

## Chapter 20

20-1

a. There are a number of ways in which BMD can increase its debt ratio

1. It can borrow \$1.15 billion and buy back stock.
2. It can borrow \$1.15 billion and pay special dividends.
3. It can borrow more than \$1.15 billion and take projects over time, in which case its optimal dollar debt will be higher.

For instance, if the money is borrowed now to take projects, the debt needed can be estimated approximately:  $X/(2,300+X) = 0.5$ , Solving for X,  $X = 2,300$ .

b. From the viewpoint of the effect on equity, there is no difference between repurchasing stock and paying a special dividend. There may be a tax difference to the recipient, since dividends and capital gains are taxed differently.

c. If BMD has a cash balance of \$250 million, it can use this cash to buy back stock. BMD, therefore, needs to borrow only \$1.025 billion to get to 50%.

20-2

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 Appreciation	11.55%	11.53%	11.52%	11.51%	11.50%	11.49%

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.

20-3

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%
Div Yld	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.

20-4

a. Current Return on Capital =  $EBIT(1-t)/(BV:D+E) = 300(1-.4) / (1,000 + 2,000) = 6.00\%$

Current Cost of Equity =  $7\% + 1.30(5.5\%) = 14.15\%$

Cost of Capital =  $14.15\%(4,000/5,000) + 8\%(1-.4)(1,000/5,000) = 12.28\%$

Given that the return on capital is less than the cost of capital, DGF Corporation should try to increase its debt ratio by buying back stock or paying dividends, unless it expects future projects to earn more than its expected cost of capital (11.28%) - i.e, 1% less than the current cost of capital.

b. I would consider future investment opportunities and the volatility of operating income in making this decision. If I expect future projects to be better than existing projects, I would be more inclined toward recommending borrowing money / taking projects.

20-5

To advise TL Corporation on designing debt, I would need to get information on the types of assets/projects that they plan to finance with the debt.

In particular, I would need to know the following:

1. Are the projects short-term or long-term?
2. What is the pattern of cash flows on these projects?
3. Are these cash flows stable or volatile?
4. What currency will these cash flows be in?
5. What other factors (economy, industry-specific facts) affect cash flows?

20-6

a. Given that the projects are long-term and require large initial investments, I would suggest long-term debt.

b. Since the cash flows are in the local currencies, I would suggest that the debt also be in local currencies.

c. Since future cash flows will depend upon the growth of the emerging markets, I would be more likely to use convertible debt.

20-7

Year	Equity	Debt	Firm Value	Long Bond Rate	GNP Growth	Dollar	Inflation Rate
1985	\$1,825	\$436	\$2,261	11.40%	6.44%	125.95	3.50%
1986	\$2,261	\$632	\$2,893	9.00%	5.40%	112.89	1.90%
1987	\$2,390	\$795	\$3,185	9.40%	6.90%	95.88	3.70%
1988	\$1,961	\$655	\$2,616	9.70%	7.89%	95.32	4.10%
1989	\$2,260	\$836	\$3,096	9.30%	7.23%	102.26	4.80%
1990	\$1,876	\$755	\$2,631	9.30%	5.35%	96.25	5.40%
1991	\$2,010	\$795	\$2,805	8.80%	2.88%	98.82	4.20%
1992	\$2,589	\$833	\$3,422	8.10%	6.22%	104.58	3.00%
1993	\$3,210	\$649	\$3,859	7.20%	5.34%	105.22	3.00%
1994	\$3,963	\$1,053	\$5,016	8.00%	5.97%	98.6	2.60%

a. To estimate the duration, we regress changes in firm value against changes in the long bond rate.

Year	Change in Firm Value	Change in Long Bond Rate
1986	27.95%	-2.40%
1987	10.09%	0.40%
1988	-17.86%	0.30%
1989	18.35%	-0.40%
1990	-15.02%	0.00%
1991	6.61%	-0.50%
1992	22.00%	-0.70%
1993	12.77%	-0.90%
1994	29.98%	0.80%

Change in Firm Value = 0.08 - 6.51 (Change in Long Bond Rate)

The t statistics for the slope coefficient is only 1.01; it is not statistically significant.

The estimate of the duration is 6.5 years.

b. To estimate the cyclicity, we regress changes in firm value against GNP growth rates.

Year	Change in Firm GNP	
	Value	Growth
1986	27.95%	6.44%
1987	10.09%	5.40%
1988	-17.86%	6.90%
1989	18.35%	7.89%
1990	-15.02%	7.23%
1991	6.61%	5.35%
1992	22.00%	2.88%
1993	12.77%	6.22%
1994	29.98%	5.34%

Change in Firm Value = 0.38 - 4.68 (GNP Growth)

The t statistic on the slope coefficient is 1.15

While the regression suggests that the firm is counter-cyclical, the t statistic is not statistically significant.

c. To estimate the sensitivity of firm value to exchange rates, regress changes in firm value against changes in weighted dollar.

Year	Change in Firm Value	Change in Weighted Dollar
1986	27.95%	-10.37%
1987	10.09%	-15.07%
1988	-17.86%	-0.58%
1989	18.35%	7.28%
1990	-15.02%	-5.88%
1991	6.61%	2.67%
1992	22.00%	5.83%
1993	12.77%	0.61%
1994	29.98%	-6.29%

Change in Firm Value = 0.10 - 0.03 (Change in Weighted Dollar)

The t statistic is close to zero.

The firm's value is unaffected by changes in exchange rates.

d. To estimate the sensitivity of firm value to inflation rates, regress changes in firm value against changes in inflation rates.

Year	Change in Firm Value	Change in Inflation Rate
1986	27.95%	-1.60%
1987	10.09%	1.80%
1988	-17.86%	0.40%
1989	18.35%	0.70%
1990	-15.02%	0.60%
1991	6.61%	-1.20%
1992	22.00%	-1.20%
1993	12.77%	0.00%
1994	29.98%	-0.40%

Change in Firm Value = 0.10 - 6.84 (Change in Inflation Rate)

Again, while the results suggest that the firm's value is negatively affected by inflation, the t statistic is only 1.30.

e. On all of these regressions, there is considerable noise in the estimates. If the results from these regressions deviate significantly from industry averages, I would use the

industry averages. In addition, if I knew that the firm was planning to enter into new businesses, I would factor these into my analysis.

20-8

a. To estimate the duration, we regress changes in Op. income against changes in the long bond rate.

Year	Change in OI	Change in Long Bond Rate
1986	-11.09%	-2.40%
1987	17.23%	0.40%
1988	12.84%	0.30%
1989	1.10%	-0.40%
1990	-17.42%	0.00%
1991	-25.05%	-0.50%
1992	21.05%	-0.70%
1993	36.96%	-0.90%
1994	43.03%	0.80%

Change in Firm Value = 0.12 + 9.25 (Change in Long Bond Rate)

The t statistics for the slope coefficient is only 1.04; it is not statistically significant.

A positive coefficient would suggest a short duration.

b. To estimate the cyclical, we regress changes in firm value against GNP growth rates.

Year	Change in OI	GNP Growth
1986	-11.02%	6.44%
1987	17.23%	5.40%
1988	12.84%	6.90%
1989	1.10%	7.89%
1990	-17.42%	7.23%
1991	-25.05%	5.35%
1992	21.05%	2.88%
1993	36.96%	6.22%
1994	43.03%	5.34%

Change in Firm Value = 0.40 - 5.25 (GNP Growth)

The t statistic on the slope coefficient is 0.90

While the regression suggests that the firm is counter-cyclical, the t statistic is not statistically significant.

c. To estimate the sensitivity of firm value to exchange rates, regress changes in firm value against changes in weighted dollar.

Year	Change in OI	Change in Weighted Dollar
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1986	-11.02%	-10.37%
1987	17.23%	-15.07%
1988	12.84%	-0.58%
1989	1.10%	7.28%
1990	-17.42%	-5.88%
1991	-25.05%	2.67%
1992	21.05%	5.83%
1993	36.96%	0.61%
1994	43.03%	-6.29%

Change in Firm Value = 0.09 - 0.10 (Change in Weighted Dollar)

The t statistic is close to zero.

The firm's operating income is unaffected by changes in exchange rates.

d. To estimate the sensitivity of firm value to inflation rates, regress changes in firm value against changes in inflation rates.

Year	Change in Firm Value	Change in Inflation Rate
1986	-11.02%	-1.60%
1987	17.23%	1.80%
1988	12.84%	0.40%
1989	1.10%	0.70%
1990	-17.42%	0.60%
1991	-25.05%	-1.20%
1992	21.05%	-1.20%
1993	36.96%	0.00%
1994	43.03%	-0.40%

Change in Firm Value = 0.09 +4.05 (Change in Inflation Rate)

While the results suggest that operating income is positively affected by inflation, the t statistic is only 0.51.

e. On all of these regressions, there is considerable noise in the estimates. If the results from these regressions deviate significantly from industry averages, I would use the industry averages. In addition, if I knew that the firm was planning to enter into new businesses, I would factor these into my analysis.

20-9

When the regression analysis is done with both operating income and firm value as dependent variables, there might be different results from each.

The reasons for the differences are as follows:

a. Operating income might be smoothed out, whereas firm value is not.

b. Firm value reflects changes not only in operating income but also in discount rates and expected future growth. I would be more inclined to use firm value to measure duration and sensitivity to economic factors. I would use operating income to examine sensitivity to inflation, especially if floating rate debt is to be issued.

20-10

a. Given that there are significant anti-takeover restrictions in the corporate charter, and assuming that management is not under stockholder pressure, I would argue that Pfizer can move to its optimal gradually rather than quickly.

b. Return on Capital =  $2000 (1-.4) / 8000 = 15.00\%$

This return on capital is greater than the cost of capital. If Pfizer can earn similar returns on capital on new projects, I would recommend taking projects, rather than buying back stock or paying dividends.

c. If Pfizer is planning to acquire another company with its excess debt capacity, I would have the following concerns:

1. If it plans to acquire another firm of equivalent risk in health care, my primary concern would be whether it can earn more than its cost of capital on the acquired firm - i.e., it might pay more than fair market value, even after allowing for synergy.

2. If it plans to acquire a firm in another business, in addition to the overpayment concern I would be worried about whether the optimal computed would still continue to hold - if the acquired firm is much riskier, it may alter the optimal.

20-11

a. Since Upjohn is a potential takeover target, I would suggest moving to the optimal debt ratio quickly.

b. Cost of Equity =  $6.50\% + 1.17 (5.5\%) = 12.94\%$

While the current return on equity > current cost of equity, the decline in the return on equity would suggest a greater emphasis on stock buybacks and dividends.

20-12

I would expect steel companies in emerging countries to use far less debt than their mature U.S. counterparts. In addition, I would expect these companies to use convertible debt rather than straight debt.

20-13

a. Given that firm value is negatively affected by changes in interest rates, and that the regression suggests that the duration of the debt should be 6.33 years, I would argue that Bethlehem Steel should have debt with a maturity greater than a year.

b. It might make sense, however, for Bethlehem Steel to use short term debt to finance long term projects, if:



- (1) they believe that they are much less risky than the market assesses them to be (bond ratings, betas.)
- (2) they anticipate changing their business mix in the near future and enter different businesses.
- (3) they believe that they can forecast changes in the term structure better than other market participants.

20-14

The assets that are purchased with the debt tend to have long lives and produce cash flows over decades -> hence the debt is long-term.

The cash flows tend to be fairly stable over time -> hence fixed-rate debt

The investments tend to be in the United States, with cash flows in dollars - hence, dollar denominated.

20-15

a. It can be argued that the slope coefficient is a measure of the duration of the assets owned by these firms; hence, it can determine the duration of the debt.

b. The slope coefficients are estimated with substantial noise; I would use the average across all 6 firms as my measure of duration for each of them.

Average Slope Coefficient = -8.93

20-16

a. Based upon the regressions, I would argue that Motorola's assets

1. have a duration of about 4 years
2. are cyclical, since firm value moves with the economy
3. are negatively affected by changes in inflation rates.
4. are negatively affected by a weaker dollar

I would design medium-term, fixed-rate debt, with an average duration of 4 years.

b. I would consider adding a call option to the debt which is linked to a high-technology stock index. Thus, when high technology stocks do well, the debt will become more valuable.