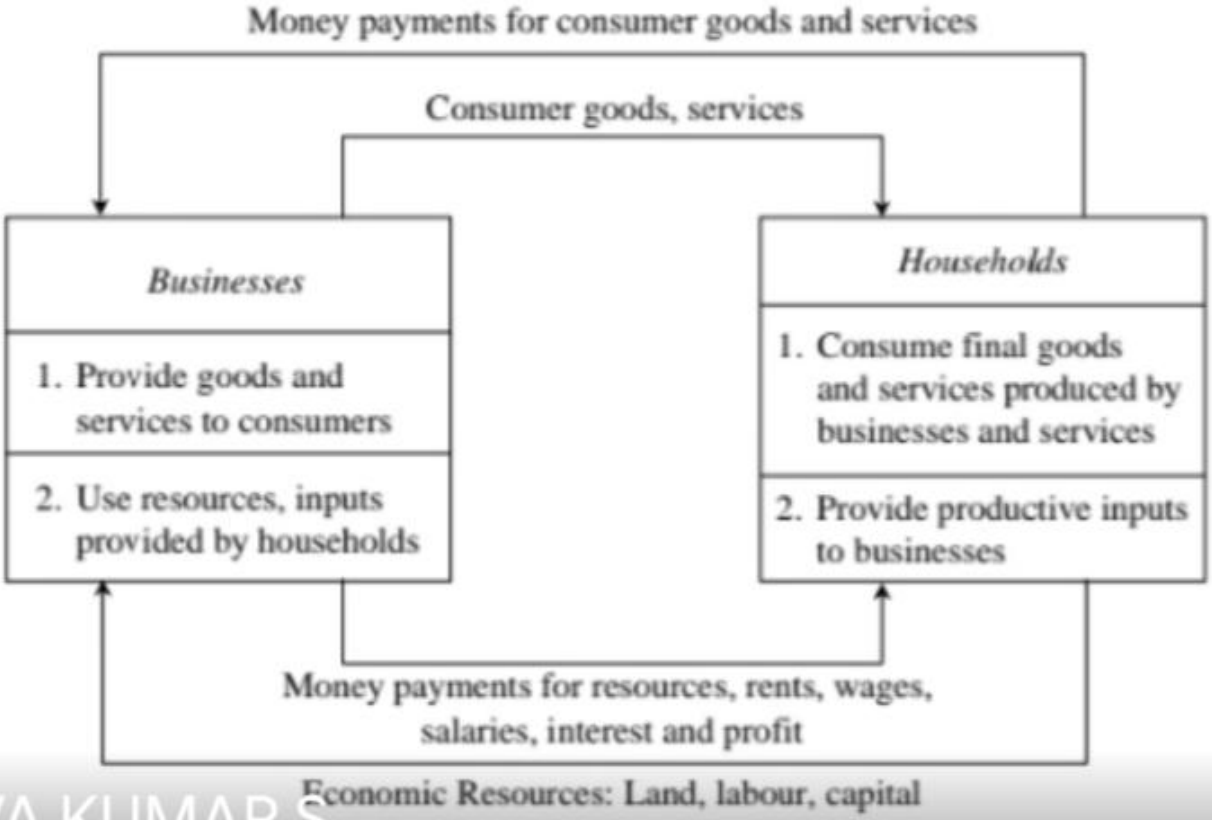

Fig. 1.1 Flow of goods, services, resources and money payments in a simple economy.

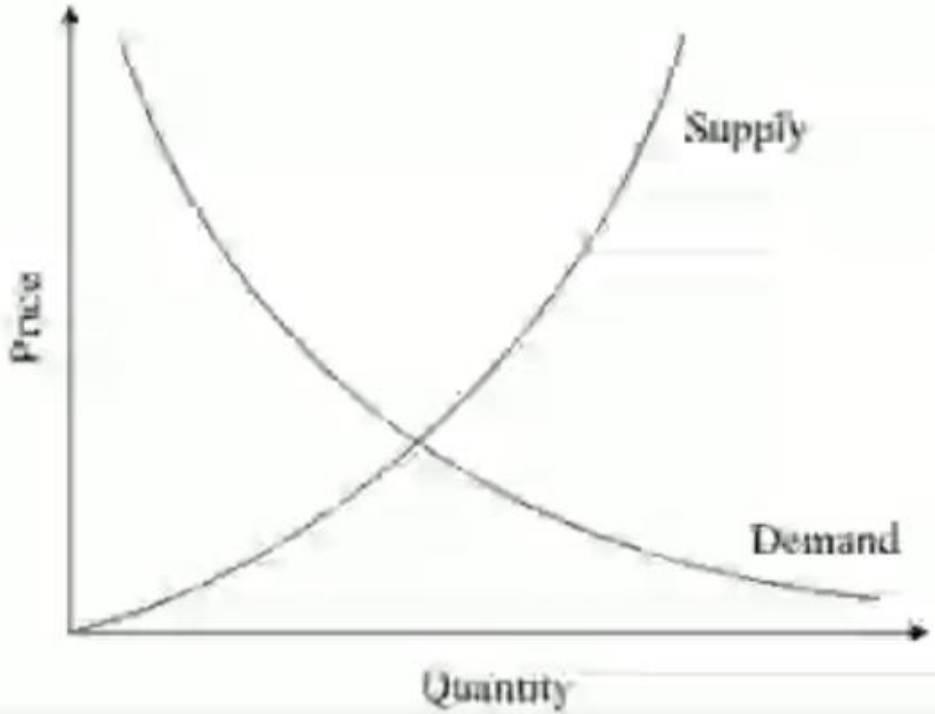

Fig. 1.2 Demand and supply curve

namely VCDs would also increase. Hence, the prices of related goods influences

which in turn will enable it to fix a lower price for its goods or services.

The following section discusses the different types of efficiency and their impact on the operation of businesses and the definition and scope of engineering economics.

1.2.1 Types of Efficiency

Efficiency of a system is generally defined as the ratio of its output to input. The efficiency can be classified into *technical efficiency* and *economic efficiency*.

Technical efficiency

It is the ratio of the output to input of a physical system. The physical system may be a diesel engine, a machine working in a shop floor, a furnace, etc.

$$\text{Technical efficiency (\%)} = \frac{\text{Output}}{\text{Input}} \times 100$$

The technical efficiency of a diesel engine is as follows:

$$\text{Technical efficiency (\%)} = \frac{\text{Heat equivalent of mechanical energy produced}}{\text{Heat equivalent of fuel used}} \times 100$$

In practice, technical efficiency can never be more than 100%. This is mainly due to frictional loss and incomplete combustion of fuel, which are considered to be unavoidable phenomena in the working of a diesel engine.

Economic efficiency

Economic efficiency is the ratio of output to input of a business system.

1.4 OTHER COSTS/REVENUES

The following are the costs/revenues other than the costs which are presented in the previous section:

- Marginal cost
- Marginal revenue
- Sunk cost
- Opportunity cost

1.4.1 Marginal Cost

Marginal cost of a product is the cost of producing an additional unit of that product. Let the cost of producing 20 units of a product be Rs. 10,000, and the cost of producing 21 units of the same product be Rs. 10,045. Then the marginal cost of producing the 21st unit is Rs. 45.

1.4.2 Marginal Revenue

Marginal revenue of a product is the incremental revenue of selling an additional unit of that product. Let, the revenue of selling 20 units of a product be Rs. 15,000 and the revenue of selling 21 units of the same product be Rs. 15,085. Then, the marginal revenue of selling the 21st unit is Rs. 85.

1.4.3 Sunk Cost

This is known as the past cost of an equipment/asset. Let us assume that an equipment has been purchased for Rs. 1,00,000 about three years back. If it is considered for replacement, then its present value is not Rs. 1,00,000. Instead, its present market value should be taken as the present value of the equipment for further analysis. So, the purchase value of the equipment in the past is known as its sunk cost. The sunk cost should not be considered for any analysis done from nowonwards.

1.4.4 Opportunity Cost

In practice, if an alternative (X) is selected from a set of competing alternatives (X,Y), then the corresponding investment in the selected alternative is not available for any other purpose. If the same money is invested in some other alternative (Y), it may fetch some return. Since the money is invested in the selected alternative (X), one has to forego the return from the other alternative (Y). The amount that is foregone by not investing in the other alternative (Y) is known as the opportunity cost of the selected alternative (X). So the opportunity cost of an alternative is the return that will be foregone by not investing the same money in another alternative.

Consider that a person has invested a sum of Rs. 50,000 in shares. Let the expected annual return by this alternative be Rs. 7,500. If the same amount is

M.S. as a per cent of sales = (M.S./Sales) × 100

EXAMPLE 1.1 Alpha Associates has the following details:

Fixed cost = Rs. 20,00,000
Variable cost per unit = Rs. 100
Selling price per unit = Rs. 200

Find
(a) The break-even sales quantity,
(b) The break-even sales
(c) If the actual production quantity is 60,000, find (i) contribution; and (ii) margin of safety by all methods.

Solution

Fixed cost (FC) = Rs. 20,00,000
Variable cost per unit (v) = Rs. 100
Selling price per unit (s) = Rs. 200

(a) Break-even quantity $= \frac{FC}{s - v} = \frac{20,00,000}{200 - 100}$

$= 20,00,000/100 = 20,000$ units

(b) Break-even sales $= \frac{FC}{s - v} \times s$ (Rs.)

$= \frac{20,00,000}{200 - 100} \times 200$

$= \frac{20,00,000}{100} \times 200 =$ Rs. 40,00,000

(c) (i) Contribution = Sales – Variable cost

$= s \times Q - v \times Q$

$= 200 \times 60,000 - 100 \times 60,000$

$= 60,00,000$

$= 20,00,000/100 = 20,000$ units

(b) Break-even sales $= \dfrac{FC}{s - v} \times s$ (Rs.)

$= \dfrac{20,00,000}{200 - 100} \times 200$

$= \dfrac{20,00,000}{100} \times 200 =$ Rs. 40,00,000

(c) (i) Contribution = Sales – Variable cost

$= s \times Q - v \times Q$

$= 200 \times 60,000 - 100 \times 60,000$

$= 1,20,00,000 - 60,00,000$

= Rs. 60,00,000

(ii) Margin of safety

METHOD I

M.S. = Sales – Break-even sales

$= 60,000 \times 200 - 40,00,000$

$= 1,20,00,000 - 40,00,000 =$ Rs. 80,00,000

METHOD II

$$\text{M.S.} = \frac{\text{Profit}}{\text{Contribution}} \times \text{Sales}$$

Profit = Sales – $(FC + v \times Q)$

$= 60,000 \times 200 - (20,00,000 + 100 \times 60,000)$

$= 1,20,00,000 - 80,00,000$

= Rs. 40,00,000

$$\text{M.S.} = \frac{40,00,000}{60,00,000} \times 1,20,00,000 = \text{Rs. } 80,00,000$$

$$\text{M.S. as a per cent of sales} = \frac{80,00,000}{1,20,00,000} \times 100 = 67\%$$