Cost of Production

Production to Cost

- Production concepts examine the amount of input(s) needed to produce a given output.

- Cost concepts examine the cost of the inputs needed to produce a given output.

- Thus cost concepts combine production concepts with input prices.

Short run

- Typically plant and equipment are **fixed inputs** in the short run
- Fixed inputs determine the **scale** of the firm's operation

Three Concepts of Cost

- Total fixed costs = TFC
- Total variable costs = TVC
- Total cost = TFC + TVC

Short-Run Cost Measures

Fixed cost (*FC*): production expense that does not vary with output.

Variable cost (*VC*): production expense that changes with quantity of output produced.

Total cost (T*C*): $TC = VC + FC$

Average Cost, AC= TC/Q= (TFC+TVC)/Q

= (TFC/Q)+(TVC/Q)

= AFC+AVC

Marginal Cost

Marginal cost, MC, is the cost of producing successive unit.

MC is the change in cost, ΔTC, when output changes by ΔQ

That is, $MC = \Delta TC/\Delta Q$

Cost Function

Since, $TC = f(Q)$

$TC = TFC + TVC$

Now $\Delta TC = \Delta TFC + \Delta TVC$

For Short run, $\Delta TFC = 0$

Thus, $\Delta TC = \Delta TVC$

For MC, $\Delta Q = 1$

Therefore, $MC = \Delta TVC$

Short run cost functions

① Linear cost fxn:

$$TC = a + bQ$$

$$TC = TFC + TVC$$

$$\Rightarrow TFC = a$$

$$\& \; TVC = bQ$$

$$AFC = a/Q$$

$$AVC = b$$

$$AC = AFC + AVC$$

$$= a/Q + b$$

$$\& \; MC = \frac{\partial}{\partial Q}(TC)$$

$$= \frac{\partial}{\partial Q}(a + bQ)$$

$$= b$$

2.) Quadratic cost function:

$$TC = a + bQ + Q^2$$

$$TFC = a \quad ; \quad TVC = bQ + Q^2$$

$$AFC = a/Q \quad ; \quad AVC = b + Q$$

$$AC = \frac{TC}{Q} = \frac{a}{Q} + b + Q$$

$$MC = \frac{\partial(TC)}{\partial Q} = b + 2Q$$

3.) Cubic cost function:

$$TC = a + bQ - cQ^2 + Q^3$$

$$TFC = a \quad ; \quad TVC = bQ - cQ^2 + Q^3$$

$$AFC = a/Q \quad ; \quad AVC = b - cQ + Q^2$$

$$AC = \frac{TC}{Q} = \frac{a}{Q} + b - cQ + Q^2$$

$$MC = \frac{\partial(TC)}{\partial Q} = b - 2cQ + 3Q^2$$

Fixed, variable, and total costs

OUTPUT	FC	VC	TC
0	2000	0	2000
1	2000	100	2100
2	2000	180	2180
3	2000	280	2280
4	2000	392	2392
5	2000	510	2510
6	2000	650	2650
7	2000	800	2800
8	2000	960	2960
9	2000	1140	3140
10	2000	1340	3340
11	2000	1560	3560
12	2000	2160	4160

Average and marginal costs

OUTPUT	AFC	AVC	ATC	MC
0				
1	2000.0	100.0	2100.0	100
2	1000.0	90.0	1090.0	80
3	666.7	93.3	760.0	100
4	500.0	98.0	598.0	112
5	400.0	102.0	502.0	118
6	333.3	108.3	441.7	140
7	285.7	114.3	400.0	150
8	250.0	120.0	370.0	160
9	222.2	126.7	348.9	180
10	200.0	134.0	334.0	200
11	181.8	141.8	323.6	220
12	166.7	180.0	346.7	600

Critical Value of output

Critical value of Output

AVC is minimum when rate of change of AVC is zero.

$$\boxed{\frac{\partial (AVC)}{\partial Q} = 0}$$

or $\boxed{AVC = MC}$

But the aim of the firm is to minimize AC to get optimum value of Q.

$$\therefore \boxed{\frac{d(AC)}{\partial Q} = 0 \quad \text{or} \quad AC = MC}$$

Practice

$TC = 1000 + 10Q - 0.9Q^2 + 0.04Q^3$ (5)

find the rate of O/P that results in min^m AVC.

Sol^n: $TC = TFC + TVC$

$= 1000 + 10Q - 0.9Q^2 + 0.04Q^3$

$AVC = 10 - 0.9Q + 0.04Q^2$

for Min^m value of AVC

$\frac{\partial}{\partial Q}(AVC) = 0$

$-0.9 + 0.08Q = 0$

$\Rightarrow Q = \frac{0.9}{0.08}$

$\Rightarrow \boxed{Q = 11.25}$

OR

$AVC = MC$

Here, $MC = 10 - 1.8Q + 0.12Q^2$

$\Rightarrow 10 - 1.8Q + 0.12Q^2 = 10 - 0.9Q + 0.04Q^2$

$\Rightarrow Q(-0.08Q + 0.9Q)$

$\Rightarrow \boxed{Q = 0 \text{ \& } Q = 11.25}$.