Efficiency and Adaptation:

**Production and Cost: Economic Cost**: In economics, a firm's costs are based on the notion of economic cost. The key principle underlying the computation of economic cost is opportunity cost.

A basic principle of economics is the Principle of Principle of Opportunity Cost [What you sacrifice to get something].

An accountant's notion of costs involves only the firm's explicit costs: the firm's actual cash payments for its inputs.

An economist includes the firm's implicit costs: the opportunity costs of nonpurchased inputs.

The following formula is used to compute the economic costs:

Economic Cost = Explicit Cost + Implicit Cost

**Short-Run Versus Long-Run Decisions**

The type of organization and how the organization is established affects whether the organization needs to make a short-run or long-run decision related to production.

For example, a firm that considers whether to add a second shift to produce additional watches in the current facility is making a short-run [A period of time over which one or more factors of production remains fixed] decision.

A firm that decides to build an additional factory building is making a long-run [A period of time long enough that a firm can change all factors of production] decision.

**Production Costs in the Short-Run**

The key principle behind a firm's short-run cost curves is this: as one input increases while the other inputs are held fixed, output increases but at a decreasing rate (diminishing returns).

The short-run production function, or total product curve, depicts the relationship between the number of workers and the quantity of output produced.

Example:

|  |  |
| --- | --- |
| **Rakes per Minute** | **Number of Workers** |
| 0 | 0 |
| 1 | 8 |
| 2 | 12 |
| 3 | 15 |
| 4 | 20 |
| 5 | 27 |
| 6 | 36 |
| 7 | 48 |
| 8 | 65 |
| 9 | 90 |
| 10 | 130 |

To draw the total product curve, we plot number of workers along the x axis and rakes per minute along the y axis. Then, using the data in the table on the previous screen, we mark the points on the graph and join the points to make a curve. The curve starts from 0 and then rises upwards.

In this example, the total product curve indicates the relationship between the quantity of labor and the quantity of output produced.

Now, let's suppose that on the graph, a part of the curve is flatter than the rest of the curve. This type of shape can be explained by diminishing returns. For the flatter portion of the curve, the marginal product of labor decreases. In other words, the output beyond a certain number of workers is increasing at a decreasing rate.

Short-Run Production Costs

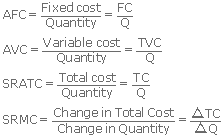
The short-run costs of production are a reflection of the relationship between labor and output in the short run under diminishing returns.

In the short run, a firm has two types of costs:

•Fixed Cost (FC): The cost of the production facility, which is independent of the amount of output produced in it.

•Variable Costs (VC): The costs of labor and materials associated with producing output.

To calculate the short-run average, costs curves require the following formulas:

A F C = Fixed cost divided by Quantity = F C divided by Q, A V C = Variable cost divided by Quantity = T V C divided by Q, S R A T C = Total cost divided by Quantity = T C divided by Q, S R M C = Change in Total Cost divided by Change in Quantity = change in T C divided by change in Q

Be sure to review the abbreviations used in each formula.

•TC = Total Cost

•FC = Fixed Cost

•TVC = Total Variable Cost

•TFC = Total Fixed Cost

•Q = Output Rate Per Minute

•SRATC = Short-Run Average Total Cost

•SRMC = Short Run Marginal Costs

Example:

|  |  |  |  |
| --- | --- | --- | --- |
| **Output: Rakes Per Minute (Q)** | **Fixed Cost (FC)** | **Total Variable Cost (TVC)** | **Short-Run Total Cost (STC)** |
| 0 | $36 | $0 | $36 |
| 1 | $36 | $8 | $44 |
| 2 | $36 | $12 | $48 |
| 3 | $36 | $15 | $51 |
| 4 | $36 | $20 | $56 |
| 5 | $36 | $27 | $63 |
| 6 | $36 | $36 | $72 |
| 7 | $36 | $48 | $84 |
| 8 | $36 | $65 | $101 |
| 9 | $36 | $90 | $126 |
| 10 | $36 | $130 | $166 |

To draw the graph, we plot the output (rakes per minute) along the x axis and cost in dollars along the y axis. Then, using the data in the table on the previous screens, we mark the points on the graph and join the points to make curves for TFC, TVC, and SRTC. The curve for TFC will be a straight horizontal line at point 36 on the y axis. The curve for TVC will start from 0 on the y axis and then rise upwards. Similarly, the curve for SRVC will start from 36 on the y axis and then rise upwards.

•Total Cost = Total Fixed Cost + Total Variable Cost

**Short-Run Marginal Costs**

Short-run marginal cost (SRMC) is the change in total cost resulting from a 1-unit increase in the output of an existing production facility.

The relationship between marginal cost and average cost curves is that the marginal cost of production is the amount of money necessary to buy the additional labor and materials necessary to produce one more unit of output.

The marginal cost of production increases because output increases at a decreasing rate with additional labor hours.

A typical short-run average total cost curve is U shaped. This implies that it is possible to have the same short-run average cost for two different quantities of output.

**Production and Cost in the Long-Run**

The key difference between the short run and the long run is that there are no diminishing returns in the long run. Diminishing returns occur because workers share a fixed facility. In the long run, the firm can expand its production facility as its workforce grows.

The long-run average cost (LAC) [Long-run average cost (LAC) is total cost divided by the quantity of output when the firm can choose a production facility of any size] curve describes the behavior of average cost as the plant size expands. Initially, the curve is negatively sloped and then beyond some point it becomes horizontal.

Because of indivisible inputs [An input that cannot be scaled down to produce a small quantity of output. Most production processes have at least one indivisible input], the long-run average cost curve will be negatively sloped.

Examples of indivisible inputs include the following:

•A computer factory uses sophisticated machines and testing equipment

•A transatlantic shipper uses a large ship to carry TV sets from Japan to the United States

•A cable-TV firm uses a cable running throughout its territory

•A steel mill uses a large furnace

•A freight hauler uses a freight truck

•A pizzeria uses a pizza oven

**Market Competition: Short-Run Versus Long-Run Costs**

Why are SATC curves U-shaped while LATC curves are L-shaped?

Each curve reflects the fact that initial production increases allow firms to spread some type of costs (fixed costs or indivisibilities) over more units. However, in the short-run case, the inability of the firm to adjust the size of the production facility eventually causes diminishing returns to occur. This need not be the case in the long run when all factors are variable.

**Perfectly Competitive Markets**

A perfectly competitive market is characterized by the following four features:

•There are many firms.

•The product is standardized, or homogeneous.

•Firms can freely enter or leave the market in the long run.

•Each firm takes the market price as given.

The perfectly competitive firm is a price-taking firm. This means that the firm takes the price from the market. As long as the market remains in equilibrium, the firm faces only one price—the equilibrium market price.

Because the perfectly competitive firm faces a constant price, the shape of its total revenue is an upward-sloping line. Total revenue changes only with changes in the quantity sold.

**The Total Approach to Profit Maximization**

One way for a company to decide how much output to produce involves the total approach. To determine how to maximize profit, the firm tries to find the largest gap between total revenue and total cost.

|  |  |  |  |
| --- | --- | --- | --- |
| **Output: Rakes Per Minute (Q)** | **Total Revenue in Dollars (TR)** | **Short-Run Total Cost (STC)** | **Profit** |
| 0 | $0 | $36 | $-36 |
| 1 | $25 | $44 | $-19 |
| 2 | $50 | $48 | $2 |
| 3 | $75 | $51 | $24 |
| 4 | $100 | $56 | $44 |
| 5 | $125 | $63 | $62 |
| 6 | $150 | $72 | $78 |
| 7 | $175 | $84 | $91 |
| 8 | $200 | $101 | $99 |
| 9 | $225 | $126 | $99 |
| 10 | $250 | $166 | $84 |

We begin by plotting rakes per minute along the x axis and cost of revenue in dollars along the y axis. The curve for TR starts from 0 and comes out to be a straight line sloping upwards. The curve for STC starts from 36 on the y axis and rises upwards, intersecting the TR line at one point.

Such a graph can be used to choose the quantity of output that maximizes profit. The biggest gap between TR and STC represents the situation where the profit is largest. In this case, the profit is maximized when the firm produces either eight or nine rakes, with a profit equal to $99.

**The Marginal Principle**

The other way to decide how much output to produce involves the Marginal Principle—another key principle of economics. This principle states that a firm should increase its level of activity if its marginal benefit exceeds its marginal cost, but reduce the level of activity if the marginal cost exceeds the marginal benefit.

If possible, the firm should pick the level at which the marginal benefit equals the marginal cost.

The following formula further explains how the marginal benefit is determined.

Marginal benefit = marginal revenue = market price

A firm maximizes profit in accordance with the Marginal Principle—by setting marginal revenue [The change in total revenue that results from selling one more unit of output] (or market price) equal to marginal cost.

**Economic Profit**

The formula to compute profit is:

Total economic profit equals: (price minus average cost) multiplied by quantity produced

An economic profit of zero means that revenues just cover all costs, including opportunity costs. At this point, we say that the firm earns normal accounting profit.

For example, consider that total revenue is $480, explicit cost is $400, and implicit cost is $80 (the value of the entrepreneur's time). The firm is making an accounting profit of $80 but an economic profit of $0.

Let's understand how the economic profit would be illustrated with our rake production company.

Suppose that revenue per unit (or price) is $25 and cost per unit (or average total cost) is $14. Then, profit per unit equals revenue per unit minus cost per unit.

($25 minus $14) = 11

Suppose that an output of 9 rakes per minute maximizes the profits. Then total economic profit equals:

(price minus average cost) multiplied by quantity produced, ($25 minus $14) multiplied by 9 = $99

**Short Run and Long Run: The Shut-Down Decision**

Sometimes it is necessary for a company to make the difficult decision regarding whether shutting down production is necessary. If the benefit of operating (total revenue) exceeds the cost of operating, or total variable cost, the company should not shut down.

The formula for determining whether shutdown is necessary is as follows:

T R = (P multiplied by Q) must be greater than STVC = SAVC multiplied by Q

Where,

•TR = Total Revenues

•P = Price per unit

•Q = Quantity

•STVC = Short-term variable costs

•SAVC = Short-term average variable cost

Therefore, if P is greater than SAVC, then the firm should continue to operate, if P is less than SAVC, then the firm should shut down.

**Short-Run Supply Curves**

A firm's short-run supply curve [A curve explaining the relationship between the price of a product and the quantity of output supplied by a firm in the short run] depicts the relationship between the market price and the quantity supplied by the firm over a period of time during which one input—the production facility—cannot be changed.

The short-run supply curve is the firm's SMC curve rising above the minimum point on the SAVC curve.

For any price above the shutdown price, the firm adjusts output along its marginal cost curve as the price level changes.

Below the shutdown price, quantity supplied equals zero.

Consider an example. Let's say a firm can produce 6 rakes per minute with a price of $9. The average cost is $12. This means that the average cost exceeds the price by $3, so the firm loses $18 per minute ($3 per rake multiplied by 6 rakes per minute). The average variable cost is $6 per rake, which is less than the $9 price, so total revenue exceeds total variable cost, and it is sensible to continue operating at a loss, rather than shut down.

**Short-Run Market Supply Curve**

The short-run market supply depicts the relationship between the market price and the quantity supplied by all firms in the short run. That is, we compare the market supply curve of an individual firm with an industry that has 100 identical firms. For each price, we get the quantity supplied for the entire market by multiplying the quantity supplied by the typical firm (from the individual supply curve) by 100. For example, if a firm produces 6 rakes at a price of $9, the market supply will be 600 rakes.

**A Market in Long-Run Equilibrium**

A market reaches a long-run equilibrium when three conditions hold:

1. The quantity of the product supplied equals the quantity demanded.

2. Each firm in the market maximizes its profit, given the market price.

3. Each firm in the market earns zero economic profit, so there is no incentive for other firms to enter the market.

By contrast, short-run equilibrium, quantity supplied equals quantity demanded and each firm in the market maximizes profit.

Let's look at an example to understand a market in long-run equilibrium.

Let's say that the demand curve intersects the short-run market supply curve at a price of $12 and a quantity of 700 rakes per minute. There are 100 firms, each of which produces 7 rakes per minute. Each firm maximizes its profit by choosing the quantity at which the marginal revenue (the price) equals the marginal cost, producing 7 rakes per minute. At the quantity chosen by each firm, price equals short-run average total cost, so each firm makes zero economic profit. Therefore, no other firms will enter the market.

Using the following formula, this example depicts a market in long-run equilibrium.

Price = Marginal cost (the profit-maximizing rule)

Price = Short-run average total cost (zero economic profit)