Microeconomics with simple mathematics
[Mohammed Saiful Islam]

C3A(10)
ECO-11

CHAPTER 7

Perfect Competition

- Properties
- Short Run Equilibrium
- Normal Profit vs Supernormal Profit
- Shut-down Point
- Profit Contribution
- Short Run Supply Function
- Long Run Equilibrium
- Producer Surplus

* A firm under Perfect Competition is a price taker

542 = 18.5 CSF
551 = 9.5 CSF
578 = 6.25 FCFF

Related Topics:

- Innovation
- Competition
- Operations management
- Supply chain
- Organizational structure
- Government

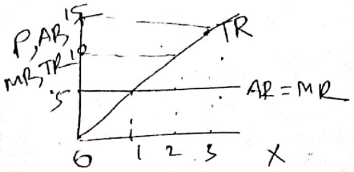
Related Articles

- Mark R. Kramer, Michael E. Porter

Up Next in Shared value

Creating Shared Value

P	Q	TR	AR	MR
5	1	5	5	5
5	2	10	5	5
5	3	15	5	5



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1385
1906
1418

7.1 Properties

Perfect competition is a market structure in which large number of buyers and sellers trade homogeneous units of goods. Perfectly competitive market is characterised by the following properties.

1. Large Number of Buyers and Sellers

The number of buyers and sellers in a competitive market is so large that a single buyer or seller or a group of buyers or sellers cannot influence market because each seller's share in the market is very insignificant relative to total market share. Similarly buyers cannot exert any pressure in market because of the presence of numerous buyers apart from the ones who group together to refuse buying from the competitive sellers. Thus a firm cannot exercise any market power.

2. Homogeneous Products

All units goods sold by the sellers in competitive market are homogeneous. Product differentiation is completely absent in such market. Buyers can buy from any seller they wisit without any hesitation regarding the quality of the product since all sellers sell identical products. Because of large number of sellers and homogeneous products, price (P) in a competitive market remains fixed. Once a market price is determined, no player can manipulate it.

Demand of a Competitive Firm

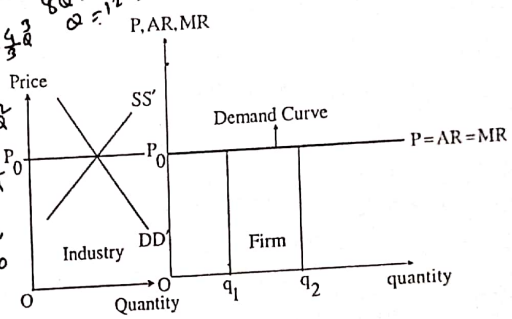

Figure- 7.1

Demand curve would be parallel to output axis as in the right panel of figure 7.1 suggesting that any amount of good can be bought at a fixed price P_0. Left panel of figure 7.1 shows how price is determined in the industry through interaction between industry demand and industry supply.

Total revenue, $TR = P \times Q$

Average revenue, $AR = \frac{TR}{Q} = \frac{P \times Q}{Q} = P$

Marginal revenue, $MR = \frac{d(TR)}{dQ} = \frac{d}{dQ}(P \times Q) = P$ (because price is constant)

In perfect competition price, average revenue and marginal revenue are equal (P = AR = MR).

3. Free Entry and Exit

Firms can enter the industry or exit from the competitive industry under any circumstances if they want. There is no barrier that could prevent firms from such free movement. Existence of economic

profit attracts new entrants and possibility of loss discourages firms to stay in the industry.

4. Profit Maximization

The key objective of a competitive firm is profit maximization. Firms try to maximize profit both in the short run and in the long run. In the long run, however, economic profit disappears because of influx of new firms, but competitive firms are able to secure excess profit in the short run.

5. No Government Regulation

Government has no role in a competitive arrangement. Government has the authority to impose tax, award subsidy, issue quota or restrict licenses. But in a competitive market structure none of the above distortions would prevail. Plainly speaking, government is just absent or silent in a competitive environment. Although this sounds unrealistic, the perfect competition itself is unrealistic.

6. Perfect Knowledge

Buyers and sellers of competitive market have perfect knowledge about the market. This knowledge is about the quallty of the product, number of buyers and sellers, about present and future situation of the market. Because of complete awareness, firms have no chance of differentiating product or charging higher price.

7. Absence of Advertisement and Selling Activities

Perfectly competitive firms sell homogeneous products. Advertisement and other selling activities are completely absent in a competitive market. This is because advertisement is a device to differentiate products but perfect competition is devoid of product differentiation.

8. Perfect Mobility of Factors of Production

Special feature of competitive market structure is the mobility of factors. If the factors wish to move to other firms, they can do so. Imposition of any restriction on factors' movement is unlikely under

competitive environment. Firm has no monopsony power in hiring labour or other factor.

7.2 Short Run Equilibrium

A competitive firm attains equilibrium if it can maximise profit. Two conditions of profit maximization are

i. $MR = MC$ and

ii. slope of MR < slope of MC

In the short run equilibrium, firms can earn economic profit, normal profit or can even make loss. Figure 7.2 describes the situation of economic profit. E is the equilibrium point where MC cuts MR from below.

Equilibrium price: OP_0

Equilibrium quantity: Oq_0

Average cost = OA

Total revenue = Price × Quantity = $OP_0 \times Oq_0 = OP_0Eq_0$

Total cost = Average Cost × Quantity = $OA \times Oq_0 = OABq_0$

Profit = Revenue – Cost = $OP_0Eq_0 - OABq_0 = ABEP_0$

* Market: Market generally means a place or a geographical area where buyers with money & sellers with their goods meet to exchang goods for money. In economics market refers to a group of buyer & sellers who involve in the transaction of commodities & services.

Short Run Equilibrium with Economic Profit

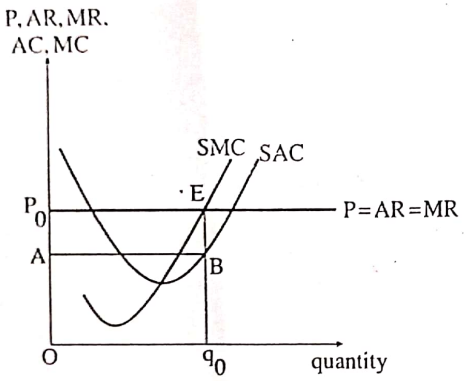

Figure- 7.2

This profit is also called economic profit or supernormal profit or abnormal profit or excess profit.

Figure 7.3 portrays equilibrium with neither profit nor loss. Equilibrium price and quantity, corresponding to equilibrium point F, are $O\bar{P}$ and $O\bar{q}$ respectively. In this case average cost is exactly equal to price. Consequently total revenue $O\bar{P}F\bar{Q}$ is equal to total cost and profit is zero.

No-Profit-No-Loss Equilibrium

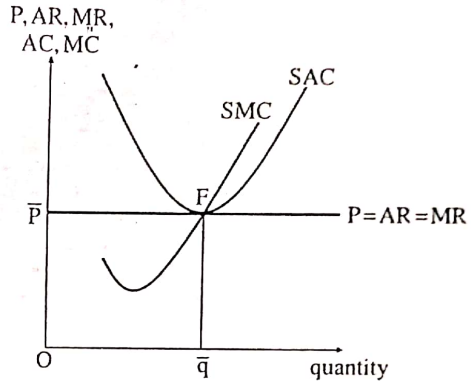

Figure- 7.3

Although economic profit appears zero, there exists normal profit equal to the return of the entrepreneur.

In short run equilibrium firm faces loss if revenue falls below cost. In the situation of loss, firm's decision of running or shutting down business depends on the magnitude of variable cost relative to earning. The firm in question would run business if price exceeds variable cost.

Running Business with Loss

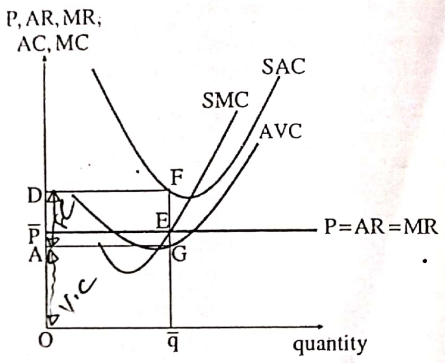

Figure- 7.4

In figure 7.4 price $O\bar{P}$ exceeds average variable cost OA. Firm can realise entire variable cost (OA) and a portion ($A\bar{P}$) of fixed cost but $\bar{P}D$ amount of fixed cost remains unrealised which accounts for loss. In this case firm's decision to continue producing output would be the right decision because if firm shuts down then the amount of loss would be higher.

Price Below Variable Cost

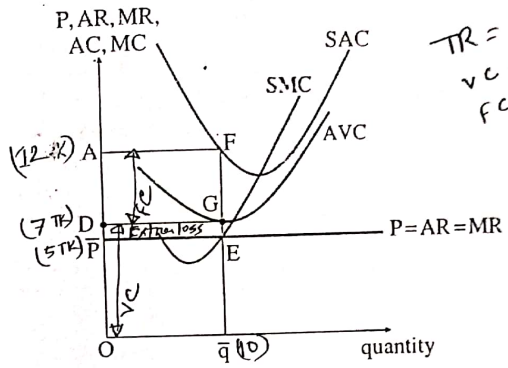

Figure- 7.5

Firm will of course shut down if price falls below variable cost. In Figure 7.5 price OP falls short of per unit variable cost OD. Therefore, the best decision would be to stop business, because in such case shut-down decision will involve a loss equal to fixed cost alone whereas the decision of producing output will amplify loss by adding part of variable cost to entire fixed cost.

If price is equal to variable cost, the firm remains indifferent between the decisions of running business or shutting down because in each case the amount of loss would be equal to the fixed cost. Figure 7.6 displays this cut-off situation of equal price and variable cost.

Shut Down Case

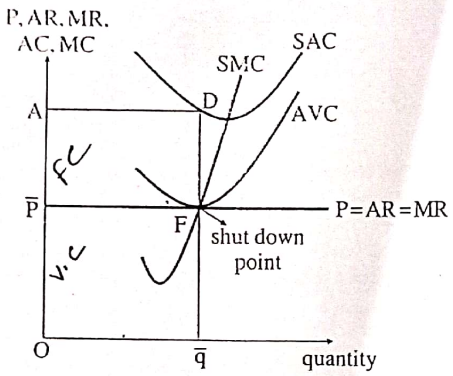

Figure- 7.6

Equilibrium point: F
Equilibrium price = $O\bar{P}$
Equilibrium quantity = $O\bar{q}$
Average variable cost = $O\bar{P}$

Price is just enough to meet variable cost. Per unit loss is equal to fixed cost $\bar{P}A$. If the producer does not go for production, loss would be the same. Thus the producer remains indifferent between producing and not producing output. Producer will not, however, produce output if price falls below the variable cost. This is why, minimum point of AVC is known as shut-down point. Point F in figure 7.6 is shut-down point.

Example 7.1

Short run cost function of a perfectly competitive firm is $C(Q) = Q^3 - 45Q^2 + 1000Q + 800$. Find the amount of maximum profit assuming P = 1000.

Solution

Total revenue (R) = Price × Quantity = $1000Q$

Marginal revenue, $MR = \frac{dR}{dQ} = 1000$

Slope of $MR = \frac{d(MR)}{dQ} = 0$

Given, $C(Q) = Q^3 - 45Q^2 + 1000Q + 800$

Marginal cost, $MC = \frac{dC}{dQ} = 3Q^2 - 90Q + 1000$

Slope of $MC = \frac{d(MC)}{dQ} = 6Q - 90$

Profit maximization requires, MC = MR

$$\Rightarrow 3Q^2 - 90Q + 1000 = 1000$$

$$\Rightarrow 3Q^2 - 90Q = 0$$

$$\Rightarrow 3Q(Q - 30) = 0$$

Thus, either $Q = 0$ or, $Q = 30$

When $Q = 30$, Slope of $MC = 6Q - 90 = (6 \times 30) - 90 = 90$ and slope of $MR = 0$.

Since slope of MR < slope of MC, profit would be maximum at $Q = 30$.

When $Q = 30$, total revenue = Price × Quantity = $1000 \times 30 = 30000$

Total cost,

$C = 30^3 - (45 \times 30^2) + (1000 \times 30) + 800 = 27000 - 40500 + 30000 + 800 = 17300$

Therefore, profit = total revenue – total cost = 30000-17300 = 12700

Example 7.2

A competitive firm's short run cost function is estimated $C = \frac{1}{3}Q^3 - 30Q^2 + 800Q + 21000$. Market price is fixed at 400. Does the firm earn economic profit in equilibrium? Should the firm continue business? Give an intuitive explanation.

Solution

Total revenue (R) = Price × Quantity = 400Q

Marginal revenue, $MR = \frac{dR}{dQ} = 400$

Slope of $MR = \frac{d(MR)}{dQ} = 0$

Total cost $C = \frac{1}{3}Q^3 - 30Q^2 + 800Q + 21000$

Marginal cost, $MC = \frac{dC}{dQ} = Q^2 - 60Q + 800$

Slope of $MC = \frac{d(MC)}{dQ} = 2Q - 60$

Setting MC = MR

$Q^2 - 60Q + 800 = 400$

$\Rightarrow Q^2 - 60Q + 400 = 0$

$\therefore Q = \frac{-(-60) \pm \sqrt{(-60)^2 - 4 \times 1 \times 400}}{2}$

$= \frac{60 \pm \sqrt{3600 - 1600}}{2} = \frac{60 \pm 44.72}{2} = 52.36 \quad \& \quad 7.64$

If Q = 52.36, Slope of MC = 2Q − 60 = (2 × 52.36) - 60 = 44.72 and slope of MR = 0.

Thus slope of MR < slope of MC.

If Q = 7.64, Slope of MC = 2Q − 60 = (2 × 7.64) - 60 = −44.72 and slope of MR = 0, i.e., slope of MR > slope of MC. This suggests, second order condition of profit maximization is satisfied when Q = 52.36.

Thus profit maximizing output = 52.36

Total revenue (R) = Price × Quantity = 400 × 52.36 = 20944

Total cost

$C = \frac{1}{3}Q^3 - 30Q^2 + 800Q = 21000 \frac{1}{3} \times (5236)^3 - 30 \times (5236)^2 + 800 \times 5236 + 21000 = 28490.44$

Since total revenue falls below total cost, the firm makes loss.

Amount of loss = total cost - total revenue = 28490.44 − 20944 = 7546.44

Despite making loss the firm should continue business because its revenue exceeds variable cost. In this case, total variable cost,

$TVC = \frac{1}{3}Q^3 - 30Q^2 + 800Q = \frac{1}{3} \times (5236)^3 - 30 \times (5236)^2 + 800 \times 5236 = 749044$

and total revenue = 20944.

The firm can meet entire amount of variable cost by spending a portion of its revenue and the residual amount is spent to finance fixed cost. After meeting variable cost the firm is left with (20944 - 7490.44) = 13453.56. An amount of fixed cost, however, remains unrealised, which remains as loss. Under present situation, total fixed cost = 21000.

Amount of fixed cost borne by the firm = 13453.56

Amount of fixed cost that can't be borne = 21000 - 13453.56 = 7546.44, which is loss.

If the firm does not run business then its loss would be equal to 21000. Thus the firm should stay in business.

Example 7.3

Assume short-run cost function of a competitive firm.

$C = Q^3 - 10Q^2 + 100Q + 500$. Determine the minimum price below which the firm will shut down business.

Solution

A firm should stop business if price falls below variable cost. In order to determine shut-down price one has to watch minimum average variable cost (AVC).

Here $TVC = Q^3 - 10Q^2 + 100Q$

$AVC = \frac{TVC}{Q} = Q^2 - 10Q + 100$

First order condition for minimum AVC, $\frac{dAVC}{dQ} = 0$

$AVC = Q^2 - 10Q + 100$

$\frac{d(AVC)}{dQ} = 2Q - 10$

Setting, $\frac{d(AVC)}{dQ} = 0$

$\Rightarrow 2Q - 10 = 0$

$\Rightarrow 2Q = 10$

$\therefore Q = 5$

$\frac{d^2(AVC)}{dQ^2} = 2 > 0$

Since $\frac{d^2(AVC)}{dQ^2} > 0$, AVC would be minimum at $Q = 5$.

Amount of minimum AVC $= 5^2 - 10 \times 5 + 100 = 25 - 50 + 100 = 75$

If price falls below 75. the firm will shut down.

7.3 Short Run Supply Function of a Competitive Firm

Supply function shows the combinations of price and output supplied.

Short Run Supply Function

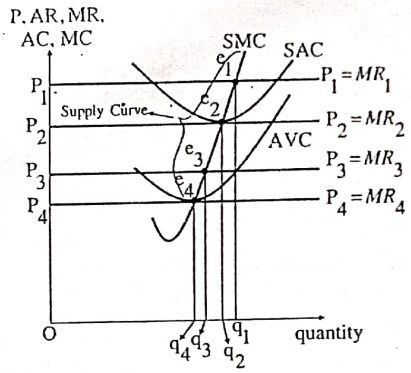

Figure- 7.7

Figure 7.7 provides the description of deriving supply curve of a competitive firm in the short run. Equality between marginal revenue and marginal cost determines price and output decision of a firm. Initial equilibrium point is e_1 where price and output are P_1 and q_1 respectively. At point e_1 the firm is making economic profit. Since e_1 point denotes a pair of price and corresponding quantity, e_1 is a point on the supply curve, which is also a point of marginal cost curve. At P_2 price, zero profit equilibrium point is e_2. Price and output are P_2 and q_2 respectively. e_2 point, representing one to one correspondence between price P_2 and output q_2, is another point of supply curve, which is again a point on marginal cost curve. Although incurring loss, e_3 is another production point representing price P_3 and output q_3. e_3 is simultaneously a point on supply curve and marginal cost curve. In each case we observe that the points on supply curve are indeed the points on marginal cost curve. However, if price falls below average variable cost then the firm will shut down. Therefore, the segment of marginal cost curve that lies above the average variable cost curve is the short run supply curve of a competitive firm.

Nalwadi

Key Differences Between GDP and GNP

The major differences between GDP and GNP are explained in the given below points:

1. The monetary value of all the goods and services produced within the geographical limits of the country is known as GDP. GNP is the money value of all the goods and services made by the citizens of the country, no matter where they dwell.
2. GDP gauges production of products within the country's boundary. Conversely, GNP measures the production of products by the companies and industries owned by the residents of the country.
3. The basis for calculating the GDP is the location, whereas GNP is based on citizenship.
4. In the case of GDP, the measurement of productivity is done on a local scale while if we talk about GNP, it measures the productivity on an international level.
5. GDP focuses on measuring domestic production, but GNP focuses on production by the nationals, i.e., individuals or corporations, of the country.
6. GDP outlines the strength of the domestic economy of a country. On the other hand, GNP outlines how the residents are contributing towards the economy of the country.

Comparison Chart

Basis for Comparison	GDP	GNP
Meaning	The worth of goods and services produced within the geographical limits of the country is known as Gross Domestic Product (GDP).	The worth of goods and services produced by the country's citizens irrespective of the geographical location is known as Gross National Product (GNP).
What is it?	Production of products within the country's boundary.	Production of products by the enterprises owned by the residents of the country.
Basis	Location	Citizenship
Calculation	GDP = Consumption + Investment + Government Spending + Net Export	GNP = GDP - NFIA
On which scale productivity is measured?	On a local scale	On international scale
Focus on	Domestic production	Production by nationals
Outlines	The strength of the country's domestic economy.	How the residents are contributing towards the country's economy.