

Chapter 8: Capital Structure: Models and Applications

Problem 1

- (1). The Debt/Equity ratio in book value terms = $2500/2500 = 1$. The market value of debt is $2500(0.80) = 2000$, since the bonds are selling at 80% of face value. The market value of the stock is $50(80) = 4000$. Hence the debt/equity ratio in market value terms = $2000/4000 = 0.5$
- (2). The Debt/(Debt+ Equity) ratio = $1/(1+1) = 0.5$ in book value terms, and $(0.5/(1+0.5)) = 1/3$ in market value terms.
- (3). The firm's after-tax cost of debt = $12(1-0.4) = 7.2\%$
- (4). The firm's cost of equity = $8\% + 1.2(5.5\%) = 14.6\%$
- (5). The firm's weighted average cost of capital = $(2/3) 14.6\% + (1/3) 7.2\% = 12.13\%$

Problem 2

- (1) From the equity investor's standpoint, the relevant cashflow is computed as Net Income + Depreciation = $9.6 + 5 = 14.6$. Using a cost of equity of 14.6%, the PV of these cash flows equals $14.6/0.146 = \$100$. The equity part of the \$100 investment = $100(2/3)$. Hence the NPV for the equity investors = $100 - 100(2/3) = \$33.33m$.
- (2). From the firm's point of view, the cashflows are $EBIT(1-tax\ rate) + Depreciation = \$17m$. (The tax rate is computed as $6.4/16 = 40\%$.) The NPV = $17/.1213 - 100 = \$40.15m$.
- (3). The cost of equity would be used as the benchmark when the cashflows being evaluated as cashflows to equity.
- (4). The cost of capital would be used as the benchmark when the cashflows being evaluated as cashflows to the firm.
- (5). We would still analyze it using the same cost of capital as above.

Problem 3

- (1). We assume that the unlevered cost of equity is not affected by the capital structure changes. The current equity beta is 1.2. However, that assumes a leverage ratio of 1/3. Unlevering this beta, we get the unlevered beta = $1.2/(1+(1-t)(D/E)) = 1.2/(1+0.6(0.5)) = 0.923$
Under option 1, the new debt/equity ratio becomes $(2000-1000)/(4000+1000) = 1/5$. The levered beta becomes $0.923(1+(1-0.4)(1/5)) = 1.034$. The cost of equity capital becomes $8+1.034(5.5) = 13.686\%$
Under option 2, the debt/equity ratio becomes $(2000+1000)/(4000-1000) = 1$. The levered beta becomes $0.923(1+(1-0.4)1) = 1.477$. The cost of equity capital becomes 16.123%
Under option 3, the debt-equity ratio becomes $(2000+3000)/(4000-3000) = 5$. The levered beta becomes 3.692, and the cost of equity capital becomes 28.308%.

(2) The cost of debt under each option becomes

- Option 1: $11(1-0.4) = 6.6\%$
Option 2: $13(1-0.4) = 7.8\%$
Option 3: $18(1-0.4) = 10.8\%$

(3) The cost of capital becomes

Option 1: $6.6\% (1/6) + 13.686(5/6) = 12.505\%$

Option 2: $7.8\% (1/2) + 16.123(1/2) = 11.962\%$

Option 3: $10.8\%(5/6) + 28.308(1/6) = 13.718\%$

(4) The value of the firm will go up by $\text{Old firm Value}(\text{Old WACC} - \text{New WACC})/\text{New WACC}$; under the best option, i.e. option 2, the firm value would go up by $6000(0.1213 - 0.11962)/0.11962 = 84.27$. Hence the new firm value = \$6084.27. The value of debt would be $2000 + 1000 = \$3000$, leaving an equity value of \$3084.

Under option 1, the change in firm value = $6000(.1213 - .12505)/.12505 = -\180 ; the new firm value would be \$5820, with a debt value of \$1000 and an equity value of \$4820.

Under option 3, the change in firm value = $6000(0.1213 - 0.13718)/0.13718 = \695 ; the new firm value = \$5305. The debt value = \$5000, while the equity value = \$305.

(5) Assuming that the cashflows do not change, it would be optimal to minimize the WACC, which happens when we pick Option 2.

(6) The more variable Rubbermaid's income, the lower would be my debt ratio choice.

(7) If the money were used to make new investments, the analysis would change in the following ways:

- I would need to add in the NPV of the new projects to firm value.
- I would need to look at the riskiness of the new projects; my stock betas would change if the projects had different riskiness from the existing firm.
- The firm value would increase by the amount of the new debt or equity issued.

(8)

- I would look at whether the cashflows were affected by the capital structure decision.
- I would look at how much the firm needs flexibility. The more the debt, the less the flexibility, since debt service payments must be made at all times, and there might be restrictive debt covenants. Hence the greater the need for flexibility, the lower would be my debt ratio choice.
- I would look at the need to impose market discipline on the firm's managers through debt.
- If I saw my role as maximizing shareholder's wealth even at the expense of bondholders, I might look for ways of expropriating bondholders. One way of doing this would be to increase leverage.

(9) The higher rating in option 1 lowers the cost of debt, but it replaces cheaper debt with more expensive equity. This increases the cost of capital, and thus reduces the value of the firm.

Problem 4

a. Given the lower Variance in EBITDA, I would expect a higher debt ratio.

The higher value of EBITDA as a proportion of the value of the firm would lead me to predict a higher debt ratio, because a higher EBITDA/Firm Value translates into higher cash flows currently

A higher tax rate would make more debt beneficial because of the tax deductibility of interest payments.

A higher R&D/Sales ratio suggests that less debt would be optimal, since 1)R&D is an intangible asset, which cannot be disposed of in financial distress, and 2) such a firm is probably a growth firm and probably does not want a bank looking over its shoulder

b. The predicted D/E ratio for Rubbermaid would be $.1 - .5(.20) + 2.0(.25) + 0.4(.4) + 2.5(.02) = 0.71$ or 71%.

Problem 5

(1), (2). 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.

(3). At this capital structure, the firm would change in value by $(200+500)(.0015/1315) = \8 million

. Hence the price per share increases to $\$ 50 + \8 million/10 million = \$50.80.

(4). 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 $10.8/.1315 - 100 = -17.17$ m. Hence the project is not desirable.

(5) 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.

Problem 6.

(1), (3) The current levered beta = 1.15. The current debt/equity ratio = $500,000/(20 \times 100,000) = 0.25$ and a leverage ratio of $0.25/1.25 = 0.2$. The current unlevered beta = $1.15/(1+(1-0.4)(1/4)) = 1$

Add'l Debt	Beta	Cost of Equity	Rating	Cost of Debt	Cost of Capital
Current	1.15	12.33%	BBB	6.00%	11.06%
500000	1.30	13.15%	BB	6.30%	10.87%
1000000	1.45	13.98%	B	6.90%	10.94%

1500000	1.60	14.80%	B-	8.10%	11.45%
2000000	1.75	15.63%	C	9.00%	11.94%

Optimal debt amount is \$ 500,000 in additional debt.

(2) Change in Firm Value = $2,500,000 (.1106-.1087)/.1087 = \$ 43,698$

Increase in Stock Price = $\$ 43,698/100000 = \0.44

(3) See above

(4) Discounting the Cash flows,

NPV = $(600000(1-.4)+100000)/.1087 - 3,000,000 = \$1,231,831$

Problem 7.

a. The optimal leverage ratio = 50%

lev. ratio	int. rate	levered beta	Cost of equity	WACC
0	0.1	1.5	0.1725	0.1725
0.1	0.105	1.6	0.178	0.1665
0.2	0.11	1.725	0.184875	0.1611
0.3	0.12	1.885714	0.193714	0.1572
0.4	0.13	2.1	0.2055	0.1545
0.5	0.14	2.4	0.222	0.1530
0.6	0.16	2.85	0.24675	0.1563
0.7	0.18	3.6	0.288	0.162
0.8	0.2	5.1	0.3705	0.1701
0.9	0.25	9.6	0.618	0.1968

b. The increase in the value of the firm can be estimated as $20(.1725-0.1530)/.1530 = \$2.549m$. The entire increase of \$2.549 will go to the equityholders. Hence the new stock price will be $\$20 + \$2.55 = \$22.55$

Problem 8

a. The market value of equity = $25 \times 10m. = \$250m$.

The market value of debt = \$25. The cost of equity = $.08+1.06(.055) = 13.83\%$; the after-tax cost of debt = $10(1-0.4) = 6\%$. The WACC = $(25/275)6 + (250/275)13.83 = 13.12\%$

b. The new value of debt = \$125m., assuming that the old debt is refinanced at 13% The equity value can be approximated as $250 - (25)(4) = 150m$.

The new after-tax cost of debt = $(1-0.4)0.13 = 7.8\%$

The unlevered beta = $1.06/(1+(1-0.4)(25/250)) = 1$; the new levered beta = $1(1+(1-0.4)(125/150)) = 1.5$. The new cost of equity = $0.08+1.5(0.055) = 16.25\%$. The WACC = $(125/275)7.8 + (150/275)16.25 = 12.41\%$

Problem 9

a. The current cost of equity = $0.07 + 1.12(0.055) = 13.16\%$

b. The current cost of debt can be estimated as Interest/LT debt = $10/100 = 10\%$.

c. The WACC = $(500/(500+100))13.16 + (100/(500+100))10(1-0.4) = 11.97\%$

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 = $(150/600)24.11 + (450/600)(1-0.2963)(15) = 13.94\%$.

Problem 10

- a. The current levered beta = 1.25; the current D/E ratio = $0.9(1000)/9(200) = 0.5$; the cost of equity = $0.06+1.25(0.055) = 12.875\%$
The unlevered beta = $1.25/(1+(1-0.4)0.5) = 0.9615$.
- b. The after-tax cost of debt = $11(1-0.4) = 6.6\%$.
- c. The current WACC = $(1/3)6.6 + (2/3)(12.875) = 10.583\%$
- d. If the firm goes in for the equity-for-debt swap, the market value of outstanding equity jumps from 1800 to 2000, and debt drops from 900 to 700. The new levered beta = $0.9615(1+0.6(700/2000)) = 1.1634$. The required rate of return on equity = $0.06 + 1.1634(0.055) = 12.40\%$
- e. The new WACC = $(7/27)(1-0.4)(10) + (20/27)(12.40) = 10.74\%$
- f. The WACC has gone up. Hence the value of the firm will drop by $(.1074 - .10583)2700/0.1074 = \39.655 . The new firm value will be $2700 - 39.655 = 2660.34$.

Problem 11

- a. The equity market value = $40 \times 20 = \$800\text{m}$. Hence, if the debt-equity ratio is 0.25, the market value of the debt = $\$200\text{m}$. The cost of equity = $.08 + 1.15(.055) = 14.325\%$.
The WACC of the firm = $(200/1000)(10)(1-0.4) + (800/1000)14.325 = 12.66\%$.
- b. The unlevered beta = $1.15/(1+0.6(0.25)) = 1$. With the new financing plan, the value of debt rises by 200m to 400m, and the value of equity falls to 600. The new levered beta = $1(1+0.6(400/600)) = 1.4$. The new cost of equity = $.08+1.4(0.055) = 15.7\%$. The WACC = $(400/1000)(11)(1-0.4) + (600/1000)(15.7) = 12.06\%$.
The increased debt will increase interest payments to $0.11(400) = \$44\text{m}$. This is less than the EBIT, and hence will not have much of an effect on the marginal tax rate.
- c. The increase in firm value = $1000(.1266 - .1206)/.1206 = 49.75$, or a per share value of $49.75/40 = \$1.244$. Hence the new stock price is $20+1.244 = \$21.244$.
- d. The firm currently pays dividends of \$1 per share. An increase to \$2 per share per year will change equity value to $800(1.1266) - 2(40) = \$821.28\text{m}$., 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 12.06%, 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 $350/821.28 = 0.426$.

Problem 12

- a. The market value of the common stock is $70 \times 10 = \$700\text{m}$. The 500,000 convertible bonds would sell at a yield of 10% if they were straight. Hence the straight bond component of the convertibles = $\frac{40}{.05} \left(1 - \frac{1}{1.05^{20}} \right) + \frac{1000}{1.05^{20}} = 498.48 + 376.89 = 875.37$.
- Since the convertibles trade at \$1000 per bond, the equity component = $\$124.63$ per convertible bond. Hence total equity = $700+125.63(0.5) = 762.32\text{m}$. The market value

of the debt component of the convertibles = $875.37(0.5) = 437.69m$. Hence the debt-equity ratio = $437.69/762.32 = 57.41\%$.

b. The required rate of return on the equity = $.06 + 1.2(0.055) = 12.6\%$. The WACC = $(.5741/1.5741)(1-0.4)10\% + ((1/1.5741)12.6\% = 10.192\%$.

c. After this borrowing, the market value of equity will be $\$762.32m - \$200m + \$25m = \$586.5m$. The market value of debt will be $687.69m$. Hence the debt-equity ratio will

be 1.17. The unlevered beta = $\frac{12}{1 + (1 - 0.4).5741} = 0.89$. Hence the levered beta will be

equal to $0.71(1 + (1 - 0.4)1.17) = 1.52$. Hence, the cost of equity = $.06 + 1.52(0.055) = 14.36\%$.

d. The WACC = $\frac{1.17}{2.17}(1 - 0.4)11 + \frac{1}{2.17}14.36 = 10.17\%$

c. The increase in the value of the firm = $(762.32 + 437.68)(.10192 - .1017) / (.1017) = \$2.36m$. Hence the new value

New Firm Value = $\$1,200 + \$50 + \$27.36 = \1277.36 million.

Problem 13

a. The market value of debt = $2800m$, the mkt. value of equity = $24270m$; the D/E ratio = 0.1154 . The levered beta = 1.47 ; hence the unlevered beta =

$\frac{1.47}{1 + (1 - 0.4)(0.1154)} = 1.3748$. The cost of equity = $0.065 + 1.47(.055) = 14.585\%$. The

WACC = $(0.1154/1.1154)(1-0.4)6.8 + (1/1.1154)(14.585) = 13.498\%$.

b. If Pfizer moved to a 30% debt ratio, the debt-equity ratio becomes $3/7 = 42.86\%$, and the levered beta becomes $1.3748(1 + 0.6(0.4286)) = 1.72$. The cost of equity becomes 15.96% . The WACC = $(0.3)(1-0.4)(8.5) + (0.7)15.96 = 12.70\%$.

c. If Pfizer has a growth rate of 6%, the change in firm value due to this change in WACC is given by $(24270 + 2800)(.1349 - .1270) / (.1270 - .06) = 3426m$. Hence the stock price will rise by $3426/24270 = 14.12\%$!

d. Generally, companies that do research and development are much more concerned about both agency costs (lenders find it difficult to monitor R&D) and flexibility. Thus, debt is used relatively little.

Problem 14

a. The market yield on the company's debt is 7.5%; the yearly coupon payment is $\$55m$, the average maturity is 10 years, and the face value = $\$664m$. Hence the market value =

$\frac{55}{.075} \left(1 - \frac{1}{1.075^{10}} \right) + \frac{664}{1.075^{10}} = 699.69m$.

b. The debt-equity ratio = $699.69 / (173 \times 30.75) = 0.1315$; the leverage ratio = 0.1162 . The cost of equity = $.065 + 1.17(.055) = 12.94\%$. Hence the cost of capital = $(0.1162)(0.075)(1-0.36) + (0.8838)(0.1294) = 0.1199$.

c. If the value per share goes up by $\$1.25$, then we have $(699.69 + 5319.75)(.1199 - \text{WACC}) / \text{WACC} = 1.25(173) = 216.25$. Solving, we find WACC = 11.57%

Problem 15

a. The expected bankruptcy cost = $0.30(0.023)(1760+527-527*.36) = \$ 14$ million. (We assume that the bankruptcy cost is estimated on the unlevered firm's value)

The present value of the tax advantage to debt = $527(0.36) = 190$ million. EBIT is comfortably above the level of interest expense, hence the marginal tax rate is still 36%. Therefore, the unlevered firm value = $2287 + 14 - 190 = 2,111$ million.

b. At a debt ratio of 50%, the new levered firm value can be written as follows:

New Levered Firm Value = $\$2111 + (.36)(.5) (\text{Levered Firm Value}) - .4661(.30)(2111)$
Solving for the levered firm value

$$\text{Levered Firm Value} = \$ 2214\text{million}$$

Problem 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 = $985 + (40)46.25 = 2835\text{m}$. 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

Problem 17

a. The bond rating of B+ seems high for a 60% debt ratio, compared to industry averages of 27% for Textile and Clothing Manufacturers, 29.18 for Consumer Durables, and 44.78 for Consumer Products. This maybe because 1995 Operating Income is abnormal. However, if one believes that the Operating Income is a correct number, then we can

compute the coverage ratio to be approximately equal to $420/[(.0592)/(1-0.3690)] \times 0.0442 \times 3343 = 76$, which justifies the high bond rating.

b. If an error has been made, and Reebok moves too quickly to this “optimal,” it will have to undo the capital structure changes made. This could be costly.

Problem 18

The leverage level of debt = 237; the current level of equity = $11(19.88) = 218.68$. Hence the current leverage ratio is computed to be $237/(237+218.68) = 0.520102$, and the corresponding D/E ratio = 1.0838.

The current beta = 1.26, and we compute the unlevered beta as $1.26/(1+(1-0.37)1.0838) = 0.7488$. We can now compute the different costs as in the table below:

d/e	lev ratio	int. rate	levered beta	cost of equity	after tax cost of debt	WACC
0.0000	0.0000	8.1800	0.7488	0.1200	0.0515	0.1200
0.1111	0.1000	8.1800	0.8012	0.1229	0.0515	0.1157
0.2500	0.2000	8.8800	0.8667	0.1265	0.0559	0.1124
0.4286	0.3000	9.1300	0.9509	0.1311	0.0575	0.1090
0.6667	0.4000	9.3800	1.0632	0.1373	0.0591	0.1060
1.0000	0.5000	10.3800	1.2205	0.1459	0.0654	0.1057
1.5000	0.6000	10.3800	1.4563	0.1589	0.0654	0.1028
2.3333	0.7000	11.8800	1.8494	0.1805	0.0748	0.1065
4.0000	0.8000	12.8800	2.6356	0.2238	0.0811	0.1097
9.0000	0.9000	13.8800	4.9942	0.3535	0.0874	0.1140

The optimal debt-equity ratio = 60%.

Problem 19

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 $150/.1012 = 1482$. 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 = $\frac{126}{1 + (1 - 0.35)1.75} = 0.5895$. Hence the

levered beta at a debt ratio of 30% = $0.5895(1+(1-0.35)(0.3/1.3)) = 0.678$; the cost of equity = $.0612 + 0.678(.055) = 0.0985$. The WACC = $(0.3)(1-0.35)(.0812) + (0.7)(.0985) = 8.478\%$. The firm value at this optimum = $(2562+1482+3000)[1+(.0893-.08478)/0.08478] = 7419.55\text{m}$. (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.

Problem 20

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 = $\frac{135}{1 + (1 - 0.365)0.029} = 1326$. 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 $(0.7)(0.6)(1-0.365) + (0.3)(\underline{\beta}_L) = 1.326$; hence $\beta_L = 3.531$

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

d. The cost of equity capital = $0.06 + 3.531(0.055) = 25.42\%$

The after tax cost of debt = $(1-.211)(16) = 12.624\%$

The WACC = $(0.7)(12.624) + (0.3)(25.42) = 16.463\%$

e. Firm value will drop to $(52.5)[1-(.16463-.13168)/.16463] = 41.99b$.

f. It is not desirable to increase debt too much.

Problem 21

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. Suppose the levered firm value at a debt ratio of 50% = x . Then, the expected bankruptcy cost = $0.23(.3)x$. The tax benefit = $(0.5)(0.36)x$, assuming that the marginal tax rate would still be 36%. Then, we have the equation, $x = 28.46 - 0.23(.3)x + (0.5)(0.36)x$. Solving, we find $x = \$32.01b$.

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

Problem 22

a. The debt-equity ratio works out to 1/6. The levered beta for comparable firms is 1.05; their corresponding unlevered beta = $1.05/[1+(1-0.4)/4] = 0.913$, assuming a tax rate of 40%. Assuming that this is also the unlevered beta for our firm, its levered beta = $0.913[1+(1-0.4)/6] = 1.004$. Hence the cost of equity = $7\% + 1.004(5.5) = 12.52\%$.

The after-tax cost of debt = $8.25\%(1-0.4) = 4.95\%$. Hence, the cost of capital = $(4.95)/7 + 12.52(6/7) = 11.44\%$

b. The new D/E ratio = $2/6 = 1/3$, and the debt ratio goes to 25%. The new levered beta = $0.913[1+(1-0.4)/3] = 1.096$ and the cost of equity = 13.026%, while the cost of debt after-

tax = $9(1-0.4) = 5.4\%$. The weighted average cost of capital = $5.4/4 + 13.026(3/4) = 11.12\%$. Assuming a zero growth rate in earnings, the consequent increase in firm value = $7(0.1144 - 0.1112)/0.1112 = 0.2014$ million

c. Using this regression, we get a debt ratio = $0.15 + 1.05(0.5/8.2306) - 0.1(1.096) = 0.1042$

d. Small firms don't have the same kind of agency problems vis-à-vis their lenders, who tend to be private as well. Hence conclusions drawn from cross-sectional regressions of large firms might not apply to small firms.

Problem 23

Even though the return on equity could rise, the value of the firm will also rise only if the consequent beta risk of the equity rises less. This need not always happen.

Problem 24

The current beta = 1.06; hence the unlevered beta = $1.06/[1+(1-0.4)/9] = 0.99375$. At a debt ratio of 20%, the D/E ratio = 1/4 and the levered beta = $0.99375[1+(1-0.4)/4] = 1.1428$. The required rate of return on equity becomes $7\% + 1.1428(5.5\%) = 13.29\%$, while the after-tax cost of debt can be based on the new coverage ratio.

In order to get a 20% debt ratio without changing the size of the firm's operations, we'd need to issue an additional \$1500 worth of debt. If we define the coverage ratio based on EBIT/Int. expense, we'd get for a 20% debt ratio, a coverage ratio of $1000/(3000 \times 0.08) = 4.17\%$, which gives us a rating of BBB and a spread over treasuries of 2%. This, in turn raises the interest rate to 9%, and the coverage ratio drops to $1000/(3000 \times 0.09) = 3.7$, which still commands the same rating. Hence the after-tax cost of debt = $9\%(1-0.4) = 5.4\%$.

The cost of capital = $(0.2)(5.4\%) + (0.8)(13.29\%) = 11.71\%$

Problem 25

The expected change in firm value = $(10 \times 25 + 50)(.11-0.1)(1.05)/(0.1-0.05) = \63m .

Increase in value per share = $\$63 \text{ million}/10 \text{ million} = \6.30

(I am assuming that investors are rational and that the stock that is bought back also gets its fair share of this value increase)

Problem 26

The duration of the firm's debt should be 5 years. The duration of the new debt should be such that the weighted average of the durations of the two issues will be 5 years.

Hence the duration of the new issue should be d, where $(100(2) + 150d)/250 = 5$, or d = 7.

Problem 27

The return on equity = 21%; i.e. E/2. Therefore, E = 0.42. The average P/E ratio = 20; hence P = 20E = \$8.4m.

Net Income = E = (EBITDA - Depreciation - Interest)(1-tax rate)

Estimated EBITDA = $0.42/(1-0.4) + 0.25 + 0.3 = 1.25\text{m}$.

The current market value debt ratio = $4.5/(4.5+8.4) = 35\%$

