

BEC 30325: MANAGERIAL ECONOMICS

Session 07

COST THEORY AND ESTIMATION

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Session Outline

- *The Nature of Costs*
- *Explicit Costs*
- *Implicit Costs*
- *Short-Run Cost Functions*
- *Long-Run Cost Curves*

The Nature of Costs

- ▶ Explicit Costs
 - ▶ Accounting Costs
- ▶ Economic Costs
 - ▶ Implicit Costs
 - ▶ Alternative or Opportunity Costs
- ▶ Relevant Costs
 - ▶ Incremental Costs
 - ▶ Sunk Costs are Irrelevant

The Nature of Costs

- Costs are incurred as a result of production.
- *Economists* define cost in terms of opportunities that are sacrificed when a choice is made. Therefore, economic costs are simply benefits lost .
- *Accountants* define cost in terms of resources consumed. Accounting costs reflect changes in stocks (reductions in good things, increases in bad things) over a fixed period of time.

Explicit Costs

- ***Explicit costs*** are actual expenditures of the firm to hire, rent, or purchase the inputs it requires in production. These includes the *wages* to hire labor, the *rental price of capital, equipment, and buildings*, and the *purchase price of raw materials and semi finished products*.

Implicit Costs

- ***Implicit costs*** refers to the value of the inputs that are owned and used by the firm in its own production activity. These includes the *highest salary* that the entrepreneur could earn in his or her best alternative employment and *the highest return* that the firm could receive from investing its capital in the most rewarding alternative use or *renting its land and buildings* to the highest bidder.

Economic Costs

- *Economic cost* refers the sum of explicit and implicit costs. These costs must be distinguished from accounting costs, which refer only to *the firm's actual expenditures, or explicit cost*, incurred for purchased or hired inputs.

Alternative or Opportunity Costs

- The cost to the firm of using a purchased or owned input is equal to what the input could earn in its best alternative use.
- The firm must include the alternative or opportunity costs because the firm cannot retain a hired input if it pays a lower price for the input than another firm.

Example 01

Senouk is currently reading for his bachelor's degree in Accounting and Finance. He has the option of engaging in an internship programme for three months, where he could earn Rs.10000 per month. For all three months he will have to spend Rs. 9000 for travelling. If he was to reject the internship opportunity he can conduct online marketing for a particular product and is able to earn an extra income of Rs. 4000 per month. For internet based marketing he has to incur Rs.1000 as monthly charges.

- ❑ Compute Accounting profit and economic profit of doing the internship.

Relevant and Irrelevant Costs

- Relevant Costs: The costs that should be considered in making a managerial decision; economic or opportunity costs.
 - Incremental costs: the total increase in costs for implementing a particular managerial decision.
- Irrelevant or Sunk Costs: The cost that are not affected by a particular managerial decision.

Short-Run Cost Functions

- In short-run period, some of the firm's inputs are fixed and some are variable, and this leads to fixed and variable costs.
- Total costs is the cost of all the productive resources used by the firm. It can be divided into two separate costs in the short run.

Total fixed and variable costs

- Total Fixed Costs: The total obligations of the firm per time period for all the fixed inputs the firm uses.
- Total Variable Costs: The total obligations of the firm per time period for all the variable inputs the firm uses.

Short-Run Cost Functions

$$\text{Total Cost} = TC = f(Q)$$

$$\text{Total Fixed Cost} = TFC$$

$$\text{Total Variable Cost} = TVC$$

$$TC = TFC + TVC$$

Average Costs

- **Average total cost** (also called **average cost**) equals **total cost** per unit of output produced

$$ATC = TC/Q$$

- Average fixed cost equals **fixed cost** divided by **quantity** produced

$$AFC = FC/Q$$

- **Average variable cost** equals **variable cost** divided by **quantity** produced

$$AVC = VC/Q$$

Average Costs and Marginal Cost

- Average total cost is also the sum of average fixed cost and average variable cost.

$$ATC = AFC + AVC$$

- Marginal (incremental) cost is the increase in total cost resulting from a one-unit increase in output. Marginal decisions are very important in determining profit levels.

$$MC = \Delta TC / \Delta Q$$

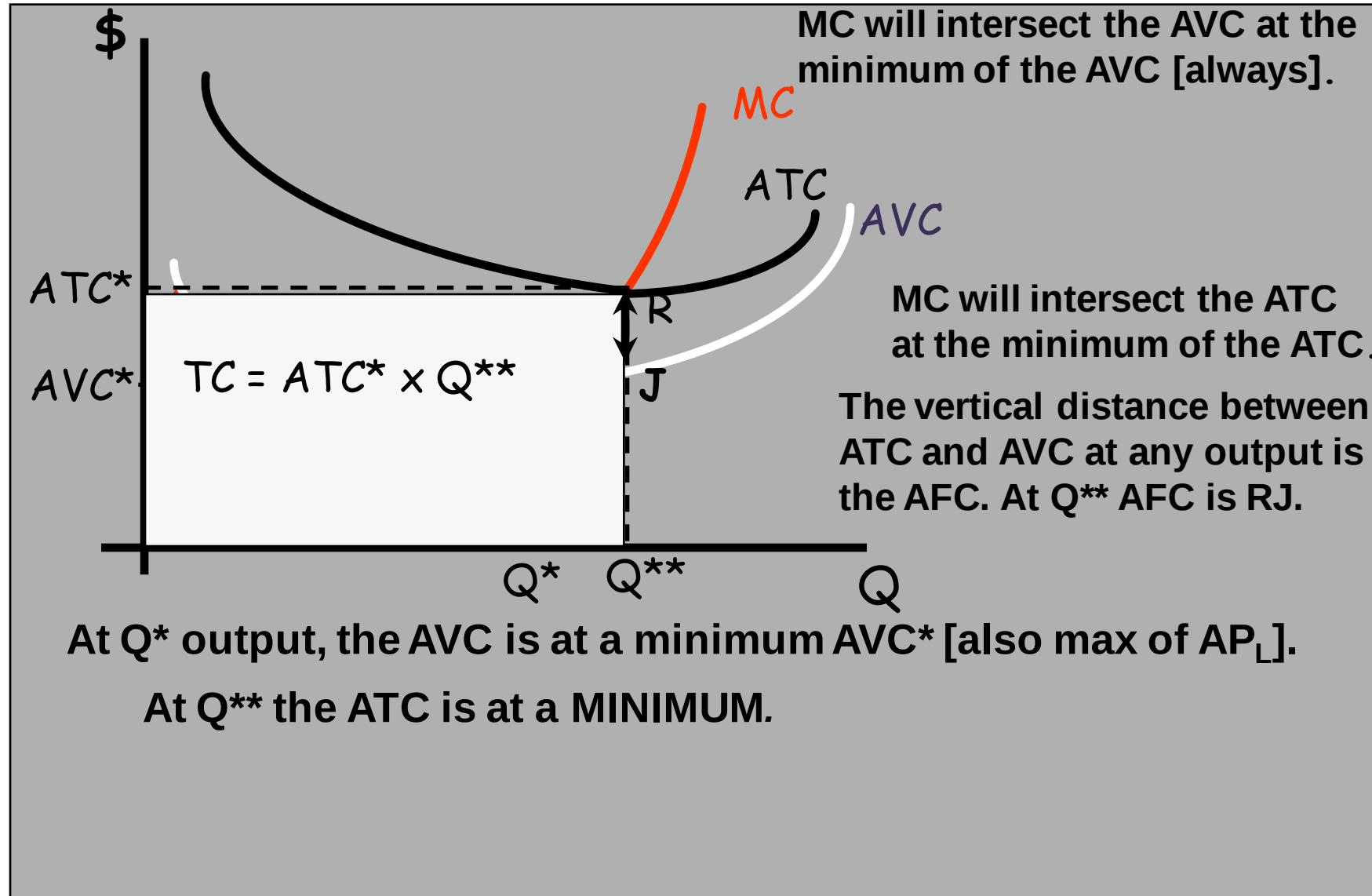
Average Costs and Marginal Cost

- The marginal cost curve, average variable cost curve and average total cost curves are generally U-shaped.
- The U-shape in the short run is attributed to increasing and diminishing returns from a fixed-size plant, because the size of the plant is not variable in the short run.

Average Costs and Marginal Cost

- The marginal cost and average cost curves are related
 - When **MC exceeds AC**, average cost must be **rising**
 - When **MC is less than AC**, average cost must be **falling**
- This relationship explains why **marginal cost** curves always **intersect average cost** curves at the **minimum** of the average cost curve.

Graphical Presentation



Relationship Between Marginal and Average Costs

If $MC > ATC$, then ATC is rising

If $MC = ATC$, then ATC is at its minimum

If $MC < ATC$, then ATC is falling

If $MC > AVC$, then AVC is rising

If $MC = AVC$, then AVC is at its minimum

If $MC < AVC$, then AVC is falling

Short-Run Cost Functions

$$\text{Average Total Cost} = \text{ATC} = \text{TC}/Q$$

$$\text{Average Fixed Cost} = \text{AFC} = \text{TFC}/Q$$

$$\text{Average Variable Cost} = \text{AVC} = \text{TVC}/Q$$

$$\text{ATC} = \text{AFC} + \text{AVC}$$

$$\text{Marginal Cost} = \Delta\text{TC}/\Delta Q = \Delta\text{TVC}/\Delta Q$$

Short-Run Cost Functions-Example

Q	TFC	TVC	TC	AFC	AVC	ATC	MC
0	60	0					
1	60	20					
2	60	30					
3	60	45					
4	60	80					
5	60	135					

Average Total Cost = $ATC = TC/Q$

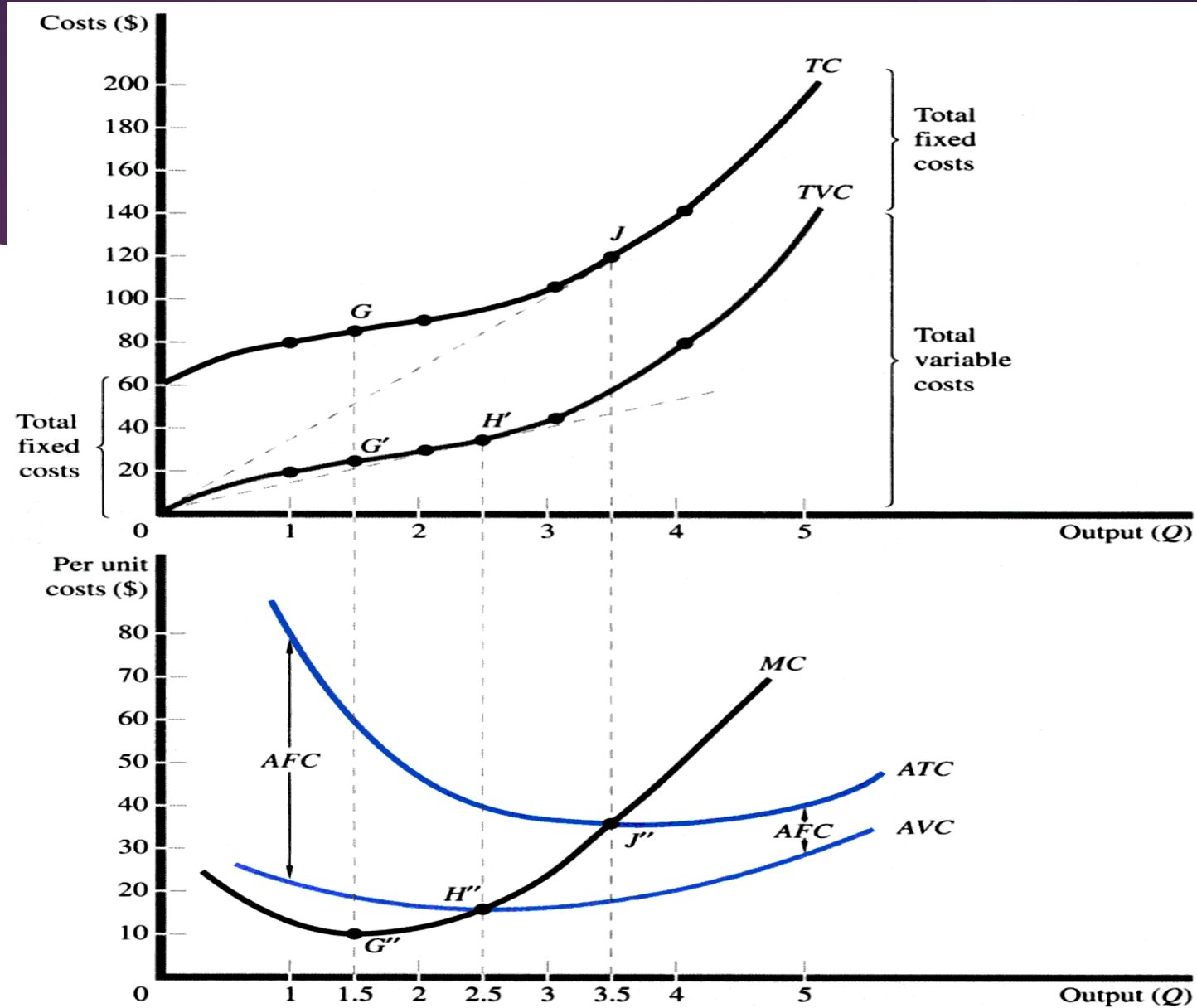
Average Fixed Cost = $AFC = TFC/Q$

Average Variable Cost = $AVC = TVC/Q$

$ATC = AFC + AVC$

Marginal Cost = $\Delta TC/\Delta Q = \Delta TVC/\Delta Q$

Graphical Presentation



Average Cost Curves-Graphical meaning

- The average fixed cost curve slopes down continuously.
- The average total cost curve is the vertical summation of the average fixed cost curve and the average variable cost curve
 - The **ATC** curve is always higher than AFC and AVC curves
- While output gets big and AFC decline to zero, the AVC curve approaches the ATC curve.

Example 02

- ▶ Suppose that the total cost function is given as below;

$$TC = 4q^2 + 16$$

- ▶ Find the variable cost, fixed cost, average cost, average variable cost, and average fixed cost.
- ▶ Assuming that the Marginal cost is $MC=8q$, Find the output that minimizes average cost.

Wage Rate

Average Variable Cost

$$AVC = TVC/Q = w/AP_L$$

Marginal Cost

$$\Delta TC/\Delta Q = \Delta TVC/\Delta Q = w/MP_L$$

Long-Run Cost Curves

- The long run is the period of time during which:
 - Technology is constant
 - All inputs and costs are variable
 - The firm faces no fixed inputs or costs
 - The long run period is a series of short run periods. [For each short run period there is a set of TP, AP, MP, MC, AFC, AVC, ATC, TC, TVC & TFC for each possible scale of plant].

Long-Run Cost Curves

Long-Run Total Cost = The minimum total costs of producing various levels of output when the firm can build any desired scale of plant: $LTC = f(Q)$

Long-Run Average Cost = The minimum per-unit cost of producing any level of output when the firm can build any desired scale of plant: $LAC = LTC/Q$

Long-Run Marginal Cost = The change in long-run total costs per unit change in output: $LMC = \Delta LTC / \Delta Q$

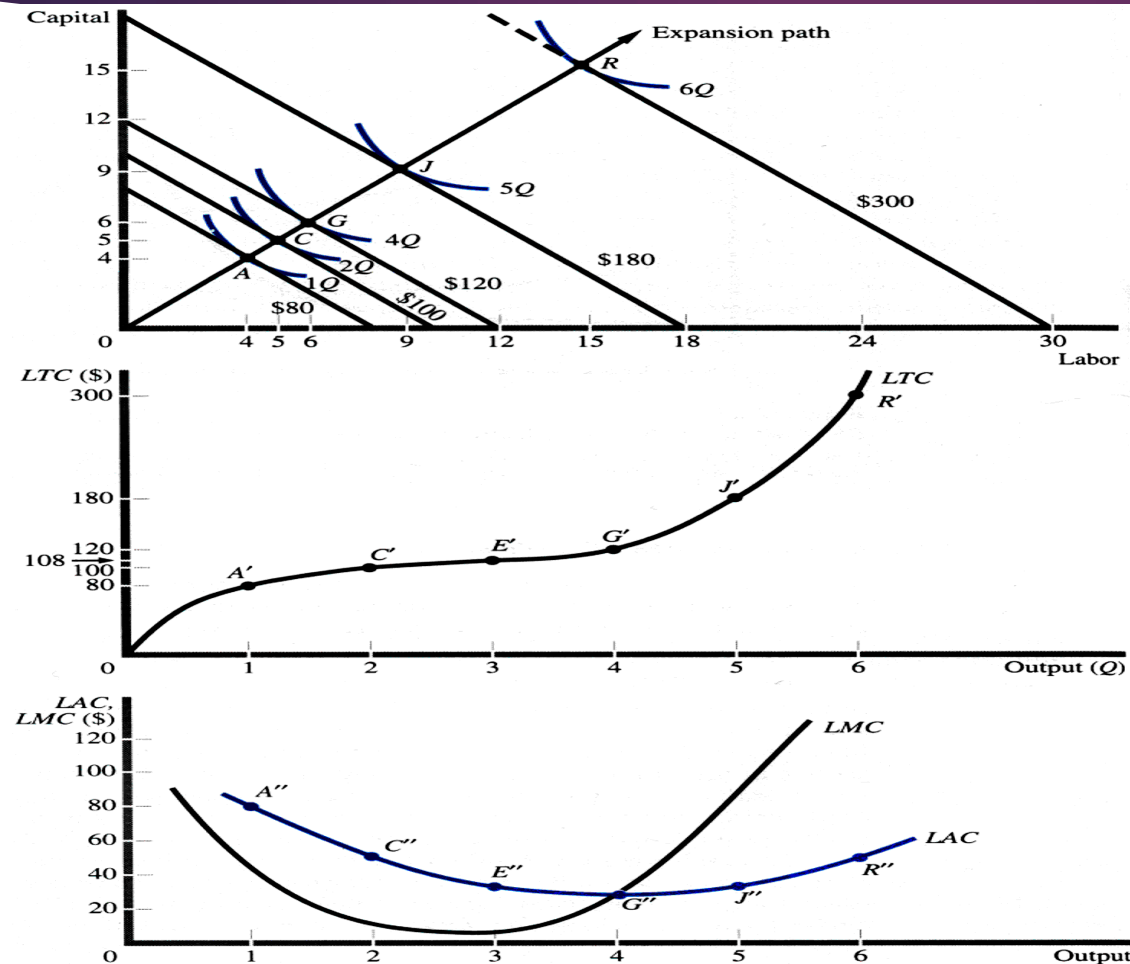
Long-Run Cost Curves

Long-Run Total Cost = LTC = $f(Q)$

Long-Run Average Cost = LAC = LTC/Q

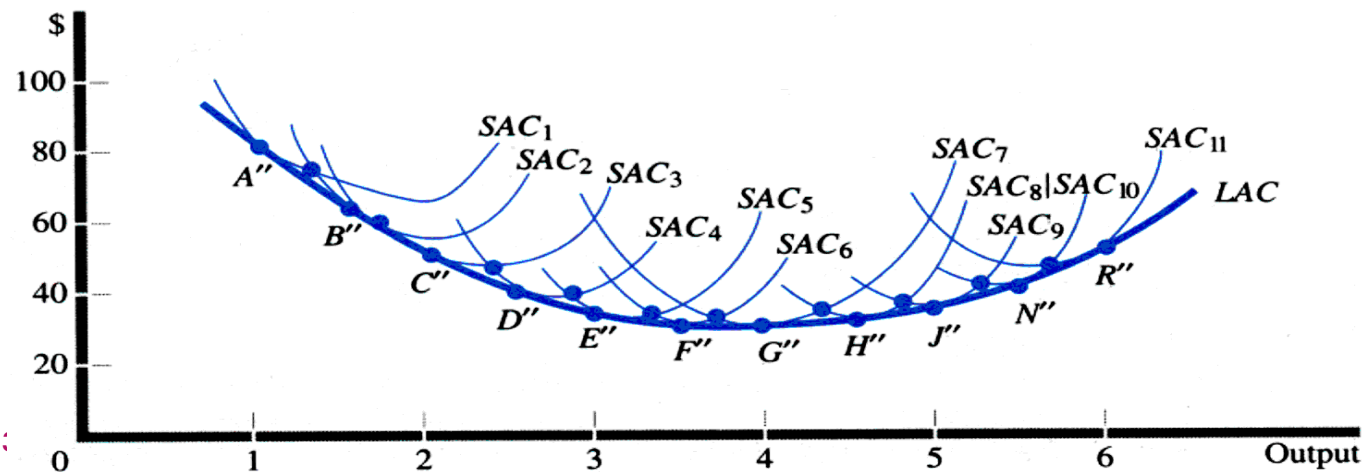
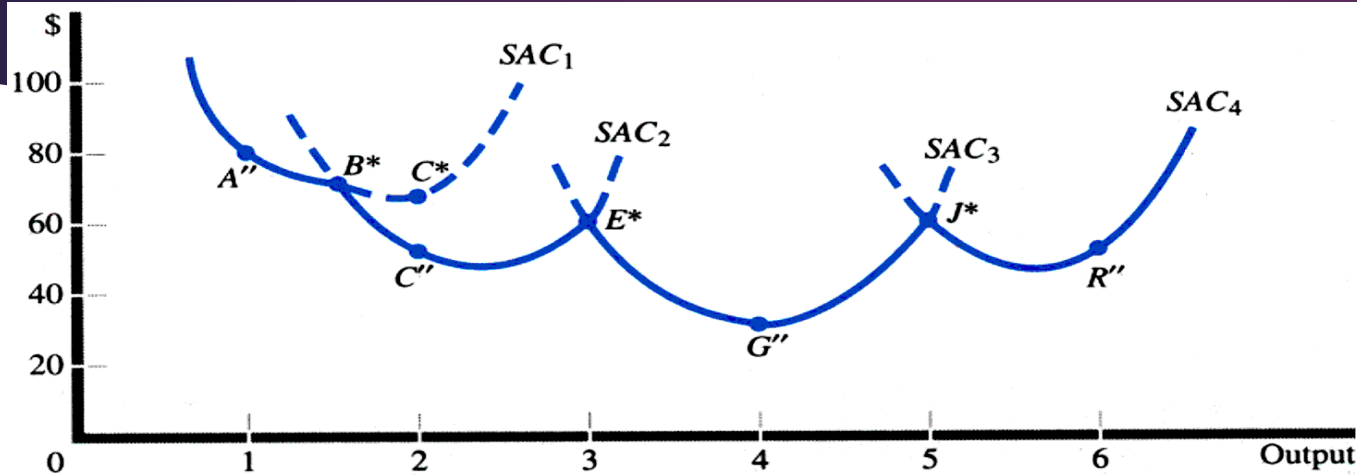
Long-Run Marginal Cost = LMC = $\Delta LTC/\Delta Q$

Derivation of Long-Run Cost Curves



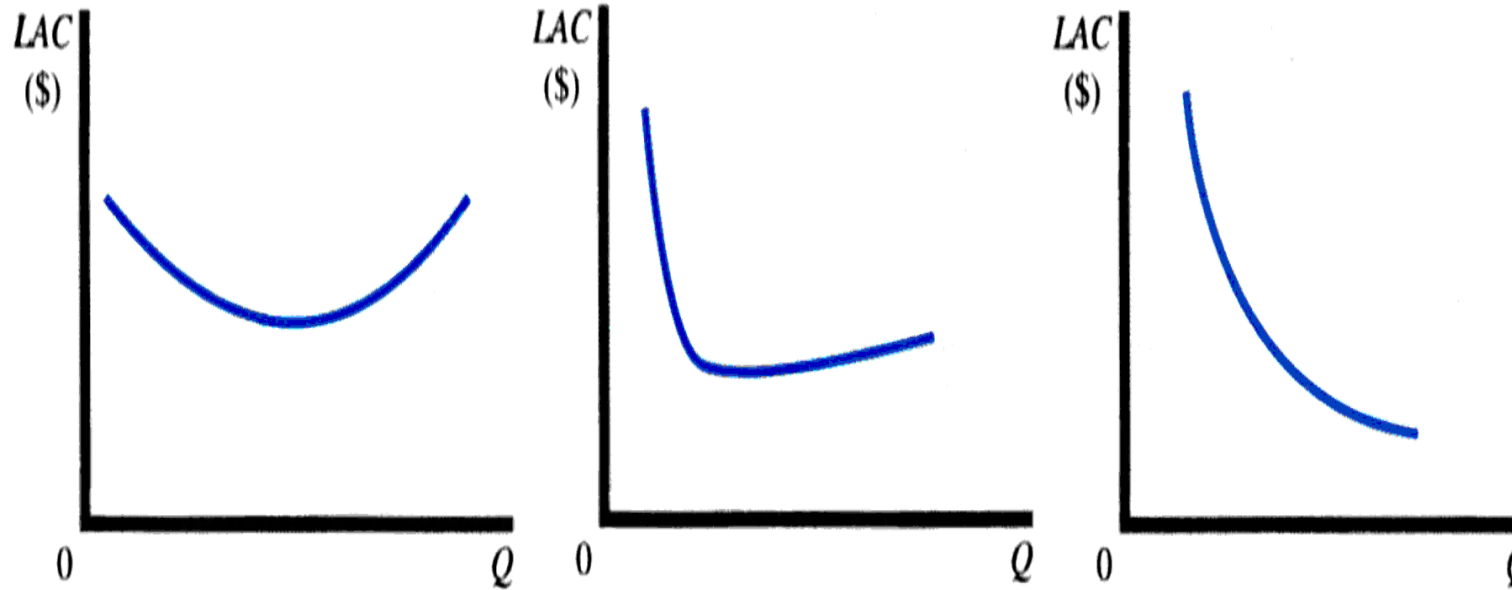
From point A on the expansion path in the first panel with $w = \$10$ and $r = \$10$, the firm uses 4 units of labor $4L$ and 4 units of capital $4k$ and the minimum total cost producing $1Q$ is \$80. This is shown as point A' and A'' on the long-run total cost curve in the middle panel and bottom panel.

Relationship Between Long-Run and Short-Run Average Cost Curves



The top panel of the figure is based on the assumption that the firm can build only four scales of plant SAC₁ etc., while the bottom panel is based on the assumption that the firm can build many more or an infinite number of scales of plant. At A'' min av cost of producing o/p is \$80. At B* the firm can produce 1.5Q at an av cost of \$70 by using either SAC₁ or SAC₂ and so on..

Possible Shapes of the LAC Curve



The left panel shows a U-shaped LAC curve which indicates first decreasing and then increasing returns to scale. The middle panel shows a nearly L-shaped LAC curve which shows that economies of scale quickly give way to constant returns to scale or gently rising LAC. The right panel shows an LAC curve that declines continuously, as in the case of natural monopolies.