

Practice I

Industrial Footwear Inc. uses capital and labor to produce work boots. Suppose this firm is using capital and labor such that the MP_K is equal to 80 and the MP_L is equal to 20.

- a) If the prices per unit of capital and labor are \$2 and \$10, respectively, is the firm minimizing its costs? If not, what factor substitution should be made to minimize costs?
- b) If the prices per unit of capital and labor are \$20 and \$5, respectively, is the firm minimizing its costs? If not, what factor substitution should be made to minimize costs?
- c) If the prices per unit of capital and labor are \$40 and \$5, respectively, is the firm minimizing its costs? If not, what factor substitution should be made to minimize costs?

a) The ratio of MP to factor price in this case are

$$K: \frac{MP_K}{P_K} = \frac{80}{2} = 40$$

$$L: \frac{MP_L}{P_L} = \frac{20}{10} = 2$$

The firm is not minimizing its costs; to do so it should use more K and less L

b) The ratio of MP to factor price in this case are

$$K: \frac{MP_K}{P_K} = \frac{80}{20} = 4$$

$$L: \frac{MP_L}{P_L} = \frac{20}{5} = 4$$

The firm is minimizing its costs. No further substitution is required.

c) The ratio of MP to factor price in this case are

$$K: \frac{MP_K}{P_K} = \frac{80}{40} = 2$$

$$L: \frac{MP_L}{P_L} = \frac{20}{5} = 4$$

The firm is not minimizing its costs; to do so it should use less K and more L

Practice II

- Explain the difference between diseconomies of scale and diminishing marginal product of the variable factor.
- Explain the difference between economies of scale and spreading overhead.

Diseconomies of scale describes what happens to unit costs as all factors of production are increased by the same proportion. E.g. if the firm increases its capital stock and its labor force by 10 percent, what happens to unit costs? (Long- run concept) Unit costs increasing as scale rises – the costs associated with planning, managing and monitoring the operations of a large firm start to rise.

Diminishing marginal product refers to the relationship between changes in output and changes in one variable factor when other factors of production are being held constant. (Short- run concept)

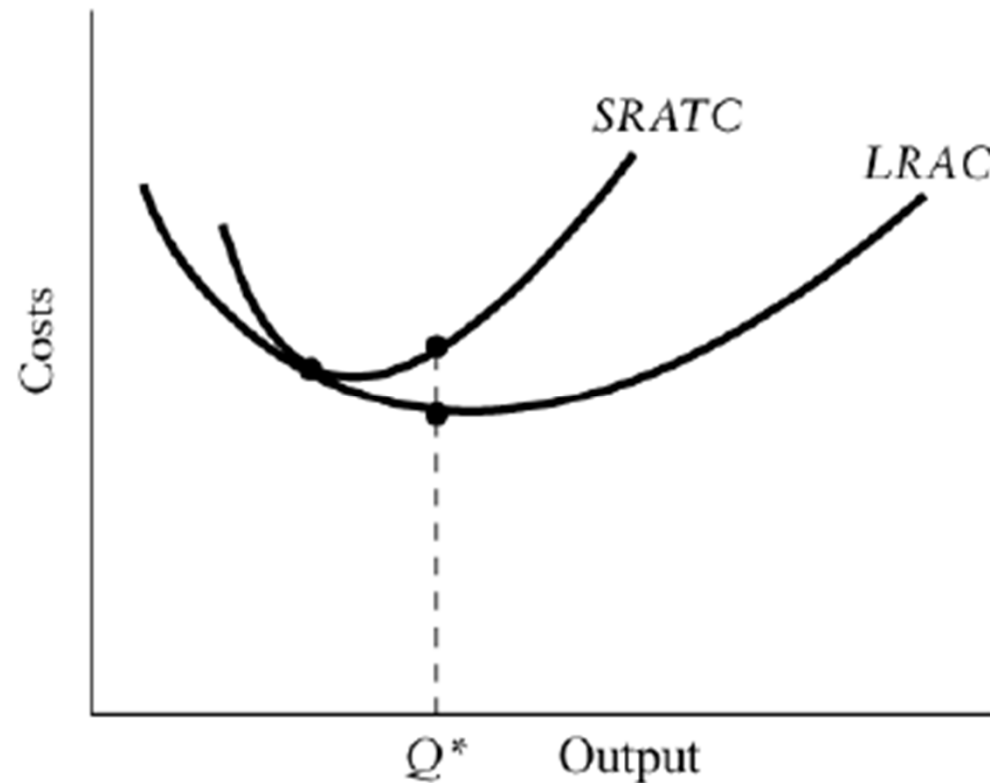
Economies of scale describes what happens to unit costs as all factors of production are increased by the same proportion. E.g. if the firm increases its capital stock and its labor force by 10 percent, what happens to unit costs? (Long- run concept) The most often cited explanation for economies of scale (unit costs decreasing as scale rises) is that as the scale of operation increase, the firm is better able to take advantage of the benefits of specialization and the division of labor. These productivity gains imply a reduction in unit costs.

The spreading of overhead refers to the behavior of average fixed costs as the level of output rises. For a given amount of fixed costs, average fixed costs clearly decline as the level of output rises. This is an important reason for declining average total costs in the short run. Even if average variable costs have started to rise due to diminishing marginal product, a large enough decline in AFC can still make ATC decline.

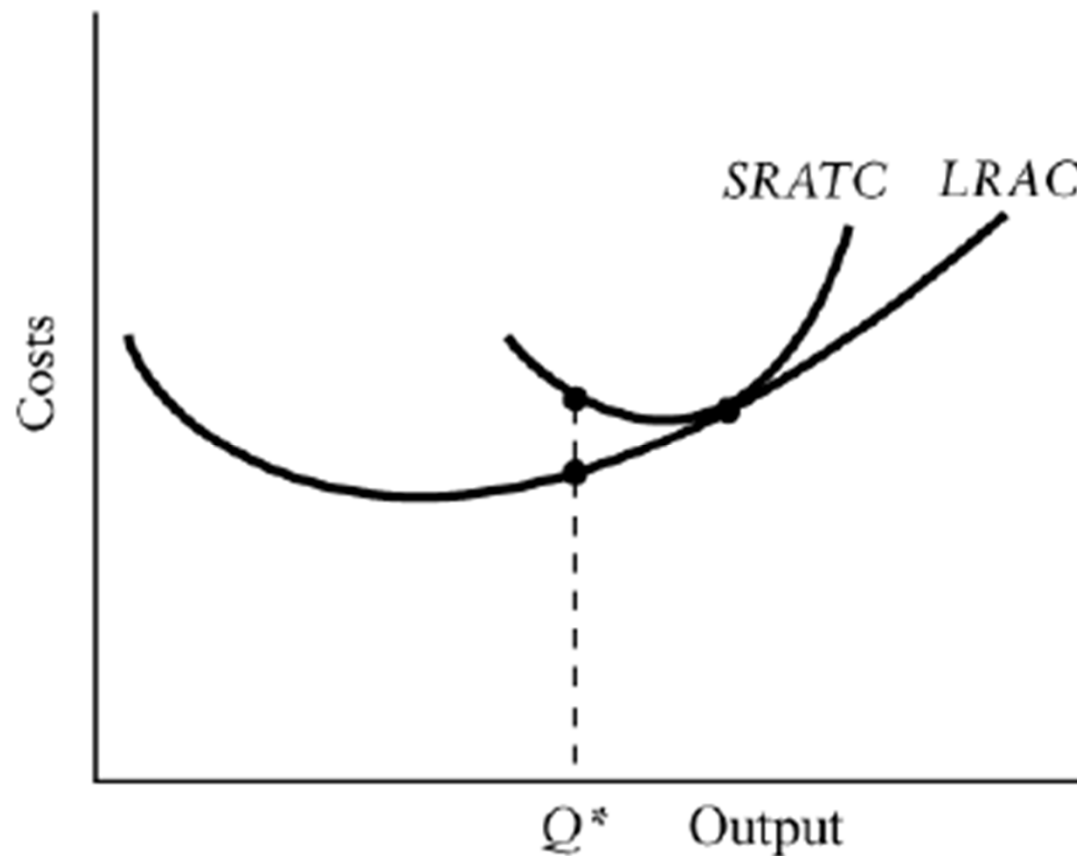
Practice III

- Draw a diagram with short-run and long-run average cost curves that illustrates *for the same level of output* economies of scale in the long run but diminishing marginal product for the variable factor in the short run.
- Draw a diagram with short-run and long-run average cost curves that illustrates for the same level of output diseconomies of scale in the long run but falling average total costs in the short run.

Economies of scale (long run) mean that we are on the downward-sloping portion of the LRAC curve. Diminishing marginal product (short run) means that we are on the upward-sloping portion of the SRATC curve.



Diseconomies of scale (long run) mean that we are on the upward-sloping portion of the LRAC curve. But falling short-run total costs means that the effect from spreading one's overhead is offsetting the falling marginal product of the variable factor.



The following table shows several methods of producing 500 rubber tires per day. There are two factors labor and capital, with prices per unit of \$3 and \$6, respectively.

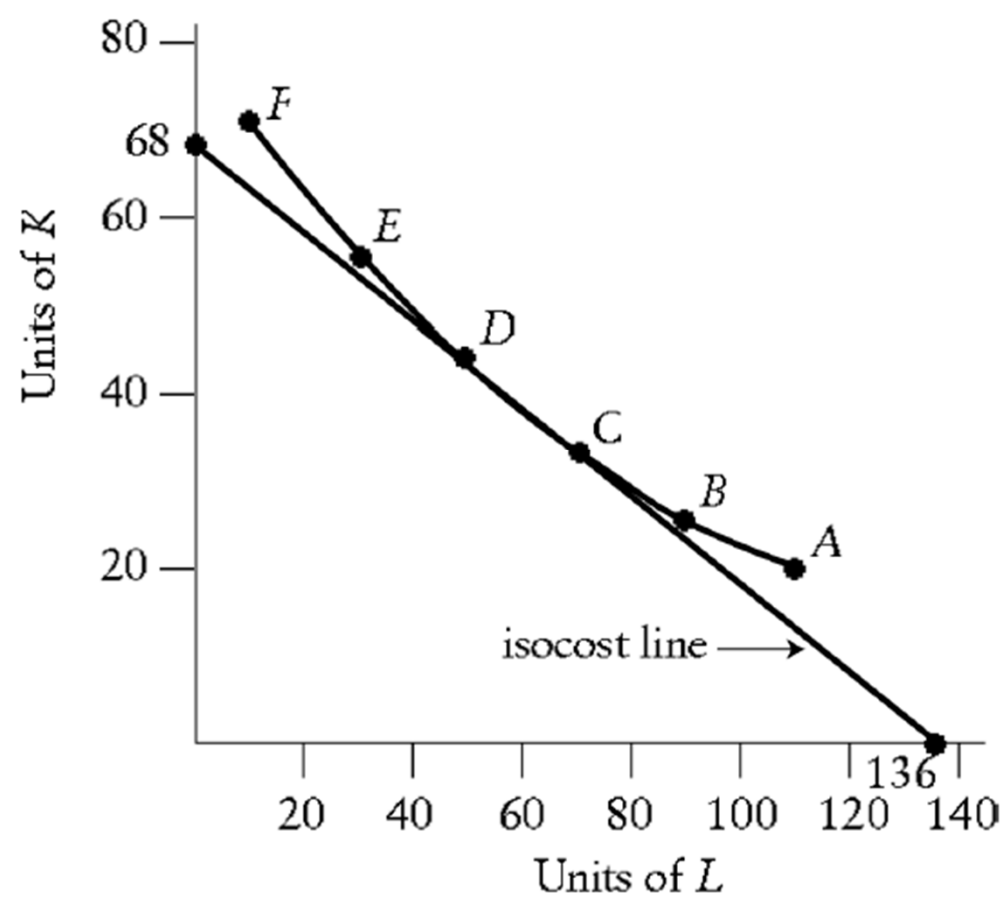
Production Method	Units of Labor	Units of Capital	Total Cost
A	110	20	
B	90	25	
C	70	33	
D	50	43	
E	30	55	
F	10	70	

- Compute the total cost for each production method and fill in the Table
- Which production method minimize costs for producing 500 tires?
- Plot the isoquant for 500 tires.
- Given the factor prices, draw the isocost line that corresponds to the cost-minimizing production method.
- Now suppose that the price of labor rises to \$5 per unit but the firm still wants to produce 500 tires per day. Explain how a cost-minimizing firm adjusts to this change (with no change in technology).

The following table shows several methods of producing 500 rubber tires per day. There are two factors labor and capital, with prices per unit of \$3 and \$6, respectively.

Production Method	Units of Labor	Units of Capital	Total Cost
A	110	20	450
B	90	25	420
C	70	33	408
D	50	43	408
E	30	55	420
F	10	70	450

- Method C and D are lower cost production methods than any of the others
- An isoquant is a curve that shows the various combination of K and L that can be used to produce a given level of output- 500 tires per day in this case
- The absolute value of the slope of the isocost line is the ratio of factor prices ($3/6=0.5$). The cost-minimizing production method at these factor prices is either method C and D. Thus the isocost line passes through both points C and D in the diagram above, but lies below points A, B, E, and F. The interpretation is that production methods A, B, E, and F cannot be achieved at the same low cost as methods C and D. The horizontal and vertical intercept of the isocost line are $K=408/6=68$ and $L=408/3=136$.



If the price of labor rises from \$3 to \$5 per unit, a cost-minimizing firm will substitute away from labor and toward capital. In the diagram above, this will be a movement up and to the left along the isoquant (we are told it still wants to produce 500 tires per day). The isocost line becomes steeper – its new slope will be $5/6 = 0.833$. The cost-minimizing method of production is now method F, with a total cost of \$470 (Remember that the rise in the price of labor makes all production methods more expensive but the least expensive is now the most capital-intensive method).