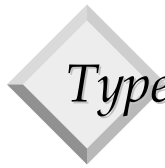


Break-even & Leverage Analysis

Timothy R. Mayes, Ph.D.
FIN 330: Chapter 12

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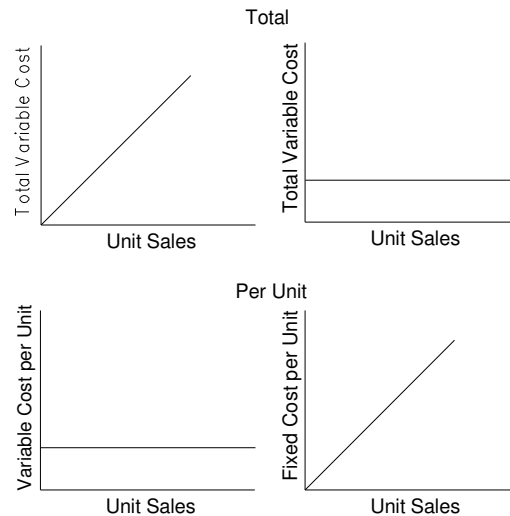


Types of Costs

- ❖ Essentially, there are two types of costs that a business faces:
 - **Variable costs** which vary proportionally with sales
 - ◆ hourly wages
 - ◆ utility costs
 - ◆ raw materials
 - ◆ etc.
 - **Fixed costs** which are constant over a relevant range of sales
 - ◆ executive salaries
 - ◆ lease payments
 - ◆ depreciation
 - ◆ etc.

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Types of Costs Grapically



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Operating (Accounting) Break-even

- ❖ The operating break-even point is defined as that level of sales (either units or dollars) at which EBIT is equal to zero:

$$\text{Sales} - \text{VC} - \text{FC} = 0$$

Or

$$Q(P - v) - \text{FC} = 0$$

- ❖ Where VC is total variable costs, FC is total fixed costs, Q is the quantity, p is the price per unit, and v is the variable cost per unit

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The Operating Break-even in Units

- ❖ We can find the operating break-even point in units by simply solving for Q:

$$Q^* = \frac{FC}{p - v} = \frac{FC}{\text{CM\$ / unit}}$$

- ❖ Where CM\$/unit is the contribution margin per unit sold (i.e., CM\$/unit = p - v)
- ❖ The contribution margin per unit is the amount that each unit sold contributes to paying off the fixed costs

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The Operating Break-even in Dollars

- ❖ We can calculate the operating break-even point in sales dollars by simply multiplying the break-even point in units by the price per unit:

$$\text{BE\$} = Q^* \times p$$

- ❖ Note that we can substitute the previous definition of Q* into this equation:

$$\text{BE\$} = \frac{FC}{p - v} p = \frac{FC}{\frac{(p - v)}{p}} = \frac{FC}{\text{CM\%}}$$

- ❖ Where CM% is the contribution margin as a % of the selling price

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Operating Break-even: an Example

- ❖ Suppose that a company has fixed costs of \$100,000 and variable costs of \$5 per unit. What is the break-even point if the selling price is \$10 per unit?

$$Q^* = \frac{100,000}{10 - 5} = 20,000 \text{ units}$$

Or

$$\text{BE\$} = 20,000 \times 10 = \$200,000$$

Or

$$\text{BE\$} = \frac{100,000}{\frac{(10 - 5)}{10}} = \$200,000$$

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Targeting EBIT

- ❖ We can use break-even analysis to find the sales required to reach a target level of EBIT

$$Q_{\text{Target}}^* = \frac{\text{FC} + \text{EBIT}_{\text{Target}}}{p - v}$$

- ❖ Note that the only difference is that we have defined the break-even point as EBIT being equal to something other than zero

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Targeting EBIT: an Example

- ❖ Suppose that we wish to know how many units the company (from the previous example) needs to sell such that EBIT is equal to \$500,000:

$$Q^* = \frac{100,000 + 500,000}{10 - 5} = 120,000 \text{ units}$$

Or

$$\text{BE\$} = 120,000 \times 10 = \$1,200,000$$

Or

$$\text{BE\$} = \frac{100,000 + 500,000}{\frac{(10 - 5)}{10}} = \$1,200,000$$

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Cash Break-even Points

- ❖ Note that if we subtract the depreciation expense (a non-cash expense) from fixed cost, we can calculate the break-even point on a cash flow basis:

$$Q_{\text{Target}}^* = \frac{\text{FC} - \text{Depreciation}}{p - v}$$

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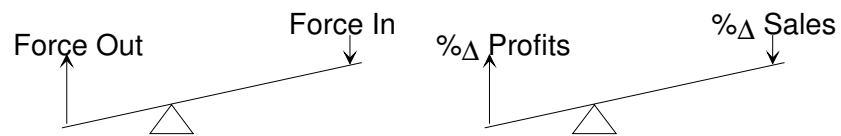


Leverage Analysis

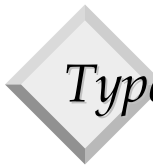
- ❖ In physics, leverage refers to a multiplication of a force into even larger forces
- ❖ In finance, it is similar, but we are referring to a multiplication of %changes in sales into even larger changes in profitability measures

Leverage in physics

Leverage in finance



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Types of Risk

- ❖ There are two main types of risk that a company faces:
 - **Business risk** - the variability in a firm's EBIT. This type of risk is a function of the firm's regulatory environment, labor relations, competitive position, etc. Note that business risk is, to a large degree, outside of the control of managers
 - **Financial risk** - the variability of the firm's earnings before taxes (or earnings per share). This type of risk is a direct result of management decisions regarding the relative amounts of debt and equity in the capital structure

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The Degree of Operating Leverage (DOL)

- ❖ The degree of operating leverage is directly proportional to a firm's level of business risk, and therefore it serves as a proxy for business risk
- ❖ Operating leverage refers to a multiplication of changes in sales into even larger changes in EBIT
- ❖ Note that operating leverage results from the presence of fixed costs in the firm's cost structure

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Calculating the DOL

- ❖ The degree of operating leverage can be calculated as:

$$\text{DOL} = \frac{\% \Delta \text{ EBIT}}{\% \Delta \text{ Sales}}$$

- ❖ This approach is intuitive, but it requires two income statements to calculate
- ❖ We can also calculate DOL with one income statement:

$$\text{DOL} = \frac{Q(p - v)}{Q(p - v) - FC} = \frac{\text{Sales} - VC}{\text{EBIT}}$$

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The Degree of Financial Leverage (DFL)

- ❖ The degree of financial leverage is a measure of the % changes in EBT that result from changes in EBIT, it is calculated as:

$$DFL = \frac{\% \Delta EBT}{\% \Delta EBIT}$$

- ❖ This approach is intuitive, but it requires two income statements to calculate
- ❖ We can also calculate DFL with one income statement:

$$DFL = \frac{EBIT}{EBT}$$

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The Degree of Combined Leverage (DCL)

- ❖ The degree of combined leverage is a measure of the total leverage (both operating and financial leverage) that a company is using:

$$DCL = \frac{\% \Delta EBT}{\% \Delta Sales} = \frac{\% \Delta EBT}{\% \Delta Sales} \times \frac{\% \Delta EBT}{\% \Delta EBT} = DOL \times DFL$$

- ❖ It is important to note that DCL is the product (not the sum) of both DOL and DFL

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Calculating Leverage Measures

	<u>Base Case</u>	<u>Sales Down 10%</u>	<u>Sales up 10%</u>
Sales	1000	900	1100
Variable Costs	450	405	495
Fixed Costs	300	300	300
Depreciation	100	100	100
EBIT	150	95	205
Interest Expense	30	30	30
EBT	120	65	175

	<u>Percentage Changes Relative to the Base Case</u>	
Sales	-10.000%	10.000%
EBIT	-36.667%	36.667%
EBT	-45.833%	45.833%

	<u>Leverage Measures</u>		
Using a single income statement:			
DOL	3.67	5.21	2.95
DFL	1.25	1.46	1.17
DCL	4.58	7.62	3.46

Using two income statements:	
DOL	3.67
DFL	1.25
DCL	4.58