Chapter 8 Leverage

The objectives of this chapter are to enable you to:

- *Evaluate risk from accounting statement data*
- *Distinguish between operating and financial risk*
- *Measure the impact of leverage on earnings variability and risk*

8.A: INTRODUCTION

Corporate earnings variability can be traced to two sources: business risk and financial risk. Business risk is the risk the firm faces by operating; its sources are variability or uncertainty of sales and cost of goods sold levels as well as operating leverage. Operating leverage is related to the fixed costs the firm incurs in the production processes. Financial risk is related to the additional earnings variability a firm faces when it pays interest on borrowed money.

8.B: BUSINESS RISK

Business risk is related to the risk of a firm's investment policy. This risk will be reflected in the variability (or uncertainty) of its revenue and cost levels. Note that this risk is entirely independent of the firm's financing policy; however, financing policy can magnify the impact of business risk on earnings variability.

The first source of business risk is variability or uncertainty with respect to sales levels. If a firm's future revenue levels are uncertain, net income after taxes (NIAT) will obviously be more difficult to forecast. A second source of business risk is uncertainty regarding the proportion of sales reflected in the firm's cost of goods sold level. This source of risk will be reflected in the variability of the firm's gross margin levels. The third source of business risk results from operating leverage. One measure of this risk, the degree of operating leverage, is equal to the firm's gross profit margin divided by its earnings before interest and taxes (EBIT):

(1) $$DOL = \frac{GM}{EBIT} = \frac{GM}{Sales - CGS - FC} = \frac{EBIT + FC}{EBIT}$$

Degree of Operating Leverage (DOL) may be measured on the basis of either past income statement data or expected income statement data. If management is attempting to determine profit variability from expected levels, it should use expected values for determining DOL (see Figures 1 and 2). If the firm wishes to determine potential variability from the previous year's profit level, management should determine DOL based on that year's income statement. The higher the level of the fixed costs faced by the firm, the higher will be its degree

of operating leverage. For example, the Monroe Company in Figure 1 operates with no fixed costs; therefore, its DOL is equal to one. The Adams Company in Figure 2 has a DOL level equal to 1.75. Notice that both companies have exactly the same sales prospects in any possible outcome; however, since a greater proportion of the Adams Company costs are fixed, its earnings (NIAT) and return-on-equity are subject to greater variability ($\sigma_{Adams} > \sigma_{Monroe}$). Thus, operating leverage simply magnifies the impact of sales variability on NIAT and ROE variability. For a firm operating without debt, a proportional change in sales will affect a proportional change in NIAT directly related to the firm's degree of operating leverage:

(2) $$\%\Delta NIAT = DOL \times \%\Delta Sales$$

Thus, a proportional change in Monroe Company sales leads to an identical proportional change in NIAT; a proportional change in the Adam Company sales level leads to 1.75 times as great a proportional change in its NIAT. This implies that a firm expecting unusually high sales levels may prefer to maintain a high level of fixed costs relative to variable costs (cost of goods sold); the resulting higher DOL level will cause the high sales level to increase NIAT even more. Conversely, a firm expecting an unusually low sales level may prefer to maintain a lower level of DOL, causing the low sales level to have a smaller unfavorable impact on NIAT. A firm with an uncertain sales level will find that increasing operating leverage will increase further its earnings variability.

Potential Monroe Income Statement Data

Outcome1		**Outcome 2**		**Expected Levels**	
Sales	$10,000,000	Sales	$20,000,000	Sales	$15,000,000
CGS (60%)	6,000,000	CGS (60%)	12,000,000	CGS (60%)	9,000,000
Gross Margin	4,000,000	Gross Margin	8,000,000	Gross Margin	6,000,000
FC	0	FC	0	FC	0
EBIT	4,000,000	EBIT	8,000,000	EBIT	6,000,000
INT	0	INT	0	INT	0
EBT	4,000,000	EBT	8,000,000	EBT	6,000,000
Taxes(30%)	1,200,000	Taxes(30%)	2,400,000	Taxes(30%)	1,800,000
NIAT	2,800,000	NIAT	5,600,000	NIAT	4,200,000
#Shs: 10,000		#Shs: 10,000		#Shs: 10,000	
EPS: $280		EPS: $560		EPS: $420	

Note: Each outcome is equally likely to occur; that is, $P_1 = P_2 = .5$

Current Monroe Company Balance Sheet

Current Assets:	$10,000,000	Debt:	$0
Fixed Assets:	$18,000,000	Equity:	$28,000,000
Total Assets:	$28,000,000	Capital:	$28,000,000

Various Monroe Company Earnings and Statistical Data

Current Share Value= $28,000,000/10,000=$2800

$NIAT_1$ =$2,800,000; $NIAT_2$ = $5,600,000; E(NIAT) = $4,200,000

ROE_1 = 2,800,000/28,000,000 = .10

ROE_2 = 5,600,000/28,000,000 = .20

E(ROE) = 4,200,000/28,000,000 = .15

$$\sigma_{ROE} = \sqrt{\sum_{i=1}^{n} (ROE_i - E[ROE])^2 \cdot P_1} = \sqrt{[(.10 - .150)^2 \cdot .5] + [(.20 - .15)^2 \cdot .5]} = .05$$

DOL = E(Sales-CGS)/E(EBIT) = (15,000,000-9,000,000)/6,000,000 = 1 = DOL_{Monroe}

$\%\Delta NIAT = DOL * \%\Delta Sales$; eg: 33% increase in NIAT results from a 33% increase Sales when INT=0

Figure 1 : Monroe Company Financial Data, Degree of Operating Leverage equal to one

Potential Adams Company Income Statement Data

Outcome1		**Outcome 2**		**Expected Levels**	
Sales.....	$10,000,000	Sales.....…….....	$20,000,000	Sales.….....	$15,000,000
CGS (30%).....	3,000,000	CGS (30%)……	6,000,000	CGS (30%)……	4,500,000
Gross Margin	7,000,000	Gross Margin....	14,000,000	Gross Margin..	10,500,000
FC.....….....	4,500,000	FC.....	4,500,000	FC.....….	4,500,000
EBIT.....…..	2,500,000	EBIT..... .	9,500,000	EBIT.....	6,000,000
Taxes(30%)..….	750,000	Taxes(30%)…….	2,850,000	Taxes(30%)……	1,800,000
NIAT.....…..	1,750,000	NIAT.....…..	6,650,000	NIAT.....…..	4,200,000
#Shs: 10,000		#Shs: 10,000		#Shs: 10,000	
EPS: $175		EPS: $665		EPS: $420	

Note: Each outcome is equally likely to occur; that is, $P_1 = P_2 = .5$

Current Adams Company Balance Sheet

Current Assets:	$10,000,000	Debt:	$0
Fixed Assets:	$18,000,000	Equity:	$28,000,000
Total Assets:	$28,000,000	Capital:	$28,000,000

Various Adams Company Earnings and Statistical Data

Current Share Value= $28,000,000/10,000=$2800

$NIAT_1$ =$1,750,000; $NIAT_2$ = $6,650,000; E(NIAT) = $4,200,000

ROE_1 = .062; ROE_2 = .238; E(ROE) = 4,200,000/28,000,000 = .15

$\sigma_{ROE} = .088 = \sigma_{ADAMS}$

DOL=(15,000,000-4,500,000)/6,000,000=1.75=DOL_{ADAMS}

$\%\Delta NIAT = DOL * \%\Delta Sales$; e.g., 58% increase in NIAT from its expected level results from a 33% in sales from its expected level when there is no debt

Figure 2: Adams Company Financial Data, Degree of Operating Leverage equal to 1.75

8.C: FINANCIAL RISK

Financial risk results from the financial policy employed by the firm. The borrowing of money by the firm results in the assumption of fixed interest obligations which must be fulfilled regardless of the profitability of the firm. Thus, interest obligations affect variability of the firm's earnings in the same manner as fixed costs. In fact, as the firm borrows more money, it assumes more fixed interest obligations, subjecting its earnings to increased variability or uncertainty. The relationship between earnings variability and the borrowing of money by the firm can be measured by its Degree of Financial Leverage:

$$(8.3)\quad DFL = \frac{EBIT}{EBT} = \frac{EBT + INT}{EBT}$$

The proportional change in profits induced by a proportional change in sales (holding fixed costs equal to zero) is directly related to the firm's DFL:

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(8.4) $\%\Delta \text{NIAT} = \text{DFL} \cdot \%\Delta \text{Sales}$

Consider the Van Buren Company whose financial data is portrayed in Figure 8.3 at the end of the chapter. Its sales and cost levels are identical to those of the Monroe Company in Figure 8.1. However, the Van Buren Company has financed fifty percent of its assets with debt; it has only half as much equity outstanding. Thus, the only differences between the two firms are their capital structures and resulting income statement effects arising from interest payments made by the Van Buren Company. Assumption of these interest payments by the Van Buren Company subjects its earnings to significantly greater variability :

$$(\sigma_{\text{VanBuren}} = .10) > (\sigma_{\text{Monroe}} = .05)$$

Thus, borrowing money increases a firm's earnings to an even higher level when sales levels are projected to be high; firm borrowing subjects earnings to even lower levels when sales are projected to be low.

The impact of debt on earnings variability can be demonstrated graphically. Consider Figure 8.4 at the end of the chapter where firm potential EPS levels are plotted against potential EBIT levels. The equation representing this relationship is:

(8.5) $$EPS = \frac{(EBIT - INT)(1-t)}{\$shs.} = -\frac{INT(1-t)}{\#shs.} + \frac{(1-t)}{\#shs.} EBIT$$

When the firm is 100% equity financed (no debt), potential EPS levels range from zero to infinity given potential EBIT levels ranging from zero to infinity. As EBIT increases from zero, its EPS level increases at a rate equal to the slope of Equation 8.5:

$$(1-\tau)/\#\text{shs.}$$

However, if the firm has borrowed money, its potential EPS ranges from $\{-[\text{INT} \cdot (1-\tau)] \div \#\text{shs}\}$ to infinity, given that EBIT ranges from zero to infinity. We want the firm's asset and sales levels to remain unchanged so we can examine only the effects of a new capital structure. To maintain this constant asset level, an increase in the debt level must be accompanied by an equal decrease in the equity level. By maintaining offsetting debt and equity changes, we are able to examine the effects of manipulating the firm's capital structure alone. Since the firm has replaced equity with debt, the number of shares of company stock outstanding will decrease. This causes the slope of Equation (8.5) to increase from $\{(1-\tau) \div \#\text{shs}_0\}$ to $\{(1-\tau) \div \#\text{shs}_1\}$. (Notice that $\#\text{shs}_0 > \#\text{shs}_1$.) The slope increase induces greater EPS variability given EBIT variability. For example, if next year's EBIT were not known with certainty, perhaps its potential range could be determined. In Figure 8.4, management has determined that its EBIT will not be lower than $EBIT_1$ nor higher than $EBIT_2$. Given this range of EBIT, the firm's EPS levels will range from EPS_2 and EPS_3 if it is entirely equity financed. However, if the firm has borrowed money, its EPS levels, given the same range for EBIT will range from EPS_1 to EPS_4. This range of potential EPS levels for a firm with some debt financing is greater than the EPS range of a

firm that is entirely equity financed. Thus, given sales or EBIT uncertainty, debt financing will magnify the impact of this uncertainty on potential EPS variability. Therefore, shareholder risk increases as the level of firm borrowing increases.

Potential Van Buren Company Income Statement Data

Outcome1		**Outcome 2**		**Expected Levels**	
Sales	$10,000,000	Sales	$20,000,000	Sales	$15,000,000
CGS (60%)	6,000,000	CGS (60%)	12,000,000	CGS (60%)	9,000,000
Gross Margin	4,000,000	Gross Margin	8,000,000	Gross Margin	6,000,000
FC	0	FC	0	FC	0
EBIT	4,000,000	EBIT	8,000,000	EBIT	6,000,000
INT	3,000,000	INT	3,000,000	INT	3,000,000
EBT	1,000,000	EBT	5,000,000	EBT	3,000,000
Taxes(30%)	300,000	Taxes(30%)	1,500,000	Taxes(30%)	900,000
NIAT	700,000	NIAT	3,500,000	NIAT	2,100,000
#Shs: 5,000		#Shs: 5,000		#Shs: 5,000	
EPS: $140		EPS: $700		EPS: $420	

Note: Each outcome is equally likely to occur; that is, $P_1 = P_2 = .5$

Current Van Buren Company Balance Sheet

Current Assets:	$10,000,000	Debt:	$14,000,000
Fixed Assets:	$18,000,000	Equity:	$14,000,000
Total Assets:	$28,000,000	Capital:	$28,000,000

Interest rate on all debt is 21.429%

Various Van Buren Company Earnings and Statistical Data

Current Share Value= $28,000,000/10,000=$2800

$NIAT_1$ =$700,000; $NIAT_2$ = $3,500,000; E(NIAT) = $2,100,000

ROE_1 = .05; ROE_2 = .25; E(ROE) = .15

$\sigma_{ROE} = .10 = \sigma_{VanBuren}$

DFL=E(EBIT)/E(EBT)=$6,000,000/$3,000,000=2=DFL Van Buren

$\%\Delta NIAT = DFL * \%\Delta Sales$; e.g., 67% increase in NIAT from its expected level results in a 33% increase in Sales from its expected level when there are no fixed costs.

Figure 3 : Van Buren Company Financial Data, Degree of Financial Leverage equal to 2

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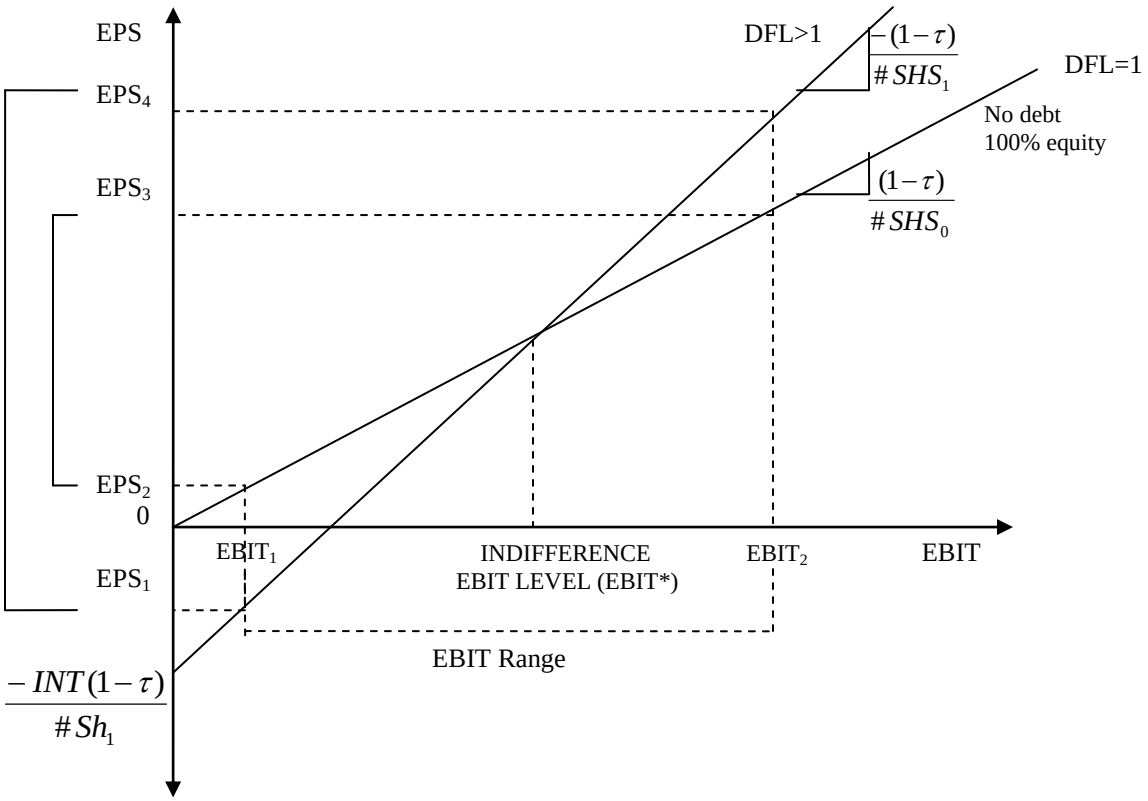

Figure 4: The relationship between EPS variability and the Degree of Financial Leverage

Fixed Payments Leverage

The total leverage induced by the total sum of a firm's fixed obligations can be determined by multiplying its DOL and DFL levels:

(7) $$FPL = DOL * DFL = \frac{Sales-CGS}{EBIT} * \frac{EBIT}{EBT} = \frac{Sales-CGS}{EBT}$$

The proportional change in profits induced by a proportional change in sales for a firm with both debt in its capital structure and fixed costs can be found by Equations 8 or 9:

(8) $\%\Delta NIAT = (DOL * DFL) * \%\Delta Sales$

(9) $\%\Delta NIAT = FPL * \%\Delta Sales$.

Thus, the Tyler Company, which incurs both fixed costs and fixed interest payments will have greater earnings variability than the Monroe, Adams or Van Buren Companies.

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Fixed Payments Leverage (or total leverage) levels for the Monroe, Adams, Van Buren and Tyler Companies are 1, 1.75, 2, and 3.167, respectively. Potential sales outcomes for each of the companies are identical; however, higher levels of FPL are associated with higher levels of earnings uncertainty.

Potential Tyler Company Income Statement Data

Outcome1		**Outcome 2**		**Expected Levels**	
Sales	$10,000,000	Sales	$20,000,000	Sales	$15,000,000
CGS (30%)	3,000,000	CGS (30%)	6,000,000	CGS (30%)	4,500,000
Gross Margin	7,000,000	Gross Margin	14,000,000	Gross Margin	10,500,000
Fixed Cost	4,500,000	Fixed Cost	4,500,000	Fixed Cost	4,500,000
EBIT	2,500,000	EBIT	9,500,000	EBIT	6,000,000
INT	3,000,000	INT	3,000,000	INT	3,000,000
EBT	(500,000)	EBT	6,500,000	EBT	3,000,000
Taxes(30%)	(150,000)	Taxes(30%)	1,950,000	Taxes(30%)	900,000
NIAT	(350,000)	NIAT	4,550,000	NIAT	2,100,000
#Shs: 5000		#Shs: 5,000		#Shs: 5,000	
EPS: -$70		EPS: $910		EPS: $420	

Note: Each outcome is equally likely to occur; that is, $P_1 = P_2 = .5$

Current Tyler Company Balance Sheet

Current Assets:	$10,000,000	Debt:	$14,000,000
Fixed Assets:	$18,000,000	Equity:	$14,000,000
Total Assets:	$28,000,000	Capital:	$28,000,000

Interest rate on all debt is 21.429%

Various Tyler Company Earnings and Statistical Data

Current Share Value= $14,000,000/5,000=$2800

$NIAT_1$ = -$350,000; $NIAT_2$ = $4,550,000; E(NIAT) = $2,100,000

ROE_1 = -.025; ROE_2 = .325; E(ROE) = .15

$\sigma_{ROE} = .175 = \sigma_{Tyler}$

FPL=DOL*DFL=[(15,000,000-4,500,000)/6,000,000]* [$6,000,000/$3,000,000]=3.5

$\%\Delta NIAT = FPL \times \%\Delta Sales$; eg: 33% increase in Sales from its expected level leads to a 116% increase in NIAT from its expected level.

Figure 5: Tyler Company Financial Data, Fixed Payments Leverage equal to 3.5

8.D. FINANCING DECISION EXAMPLE

If the objective of a firm's management is to maximize the company's EPS, and if management knows with certainty what will be the firm's level of EBIT, Equation 8.5 can be used to determine the proper method of financing a project. For example, consider the Harrison Company that must determine whether to borrow money at 12% or issue new shares of stock to finance a $500,000 expansion. This expansion will enable the company to attain an EBIT level next year amounting to $600,000. Harrison is required to make $200,000 in annual interest payments on debt that it has previously incurred. The Harrison Company operates in the forty percent income tax bracket. The company currently has outstanding 10,000 shares of stock; new

shares can be issued for $100 apiece. Based on this EBIT level of $600,000, should the Harrison Company sell new shares of stock or borrow money to finance its new expansion?

To decide what the Harrison Company should do, we need only determine whether the company attains a higher EPS level if it sells new equity than if it sells new debt. Thus, we solve Equation 8.5 twice: once assuming the company sells new equity, then a second time assuming the company sells new debt:

$$EPS_E = \frac{(\$600{,}000 - \$200{,}000)(1 - .4)}{10{,}000 + 5{,}000} = \$16.00$$

If Harrison sells new equity, its interest payments remain constant at the $200,000 level it is already required to make. However, the company must issue 5000 new shares of stock at $100 apiece to raise the necessary $500,000. If, alternatively, Harrison sells new debt, its EPS level will be $20.40, accounting for interest payments the new debt will require:

$$EPS_D = \frac{(\$600{,}000 - (\$200{,}000 + \$60{,}000))(1 - .4)}{10{,}000} = \$20.40$$

Since the Harrison Company will attain a higher EPS levels if it borrows money, debt financing will be preferred to equity financing.

Whether debt financing is preferred to equity financing will depend on the level of the known EBIT. If it is certain that EBIT will be higher than the indifference level depicted in Figure 8.4 (such as EBIT), debt financing will be preferred since it corresponds with a higher level of EPS. An EBIT level lower than the indifference level will imply that equity financing is preferred. If EBIT will be at the indifference level, the firm is indifferent as to how it will finance a project.

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QUESTIONS AND PROBLEMS

8.1. Using a graph depicting the relationship between EBIT and EPS, demonstrate how increased debt financing results in increases in shareholder's earnings variability.

8.2. The following are accounting statements for the Lee Company:

Income Statement,2004

Sales...$900,000
CGS(56%).500,000
GM.....400,000
FC.....0
EBIT.....400,000
INT..... 0
EBT.....400,000
Taxes....200,000
NIAT.....200,000
#shs..... 800
EPS..... 250

Balance Sheet, Dec.31,2004

ASSETS	CAPITAL
Total Assets..$800,000	Debt..... $0
	Equity....800,000
	Total Capital.800,000

The following are accounting statements for the Sherman Company:

Income Statement,2004

Sales...$900,000
CGS(22%).200,000
GM.....700,000
FC.....300,000
EBIT.....400,000
INT..... 50,000
EBT.....350,000
Taxes....175,000
NIAT.....175,000
#shs..... 400
EPS..... 437.50

Balance Sheet, Dec.31,2004

ASSETS	CAPITAL
Total Assets..$800,000	Debt.....$400,000
	Equity.....400,000
	Total Capital..800,000

For the questions which follow, assume that book values equal market values.

a. Compute the Degree of Operating Leverage for each of the two companies.
b. Compute the Degree of Financial Leverage for each of the two companies.
c. Compute the levels of Fixed Payments Leverage for both companies.
d. If 2005 sales levels were to increase to $1,200,000 for each of the two companies, what would be each of their NIAT levels? What would be each company's EPS level? (Assume Fixed Costs and Interest Payments remain constant.)

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e. If 2005 sales levels were to decrease to $600,000 for each of the companies, what would be each of their NIAT levels? What would be each company's EPS level? (Assume Fixed Costs and Interest Payments remain constant.)

f. What will be each company's potential EPS variance in 2005? What will be the standard deviation associated with EPS over this period? Assume that each potential sales outcome is equally likely.

g. Which of the companies' stock is riskier?

8.3. Would a company making exactly the same dividend payment each year regardless of earnings show steadier earnings growth than a company paying dividends as a constant proportion of earnings?

8.4. Are highly leveraged companies more likely to go bankrupt than companies that are primarily equity-financed given that all companies' sales levels are subject to significant variability?

8.5. Companies operating in highly unstable environments resulting in significant revenue uncertainty are more capable of sustaining high levels of debt than are firms operating in stable environments. Is this statement true? Why or why not?

8.6. The Grant Company is purchasing for $300,000 a machine that will increase its EBIT level to $600,000. It currently owes $500,000, on which it must pay interest at a rate of ten percent. If the company borrowed funds to finance the machine, it would pay interest at a twelve percent rate. Alternatively, the company could sell new shares of stock for $100 apiece. Twenty five thousand shares of Grant Company stock are currently outstanding. If the Grant Company operates in the 40% tax bracket, should the required $300,000 be borrowed or financed with a new equity issue?

8.7. The Jackson Company has purchased a new product line that will increase its annual sales level 20% from its current $840,000 level. The company's Cost of Goods Sold level is always fifty percent of its sales, and its fixed costs are $100,000. The company operates in the thirty percent tax bracket and must pay a five percent rate of interest on any new funds it borrows. The product line required a $500,000 investment and was financed by selling 10,000 new shares of stock. Previous to the new equity issue, ninety thousand shares of Jackson Company stock were outstanding. Would the Jackson Company have been better off selling debt?

8.8. Assume the anticipated 2005 sales level for the Sherman Company in Problem 8.2 is $1,200,000. Would the firm have a higher anticipated EPS if it increased its level of debt from $400,000 to $600,000 while buying back $200,000 in equity? Would this same result still hold if Sherman's 2005 anticipated sales level were only $600,000?

8.9. At what sales level would the Sherman Company be indifferent as to its financing policy?

8.10. Why might corporate managers borrow less money than necessary to maximize earnings per share?