regressing past returns of HP against a market index will not be the same as 1.377.

(Note: Since the problem did not provide a tax rate, I am assuming a 36% tax rate)

b. If the T. bond rate is 7.5%, the cost of equity for the divisions can be computed as follows (I am using the betas I estimated with the second approach. If you assume the betas are equity betas, you can use them directly)

Business Group	Beta and Cost of Equity
Mainframes	Levered Beta = 1.1 (1+(1-.36) (1/8)) = 1.19 0.075+1.19(0.055) = 14.03%
Personal Groups	Levered Beta = 1.5(1+(1-.36) (1/8)) = 1.62

	0.075+1.5(0.055) = 16.41%
Software	Levered Beta = 2.0(1+(1-.36) (1/8)) = 2.16
	0.075+2.16(0.055) = 19.38%
Printers	Levered Beta = 1.0 (1+(1-.36) (1/8)) = 1.08
	0.075+1.0(0.055) = 13.44%

To value the printer division, we would use a cost of equity of 13.44%.
c. We will assume that the mainframe division is sold for its estimated value of $2.25 billion. The value of the remaining divisions is now $ 6.75 billion.
After the divestiture, we'd have the unlevered beta equal to

$\left(\frac{2.25}{6.75}\right)1.5 + \left(\frac{1.125}{6.75}\right)2.0 + \left(\frac{3.375}{6.75}\right)1.0 = 1.333$. If the proceeds are used to buy back

stock, the market value of equity will drop to $5.75 billion. Using the information that HP had debt outstanding equal to $1.0 billion, the levered beta equals
1.333(1+(1-0.36)(1/5.75))=1.48

4-9
a. The degree of operating leverage is computed as %Δ Operating Income/% Δ Revenue.

Firm	Degree of Operating Leverage	Beta
PharmaCorp	25/27 = 0.92	1.0
SynerCorp	32/25 = 1.28	1.15
BioMed	36/23 = 1.56	1.3
Safemed	40/21 = 1.90	1.4

b. There is a clear relationship between the degree of operating leverage and the beta. The greater the degree of operating leverage, the more responsive income (and presumably stock returns) will be to changes in revenue which are correlated with changes in market movements.

4-10
It is possible that the service is adjusting the beta estimate towards the mean of 1.0. It is also possible that you used different end points for the week. For instance, using Monday to Monday returns will give you different betas from Friday to Friday returns.

4-11
The volatility in commodity prices will be reflected in the beta only to the extent that commodity price movements are correlated with market movements. Commodity prices probably do not move closely with the rest of the market.

4-12
a. Here are the results of the regression of AD Corp. returns on the NYSE returns:

	Coefficients	Standard Error
Intercept	-0.14706	6.59342
X Variable	0.735294	0.670845

R^2 = 0.285948
The beta value of 0.735. The alpha is computed as −0.147.
b. Using the annualized 6-month T. bill rate as the riskfree rate, we get an expected return of 0.06 + 0.735(0.0876) = 12.44%.
c. Comparing the alpha of -0.147 to $(1-\beta)R_f$ = (1-0.735)0.06 = .0159, we see that AD did worse than expected relative to the market.

d. If you were undiversified, you would be much more interested in the total standard deviation in the stock, since you cannot eliminate the firm specific risk. 72% (1-0.28) of this risk is diversifiable.

e. $0.735 = (0.2)(2 \times 0.735) + (0.8)\beta_{rem}$, where β_{rem} is the beta of the remaining firm. Solving, we find $\beta_{rem} = 0.55$.

4-13

a. The required rate of return is $0.06 + 0.46(0.055) = 8.53\%$

b. $(1-R^2) = 95\%$ of this firm's risk is diversifiable.

c. The current unlevered beta = $0.46/(1+(1-0.36)(20/40)) = 0.35$. The total firm is worth 60 m. The average beta of the divisions that will be kept must equal

. Solving, $\beta_{rem} = 0.425$. The new unlevered beta equals

$$\left(\frac{40}{40+50}\right)0.425 + \left(\frac{50}{40+50}\right)0.80 = 0.63$$

The new levered beta = $0.63(1+(1-0.36)(50/40))=1.134$

4-14

a. (β^2)(Var. of mkt)/Var. of stock = R^2; hence the $\beta = 1.41$

b. Intercept $- (1-\beta)R_f = 0.0039$; the monthly riskfree rate is computed as $(1.0484)^{1/12} - 1 = 0.0039465$ or 0.39465%.

Intercept $= 0.0039 - (1-1.41)(.0039465) = .23\%$

c. The two firms need not have the same beta, if the extents to which their relative stock price movements covary with the market are different. If AMR has a higher beta, then it will also have correspondingly a lower amount of diversifiable firm-specific risk.

4-15

a. The expected return over the next year = $0.048 + (1.65)(0.0876) = 19.25\%$. (Again, I am using the arithmetic average premium for stocks over T.Bills. This number was 8.76% at the time this problem was solved but no longer..>)

b. In this case, we would use a geometric average estimate of the risk premium and a long-term T. bond rate to get $0.064 + (1.65)(0.055) = 15.48\%$

c. The extent of the monthly overperformance = $(1.511)^{1/12} - 1 = 3.5\%$. Hence, Intercept $- (1-\beta)R_f = 0.035$, using a value of 0.0328 for the intercept, $R_f = 4.14\%$, after annualizing.

d. It's current unlevered beta = $1.65/(1+(1-0.4)(.03)) = 1.62$. Taking into account the new leverage ratio of $[2000+.03(265)(30)]/(265)(30) = 0.2816$, the new levered beta becomes $1.62(1+(1-0.4)(.2816)) = 1.89$.

4-16

a. The riskfree rate on a monthly basis equals 0.4868%. Hence the extent of overperformance equals $-0.0005 - (1-1.2)(0.00487) = 0.05\%$ approximately.

b. After the sale of the division and the share repurchase, MAD had $40m. in debt and $120 in equity. Hence, before these events, it would have had $160m. in equity and $20m. in debt. Assuming, for convenience, that the beta before the restructuring is still 1.2, we can compute its unlevered beta as $1.2/(1+(1-0.4)(20/160)) = 1.116$. The unlevered beta of the leftover firm other than the magazine division, β_{rem}, must satisfy $\left(\frac{20}{180}\right)0.6 + \left(\frac{160}{180}\right)b_{rem} = 1.116$; hence $\beta_{rem} = 1.1805$.

The new levered beta equals $1.1805(1+(1-0.4)(40/120)) = 1.4166$.

4-17

a. The unlevered beta equals $1.61/(1+(1-0.4)(10/10))=1.01$

b. If the debt ratio goes from 1 to .9 and then to 0.8, the levered beta would become $1.01(1+(1-0.4)(0.9)) = 1.5554$ and 1.4948 respectively.

4-18

a. Unlevered Beta of the firm including cash can be computed by:

$1.05/(1+(1-.36)(13000/355*50)) = 0.715$

This beta is depressed by the fact that the firm has a substantial amount of cash on its balance sheet.

Unlevered beta of non-cash assets = Unlevered Beta / (1- Cash/ Firm Value)

$= 0.715/(1- 8000/(13000 + 355*50)) = 0.966$

b. If some of the cash is paid out, the unlevered beta of the firm will increase:

Value of Firm after cash dividend = 13000 + 355*50 – 5000 = 25750

New unlevered beta = 0.966 (22750/25750) + 0 (3000/25750) = 0.85

c. The debt ratio would be rise to 13000/(355x50-5000). The levered beta is $0.85(1+(1-0.36)(13000/(355x50-5000))) = 1.41$

4-19

Firm	Beta	Debt	Equity	d/e	unlevered beta
Black and Decker	1.4	2500	3000	0.833333	0.933333
Fedders	1.2	5	200	0.025	1.182266
Maytag	1.2	540	2250	0.24	1.048951
National Presto	0.7	8	300	0.026667	0.688976
Whirlpool	1.5	2900	4000	0.725	1.045296

The average unlevered beta = 0.9798. Using the private firm's leverage ratio of 25%, we can compute a levered beta of $0.9798(1+(1-0.4)(0.25))= 1.1268$. (If, instead of estimating the unlevered beta for each of the comparable firms, you had used the average beta and debt to equity ratio for the sector to compute an unlevered beta, you would have estimated an unlevered beta of 0.9820)

b. Given the range of unlevered betas for these publicly traded firms, it might be that there are differences amongst these firms and between these firms and the private firm that are not averaged out in the numbers. For example, the degree of operating leverage might be different. In addition, the private firm owner may not be diversified, in which case it may be inappropriate to use betas in the first place.

4-20

a. The unlevered beta for the comparable firms would be $0.95/(1+(1-0.36)(0.35))= 0.7761$. The levered beta for the division would be $0.7761(1+(1-0.36)(0.25))=0.90$

b. If RJR Nabisco had a much higher fixed cost structure than comparable firms, then the division would probably have a higher unlevered beta as well.

4-21

The unlevered beta for the current business in 1995 would be $0.9/(1+(1-0.36)(1.0))= 0.5488$. The unlevered beta of comparable media business firms is

1.2/(1+(1-0.36)(0.50)) = 0.9091. Hence the unlevered beta of the new business (including the media division) in 1999 can be estimated as 0.3(0.9091) + 0.7(0.5488) = 0.6569. Leveraging it up, we get the levered beta estimate of 1.077. Southwestern's debt-to-capital ratio = ½; if it decided to finance its media operations with a debt equity ratio of 50%, then the media division's debt-to-capital ratio would be 1/3. Hence, Southwestern's over-all debt-to-capital ratio would be 0.3(1/3) + 0.7(1/2) = 0.45; hence it's debt to equity ratio would be 9/11. Hence the levered beta would be 0.6569(1+(1-0.36)(9/11)) = 1.00

4-22
a., b. Not necessarily. A growing firm would expect its beta to decline, as its customer base and product offerings become more diversified.
The rate of decline would decrease eventually, especially as the beta approaches one and the firm becomes very large.

4-23
a. The levered beta using comparable firm data would be 1.15(1+(1-0.4)(0.2)) = 1.288.
b. Using the regression, a range estimate with a likelihood of 95% that the true beta lies within it, is −0.25 to 1.75. (Plus or minus two standard errors on the beta)
c. The beta estimated from comparable firms is within the regression beta range. It is not that one beta is right and the other is wrong but that the regression beta is far less precise.