

Chapter 16 Short-Run Costs

Cost = the least cost of producing a given output Q by the use of inputs (labor L and capital K),

- with fixed input prices (wage w and interest r)
- in the most efficient way (no unnecessary wastes)
- with the available best technology
- in the specified time frame (Short-Run/Long-Run)

Thus, the cost function is a function of quantity.

Short-Run Costs: the least cost of producing a given output Q where at least one input is fixed.

- K is assumed to be the fixed input at $K = K_0$, at price r /unit of capital

$$\begin{aligned}\Rightarrow r \cdot K_0 &= \text{Total Fixed Cost} \\ &= TFC(Q)\end{aligned}$$

—a constant that does not vary with Q .

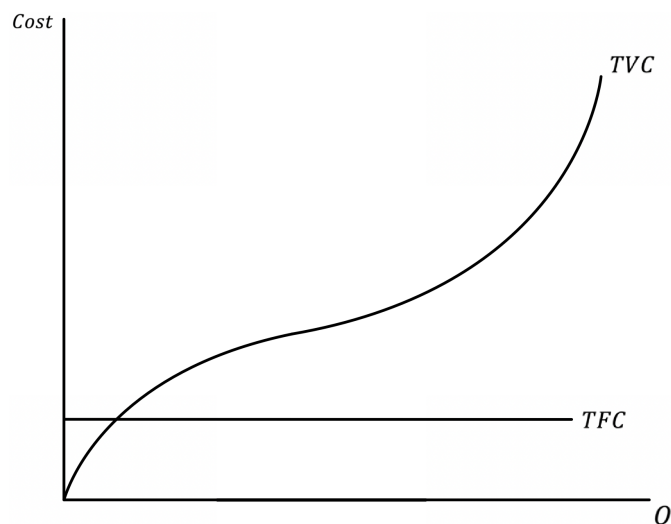
- L is variable at price w /unit of labor

$$\begin{aligned}\Rightarrow w \cdot L &= \text{Total Variable Cost} \\ &= TVC(Q)\end{aligned}$$

—Note that $TVC(Q)$ varies with the quantity Q , thus the name variable cost.

$$\begin{aligned}\text{Total Cost} &= \text{Total Fixed Cost} + \text{Total Variable Cost} \\ TC(Q) &= TFC(Q) + TVC(Q)\end{aligned}$$

Relation of Total, Fixed and Variable Costs:



Relationships of Total, Average, and Marginal of Total, Fixed and Variable Costs

—each of Total costs has its Average and Marginal

Average Costs:

$$\begin{aligned}AC(Q) &= \frac{TC(Q)}{Q} \\AVC(Q) &= \frac{TVC(Q)}{Q} \\AFC(Q) &= \frac{TFC(Q)}{Q}\end{aligned}$$

- Since $TC(Q) = TFC(Q) + TVC(Q)$, we have

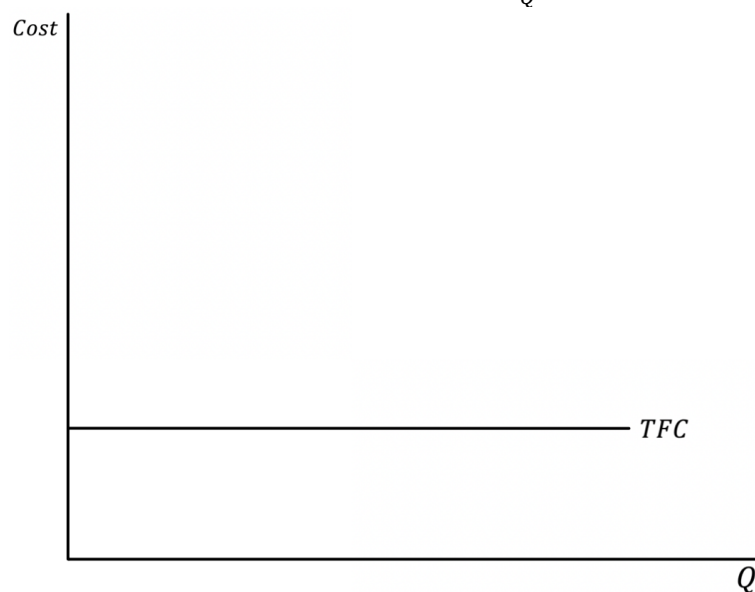
$$\begin{aligned}\frac{TC(Q)}{Q} &= \frac{TFC(Q)}{Q} + \frac{TVC(Q)}{Q} \\AC(Q) &= AFC(Q) + AVC(Q)\end{aligned}$$

Marginal Cost:

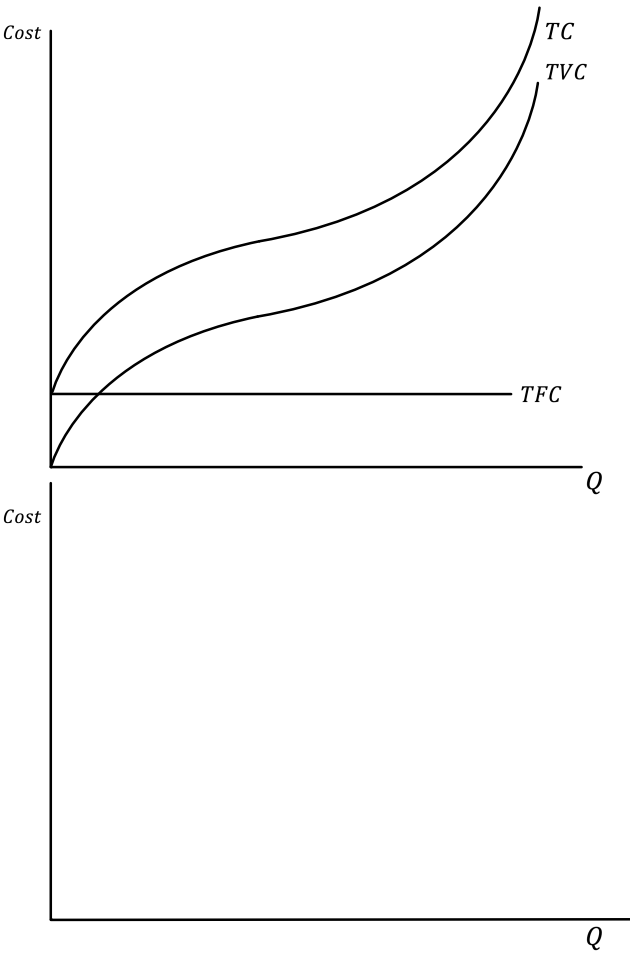
$$\begin{aligned}MC(Q) &= \frac{d}{dQ}TC(Q) \\&= \frac{d}{dQ}(TFC(Q) + TVC(Q)) \\&= \frac{d}{dQ}TVC(Q)\end{aligned}$$

- Marginal Cost is the slope of Total Cost, which is the same as the slope of Total Variable Cost

Graph of $AFC(Q) = \frac{TFC(Q)}{Q}$



- We can demonstrate the relationships of these Totals, Averages, and Marginals by the following diagrams.



Total	Average	Marginal

- The relationship between Average and Marginal can also be verified by calculus. By definition,

$$TC(Q) = AC(Q) \cdot Q$$

- Note that the vertical difference between AC and AVC is AFC . That is,

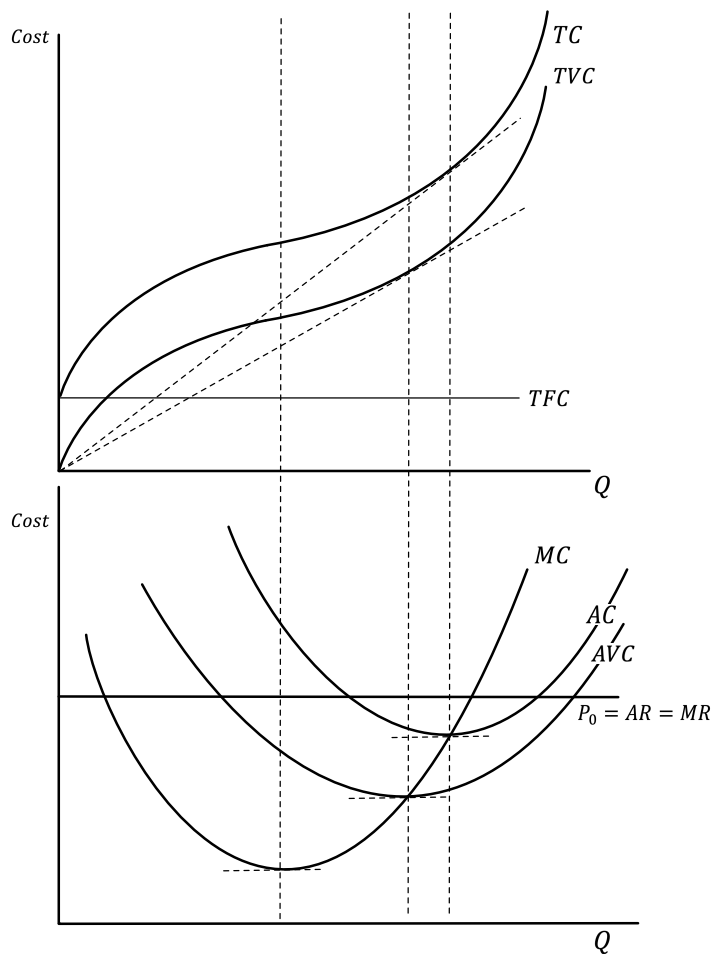
$$AFC(Q) = AC(Q) - AVC(Q).$$

Changes of Cost Curves

- Change in TFC —higher rent or higher price of fixed factor

$$TC(Q) = TFC(Q) + TVC(Q)$$

$$TC'(Q) = TFC'(Q) + TVC'(Q)$$



- Change in TVC The government imposes tax of 10 Bahts/unit on the producer.

$$TC(Q) = TFC(Q) + TVC(Q)$$

$$TC'(Q) = TFC'(Q) + TVC'(Q)$$

Change in Average Costs,

$$TVC'(Q) = TVC(Q) + 10Q$$

$$AVC'(Q) = AVC(Q) + 10$$

$$\frac{TC'(Q)}{Q} = \frac{TFC(Q)}{Q} + \frac{TVC(Q)}{Q} + \frac{10Q}{Q}$$

$$AC'(Q) = AFC(Q) + AVC(Q) + 10 = AC(Q) + 10$$

Change in Marginal Cost,

$$TVC'(Q) = TVC(Q) + 10Q$$

$$MC'(Q) = MC(Q) + 10$$

