

4 Production Theory

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I Concept of Cost

1 Definition

The cost of an act or a decision is (the value of) the highest-valued option currently forgone.

- * Economists specify the cost of an act or a decision because the cost of doing an act, deciding an act, and the cost incurred after an act is done are all different. For example, it is different to refer to the **cost of making** notes to students with the **cost of printing** notes.
- * We face with options in our daily life. We value these options differently based on our subjective and objective valuation. As rational men, we must choose the highest-valued option because we want to maximize our gain. It is this option that allows us to achieve maximization.
- * Suppose we don't have the highest-valued option available, we then follow, obviously by choosing the " second highest-valued option ". In other words, in choosing the " first highest-valued option " we sacrifice the " second highest-valued option " **only**. In economics, the so-called " second highest-valued option " is termed the " highest-valued option **forgone** ".

2 Importance of " The Cost of Doing An Act "

- * By comparing the cost & benefit of doing an act, we can explain and predict whether the act will be enacted or not.
- * If we can identify that the cost of doing something has changed, we can predict that human behaviour will change accordingly, ceteris paribus.
- * Only when the highest-valued option forgone has changed will the cost of doing something change. The bad consequence of an act is different from its cost.
For example, a poorly conducted lesson is just the **nature**, not the **cost of attending** this lesson.

3 An Example on Cost

Consider a person deciding whether or not to have a Karaoke set. He determines that the "good" consequences of the set are worth what we shall call 100 units, while the "bad" results are equivalent to the loss of 40 units. The best option other than the set is, let us say, to take option A (let it be a new T.V. set), with "good" attributes valued at 70 units and "bad" valued at a loss of 20 units.

The Karaoke set has a net value of 60 units (= 100 - 40 units) while option A is worth 50 units (= 70 - 20 units). What is lost if the Karaoke set is finally selected is the 50 units of value otherwise available by choosing option A (not the loss of 40 units).

If the person takes a much longer time and effort to set up the Karaoke set (e.g. in connecting the cords) and as a result, is blamed by his family members of being disturbing, he considers the blame as an unexpected pain. The existence of pain does not affect the option. What the pain does is to reduce the net value of the choice of the Karaoke set. It is the **consequence** of an act, not the cost of it.

4 Types of Cost : Traditional Classification

The traditional classification of cost is based on the relation between output and factor input.
The fixed cost (overhead cost) and variable cost (operating cost) are the results of the classification.

5 Types of Cost : Other Classification

(I) A. Alchian

* Operating Cost : This is the cost of using an asset. In production, it is the cost of production with respect to an increase in output, i.e. the commonly called variable cost.

* Acquisition Cost : It is the difference between the purchase price of an asset and its immediate resale price. It is the cost to you only at the moment that you are to acquire or to buy the asset. Once you have bought it, you have already incurred this cost - so it becomes a sunk cost then. The lower the immediate resale value, the higher the acquisition cost.

* Possession Cost : It is the reduction in the resale value of an asset without using it. It is the interest which could have been earned by the current resale value (not the purchase price) of an asset, plus the depreciation over the year (and the taxes and insurance incurred on the asset).

* Sunk Cost : It is an expenditure made in the past. It is a measure between the actual cost and the scrap value. Sunk cost does not represent current options or decisions because the costs are measured by the options passed up over the period of time you *intend to possess* the asset. Sunk costs are by-gones. Yesterday's opportunity is today's sunk cost. All past costs are sunk costs.

(II) Ronald Coase : Transaction Cost

It refers to all those costs that are not directly incurred during the process of production. In any economy (with more than one person), exchanges involve transaction costs of some kinds.

* Information cost is incurred before an exchange is made when people gather information about the goods and services intended to buy.

* Contractual cost arises from the process of exchange and is often not included into the sale price.

* Policing cost involves the expenses sometimes necessary to protect the property or to convince the others to carry out an agreement or contract.

II Theory of Production

1 Introduction

Just as the consumer theory serves as the fundamental theory in the demand side in microeconomic theory, the production theory serves to explain the behaviour of firm in the supply side.

Consumers maximize their value or benefit gained whereas producers and suppliers maximize their wealth gained from sale.

Production

* Production is a process and takes time, i.e. it is a flow of output per unit of time.

* It occurs when the physical characteristics of resources are improved. It may take the form of a change in place, in time, and forms of inputs. It also includes an improvement in the time period needed to have the resources available or the location of the good.

* It is a planned activity involving the use of scarce resources. It follows the assumption of certainty in production as well as the limitation in the level of technology.

* It refers to the physical or technical relation between the inputs and outputs.

* Production constitutes the technical aspect in supply. A consideration of cost together with physical output will be sufficient to constitute the supply side.

Supply alone cannot determine price. It is the market - demand & supply altogether - that determines the market price.

2 Assumptions

- * Rationality on the part of producers is assumed, i.e. they have planned sets of production decisions and processes.
- * There is certainty concerning the information on technology and market.
- * The owner of a firm asks for wealth maximization, based on a desire for efficiency.

3 Production Function & Curves On Outputs

A production function tells the amount of inputs required to produce a certain level of output. It gives a technical or physical relation between input factors and outputs.

In general, we assume :

- * factors of production are homogeneous or identical. they are perfectly divisible and substitutable among the factors ;
- * the production process is continuous in the form of minute changes.

Production Function

Total Product (Q) = f (L, K, T) ⇒ Very Long Run

Total Product (Q) = f (L, K) ⇒ Long Run

Total Product (Q) = f (L) ⇒ Short Run

Short Run

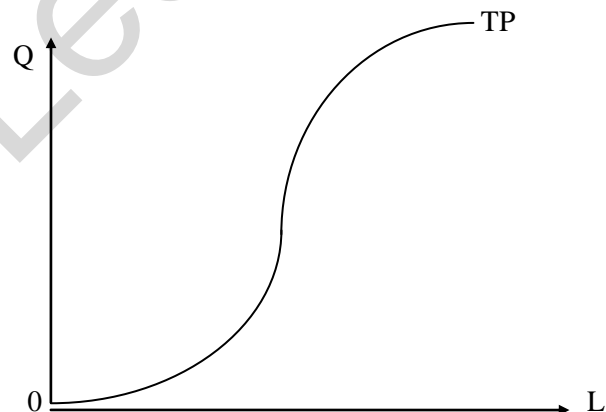
It refers to a specific situation during which there is at least one factor of production fixed and the rest of the factors varied. The cost of the fixed factor(s) is called fixed cost.

Long Run

It refers to a situation which all factors can be varied according to a plan. There is no fixed factor and hence no fixed cost. All costs and factors can be varied. The very long run refers to a situation with a change in technology.

A Total Product (Q) Curve In The Short Run

- * Capital is fixed and labour can be varied.
- * Technology is known and fixed.
- * It rises very fast at first but rises very slowly with more and more labour (hours or effort) is applied.
- * The rate of increase is different at different level of input (labour here).



Total Product

It refers to the total amount of output produced by all factors of production, including both fixed and variable factors in a given situation.

Average Product

It means the average amount of output per unit of variable factor, say, labour.

Marginal Product

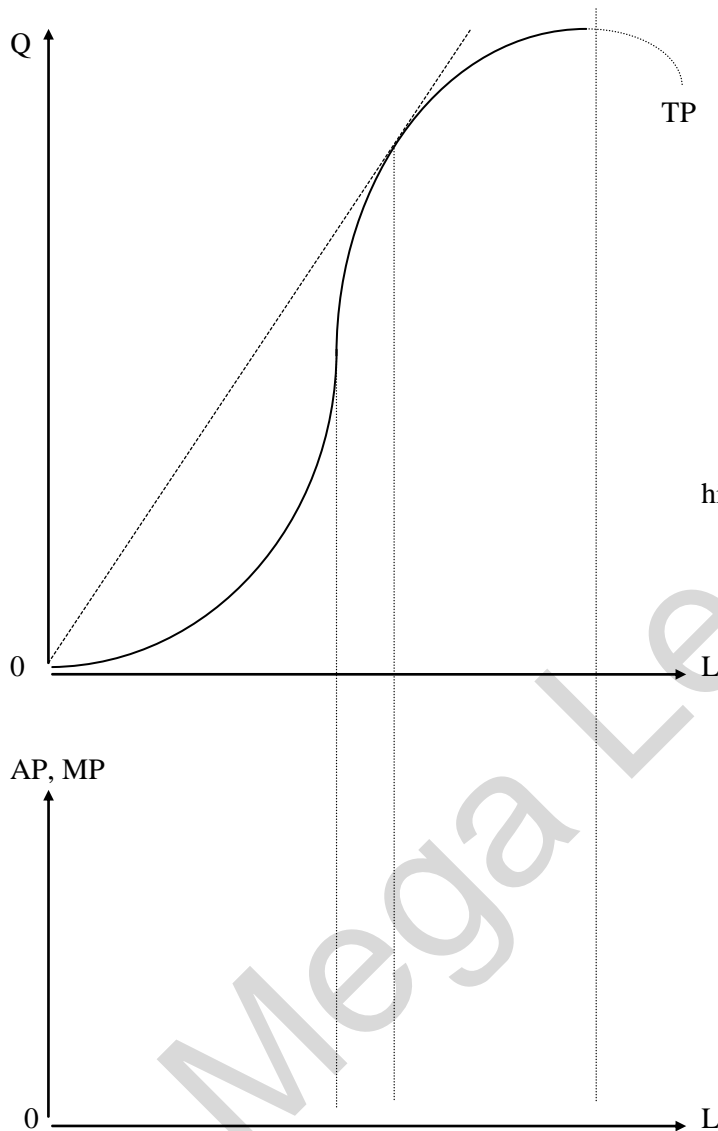
It means the amount of additional output when one more (infinitely small) unit of variable factor is applied in production. It tells the change (normally an increase) in output because of a change in input. The change, in mathematics, refers to a minute change.

Graphs Of The Product Curves : TP, AP, MP

The relation among the 3 curves is shown below.

- * When TP rises, MP is positive and vice versa. Both AP & MP rise at first and fall later.
- * MP rises faster than AP but falls also faster than AP.
- * The MP curve meets the AP curve at the maximum value of AP.

State 1 : AP rises at first as the variable factor (L) is relatively small in quantity compared with the fixed factor (K). Labour is over-utilized and capital is under-utilized in production. If more labour (time or effort) is applied, both L & K will be more efficient.



State 2 : AP falls with MP falling already. The efficiency of the extra unit of labour falls so that MP falls. The fall in MP is so large that the average value - AP - starts to fall also.

The TP curve reaches a maximum where the MP is zero.

State 3 : The fixed factor (K) is being used to its full extent - its efficiency reaches a maximum when TP is highest.

If more labour is applied, it cannot produce more than before. The short run output cannot be increased anymore.

4 The Law of Diminishing Marginal Returns (Products)

When more and more variable factors are applied together with a given amount of fixed factors in production, the extra output produced by each extra unit of variable factor will **eventually** decrease, ceteris paribus. In economic terms, the marginal product will rise at first (?) but eventually, it must decrease in the short run. The law is an empirical **assertion** supported by real life observation.

III Theory of Cost & Cost Curves

1 Cost Curves In The Short Run

The cost function gives the amount of factor payments needed to produce a given level of output.

Cost Function

Total Cost = $f(Q)$ and $Q = f(L, K)$ where wage : the labour cost ; interest : the capital cost.

In other words, cost function is determined by the production function and the costs of factor inputs.

Total Cost

It is the total amount of factor payments for all the factors of production used at a time period in production.

$$\text{Total Cost (TC)} = \text{Total Fixed Cost (TFC)} + \text{Total Variable Cost (TVC)}$$

$$\text{Average Cost (AC)} = \text{Average Fixed Cost (AFC)} + \text{Average Variable Cost (AVC)}$$

$$\text{Marginal Cost (MC)} = \frac{\text{Change in total variable cost}}{\text{Change in output}}$$

Total Fixed Cost & Total Variable Cost

Total fixed costs are costs that do **not** change when output changes. They are different from sunk costs because they may be recaptured when the fixed factors are sold out.

Total variable costs are costs that change with a change in output.

Marginal Cost

Marginal cost is the change in total (variable) cost resulting from a per unit change in output. As there is no change on the fixed cost, the concept “marginal” does not apply here so that the marginal cost is the same as marginal variable cost ($MC = MVC$).

Graphs of the Curves : TC , TVC, AC, AVC, MC

The AC is the slope of any line drawn through any point on the TC curve with the origin.
The AVC is the slope of any line drawn through any point on the TVC curve with the origin.
MC is just the slope of the TC & TVC (their slopes are the **same**) and cuts the minimum point of the AC & AVC curves.

When AC falls, the firm experiences the so-called economies of scale. When AC rises, it is in diseconomies of scale.
Both the TFC & AFC are not useful in analysis because they are not directly related with output.

The MC curve falls faster than the AC & AVC at first but rises faster than AC & AVC later.

As TFC is constant with respect to the output, AFC curve is a decreasing curve all through.

2 Relation Between Cost & Product

Each variable factor, say labour, adds the **same** amount to the total cost because it is assumed that their payment (wage) is a constant, but contributes **differently** on the amount of output.

If the output per unit of input (L) is rising, i.e. AP is rising, then the AVC (VC per unit of output) must be falling. In other words, if the labour is contributing more and more on the average, the payments used in employing them become smaller on the average; given their payment per unit is a constant, i.e. wage rate.

Mathematical Proof :

$$\begin{aligned} \text{AVC} &= \text{TVC} / \text{Q} = \text{Factor Price} \times (\text{Amount of Variable Factor} / \text{Amount of Output}) \\ &= \text{Factor Price} \times (\text{L} / \text{Q}) \\ &= \text{Factor Price} \times (1 / \text{AP}) \quad \text{where AP} = \text{Q} / \text{L} \\ &= \text{Factor Price} / \text{AP} \end{aligned}$$

AVC is inversely proportional to AP.

$$\begin{aligned} \text{MC} &= \text{Change in TC} / \text{Change in Output} \\ &= \text{Change in TVC} / \text{Change in Output} \\ &= \text{Factor Price} \times (\text{Change in Variable Factor} / \text{Change in Output}) \\ &= \text{Wage} \times (\Delta \text{L} / \Delta \text{Q}) \\ &= \text{Wage} \times (1 / \text{MP}) \quad \text{where MP} = \Delta \text{Q} / \Delta \text{L} \\ &= \text{Wage} / \text{MP} \end{aligned}$$

MC is inversely proportional to MP.

In other words, the production function and cost function are telling the same things if factor prices are given, i.e. constants.

When factor prices are given, it implies that the factor market is in equilibrium. When the supply side of the product market is considered, other things are held constant which include the factor market & its equilibrium prices.

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Mega Lecture