Introduction to Market Structures

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- We have derived the cost functions. The cost function gives the minimum amount of cost incurred in production of a given amount of output. We get it from the cost minimization subject to a given level of output.

Min $\quad wl + rk$

s.t. $\quad y_0 = f(l, k)$

$l^a, \; k^a$

$wl^a + rk^a$

Cost fn

- In the example done in the last class , we get the following cost function when both labour and capital can be varied
$$c(w,r,y) = y^{\frac{1}{\beta+\alpha}}\Lambda,$$
where $\Lambda = \left(w.\left(\frac{r\alpha}{w\beta}\right)^{\left(\frac{\beta}{\beta+\alpha}\right)} + r.\left(\frac{w\beta}{r\alpha}\right)^{\left(\frac{\alpha}{\beta+\alpha}\right)}\right)$
- Suppose capital is fixed at some level $\bar{k}$. This is the minimum amount the producer has to install in the firm. In that case, the firm is always incurring a fixed cost of the amount $r\bar{k}$.

$\bar{k}$ $r\bar{k}$ $\bar{k}$

$y = l^{\alpha} k^{\beta}$

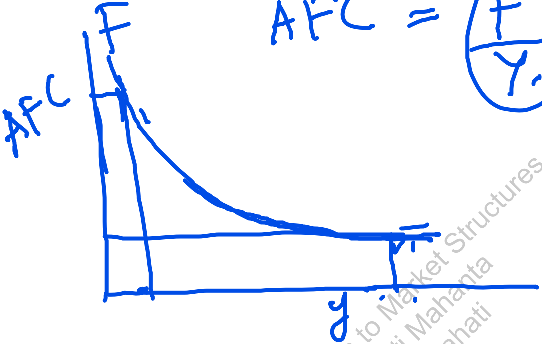
- In this case the cost function is
  $c(y) = w.\left(\frac{y_o}{\bar{k}^{\beta}}\right)^{\frac{1}{\alpha}} + r\bar{k}.$
  $c(y) = \gamma y^{\frac{1}{\alpha}} + F$. Here F is the fixed cost.
- Types of cost: variable cost, fixed cost, sunk cost.
- Variable cost: varies with the level of output. If the level of output increases, the variable cost always increases.
- Fixed cost. A fixed amount of cost independent of the level of output. Even if the level of output is zero, the producer bears fixed cost.
- Sunk cost: cost which cannot be recouped. Like amount of money spent on market research before entering a market. While refurnishing the firm: one example can be the amount spent on painting, but furnishers can be resold and some amount of expenditure can be recouped.

$y \quad C(y) = C_v(y) + F$

- Most common form of cost function is $c(y) = c_v(y) + F$. Here $c_v(y)$ is the variable cost component and F is the fixed cost.
- Average cost: cost per unit of output.
  $\dfrac{c(y)}{y} = \dfrac{c_v(y) + F}{y} = AC$
- $AC = \dfrac{C_v(y)}{y} + \dfrac{F}{y}$. Here $\dfrac{C_v(y)}{y}$ is average variable cost (AVC) and $\dfrac{F}{y}$ average fixed cost (AFC).
- Nature of average variable cost curves and average fixed cost curve.

$$AFC = \frac{F}{y}$$

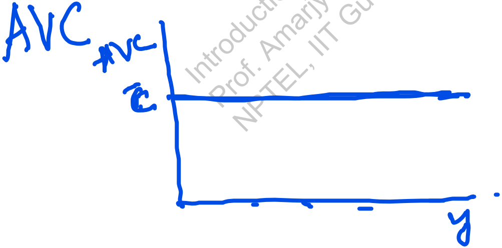
$y \uparrow$, $\frac{F}{y} \downarrow$

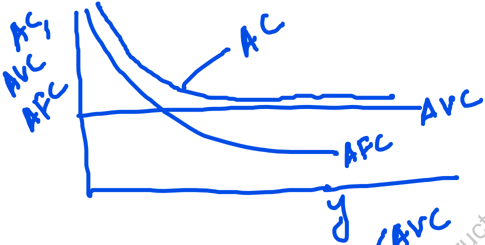


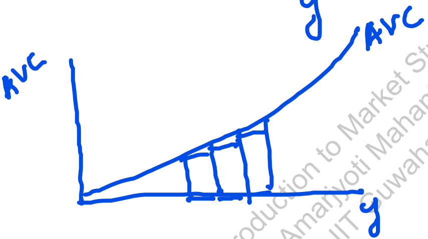
$$C(y) = C_v(y) + F$$

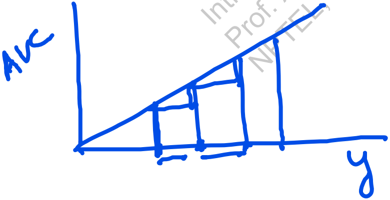
$$C_v(y) = \bar{c}\, y$$

$$\frac{C_v(y)}{y} = \bar{c}$$









$$AC = AVC + AFC$$

$$c(y) = \bar{c}\,y + F$$

$\bar{c} > 0$

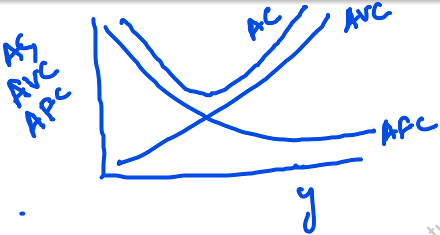
$$c(y) = \bar{c}\,y^3 + F$$

$$AVC = \bar{c}\,y^2$$

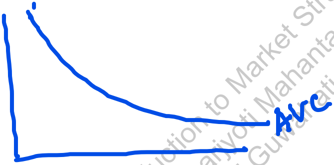
Law of diminishing marginal product.

$$c(y) = \bar{c}\,y^2 + F$$

$$AVC = \bar{c}\,y.$$



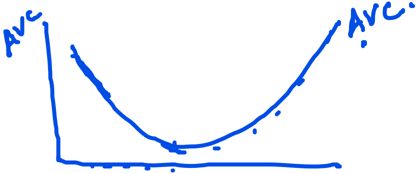
$$AC = AVC + AFC$$



$$c(y) = \bar{c}\, y^{1/2} + F$$

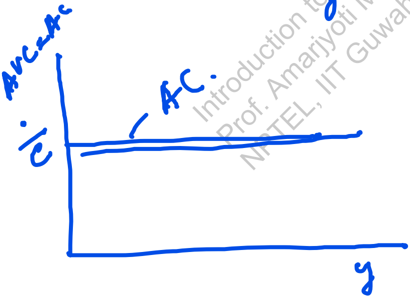
$$AVC = \frac{\bar{c}}{y^{1/2}}$$

$y\uparrow$, $AVC\downarrow$



U shaped.

U shaped



$c(y) = c_v(y)$

$AC = AVC.$

$c(y) = \bar{c}\, y..$

CRS.

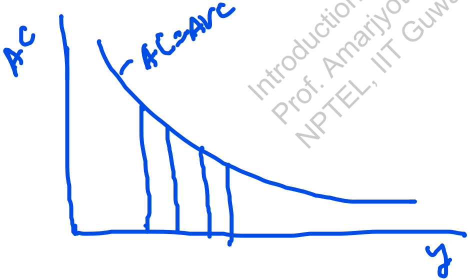
DRS

$$c(y^\alpha) = \frac{wl^\alpha + rk^\alpha}{\theta y^\alpha}$$

$$= w\theta l^\alpha + rk^\alpha\theta$$

$$= \frac{\cancel{\theta}(wl^\alpha + rk^\alpha)}{\cancel{\theta} y^\alpha}$$

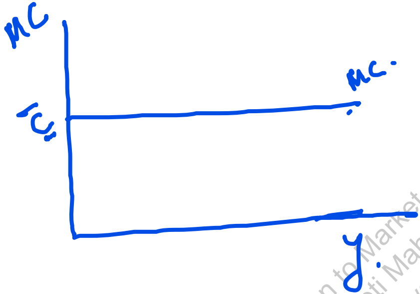
$$c(y) = C_v(y)$$



IRS

- Marginal Cost (MC)= The additional cost incurred if output is increased by one more unit at the margin.
  $c(y) = c_v(y) + F$ and $c(y+1) = c_v(y+1) + F$.
  $MC = \triangle c(y) = c(y+1) - c(y) = c_v(y+1) - c_v(y)$.
  $\dfrac{dc(y)}{dy} = \dfrac{dc_v(y)}{dy}$.
- The nature of marginal cost curves

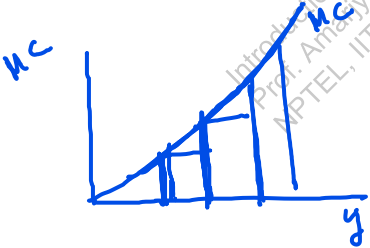
$$c(y) = \underline{c_v(y)} + \underline{F}$$



$$c(y) = \bar{c}\,y + F$$

$$MC = \bar{c}$$

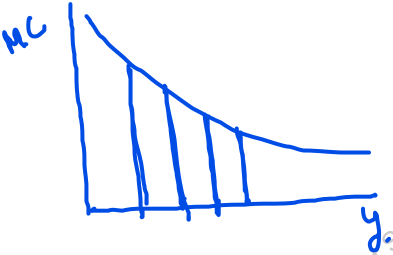
$$\frac{dc(y)}{dy} = \bar{c}$$



$$c(y) = \bar{c}\,y^3 + F$$

$$MC = 3\bar{c}\,y^2$$

– Law of diminishing marginal product of labour.



$$c(y) = \bar{c}\, y^{1/2} + F$$

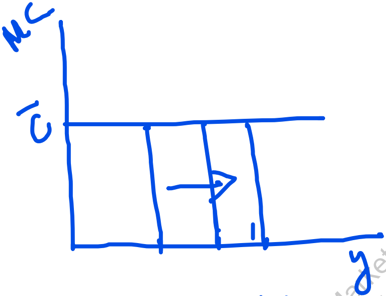
$$MC = \bar{c}\,\frac{1}{2}\,\frac{1}{y^{1/2}}$$

$C(y) = C_v(y)$

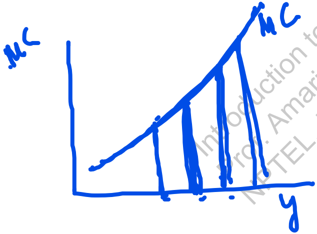
CRS

$c(y) = \bar{c}\, y$

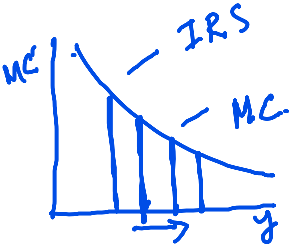
$MC = \bar{c}$



$c(y) = C_v(y)$



DRS



Relationship between average cost curve and marginal cost curve

$$\frac{d(\frac{c(y)}{y})}{dy} = \frac{y\frac{dc(y)}{dy} - c(y)}{y^2} = \frac{MC - AC}{y}$$

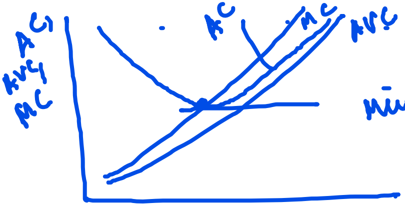
When average cost curve is falling, the marginal cost curve must lie below the average cost curve. When average cost curve is rising, the marginal cost curve must lie above the average cost curve. So average cost curve must intersect marginal cost curve in the minimum point of the average cost curve.

The relationship is same between average variable cost curve and marginal cost curve.

$$\frac{d}{dy}\left(\frac{C_v(y)}{y}\right) = \frac{y\frac{dC_v(y)}{dy} - C_v(y)}{y^2} = \frac{MC - AVC}{y} \geq 0$$

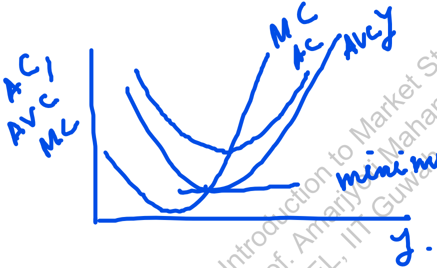
$MC - AC > 0$ $MC > AC$

$MC - AC < 0$ $MC < AC$

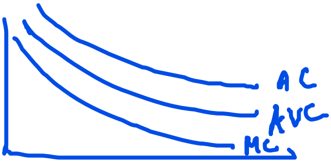


F

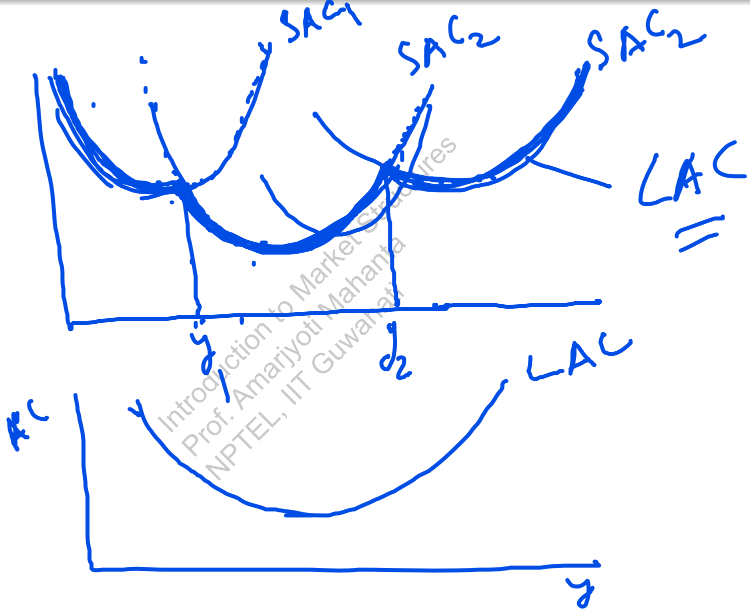
minimum of AC.



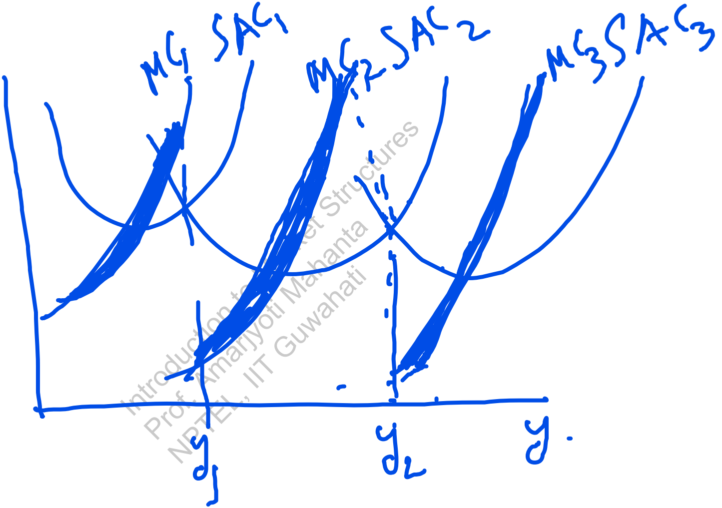
minimum of AVC.



Long Run Average Cost curve



Long Run Marginal Cost curve



Module 2; Production and Cost curves: Intermediate Microeconomics A Modern Approach 8th edition
by Hal R Varian
Chapters: Technology, Chapter 18; Cost minimization Chapter 20; Cost Curves, Chapter 21