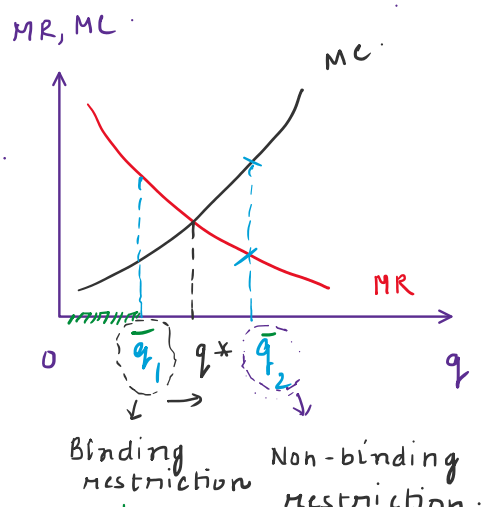


Note: For a monopolist,

π-max condition: $MR = MC \Rightarrow$ solve for q^*.

Monopolist will produce q^* if there are no restrictions.

For $q = q_1$: $MR\big|_{q_1} > MC\big|_{q_1}$

$\Rightarrow$ Monopolist would have an incentive to increase production: $q \uparrow$

For $q = q_2$: $MR\big|_{q_2} < MC\big|_{q_2}$

$\Rightarrow$ Monopolist would cut down on output: $q \downarrow$

(*) If restriction level > non-restriction output

$\Rightarrow$ usual π-max will done.

(*) If restriction level < non-restriction output

$\Rightarrow$ Firm will produce restriction level.

Q. Consider a monopolist facing mkt dd: $P = 20 - q$ and has a production fn $q = \min\left\{\frac{L}{2}, \frac{K}{3}\right\}$ and there is physical restriction on the availability of capital (say $\bar{K}$). Let $w = r = 1$.

(a) Find π-max output if $\bar{K} = 24$.

Restricted output level $= \min\left\{\frac{L}{2}, \frac{K}{3}\right\} = 8$.

$\therefore \bar{q} = 8$ (Non-binding restriction)

$\therefore q = \min\left\{\frac{L}{2}, \frac{K}{3}\right\}$

At opt: $\frac{L}{2} = \frac{K}{3} = q \Rightarrow L^* = 2q, K^* = 3q$

Cost fn $C = wL^* + rK^* = L^* + K^* = 5q$.

$\pi = (20 - q) \cdot q - 5q$.

FOC: $\frac{d\pi}{dq} = 0 \Rightarrow 20 - 2q - 5 = 0 \Rightarrow 15 = 2q \Rightarrow q^* = 7.5 < 8$.

$p^* = 20 - 7.5 = 12.5$.

(b) Find the π-max output level if $\bar{K} = 18$.

New restriction: $\bar{q} = 6 <$ Non-restriction output level.

$\therefore q^* = 6, \; p^* = 20 - 6 = 14$.

Q. Consider a monopolist having a constant $MC = c > 0$. Govt imposes a per-unit tax on the monopolist at Rs. 't' per unit.

(a) If the mkt demand is $P = a - bq$, $a, b > 0$. Find the impact of tax on the price charged by the monopolist.

p^* = π-max price level. Find $\frac{dp^*}{dt}$.

$MC = c, \quad C(q) = c \cdot q$.

with tax: $\pi = P \cdot q - C(q) - tq = (a - bq) \cdot q - c \cdot q - t \cdot q$

FOC: $\frac{d\pi}{dq} = 0 \Rightarrow a - 2bq - c - t = 0$.

$a - c - t = 2bq \Rightarrow q^* = \frac{a - c - t}{2b}$.

$p^* = a - bq^* = a - b\left(\frac{a - c - t}{2b}\right)$.

$p^* = a - \frac{a - c - t}{2}$.

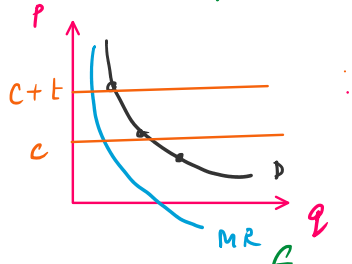
$\frac{dp^*}{dt} = \frac{1}{2}$ $\Rightarrow$ Post-tax increase in price does not depend on elasticity of demand.

(b) If the mkt demand is $q = Ap^{-\epsilon}$, $\epsilon > 1$. Find the impact of tax on the price charged by the monopolist.

$\therefore$ Post tax opt condition: $MR = MC + t$.

$q = Ap^{-\epsilon} \Rightarrow MR = P\left(1 - \frac{1}{\epsilon}\right)$

At opt: $P\left(1 - \frac{1}{\epsilon}\right) = c + t$.



$p^* = c + t \Rightarrow \frac{dp^*}{dt} = \frac{\epsilon}{\epsilon - 1} > 1$

$$p^* = \frac{c+t}{\left(1-\frac{1}{\epsilon}\right)} \Rightarrow \frac{dp^*}{dt} = \frac{1}{\left(1-\frac{1}{\epsilon}\right)} = \frac{\epsilon}{\epsilon-1} > 1$$

$\therefore \quad \frac{dp^*}{dt} > 1 \Rightarrow$ Price will increase more than amount of the per-unit tax.