



BREAK EVEN ANALYSIS

ENGINEERING ECONOMY

BREAK EVEN ANALYSIS



- ▶ Industry is faced with certain situations where two or more methods are applicable to a certain operation and are related by a common variable. Break even analysis in this case will involve the determination of the break-even cost, which is the cost at which all the methods will be equal.
- ▶ Below this cost, one method will be more economical, and above this cost the other will prove to be the better one economically.

BREAK EVEN ANALYSIS



- ▶ Investment of capital, production of goods, and the rendering of service are usually done for obtaining profit. In all situations, production output can be varied under certain conditions.
- ▶ Related to such output are fixed and variable cost, previously explained. At a certain level of production, the total income will just equal the total expenses, resulting in no profit.

BREAK EVEN ANALYSIS

- ▶ This level of production where the total income is equal to the total expenses is called the break-even point.
- ▶ Below this break-even point, a loss will result for the enterprise, and above this a profit will be realized. It is the responsibility of management to know at all times the value at which break-even occurs, and to see to it that the production exceeds this value, if the profit is to be related.

EX. 1

- ▶ A shoe manufacturer produces a pair of shoes at a labor cost of P8.50 and materials cost of P23.50. The fixed charges on the business are P10,125 a month and the variable costs are a P2.50 a pair. If the shoes sell to retailers for P48.00 a pair, how many pairs must be produced and sold each month for the manufacturer to break even?

SOL. 1

Let N = number of pairs to be produced and sold each month to break even.

$$\text{Total income} = P48N$$

$$\text{Total expenses} = P10,125 + (P8.50 + P23.50 + P2.50) N$$

$$= P10,125 + 34.5N$$

$$\text{To break even: } 48N = 10,125 + 34.5N$$

$$N = 750 \text{ pairs}$$

EX. 2

- ▶ An apartment house consisting of 10 independent units was built at a cost of P20,000 per unit. The lot on which it was built was bought at a cost of P60,000. The investment in the apartment house is expected to be recovered in 10 years. From similar houses built, it was found that the average maintenance cost per year was P2,000 for the 10 units. Insurance on the building is 3% of the first cost and real estate taxes on the building and lot is 3.5% annually on a total assessed valuation of P120,000. Income tax on the rental amounts to 10% on the gross revenue. The lot is expected not to decrease in value.
- ▶ If money is worth 12% to the owner and the average occupancy is 90%, determine the average monthly rental for each unit so that income and expenses will break even.

SOL. 2

Total capital investment:

$$10(\text{P}20,000) + \text{P}60,000 = \text{P}260,000$$

Annual expenses:

Depreciation on building

$\text{P}200,000$ (A/F, 12%, 10)

$$\text{P}200,000 (0.05698416) = \text{P}11,397$$

Building insurance:

$$0.03(\text{P}200,000) = \text{P}6,000$$

SOL. 2

Real estate taxes:

$$0.035(P120,000) = P4,200$$

Maintenance = P2,000

Minimum required profit on capital

$$0.12 (P260,000) = P31,200$$

Total annual expense = P54,797

SOL. 2

Let R = average monthly rental for each unit.

Gross annual income with 90% average occupancy:

$$0.90 (10) (12R)$$

$$\text{Income tax} = 0.10 (P108R) = P10.8R$$

$$\text{Net annual income: } 108R - 10.8R = 97.2R$$

To break even:

▶ $97.2R = P54,797$

▶ $R = P564$

EX. 3

- ▶ The cost of producing a small transistor radio set consists of P23.00 for labor and P37.00 for materials. The fixed charges on operating the plant is P100,000 per month. The variable cost per piece is P1.00. The radio set can be sold for P75.00 each. Determine how many sets must be produced per month to break even.

SOL. 3

Let N = number of radio sets produced and sold each month to break even.

Monthly income = P75N

Monthly expenses = P100,000 + (P23 + P37 + P1)N
 $= 100,000 + 61N$

To break even:

$$75N = 100,000 + 61N$$

$$N = 7,142.86 \text{ or } 7,143 \text{ sets per month}$$

EX. 4

- ▶ A firm has the capacity to produce 1,000,000 units of a product per year. At present, it is able to produce and sell only 600,000 units yearly at a total income of P720,000. Annual fixed costs are P250,000 and the variable costs per unit are P0.70

EX. 4

- ▶ A. Calculate the firm's annual profit or loss for this production
- ▶ B. How many units should be sold annually to break-even?
- ▶ C. If the firm can increase its sales to 80% of full capacity what will its profit or loss be, assuming that its income and variable costs per unit remain constant?
- ▶ D. Draw a break-even chart indicating the above results on the chart.

SOL. 4

Solution for A:

Total annual cost: $P250,000 + 600,000 (P0.70) = P670,000$

Annual profit: $P720,000 - P670,000 = P50,000$

SOL. 4

Solution for B:

Selling price per unit:

$$P720,000 / 600,000 = P1.20$$

Let N = number of units to break-even.

Annual income = P1.20N

Annual expenses = P250,000 + P0.70N = 1.20N = 250,000 + 0.70N

N = 500,000 units

SOL. 4

Solution for C:

- ▶ At 80% of full capacity, annual production: 800,000 units
- ▶ Annual income: $800,000 (P1.20) = P960,000$
- ▶ Annual expense: $P250,000 + 800,000 (P0.70) = P810,000$
- ▶ Annual profit: $P960,000 - P810,000 = P150,000$

EX. 5

- ▶ A certain manufacturing operation is now being done manually. The labor cost per unit is P1.80, and the annual fixed cost, including tool depreciation chargeable to this product, is P2,000 a year.
- ▶ A machine is now available for doing the same task at a cost of P40,000 with a salvage value of P5,000 at any time and a fixed operation cost, excluding depreciation, of P3,000 a year.
- ▶ Using this machine, the labor cost will be reduced to P0.50 per unit. If the money is worth 12% to the company and the machine has an estimated life of 8 years, determine the number of units per year for which the two methods will break-even.

SOL. 5

- ▶ Let N = the number of units per year for the two methods to break even.
- ▶ Manual Labor:
- ▶ Total annual cost: $P1.80N + P2,000$
- ▶ With machine:
- ▶ Depreciation = $(P40,000 - P5,000) (A/F, 12\%, 8)$
= $35,000 (0.08130284)$
= $P2,846$

SOL. 5

Operation cost: P3,000

Labor Cost: 0.50N

Minimum required profit on the investment:

$$0.12 (P40,000) = P4,800$$

Total annual cost: 0.50N + P10,646

To break-even:

$$P1.80N + P2,000 = P0.50N + P10,646$$

$$N = 6,651 \text{ units}$$

EX. 6

- ▶ The annual maintenance cost of a machine shop is P69,994. If the cost of making a forging is P56 per unit and its selling price is P135 per forged unit, find the number of units to be forged to break-even.

SOL 6

Let x = number of units to be forged

Income = Expenses

$$135x = 56x + 69,994$$

$$79x = 69,994$$

$$x = 886 \text{ units}$$

EX. 7

A manufacturer produces certain items at a labor cost of P115 each, material cost of P76 each and variable cost of P2.32 each. If the item has a unit price of P600, how many number of units must be manufactured each month for the manufacturer to break even if the monthly overhead is P428,000.

SOL 7

Let x = number of units to be manufactured per month

Income = Expenses

$$600x = 115x + 76x + 2.32x + 428,000$$

$$406.68x = 428,000$$

$$x = 1053 \text{ units}$$

EX. 8

A steel drum manufacturer incurs a yearly fixed operating cost of \$200,000. Each drum manufactured cost \$160 to produce and sells \$200. What is the manufacturer's break even sales volume in drums per year?

SOL. 8

Let x = number of units to be sold out per year

Income = Expenses

$$200x = 200,000 + 160x$$

$$40x = 200,000$$

$$x = 5,000 \text{ units}$$

EX. 9

JRT Industries manufactures automatic voltage regulators at a labor cost of P85 per unit and material cost of P350 per unit. The fixed charges on the business are P15,000 per month and the variable costs are P20 per unit. If the automatic voltage regulators are sold to retailers at P580 each, how many units must be produced and sold per month to break even.

SOL. 9

Let x = number of units to be produced per month

Income = Expenses

$$580x = 85x + 350x + 20x + 15,000$$

$$125x = 15,000$$

$$x = 120 \text{ units}$$

EX. 10

A company which manufactures electric motors has a production capacity of 200 motors a month. The variable costs are P150 per motor. The average selling price of the motors is P275. Fixed costs of the company amount to P20,000 per month which includes taxes. The number of motors that must be sold each month to break even is?

SOL. 10

Let x = number of motors to be sold each month

Income = Expenses

$$275x = 150x + 20,000$$

$$125x = 20,000$$

$$x = 160 \text{ units}$$