

**Subject: Microeconomic Theory I**

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**Lecture Notes: 14<sup>th</sup>**

### **Long-Run Cost Curves:**

Empirical evidence about the long-run average cost curve reveals that the LAC curve is L-shaped rather than U-shaped. In the beginning, the LAC curve rapidly falls but after a point “the curve remains flat, or may slope gently downwards, at its right-hand end.” Economists have assigned the following reasons for the L-shape of the LAC curve.

#### **1. Production and Managerial Costs:**

In the long run, all costs being variable, production costs and managerial costs of a firm are taken into account when considering the effect of expansion of output on average costs. As output increases, production costs fall continuously while managerial costs may rise at very large scales of output. But the fall in production costs outweighs the increase in managerial costs so that the LAC curve falls with increases in output. We analyse the behaviour of production and managerial costs in explaining the L-shape of the LAC curve.

#### **Production Costs:**

As a firm increases its scale of production, its production costs fall steeply in the beginning and then gradually. This is due to the technical economies of large scale production enjoyed by the firm. Initially, these economies are substantial. But after a certain level of output when all or most of these economies have been achieved, the firm reaches the minimum optimal scale or minimum efficient scale (MES).

Given the technology of the industry, the firm can continue to enjoy some technical economies at outputs larger than the MES for the following reasons:

(a) from further decentralisation and improvement in skills and productivity of labour; (b) from lower repair costs after the firm reaches a certain size; and

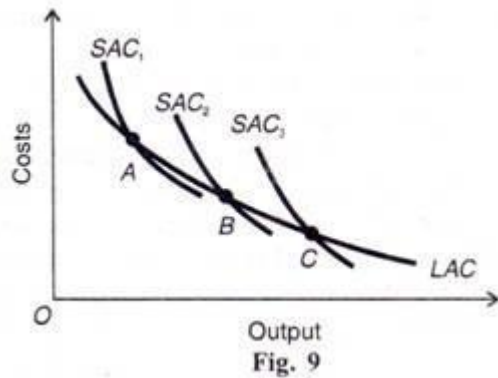
(c) by itself producing some of the materials and equipment cheaply which the firm needs instead of buying them from other firms.

### **Managerial Costs:**

In modern firms, for each plant there is a corresponding managerial set-up for its smooth operation. There are various levels of management, each having a separate management technique applicable to a certain range of output. Thus, given a managerial set-up for a plant, its managerial costs first fall with the expansion of output and it is only at a very large scale output, they rise very slowly.

To sum up, production costs fall smoothly and managerial costs rise slowly at very large scales of output. But the fall in production costs more than offsets the rise in managerial costs so that the LAC curve falls smoothly or becomes flat at very large scales of output, thereby giving rise to the L-shape of the LAC curve.

In order to draw such an LAC curve, we take three short-run average cost curves  $SAC_1$ ,  $SAC_2$ , and  $SAC_3$  representing three plants with the same technology in Figure 9. Each SAC curve includes production costs, managerial costs, other fixed costs and a margin for normal profits. Each scale of plant (SAC) is subject to a typical load factor capacity so that points A, B and C represent the minimal optimal scale of output of each plant.

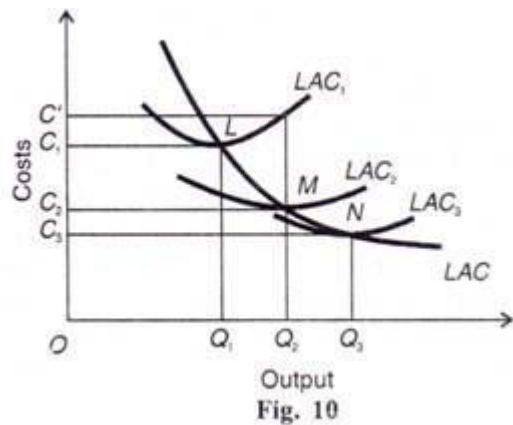


By joining all such points as A, B and C of a large number of SACs, we trace out a smooth and continuous LAC curve, as shown in Figure 9. This curve does not turn up at very large scales of output. It does not envelope the SAC curves but intersects them at the optimal level of output of each plant.

## 2. Technical Progress:

Another reason for the existence of the L-shaped LAC curve in the modern theory of costs is technical progress. The traditional theory of costs assumes no technical progress while explaining the U-shaped LAC curve. The empirical results on long-run costs conform the widespread existence of economies of scale due to technical progress in firms.

The period between which technical progress has taken place, the long-run average costs show a falling trend. The evidence of diseconomies is much less certain. So an upturn of the LAC at the top end of the size scale has not been observed. The L-shape of the LAC curve due to technical progress is explained in Figure 10.



Suppose the firm is producing  $OQ_1$  output on  $LAC_1$  curve at a per unit cost of  $OC_1$ . If there is an increase in demand for the firm's product to  $OQ_2$ , with no change in technology, the firm will produce  $OQ_2$  output along the  $LAC_1$  curve at a per unit cost of  $OC_2$ . If, however, there is technical progress in the firm, it will install a new plant having  $LAC_2$  as the long-run average cost curve. On this plant, it produces  $OQ_2$  output at a lower cost  $OC_2$  per unit.

Similarly, if the firm decides to increase its output to  $OQ_3$  to meet further rise in demand technical progress may have advanced to such a level that it installs the plant with the  $LAC_3$  curve. Now it produces  $OQ_3$  output at a still lower cost  $OC_3$  per unit. If the minimum points, L, M and N of these U-shaped long-run average cost curves  $LAC_1$ ,  $LAC_2$  and  $LAC_3$  are joined by a line, it forms an L-shaped gently sloping downward curve LAC.

### 3. Learning:

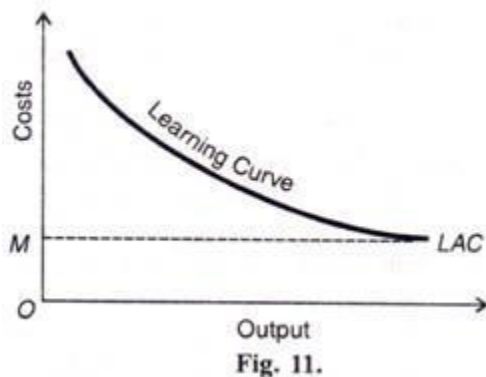
Another reason for the L-shaped long-run average cost curve is the learning process. Learning is the product of experience. If experience, in this context, can be measured by the amount of a commodity produced, then higher the production is, the lower is per unit cost.

The consequences of learning are similar to increasing returns. First, the knowledge gained from working on a large scale cannot be forgotten. Second, learning increases the rate of productivity. Third, experience is measured by the aggregate output produced since the firm first started to produce the product.

Learning-by-doing has been observed when firms start producing new products. After they have produced the first unit, they are able to reduce the time required for production and thus reduce their per unit costs. For example, if a firm manufactures airframes, the fall observed in long-run average costs is a function of experience in producing one particular kind of airframe, not airframes in general.

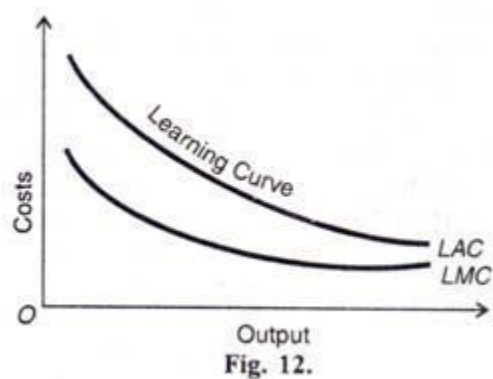
One can, therefore, draw a “learning curve” which relates cost per airframe to the aggregate number of airframes manufactured so far, since the firm started manufacturing them. Figure 11 shows a learning curve LAC which relates the cost of producing a given output to the total output over the entire time period.

Growing experience with making the product leads to falling costs as more and more of it is produced. When the firm has exploited all learning possibilities, costs reach a minimum level,  $M$  in the figure. Thus, the LAC curve is L-shaped due to learning by doing.

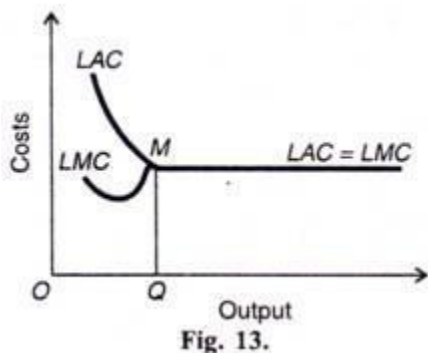


### **Relation between LAC and LMC Curves:**

In the modern theory of costs, if the LAC curve falls smoothly and continuously even at very large scales of output, the LMC curve will lie below the LAC curve throughout its length, as shown in Figure 12.



If the LAC curve is downward sloping up to the point of a minimum optimal scale of plant or a minimum efficient scale (MES) of plant beyond which no further scale economies exist, the LAC curve becomes horizontal. In this case, the LMC curve lies below the LAC curve until the MES point M is reached, and beyond this point the LMC curve coincides with the LAC curve, as shown in Figure 13.



### Conclusion:

The majority of empirical cost studies suggest that the U-shaped cost curves postulated by the traditional theory are not observed in the real world. Two major results emerge predominantly from most studies. First, the SAVC and SMC curves are constant over a wide-range of output.

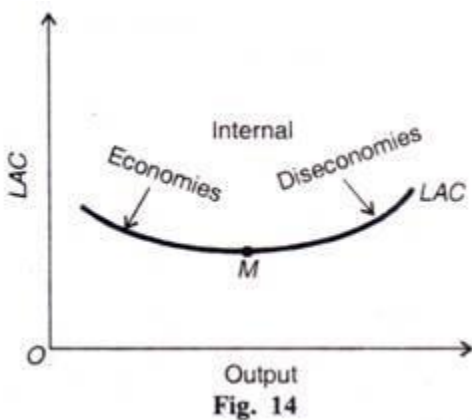
Second, the LAC curve falls sharply over low levels of output, and subsequently remains practically constant as the scale of output increases. This means that the LAC curve is L-shaped rather than U-shaped. Only in very few cases diseconomies of scale were observed, and these at very high levels of output.

## Economies of Scale and the LAC Curve:

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The shape of the LAC curve depends fundamentally upon the internal economies and diseconomies of scale, while the shift in the LAC curve depends upon external economies and diseconomies of scale. The LAC curve first declines slowly and then rises gradually after a minimum point is reached.

Initially, the LAC curve slopes downwards due to the availability of certain internal economies of scale to the firm like the economical use of indivisible factors, increased specialisation, use of technologically more efficient machines, better managerial and marketing organisation, and benefits of pecuniary economies. All these economies lead to increasing returns to scale. It means that as output increases, the LAC curve declines, as shown in Figure 14 where the LAC curve falls gradually up to point M.



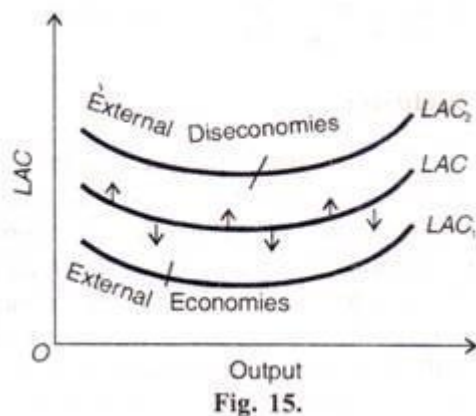
The economies of scale exist only up to this point which is the optimum point of the LAC curve. If the firm expands its output further than this optimum level, diseconomies of scale arise. The diseconomies of scale result from lack of coordination, inefficiencies in management, and problems in marketing, and increases in factor prices as the firm expands its scale.

As a result, there are decreasing returns to scale which turn the LAC curve upwards, as shown in the figure where the LAC curve starts rising from point M. Thus internal economies and

diseconomies of scale are built into the shape of the LAC curve because they accrue to the firm from its own actions as it expands its output level. They relate only to the long run.

On the other hand, external economies and diseconomies of scale affect the position of the LAC curve. External economies of scale are external to a firm and accrue to it from actions of other firms when the output of the whole industry expands. They reflect interdependence among firms in an industry.

They are realised by a firm when other firms in the industry make inventions and evolve specialisation in production processes thereby reducing its per unit cost. They also arise to firms in an industry from reductions in factor prices. As a result, per unit cost falls and the LAC curve unfits downwards as shown by the shifting of the LAC curve to LAC in Figure 15.



On the contrary, external diseconomies shift the LAC curve upwards. External diseconomies arise solely through a rise in the market prices of factors used in an industry. When an industry expands, the increase in the demand for factors like labour, capital, equipment, raw materials, power, etc. rises and when the industry is unable to meet this demand due to shortages, per unit cost of firms rises. As a result, the LAC curve shifts upwards, as shown by the shifting of the LAC curve to LAC in Fig. 15.



**Books**

1. Pindyck and Rubinfeld with Mehta (2005), Microeconomics- latest available Edition in market.
2. D.N Dwivedi (2016), Microeconomics Theory and Application-- latest available Edition in market.
3. Koutsoyiannis, A., Modern Microeconomics, Macmillan, London.