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# CRITERIA OF EFFICIENCY FOR RESOURCE ALLOCATION

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Generally, an economic agent is faced with the decision how to allocate his resources in order to attain economic efficiency. Economic efficiency exists in production when resources are used to give maximum profit to the operator of the firm. This involves making a choice of which one of many uses of resources and methods of production will maximize one's goal. The most profitable point of operation for an enterprise can be determined either by most profitable levels of output or by most profitable amount of input.

Under perfect competition, the enterpreneur is assumed to buy inputs and sell his output in a perfectly competitive market, where prices and production functions are assumed to be known and where resources constraints do not exist. In such a market, a rational enterpreneur will tend to allocate the different inputs in the following manner in order to maximize his profit (1, 4).

(1) where a single variable input x (water) and one product q (wheat) is involved, as $q = f(x)$, a rational farmer will allocate input x to the production of q until the marginal value product of input x producing output q is equal to the input price, i.e., $MVP_{xq} = P_x$

$$q = f(x)$$

$$\pi = P_q q - P_x X - F$$

$$\pi = P_q f(x) - P_x X - F$$

where $\pi$ is the profit, F represents fixed cost, $P_q$ is the price of output q, and $P_x X$ is the variable cost of operation. The enterpreneur adjusts his input usage so as to maximize profit. This condition implies

$$\frac{\sigma \pi}{\sigma x} = P_q f'(x) - P_x = 0$$

$$P_q f'(x) = P_x$$

$$P_q \frac{\sigma q}{\sigma x} = P_x$$

$$P_q MPP_{xq} = MvP_{xq} = P_x$$

$$\frac{P_q (MPP_{xq})}{P_x} = 1$$

where $MVP_{xq}$ = marginal value product of input x of producing output q

$P_x$ = price per unit of input x

$P_q$ = price per unit of output q

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$MPP_{xq}$ = marginal physical product of input x in the production of q.

In short, the above formulation tells us that a rational enterpreneur will employ a variable input to the optimal point where the last unit applied can pay for itself. Additional input employed beyond this quantity will have a deleterious effect on profit, i.e., marginal cost of the increased input exceeds the marginal revenue.

(2) In the case, where a single factor is used to produce multiple products, the profit maximization rule calls for the variable input to be applied in such an intensity until $MVP_x = P_x$ in each product as indicated below

$$\frac{P_{q_j}\left(\frac{\sigma q_j}{\sigma x}\right)}{P_x} = 1, \quad j = 1,2,3,4,\ldots,n$$

where in index j represents a different product.

(3) The third case involves a situation in which several inputs are employed to produce a single product q. Here again the optimum use of resources for profit maximization demands that the various inputs should be used in such a way until the marginal value product of each resource in the production certain product q is equal to the price of the different factor of production, i.e..

$$\frac{P_q\left(\frac{\sigma q}{\sigma x_i}\right)}{P_{x_i}} = 1, \quad i = 1,2,\ldots,m \text{ (inputs)}$$

(4) The last case deals with multiple factors and products. The MVP's of each input in each product must be equal to the price of the different factors, i.e.,

$$\frac{P_{q_j}\left(\frac{\sigma q_j}{\sigma x_i}\right)}{P_{x_i}} = 1, \quad \begin{array}{l} j = 1,2,\ldots,n \text{ (products)} \\ i = 1,2,\ldots,m \text{ (inputs)} \end{array}$$

The criteria, used so for have some shortcomings because they are based on:

(1) no resource constraint,
(2) absence of uncertaintiy, and
(3) existence of perfect competition.

In the real world the assumption of unlimited or perfectly elastic supply of resources is nothing more than an expression of a good wish. Also, the assumption of the farmer's ability to forecast and predict the future is unrealistic. In agriculture, for instance, weather and price fluctuations are quite common. The enterpreneur has no way to anticipate them with certainty.

Modifying some of the earlier assuptions, a rational economic agent will tend to allocate inputs at his disposal among the various uses. In the real world resources are also scarce; therefore, their allocation must be considered in the light of scarcity rather than abundance. Thus assuming a limited resource availability a rational enterpreneur will tend to allocate his input so that the marginal value product of resource exceeds the price of the input (1 2). Mathematically:

(1) where one resource and one output is involved

$$\frac{P_q\left(\frac{\sigma q}{\sigma x}\right)}{P_x} = c, \quad \text{where } c > 1$$

(1) Limited resource availability implies that an economic agent has a finite amount of money to purchase factor(s) of production. OR a limited quantity of input(s) is available to him to produce certain product(s).

(2) Under resource constraint an economic agent may be minimizing cost by using variable resources in the correct combination and still not be maximizing profit. Because the profit maximizing level of output requires the use of variable resources in correct combination and also in correct absolute amount.

(2) when a single factor is used in the production of multiple products, the given resource must be allocated in such a way that its marginal earnings in different enterprises must be equal in all, i.e.,

$$\frac{P_{q_1}\left(\frac{\partial q_1}{\partial x}\right)}{P_x} = \frac{P_{q_2}\left(\frac{\partial q_2}{\partial x}\right)}{P_x} = \frac{P_{q_n}\left(\frac{\partial q_n}{\partial x}\right)}{P_x} = c$$

or

$$\frac{P_{q_j}\left(\frac{\partial q_j}{\partial x}\right)}{P_x} = c \qquad \text{where } j = 1,2,\ldots,n$$

The index j represents different projects.

(3) It involves a situation in which several inputs are employed to produce a single product q. The optimum use of resources for profit maximization demands that the various inputs should be used in such a way until the marginal value product of each resource in the production of certain product q is greater than its price and marginal earnings of different resources must be equal in all (2. 3), i.e.,

$$\frac{P_q\left(\frac{\partial q}{\partial x_1}\right)}{P_{x_1}} = \frac{P_q\left(\frac{\partial q}{\partial x_2}\right)}{P_{x_2}} = \frac{P_q\left(\frac{\partial q}{\partial x_m}\right)}{P_{x_m}} = c$$

or

$$\frac{P_q\left(\frac{\partial q}{\partial x_i}\right)}{P_{x_i}} = c, \qquad i = 1,2,\ldots,m \text{ (inputs)}$$

(4) The more general case in the real world resource utilization pertains to the multiple product and multiple factor use. To maximize the profit, the economic agent will allocate his resources as follows:

$$\frac{P_{q_j}\left(\frac{\partial q_j}{\partial x_i}\right)}{P_{x_i}} = c, \qquad \text{where } j = 1,2,\ldots,n \text{ (products)}, \quad i = 1,2,\ldots,m \text{ (inputs)}$$

In all the above formulations $c > 1$, i.e., under the condition of resource constraint an economic agent will apply resources to the production of certain products as long as the marginal value return of the individual factor is greater than the factor price.


## SUMÁRIO

O autor tenta enfatizar como os recursos limitados e não limitados podem ser alocados eficientemente entre os vários usos.

Sob condições de não restrição na quantidade de recursos e competição perfeita, o empresário racional empregará um insumo variável no ponto ótimo quando a última unidade aplicada se paga por si mesma. Entretanto, quando existe a limitação na quantidade de recursos que ele pode comprar, um agente econômico aplicará um fator na produção de certos produtos até onde o valor marginal do retorno desse fator individual for maior que o seu preço.


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