LECTURE 14: SHORT-RUN COSTS AND FIRM BEHAVIOR

ANSWERS AND SOLUTIONS

True/False Questions

True_ Long run production costs are never higher than short-run production costs.

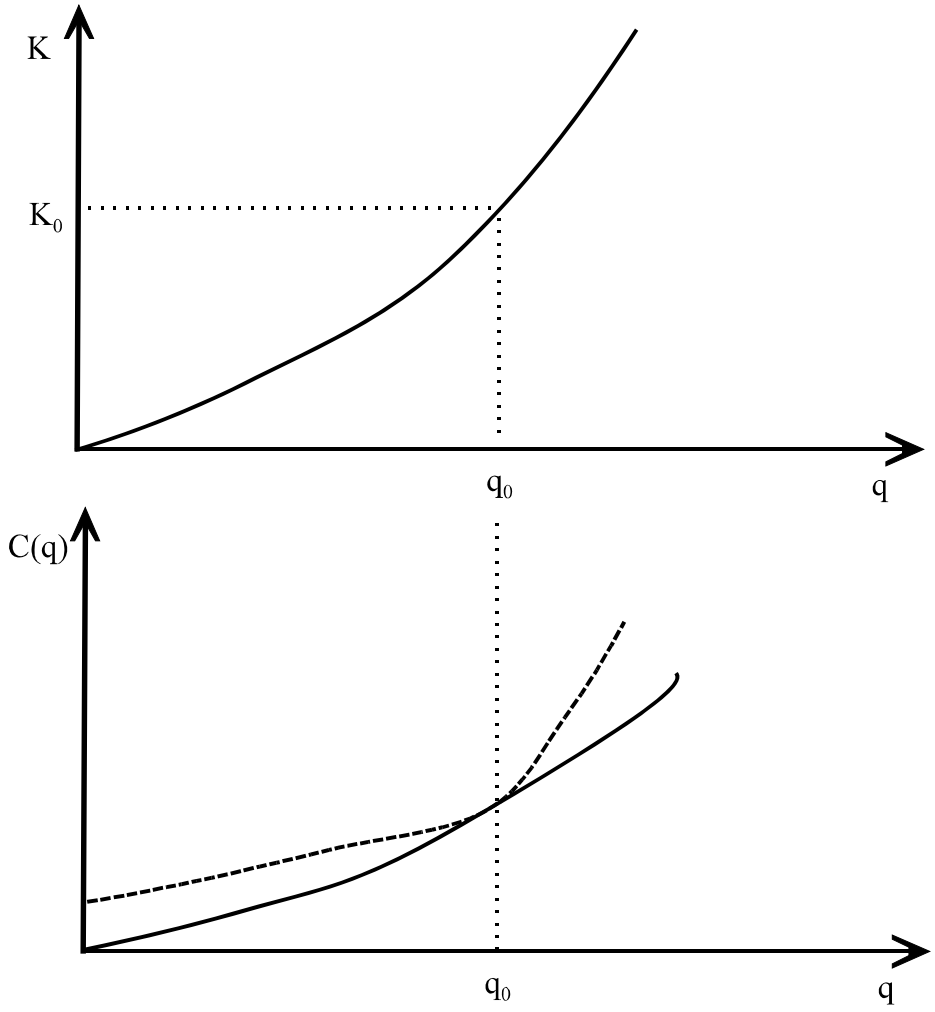
True_ Labor inputs are generally more easily adjustable than capital inputs, but generally less easily adjustable than supplies and energy inputs.

False_ In the short run, the cost function is above the profit function, while in the long-run the profit function is above the cost function.

False_ Suppose that $L^*(q)$ and $K^*(q)$ is the input use that minimizes the cost at which a firm can produce an output level q. Then, an increase in the market price P will reduce both $L^*(q)$ and $K^*(q)$.

Short Questions

1. A firm's production function is given by $q = f(K, L)$. The optimal level of capital used by the firm, as a function of output produced, q, is plotted in the figure below. The firm is currently producing output q_0, and therefore uses a capital stock of K_0. The firm's long run cost function is given in the second figure below, which is stacked right below the first figure.



A. Does this firm's production function exhibit increasing, decreasing, or constant returns to scale? Explain your answer.

The production function exhibits decreasing returns to scale because the cost function is increasing faster than output. In particular, it can be readily seen by drawing lines from the origin to the cost function that average cost is increasing in q.

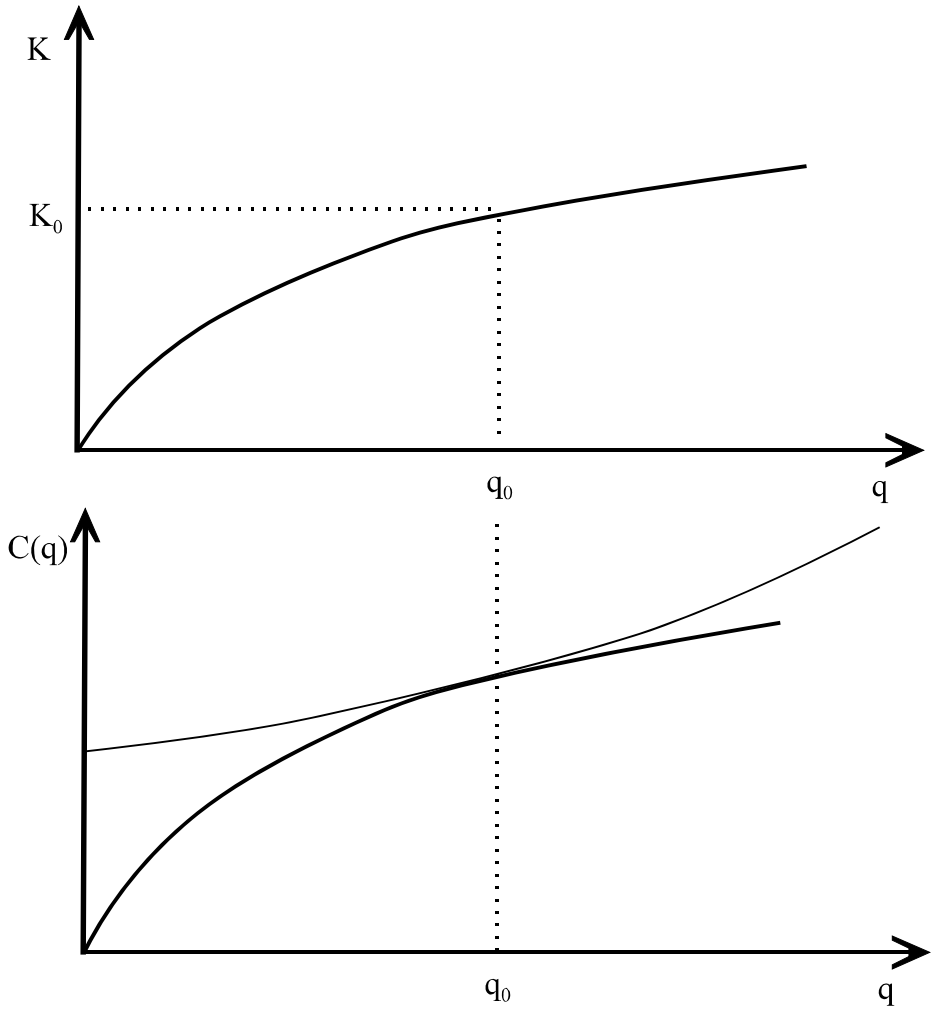
B. Suppose that capital is fixed in the short-run. Draw in the second graph above the firm's short-run cost function when capital is fixed at K_0.

The short-run cost function is drawn with the dotted line. Notice that it is increasing in q, it is everywhere above the long run cost function, touches the long run cost function at q_0, and the gap between the two is increasing the further one moves from q_0.

2. What is the distinction between short-run and long-run costs ?

In the short-run, some of the inputs in the production process are considered fixed; the firm can not vary them. In the long run, all inputs in the production process are considered variable. In practice, short and long runs are not well defined. In production processes with many inputs, some will never become variable [they are inherently scarce], others can vary after, say, a year, others in even shorter time. Also, it may well be possible to vary some inputs quickly, but at a higher cost, while if they are changed slowly, the cost of adjustment will be lower. For example, laying off labor is possible but costly if done before contracts expire, but less costly when done through attrition.

3. A firm's production function is given by $q = K^{\alpha} L^{\beta}$. The optimal level of capital used by the firm, as a function of output produced, *q*, is plotted in the figure below. The firm is currently producing output q_0, and therefore uses a capital stock of K_0. The firm's long run cost function is given in the second figure below, which is stacked right below the first figure.



A. Does this firm's production function exhibit increasing, decreasing, or constant returns to scale? Explain your answer. [No need to do any calculations: a verbal explanation is enough.]

It exhibits increasing returns to scale, because costs increases slower than output (bottom panel), or equivalently, input use increases slower than output (top panel).

B. Suppose that capital is fixed in the short-run at a level K_0. Draw the corresponding short-run cost function in the second graph above. [No need to do any calculations; just draw the short-run cost curve in the appropriate way.]

The short-run cost function is the thin line drawn in the second panel. It has a fixed cost, has a smaller marginal cost than the long-run cost function for output levels less than q_0, touches the long-run cost function at q_0, and for higher levels of output has a higher marginal cost than the long-run cost function.

Problems

Problems will be posted as part of the next lecture.