you are doing it most efficient.

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.

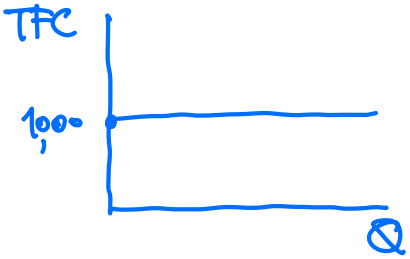
Short-Run Costs: the least cost of producing a given output Q where at least one input is fixed.

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

$$\Rightarrow r \cdot K_0 = Total\ Fixed\ Cost = TFC(Q)$$

—a constant that does not vary with Q.

$r = 100$ ฿
$K_0 = 10$.
$TFC = 100 \cdot 10 = 1{,}000$ ฿
$Q = 0$, $TFC = 1{,}000$
$Q = 20$, $TFC = 1{,}000$.



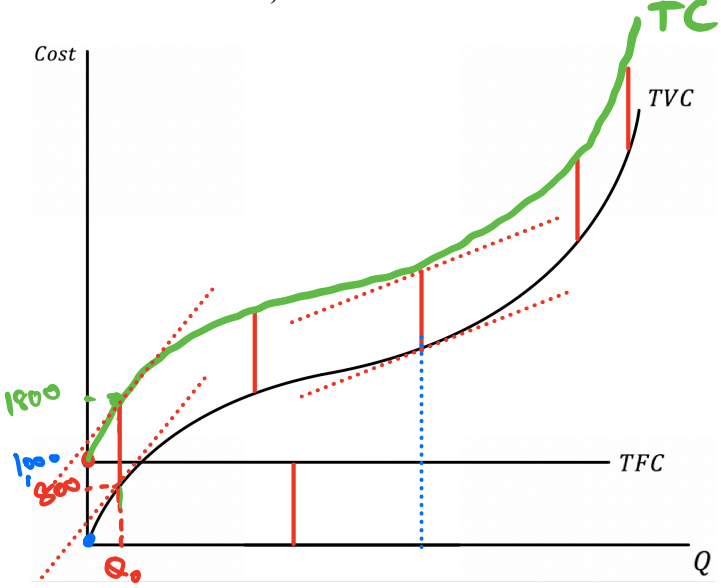
- L is variable at price w/unit of labor

$$\Rightarrow w \cdot L = Total\ Variable\ Cost = TVC(Q)$$

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

$$Total\ Cost = Total\ Fixed\ Cost + Total\ Variable\ Cost$$
$$TC(Q) = TFC(Q) + TVC(Q$$

Relation of Total, Fixed and Variable Costs:



TVC(Q) always increase

Q	TFC	TVC	TC
0	1000	0	1000
Q_0	1000	800	1,800

Relationships of Total, Average, and Marginal of Total, Fixed and Variable Costs
—each of Total costs has its Average and Marginal

Average Costs:

$$AC(Q) = \frac{TC(Q)}{Q}$$
$$AVC(Q) = \frac{TVC(Q)}{Q}$$
$$AFC(Q) = \frac{TFC(Q)}{Q}$$

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

$$\frac{TC(Q)}{Q} = \frac{TFC(Q)}{Q} + \frac{TFC(Q)}{Q}$$
$$AC(Q) = AFC(Q) + AVC(Q)$$

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

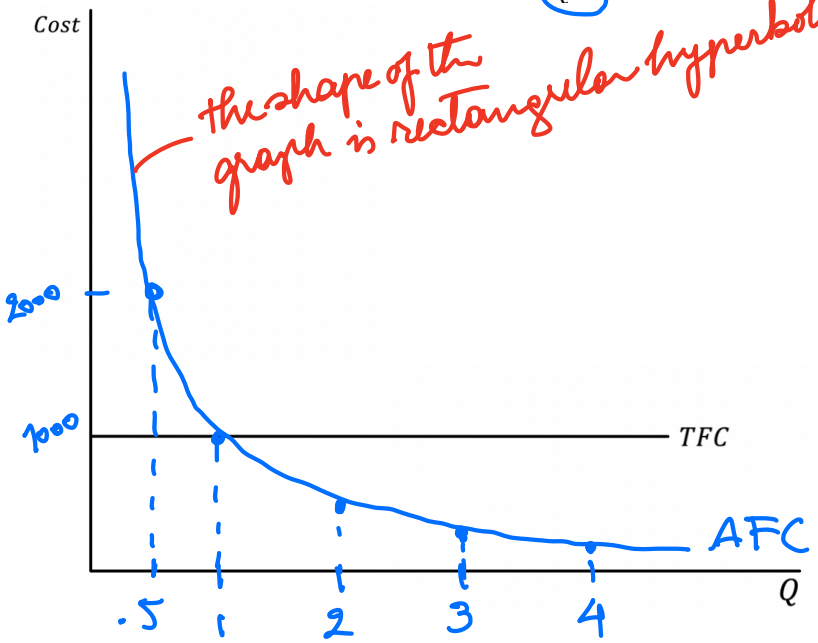
Marginal Cost:

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

a constant.

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

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

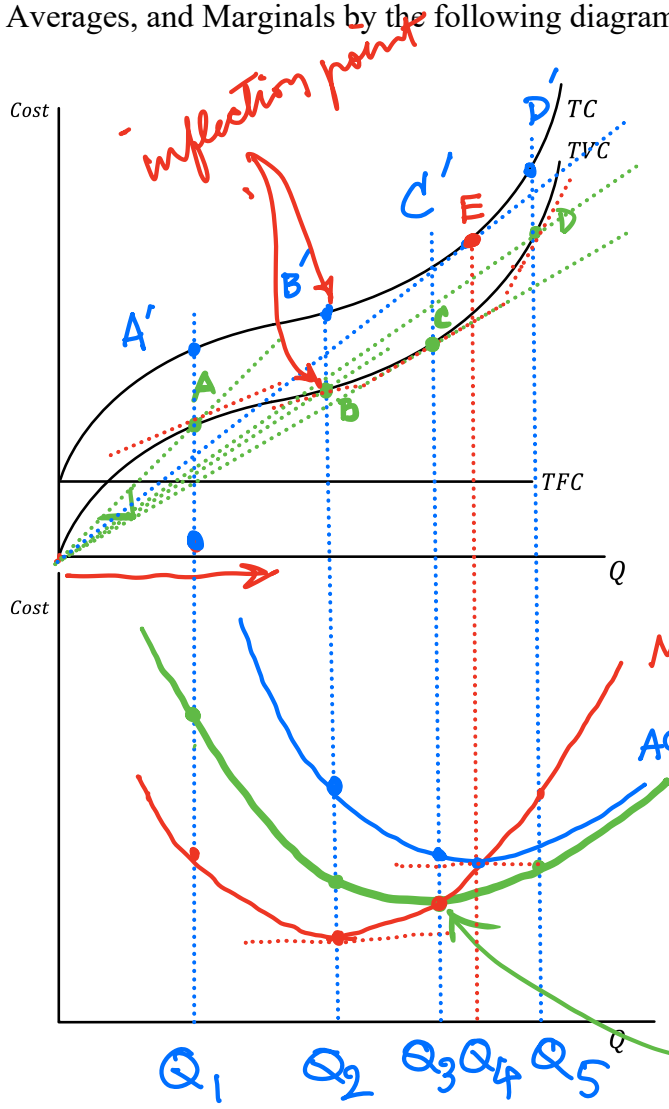


the shape of the graph is rectangular hyperbolar.

Q	TFC	AFC
0.5	1000	2000
1	1000	1000
2	1000	500
3	1000	333.3
4	1000	250

$y = \frac{1000}{x}$.

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



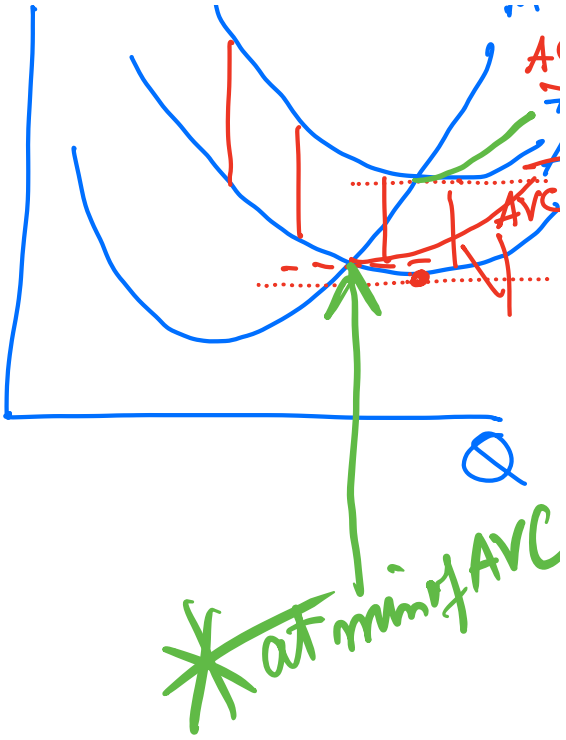
Total	Average	Marginal

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

$$\frac{d}{dQ}TC(Q) = \frac{d}{dQ}\left(AC(Q)\cdot Q\right) = AC(Q)\frac{dQ}{dQ} + Q\frac{d\,AC(Q)}{dQ}$$

$$MC(Q) = AC(Q) + Q\cdot\frac{d\,AC(Q)}{dQ}$$

$$\frac{d}{dQ}TVC(Q) = \frac{d}{dQ}\left(AVC(Q)\cdot Q\right)$$



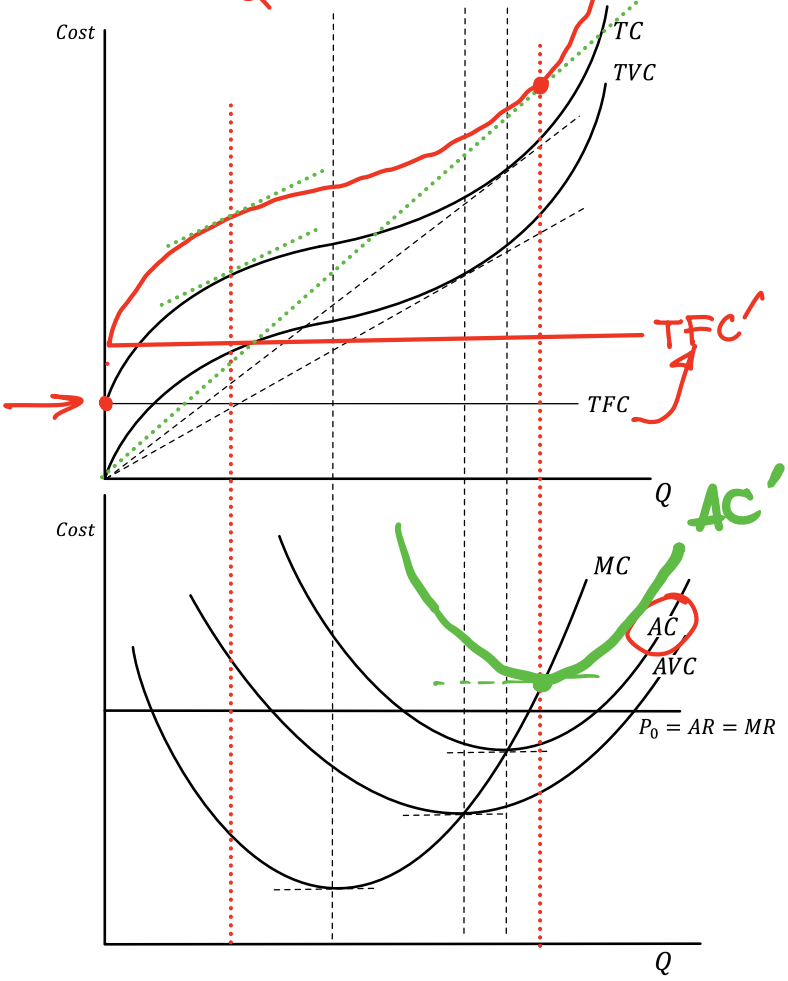
- Note that the vertical difference between AC and AVC is AFC. That is,

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

Changes of Cost Curves

1. Change in TFC —higher rent or higher price of fixed factor

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



$TC = 10{,}000 + TVC$.

$TC' = 30{,}000 + TVC$.

$\frac{TC' - TC}{Q} = \frac{20{,}000}{Q}$.

$AC' - AC = \frac{20{,}000}{Q}$

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

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

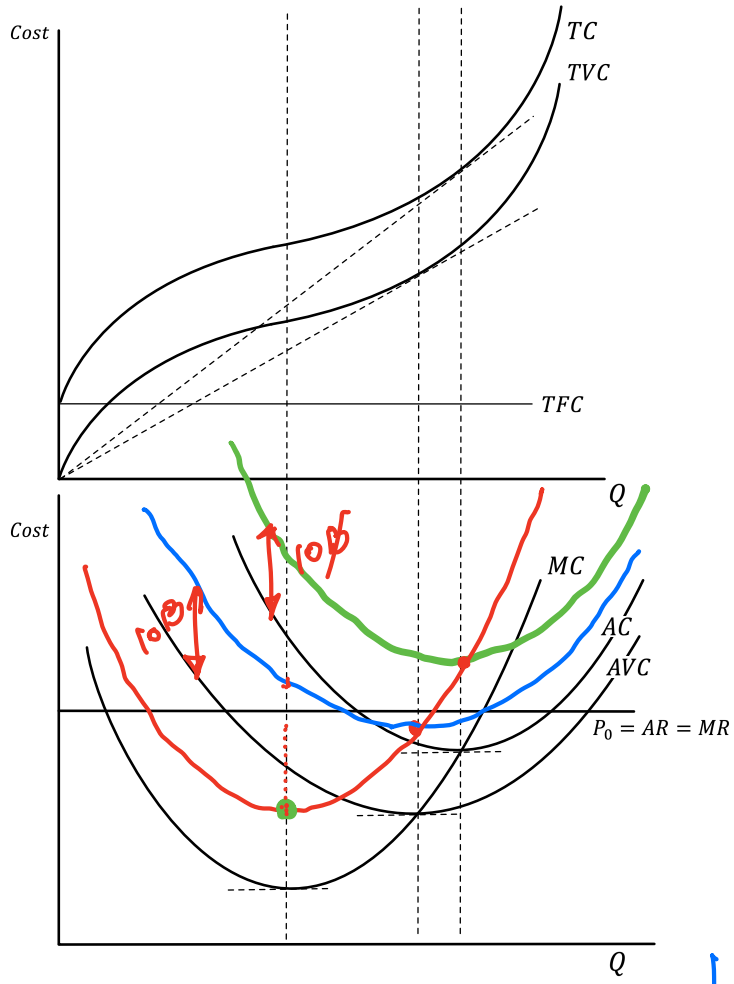
Change in Average Costs,

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

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

Change in Marginal Cost,

$$\frac{d}{dQ}\,TVC'(Q) = \frac{d}{dQ}TVC(Q) + 10Q$$
$$MC'(Q) = MC(Q) + 10$$



In economic analysis, we use only MC, AC, AVC curves. Do not draw TC, TVC, TFC unless explicitly asked to do so.