Q. Consider a setup with monopsonist in the factor mkt and a monopolist in the good's mkt as follows:

Production fn: $q = q(L, \bar{K})$, $q_L > 0$, $q_{LL} < 0$ ✓

Mkt demand: $P = P(q)$, $P' < 0$. ✓

Labour supply: $w = w(L)$, $w' > 0$. ✓

i) Find the optimal condition. $\left[\frac{\partial \pi}{\partial L} = 0 \right]$.

ii) What should be restriction on the Mkt demand curve & the labour supply curve s.t the sufficiency condition is satisfied. $\left[\frac{\partial^2 \pi}{\partial L^2} < 0 \Rightarrow \text{check!} \right]$.

(i). $\pi = P \cdot q - w \cdot L$.

$\pi = P \cdot q(L, \bar{K}) - w(L) \cdot L$.

$\pi = P(q) \cdot q(L, \bar{K}) - w(L) \cdot L$

$\pi = P\{q(L, \bar{K})\} \cdot q(L, \bar{K}) - w(L) \cdot L$.

$$\frac{\partial \pi}{\partial L} = 0 \Rightarrow P' \cdot q_L \cdot q + P \cdot q_L - w' \cdot L - w = 0.$$

$$\Rightarrow q_L [P' \cdot q + P] - w' \cdot L - w = 0 \quad \text{———} (*)$$

$$\Rightarrow \underbrace{q_L}_{MP_L} \underbrace{[P' \cdot q + P]}_{MR} = \underbrace{w' \cdot L + w}_{ME} \Rightarrow \boxed{MP_L \cdot MR = ME}$$

↳ optimal condition.

(ii). $$\frac{\partial \pi}{\partial L} = \underbrace{q_L}\,\underbrace{[P' \cdot q + P]} - w' \cdot L - w$$

$$\frac{\partial^2 \pi}{\partial L^2} = [P' \cdot q + P] \cdot q_{LL} + q_L [P'' q_L q + P' \cdot q_L]$$

$$- [w'' \cdot L + w'] - w'$$

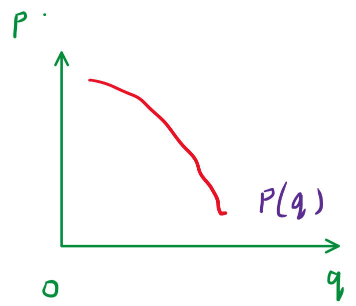
∂L^2

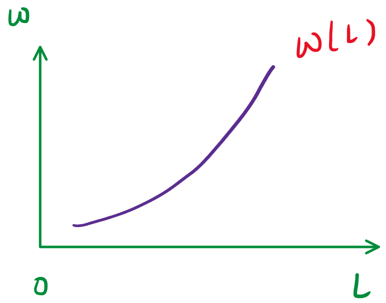
$$- [w'' \cdot L + w'] - w'$$

$$= [P' \cdot q + P] \cdot q_{LL} + (q_L)^2 [P'' q + P'] - w'' L - 2w'$$

$$= [\underbrace{\underbrace{P' q + P}_{MR>0} \cdot \underbrace{q_{LL}}_{<0}}_{<0}] + \underbrace{(q_L)^2}_{>0} [\underbrace{P''}_{<0} q + \underbrace{P'}_{<0}] - [\underbrace{w''}_{>0} L + \underbrace{2w'}_{>0}]$$

For sufficiency, $\frac{\partial^2 \pi}{\partial L^2} < 0$ which is ensured when $P'' < 0$ and $w'' > 0$.





Oligopoly

1 —— (n) —— → ∞

There are small no. of firms in the mkt ⇒ They are neither price takers (as each of the firms have a significant mkt share) and no one can independently cater to the whole mkt (since they are not large enough to be a monopoly)

Monopoly (one firm)
↳ one firm had the entire mkt power.

Perfect competition (Large no. of firms).
↳ Firms are price takers

(*) "Firms engage in strategic interaction b/w them to maximize profits".

Eg: Suppose there are 'n' firms in the mkt, producing $q_1, q_2, \ldots, q_n$ units of output. Mkt share of ith firm, $s_i = \frac{q_i}{\sum_{i=1}^{n} q_i} = \left(\frac{q_i}{q}\right)$.

[Higher mkt share => Higher is mkt power].

↓

[Ability of a firm to impact the mkt outcome => Price in the mkt, Quantity in the mkt].

For any firm, there are 2 choice variables:

Competing through Quantity

(i) Cournot Model

[Simultaneous determination of output]

(ii) Stakelberg Model

[Leader-follow model].

Competing through Price

(i) Bertrand Model.

[Simultaneous determination of prices].

(ii) Price-leadership Model.

Cournot Model.

Q. Consider 2 firms engaged in cournot mkt structure. The inverse mkt demand curve is $P = a - bq$; $a, b > 0$.

$q = q_1 + q_2$.

Cost fn of Firm I: $C_1(q_1) = c_1 \cdot q_1$, $c_1 > 0$.

Cost fn of Firm II: $C_2(q_2) = c_2 \cdot q_2$, $c_2 > 0$.

(i) Find the π-max output levels for both the firms.

$\pi_1 = P \cdot q_1 - C_1 = [a - b(q_1 + \bar{q}_2)] \cdot q_1 - c_1 \cdot q_1$ -- [Max π_1 by choosing q_1]

$\pi_2 = P q_2 - C_2 = [a - b(\bar{q}_1 + q_2)] \cdot q_2 - c_2 q_2$ -- [Max π_2 by choosing q_2].

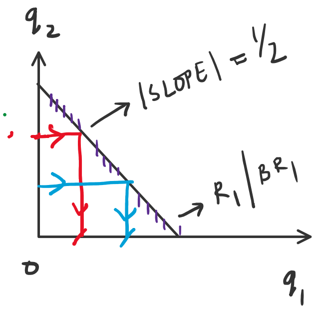
Note: Firm I takes Firm II's output ...

Note: Firm I takes Firm II's output level as given to evaluate q_1^* & similarly for Firm II.

Firm I: $\frac{\partial \pi_1}{\partial q_1} = 0 \Rightarrow -b \cdot q_1 + a - b(q_1 + q_2) - c_1 = 0$.

$\Rightarrow \quad 2b \cdot q_1 + b \cdot q_2 = (a - c_1)$ ---- (i)

$\Rightarrow \quad q_1 = \left[\frac{(a - c_1) - b\bar{q}_2}{2b} \right]$ --- (ia)



[If firm II produces output level $\bar{q}_2$, then for π-max firm I should produce q_1, (given by ia)

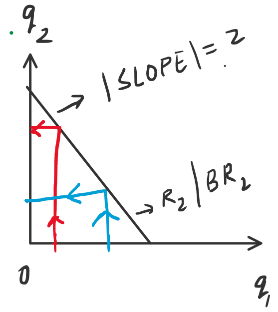
$\Rightarrow$ Producing q_1 (according to (ia)) is the Best Response of Firm I to firm II

$\Rightarrow$ Eqn (i) / (ia) is known as the Reaction fn of Firm I / Best Response fn of Firm I].

For Firm II: $\frac{\partial \pi_2}{\partial q_2} = 0 \Rightarrow a - b(q_1 + q_2) - bq_2 - c_2 = 0$.

$\Rightarrow \quad b \cdot q_1 + 2bq_2 = (a - c_2)$ --- (ii)

$\Rightarrow \quad \boxed{q_2 = \frac{a - c_2 - b\bar{q}_1}{2b}}$ ---- (iia)



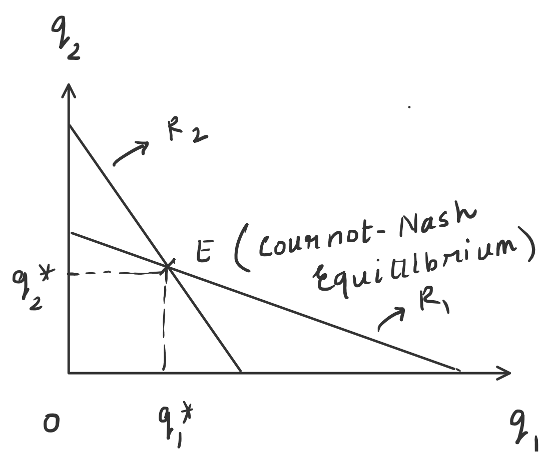
(ii) & (iia) are R_2 / BR_2.

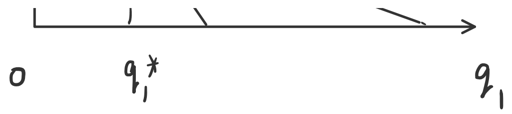
HW.

For finding q_1^*, q_2^* solve:

$2b \cdot q_1 + b \cdot q_2 = (a - c_1)$ --- (i)

$b q_1 + 2b q_2 = (a - c_2)$ --- (ii)




0
q_1^*
q_1