a capitalist economy, main problem of personal distribution is **inequality in the distribution of income and its causes.**

(2) **Functional Distribution:** It refers to the distribution of income among different factors of production, *viz.*, land, labour, capital and entrepreneur, according to their functions. It relates to the **source of income**, *i.e.*, rent, wage, interest and profit.

2. What is Theory of Factor Pricing?

Large number of goods and services are produced in our country every year. In order to produce these goods and services, we need the services of factors of production like land, labour, capital and entrepreneur. The price which is paid to these factors for their services is called factor price, *e.g.* wages to labour, interest to capital, rent to land and profit to entrepreneur. Theory of factor pricing is, therefore, concerned with the determination of prices of the services of different factors of production.

There are two aspects of the price of each factor:

(1) **Price Aspect:** The amount paid by a firm to a factor for its services, *e.g.* wages, interest, etc., constitutes the price of the factor concerned.

(2) **Income Aspect:** The amount received by a factor in return for its services, *e.g.* rent, wages, interest and profit constitutes its income. The aggregate of the income so received by different factors of production is called national income or national product. This national income or product is distributed among these very factors.

Definition

According to **Prof. Anatol Murad,** *"The Theory of factor pricing deals with the prices paid for factor services (land, labour, capital, entrepreneur) and received by the sellers of factor services. It deals with wage rates, interest rates, specific rent and profit."*

The theory of factor pricing is also called the **Theory of Distribution**. These factors are also known as Production Services, Resources or Inputs.

2.1 Why a Separate Study of Factor Pricing?

Under the theory of value, we have studied the determination of product prices. We have seen that in the commodity market, the prices are determined by the interaction of the forces of demand and supply. In the factor market also, prices of factors of production are determined by the interaction of demand and supply forces. There is much similarity in the theory of factor pricing and product pricing. Both are fundamentally based upon the interaction of buyers and sellers. However, the roles of buyers and sellers in factor pricing are reversed. Firms are sellers in product markets but they are buyers in factor markets. The households and individuals are the buyers in the product market and sellers in the factor markets. Then, why not extend the theory of value to studying the determination of prices in the factor market? *Where is the need for a separate theory?* The answer lies in the fact that the nature of demand and supply of factor services in the factor market is entirely different from the nature of demand and supply in the commodity market. This difference is as follows:

labour may increase in response to higher wage rate, but only when the level of wages is low, and the workers are striving for a meaningful existence. After a particular level of wages is reached (offering a reasonable living to the workers) more of labour may not be supplied in response to higher wage rate. Workers may start preferring leisure to work, in which case the supply curve of labour will be backward sloping. Such a phenomenon is not found in the commodity market. Supply of land is a unique case in itself. Land is a free gift of nature and is fixed in supply. From the viewpoint of the economy as a whole, supply of land is just independent of its price.

(ii) Relation between Cost and Supply

Supply of goods is very closely determined by the cost of producing these goods. But it is not equally true in the case of factors of production. In fact, it is so very difficult to work out the cost of supplying factors of production. Can you, for example, make any cost-estimate of supplying your labour in a software computer factory? Will that cost-estimate be the same when you are supplying the same amount of labour in a chemical factory? Perhaps not! Likewise, what is the cost of savings or capital accumulation? Savings involve abstinence from consumption. But 'abstinence' is purely a subjective phenomenon. It differs from person to person. Such ambiguities render it difficult to work out any specific relationship between the 'cost' and 'supply' of factors of production.

It is because of the above peculiarities with regard to demand for and supply of factors that the theory of factor pricing is studied separately from the theory of product pricing.

■ 3. Some Basic Concepts

We must appreciate some basic concepts before analysing the theory of factor pricing. In fact these concepts are to be extensively used in our examination of factor price determination. These concepts relate to:

(1) Productivity of the Factor, and

(2) Cost of the Factor.

● 3.1 Productivity of the Factor

Productivity of the factor is perhaps the most important parameter in the theory of factory pricing. It refers to contribution of the factor to the total output. It has two aspects:

(1) Marginal Productivity, and

(2) Average Productivity.

(1) Marginal Productivity

Marginal productivity of a factor refers to 'additional product' as a result of the employment of an additional unit of a factor, keeping the application of other factors as constant. 'Additional product' may be measured either in terms of additional units of the commodity produced, or in terms of additional revenue accruing to the producer on account of the sale of additional units produced. Thus, the term marginal productivity can be used in the following three senses:

(i) Marginal Physical Productivity,

(ii) Marginal Revenue Productivity, and

(iii) Value of Marginal Physical Productivity.

(i) Marginal Physical Productivity

When measured in terms of additional units of the commodity produced, marginal productivity is referred to as **Marginal Physical Productivity**. In the words of **Prof. M.J. Ulmer**, *"Marginal Physical Productivity may be defined as the addition to total production resulting from employment of one more unit of a factor of production, all other things being constant."*

Formula for Estimating Marginal Physical Productivity

Marginal Physical Productivity of a factor is estimated using the following formula:

$$MPP_n = TPP_n - TPP_{n-1}$$

Or

$$MPP = \frac{\Delta TP}{\Delta L}$$

(Here, MPP_n = Marginal physical productivity of a factor 'nth' unit of the factor is employed; TPP_n = Total physical productivity of a factor when 'n' units of the factor are employed; MPP = Marginal physical productivity of a factor; TPP_{n-1} = Total physical productivity of a factor when 'n–1' units of the factor are employed; ΔTP = Change in total product; ΔL = Change in factor.)

Illustration

Suppose 100 pairs of shoes are produced in a day when 10 workers are employed along with 10 units of capital. Instead, if 11 workers are employed along with 10 units of capital, 110 pairs of shoes are produced. The contribution of 11th worker to the total output thus is 110 – 100 = 10 pairs of shoes. This exactly is the Marginal Physical Productivity of labour. Using the above stated formula, this is worked out as under:

$$MPP = TPP_n - TPP_{n-1}$$

$$= 110 - 100 = 10$$

[In this case, n = 11 and n – 1 = 10.]

(ii) Marginal Revenue Productivity

The concept of marginal revenue productivity is related to change in total revenue. In the words of **Prof. M.J. Ulmer,** *"Marginal revenue productivity may be defined as the addition to total revenue resulting from employment of one more unit of a factor of production, all other things being constant."*

Formula for Estimating Marginal Revenue Productivity

Marginal Revenue Productivity is estimated using the following formula:

$$MRP_n = TRP_n - TRP_{n-1}$$

Or

$$MRP = \frac{\Delta TRP}{\Delta L}$$

(Here, MRP_n = Marginal revenue productivity of 'nth' unit of the factor; TRP_n = Total revenue productivity when 'n' units of the factor are employed; TRP_{n-1} = Total revenue productivity when 'n–1' units of the factor are employed; MRP = Marginal revenue productivity of the factor; ΔTRP = Change in total revenue productivity; ΔL = Change in factor.)

Or

$$MRP = MPP \times MR$$

(Here, MRP = Marginal revenue productivity of the factor; MPP = Marginal physical productivity of the factor; MR = Marginal revenue which is the additional revenue accruing to the producer on account of the sale of one additional unit of the commodity.)

Note the Difference between MR and MRP

MRP refers to the additional revenue accruing to the producer on account of the sale of **ALL** additional units of the commodity produced, resulting from the employment of **ONE** additional unit of the factor. MR, on the other hand, refers to additional revenue accruing to the producer on account of the sale of just **ONE** additional unit of the commodity produced.

Illustration

Continuing the previous example, if 100 pairs of shoes produced by 10 workers (along with 10 units of capital) fetch a revenue of ₹ 10,000 (each pair being sold for ₹ 100), and if 110 pairs of shoes fetch a revenue of ₹11,000, then MRP is ₹ 11,000 – ₹ 10,000 = ₹ 1,000. Using the above formula, this is worked out as under:

$$MRP_n = TRP_n - TRP_{n-1}$$
$$= ₹\ 11,000 - ₹\ 10,000$$
$$= ₹\ 1,000$$

Alternatively, if one additional pair is sold for ₹ 100, so that MR = 100, then

$$MRP = MPP \times MR$$
$$= 10 \times ₹\ 100$$
$$= ₹\ 1,000$$

(iii) Value of Marginal Physical Productivity

According to **Ferguson and Maurice,** *"The value of the marginal product (VMP) of a variable factor is equal to its marginal physical product multiplied by the market price of the commodity in question."* Thus, the value of the marginal product is equal to the marginal product multiplied by commodity price. In other words, the value of marginal product of a factor measures the extra

revenue the competitive firm can receive by selling the additional output generated when it increases employment of the factor by one unit.

Formua for Estimating Value of Marginal Physical Productivity

Value of marginal physical productivity of a factor is estimated using the following formula.

$$VMP = MPP \times AR$$

(Here, VMP=Value of marginal physical productivity; MPP = Marginal physical productivity; AR = Average revenue or price.)

Illustration

Continuing the previous illustration of Marginal Physical Product, suppose the price of the shoe is ₹ 100 per pair and MPP of 11th worker is 10 pair of shoes, the value of marginal physical product of 11th worker is 10 × ₹ 100 = ₹ 1,000. Using the above formula, it is worked out as:

$$VMP = MPP \times AR$$
$$= 10 \times ₹\ 100$$
$$= ₹\ 1,000$$

Illustration

Table 1 below illustrates the equality between MRP and value of MPP under conditions of perfect competition.

Table 1. Equality between MRP and Value of MPP Under Perfect Competition

Units of Labour	Total Product (metres of cloth)	MPP	Price = AR (AR = MR) (=₹ 5)	MRP = MPP × MR (₹)	Value of MPP = MPP × AR (₹)
1	5	5	5	25	25
2	9	4	5	20	20
3	12	3	5	15	15
4	14	2	5	10	10
5	15	1	5	5	5

Table 1 shows diminishing MPP in accordance with the law of diminishing returns or the law of variable proportions. It shows AR = MR as under perfect competition. Last two columns of the table show identity between MRP and the value of MPP.

■ 5. Marginal Productivity Theory of Distribution or Factor Pricing

Marginal productivity theory is the oldest and most significant theory of factor pricing. It was propounded in 1826 by German economist **T.H.Von Thunen**. It was further developed by Austrian economists **Karl Menger** and **Bohm Bawerk,** French economist **Walras,** English economist **Wicksteed, Edgeworth** and American economist **Clark.** According to marginal productivity theory under perfect competition, every factor of production gets a remuneration equal to its marginal revenue productivity.

Factors are demanded because they have the capability to produce goods and services. This capability to produce goods and services is called marginal productivity of the factors. Thus, factor of production is demanded for its productivity. To find out the productivity of a factor it is essential to use one more unit of that factor while keeping the supply of other factors constant. As a result of it, whatever increase is made in the total production, will mainly be due to the use of additional unit of that factor. This increase in total production is called the marginal productivity of that factor. Thus, due to their interdependence, demand for factors depends upon their marginal productivity.

◣ Definition

➠ In the words of **Leibhafsky,** *"The marginal productivity theory of income distribution states that under perfect competition, factors of production would tend to receive a real rate of return which was exactly just equal to their marginal productivity."*

➠ According to **Mark Blaug,** *"The marginal productivity theory contends that in equilibrium each productive agent will be rewarded in accordance with its marginal productivity."*

● 5.1 Assumptions

Marginal productivity theory of factor pricing is based on the following assumptions:

(1) Perfect Competition in Product Market: There is perfect competition in the market where produced goods are sold. Accordingly, marginal revenue and average revenue of the product will be equal. This implies that (i) AR = MR, and (ii) MRP = VMP.

(2) **Perfect Competition in Factor Market:** There is perfect competition in factor market as well. It means that each firm will have to pay the prevailing price of the factor. It also implies that at the prevailing factor price, a firm can hire whatever amount of the factor it wishes to hire. In other words, supply of a factor to a particular firm is perfectly elastic. In such a market, it is implicitly assumed that

(i) All units of the factor are homogeneous, and

(ii) Factors of production are perfectly mobile.

(3) **Variable Proportion Type Production Function:** It is assumed that production is of variable proportion types. In other words, output can be increased by changing the factor ratio.

(4) **Possibility of Factor Substitution:** It is technically possible to substitute different factors for each other. It means capital can be substituted for labour and vice-versa.

(5) **Divisible Factor:** Different factors of production can be divided into small units to facilitate substitution for each other.

(6) **Maximum Profit:** Every producer aims at maximising profit.

(7) **Full Employment:** There is full employment in the system. It implies that the supply of the factor is constant.

(8) **State of Technology remains Constant:** There is no change in the technique of production.

(9) **One Variable Input:** The firm uses only one variable input. Other factors are fixed during the period being considered.

(10) **Law of Variable Proportions:** The production is subject to law of variable proportions.

• 5.2 Explanation of the Theory

The theory addresses itself basically to two questions:

(i) From the viewpoint of the industry, it studies how the price of a factor is determined, and

(ii) From the viewpoint of a particular firm, it studies how much of the factor will be employed.

In the words of **Blaug,** *"The marginal productivity theory is a theory of factor pricing on industry's level, the supply of factor to the industry being given, for the firm it is employment theory, the rate of factor pricing being given."*

• 5.3 Explanation of the Theory from the Viewpoint of an Industry

As noted earlier, from the viewpoint of an industry, the marginal productivity theory studies how the price of a factor is determined. Under perfect competition price of a factor is determined at that level where the market demand for the factor is equal to its supply. However, the theory assumes the state of full employment in the system. Under this situation, supply of the factor becomes constant. Hence, factor price will be determined by its demand alone.

Industry's Demand for a Factor

An industry consists of a group of many firms. Accordingly, an industry's demand curve for a factor can be drawn with the help of demand curves of all the firms for that factor. We know that to a

firm, marginal revenue productivity (MRP) curve of a factor constitutes its demand curve. It is so because a firm's demand for a factor depends upon its marginal revenue productivity. A profit maximising firm will employ those units of the factor at which their marginal revenue productivity is equal to the prevailing factor price or marginal factor cost (MRP = MFC). The firm's demand curve or MRP curve, when other inputs are not varied must slope downwards. This is because of the application of the law of diminishing returns. The market or industry's demand for a factor of production is the total demand for that factor by all firms. The industry demand curve for a given factor is obtained by adding up the quantities demanded of that factor by each firm. It will be a horizontal summation of the falling portion of the MRP curves (for the concerned factor) for all the firms in the industry. Demand curve of the industry for a factor of production is illustrated in **Fig. 4**.

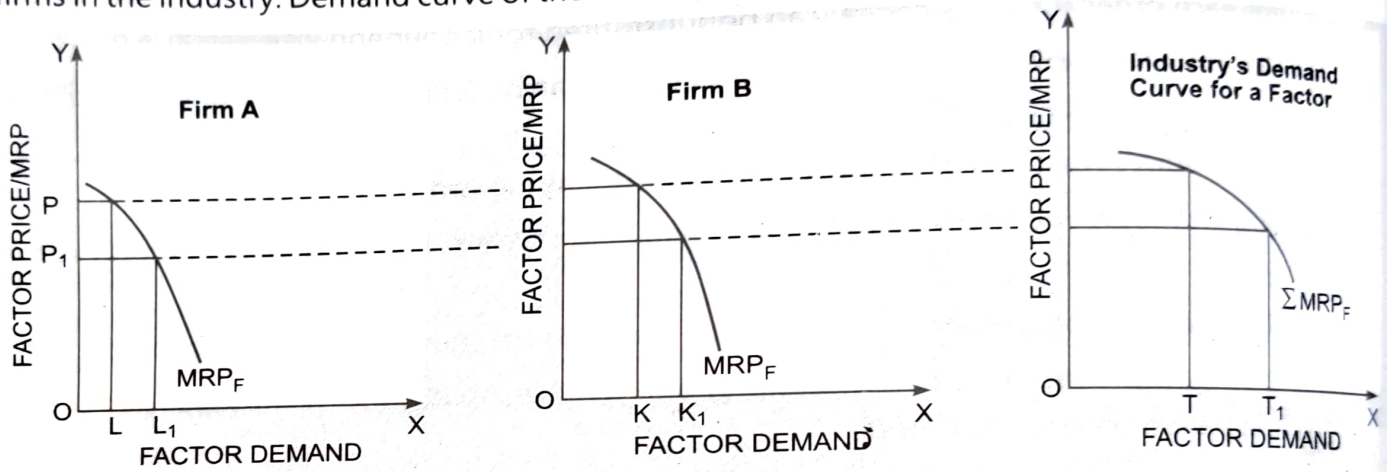

Fig. 4

It is clear from the **Fig. 4** that, when price of the factor is OP, firm A demands OL units of the factor and firm B demands OK units of the factor. On the assumption that there are only two firms in the industry, total demand for the factor (by the industry) = OL + OK = OT. Likewise, when price reduces to OP_1, firm A's demand extends to OL_1, firm B's demand extends to OK_1 and industry's demand extends to $OT_1 = (OL_1 + OK_1)$. Thus, ΣMRP_F indicating industry's demand curve is derived as a horizontal summation of the falling segments' of MRP_F curves for all the firms in the industry.

Factor Price Determination

Price of a factor will be determined at a point where industry's demand curve for the factor intersects its supply curve. Supply of the factor is assumed to be fixed from industry's point of view. Hence, price of the factor will mainly be determined by the demand curve, as determined by marginal productivity of the factor. It is clarified in **Fig. 5**.

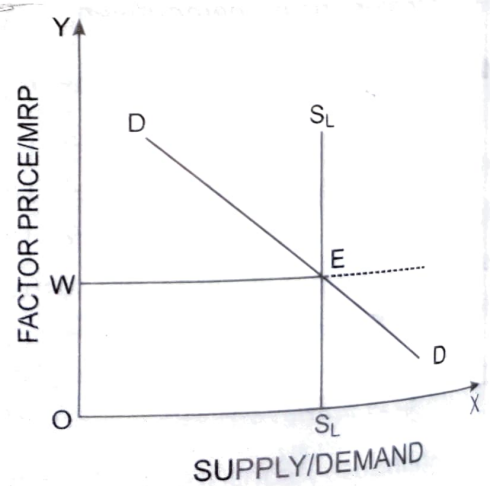

Fig. 5

In **Fig. 5**, factor supply/demand are shown on X-axis and factor price on Y-axis. DD curve represents industry's demand curve for a factor. It slopes downward. S_LS_L is

factor's supply curve. It is parallel to Y-axis. It indicates that under full employment condition, OS_L supply of factor is fixed. Demand curve of factor and its supply curve cut each other at point E which indicates equilibrium point. At this point, demand for and supply of factor are equal. Point E shows that OW factor price will be determined.

Given this factor price, a firm under perfect competition takes its decision regarding employment of the factor.

5.4 Explanation of the Theory from the Viewpoint of a Firm

Under perfect competition, cost of a factor being given to a firm, the only decision that a firm is to take is 'how much of the factor is to be employed.' According to this theory, a firm, under perfect competition will employ that number of a factor at which marginal factor cost is equal to the marginal revenue product or value of its marginal physical product (VMP), (MFC = MRP or VMP). Thus, from the point of view of a firm, the theory indicates how many units of a factor it should demand. That is why, it is also called Theory of Factor Demand. Other things remaining the same, as more and more units of the factor are employed by a firm, their marginal physical productivity goes on diminishing. As we know, price (AR = MR) of the product under perfect competition is given to a firm, so when the marginal physical productivity of the factor goes on diminishing, it means, marginal revenue productivity (MPP × MR) will also go on diminishing. In order to achieve its objective of maximum profit, a firm will employ units of factor of production upto the point where their marginal revenue productivity (MRP) is equal to price of the factor. If the firm employs units of factor upto the point where their MRP is less than their price, then it will suffer losses. This theory is explained with the help of **Table 2** and **Fig. 6**.

Table 2. Factor Demand by the Firm

Units of Factors	MPP	Price of Product (AR = MR) (₹)	MRP (=MPP × MR) (₹)	Factor Price (₹)
1	10	2	10 × 2 = 20	8
2	8	2	8 × 2 = 16	8
3	6	2	6 × 2 = 12	8
4	4	2	4 × 2 = 8	8
5	2	2	2 × 2 = 4	8

It is clear from **Table 2** that factor cost is ₹ 8 per unit. Price of the product produced by the factor is ₹ 2 per unit. When the firm employs one unit of the factor, his marginal physical productivity is 10 units of the product. Multiplying marginal physical productivity by the price (AR = MR) of the product, one gets marginal revenue productivity or value of marginal physical productivity (MRP = VMP). In this case, it is ₹ 20 (= 10 × ₹ 2). It may be noted that under perfect competition where AR = MR, marginal revenue productivity (MPP × MR) = value of marginal physical productivity (MPP × AR). Marginal revenue productivity of the second unit of the factor is ₹ 16 (= 8 × ₹ 2), of third unit of

factor is ₹ 12 (= 6 × ₹ 2) and of fourth unit of factor is ₹ 8 (= 4 × ₹ 2). Marginal revenue productivity of the fourth unit of factor (₹ 8) is equal to his factor price (= ₹ 8). Hence, to earn maximum profit the firm will employ 4 units of factor only. If the firm employs the fifth unit of the factor it will suffer a loss of ₹ 4, because his marginal revenue productivity is ₹ 4 while the firm pays him prevailing factor price of ₹ 8. Thus, to earn maximum profit, a firm will employ a factor up to the point where its marginal revenue productivity is equal to marginal factor cost.

Thus, the basic rule with respect to employment of a factor by a firm may be summed up as follows:

(i) If for a particular factor **MRP > MFC**, the firm would employ more units of a factor.

(ii) If for a particular factor **MRP < MFC**, the firm would decrease the employment of the factor.

(iii) The firm is in equilibrium when for a particular factor, **MRP = MFC.**

Fig. 6 offers a diagrammatic explanation of the theory of marginal productivity from the point of view of the firm. In it, units of a factor are shown on X-axis and factor cost/productivity are shown on Y-axis. MRP is marginal revenue productivity curve and WW line indicates the prevailing factor price. Under perfect competition, factor price is given to a firm, that is why, WW curve is parallel to X-axis. Marginal revenue productivity (MRP) curve is sloping downward. This is in accordance with the law of diminishing returns. It cuts factor cost curve WW at point E; the equilibrium point (MRP = factor cost = ₹ 8). Equilibrium point E indicates that at the factor cost of ₹ 8 a firm will demand 4 units of a factor only. Employing 5th unit of the factor by the firm would mean a loss of ₹ 4, as the marginal revenue productivity of this unit is ₹ 4 while its factor cost is ₹ 8.

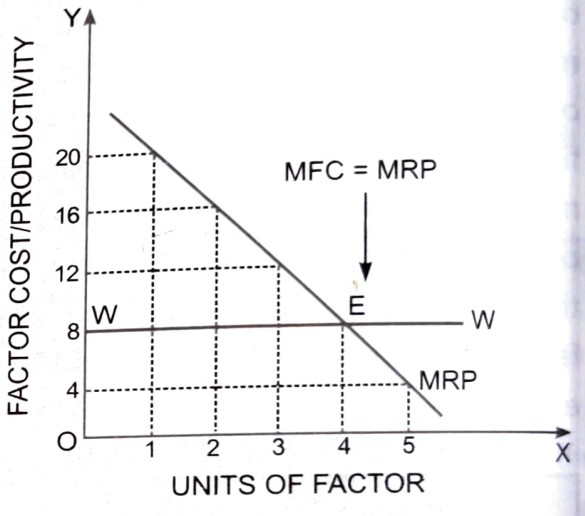

Fig. 6

We can conclude with **Maurice and Philips,** *"A profit maximising competitive firm will employ units of a variable productive resource until the point is reached where the value of the marginal product of the input is equal to input price."* In other words, the profit maximising amount of a factor should satisfy the following conditions:

(i) When there is only one variable factor, for example, labour.

$$MRP_L \text{ (VMP)} = MFC_L \text{ (Price of Labour)}$$

Or,
$$\frac{MRP_L}{MFC_L} = 1$$

Or,
$$\frac{MRP_L}{\text{Price of Factor (Labour)}} = 1$$

(Here, MRP_L = Marginal revenue productivity of labour; MFC_L = Price of factor.)