

## Chapter 9: Capital Structure: The Financing Details

1. a. Currently it has no debt. If the issue of debt were not to affect the valuation of its existing operations, it could get to a debt ratio of 50% by issuing \$2 billion worth of debt and doubling the size of the firm. Alternatively, it could issue \$1b. worth of debt and use the proceeds to buy back \$1b. worth of equity.

However, we are told that the value of the firm's existing operations would go up by \$300m. In other words, the total firm value would jump to \$2.3b. At this firm value, 50% debt works out to \$1.15b. Hence BMD Inc. can either issue \$1.15b. worth of debt and retire an equal amount of equity or issue \$1.15b. and pay out the proceeds as a special dividend. Alternatively, it could borrow more than \$1.15b. and increase the size of the firm. Assuming that the value of the firm would go up by \$300m. with a debt ratio of 1, independent of the size of the firm, we have the equation:

$$\frac{\text{Amount of new borrowing}}{2b. + 300m. + \text{Amount of new borrowing}} = 0.5$$

Solving, we find that the amount of new borrowing = \$2.3b.

b. The difference is that with a special dividend, all existing shareholders are forced to receive the money and pay tax on it. If they do not want the distribution, they would then have to incur transactions costs to buy new stock or part of the new debt.

c. If BMD has a cash balance of \$250m., part of that cash balance could be used to pay the special dividend or to buy back equity. In this case, only \$1.025 b. of new funds need be raised. These new funds plus the \$250, for a total of 1.225b. would be used to buy back equity. The total value of the firm would be \$2b. + 300m. - 250m. = \$2.05b., and the debt ratio would be  $1.025/2.05 = 0.5$ .

2.

The current debt ratio =  $100/(100+9(100)) = 10\%$ . Next year, the value of debt will remain at \$100m. assuming that the debt is currently selling at par. Retained earnings will be  $\$7.5(9m.)(1.1)(0.8) = \$59.4m$ . Hence the book value of equity next year will be 959.4 next year. The debt ratio next year will, therefore, be  $100/(100+959.4) = 9.44\%$  on a book value basis.

We can, however, also estimate the debt ratio on a market value basis. The key is to price the stock next year. Since the cost of equity =  $.07 + 1.1(.055) = 13.05\%$  and the dividend yield is 1.50%, the expected price appreciation next year is 11.55%.. Thus, the value of equity next year is the current equity increased by 11.55% to \$ 1,003.95 million. The debt ratio, therefore, in market value terms becomes  $100/1003.95 = 9.06\%$ . This leads to a new beta and a new cost of equity in year 1, and the process is repeated. This can be repeated to obtain the debt ratio for the next four years as well. Note that the current beta is used to compute the cost of equity and thereby the expected price appreciation for the year to come.

a.)	Current	1	2	3	4	5
Debt	\$ 100.00	\$ 100.00	\$ 100.00	\$ 100.00	\$ 100.00	\$ 100.00
Equity	\$ 900.00	\$ 1,003.95	\$ 1,119.72	\$ 1,248.68	\$ 1,392.35	\$ 1,552.42
D/(D+E)	10.00%	9.06%	8.20%	7.41%	6.70%	6.05%
D/E	11.11%	9.96%	8.93%	8.01%	7.18%	6.44%
Net Income	\$ 67.50	\$ 74.25	\$ 81.68	\$ 89.84	\$ 98.83	\$ 108.71
Dividends	\$ 13.50	\$ 14.85	\$ 16.34	\$ 17.97	\$ 19.77	\$ 21.74
Beta	1.10	1.09	1.09	1.08	1.08	1.07
Expected Return	13.05%	13.01%	12.98%	12.94%	12.92%	12.89%
Dividend Yield	1.50%	1.48%	1.46%	1.44%	1.42%	1.40%
Exp. Price Appr.	11.55%	11.53%	11.52%	11.51%	11.50%	11.49%

- a. Suppose we assume that the dividend payout ratio doubles next year and remains at that level for the next 4 years. Assume also that 5% of the outstanding stock is repurchased at the end of every year. Then the debt ratio would be larger each year, relative to the levels in part a., because the amount of equity would be lower. The debt-equity ratios can be computed in analogous fashion. Note, however, that there may be an inconsistency in continuing to assume that earnings will grow at 10%. If retained earnings are lower, growth may well be lower. The numbers below, however, assume that earnings continue to grow at 10%.

b.)	Current	1	2	3	4	5
Debt	\$ 100.00	\$ 100.00	\$ 100.00	\$ 100.00	\$ 100.00	\$ 100.00
Equity	\$ 900.00	\$ 940.93	\$ 978.71	\$ 1,012.06	\$ 1,039.43	\$ 1,059.00
D/(D+E)	10.00%	9.61%	9.27%	8.99%	8.78%	8.63%
D/E	11.11%	10.63%	10.22%	9.88%	9.62%	9.44%
Net Income	\$ 67.50	\$ 74.25	\$ 81.68	\$ 89.84	\$ 98.83	\$ 108.71
Dividends	\$ 27.00	\$ 29.70	\$ 32.67	\$ 35.94	\$ 39.53	\$ 43.48
Stock Buybacks		\$ 49.52	\$ 55.16	\$ 61.41	\$ 68.34	\$ 76.02
Beta	1.10	1.10	1.09	1.09	1.09	1.09
Expected Return	13.05%	13.03%	13.02%	13.01%	13.00%	12.99%

Dividend Yield	3.00%	3.16%	3.34%	3.55%	3.80%	4.11%
Exp. Price Appr.	10.05%	9.88%	9.68%	9.46%	9.20%	8.89%

To estimate the stock bought back in year 1, estimate first the value of the equity at the end of year 1, which will be \$ 900 (1.1005). Then take 5% of that number, since the buyback occurs at the end of the year.

3. The solution to this problem is similar to that of problem 2, except that dividends are constant in this case.

*a) If the existing policy of paying \$ 50 million in dividends is continued.*

	Current	1	2	3	4	5
Debt	\$ 5,000.00	\$ 5,000.00	\$ 5,000.00	\$ 5,000.00	\$ 5,000.00	\$ 5,000.00
Equity	\$ 500.00	\$ 518.00	\$ 537.43	\$ 558.40	\$ 581.04	\$ 605.48
D/(D+E)	90.91%	90.61%	90.29%	89.95%	89.59%	89.20%
D/E	1000.00%	965.25%	930.35%	895.41%	860.52%	825.79%
Dividends	\$ 50.00	\$ 50.00	\$ 50.00	\$ 50.00	\$ 50.00	\$ 50.00
Beta	1.20	1.16	1.13	1.09	1.06	1.02
Expected Return	13.60%	13.40%	13.21%	13.01%	12.81%	12.61%
Dividend Yield	10.00%	9.65%	9.30%	8.95%	8.61%	8.26%
Exp. Price Appr.	3.60%	3.75%	3.90%	4.05%	4.21%	4.36%

b. When dividends drop to zero, the debt ratio drops faster. However, starting from a ratio of 90.91%, it is necessary to adopt more drastic strategies such as buying back equity to reach the desired debt-equity ratio of 30%.

	Current	1	2	3	4	5
Debt	\$ 5,000.00	\$ 5,000.00	\$ 5,000.00	\$ 5,000.00	\$ 5,000.00	\$ 5,000.00
Equity	\$ 500.00	\$ 568.00	\$ 641.40	\$ 720.63	\$ 806.16	\$ 898.47
D/(D+E)	90.91%	89.80%	88.63%	87.40%	86.12%	84.77%
D/E	1000.00%	880.28%	779.54%	693.83%	620.23%	556.50%
Dividends	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Beta	1.20	1.08	0.97	0.89	0.81	0.74
Expected Return	13.60%	12.92%	12.35%	11.87%	11.45%	11.09%

Dividend Yield	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Exp. Price Appr.	13.60%	12.92%	12.35%	11.87%	11.45%	11.09%

The information on growth rates in operating income and depreciation could be used, if desired, to obtain a different estimate of the market value of equity.

Problem 4.

The required rate of return on equity =  $.07 + 1.3(.055) = 14.15\%$ , while the cost of debt, after-tax =  $(1-0.4)8\% = 4.8\%$ . The WACC =  $(1/5)4.8 + (4/5)14.15 = 12.28\%$ . If the firm moves to its optimal debt ratio, the WACC would drop to 11.28%. The firm's return on capital =  $0.30(1-0.4)/3 = 6\%$ . Since this rate of return is lower than its cost of capital even at the optimum debt ratio, the firm would be better off reducing its size by dropping some of its unprofitable operations. It should sell some of its assets and pay additional dividends or buy back stock.

b. The correct decision should be taken, however, after looking at the firm's prospects for the future, rather than its past earnings record. Also, the choice of special dividends or stock buyback would depend on the firm's stockholders and their tax status.

Problem 5.

In order to determine the maturity of the debt, I would want to know the nature of the assets that the debt issue would be financing. In fact, I would want to consider the existing match between the duration of cashflows from assets and the duration of existing liabilities.

I would want to know the interactions between the current project for which financing is being sought and other existing projects. This would help me to determine whether project financing is appropriate or not.

The currency in which the project would generate cashflows is important to determine which currency the debt should be floated in. Finally depending on whether future flexibility is important or not, I would determine the extent of covenant protection appropriate for the new issue.

Problem 6.

I would structure the new debt as a long term issue, denominated in local currencies as far as possible. I would attempt to tie the coupon payments to the strength of the economies as well, perhaps by linking the amount of the payment to commodity prices if the local economies are commodity-dependent.

Problem 7.

A. Regressing the percentage change in firm value on the change in the long bond rate provides a measure of duration of the firm's assets. The estimated regression equation has

a slope of -6.51. In other words, a 100 basis point increase in the long bond rate leads to an 6.5% drop in the value of the firm. The duration of the firm's projects is 6.51.

Regressing the percentage change in firm value on the percentage change in (1 + the long bond rate) will provide a measure of duration of the firm's assets that is more comparable to the way that bond durations are estimated. According to this method, the estimated duration is 7 years. Note, however, that neither t-statistic is significant.

I would design the bonds to have a duration of about 7 years, keeping in mind that the duration estimate is not very accurate.

b. Regressing the percentage change in firm value on the GNP growth rate gives a slope coefficient of -4.68. In other words, this firm is moderately anti-cyclical. However, the t-statistic is not significant. Hence I would not use this information.

c. The regression of percentage change in firm value on the percentage change in the weighted dollar yields a slope coefficient of -0.03 with an insignificant t-statistic. It is difficult to measure the sensitivity of the firm value to changes in exchange rates.

d. The regression of percentage change in firm value on the change in the inflation rate yields a slope coefficient of -6.83 with an insignificant t-statistic. Hence there is not much sensitivity of firm value to inflation.

e. Given the noisiness of the estimates, I would try and obtain other estimates perhaps using fundamental analysis. Another alternative is to use industry averages to measure firm sensitivities.

#### Problem 8.

The sensitivity of operating income changes to changes in the macroeconomic variables are as follows:

bond rate	GNP growth	weighted dollar	inflation
9.248083	5.25	-0.10	4.05

Once again, the t-statistics are barely significant.

#### Problem 9.

Changes in firm value reflect not just current changes in operating income, but also expected future changes in operating income. Changes in firm value also reflect changes in discount rates.

I would go with the results of the regression analysis using firm value. I would use the operating income regression if I were interested in changes in firm liquidity. Thus, if external short-term financing might be a problem in the future, and I might have to depend on internally generated funds, I would want to know the factors affecting the volatility of these funds.

Problem 10.

a. Given firm income of  $EBIT(1-t) = 2(1-0.4) = \$1.2b$ , and an estimated firm value of \$8 billion, a cost of capital of 14.51%, the estimated growth rate is negligible. The impact of the move to a higher debt ratio on Pfizer's value would therefore be approximately  $(.1451-.1345)/.1345 = 7.9\%$ , which is significant. This could attract potential acquirers. On the other hand, Pfizer has significant anti-takeover restrictions. Hence, it could afford to move gradually in increasing its debt ratio.

b. Pfizer's earnings on capital are about 15% ( $1.2/8$ ), which is higher than the cost of capital at the optimum. This would suggest floating new debt and using the additional funds for expansion.

c. It should re-evaluate the optimal debt ratio for the merged firm. If the asset characteristics of the acquisition are different, the optimal debt ratio could vary. Also, the target firm might have its own liabilities, which might have to be taken over by Pfizer.

Problem 11.

a., b. The required rate of return on equity is  $.065 + 1.17(0.055) = 12.94\%$ , while the return on equity is much higher, i.e. 14.5%. On the other hand, this number is expected to drop. Taken together with rumors of Upjohn being a takeover target, it might be desirable for the company to increase the debt-ratio through a debt-for-equity swap or payment of a special dividend rather than increase the debt ratio gradually.

Problem 12.

Steel companies in emerging markets with high growth and high risk will probably not have high leverage. The reason is that agency costs would be significantly higher than in mature markets. So would problems with asymmetric information. Flexibility would be important, and debt would probably entail restrictive covenants.

Problem 13.

a. Bethlehem's firm value is very sensitive to changes in interest rates. A duration matching approach suggests debt with a duration of 6 years at least. Excessive dependence on short-term debt is inappropriate.

b. If management believes that interest rates are headed downwards, it might want to wait awhile before floating long-term debt. In general, if Bethlehem Steel expects to be involved in major structural changes, which are not entirely predictable right now, short-term debt would provide more flexibility.

Problem 14.

Assets of railroad companies are generally long-lived, and revenues are mainly domestic. This explains the reliance on long-term fixed rate, dollar-denominated debt.

Problem 15.

a. Timberland should have debt that is longer term; the others might want to choose debt durations related to the absolute value of the slope coefficients, which are approximate measures of the durations of the firm's assets.

b. The variation might be due to estimation error. Differential marketing and production strategies might also explain the difference. Firms that are high beta are also likely to have high interest rate sensitivities. Using the average would be a way of dealing with estimation error.

Problem 16.

a. I would suggest debt of medium duration, given the estimate of duration estimate of 3.87 for Motorola's assets. The last regression suggests that a significant portion of Motorola's cashflows are D-Mark denominated. This would suggest that some of Motorola's debt be denominated in D-Marks as well. The sensitivity to business cycles indicated by the GNP regression coefficient. A lower coupon rate would be useful as a shield against the implied higher bankruptcy risk. This might be achieved by making the debt convertible. Alternatively, a floating coupon rate could be used with the coupon adjusted annually. On the other hand, the higher inflation rate suggests a lower ability to pay when the nominal rate is pushed up by higher inflation. This contradicts the previous suggestion, to some extent.

b. I would make the debt convertible into stock. When the high-technology sector is doing well, and Motorola as well, the value of the debt will rise due to its convertibility. This will also have the advantage of reducing debt-service pressures at a time when Motorola might want to invest more in this sector.

Problem 17.

Convertible debt would be appropriate. Flexibility is important; hence, there should not be too many covenants.

Problem 18.

Agency costs are minimized for such businesses. Furthermore, they are likely to be quite stable. Hence, fixed rate, long maturity, dollar-denominated bonds are optimal.

Problem 19. Bonds indexed to inflation would be appropriate. Floating rate bonds would achieve the same effect. Another possibility is for the coupon rate to be indexed to commodity prices.

Problem 20. One reason would be to take advantage of their reputation in local markets. The currency risk can then be hedged in the foreign exchange markets or through a swap.

Problem 21. This is a fallacious argument because the short-term debt will have to be refinanced. The CEO is, therefore, increasing his refinancing risk.

Problem 22.

I would concur. Since the market is apparently overestimating the firm's cash flow volatility, the market would also overestimate the value of the convertibility option.

Problem 23. Obviously, warrants are not useful if the funds are needed right away. However, if the firm needs seed money now, with potentially higher needs in the future if the initial research should prove favorable, then warrants would be indicated.

