FACT SHEET

L-1093

INVESTMENT ANALYSIS--BREAK-EVEN METHOD

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Break-even analysis is a useful financial tool for studying the relationship between fixed costs, variable costs and profit. What it does, as the name implies, is to point out the volume of production or sales from a production activity necessary to cover all costs. To explain how break-even analysis works, it is necessary to define the cost items.

Fixed Costs. These costs, incurred after the decision to enter into a business activity is made, are not directly related to the level of production. Fixed costs include, but are not limited to, depreciation on equipment, interest charges, taxes and general overhead expenses.

Variable costs. These costs change in direct relation to volume of output. They may include cost of goods sold or production expenses such as labor and power costs, and direct sales expenses such as transportation, salesmen's commissions and other expenses.

Graphic Explanation

The following graph illustrates break-even analysis. Fixed costs are indicated by a broken horizontal line which indicates that total fixed costs do not change as production increases.

Variable costs of production are indicated by the broken line sloping upward illustrating that variable costs increase directly as production increases.

The total cost line is the sum of fixed costs and variable costs. Note that this cost line parallels the variable cost line but that it begins at the level of the fixed cost line.

The income line is the gross value of the output. This is shown as a dotted line in figure 1, starting at the lower left of the graph and slanting upward. At any point, the income line is equivalent to the number of units produced multiplied by the price per unit.

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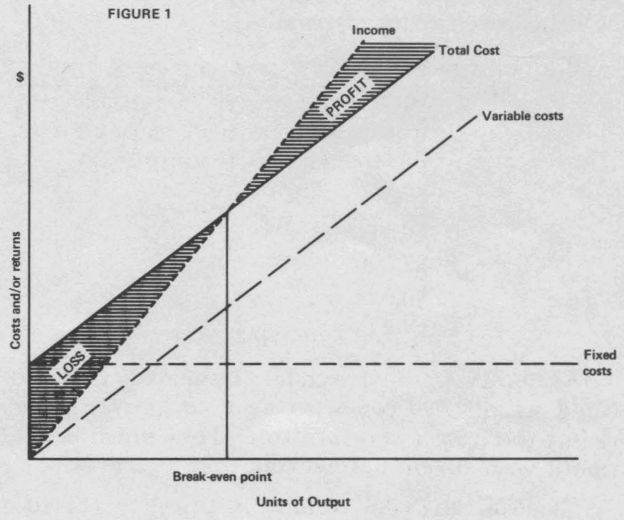
The important point is the *intersection of the total cost line and the income line.* A vertical line down from this point shows the level of production necessary to break even. Volume greater than this produces profits, but losses are incurred at lower volumes.

FIGURE 1



Mathematical Explanation

The graphic method of analysis facilitates understanding of the concept of break-even point. However, graphing the cost and income lines are laborious techniques. The break-even point can be determined much faster and more accurately by the following formula:

$$\text{B-E point} = \frac{F}{P-V}$$

where F = fixed costs
V = variable costs
P = price

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Various Uses of B-E Analysis

Example 1. Consider a person adding an ice cream cone sales operation to a department store. The fixed costs for the ice cream freezer, remodeling and other equipment are $8,000 per year. The variable costs per ice cream cone, including ice cream, cone, labor, electricity etc., are $.06 per cone sold. How many 11-cent cones must be sold per year to break even? The calculations to solve this are as follows:

$$\text{B-E point} = \frac{\$8{,}000 \text{ fixed cost}}{\$0.11 \text{ price} - \$0.06 \text{ variable cost}}$$

$$= \frac{\$8{,}000}{\$0.05}$$

$$= 160{,}000 \text{ cones per year}$$

Example 2. Break-even analysis can be extended easily to consider other changes. For example, assume the ice cream cone vendor above had the alternative to lease a freezer and other furniture at a variable cost of 2 cents per cone, and by doing that he would lower his fixed costs from $8,000 to $2,500. What would his break-even point be if he selected this alternative?

$$\text{B-E point} = \frac{\$2{,}500 \text{ fixed cost}}{\$0.11 \text{ price} - (\$0.06 \text{ variable cost from above} + \$0.02 \text{ variable cost for freezer and furniture})}$$

$$= \frac{\$2{,}500}{\$0.11 - \$0.08}$$

$$= \frac{\$2{,}500}{\$0.03}$$

$$= 83{,}333 \text{ cones per year}$$

Example 3. The vendor estimated that he could sell 400,000 cones per year, so he was going to buy the freezer and furniture. How much profit would he make at 400,000 cones per year?

$$\text{Profit} = (\text{Sales volume} \times \text{price}) - (\text{Fixed costs} + \text{variable costs})$$

$$= 400{,}000 \times \$0.11 - (\$8{,}000 + 400{,}000 \times \$0.06)$$

$$= \$44{,}000 - (\$8{,}000 + \$24{,}000)$$

$$= \$44{,}000 - \$32{,}000$$

$$= \$12{,}000.$$

Questions. As in all businesses, costs go up. If the cost of ice cream went up 1 cent per cone, the variable costs would rise to $0.07 per cone. (1) How would this affect the B-E point? (2) At 400,000 cones sold per year, how would this affect the vendor's profits? (See answers at the end of the fact sheet.)

Appraisal of B-E Analysis

The main advantage of break-even analysis is that it points out the relationship between cost, volume and profit interaction. It can be extended to show that changes in the fixed costs-variable costs relationships or in prices would affect profit levels and B-E points.

Limitations of B-E analysis include these factors:

- It is best suited to the analysis of one product at a time.
- It may be difficult to identify all costs as absolutely variable or absolutely fixed. Some cost items have characteristics of both categories, depending upon the time period under consideration and variable salvage values of assets.
- It assumes all income functions and cost functions are linear. This, in many operations, is an over-simplification.
- There may be a tendency to keep using a break-even analysis after the cost and income functions have changed.

Break-even analysis is most useful when used in conjunction with partial budgeting or capital budgeting techniques. The major benefit to using break-even analysis is that it indicates the lowest amount of business activity necessary to prevent losses.

Answers to questions:

(1) B-E point is now $= \frac{\$8{,}000}{\$0.11 - 0.07} = 200{,}000$

versus $\frac{\$8{,}000}{\$0.11 - 0.06} = 160{,}000$

so B-E point would be raised 40,000 cones.

(2) Profits would be $4,000 lower.

This Fact Sheet is one in a series on investment analysis. Others in the series include *Investment Analysis—Partial Budget Method* (L-1092, Texas Agricultural Extension Service) and *Investment Analysis—Capital Budgeting Methods* (L-1091, Texas Agricultural Extension Service).

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