

Problem Set 6

Long Run Cost

1. Let $F(L,K)=L^{1/3}K^{2/3}$. What are the firm's output-constrained factor demand functions, $L^*(Q, w, r)$ and $K^*(Q,w, r)$? What is the firm's long run cost minimizing input bundle when $w=4$, $r=1$, and $Q=4$?

2. A firm is producing an output level of Q_0 in a long run cost minimizing manner using input levels L_0, K_0 , where all we know is that

$$MP_L(L_0, K_0) = 12 \quad MP_K(L_0, K_0) = 16 \quad w=3 \quad r=4 .$$

- If the firm were to spend \$1 less on **labor**, how much production would it lose?
- If the firm were to spend \$1 more on **capital**, how much production would it gain?

3. Let $L^*(Q, w, r)$ and $K^*(Q,w,r)$ denote a firm's output-constrained factor demand functions.

- $K^*(100, 3, 5) = 7$. Explain in words what this means.
- $LTC(100, 3, 5) = 51$. Explain in words what this means.
- Given a) and b), what is the numerical value of $L^*(100, 3, 5)$

4. A firm produces cars using automated assembly lines. Each assembly line has 14 machines and produces 20 cars a day. Exactly 2 workers are needed to oversee the 14 machines.

- Write down a production function for the firm.
- What is the long-run total cost function, $LTC(Q, w,r)$, for this firm?

5. Using 2 isocost lines and at least 1 isoquant, draw a situation in which an increase in the wage rate alters the long run total cost of producing a fixed quantity of output, Q_0 . Does LTC rise or fall?

6. Using 2 isocost lines and at least 1 isoquant, draw a situation in which an increase in the wage rate **does not alter** long run total cost of producing a fixed quantity of output, Q_0 .

7. If a firm's production function takes the form $F(L, K) = L + 2K$, and it faces wage rate, $w=3$, and rental rate on capital, $r=4$, what is $LTC(220, 3, 4)$?

8. Suppose at $Q=100$, $w=2$, $r=3$, and $\bar{K} = 11$, we have $STC(100,2, 3, 11)=20$. Suppose it is also true that $LTC(100, 2, 3)=15$. What is the most we can say about $K^*(100, 2, 3)$?