Chapter 4: Risk Measurement and Hurdle Rates in Practice

1. e. If you are doing the analysis in nominal pesos, you would use this rate.

2. A. b. Ceteris paribus, I would expect the publicly traded company to win since its cost of capital would only reflect non-diversifiable risk.
B. d.
C. e.
D. c (though a case can be made for a as well).
E. c.
F. c.
G. d (REITs have tax advantages of real estate corporations but not necessarily over real estate investors).

3. a. A 67% confidence interval represents approximately a 1 standard deviation range. Hence the required range is 1.20 _ 0.38, i.e. between 0.82 and 1.58
b. The expected return = 0.06 + 1.2(0.055) = 12.6%
c. The annual expected return = $(75/45)^{(1/5)}$ = 10.76% < 12.6%. Hence, this stock is not a good investment. However, this answer assumes that our investor is a long-term investor, else the use of a 12.6% required rate of return would not be entirely appropriate.
d. Yes, since the 14.5% return is superior to the hurdle rate of 12.6%
e. We compare the actual intercept of .22% with the expected value of $R_f(1-\beta)$ = -0.96%. Hence Nike's performance is better than expected.
f. (1-0.15) or 85% of the risk will not be rewarded.

4. a. The average unlevered betas for the sectors can be computed as $\beta_{levered}/[1+(1-t)(D/E)]$, or 1 and 0.8 respectively. Hence the unlevered beta for the company equals (.70)(1) + (0.3)(0.8) = 0.94. The levered beta = $\beta_{unlevered}[1+(1-t)(D/E)]$ = 0.94 (1+ (1-0.3)(1.50)) = 1.93
b. The cost of equity for this company in Korean won = 0.12 + 1.93(.055+.02) = 26.48%. Given the dominance of this stock in the local index, I would not trust the beta estimate of 1.10.
c. In US dollars, the cost of equity = 0.06 + 1.93 (.075) = 20.48%. Hence the market risk premium that is relevant is still the market risk premium for Korea. The only adjustment necessary is for the exchange rate differential. This can be proxied by the difference in expected inflation rates, which is presumably reflected in the government bond rates for the two countries.

5. The Jensen's alpha is the difference between the actual intercept and the expected intercept of $R_f(1-\beta)$, i.e. -0.2 - R_f(1-1.5) = .10%; solving, we find that R_f = 0.6%.

6. Using the formulas in Problem 4, we can compute the following quantities:

	Levered beta	D/E ratio	Unlevered beta

Food	0.92	0.25	0.8
Tobacco	1.17	0.5	0.9
GenCorp	1.376	1.0	0.86

Hence the current cost of equity = 6% + 1.376(5.5%) = 13.57%

7. a. Formerly, GenCorp had debt equal to (10+15)/2 = $12.5b. and equity = $12.5b. The new values for debt and equity are 12.5 - 10 = 2.5 and 12.5. Hence the debt-equity ratio = 0.2, the relevant unlevered beta is the unlevered beta for the tobacco industry, which is 0.9, and the levered beta becomes 1.008
b. The unlevered beta is now the weighted average of 0.9 and zero, which is the beta for the government securities, or (10/25)0 + (15/25)0.9 = 0.54; the market values of debt and equity are as in Q. 6 and the D/E ratio = 1. The levered beta becomes 0.864.
c. The relevant unlevered beta is again 0.9, but the values for debt and equity are 12.5 and 2.5 respectively, or a D/E ratio of 5. The levered beta = 3.60.

8. The estimated beta from the regression is 0.90; the D/E ratio was 0.1111 (i.e. 25/225), hence the unlevered beta can be computed as 0.844. Now the debt-equity ratio changes to 1 (i.e. (25+100)/(225-100); hence the new levered beta equals 1.35.

9. The D/E ratio for SunCoast is 100/(10x50) = 1/5 = 0.2; the levered beta was 1.2. Hence the unlevered beta was 1.07.
The D/E ratio for MF Capital was 100/(5x10) = 2; the levered beta was 0.9. Hence the unlevered beta 0.41.
The terms of the stock swap are essentially based on the current market prices; hence the new debt equity ratio = (100+100)/(500+50) = 200/550 = 0.3636; the new unlevered beta = (600/(600+150))(1.07) + (150/(600+150))(0.41) = 0.94 and the new levered beta = 1.14.

10. Using the formula, Index level = (dividend yield x Index level)/(expected return on the market less growth rate), we get 1050 = (1050 x .03)/(expected return on market - 0.06), or expected return on market = 6% = 3% = 9%. Hence, the implied risk premium on equities = 9% - 6.5% = 2.5%.

11. a. We use the CAPM:
The Expected Return on the stock = 0.058 + 0.95(0.0876) = 0.1412 = 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.
b. For a long-term investor, we would use the T-bond rate, and the geometric mean:
The expected return = 0.064 + 0.95(0.0561) = 0.1173 or 11.73%, where 5.61% is used as the estimate of the market risk premium, since that is the geometric average of the market premium using the long-term T-bond rate as the riskfree rate. If we 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.

12. a. The levered beta of the company is given by formula: $\beta_L = \beta_u(1+(1-t)(D/E))$.
Solving, we get $_{unlevered} = 0.95/(1+(1-0.36)(1.7/1.5)) = 0.55$
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.

13. 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.

14. a. The expected return on the stock, assuming that the marginal investor is a Malaysian with primarily domestic holdings is $0.115 + 1.15(0.0675) = 19.26\%$, using the risk premium based on country risk provided by ratings agencies.
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.

15. a. Using the CAPM, we compute the expected return as $0.03 + 1.2(0.0876) = 13.51\%$. 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 conditional expected return would have been -7%, based on the prevailing T-bill rate then of 5%. E(R) = 5% + 1.2 (-5-5) = -7% (use actual Return on the market)
d. The actual returns were $(-4+2)/54 = -3.70\%$
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.

16. It's current levered beta is 1.2. Using the formula for leveraging a beta $\beta_L = \beta_u(1+(1-t)(D/E))$, 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.

17. a. The combined beta for Novell after the acquisition equals
$$\frac{2}{1+2}\, 1.5 + \frac{1}{1+2}\, 1.3 = 1.43$$
b. If Novell borrowed the $1m., we would lever this beta to get $1.43(1+(1-0.4)(1/2)) = 1.86$

17. a. The unlevered beta for Hewlett Packard as a company can be computed as the weithed averages of the unlevered betas, with the weights based upon the market values of each division.

$$\frac{2}{8}\ 1.1 + \frac{2}{8}\ 1.5 + \frac{1}{8}\ 2.0 + \frac{3}{8}\ 1.0 = 1.275.$$

(We assume that the divisional betas are unlevered betas.) Since the divisional structure of Hewlett Packard has changed over the years, the beta obtained by regressing past returns of HP against a market index will not be the same as 1.275.

b. If the T. bond rate is 7.5%, the cost of (unlevered) equity for the divisions can be computed as follows:

Business Group	
Mainframes	0.075+1.1(0.055) = 13.55%
Personal Groups	0.075+1.5(0.055) = 15.75%
Software	0.075+2.0(0.055) = 18.5%
Printers	0.075+1.0(0.055) = 13.00%

To value the printer division (assuming no leverage), we would use a cost of equity of 13%.

c. Assuming that the leverage is distributed across the divisions based upon their proportional values, we get the following values for each division, with the unlevered beta following:

Division	Beta	Unlevered Beta	Value of Equity	Value of Debt	Total Value
Mainframes	1.10	1.019	2.000	0.25	2.25
PCs	1.50	1.389	2.000	0.25	2.25
Software	2.00	1.852	1.000	0.125	1.125
Printers	1.00	0.926	3.000	0.375	3.375

After the divestiture, we'd have the unlevered beta equal to

$$\frac{2.25}{6.75}\ 1.389 + \frac{1.125}{6.75}\ 1.852 + \frac{3.375}{6.75}\ 0.925 = 1.235.$$

Using the information that HP had debt outstanding equal to $1.0 billion, the levered beta equals

a. (1+(1-0.36)(1/5.75))= 1.36.

The equity drops in value, because the $2.25 million gets paid out as a dividend.

19. a. The degree of operating leverage is computed as %⎯ Operating Income/% ⎯ 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.

20. It is possible that the service is regressing the beta estimate towards the mean of 1.0

21. 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 market movements.

22. 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. The measure of risk that's relevant for an undiversified investor is the total risk. This is computed as $\beta/R^2 = 0.7353/.2859 = 2.57$. 72% (1-0.28) of this risk is diversifiable.
e. $0.735 = (0.2)(2\text{x}0.735) + (0.8)\beta_{rem}$, where β_{rem} is the beta of the remaining firm. Solving, we find $\beta_{rem} = 0.55$.

23. 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. To estimate the beta after this transaction, let us begin with the financial balance sheet before the transaction:

Assets		Liabilities	
Division A	20	Debt	20
Division B	20	Equity	40
Division C	20		

Unlevered Beta before the transaction = $0.46/(1+ (1-0.36) (20/40)) = 0.35$
Assuming that division C is the division being sold,
Unlevered Beta of the remaining divisions =$[0.35 – 0.20 (20/60)]/(40/60) = 0.425$
The financial balance sheet after the transaction is as follows:

Assets		Liabilities	
Division A	20	Debt	50
Division B	20	Equity	40
Division D (New)	50		

New Unlevered Beta = (40/90) (0.425) + (50/90) (0.80) = 0.63
New levered beta after the transaction = 0.63 (1 + (1-.36) (50/40)) = 1.14

24. a. (β^2)(Var. of mkt)/Var. of stock = R^2; hence the β = 1.41
b. Intercept – (1-β)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) = - .55%
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.

25. a. The expected return over the next year = 0.048 + (1.65)(0.0876) = 19.25%.
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-β)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.

26.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

$$\frac{20}{180} \, 0.6 + \frac{160}{180} \, \beta_{rem} = 1.116; \text{ hence } \beta_{rem} = 1.1805.$$

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

27. a. The unlevered beta equals 1.61/(1+(1-0.4)(10/10))=1.01
b. If the debt to equity 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. If the debt to capital ratio drops by 10% from 50 to 40%, the debt equity ratio will decrease from 100% to 66.67%, yielding a beta estimate of 1.41.

28.a. Using the gross debt ratio, we can estimate an unlevered beta for Chrysler with the cash treated as an asset:
Unlevered Beta = 1.05 / (1 +(1- 0.36) (13,000/355x50)) = 0.715
b. If the beta is estimated for Chrysler with the cash, paying a special dividend of $ 5 billion will change the unlevered beta. In the analysis above, if 0.715 is the unlevered beta with cash of $ 13 billion in the firm, the unlevered beta after the special dividend can be estimated as follows:
Value of Non-cash assets = 13000 + 355*50 – 8000 = 22,750

Beta of non-cash assets (22,750/30,750) + 0 (8000/30,750) = 0.715m
[Beta for cash=0]
Beta of Non-cash assets = 0.715/(22750/30750) = 0.966
New Unlevered Beta = 0.966 (22,750/25,750) + 0 (3000/25750) = 0.853
c. The new debt ratio would be rise since dividends reduce the value of the equity:
13000/(355x50-5000) = 101.96%
. The levered beta is
0.853(1+(1-0.36)(1.0196))) = 1.41

29.

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
Average	1.2			0.37	1.045296

The average unlevered beta can be computed in one of two ways. The average beta for
the comparable firms and the average debt/equity ratio can be used to compute it:
Unlevered Beta = 1.20 / (1 + (1-0.4) (0.37)) = 0.982
Alternatively, the unlevered beta for each firm can be estimated, and the average
unlevered beta = 0.9798.
The first approach is less time consuming, and provides estimates that are very close to
the second one.
Using the private firm's leverage ratio of 25%, we can compute a levered beta of
0.982(1+(1-0.4)(0.25))= 1.129.
b. 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, as might the business mix in each firm.

30. 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.

31. 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. (We use the debt/equity ratio of 100%)
Southwestern's debt-to-capital ratio = _; 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 ratio would be 9/11. Hence the levered beta would be 0.6569(1+(1-0.36)(9/11)) = 1.00

32. a., b. Not necessarily. A growing firm would expect its beta to decline, since it is becoming a larger portion of the market portfolio. Presumably, in some ways, it is also getting diversified.
The rate of decline would decrease eventually, and in any case, the beta shouldn't drop below 1.0, unless the firm sees other changes.

33. 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.
c. The levered beta estimate in (a) lies well within the range of the estimate in b. Given the standard error on an average beta is much lower than the standard error on the regression beta, I would be inclined to use the comparable firm estimate. Alternatively, one could combine both estimates. For example, if we believe that all the firms essentially have the same unlevered beta, we could compute a weighted average of 1.288 and 0.75, giving the comparable firm number more weight. Exactly how much weight we want to give it would depend on the relative standard errors. Thus if the standard error of the comparable firm average was only 5%, it would be weighted 10 times more than the regression beta.

34. a. I would use a different discount rate. Since the cashflows are all in dollars, I would use the US T-bond rate as the riskfree rate. However, I would use the additional risk premium to reflect the additional risk of the Indonesian market. (I assume that the typcial investor is an Indonesian, and betas have been computed with respect to an Indonesian index.)
b. The cash flow estimation should be in dollars. Only inflation in dollar values should be built in.

35. We assume that the risk aversion of investors has not changed over time, and that the average riskiness of investments has not changed either.

36. The Thai market does not have a sufficiently long history, which we can use to estimate historical risk premiums. Furthermore, one might argue that given the structural changes in the Thai economy, the risk premium has been unstable. Part of this might be due to the increasing globalization of the Thai economy, making risk premiums lower on average.

37. a. The difference would essentially be expected inflation.
b. The real riskfree rate would be approximately 7 - 3 or 4%. More precisely, the real riskfree rate can be estimated as follows:
1.07/1.03-1 = 3.88%
c. This would allow us to avoid having to predict future inflation. This would be useful if inflation were expected to be unstable in the future.

38. a. The estimated beta would be the average unlevered beta of the publicly traded firms. This is approximately equal to $1.4/[1+(1-0.4)(0.15)] = 1.28$

b. If the firm decided to move to the industry average, its beta would move to the industry average as well, i.e. 1.4.

c. Chances are that the book value of equity is underestimating the true market value of equity. Hence I would be cautious in using these numbers.

d. I would increase the cost of equity to include a premium for non-market risk as well, which will have to be borne by the owner, whose portfolio is presumably relatively undiversified. Since the non-market risk is 75% of the total risk, I would effectively quadruple my beta estimate.

e. Yes. In this case, the relevant risk would be the risk that a public traded company would care about, i.e. non-diversifiable or market risk.

39. a. The cost of equity $= 0.06 + 1.2(0.055) = 12.6\%$

b. The cost of debt $= 6.2\%$ before tax, and $6.2(1-0.4) = 3.72\%$, assuming a tax rate of 40%. The market value of equity $= 93(430) = \$39.99b$. The market value of debt $= \$2.5b$. Hence the cost of capital $= (39.99/(39.99+2.5))(12.6\%) + (2.5/(2.5+39.99))(3.72\%) = 12.08\%$

c. In that case, I would compute the new levered beta for Allstate based upon the unlevered beta estimate of 1.2 from the regression. Given a D/E ratio of 2.5/39.99 or 6.25%, the new levered beta estimate would be 1.245, and the cost of equity would be 12.85%. The new cost of capital would be 12.41%

40. a. The interest coverage ratio for this firm $=$ EBIT/Int. expense $= 3.5/((.1)(5)) = 7$; hence it could expect to get a bond rating of A, with a current market yield of $6 + 1 = 7\%$.

b. This rate is different because T-bond rates were higher then. Also, presumably the bond ratings for the firm were worse at that time, to warrant a 2% premium over the riskfree rate.

c. If the firm has an option to extend the life of the debt, or if it has an option to issue additional debt at the same rate.

41. a. Based on the industry average, our estimate for Sybase would be $1.5/[1+(1-0.4)(0.10)] = 1.415$; my regression estimate is 1.1 with 95% confidence interval of 0.1 to 2.1, which includes 1.415. I would therefore estimate the precision of the 1.415 industry estimate and then take a weighted average of 1.415 and 1.1, weighting each number proportional to its precision. If I assume that the industry precision is twice as much as the precision of the regression estimate (given the diversification of the error for the former), I would come up with an estimate of 1.31.

b. Using a treasury bond rate of 6%, I get a cost of equity of $.06 + 1.31(.055) = 13.205\%$

c. This approach would count the risk twice: once in the beta, and once in the risk premium per unit of beta. This is incorrect.

42. a. The debt to capital ratio $= 3.4/(3.4+6.05) = 0.36$; the cost of equity $= .06 +0.85(.055) = 10.675\%$ and the cost of debt $= 6 + 0.7 = 6.7\%$. Hence the cost of capital $= (0.36)(0.067)(1-0.4) + (0.64)(.10675) = 8.28\%$, assuming a tax rate of 40%.

b. The market value of equity = 532 x 22 = 11.704b. The market value of the debt can be estimated using the average debt maturity of 4 years, a coupon rate of 225m/3.4b = 6.62%, a yield to maturity of 6.7% and a face value of $3.4b. This works out to a market value of debt of (0.997)($3.4b) = $3.39b. Using these numbers, the debt-to-capital ratio = 3.39/(11.704+3.39) = 0.2246. The cost of capital, therefore, works out to (0.2246)(1-0.4)(.067) + (1-0.2246)(.10675) = 9.18%