Application of Production Theory and Its Scope

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ABSTRACT:

An essential idea in economics, the theory of production examines the connection between inputs and outputs in the production process. It investigates how businesses combine resources like lab our, capital, and technology to effectively generate goods and services. A summary of the theory of production's essential elements, guiding principles, and application to the study of economics is given in this chapter. It examines ideas including returns to scale, production factors, production functions, and cost analysis. The chapter also looks at the part that managerial choices, innovation, and technology play in the production process.

KEYWORDS:

Cost Curves, Factors Production, Marginal Cost, Production Function, Returns Scale.

I. INTRODUCTION

The conversion of inputs into outputs is referred to as production in economics. The raw materials or other productive resources utilised to create output, or finished goods, are referred to as inputs. Production is the technical term for the act of creating something useful or something that satisfies a consumer's want. Any good that is valuable to us or meets our needs qualifies for consumption.Thus, boosting utility can increase the usefulness of a good. For instance, unless it is made into bread output, we cannot eat raw wheat flour when we are hungry the process of producing usefulness is the turning of wheat flour into bread. There are three ways to construct utilities. These are listed below:

1. By altering a good's form, shape, or size. Bread slices have replaced the wheat flour that was previously powdery. As a result, the good's form has been altered. Similar examples of altering the shape or size of a good and so producing utility are a carpenter giving a piece of wood the shape of a chair or a chef transforming a lump of dough into mouthwatering pizzas.
2. Making use of the limited resources at the precise moment when they are most needed.
3. The government has a buffer supply so that it can distribute food grains to the market to meet demand during a crisis.
4. by moving a good to a location where its use will be beneficial. Sand's utility is increased when it is moved from the riverbank to the construction site.

Production Function

The functional connection between physical inputs and physical outputs is known as the production function. Stigler claims that the relationship between the rates of input for productive services and the rates of output for goods is known as the production function. It is a summary of technological knowledge provided by an economist. One way to express production function is as follows:

A, B, C, D = Q

Where Q represents for output, a, b, c, d... are the productive inputs that aid in making Q output, and f stands for function. As a result, Q depends on a, b, c, and d because Q is a function of those variables. In light of this, a production function displays the greatest quantity of output that can be generated from a specific set of inputs according to the state of technology at the time[1], [2].

Goes Back to A Factor and Goes Back to Scale

In economics, two different types of production functions are typically utilised. First, the production function where certain input numbers are fixed and one or a small number of input quantities are altered. The law of changing proportions is used to study this type of production function. Additionally known as short-run production functions, these. The short-run is a time frame in which the amount of one or more production elements is fixed. A business cannot afford to change its plants or equipment. The second category is the production processes, where all inputs are modified. This is what the law of returns to scale is based on. Additionally known as long-run manufacturing functions, these. The long term is a time frame in which every aspect is subject to change. An outdated plant can be replaced by a new one[3], [4].

Law of Diminishing Returns and Law of Variable Proportions

The law of changing proportions is a key concept in economic theory. While maintaining the quantities of other variables constant, it investigates the production function with just one factor variable. This law explains how a change in the proportion of the factors used has an impact on the total output or marginal production. The following is a legal presumption:

1. It is thought that technology is always in a state of flux.
2. A certain number of inputs must have a set quantity.
3. The law is founded on the idea that different combinations of the various elements can result in different products. It cannot be utilised in situations where the factors must be combined in a specific order to get a result.

Following are three stages of the law of varying proportions that we observe:

1. The first stage travels from the origin to the location point S, where the average output is at its highest level. The marginal product grows at this stage. This phase is referred to as the phase of rising returns. The constant quantity of the fixed component is used more efficiently and intensively as more units of the variable factor are added to it, which is why returns are increasing. The result is a rapid increase in output.
2. The second stage extends from the maximum average output point to the zero marginal output point point N. The marginal product now begins to decline. When the fixed factor is being used most effectively, further increases in the variable factor lead to a drop in marginal and average products because the fixed element is now in short supply in comparison to the quantity of the variable factor. As a result, this phase is sometimes referred to as the phase of declining returns.
3. When the total product reaches its maximum and the marginal product reaches zero, the third stage begins. The marginal product now turns negative. At this point, there are too many variable factors in relation to the fixed component, which causes the total output to decrease and the marginal output to turn negative. This stage is referred to as the stage of negative returns for this reason[5], [6].

II. DISCUSSION

Size of the plant has an impact on production volume. Every business owner must make a decision on the size of his facility or operation. How big should a firm be is the question. 'Economies of scale' exist up to a particular size of plant, for this reason. Economies are advantages that result from a business's growth. Internal and external economies of scale can be broadly separated into two groups. Internal variables that are unique to the company and unshared by other enterprises are what lead to internal economies. One or more examples of internal economies/benefits that a corporation enjoys include the use of superior technology, the acquisition of raw materials at lower costs and the sale of finished items at higher prices, the simplicity of obtaining financing from financial institutions, etc. All businesses located in a region can take advantage of external economies.

Examples of external economies include the advancement of transportation, quick and efficient communication, and good banking and insurance services. A plant or business that is either too large or too tiny is not economically viable. The ideal plant size is preferable to a plant that is either too small or too large, as long as it at least covers the cost per unit of output. Returns to scale is the study of how production varies as a result of changes increase or decrease in scale. A change in the scale means that all of the inputs have changed in the same proportion. Therefore, in returns to scale, we investigate the impact of doubling, tripling, etc., all inputs on the overall output. A table like the one below can be used to explain the law: As a result, the three stages of returns to scale are as follows. Marginal product or return increases up to the fourth worker. Over the fifth and sixth units of lab our, returns remain constant; after that, they start to decrease.

Stage I: A bigger proportion of the rise in inputs than the increase in output occurs. Thus, growing returns to scale work if all inputs are increased by 10% and the output increases by 20% as a result. This is depicted in Fig. 6.2 down below as well. When the scale is first enlarged, more division of lab our is available and is done, which causes output to increase quickly.

Stage II: Returns to scale are constant if all inputs are increased in a specific percentage and the output increases in the same proportion. More specifically, consistent returns to scale apply if all inputs are increased by 10% and as a result, output rises by 10% as well. Division of lab our is conceivable up to a limit. After then, additional scale expansion will cause returns to stabilize.

Stage III: Returns to scale are diminishing if all inputs are increased in a certain proportion but the output increases in a lesser proportion. Declining returns to scale apply if all inputs are increased by 10% and output grows by 6% as a result. Returns start to decrease when scale is raised to the point where division of lab our is impossible.

The theory of production is an attempt to explain the fundamentals by which a business firm chooses how much of each good it will sell its outputs or products and how much of each type of lab our, raw material, fixed capital good, etc., it will employ its inputs or factors of production, according to the principles of production. Some of the most fundamental economic ideas are included in the theory. These include the connections between the costs of producing goods and the costs or wages or rents of the productive factors used to do so, as well as the connections between the costs of producing goods and the quantities of those goods and productive factors that are produced or used.

Three levels of increasing complexity can be used to categories the many decisions a business firm makes concerning its productive activities. Making decisions on how to produce a specific output quantity in a plant with a specific size and equipment is included in the first layer. It has to do with the so-called short-run cost reduction dilemma. The second layer addresses what is referred to as short-run profit maximization and includes determining the most profitable product amounts to manufacture in any given plant. The third layer, which deals with choosing the plant's most profitable size and configuration, is related to what is known as long-run profit maximization [7], [8].

Reduction of Immediate Costs

The goal of a business enterprise is to create an item as inexpensively as possible, regardless of how much of it is produced. The firm's duty is to identify the least expensive combination of elements of production that can create the specified output, taking the quality of the product and the prices of the producing factors as known which is the typical case. The production function, an equation that expresses the relationship between the quantity of ingredients used and the amount of product obtained, is the best way to understand this process. It details the potential yield of each and every possible concoction of elements. Mathematically, this relation. In this case, y stands for the output's volume. It is assumed that the company uses n variable components of production, i.e., elements like hourly production staff and raw materials, whose quantities can change. The first variable factor's quantity is indicated in the formula by the letters x1, and so on. The employment of fixed factors by the company, or factors like fixed equipment, salaried employees, etc., whose amounts cannot be easily or regularly changed, is also presumptive.

The formal gives the accessible quantity of the first fixed factor as k1 and so on. The total formula represents the amount of output that is produced when a set number of factors are used. It is important to remember that although the amount of the factors affects the quantity of the output, the opposite is not always true. As a rule, different combinations of productive elements may be employed to generate the same output. The challenge of cost minimization is choosing the least expensive option. The expenses of all the different elements are simply added together to form the cost of production. It can be expressed as follows: where P1 represents the cost of a unit of the first variable factor, R1 represents the annual cost of ownership and maintenance of the first fixed factor, and so on. Again, in this context, the first group of phrases refers to variable expenses generally referred to as direct costs in accounting parlance, which are easily modifiable, while the second group refers to fixed costs accountants' overhead costs, which include items not readily modifiable. The topic of variable cost will be covered first.

An easy example can be used to illustrate the ideas involved in choosing the least expensive combination of variable components. The production function for a company making gold necklace chains will be y = f x1, x2; k, where the symbol k is included merely to serve as a reminder that the number of chains that can be produced by using x1 feet of gold wire and x2 goldsmith-hours depends on the amount of machinery and other fixed capital that is available. This production function can be graphically represented in an isoquant because there are only two variables. The graph shows the number of feet of gold wire used each month vertically and the number of goldsmith hours each month horizontally. The number of necklace chains formed will then be represented by one of the curved lines, known as an isoquant. According to the information given, 200 necklace chains may be made using 100 goldsmith hours and 900 feet of gold wire.

However, alternative combinations of variable inputs could also result in the monthly production of 200 necklace chains. The goldsmiths can make 200 chains from 850 feet of wire if they work more slowly and carefully, but it will take them more goldsmith hours possibly 130 to make that many chains. All the possible permutations of the variable inputs that will just be enough to generate 200 chains are displayed in the isoquant with the number 200. The interpretation is the same for the other two isoquants displayed. It seems to reason that an endless number of additional isoquants might theoretically be drawn. The relationships stated in the production function are represented graphically in this diagram. The concept of factor replacement is also well-illustrated by the isoquants. This means that one variable factor can be used in place of another; typically, a more extravagant use of one variable component will allow for the production of the same quantity of output with fewer units of some or all of the other variables. In the previous illustration, lab our was physically equivalent to gold and could be used in its place. After y, the number of chains to be produced, was determined, there would be no room for additional decision-making if it weren't for factor substitution.

It is crucial to note the shape of the isoquants, which has strong empirical backing. The graphic illustration of factor substitutability shows that as an isoquant moves along, the more of one factor is used, the less of the other will be required to maintain the specified output. A corollary, however, states that the more of one factor is used, the less it will be able to minimize the usage of the other by using more of the first. This characteristic is referred to as diminishing marginal rates of substitution. The number of units by which x1 can be decreased for each increase in x while output remains constant is known as the marginal rate of substitution of component 1 for factor 2. The steepness the opposite of the slope of the isoquant in the diagram, where feet of gold wire are represented by x1 and goldsmith hours by x2, represents the marginal rate of substitution. It can be seen that this rate decreases steadily as x2 rises because it becomes more difficult to conserve gold simply by exercising greater caution. The rest of the study is strongly predicated on the notion that production processes often include diminishing marginal rates of substitution.

There are three is cost lines depicted, and they stand for v1, v2, and v3 in terms of variable costs. Since the v1-isocost line never reaches the isoquant for 200 units, spending v1 on variable factors will not be enough to generate 200 units. The minimum variable cost at which 200 units can be produced is v2, and an investment of v3 is more than adequate. The coordinates of the point where the v2 is cost line touches the 200-unit isoquant are the quantities of the two factors that will be used when 200 units are to be produced, and the prices of the two factors are in the ratio of p2/p1, making v2 the minimum variable cost of producing 200 units just as v3 is of 300 units. It should be emphasized that the location where the relevant isoquant is tangent to an is cost line is where the cheapest combination for producing any quantity will be determined. Therefore, any company attempting to manufacture as inexpensively as possible will always purchase or employ factors in amounts such that the marginal rate of substitution will match the ratio of their prices. This is because the slope of an isoquant is determined by the marginal rate of substitution. The variable cost of that quantity of output is known as VCy, and it is the cost incurred when the least-cost combination of inputs is combined with a specific set of fixed equipment. The short-run cost of that output, denoted SRCy, is the sum of the costs incurred, both fixed and variable. SRCy is clearly equal to VCy plus R K, where the second term represents the total annual cost of the fixed factors that are accessible.

Marginal Expense

The marginal variable cost, abbreviated as MCy, is essentially the rise in variable costs brought on by an increase in production of one unit; specifically. Though considering VCy as a continuous function of output can theoretically result in a more exact definition, this is not necessary in the current scenario. In this diagram, output is shown horizontally while costs are vertically measured in dollars per unit. The average expenses are rather high for very low levels of output relative to the size of the plant, as can be seen in the figure when it is drawn for a specific stationary plant. This is partly because there is not enough work to keep a well-balanced work force fully employed. Most of the time, people are either unoccupied or moving from job to work on a costly basis. Average costs decrease to a low plateau as output rises from a low level. However, as the facility's capacity is approached, inefficiencies brought on by plant congestion drive average costs up quickly. There may not be enough time to take machinery off the line for routine maintenance, overtime may be required, outdated equipment and inexperienced workers may be called upon, and tiny delays and breakdowns may drastically upset schedules due to a lack of slack and reserves. As a result, the AVC curve has the depicted flat-bottomed U-shape. As would be predicted, the MC curve rises and falls more quickly than the AVC curve.

Maximization of Profits in The Short Term

The determination of the most profitable level of output to create in a particular plant is the second-level problem, and its resolution depends on the average and marginal cost curves that were just derived. The cost of the product, let's say p0, is the only other datum required. These data can be used to determine the output that is the most profitable. Sales revenues will increase more than costs if output is increased by one unit or even a few more if the marginal cost of any given output y is less than the price. As a result, profits will increase. In contrast, if the marginal cost exceeds the price, output must be reduced by at least one unit in order to increase profits. Thus, the output for which MCy = p0 is the one that maximizes profits. The second fundamental result is that the profit-maximizing firm will create and sell the quantity for any price at which the marginal cost is equal to that price.

Pricing and Margins

The conclusion that marginal cost tends to equal price is significant because it demonstrates how the market price affects how much an organization produces. The company will cut its losses by ceasing production if the market price is less than the point when the average variable cost curve is at its lowest level. The company will produce the amount for which marginal cost equals the higher market price. Thus, by reading the marginal cost curve in Figure 3, one may determine the quantity that the firm will produce in response to any price. For this reason, the marginal cost curve is referred to as the short-run supply curve for the firm.The short-run supply curve for a product, which represents the overall volume that all companies producing it will produce in response to any market price, follows immediately and is defined as the sum of the short-run supply curves or marginal cost curves, unless the price is below the bottoms of some companies' average variable cost curves.

This curve is crucial for economic research since it, along with the product's demand curve, determines the market price of the good as well as how much will be produced and bought. However, there is one danger to be aware of. It was believed that factor prices were fixed in the display of the supply curves for the firms and consequently for the industry. Even though this is reasonable for a single firm, it is a fact that if all firms strive to boost their outputs at the same time in reaction to a rise in the product's price, they will likely bid up the costs of some or all of the elements of production they use. In that case, the output increase that will result from a price increase will be overstated by the product supply curve as estimated. Therefore, a more complex supply curve that takes into account induced variations in factor prices is required. The traditional literature on this subject discusses these curves.

Marginal Item

The link between product prices and factor prices, the cornerstone of the theory of income distribution, may now be derived. The amount that output would rise if one more unit of a factor were used, with all other factors staying constant, is referred to as the marginal product of a factor in this context. The difference between the product of a given amount of the factor and the product when that factor is increased by an additional unit can be written algebraically as the factor. One extra unit of output can be acquired by using 1/f1 more units of factor 1 if, for example, an additional unit of factor 1 will boost output by f1 units. Similar to the last example, if factor 2's marginal product is f2, then reducing its use by 1/f2 units will result in a one-unit decrease in output. As a result, output will remain roughly the same if 1/f1 units of factor 1 are utilised in place of 1/f2 units of factor 2. Therefore, f2/f1, or the ratio of the marginal products of the two factors, is the marginal rate of substitution.

The marginal rate of substitution has already been demonstrated to be equal to the ratio of the factor prices, which implies that the factor prices or salaries are proportionate to their marginal outputs. One of the most important theoretical discoveries in economics is this. In a nutshell, manufacturing inputs are compensated in relation to their marginal products. This is simply a result of businessmen's attempts to produce as inexpensively as possible and is not a matter of social equity. Furthermore, there is a strong correlation between the marginal products of the factors and marginal costs, and consequently, with pricing of goods. Because output will increase by MP1x1 units and variable cost by p1 if factor 1 is used one more time, the marginal cost of additional units produced will be equal to p1/MP1x1.

As a result, it has been determined and so forth, or that the price of each factor is equal to the product's marginal product's value. This is one of the most important economic theorems and a key principle of income distribution. Its rationale is immediately clear. If any factor's equality is not met, the businessman can enhance his profits by either employing units of that factor or firing them until that factor's equality is met, and it is likely that the businessman will do both until that factor's equality is met. The theory of production decisions in the short run, as just described, leads to two conclusions about how business firms react to market prices of the goods they produce and the factors of production they buy or hire:

1. 1 The firm will produce the quantity of its product for which the marginal cost is equal to the market price and
2. 2 It will buy or hire factors of production in such quantity. The first discusses how an economy's supply curves for various goods are shaped. The results are obviously applicable to all situations, even though they were drawn in the context of a company that uses two factors of production.

Maximizing Long-Term Gains

The short-run theory that was just provided serves as the foundation for the idea of long-run profit maximization, although it is significantly more complex due to two factors: The long-run behaviour of an industry cannot be inferred just from the long-run behaviour of the enterprises that make up that industry since the list of firms is susceptible to change. Long-run cost curves, to be defined below, are more diverse in shape than the analogous short-run cost curves. Long-term adjustments must fundamentally be brought about by the expansion or contraction of fixed productive capacity by both established businesses and newly founded or existing businesses. An established company with an existing plant will, at any given time, compare the prevailing price of its commodity with the cost curves relating to that plant when making short-term decisions. Its marginal costs will be high higher than its average costs and it will be making operating profits if the price is so high that the company is running on the rising leg of its short-run cost curve. The company will then think about whether expanding its factory would enhance profits. By relieving the pressure on a restricted number of production facilities, plant expansion has the effect of lowering the variable cost of producing high levels of output at the expense of raising the level of fixed expenses.

The firm will want and finally buy the fixed plant for which the short-run costs of that level of output are as low as possible in response to any level of output it anticipates continuing for a while. The long-run costs of any level of output are the short-run costs of generating that output in the plant that makes those short-run costs as low as feasible. This leads to the idea of the long-run cost curve. These come about as a result of weighing the fixed costs that any plant incurs against the immediate costs of producing in that plant. LRCy stands for long-run costs of manufacturing y. The long-run cost per unit of y is the average long-run cost of y [LACy = LRCy/y in algebra]. The rise in long-term costs brought on by a one-unit increase in output level is known as the marginal long-run cost. In response to a minor rise in the output rate, it represents a combination of short-run and long-run changes. When the cost-minimizing fixed plant is used, it can be demonstrated that the long-run marginal cost matches the marginal cost as previously established.

Curves of Long-Term Costs

Compared to short-run cost curves, long-run cost curves have a wider range of shapes and can be divided into three categories. With the exception of the absolute lowest output level, the average cost is roughly the same in industries with constant costs. Constant costs predominate in manufacturing sectors when capacity is increased by reproducing facilities without altering the method of production, as in the case of a cotton mill expanding by adding more spindles. In industries with declining costs, average cost decreases as output rate increases, at least until the plant is big enough to serve a sizable portion of the market. Manufacturing, when heavy, automated machinery is economical for high output volumes, is characterized by declining costs. Manufacturing of automobiles and steel are two prime examples. Reduced prices make it impossible for smaller rivals to survive, which is incompatible with a competitive environment. Last but not least, in industries with rising costs, average costs typically increase with production volume since the company is unable to find new fixed capacity that is as effective as its current plant. The agricultural and extractive industries are the two most significant examples.

Objections to the Theory

There has been a lot of opposition to the theory of production. One criticism is that the idea of the production function is not based on experience or observation. Even the most advanced businesses are unaware of the direct functional connection between their fundamental raw inputs and their final products. By using recently discovered linear programming approaches, which use observable data without using the production function and arrive at almost identical conclusions, this argument can be overcome. The theory has been accused of being oversimplified on another level. It ignores changes in production technique and pays no regard to the risks and uncertainties that cloud all business decisions while individual enterprises and industries are making the adjustments outlined in the theory. It also makes the assumption that the rest of the economy will remain unchanged. Particularly vulnerable to these arguments is the theory of long-run profit maximization.

On a different level, detractors of the thesis contend that executives are not always focused on maximizing revenue or cutting expenses. Even though all of the critiques are valid, the simplified theory of production does point out some fundamental economic forces and trends. Instead of being seen as constant and immediate realities, the theorems should be seen as conditions that the economy tends to. It is uncommon for them to be fulfilled exactly, but it is also uncommon for the theorems to continue to be violated in significant ways. The above description of the theory only covered its most basic elements. It may be easily expanded to include businesses that generate more than one product, which is practically all businesses. Applying it to businesses with monopolies, monopolistic competition, or monopsony which affect the prices at which they sell and buy would be more challenging. Research and debate continue to surround the oligopoly theory of production, which describes the actions of other businesses that are aware of the prospect that their rivals may react.

III. CONCLUSION

An essential idea in economics, the theory of production sheds light on how inputs and outputs interact during the manufacturing process. The theory of production provides useful insight into resource allocation, productivity development, and economic wellbeing by examining how organizations combine resources to produce goods and services effectively. The theory of production includes a number of crucial elements, such as cost analysis, returns to scale, production functions, and factors of production. It looks at how input levels affect output levels and investigates the best way to combine resources to increase production effectiveness. The theory of production also recognizes how managerial choices, technological advancements, and innovations have shaped the production process and increased productivity.

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