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Lecture
Code of ethics

these distractions are things you
to get rid of these, just write
it. I always carry a notebook with
can write these things down in. The
also serves to focus my thoughts
ave a spare moment and need to
what to do next. By keeping everyth
here, any part of my brain that
ried about what I have to do goes

Operating and Financial Leverage

Learning Objectives

Leverage represents the ***use of fixed cost items*** to magnify the firm's results.

Break-even analysis allows the firm to determine the magnitude of operations necessary to avoid loss.

Operating leverage indicates the extent to which fixed assets (plant and equipment) are utilized by the firm.

Financial leverage shows how much debt the firm employs in its capital structure.

Combined leverage takes into account both the use of fixed assets and debt.

By **increasing leverage**, the firm increases its **profit** potential, but also its **risk** of failure.

Chapter Opening

What is leverage?

- Use of special force or effects to produce more than normal results from a given course of action
- Emphasis on employment of fixed cost items to magnify returns at high levels of operation
- Can produce beneficial results in favorable conditions
- Can produce highly negative results in unfavorable conditions

Leverage in a Business

Determining type of fixed operational costs

- Plant and equipment
  - Eliminates labor in production of inventory
- Expensive labor
  - Lessens opportunity for profit but reduces risk exposure

Determining type of financing

- Debt financing
  - Substantial profits but failure to meet contractual obligations can result in bankruptcy
- Selling equity
  - Reduces potential profits but minimizes risk exposure

Operating Leverage

Extent to which fixed assets and associated fixed costs are utilized in business

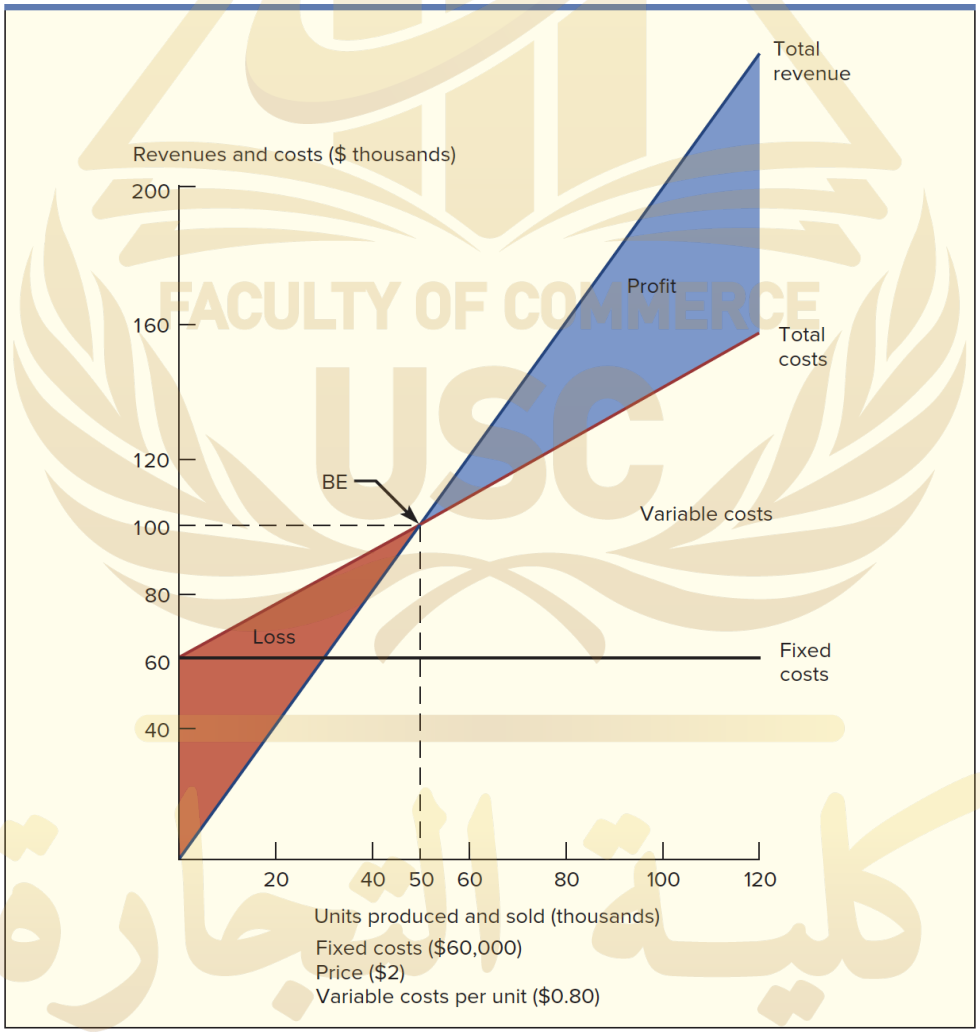
Operational costs are classified

- Fixed
- Variable
- Semivariable

Table 5-1 Classification of Costs

Fixed	Variable	Semivariable
Lease	Raw material	Utilities
Depreciation	Factory labor	Repairs and maintenance
Executive salaries	Sales commissions	
Property taxes		

Figure 5-1 Break-Even Chart: Leveraged Firm



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Break-Even Analysis 1

Break-even point is 50,000 units, where total costs and total revenue lines intersect

Units = 50,000				
Total Variable Costs (TVC)	**Fixed Costs (FC)**	**Total Costs (TC)**	**Total Revenue (TR)**	**Operating Income (loss)**
(50,000 × $0.80)	$60,000	$100,000	(50,000 × $2)	0
$40,000			$100,000	

Break-Even Analysis 2

The break-even point can also be calculated by:

$$\frac{\text{Fixed costs}}{\text{Contribution margin}} = \frac{\text{Fixed costs}}{\text{Price} - \text{Variable cost per unit}} = \frac{FC}{P - VC}$$

i.e.

$$\frac{\$60{,}000}{\$2.00 - \$0.80} = \frac{\$60{,}000}{\$1.20} = 50{,}000 \text{ units}$$

Table 5-2 Volume-Cost-Profit Analysis: Leveraged Firm

Units Sold	Total Variable Costs	Fixed Costs	Total Costs	Total Revenue	Operating Income (Loss)
0	$0	$60,000	$60,000	$0	$(60,000)
20,000	16,000	60,000	76,000	40,000	(36,000)
40,000	32,000	60,000	92,000	80,000	(12,000)
50,000	40,000	60,000	100,000	100,000	0
60,000	48,000	60,000	108,000	120,000	12,000
80,000	64,000	60,000	124,000	160,000	36,000
100,000	80,000	60,000	140,000	200,000	60,000

A More Conservative Approach

Some firms choose not to operate at high degrees of operating leverage

More expensive variable costs may be substituted for automated plant and equipment

An unleveraged approach may cut into potential profitability of firm

Indicated in Figure 5-2

Figure 5-2 Break-Even Chart: Conservative Firm

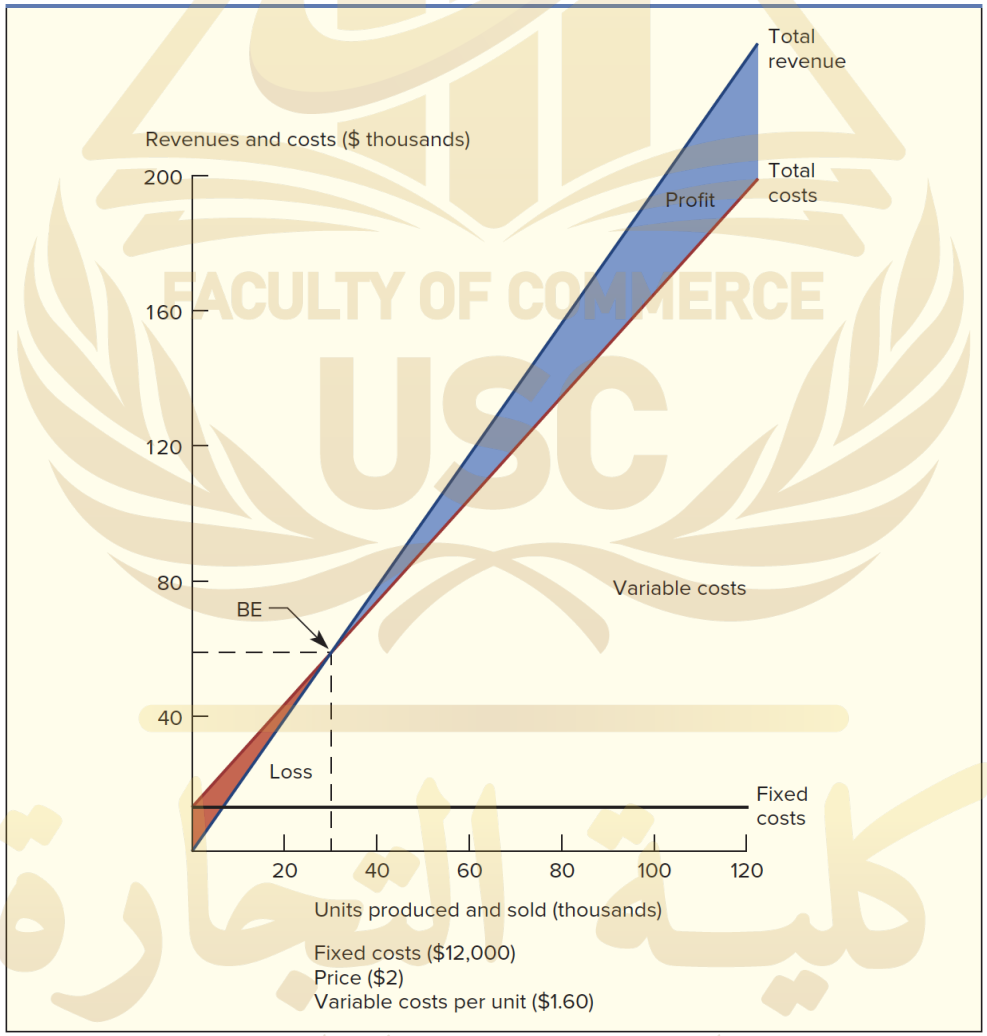

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Table 5-3 Volume-Cost-Profit Analysis: Conservative Firm

Units Sold	Total Variable Costs	Fixed Costs	Total Costs	Total Revenue	Operating Income (Loss)
0	0	$12,000	$12,000	0	$(12,000)
20,000	$32,000	12,000	44,000	$40,000	(4,000)
30,000	48,000	12,000	60,000	60,000	0
40,000	64,000	12,000	76,000	80,000	4,000
60,000	96,000	12,000	108,000	120,000	12,000
80,000	128,000	12,000	140,000	160,000	20,000
100,000	160,000	12,000	172,000	200,000	28,000

The Risk Factor

Factors influencing decision on maintaining conservative or leveraged position include

- Economic conditions
- Competitive position within industry
- Future position—stability versus market leadership

Matching acceptable returns with desired level of risk

Cash Break-Even Analysis

Deals with cash flows rather than accounting flows

Helps in analyzing short-term outlook of firm

Examples of excluded noncash items

- Depreciation
- Credit sales
- Credit purchase of materials

Degree of Operating Leverage (DOL)[1]

Percentage change in operating income as result of percentage change in units sold

Computed only over profitable range of operations

Closer the DOL is to the firm's break-even point, the higher the number will be

$$\text{DOL} = \frac{\text{Percent change in operating income}}{\text{Percent change in unit volume}}$$

Table 5-4 Operating Income or Loss

Units	Leveraged Firm (Table 5-2)	Conservative Firm (Table 5-3)
0.....	$(60,000)	$12,000
20,000.....	(36,000)	(4,000)
40,000.....	(12,000)	4,000
60,000.....	12,000	12,000
80,000.....	36,000	20,000
100,000.....	60,000	28,000

Degree of Operating Leverage (DOL)$_2$

Leveraged firm

$$\text{DOL} = \frac{\text{Percent change in operating income}}{\text{Percent change in unit volume}} = \frac{\frac{\$24,000}{\$36,000} \times 100}{\frac{20,000}{80,000} \times 100}$$

$$= \frac{67\%}{25\%} = \mathbf{2.7}$$

Conservative firm

$$\text{DOL} = \frac{\text{Percent change in operating income}}{\text{Percent change in unit volume}} = \frac{\frac{\$8,000}{\$20,000} \times 100}{\frac{20,000}{80,000} \times 100}$$

$$= \frac{40\%}{25\%} = \mathbf{1.6}$$

Degree of Operating Leverage (DOL) Concluded

$$\text{DOL} = \frac{Q(P - VC)}{Q(P - VC) - FC}$$

Where,

Q = Quantity at which DOL is computed

P = Price per unit

VC = Variable costs per unit

FC = Fixed costs

For the leveraged firm, assume *Q* = 80,000, with *P* = \$2, *VC* = \$0.80, and *FC* = \$60,000:

$$\text{DOL} = \frac{80{,}000(\$2.00 - \$0.80)}{80{,}000(\$2.00 - \$0.80) - \$60{,}000}$$

$$= \frac{80{,}000(\$1.20)}{80{,}000(\$1.20) - \$60{,}000} = \frac{\$96{,}000}{\$96{,}000 - \$60{,}000}$$

$$\text{DOL} = 2.7$$

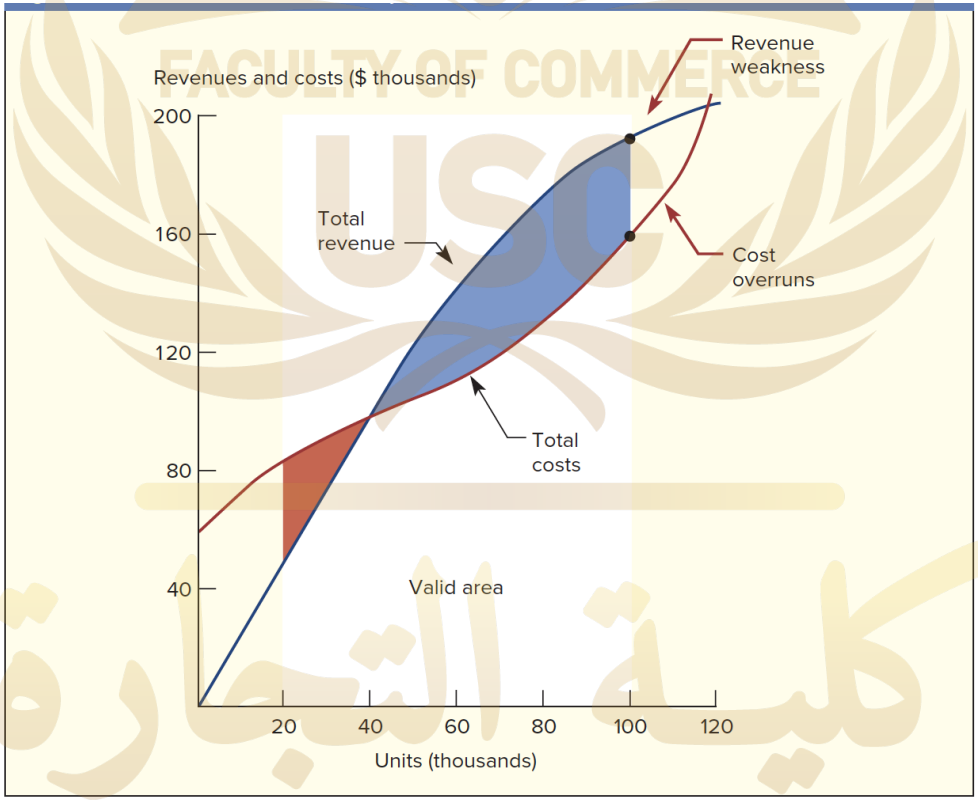
Limitations of Analysis

Assumes existence of constant or linear function for revenues and costs as volume changes

- May not be constant in the real world
  - Price weakening to capture increasing market
  - Cost overruns when moved beyond optimum-size operation
- Relationships are not so fixed as assumed

Figure 5-3 Nonlinear Break-Even Analysis

Assumption of exact linear relationship does not hold well in reality



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Financial Leverage

Reflects amount of debt used in capital structure of firm

Determines how to finance operation

Determines performance between two firms with equal operating capabilities

BALANCE SHEET

Assets	Liabilities and Net Worth
Operating Leverage	Financial Leverage

Impact on Earnings

Examine two financial plans for firm where $200,000 is required to carry assets

	Total Assets—$200,000			
	Plan A (leveraged)		Plan B (conservative)	
Debt (8% interest)	$150,000	($12,000 interest)	$ 50,000	($4,000 interest)
Common stock	50,000	(8,000 shares at $6.25)	150,000	(24,000 shares at $6.25)
Total financing	$200,000		$200,000	

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Table 5-5 Impact of Financing Plan on Earnings per Share[1]

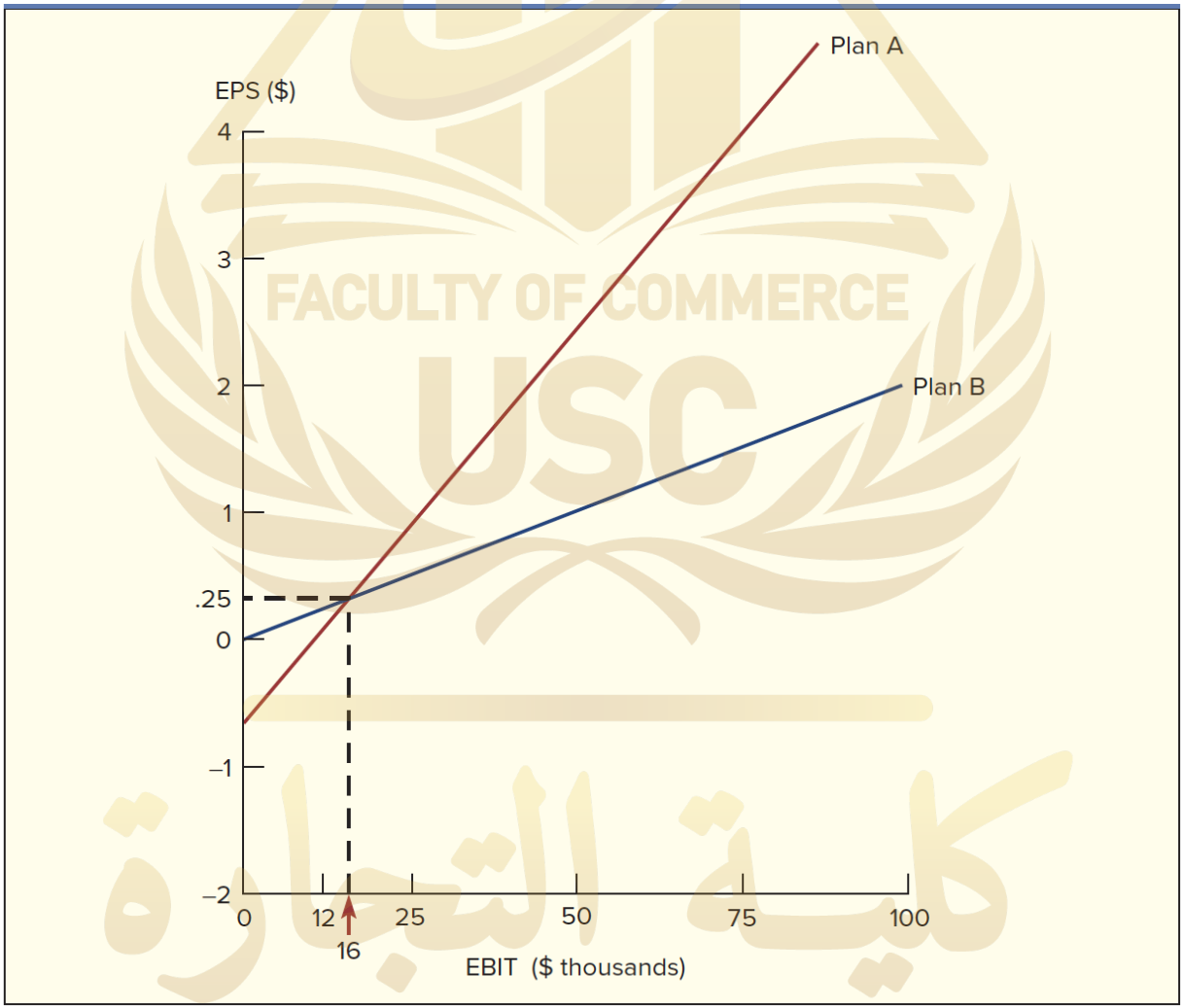
	Plan A (leveraged)	Plan B (conservative)
1. EBIT (0)		
Earnings before interest and taxes (EBIT)	0	0
− Interest (*I*)	$ (12,000)	$ (4,000)
Earnings before taxes (EBT)	$ (12,000)	$ (4,000)
− Taxes (*T*)*	(6,000)	(2,000)
Earnings after taxes (EAT)	$ (6,000)	$ (2,000)
Shares	8,000	24,000
Earnings per share (EPS)	$ (0.75)	$ (0.08)
2. EBIT ($12,000)		
Earnings before interest and taxes (EBIT)	$ 12,000	$ 12,000
− Interest (*I*)	12,000	4,000
Earnings before taxes (EBT)	$ 0	$ 8,000
− Taxes (*T*)	0	4,000
Earnings after taxes (EAT)	$ 0	$ 4,000
Shares	8,000	24,000
Earnings per share (EPS)	$ 0	$ 0.17
3. EBIT ($16,000)		
Earnings before interest and taxes (EBIT)	$ 16,000	$ 16,000
− Interest (*I*)	12,000	4,000
Earnings before taxes (EBT)	$ 4,000	$ 12,000
− Taxes (*T*)	2,000	6,000
Earnings after taxes (EAT)	$ 2,000	$ 6,000
Shares	8,000	24,000
Earnings per share (EPS)	$ 0.25	$ 0.25

Table 5-5 Impact of Financing Plan on Earnings per Share 2

	Plan A (leveraged)	Plan B (conservative)
4. EBIT ($36,000)		
Earnings before interest and taxes (EBIT)	$ 36,000	$ 36,000
– Interest (*I*)	12,000	4,000
Earnings before taxes (EBT)	$ 24,000	$ 32,000
– Taxes (*T*)*	12,000	16,000
Earnings after taxes (EAT)	$ 12,000	$16,000
Shares	8,000	24,000
Earnings per share (EPS)	$ 1.50	$ 0.67
5. EBIT ($60,000)		
Earnings before interest and taxes (EBIT)	$ 60,000	$ 60,000
– Interest (*I*)	12,000	4,000
Earnings before taxes (EBT)	$ 48,000	$56,000
– Taxes (*T*)	24,000	28,000
Earnings after taxes (EAT)	$ 24,000	$28,000
Shares	8,000	24,000
Earnings per share (EPS)	$ 3.00	$ 1.17

*The assumption is that large losses can be written off against other income, perhaps in future years, thus providing the firm with a tax savings benefit. The tax rate is 50 percent for ease of computation.

Figure 5-4 Financing Plans and Earnings per Share



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Degree of Financial Leverage

$$\text{DFL} = \frac{\textbf{Percent change in EPS}}{\textbf{Percent change in EBIT}}$$

For the purpose of computation, it can be restated as:

$$\text{DFL} = \frac{\text{EBIT}}{\text{EBIT} - I}$$

DFL can be calculated using values from Table 5-5

Plan A (Leveraged):

$$\text{DFL} = \frac{\text{EBIT}}{\text{EBIT} - I} = \frac{\$36,000}{\$36,000 - \$12,000} = \frac{\$36,000}{\$24,000} = 1.5$$

Plan B (Conservative):

$$\text{DFL} = \frac{\text{EBIT}}{\text{EBIT} - I} = \frac{\$36,000}{\$36,000 - \$4,000} = \frac{\$36,000}{\$32,000} = 1.1$$

Limitations to Use of Financial Leverage

Beyond a certain point, debt financing is detrimental to a firm

- Lenders will perceive greater financial risk
- Common stockholders may drive down price

Debt is beneficial and recommended for firms

- In industries that offer degree of stability
- Are in a positive stage of growth
- Operating in favorable economic conditions

Combining Operating and Financial Leverage

Combining operating and financial leverage allows firms to maximize returns

- Operating leverage
  - Affects asset structure of firm
  - Determines return from operations
- Financial leverage
  - Affects debt-equity mix
  - Determines how benefits received are allocated to debt holders and stockholders as earnings per share

Table 5-6 Income Statement

Sales (total revenue) (80,000 units @ $2)	$160,000
− Fixed costs	60,000
− Variable costs ($0.80 per unit)	64,000
Operating income	$ 36,000
Earnings before interest and taxes	$ 36,000
− Interest	12,000
Earnings before taxes	$ 24,000
− Taxes	12,000
Earnings after taxes	$ 12,000
Shares	8,000
Earnings per share	$1.50

Operating leverage

Financial leverage

Last item under operating leverage, operating income, becomes initial item for determining financial leverage

"Operating income" and "Earnings before interest and taxes" are the same, representing return to owners before interest and taxes are paid

Figure 5-5 Combining Operating and Financial Leverage

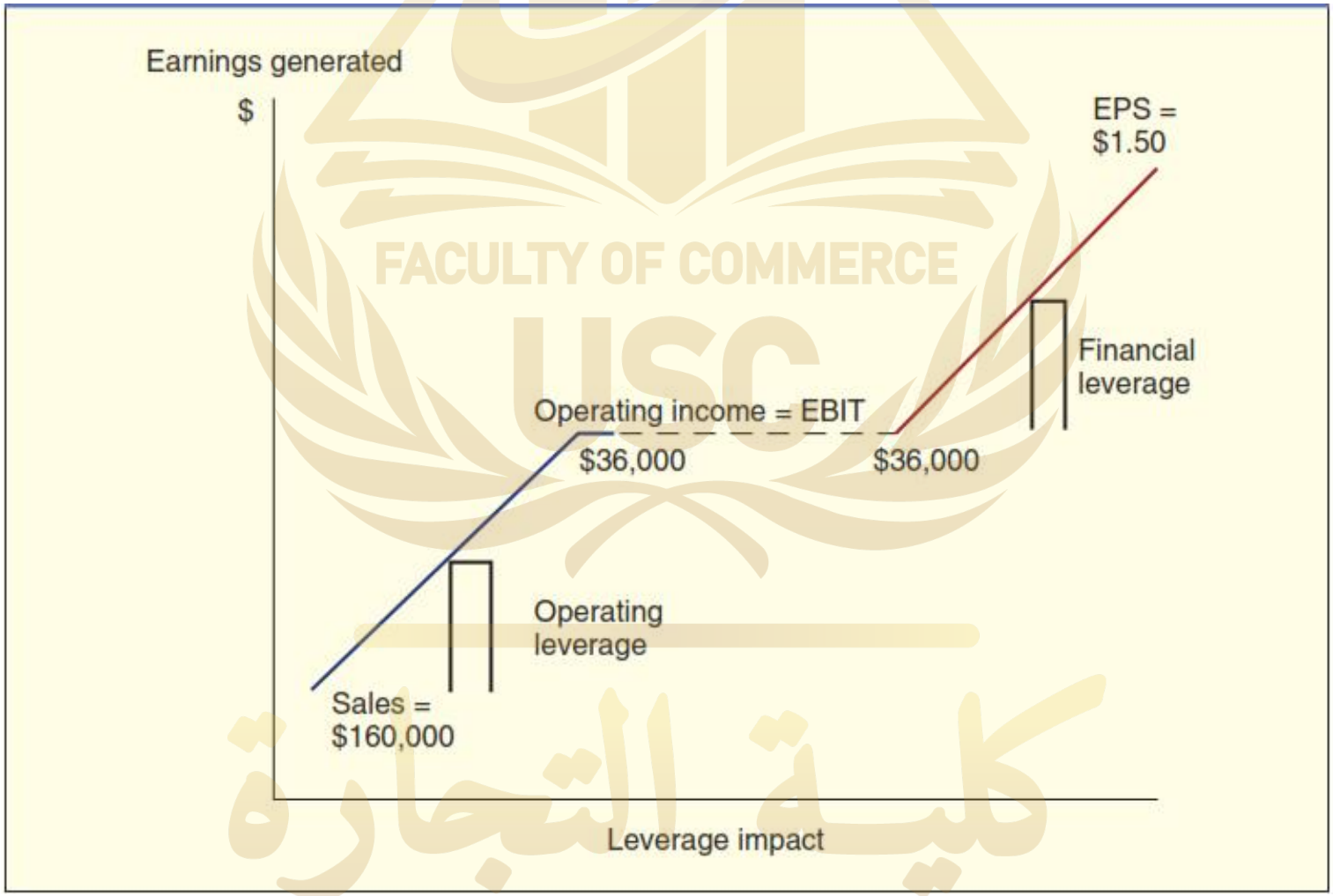

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Table 5-7 Operating and Financial Leverage

	80,000 Units	100,000 Units
Sales—$2 per unit	$160,000	$200,000
− Fixed costs	60,000	60,000
− Variable costs ($0.80 per unit)	64,000	80,000
Operating income = EBIT	$ 36,000	$ 60,000
− Interest	12,000	12,000
Earnings before taxes	$ 24,000	$ 48,000
− Taxes	12,000	24,000
Earnings after taxes	$ 12,000	$ 24,000
Shares	8,000	8,000
Earnings per share	$1.50	$ 3.00

Degree of Combined Leverage (DCL)[1]

Uses the entire income statement

Shows impact of change in sales or volume on bottom-line earnings per share

$$\text{DCL} = \frac{\text{Percent change in EPS}}{\text{Percent change in sales (or volume)}}$$

Using data from Table 5-7:

$$\frac{\text{Percent change in EPS}}{\text{Percent change in sales}} = \frac{\frac{\$1.50}{\$1.50} \times 100}{\frac{\$40,000}{\$160,000} \times 100} = \frac{100\%}{25\%} = 4$$

Degree of Combined Leverage (DCL)$_2$

$$\text{DCL} = \frac{Q(P - VC)}{Q(P - VC) - FC - I}$$

From Table 5-7, *Q* (Quantity) = 80,000; *P* (Price per unit) = $2.00; VC (Variable costs per unit) = $0.80; FC (Fixed costs) = $60,000; and *I* (Interest) = $12,000.

$$\text{DCL} = \frac{80{,}000(\$2.00 - \$0.80)}{80{,}000(\$2.00 - \$0.80) - \$60{,}000 - \$12{,}000}$$

$$= \frac{80{,}000(\$1.20)}{80{,}000(\$1.20) - \$72{,}000}$$

$$\text{DCL} = \frac{\$96{,}000}{\$96{,}000 - \$72{,}000} = \frac{\$96{,}000}{\$24{,}000} = 4$$