10 units - cost 200 ฿.

Chapter 16 Short-Run Costs

Cost = the least cost of producing a given output Q. The cost is determined 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)

L K.

Cost(Q).

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.

K_0 = 10 unit.
price r = 100 ฿.
TFC = $r \cdot K_0$ = 100 · 10 = 1000 ฿.
Q = 0. TFC = 1,000.
Q = 20 TFC = 1,000

- L is variable at price w/unit of labor

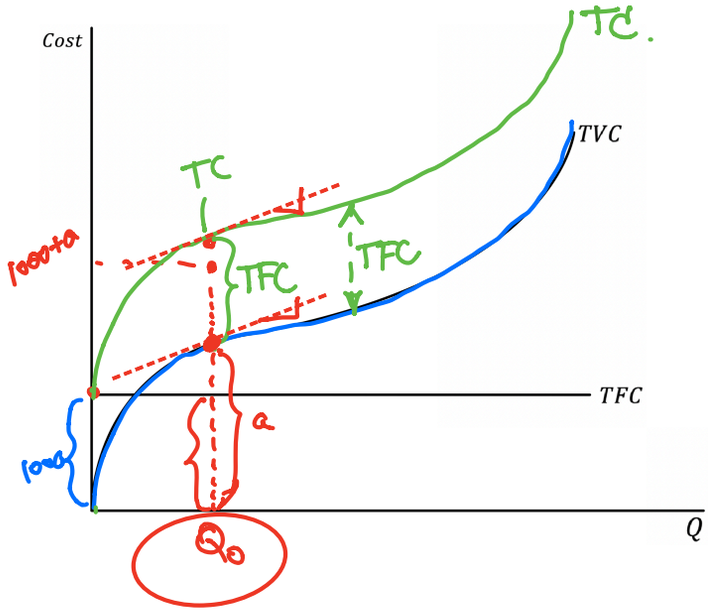
$$\Rightarrow w \cdot L = Total\ Variable\ Cost = TVC(Q)$$

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

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

Q	TVC
0	0
20	120.

Relation of Total, Fixed and Variable Costs:



Q	TFC	TVC	TC
0	1,000	0	1,000
Q_0	1,000	a	1000+a

3 total curves. < Average, Marginal.

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

$$\frac{TC(Q)}{Q} = \frac{TFC(Q)}{Q} + \frac{TVC(Q)}{Q}$$
$$AC(Q) = AFC(Q) + AVC(Q) \iff AFC(Q) = AC(Q) - AVC(Q).$$

Marginal Cost: — slope of TC.

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

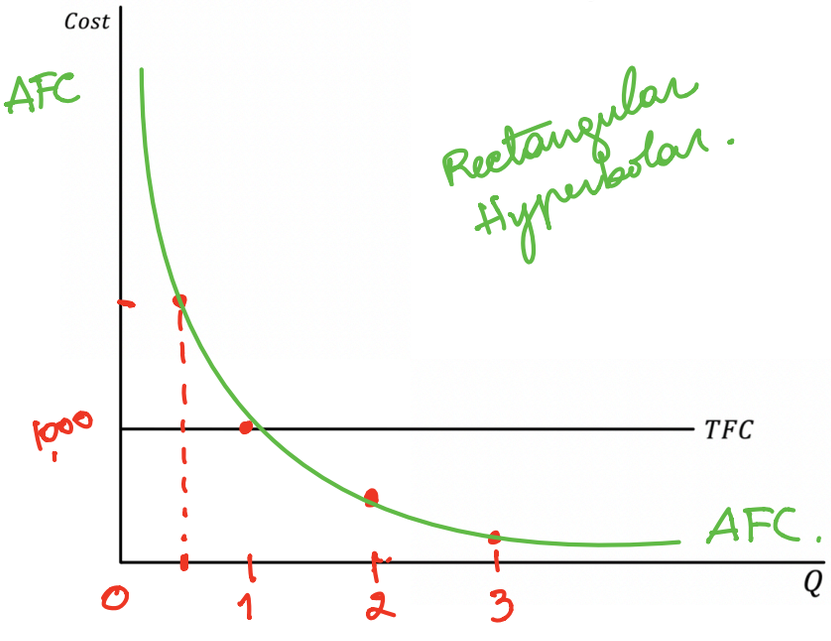
$= 0$ (1,000.)

$f(x) = 1{,}000 + x^2$

$f'(x) = 2x.$

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

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



Rectangular Hyperbolar.

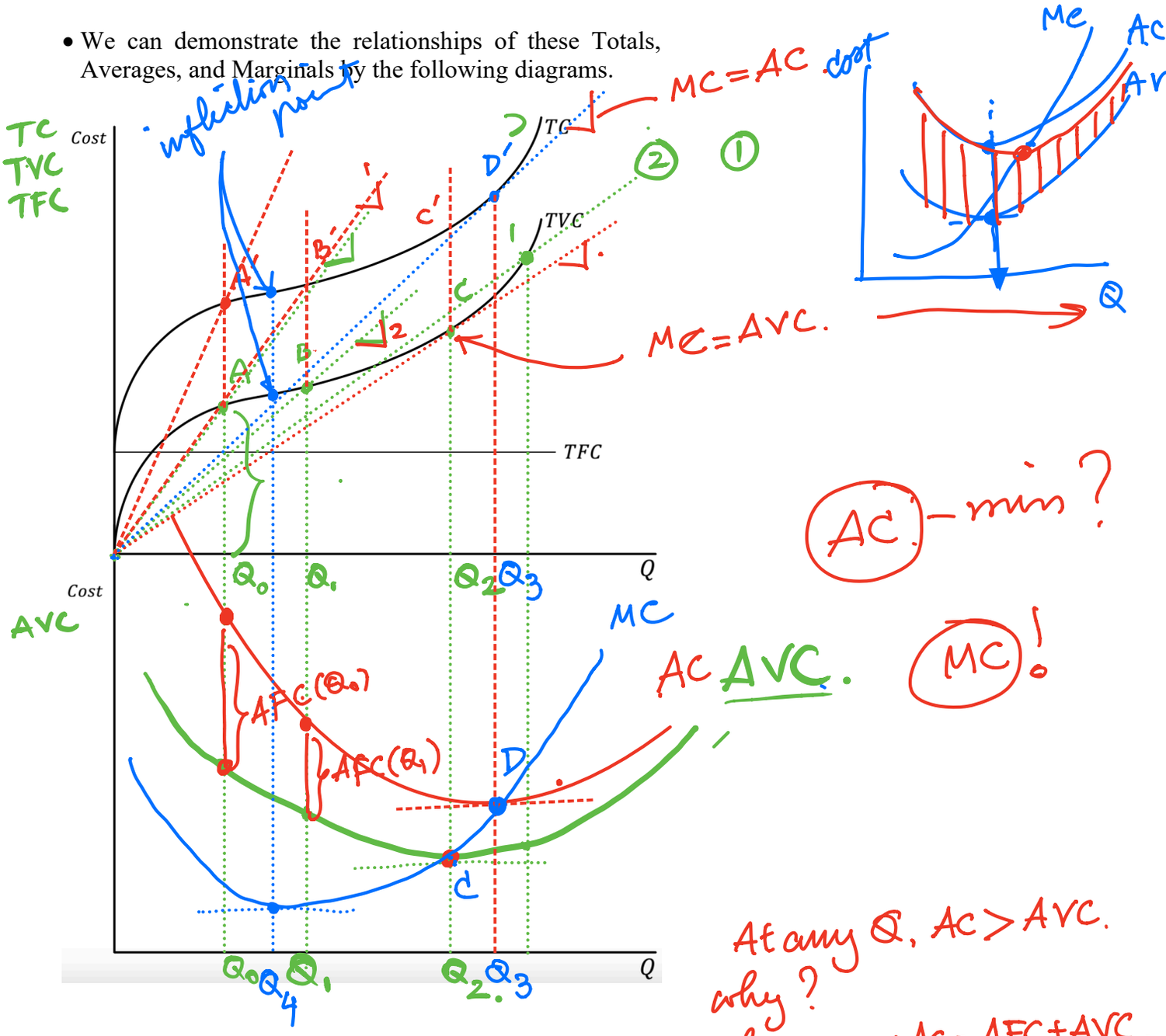
$AFC(Q) = \frac{TFC(Q)}{Q} = \frac{1000}{Q}$.

Q	AFC.
0	∞
0.5	2000
1	1000.
2	500
3	333.33

Slope of TFC = 0.

R&D.

- 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,

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

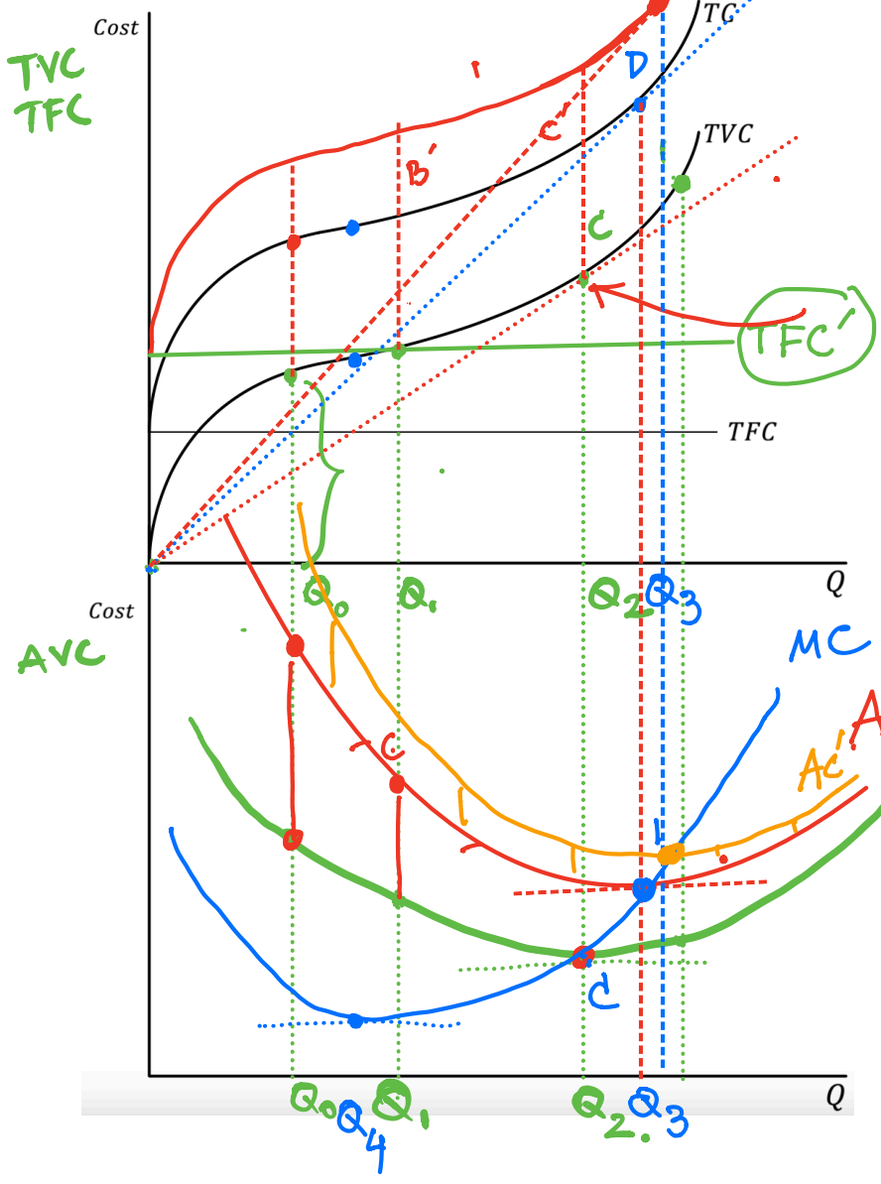
$$MC(Q) = AC(Q) + Q\cdot\frac{dAC(Q)}{dQ}$$

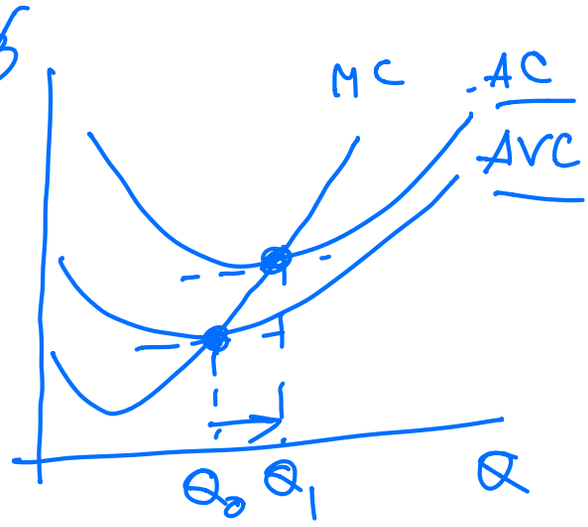
$$TVC(Q) = AVC(Q)\cdot Q \Rightarrow MC(Q) = AVC(Q) + Q\cdot\frac{dAVC(Q)}{dQ}$$

Changes of Cost Curves

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

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





- MC & AVC does not change.
- AC increases to AC' where MC intersects AC' at min AC'

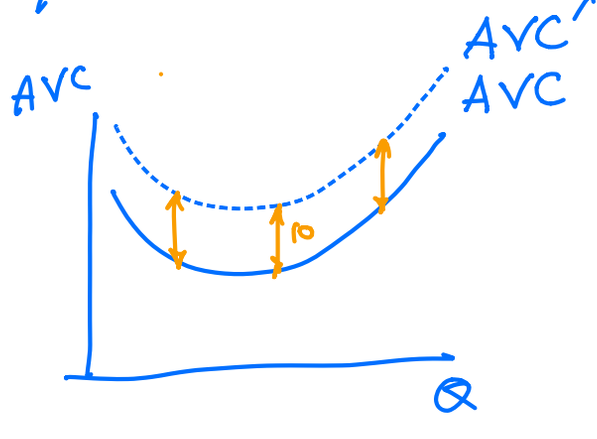
2. Change in TVC The government imposes tax of 10 Bahts/unit on the producer.

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

Change in Average Costs,

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

10/unit. tax = 10·Q.



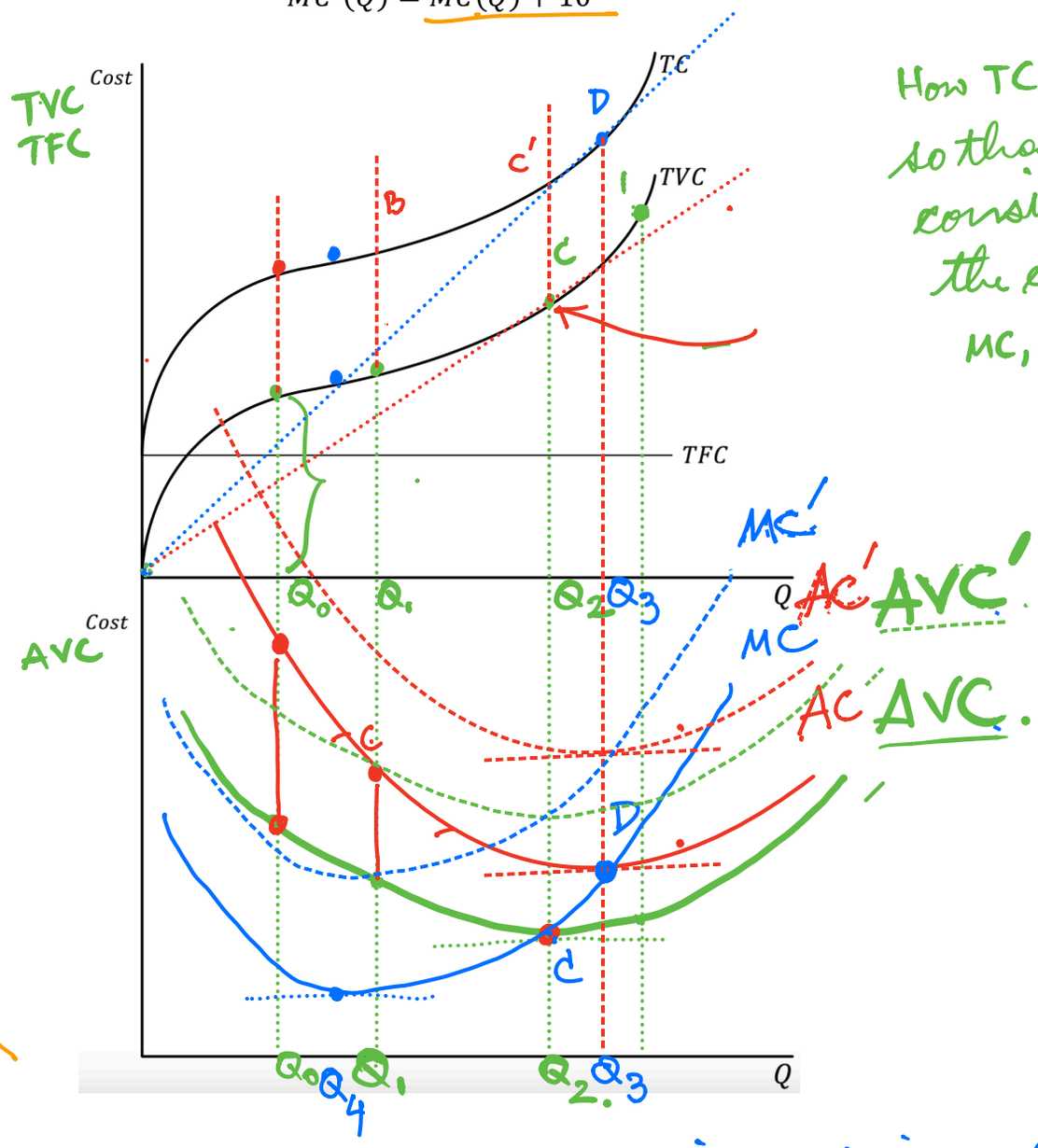
$$\frac{TC'(Q)}{Q} = \frac{TFC(Q)}{Q} + \frac{TVC(Q)}{Q} + \frac{10Q}{Q}$$

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

Change in Marginal Cost,

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

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



How TC & TVC change so that they are consistent with the changes in MC, AVC, and AC?

what if the government gives subsidy 10฿/unit to each firm?