

Lecture 7

Short-Run Costs and Output Decisions

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Principles of Microeconomics

Decisions Facing Firms

decisions

1. Quantity of output to supply
2. How to produce that output (which technique to use)
3. Quantity of each input to demand

**are
based
on**

information

1. The price of output
 2. Techniques of production available*
 3. The price of inputs*
- * Determines production costs

Costs in the Short Run

The short run is a period of time for which two conditions hold:

1. Firm is operating under a fixed scale (fixed factor) of production and
2. Firms can neither enter nor exit an industry.

In the short run, all firms have costs that they must bear regardless of their output. These kinds of costs are called fixed costs.

Costs in the Short Run

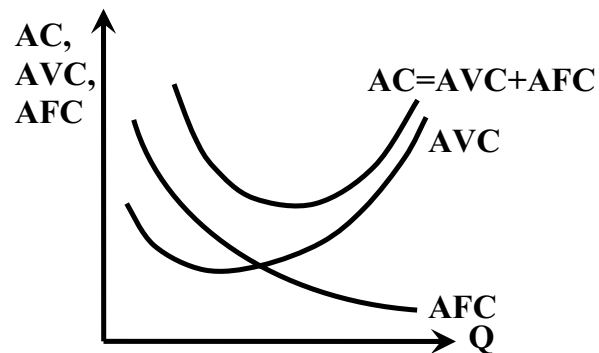
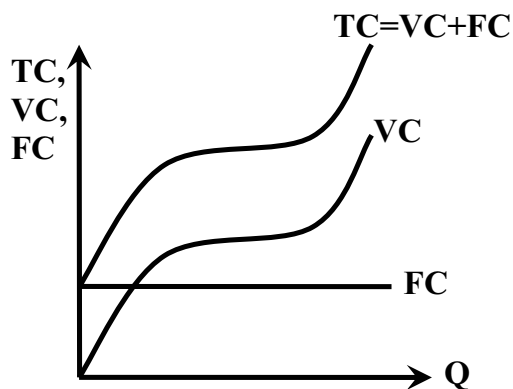
Fixed cost:

- any cost that does not depend on the firm's level of output. (The firm incurs these costs even if it doesn't produce any output).
- firms have no control over fixed costs in the short run. (For this reason, fixed costs are sometimes called sunk costs).
 - obvious examples: property taxes, loan payments, etc.
 - not-so-obvious example: firm must pay "rent" to hired capital. If that level of capital cannot be adjusted immediately ("fixed factor"), then rental payments are a fixed cost in the short-run

Variable cost:

- depends on the level of production
- derived from production requirements and input prices
 - variable cost rises as output rises because firm has to hire more inputs (kapital and labor) to produce larger quantities of output

Costs – Total vs. Average



$$\text{Total Cost (TC)} = \text{Fixed Cost (FC)} + \text{Variable Cost (VC)}$$

$$TC = FC + VC$$

$$\frac{TC}{Q} = \frac{FC}{Q} + \frac{VC}{Q}$$

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

$$AC = AFC + AVC$$

Marginal Cost

Marginal cost:

- **increase in total cost from producing one more unit of output** (the additional cost of inputs required to produce each successive unit of output)
- **only reflects changes in variable costs**
 - fixed cost does not increase as output increases
 - marginal cost is the slope of both total cost and variable cost

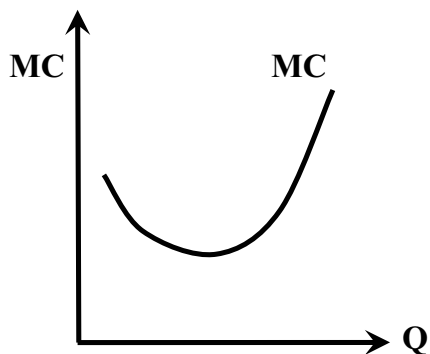
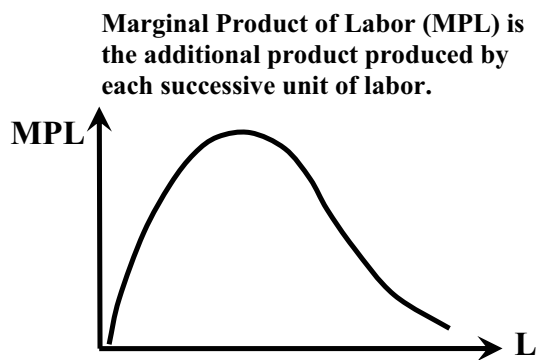
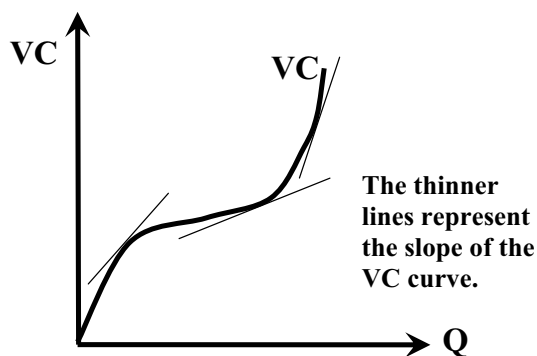
Shape of the Marginal Cost Curve

In the short run, the firm is constrained by a fixed input, therefore:

1. the firm faces diminishing returns to variable inputs and
2. the firm has limited capacity to produce output

As the firm approaches that capacity it becomes increasingly costly to produce successively higher levels of output. Marginal costs ultimately increase with output in the short run.

Marginal Cost



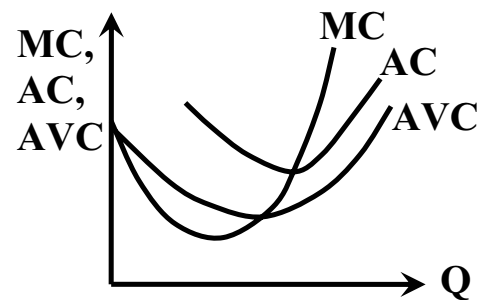
VC increases as Q increases because the returns to each successive unit of a variable factor (such as labor) eventually diminish when other factors (such as capital) are held fixed.

Marginal Cost is NOT Average Variable Cost

Average Variable Cost – the (Total) Variable Cost divided by total quantity produced. (It's a simple fraction).

Marginal Cost – the increase in (Total) Variable Cost incurred by producing one additional unit of output. (It's a derivative).

Marginal Cost curve intersects the Average (Total) Cost and Average Variable Cost curves at their minimum points.



Short-Run Average and Marginal Cost

- If a firm's capital stock is fixed in the short-run, then the rental payments that the firm makes on its capital stock is a fixed cost.
- We can use that assumption to derive short-run average and marginal cost curves.
- So start by assuming that a firm's production function is given by:

$$X = K^{2/3} L^{1/3}$$

- Since the firm's capital stock is fixed (by assumption) we can solve the production function for labor to find the amount of labor needed to produce various levels of output:

$$L = \frac{X^3}{K^2}$$

- Its total costs are given by:

$$TC = rK + wL$$
$$TC = rK + w \frac{X^3}{K^2}$$

Short-Run Average and Marginal Cost

To find Short-Run Average Cost simply divide by Total Cost by X:

$$AC = \frac{TC}{X} \Rightarrow AC = \frac{rK}{X} + w \frac{X^2}{K^2}$$

$$AC = AFC + AVC$$

To find Short-Run Marginal Cost take the derivative of Total Cost with respect to X:

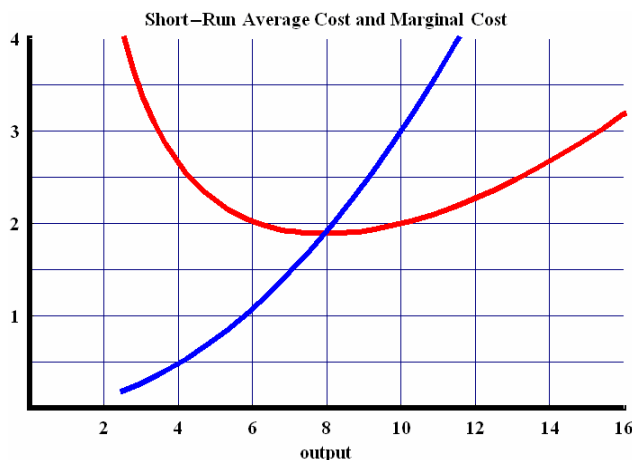
$$MC \equiv \frac{d TC}{d X} \Rightarrow MC = 3w \frac{X^2}{K^2}$$

So if the wage and rental rate are both equal to \$1 and the capital stock is equal to 10 units, then:

$$w = \$1$$

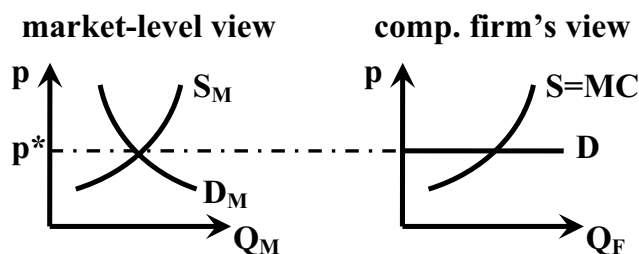
$$r = \$1$$

$$K = 10$$



Output: Revenues, Costs and Profit Maximization

- In the short run, a competitive firm faces an infinitely elastic demand curve (which corresponds to the market equilibrium price).
- (A monopolist faces the downward-sloping market demand curve).



- Each household has a downward sloping demand curve, but:
 - price is determined by market supply and demand
 - so shifts of one firms's supply curve do not affect the market price
- Each firm faces infinitely elastic (horizontal) demand

Total Revenue and Marginal Revenue

- **Total Revenue** – total amount that firm receives from sale of its output
- **Marginal Revenue** – additional revenue that a firm takes in when it increases output by one additional unit.

If the market demand curve is given by: $D_M = 10 - p$
and if the competitive industry equilibrium price = \$8

Comp. Firm's MR = p*				Monopolist's MR			
p	qty. dem.	TR	MR	p	qty. dem.	TR	MR
8	0	0	8	10	0	0	10
8	1	8	8	9	1	9	8
8	2	16	8	8	2	16	6
8	3	24	8	7	3	21	4
8	4	32	8	6	4	24	2
8	5	40	8	5	5	25	0
8	6	48	8	4	6	24	-2
8	7	56	8	3	7	21	-4

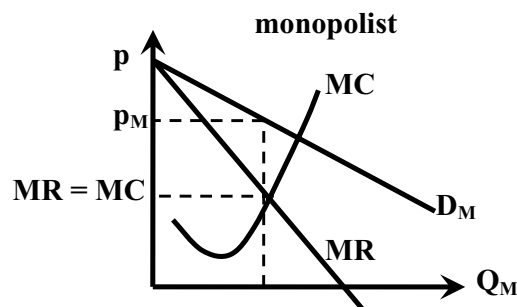
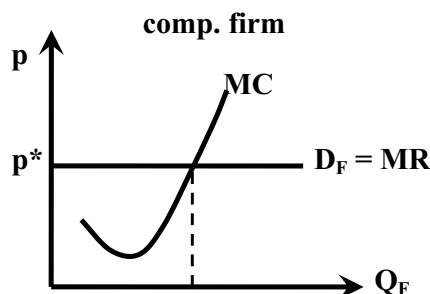
Note that: $Q = 10 - p \Rightarrow p = 10 - Q \Rightarrow TR \equiv p \cdot Q = (10 - Q) \cdot Q = 10Q - Q^2$

therefore: $MR \equiv \frac{dTR}{dQ} = 10 - 2Q$ in the case of a monopoly

Profit-Maximization

Profit-maximizing level of output for all firms is the output level where firms' MR = MC

- **Perfectly competitive firm's** $MR = p^*$, so it will produce up to the point where $p^* = MC$.
- **Monopolist** produces up to the point where $MR = MC$, but this occurs at a lower output level than would occur if the industry were perfectly competitive (and monopolist sells at a price that exceeds MR and MC)
- The key idea here is that firms will produce as long as marginal revenue exceeds marginal cost.



Short-Run Supply Curve

- At any market price, the marginal cost curve shows the output level that maximizes profit.
- Thus, the marginal cost curve of a perfectly competitive profit-maximizing firm is the firm's short-run supply curve.

