13.1, 13.2 – Breakeven Analysis

A breakeven analysis involves the determination of the value of a specified variable that will make the revenues exactly equal to the costs - i.e. breakeven. This technique can be used for one project or for determining the best of two or more alternatives. The basic technique involves identifying the variable of interest and then finding the magnitude of that variable that will lead to breakeven. Once the breakeven point is known, the available information about whether that variable is likely to have a value above or below the breakeven point can be used to determine which course of action should be taken. The next example illustrates a breakeven calculation.

Example 13.1

A chemical company is trying to decide which type of coating to use inside its chemical storage tanks. A bituminous coating will cost $6,000 initially and will last for 10 years if 'touched up' at the end of year 4. An epoxy coating will cost $15,000, but it will last for 10 years with no other maintenance required. At an interest rate of 15% per year, how much would the touch-up cost have to be in order for the alternatives to break even?

Solution

Write an equation which sets the costs of the two alternatives equal to each other and then solve for the unknown value. Using a present worth equation and letting x represent the value of the touch-up in year 4,

$$-6000 - x\,(P/F,\ 15\%,\ 4) = -15{,}000$$
$$x\,(0.5718) = 9{,}000$$
$$x = \$15{,}740$$

Thus, if the touch-up cost is expected to be less than $15,740 four years from now, the bituminous coating should be used. Otherwise, select the epoxy coating.

Breakeven-type problems oftentimes involve determining the level of production of a certain item that is required for breakeven. Problems of this type usually have fixed costs which do not vary with level of production (like rent, insurance, etc) and variable costs which vary directly with level of production (like labor, materials, etc). The next example illustrates this type of problem.

Example 13.2 - The cost of a machine for producing a certain part is $40,000. The machine is expected to have a maintenance cost of $14,000 and an $8,000 salvage value after its 5-year economic life. If the variable cost for producing the part is $1.50 per unit and the part can be sold for $4.00 per unit, how many parts per year must the company sell in order to breakeven at an interest rate of 12% per year?

Solution - Let x represent the number of parts per year required for breakeven. The annual worth equation is:

$$0 = -40{,}000\ (A/P, 12\%, 5) - 14{,}000 + 8000\ (A/F, 12\%, 5) - 1.50x + 4.00x$$
$$0 = -40{,}000\ (0.27741) - 14{,}000 + 8000\ (0.15741) + 2.50x$$
$$2.50x = 23{,}837$$
$$x = 9{,}534 \text{ parts/yr}$$

Thus, if the company expects to sell more than 9,534 parts per year, it should produce the part. At any sales level below 9,534 parts per year, the company would lose money and, therefore, should not invest in the machine.

When the economic analysis involves two alternatives with variable costs, the annual worths of the alternatives are set equal to each other and the equation is solved for the unknown quantity as shown in the next example.

Example 13.3 Two methods of weed control in an irrigation ditch are under consideration. Method A involves lining the ditch at a cost of $30,000. The lining is expected to last 20 years. Maintenance with this method will cost $2 per mile per year. Method B involves spraying a chemical which costs $45 per gallon, with one gallon capable of treating 10 miles. Spraying equipment will cost $2,500 and will have a life of 3 years with no salvage value. At an interest rate of 10% per year, (a) how many miles of ditch must require treatment in order for the two methods to breakeven, and (b) if 400 miles of ditch must be treated each year, which method should be selected?

Solution :

(a) Set the annual worths for the two methods equal to each other and solve for x miles/yr:

$$-30{,}000\ (A/P, 10\%, 20) - 2x = -2500\ (A/P, 10\%, 3) - 45/10x$$
$$-30{,}000\ (0.11746) - 2x = -2500\ (0.40211) - 4.5x$$
$$2.5x = 2518.53$$
$$x = 1{,}007 \text{ miles/year}$$

(b) At 400 miles per year, the spray method has the lower cost (check by replacing x with 400 in each equation and get -$4324 vs $-2805)