

Course Title: Microeconomics-II

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Topic: Cournot and Bertrand Model

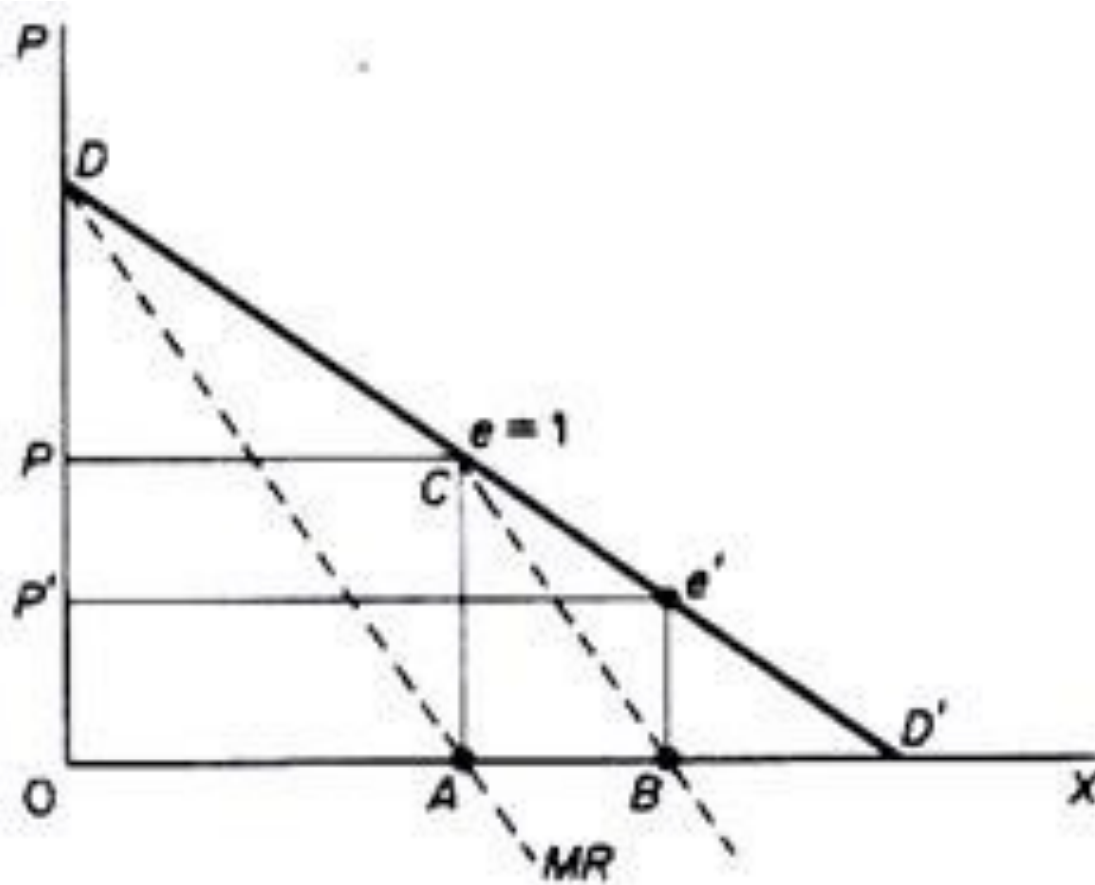
Cournot Model of Duopoly

- The earliest duopoly model was developed in 1838 by the French economist Augustin Cournot.
- The original version is quite limited in that it makes the assumption that the duopolists have identical products and identical costs.
- Cournot illustrated his model with the example of two firms each owning a spring of mineral water, which is produced at zero costs.

Assumptions

- Cournot assumed that there are two firms. Thus it is a duopoly model.
- Cournot also assumed that there are two firms each owning a mineral well, and operating with zero costs. Thus this model applies to identical product and identical cost conditions.
- He also assumed that each firm acts on the perception that its competitor will not change its output, and decides its own output so as to maximize profit.

Equilibrium



Firm A: The Beginner

- Assume that firm A is the first to start producing and selling mineral water. It will produce quantity A , at price P where profits are at a maximum, because at this point $MC - MR = 0$. The elasticity of market demand at this level of output is equal to unity and the total revenue of the firm is a maximum. With zero costs, maximum total revenue implies maximum profits. Now firm B assumes that A will keep its output fixed, and hence considers that its own demand curve is CD' .

Firm B: The New Entrant

- Clearly firm B will produce half the quantity AD' , because (under the Cournot assumption of fixed output of the rival) at this level (AB) of output (and at price F) its revenue and profit is at a maximum. B produces half of the market which has not been supplied by A, that is, B's output is $\frac{1}{4}$ of the total market.

The Reaction Pattern of Firms

- While deciding his own output in reaction to its competitors output, each firm will be guided by the following formula.
- One Firm's Output = $\frac{1}{2}$ (Total Market Demand – Present Output of the Other Firm)
- At the time of entry output of Firm-A is:
 $\frac{1}{2} (OD' - 0) = \frac{1}{2} OD' = OA.$

Firm's Reaction

- Following OA output of Firm-A, output of Firm-B is

$$\frac{1}{2} (OD' - \frac{1}{2} OD') = \frac{1}{2} OD' - \frac{1}{4} OD' = \frac{1}{4} OD' = AB$$

- Firm-B will react to this by producing the following level output

$$\frac{1}{2} (OD' - \frac{1}{4} OD') = \frac{1}{2} OD' - \frac{1}{8} OD' = \frac{3}{8} OD'$$

Final Outcome

- This action-reaction pattern continues, since firms have the naive behaviour of never learning from past patterns of reaction of their rival. However, eventually an equilibrium will be reached in which each firm produces one-third of the total market. Together they cover two-thirds of the total market. Each firm maximises its profit in each period, but the industry profits are not maximised.

Equilibrium Output

- When Firm-A produces $\frac{1}{3} OD'$ the Firm-B will be in equilibrium by producing the same level of output.

$$\text{Firm-B's Output} = \frac{1}{2} (OD' - \frac{1}{3} OD') = \frac{1}{2} OD' - \frac{1}{6} OD' = \frac{1}{3} OD'$$

$$\text{Firm-A's Output} = \frac{1}{2} (OD' - \frac{1}{3} OD') = \frac{1}{2} OD' - \frac{1}{6} OD' = \frac{1}{3} OD'$$

- Thus both will be in equilibrium by producing one third of output and total output will be two-third of the total market demand.

Number of Firms & Output

- When there are two firms total output produced is $\frac{2}{3}$ of total market demand.
- And, in general, if there are n firms in the industry each will provide $\frac{1}{n+1}$ of the market, and the industry output will be $\frac{n}{n+1} = \frac{1}{n+1} * n$.
- Clearly as more firms are assumed to exist in the industry, the higher the total quantity supplied and hence the lower the price.
- The larger the number of firms the closer is output and price to the competitive level.

Bertrand's Model of Oligopoly

- This model was formulated in 1883 by Joseph Louis Francois Bertrand.
- It describes interactions among firms (sellers) that set prices and their customers (buyers) that choose quantities at the prices set.
- This model applies to the form of Oligopoly/Duopoly when the products are identical.

Assumptions

- There are at least two firms producing a homogeneous (undifferentiated) product.
- Firms compete by setting prices simultaneously and consumers want to buy everything from a firm with a lower price.
- Both firms have the same constant unit cost of production, so that marginal and average costs are the same.

Assumptions Cont...

- Both the firms have unlimited productive capacity
- This means that a firm by setting a price just below its competitor can capture the entire market demand and it has the sufficient productive capacity to meet the entire market demand.

The Model

- If the initial price is higher than the marginal cost ($P > MC$), then one firm may think to slightly lower the price and meet the entire market demand.
- So he will charge $P - \varepsilon$ price where ε is a very small amount.
- The other firm will also react in the same way and charge slightly lower price than the present one.
- This process of undercutting the price is called competitive bidding.

Equilibrium

- This competitive bidding will continue until the price becomes equal to the marginal cost.
- When $P = MC$, no firm will further have the incentive to reduce the price since it will cause loss to the firm.
- Also there will be no incentive to increase the price since that will drive the entire market demand to the other firm

Equilibrium Price & Output

- Thus the final price will be equal to the marginal cost.
- This price is same as the price achieved in the perfectly competitive market.
- Also the joint output of both the firms will also be equal to the perfectly competitive level of output.
- Thus the Bertrand's solution will produce the same result as the perfectly competitive market.