3.5. Price competition and capacity constraints- Edgeworth Solution

Matilde Machado

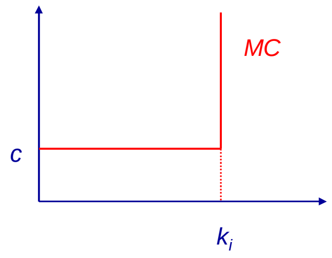
3.5. Edgeworth Solution

- Homogenous goods
- Same marginal cost, no Fixed cost
- Each firm i has capacity k_i<D(c) – they cannot serve the whole market at price=c by itself
- Firms choose prices non-cooperatively and simultaneously
- ➡ The Bertrand paradox disappears

3.5. Edgeworth Solution

Capacity constraints:

- Marginal costs are constant up to k_i and infinite beyond that quantity



- This means that in the short run it is impossible to produce beyond k_i

3.5. Edgeworth Solution

- In Cournot we had p>c and positive profits. Would it be possible to get the Cournot equilibrium when firms choose prices?
- Demand: D(p)=9-p
- 2 firms: c1=c2=0
- Let's derive first the Cournot equilibrium:

$$\underset{q_1}{Max}\ \pi = (9 - q_1 - q_2)q_1$$

$$FOC: \frac{\partial \pi}{\partial q_1} = 0 \Leftrightarrow 9 - 2q_1 - q_2 = 0 \Leftrightarrow q_1 = \frac{9 - q_2}{2} \text{ Firm 1 reaction function}$$

Because of symmetry $q_1 = q_2 = q^N$

$$q^N = \frac{9 - q^N}{2} \Leftrightarrow \frac{3}{2}q^N = \frac{9}{2} \Leftrightarrow q^N = 3 \Rightarrow Q^N = 2q = 6;\ p^N = 9 - 6 = 3$$

$$\pi^N = (p^N - c)q^N = 9$$

3.5. Edgeworth Solution

- Suppose firms decide prices but have capacities: k1=k2=3 (i.e. they cannot produce more than in Cournot)
- Would the Cournot price p1=p2=3 an equilibrium?
- 2 questions:
  - 1) Given p2=3, does firm 1 want to deviate?
  - 2) Given p1=3, does firm 2 want to deviate?

3.5. Edgeworth Solution

- If p2=3 and p1=3 demand is Q=9-3=6 and they split the quantity equally q1=q2=3. In this case they produce at maximum capacity given that k1=k2=3.
- If firm 1 lowers its price to p'1 it would face all the demand D(p'1) but it could only produce 3, therefore it would lead to a lower profit Π=(p'1-0)*3<(3-0)*3=9 since p'1<3. Hence firm 1 would not lower its price. What about an increase in price? If firm 1 increases its price than firm 2 faces all the demand but again only satisfies 3. Firm 1 would face a residual demand given by D1(p1,p2)=D(p)-q2=9-p-3=6-p.

3.5. Edgeworth Solution

- We compute the optimal price for firm2 given this residual demand :

$$\underset{p_1}{Max} = (6 - p_1)p_1$$

$$FOC: \frac{\partial \pi}{\partial p_1} = 0 \Leftrightarrow 6 - 2p_1 = 0 \Leftrightarrow p_1 = 3$$

Firm 1 does not want to increase its price

- Conclusion: Firm 1 does not want to increase or decrease price. The same applies to firm 2. Therefore, if firms' capacities are equal to the Cournot quantities and they compete in prices the Nash equilibrium is prices equal to Cournot prices: $p1=p2=p^N$

3.5. Edgeworth Solution

What if firms can choose capacities?

- Period 1: Choose capacities – long term decision
- Period 2: Compete in prices – short term decisions

Firms would choose capacities that are equal to the Cournot quantities and prices would be Cournot prices. Firms would then set price>c and have positive profits.

3.5. Edgeworth Solution

Conclusions:

1. Capacity constraints soften the competition between firms. Equilibrium prices are not as low and we obtain p>MC and firms have positive profits. Firms avoid accumulating too much capacity (which is costly) in order to soften price competition. The capacity choice is a compromise that price competition is going to be soft.
2. Examples where capacity choice are relevant:
   1. Hotels – they cannot adjust their capacity in the short run
   2. Airlines
3. The equilibrium from this game coincides with the Cournot equilibrium.