

Price and Output Determination Under Perfect Competition Market

Perfect competition is a market structure in which there are large numbers of sellers and buyers competing for homogeneous products at a fixed price determined by the interaction of market/industry demand and supply. Sellers or firms are price takers and thus they face a horizontal straight-line demand curve/AR curve that matches with the MR curve. So, under a perfect competition market, $P=AR=MR$, but the cost condition of the firms under an industry may be different. The short-run, as well as long-run equilibrium/price and output determination in the short run as well as the long run of the firm under perfect competition market, is explained below.

Price and Output Determination/Equilibrium of Firm and Industry Under Perfect Competition in the Short-run

Determination of Price

Under a perfect competition market, the price of the product is fixed and is determined by industry. When the industry reaches a state of equilibrium, the price of the product is determined. There are two conditions for the industry equilibrium as market equals market supply and all the firms are in equilibrium.

Determination of Output

The duty to determine the level of output is of the firms as they are the price taker. Thus, the firm must satisfy the following two conditions to be in equilibrium or to determine the level of output.

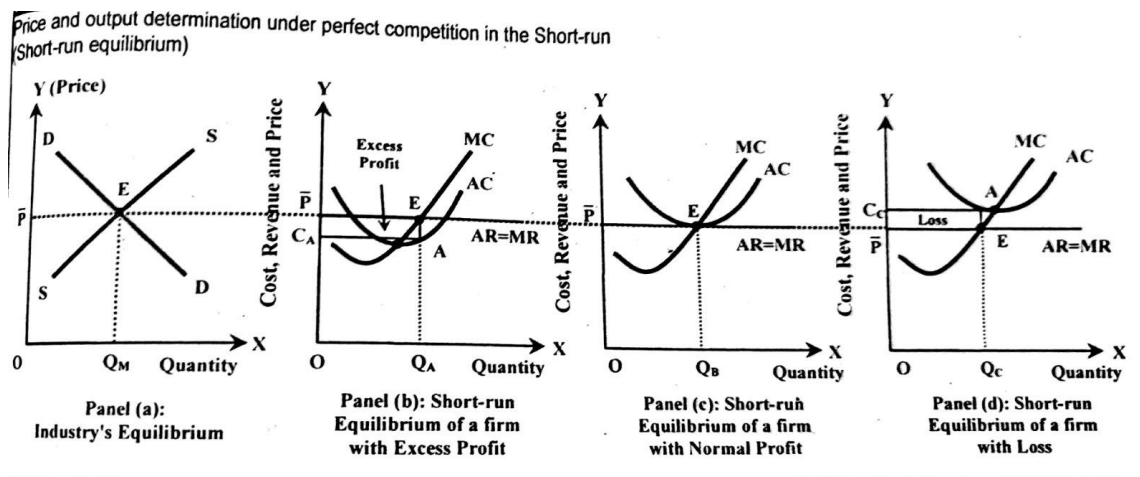
1. Marginal revenue must be equal to marginal cost, i.e., $MR=MC$.
2. The slope of the MC curve is greater than the slope of the MR curve. It means the MC curve must intersect the MR curve from below.

Short Run Equilibrium

The short-run refers to the period during which no firms can adjust their fixed factor and supply according to change in market demand. An industry (a group of firms producing homogeneous products) is said to be in equilibrium in the short run when the market demand is cleared at a given price. It means the industry is in equilibrium or the industry measures its price and output at the point where the quantity demanded and supplied are equal. Similarly, for an industry to be in equilibrium, all the firms operating under it also need to be in equilibrium. The firm in equilibrium does not ensure that it makes an excess profit only. Whether the firm earns maximum profits, normal profits or losses depends on the efficiency of the firm and the level of average cost at the short-run equilibrium. There are three possible cases in the short run.

1. If $AR=AC$, it implies firm obtains normal profit
2. If $AR>AC$, it implies firm obtains excess profit
3. If $AR<AC$, it implies firm incurs losses.

The following figure shows the measurement of price and output of the firm and industry in the short run.



The above figure shows the short-run equilibrium of the industry and firm. In the panel 'a' industry equilibrium is shown where the price \bar{P} and output Q_M are determined at the interaction between market demand and market supply curves. As the firms are price takers, all the firms must sell their product at the price \bar{P} determined in the industry.

Panel 'b', 'c', and 'd' in the above figure show the equilibrium of the firms in the short run. At equilibrium, a perfectly competitive firm may earn an excess profit ($P > AC$) or normal profit ($P = AC$) or suffer loss ($AVC < P < AC$) in the short run based on short-run average cost. These conditions are briefly explained below.

Excess Profit/Supernormal profit/Abnormal Profit ($AR/P > AC$)

Figure 'b' in the above figure shows the case of excess profit. At equilibrium, the firm is producing OQ_A units of output at per unit cost OC_A and selling at the price \bar{P} . In this case, the firm is earning excess profit in the short run as equilibrium price \bar{P} is higher than the average cost that is price is greater than average cost. The excess profit of the firm is represented by the area $AE\bar{P}C_A$. In the figure, total revenue is $OQ_AE\bar{P}$, the total cost is OC_AAQ_A and the total profit is $OQ_AE\bar{P} - OC_AAQ_A = AE\bar{P}C_A$.

Normal Profit ($AR = AC$)

In the panel 'c' of the above figure, the equilibrium point shows that the firm is producing OQ_B units of output at per unit cost Q_BE and selling at the price \bar{P} and the firm is earning just the normal profit as equilibrium price \bar{P} is equal to the average cost Q_BE that is $P = AC$. Normal profit is the profit that is just sufficient to run the business. Here in the figure, total revenue is $OQ_BE\bar{P}$, the total cost is $OQ_BE\bar{P}$ and total profit is $OQ_BE\bar{P} - OQ_BE\bar{P} = 0$.

Loss ($AR < AC$)

In the panel 'd' of the above figure, the equilibrium point shows that the firm is producing OQ_C units of output at per unit cost OC_C and selling at the price \bar{P} and the firm is bearing loss as equilibrium price \bar{P} is less than the average cost OC_C that is $P < AC$. Here in the figure, total revenue is $OQ_CE\bar{P}$, the total cost is OQ_CAC_C and the total profit is $OQ_CE\bar{P} - OQ_CAC_C = -EAC_C\bar{P}$.

The firm in the short run will continue to produce if the revenues cover the variable cost that is until the price is greater than the average variable cost and losses equal total fixed costs,

whether the firm produces or not. Thus, the lowest point on the AVC curve, at which $MC=AVC$ is known as called shutdown point of the firm.

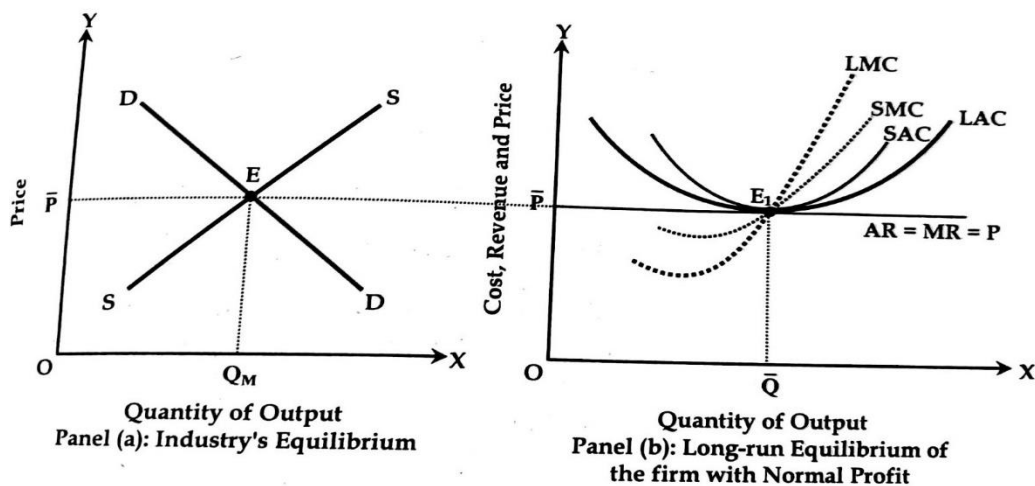
Long-Run Equilibrium

Under a perfect competition market, firms can freely enter and exit out of the industry in the long run only. In the long run existing firms have also able to adjust their capacity according to the demand of the market. Therefore, the firm and industry reach their respective long-run equilibrium through a continuous process of adjustment and readjustment of price and output with a change in market conditions. If after adjustments, the firms are still unable to cover their total costs or the firms incurring losses ($P < AC$), will exit the industry. If the existing firms are earning an excess profit ($P > AC$), then new firms will enter the industry. The exit of firms from the industry will shift the supply curve to the left and pushing the price up until $P = \text{minimum AVC}$ and entering new firms will shift the supply curve of the firm to the right and pushing the price down until $P = \text{minimum point of LAC}$. Here $P = \text{minimum point of LAC}$ ensures normal profit.

The following conditions must be fulfilled by a firm to attain equilibrium in the long run.

1. Price (P) or AR or $MR = LAC = LMC = SAC$
2. LMC curve must intersect MR curve from below

Therefore, in the case of a perfect competition market, whatever may be the profit loss situation in the short-run equilibrium, the firm earns just normal profit in the long-run equilibrium. This can be shown in the following diagram.



The above figure shows the long-run equilibrium of firms and industry with the help of short-run equilibrium. Demand and supply are intersected at point E in panel 'a' of the above figure that determines equilibrium quantity Q_M and price \bar{P} . In figure 'b' when the price is \bar{P} the firm is in equilibrium at point E1 where AC is equal to MR . It means at that point $\bar{P} = LAC = LMC = SAC = SMC$ and LMC curve is intersecting MR curve from below. Similarly, the LAC curve is tangent to the AR curve that is $P = \text{minimum LAC}$. Therefore, at equilibrium, the firm is producing $O\bar{Q}$ units of output at a per-unit cost $\bar{Q}E1$ and selling at a price \bar{P} . Here equilibrium price \bar{P} is equal to the average cost $\bar{Q}E1$ i.e. $P = LAC$. Therefore, the firm is earning normal profit in the long run.

At the minimum point of LAC, the following equilibrium condition is fulfilled

$$SMC=LMC=LAC=SAC=P=AR=MR$$

A perfect competition market is regarded as an efficient market as it ensures minimum production cost. The existing plants are also used at their full capacity or there is full utilization of the plants in the long run. So, under this market, the output is produced at the minimum point of the LAC curve, so it is considered as the socially desirable market.

Shut Down Point of a Firm in the Short Run

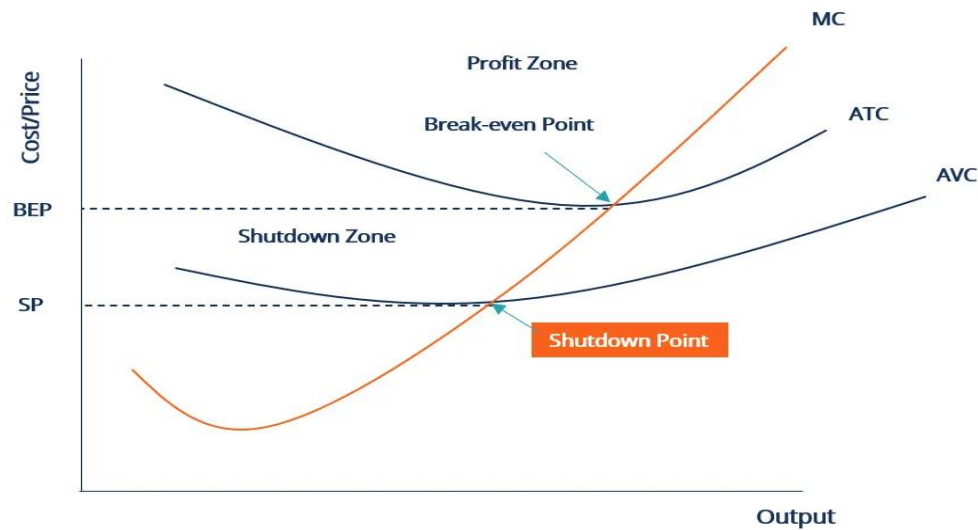
A shutdown point is an operating level where a business does not benefit in continuing production operations in the short run when revenue from selling their product is unable to cover variable costs of production. The shutdown point represents a point where a firm will incur higher and increasing losses if it continues production, as opposed to reduced losses if production is ceased. The shutdown point occurs at a point where marginal profit reaches a negative scale.

A shutdown arises when price or average revenue (AR) falls below average variable cost (AVC) at the profit-maximizing output level. Continued production will incur additional variable costs but will not generate enough revenue to cover them. At the same time, the firm will still have fixed costs to pay, further increasing the losses. A shutdown point is typically a short-run position; however, in the long run, the firm should shut down and leave the industry if its product price is less than its average total cost. Therefore, there are two shutdown points for a firm – in the short run and the long run. The decision to shut down is dependent on which costs the firm can avoid by shutting down production. The short run is a period where at least one of the firm's inputs is fixed, resulting in fixed costs incurred despite the decision to shut down.

In summary, the shutdown point has the following characteristics.

- It is the output and price point where a firm can just cover its total variable cost.
- The average variable cost (AVC) is at its minimum point.
- It is where the marginal cost (MC) curve intercepts the average variable cost (AVC) curve.

- The firm is indifferent between shutting down and continuing production where losses equal to the total fixed costs are incurred regardless of either decision



Where MC is Marginal Cost; ATC is Average Total Cost; AVC is Average Variable Cost; SP is Shutdown Price; and BEP is Break-even Price.

Short-Run Shutdown Decision

The cost of production is divided into two parts – fixed costs and variable costs. The break-even point is a point where revenue generated from sales of a product is equal to the production cost (fixed cost plus variable cost). Zero profit is generated at the break-even point. On the graph above, it is the point where the average total cost (ATC) is equal to marginal cost (MC) (i.e., $MC = ATC$). Marginal cost equals a change in total costs for each additional unit produced. Fixed costs do not change in the short run; hence, the change in total costs refers to variable cost only.

The shutdown zone represents an area between the break-even point and the shutdown point. It is an area where production can continue, as average revenue (AR) will still be able to cover average variable cost (AVC). However, in the shutdown zone, the firm will be making losses as the price is below average total cost (ATC). The firm operates at any level above the AVC curve if it is where $MC = MR$ (price). The MC curve above the AVC is also the short-run supply curve of the firm.

The shutdown rule states that a firm should continue operations if the price (average revenue) is able to cover average variable costs. The firm can continue operating, as it will be producing where marginal revenue (price, average revenue) is equal to marginal cost, a condition that ensures profit maximization or loss minimization.

A continuation of the shutdown rule states that in the short run, fixed costs are considered as sunk costs. Hence, it should not be considered in the decision of whether to shut down or continue with operations. In addition, in the short run, if the firm's total revenue is less than variable costs, the firm should shut down. A short-run decision to shut down is not the same as exiting the industry. Several firms in seasonal industries – such as agriculture, fishing, etc. – shut down their firms during the offseason to avoid unnecessary operating costs. They will not be generating any revenue during the off-season; hence they are unable to cover variable costs arising. It makes sense to temporarily shut down until the upcoming season commences.