Intermediate Microeconomics Exercise Class 5

Rui Ai

ruiai@pku.edu.cn

November 19, 2022

Content

Cost

- Cost Category
  - Accounting Cost
  - Economic Cost=Accounting Cost + The Value of Opportunity Cost
- Total Cost (TC)
- Average Cost (AC) or Average Total Cost (ATC)
- Fixed Cost (FC)
- Quasi-Fixed Cost
- Average Fixed Cost (AFC)
- Variable Cost (VC)
- Average Variable Cost (AVC)
- Marginal Cost (MC)

Cost Cont'd

- Sunk Cost: Expenditure that has been made and cannot be recovered.
- It should always be ignored when making future economic decisions.

Cost Cont'd

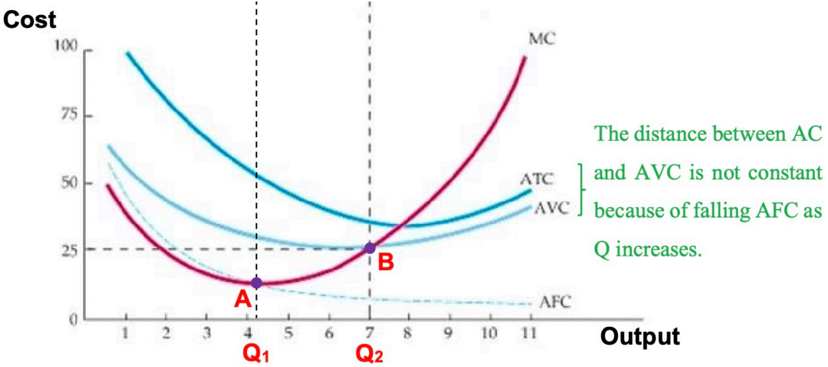
- Cost Function
- $\min_{x_1,x_2} w_1x_1 + w_2x_2$ such that $f(x_1, x_2) = y$

Cost Cont'd

- Cost in the Short-Run
- $MC = \frac{W}{MP_L}$
- MC curve is the reverse of MP curve
- Diminishing marginal returns: MC will increase

Cost Cont'd

- The Shape of Cost Curves in the Short-Run



Cost Cont'd

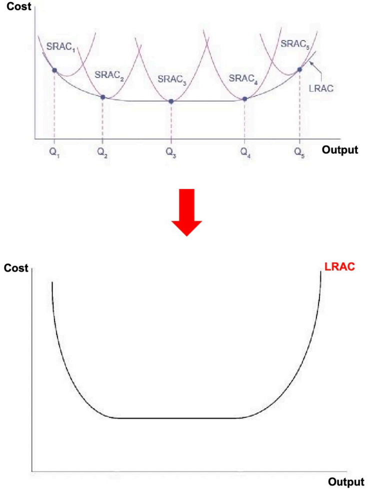
- Cost in the Long-Run
- Isocost Line: $K = \frac{c}{r} - \frac{w}{r}L$
- Optimal Production: Produce at minimal cost
- $\frac{w}{r} = \frac{MP_L}{MP_K}$
- Conditional Factor Demand Function: e.g. $x_1(w_1, w_2, y)$

Cost Cont'd

- Perfect Complements: $f(x_1, x_2) = \min\{x_1, x_2\}$
- Perfect Substitutes: $f(x_1, x_2) = x_1 + x_2$
- Cobb-Douglas: $f(x_1, x_2) = x_1^a x_2^b$

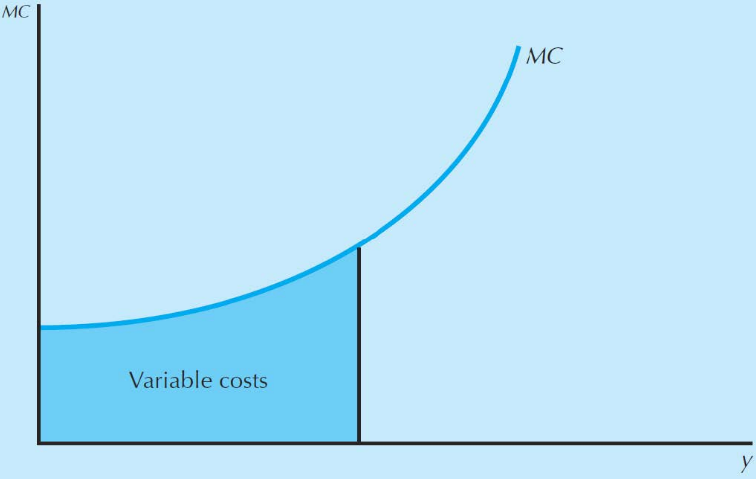
Cost Cont'd

- Applications of Cost Function



Cost Cont'd

- The Relationship between MC and VC
- $MC(y) = \frac{dVC(y)}{dy}$
- $\int_0^y MC(x)dx = VC(y)$



Cost Cont'd

- Economies of Scale: Increasing returns to scale
- Diseconomies of Scale: Decreasing returns to scale

Cost Cont'd

- Reasons for Economies of Scale
  - Larger scale allows workers to specialize
  - Scale can provide flexibility by varying the combination of inputs, so that managers can organize more effectively
  - Firms can acquire inputs at lower cost because buying them in large quantities and therefore negotiate better prices

Cost Cont'd

- Reasons for Diseconomies of Scale
  - Limited factory space and machinery reduce efficiency
  - Managing a larger firm becomes more complex and inefficient as the number of tasks increases
  - The advantages of buying in bulk will disappear at some point because of limited supply

Cost Cont'd

- Economies of Scope
  - Produce more overall: Lower unit cost
  - Common factors of production
- $C(Q_1, Q_2) < C(Q_1, \emptyset) + C(\emptyset, Q_2)$

Revenue and Profit

- Revenue
  - Total Revenue
  - Average Revenue
  - Marginal Revenue$=\frac{dTR}{dQ}$

Revenue and Profit Cont'd

- Profit
  - Accounting Profit = Total Revenue − Accounting Cost
  - Economic Profit = Total Revenue − Economic Cost = Accounting Profit − The Value of Opportunity Cost
- $\Pi(Q) = (P - AC)Q$
- Profit Maximization: $MR = MC$

Revenue and Profit Cont'd

- Short-Run Profit Maximization
- $\max_{x_1} pf(x_1, \bar{x}_2) - \omega_1 x_1 - \omega_2 \bar{x}_2$
- $pMP_1(x_1^*, \bar{x}_2) = \omega_1$

Revenue and Profit Cont'd

- Long-Run Profit Maximization
- $\max_{x_1,x_2} pf(x_1,x_2) - \omega_1 x_1 - \omega_2 x_2$
- $pMP_1(x_1^*, x_2^*) = \omega_1$
- $pMP_2(x_1^*, x_2^*) = \omega_2$

Revenue and Profit Cont'd

- Welfare Economics
  - Consumer Surplus
  - Willingness to Pay (WTP)
  - Producer Surplus
  - Willingness to Sell (WTS)
  - Total Surplus (TS)

Question 1

Let the consumer demand D for the product depends on the price p of the product and the advertising level a, i.e. $q = D(p, a)$. Assume that the cost to the vendor of providing the product is a function of the output q, i.e., $C(q) = C(D(p, a))$, so that the vendor's profit π is equal to the total revenue minus the cost and the advertising input a. The profit function can be written as

$$\pi(p, a) = pD(p, a) - C(D(p, a)) - a.$$

Now, try to prove that for a rational (profit-maximizing) vendor, the ratio of the advertising input a to the total revenue pq equals the ratio of the advertising elasticity of demand to the price elasticity of demand.

Question 2

A set of short-term cost functions is determined by the following functions

$$C = 0.04q^3 - 0.9q^2 + 11 - kq + 5k^2$$

(Here $k = 1, k = 2...$). This is the short-term cost function of the enterprise at different stages, and find the long-term cost function.

Question 3

$q = Ax_1^{\alpha}x_2^{\beta}$, here $\alpha > 0$, $\beta > 0$ but $\alpha + \beta < 1$, $x_1 > 0$, $x_2 > 0$. Find the enterprise demand function of x_1 and x_2 of r_1, r_2 and p.

Question 4

If the production function is $y = x_1^a \bar{k}^{1-a}$, r_1 is the unit price of x_1, $\bar{r}_2$ is the unit price of $\bar{k}$ ($\bar{k}$ is the fixed input), and p is the unit price of output, find the profit function $\pi(p, r_1, \bar{r}_2, \bar{k})$; Find the output function (supply function) $y(p, r_1, \bar{r}_2, \bar{k})$.

Question 5

If the short run cost function of an enterprise is $STC = 16 + 2\frac{q^2}{100}$. Find the short-term supply function of the firm.

Question 6

Given that the production function of a firm is $Q = 21L + 9L^2 - L^3$.
a) Calculate the average output function and marginal output function of the enterprise.
b) If the enterprise now uses three-unit labor forces, is it reasonable? What is the reasonable range?
c) If the market price of the enterprise's products is \$3 and the market price of the labor force is \$63. So what is the optimal labor input for this firm?

Question 7

If the production function is $q = 6KL$, wage $\omega = 5$, and interest rate (cost of capital) $r = 10$, try to find the optimal ratio of labor (L) to capital (K).

Thanks!