

Problems and Questions

1. Plastico, a manufacturer of consumer plastic products, is evaluating its capital structure. The balance sheet of the company is as follows (in millions):

<i>Assets</i>		<i>Liabilities</i>	
Fixed assets	\$4,000	Debt	\$2,500
Current assets	\$1,000	Equity	\$2,500

In addition, you are provided the following information:

- The debt is in the form of long-term bonds, with a coupon rate of 10%. The bonds are currently rated AA and are selling at a yield of 12% (the market value of the bonds is 80% of the face value).
- The firm currently has 50 million shares outstanding, and the current market price is \$80 per share. The firm pays a dividend of \$4 per share and has a price/earnings ratio of 10.
- The stock currently has a beta of 1.2. The riskfree rate is 8%.
- The tax rate for this firm is 40%.
 - a. What is the debt/equity ratio for this firm in book value terms? In market value terms?
 - b. What is the debt/(debt + equity) ratio for this firm in book value terms? In market value terms?
 - c. What is the firm's after-tax cost of debt?
 - d. What is the firm's cost of equity?
 - e. What is the firm's current cost of capital?

2. Now assume that Plastico is considering a project that requires an initial investment of \$100 million and has the following projected income statement (depreciation for the project is expected to be \$5 million a year forever.):

EBIT	\$20 million
– Interest	\$4 million
EBT	\$16 million
Taxes	\$6.40 million
Net income	\$9.60 million

This project is going to be financed at the same debt/equity ratio as the overall firm and is expected to last forever. Assume that there are no principal repayments on the debt (it too is perpetual).

- a. Evaluate this project from the equity investors' standpoint. Does it make sense?
- b. Evaluate this project from the firm's standpoint. Does it make sense?
- c. In general, when would you use the cost of equity as your discount rate/benchmark?
- d. In general, when would you use the cost of capital as your benchmark?
- e. Assume, for economies of scale, that this project is going to be financed entirely with debt. What would you use as your cost of capital for evaluating this project?

3. Plastico is considering a major change in its capital structure. It has three options:

- *Option 1:* Issue \$1 billion in new stock and repurchase half of its outstanding debt. This will make it an AAA-rated firm (AAA rated debt is yielding 11% in the marketplace).
 - *Option 2:* Issue \$1 billion in new debt and buy back stock. This will drop its rating to A-. (A- rated debt is yielding 13% in the marketplace).
 - *Option 3:* Issue \$3 billion in new debt and buy back stock. This will drop its rating to CCC (CCC rated debt is yielding 18% in the marketplace).
- a. What is the cost of equity under each option?
 - b. What is the after-tax cost of debt under each option?
 - c. What is the cost of capital under each option?
 - d. What would happen to (i) the value of the firm; (ii) the value of debt and equity; and (iii) the stock price under each option if you assume rational stockholders?
 - e. From a cost of capital standpoint, which of the three options would you pick, or would you stay at your current capital structure?
 - f. What role (if any) would the variability in Plastico's income play in your decision?
 - g. How would your analysis change (if at all) if the money under the three options were used to take new investments (instead of repurchasing debt or equity)?

- h. What other considerations (besides minimizing the cost of capital) would you bring to bear on your decision?
- i. Intuitively, why doesn't the higher rating in option 1 translate into a lower cost of capital?

4. Plastico is interested in how it compares with its competitors in the same industry.

	<i>Plastico</i>	<i>Competitors</i>
Debt/Equity Ratio	50%	25%
Variance in EBITDA	20%	40%
EBITDA/MV of firm	25%	15%
Tax rate	40%	30%
R&D/sales	2%	5%

- a. Taking each of these variables, explain at an intuitive level whether you would expect Plastico to have more or less debt than its competitors and why.
- b. You have also run a regression of debt/equity ratios against these variables for all the firms on the NYSE and have come up with the following regression equation:

$$D/E = 0.10 - 0.5 (\text{Variance in EBITDA}) + 2.0 (\text{EBITDA/MV}) + 0.4 (\text{Tax Rate}) + 2.5 (\text{R\&D/Sales})$$
 (All inputs to the regression were in decimals, i.e., 20% was inputted as 0.20.)
 Given this cross-sectional relationship, what would you expect Plastico's debt/equity ratio to be?

5. As CEO of a major corporation, you have to make a decision on how much you can afford to borrow. You currently have 10 million shares outstanding, and the market price per share is \$50. You also currently have about \$200 million in debt outstanding (market value). You are rated as a BBB corporation now.

- Your stock has a beta of 1.5 and the riskfree rate is 8%.
- Your marginal tax rate is 46%.
- You estimate that your rating will change to a B if you borrow \$100 million. The BBB rate now is 11%. The B rate is 12.5%.

- a. Given the marginal costs and benefits of borrowing the \$100 million, should you go ahead with it ?
- b. What is your best estimate of the weighted average cost of capital with and without the \$100 million in borrowing ?
- c. If you borrow the \$100 million, what will the price per share be after the borrowing?
- d. Assume that you have a project that requires an investment of \$100 million. It has expected before-tax revenues of \$50 million and costs of \$30 million a year in perpetuity. Is this a desirable project by your criteria? Why or why not?
- e. Does it make a difference in your decision if you were told that the cash flows from the project in **d** are certain?

6. You have been hired as a management consultant by AD Corporation to evaluate whether it has an appropriate amount of debt (the company is worried about a leveraged buyout). You have collected the following information on AD's current position:

- There are 100,000 shares outstanding at \$20/share. The stock has a beta of 1.15.
- The company has \$500,000 in long-term debt outstanding and is currently rated BBB. The current market interest rate is 10% on BBB bonds and 6% on treasury bonds.
- The company's marginal tax rate is 40%.

You proceed to collect the data on what increasing debt will do to the company's ratings:

Additional Debt*	New Rating	Interest Rate
\$500,000	BB	10.5
\$1,000,000	B	11.5
\$1,500,000	B-	13.5
\$2,000,000	C	15

*In addition to the existing debt of \$500,000.

- a. How much additional debt should the company take on?
- b. What will the price per share be after the company takes on new debt? (You can assume a 2% growth rate in perpetuity)
- c. What is the WACC before and after the additional debt?

d. Assume that you are considering a project that has the following earnings in perpetuity and is of comparable risk to existing projects.

Revenues/year	\$1,000,000
Cost of goods sold	\$400,000 (includes depreciation of \$100,000)
EBIT	\$600,000
Debt payments	\$100,000 (all interest payments)
Taxable Income	\$500,000
Tax	\$200,000
After-tax profit	\$300,000

If this project requires an investment of \$3,000,000, what is its NPV?

7. UB is examining its capital structure with the intent of arriving at an optimal debt ratio. It currently has no debt and has a beta of 1.5. The riskless interest rate is 9%. Your research indicates that the debt rating will be as follows at different debt levels:

$D/(D + E)$	Rating	Interest Rate
0%	AAA	10%
10%	AA	10.5%
20%	A	11%
30%	BBB	12%
40%	BB	13%
50%	B	14%
60%	CCC	16%
70%	CC	18%
80%	C	20%
90%	D	25%

The firm currently has 1 million shares outstanding at \$20 per share (tax rate = 40%).

- What is the firm's optimal debt ratio?
- Assuming that the firm restructures by repurchasing stock with debt, what will the value of the stock be after the restructuring? (Assume a 5% growth rate in perpetuity)

8. GenCorp, an automotive parts manufacturer, currently has \$25 million in outstanding debt and has 10 million shares outstanding. The book value per share is \$10, and the market value is \$25. The company is currently rated A, its bonds have a yield to maturity of 10%, and the current beta of the stock is 1.06. The riskfree rate is 8% now, and the company's tax is 40%.

- a. What is the company's current weighted average cost of capital?
- b. The company is considering a repurchase of 4 million shares at \$25 per share with new debt. It is estimated that this will push the company's rating down to a B (with a yield to maturity of 13%). What will the company's WACC be after the stock repurchase?

9. You have been called in as a consultant for Herbert's a sporting goods retail firm, which is examining its debt policy. The firm currently has a balance sheet as follows:

<i>Liability</i>		<i>Assets</i>	
LT Bonds	\$100	Fixed assets	\$300
Equity	\$300	Current assets	\$100
Total	\$400	Total	\$400

The firm's income statement is as follows:

Revenues	\$250
Cost of Goods Sold (cogs)	\$175
Depreciation	\$25
EBIT	\$50
Long-term interest	\$10
EBT	\$40
Taxes	\$16
Net Income	\$24

The firm currently has 100 shares outstanding, selling at a market price of \$5 per share and the bonds are selling at par. The firm's current beta is 1.12, and the riskfree rate is 7%.

- a. What is the firm's current cost of equity?
- b. What is the firm's current cost of debt?
- c. What is the firm's current weighted average cost of capital?

- a. Assume that management of Herbert's is considering doing a debt-equity swap (i.e., borrowing enough money to buy back seventy shares of stock at \$5 per share). It is believed that this swap will lower the firm's rating to C and raise the interest rate on the company's debt to 15%.
- d. What is the firm's new cost of equity?
- e. What is the effective tax rate (for calculating the after-tax cost of debt) after the swap?
- f. What is the firm's new cost of capital?

10. Terck, a leading pharmaceutical company, currently has a balance sheet that is as follows:

<i>Liability</i>		<i>Assets</i>	
Long-term bonds	\$1,000	Fixed assets	\$1,700
Equity	\$1,000	Current assets	\$300
Total	\$1,000	Total	\$1,000

The firm's income statement looks as follows:

Revenues	\$1,000
Cost of Goods Sold (COGS)	\$400
Depreciation	\$100
EBIT	\$500
Long-term interest expense	\$100
EBT	\$400
Taxes	\$200
Net income	\$200

The firm's bonds are all twenty-year bonds with a coupon rate of 10% that are selling at 90% of face value (the yield to maturity on these bonds is 11%). The stocks are selling at a P/E ratio of 9 and have a beta of 1.25. The riskfree rate is 6%.

- a. What is the firm's current cost of equity?
- b. What is the firm's current after-tax cost of debt?
- c. What is the firm's current weighted average cost of capital?

Assume that management of Terck, which is very conservative, is considering doing an equity-for-debt swap (i.e., issuing \$200 more of equity to retire \$200 of debt). This action is expected to lower the firm's interest rate by 1%.

- d. What is the firm's new cost of equity?
- e. What is the new WACC?
- f. What will the value of the firm be after the swap?

11. You have been asked to analyze the capital structure of DASA, an environmental waste disposal firm, and make recommendations on a future course of action. DASA has 40 million shares outstanding, selling at \$20 per share, and a debt/equity ratio (in market value terms) of 0.25. The beta of the stock is 1.15, and the firm currently has a AA rating, with a corresponding market interest rate of 10%. The firm's income statement is as follows:

EBIT	\$150 million
Interest expenses	\$20 million
Taxable income	\$130 million
Taxes	\$52 million
Net income	\$78 million

The current riskfree rate is 8%.

- a. What is the firm's current WACC?
- b. The firm is proposing borrowing an additional \$200 million in debt and repurchasing stock. If it does so, its rating will decline to A, with a market interest rate of 11%. What will the WACC be if they make this move?
- c. What will the new stock price be if the firm borrows \$200 million and repurchases stock (assuming rational investors)?
- d. Now assume that the firm has another option to raise its debt/equity ratio (instead of borrowing money and repurchasing stock). It has considerable capital expenditures planned for the next year (\$150 million). The company also currently pays \$1 in dividends per share. If the company finances all its capital expenditures with debt and doubles its *dividend yield* from the current level for the next year, what would you expect the debt/equity ratio to be at the end of the next year?

12. You have been asked by JJ Corporation, a California-based firm that manufactures and services digital satellite TV systems, to evaluate its capital structure. They currently have 70 million shares outstanding trading at \$10 per share. In addition, the company has

500,000 convertible bonds, with a coupon rate of 8%, trading at \$1000 per bond. JJ is rated BBB and the interest rate on BBB straight bonds is currently 10%. The beta for the company is 1.2, and the current risk-free rate is 6%. The tax rate is 40%.

- a. What is the firm's current debt/equity ratio?
- b. What is the firm's current weighted average cost of capital?

JJ Corporation is proposing to borrow \$250 million and use it for the following purposes:

- Buy back \$100 million worth of stock.
- Pay \$100 million in dividends.
- Invest \$50 million in a project with a NPV of \$25 million.

The effect of this additional borrowing will be a drop in the bond rating to B, which currently carries an interest rate of 11%.

- c. What will the firm's cost of equity be after this additional borrowing?
- d. What will the firm's weighted average cost of capital be after this additional borrowing?
- e. What will the value of the firm be after this additional borrowing?

13. Pfizer, one of the largest pharmaceutical companies in the United States, is considering what its debt capacity is. In March 1995, Pfizer had an outstanding market value of equity of \$24.27 billion, debt of \$2.8 billion, and a AAA rating. Its beta was 1.47, and it faced a marginal corporate tax rate of 40%. The Treasury bond rate at the time of the analysis was 6.50%, and AAA bonds trade at a spread of 0.30% over the treasury rate.

- a. Estimate the current cost of capital for Pfizer.
- b. It is estimated that Pfizer will have a BBB rating if it moves to a 30% debt ratio and that BBB bonds have a spread of 2% over the Treasury rate. Estimate the cost of capital if Pfizer moves to its optimal.
- c. Assuming a constant growth rate of 6% in the firm value, how much will firm value change if Pfizer moves its optimal? What will the effect be on the stock price?
- d. Pfizer has considerable R&D expenses. Will this fact affect whether Pfizer takes on the additional debt?

14. Upjohn, another major pharmaceutical company, is also considering whether it should borrow more. It has \$664 million in book value of debt outstanding and 173 million shares outstanding at \$30.75 per share. The company has a beta of 1.17, and faces a tax rate of 36%. The Treasury bond rate is 6.50%.

- a. If the interest expense on the debt is \$55 million, the debt has an average maturity of ten years, and the company is currently rated AA– (with a market interest rate of 7.50%), estimate the market value of the debt.
- b. Estimate the current cost of capital.
- c. It is estimated that if Upjohn moves to its optimal debt ratio, and no growth in firm value is assumed, the value per share will increase by \$1.25. Estimate the cost of capital at the optimal debt ratio.

15. Bethlehem Steel, one of the oldest and largest steel companies in the United States, is considering the question of whether it has any excess debt capacity. The firm has \$527 million in market value of debt outstanding and \$1.76 billion in market value of equity. The firm has earnings before interest and taxes of \$131 million and faces a corporate tax

rate of 36%. The company's bonds are rated BBB, and the cost of debt is 8%. At this rating, the firm has a probability of default of 2.30%, and the cost of bankruptcy is expected to be 30% of firm value.

- a. Estimate the unlevered value of the firm.
- b. Estimate the levered value of the firm, using the APV approach, at a debt ratio of 50%. At that debt ratio, the firm's bond rating will be CCC, and the probability of default will increase to 46.61%.

16. Kansas City Southern, a railroad company, had debt outstanding of \$985 million and 40 million shares trading at \$46.25 per share in March 1995. It earned \$203 million in EBIT, and faced a marginal tax rate of 36.56%. The firm was interested in estimating its optimal leverage using the APV approach. The following table summarizes the estimated bond ratings and probabilities of default at each level of debt from 0% to 90%.

<i>Debt Ratio</i>	<i>Bond Rating</i>	<i>Probability of Default</i>
0%	AAA	0.28%
10%	AAA	0.28%
20%	A-	1.41%
30%	BB	12.20%
40%	B-	32.50%
50%	CCC	46.61%
60%	CC	65.00%
70%	C	80.00%
80%	C	80.00%
90%	D	100.00%

The direct and indirect bankruptcy costs are estimated to be 25% of the firm value. Estimate the optimal debt ratio of the firm, based on levered firm value.

17. In 1995, an analysis of the capital structure of Reebok provided the following results on the cost of capital and firm value.

	<i>Actual</i>	<i>Optimal</i>	<i>Change</i>
Debt ratio	4.42%	60.00%	55.58%
Beta for the stock	1.95	3.69	1.74
Cost of equity	18.61%	28.16%	9.56%
Bond rating	A-	B+	
After-tax cost of debt	5.92%	6.87%	0.95%

Cost of capital	18.04%	15.38%	-2.66%
Firm value (with no growth)	\$3,343 million	\$3,921 million	\$578 million
Stock price	\$39.50	\$46.64	\$7.14

This analysis was based on the 1995 EBIT of \$420 million and a tax rate of 36.90%.

- a. Why is the optimal debt ratio for Reebok so high?
- b. What might be some of your concerns in moving to this optimal?

18. You are trying to evaluate whether United Airlines (UAL) has any excess debt capacity. In 1995, UAL had 12.2 million shares outstanding at \$210 per share and debt outstanding of approximately \$3 billion (book as well as market value). The debt had a rating of B, and carried a market interest rate of 10.12%. In addition, the firm had leases outstanding, with annual lease payments anticipated to be \$150 million. The beta of the stock is 1.26, and the firm faces a tax rate of 35%. The treasury bond rate is 6.12%.

- a. Estimate the current debt ratio for UAL.
- b. Estimate the current cost of capital.
- c. Based on 1995 operating income, the optimal debt ratio is computed to be 30%, at which point the rating will be BBB, and the market interest rate is 8.12%.
- d. Would the fact that 1995 operating income for airlines was depressed alter your analysis in any way? Explain why.

19. Intel has an EBIT of \$3.4 billion and faces a marginal tax rate of 36.50%. It currently has \$1.5 billion in debt outstanding, and a market value of equity of \$51 billion. The beta for the stock is 1.35, and the pretax cost of debt is 6.80%. The Treasury bond rate is 6%. Assume that the firm is considering a massive increase in leverage to a 70% debt ratio, at which level the bond rating will be C (with a pretax interest rate of 16%).

- a. Estimate the current cost of capital.
- b. Assuming that all debt gets refinanced at the new market interest rate, what would your interest expenses be at 70% debt? Would you be able to get the entire tax benefit? Why or why not?

- c. Estimate the beta of the stock at 70% debt, using the conventional levered beta calculation. Reestimate the beta, on the assumption that C rated debt has a beta of 0.60. Which one would you use in your cost of capital calculation?
- d. Estimate the cost of capital at 70% debt.
- e. What will happen to firm value if Intel moves to a 70% debt ratio?
- f. What general lessons on capital structure would you draw for other growth firms?

20. NYNEX, the phone utility for the New York City area, has approached you for advice on its capital structure. In 1995, NYNEX had debt outstanding of \$12.14 billion and equity outstanding of \$20.55 billion. The firm had an EBIT of \$1.7 billion and faced a corporate tax rate of 36%. The beta for the stock is 0.84, and the bonds are rated A– (with a market interest rate of 7.5%). The probability of default for A– rated bonds is 1.41%, and the bankruptcy cost is estimated to be 30% of firm value.

- a. Estimate the unlevered value of the firm.
- b. Value the firm, if it increases its leverage to 50%. At that debt ratio, its bond rating would be BBB and the probability of default would be 2.30%.
- c. Assume now that NYNEX is considering a move into entertainment, which is likely to be both more profitable and riskier than the phone business. What changes would you expect in the optimal leverage?

21. A small, private firm has approached you for advice on its capital structure decision. It is in the specialty retailing business, and it had an EBIT last year of \$500,000.

- The book value of equity is \$1.5 million, but the estimated market value is \$6 million.
- The firm has \$1 million in debt outstanding and paid an interest expense of \$80,000 on the debt last year. (Based on the interest coverage ratio, the firm would be rated AA, and would be facing an interest rate of 8.25%.)
- The equity is not traded, but the average beta for comparable traded firms is 1.05, and their average debt/equity ratio is 25%.
 - a. Estimate the current cost of capital for this firm.
 - b. Assume now that this firm doubles its debt from \$1 million to \$2 million and that the interest rate at which it can borrow increases to 9%. Estimate the new cost of capital and the effect on firm value.

- c. You also have a regression that you have run of debt ratios of publicly traded firms against firm characteristics:

$$\text{DBTFR} = 0.15 + 1.05 (\text{EBIT}/\text{Firm Value}) - 0.10 (\text{Beta})$$

Estimate the debt ratio for the private firm, based on this regression.

- d. What are some of the concerns you might have in extending the approaches used by large publicly traded firms to estimate optimal leverage to smaller firms?
- e. 22. XCV Inc., which manufactures automobile parts for assembly, is considering the costs and the benefits of leverage. The CFO notes that the return on equity of the firm, which is only 12.75% now based on the current policy of no leverage, could be increased substantially by borrowing money. Is this true? Does it follow that the value of the firm will increase with leverage? Why or why not?