

Oligopoly

① Price that each firm chooses
Quantity that each firm produces } 4 variables of interest

② Homogenous Product
2 firms in market }

③ Price leader | quantity leader
Price follower | quantity follower

④ Strategic interactions
↳ sequential games

Simultaneous Games

↳ each firm can simultaneously choose price or quantity.

4 possibilities

- ① quantity leadership
- ② Price leadership
- ③ simultaneous qty setting
- ④ " " Price setting

Another possibility

↳ collusion (cooperative game)

① Quantity leadership

↳ what output should leader choose to maximize its profit?

Follower's Problem

In order for leader to make a sensible decision, it has to consider follower's profit max. problem

Follower

$$\max_{y_2} P(y_1, y_2) y_2 - C_2(y_2)$$

The leader's output is predetermined. The production by leader has already been made, and follower simply views it as a constant.

followers choose an output where $MR = MC$

$$MR_2 = P(y_1 + y_2) + \frac{\Delta P}{\Delta y_2} y_2 = MC_2$$

$$y_2 = f_2(y_1) \rightarrow \text{Reaction function.}$$

$$\pi_2(y_1, y_2) = [a - b(y_1 + y_2)]y_2 \quad [\text{since cost} = 0]$$

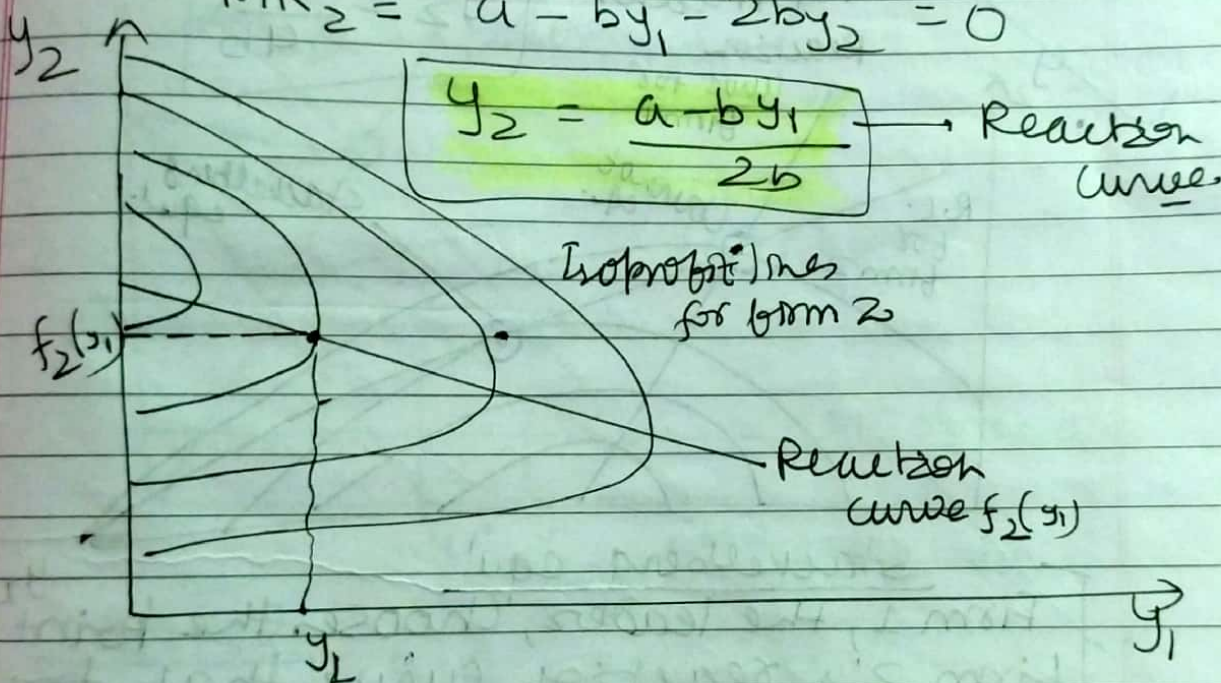
$$\pi_2 = ay_2 - by_1y_2 - by_2^2$$

Use this expression to draw isoprofit lines

$$ay_2 - by_1y_2 - by_2^2 = \pi_2$$

For each possible choice of y_1 , firm 2 has y_2 :

$$MR_2 = a - by_1 - 2by_2 = 0$$



When $y_1 = 0$, $y_2 = \text{Monopolist} = \text{Maximum profit}$

Leader's problem

$$\max_{y_1} P(y_1 + y_2)y_1 - C_1(y_1)$$

$$\text{such that } y_2 = f_2(y_1)$$

$$\max_{y_1} P[y_1 + f_2(y_1)]y_1 - C_1(y_1)$$

When leader contemplates changing its output it has to recognise the influence it exerts on followers.

$$\pi_1 = ay_1 - by_1^2 - by_1 y_2$$

$$\pi_1 = ay_1 - by_1^2 - by_1 f_2(y_1)$$

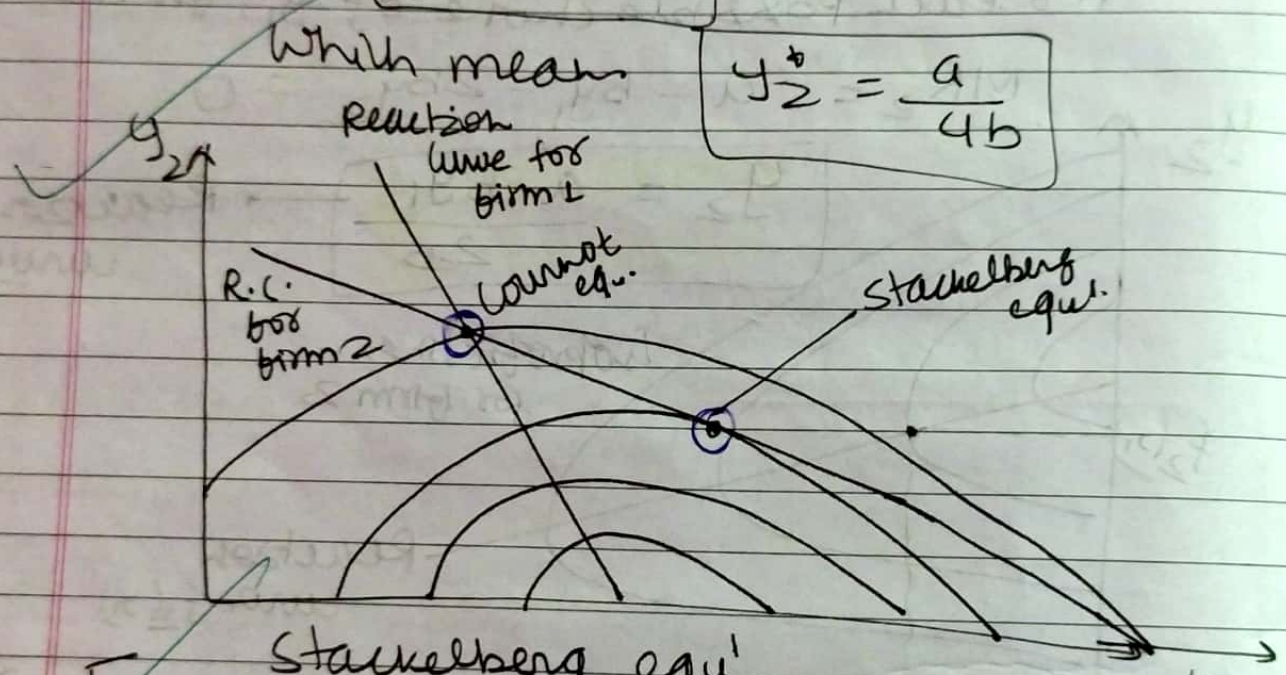
$$\pi_1 = ay_1 - by_1^2 - by_1 \frac{a - by_1}{2b}$$

$$\pi_1 = \frac{a}{2} y_1 - \frac{b}{2} y_1^2$$

$$MR = \frac{a}{2} - by_1 = 0$$

$$y_1^* = \frac{a}{2b}$$

$$y_2^* = \frac{a}{4b}$$



Stackelberg equ'
 Firm 1, the leader, chooses the point of firm 2's reaction curve that touches firm 1's lowest possible drop profit line, thus yielding the highest possible profits for firm 1.

Cournot equilibrium
 where both reaction curves meet.

PRICE leadership

In equi, the follower must always set same price as the leader. 2 firms are selling identical products where leader has set price. Follower takes price as outside his control

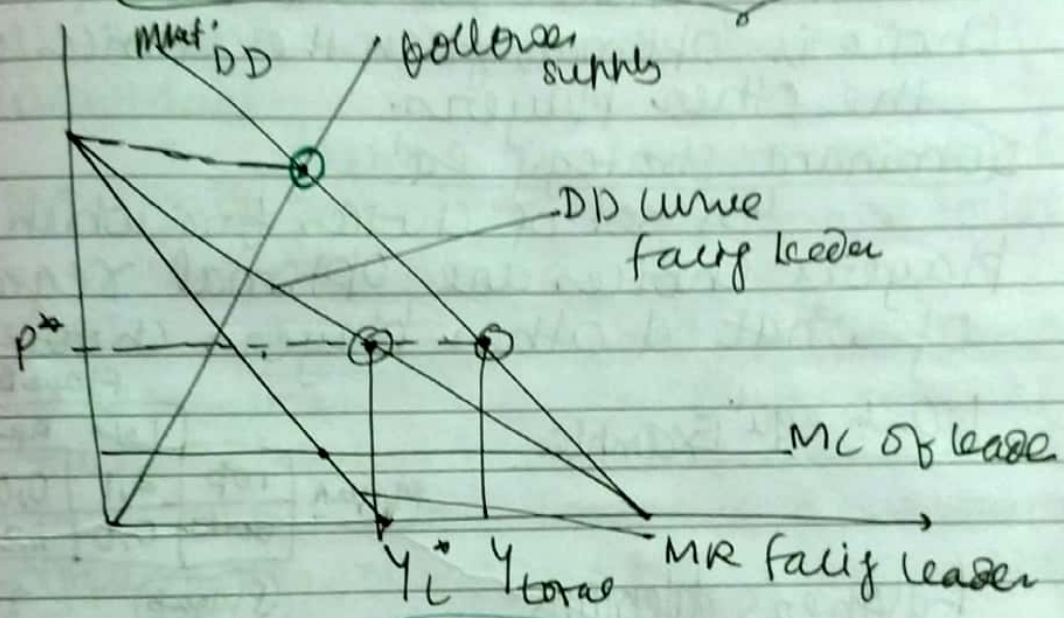
$$\text{Max}_{y_2} P y_2 - C_2(y_2)$$

Follower sets price, $P = MC$.

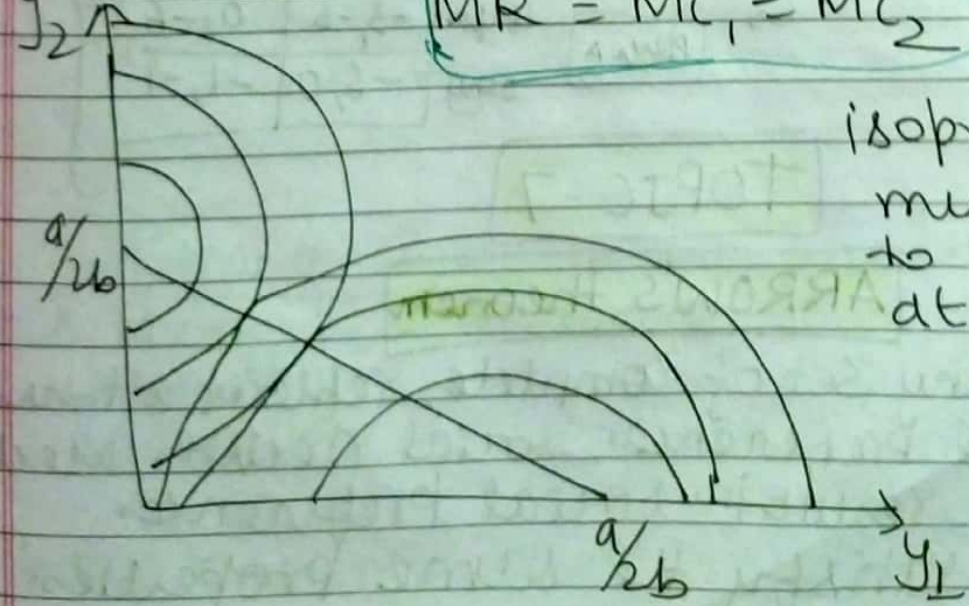
Now, [Leader Problem]

$$R(P) = D(P) - S(P)$$

$$\pi_1(P) = (P - c) [D(P) - S(P)] = (P - c) R(P)$$



cartel



$$MR = MC_1 = MC_2$$

isoprofit curves must be tangent to one another at profit max level of output

Comparison of solutions

Quantity leadership (Stackelberg)

Price leadership

Simultⁿ qty. setting (Cournot)

" Price " (Bertrand)

Collusive solution

Highest Output + lowest price ←

Smallest Output + highest price ←