Lesson: Oligopoly and Game Theory

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Chapter: Oligopoly and Game Theory

Learning Objectives

After study this chapter, you will learn:

1. The meaning of oligopoly market
2. Features of the oligopoly market
3. Cournot's Model
4. Betrand Model
5. Stackelberg Model
6. Price Leadership
7. Game Theory
8. Prisoner Dilemma

Oligopoly

2.Introduction

In perfect competition market, there is large number of buyers and sellers and in monopoly; there is only one large firm in the market. However, these are two extreme and reality lies between these two markets. In real situation, only few firms make up an industry and these firms has control over price and there are high barriers to entry. This market is called as oligopoly.

> Oligopoly is a market where there are few sellers selling homogeneous or differentiated products.
>
> Duopoly is a market where there are only two sellers in the market.

Thus, an oligopoly is a market where there exist few firms producing either homogeneous or differentiated product. However, there is no specific number of sellers in the oligopolistic market. It depends upon the size of the market. Duopoly is a special case of oligopoly where there exist only two sellers.

Oligopoly market is called as pure or homogeneous oligopoly, if firms in the market sell homogeneous product, for instance, firms produce cooking gas, bread etc. Market is called as differentiated or heterogeneous oligopoly, if firms sell differentiated products, for instance, soft drinks, soaps and detergents.

3.Features/Characteristics of Oligopoly:

(i) Few dominant firms: In this market structure, there are few large firms, which dominant whole industry and each firm produces significant portion of total market output.

(ii) Interdependence: The firms are interdependent in decision-making, i.e., output and price decisions of one firm affect probability of the other firms in the market and because of this interdependence, the analysis of equilibrium under oligopoly becomes complicated.

(iii) Barriers to entry: This limits the threat of competition and this arises because of economics of scale, absolute cost advantage of old firms, patent rights, huge investment required etc.

(iv)Homogenous or differentiated products: In this market structure, firms can produce either homogenous or differentiated products. Market is called as pure oligopoly if it produces homogenous products like cement and it is called as differentiated or imperfect oligopoly, if products are differentiated like automobiles.

(v) Profit is not the only motive: A firm under oligopoly may not always maximizes its profits. There are some other motives also like sales maximization, risk minimization etc.

(vi)Advertisement/selling cost: Due to the presence of huge competition, firm spends huge amount on advertisement. Because of price rigidity and high cross elasticity of demand, the firm can boost sales only through advertising its products. Hence, demand curve can shift in favor of the advertised product.

(vii)Behavior of Oligopolistic firm: The decision of one firm is affected by the other firms in the industry. Hence, the firm behave either in strategic way or non-strategic way.

4.Choice of Strategy:

There are two firms producing homogenous products. Thus, there are four variables, i.e. prices of both firm charges, and quantity of both the firm produces.

There are three types of games. If one firm sets its price or output when firm already know the choices of other firm. This strategic interaction is called as sequential game. If one firm decides its price and other firm follows that price, then first firm is called as price leader and its rival is called as price follower. On the other hand, if one firm sets its output first, and other follows then first firm is called as quantity leader and its rival is quantity follower.

Secondly, if first firm makes it movement and does not know about the movement of other firm in the market is called as simultaneous game. In this case, one firm expect about the movement of other firm while making its own decisions. Further, two decisions choices are there: one is the firm simultaneously choose prices and another is simultaneous choose quantities.

Lastly, firms collude to make decisions on price and quantities to maximize profit jointly; this collusion is called as cooperative game.

5.COURNOT MODEL

French Economist, Augustine Cournot developed the first model of oligopoly in 1838 in the form of Duopoly model. While developing this model, he made following assumptions:

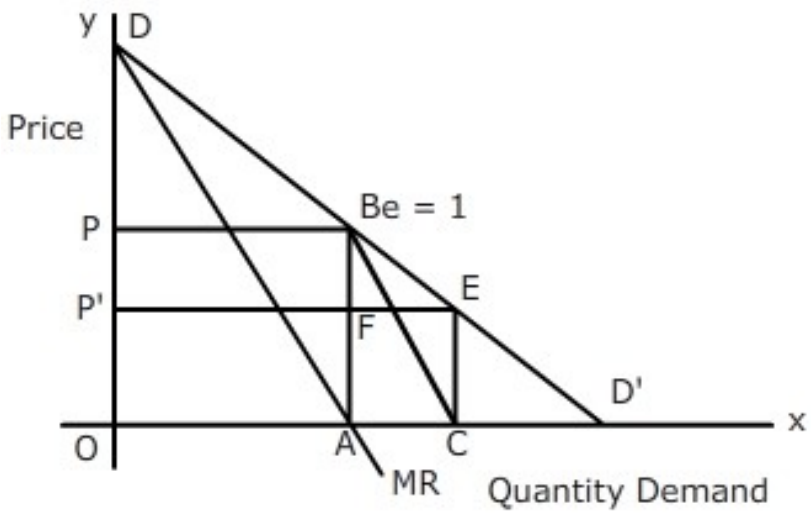
1. There are only two firms selling homogenous products in the market.
2. There is zero cost of production for both of the firms in the market, i.e. MC=0.
3. The firm faces straight-line downward sloping demand curves.

4. Each firm assumes that the other firm holds its output constant while deciding their own output and profit (Cournot's Behavioral assumption).

These two firms' produces homogenous products. Each firm assumes that rival firm will keep its output constant to produce profit maximization output.

This model can be explained with the help of an example, let two firms, A and B, start manufacturing mineral well. The cost of producing mineral well is zero. The main aim of the firm is to maximize profit to max profit total revenue should be max and it is max where marginal revenue (MR) is zero and it is equal to MC.

This model can be explained with the help of a diagram 1. Let the firm A enters the market and start producing OA market demand, which is half of the total market demand OD'. Here, MC=MR=0 and TR is maximum and hence profit is maximum. Now firm B enters the market and assumes that firm A will not change its output. Market for firm B is AD', which is half of the total market and its demand curve is BD'. In order to maximize its profit and revenue, firm B start producing half of the available market, i.e. AC at price OP'.



Hence, the firm B's output is ¼ (=1/2* ½) of the market output.

Now, firm A's profit is affected because with the entry of firm B price falls to OP'. Hence, it is expected profit falls to OP'FA. Therefore, firm A reacts by assuming firm B will no change its output and start producing one-half of the market which is not supplied by firm B. Firm B have one-quarter of the market; therefore, now firm A produces 1/2 (1-1/4)=3/8 of the total market demand.

Again, firm B reacts and start producing one-half of the unsupplied demand of the market, which is ½(1-3/8)=5/16

This process of action-reaction continues. Equilibrium will reached when their supply 1/3 of the share and change same price.

The process of action and reaction is given in table 1.

An Iso-profit curve is defined by different levels of output of a firm and its rival, which gives the same level of profit to the firm.

Period	A	B
I	$\frac{1}{2}$ →	← $\frac{1}{2}\left(1-\frac{1}{2}\right)=\frac{1}{4}$
II	$\frac{1}{2}\left(1-\frac{1}{4}\right)=\frac{3}{8}$ →	← $\frac{1}{2}\left(1-\frac{3}{8}\right)=\frac{5}{16}$
III	$\frac{1}{2}\left(1-\frac{5}{16}\right)=\frac{11}{32}$ ←	→ $\frac{1}{2}\left(1-\frac{11}{32}\right)=\frac{21}{64}$
- -	— — —	— — —
- -	— — —	— — —
- -	— — —	— — —
n	$\frac{1}{2}\left(1-\frac{1}{3}\right)=\frac{1}{3}$ ←	→ $\frac{1}{2}\left(1-\frac{1}{3}\right)=\frac{1}{3}$
	A's output goes on decreasing	B's output goes on increasing
	$\frac{1}{2}, \frac{-1}{8}, \frac{-1}{32}, \text{----}$	$\frac{1}{4}, \frac{1}{16}, \frac{1}{64}, \text{----}$
	for A $=\int\frac{a}{1-r}=\frac{1}{2}-\frac{1/8}{1-1/4}=\frac{1}{3}$	for B $=\int\frac{a}{1-r}=\frac{1/4}{1-1/4}=\frac{1}{3}$
	Total Market Demand $=\frac{1}{3}+\frac{1}{3}=\frac{2}{3}$	

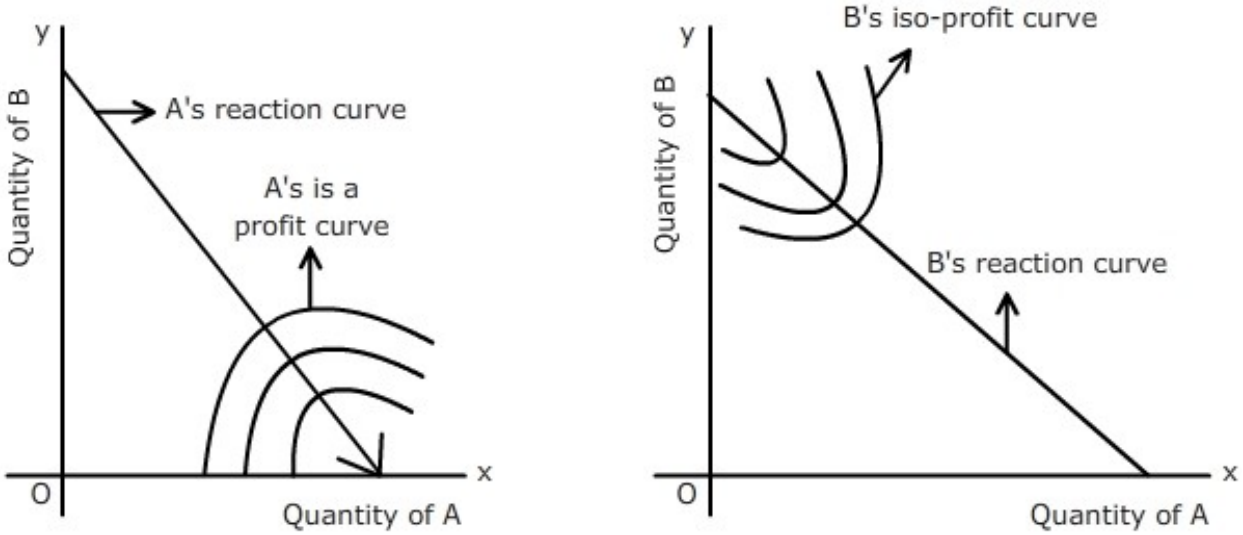
Hence, this equilibrium is stable equilibrium, where each firm supplied one-third of total market demand.

Reaction curves Approach of Cournot Model

This approach is based on iso-profit curves of rivals, which was based on Stackelberg's indifference curve analysis.

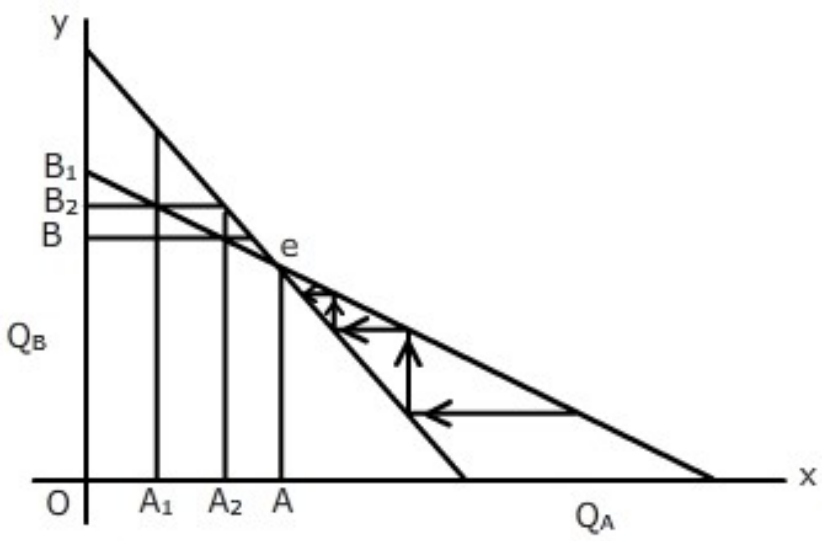
An Iso-profit curve is defined by different levels of output of firm and competitor, which gives same level of profit to the firm.

Firm A iso-profit curve can be derived by the locus of points at different levels of output of firm A and firm B, yielding same level of profit to firm A (as shown in Diagram II(A), an iso-profit curve of B firm is the locus of points of various levels of output of both firms which gives same level of profit to firm B.



Iso-profit curves are concave to origin, when highest point of A firm isoprofit curves are joined and get reaction curve of the particular firm. Hence the firm A's reaction curve can be defined as the locus of points of highest profits that firm A can obtain keeping B's output constant, firm B's reaction curve can be derived. Each and every point of Reaction curve shows that how firm A reacts and will determine its output, when its rival firm B's decides its output to a certain level. In other words, in order to maximise its profit, how much A will produce when its rival output is given.

Equilibrium is determined when two reaction's curves intersects, (at point 'e' given in diagram), this equilibrium is a stable equilibrium given by Cournot.



Suppose that firm A decides its own output at A, which is less than the equilibrium output A. Given OA, output of firm A, B decides to produce OB, level of output. Assuming that B will not change its output, now A increases its output from A1 to A2. Again, firm B reacts and producing B2 level of output. This process will goes on until equilibrium point 'e' is reached. The same point of equilibrium is reached when we start from a point to the right of 'e', hence the equilibrium point 'e' is stable equilibrium.

Reaction Curve shows the relationship between a firm's profit-maximizing output and the amount it thinks its competitor will produce

Example: Suppose there are two firms in the market faces linear market demand curve Market demand is P = 30 - Q ; where Q is total production of both firms: i.e, $Q = Q_1 + Q_2$ and both firms have zero cost of production i.e, $MC_1 = MC_2 = 0$. Find reaction curves and Cournot equilibrium.

Solution : Market demand curve is given by:

$$P = 30 - Q;$$

$$P = 30 - Q_1 - Q_2$$

$$TR_1 = PQ_1 = (P = 30 - Q_1 - Q_2)\, Q_1$$

$$= 30\, Q_1 - Q_1^2 - Q_2 Q_1$$

Firm 1's Reaction Curve → $MR_1 = MC_1$

$$MR_1 = \Delta R_1 / \Delta Q_1$$

$$= 30 - 2Q_1 - Q_2$$

$$MR_1 = MC_1 = 0$$

$$30 - 2Q_1 - Q_2 = 0$$

Therefore, Reaction curve of A is

$$Q_1 = 15 - \tfrac{1}{2}\, Q_2$$

Similarly, $TR_2 = PQ_2 = (P = 30 - Q_1 - Q_2)\, Q_2$

$$= 30\, Q_2 - Q_2^2 - Q_2 Q_1$$

Firm 2's Reaction Curve → $MR_2 = MC_2$

$$MR_2 = \Delta R_2 / \Delta Q_2$$

$$= 30 - 2Q_2 - Q_1$$

$$MR_2 = MC_2 = 0$$

$$30 - 2Q_2 - Q_1 = 0$$

Therefore, Reaction curve of B is

$$Q_2 = 15 - \tfrac{1}{2}\, Q_1$$

Putting the value of Q_2 in Q_1

$$Q_1 = 15 - ½ (15 - ½ Q_1)$$

Hence, $Q_1 = 10$

Since, in Cournot's equilibrium $Q_1 = Q_2$

Hence, $Q_1 = Q_2 = 10$.

Equilibrium quantity in Cournot's equilibrium is 20 ($Q_1 + Q_2 = 20$) and price = 30 – 20 = 10.

6. Bertrand Model of Duopoly

The Bertrand Model developed by French economist Joseph Bertrand in 1883. This model is different from Cournot's model. Cournot assumes that each firm will assume the rival firm's output as constant while deciding their own profit maximizing output; whereas, Bertrand assumes that each firm decides its own price and expects that its rival firm will keep its price as constant. Cournot model finds equilibriums that lies somewhere in between the monopolistic equilibrium and competitive equilibrium, whereas the Bertrand model equilibrium is the competitive equilibrium, where profits of the firms are zero. This model of duopoly relies on the following:

1. There are only two firms producing homogenous product and cannot cooperate in any way.
2. Both firms make their choice simultaneously.
3. Both firms have same cost of production, thus, average and marginal are same for both firms.

In this model, equilibrium is reached when there are no profits to the firm. In other words, the Bertrand equilibrium is merely the profitless equilibrium. In fact, the Bertrand outcome is only equilibrium. Lets suppose, we take an example that there are two same companies manufacturing homogenous

product and sells their product at market price P and because of the competition with each other both companies did not earn profit. Hence, at the same price, each company covers half of their market and if Firm A is to increase its price above the market price P, then it would lose all of it sale to its competitor, i.e. Firm B and simply would have to leave the market and on the other hand, if Firm A lowers its cost below the market price P then it is below their cost and will get a loss overall. Therefore, Firm A can never increase their profits by increasing or decreasing in their price is any direction and Firm B has also the same reason to change its price or go for higher profits. Therefore, the profitless outcome is an equilibrium, in fact a Nash equilibrium, in the Bertrand model.

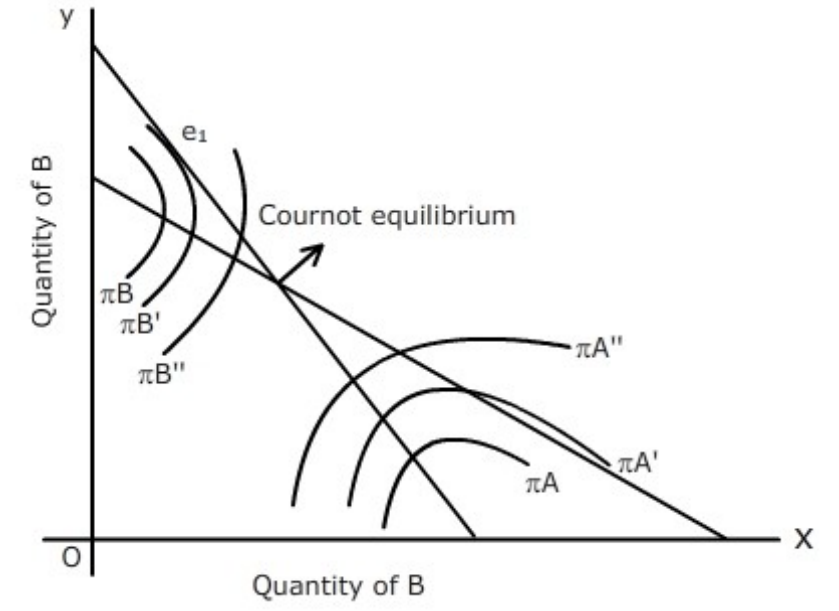
It is understood that there can be no equilibrium where profits are negative and if it remains the same, then all firms would only get losses and obviously would exit the market. On the other hand, it is to show that there is no equilibrium where profits are positive. If firm A wants to increase its price than the market price then firm A would lose its sale to Firm B. However, if firm A wants to lower its price just slightly also below the market price P, then it would be a risk for firm B that it can capture the whole market of firm B and this example also implies on firm B with same criteria, so firm A and firm B would undergo with same competition until their profits will come down to zero only, so therefore; no equilibrium exists when profits are positive in the Bertrand model.

7.Stackelberg duopoly

This model of Duopoly is developed by German economist Heinrich Stackelberg in 1934 in his book “The Theory of the Market Economy”. This model is also based on non- cooperative game and extension of Cournot model. Cournot model assume that firms make their output decision at the same time but this model assumes that if one firm sets its output first then

this firm have an advantage over the another firm and this firm is known as first mover advantage. Assumptions of this model are:

1. There are two firms only.
2. They sell homogenous goods.
3. Both firms have same demand and cost curves.



This model can be explained with the help of Diag.4 where one firm is the leader firm and other firm is the follower. Iso-profit curves and reaction curves of two firms are shown in the diagram. Suppose firm A is the leader firm and assumes that its competitor firm B will act on the basis of its own reaction curve. Leader firm, firm A, will decide its output level which maximize its profit. This is shown by point 'e' in the diagram. This point 'e' gives maximum profit to firm A because this point lies on the lowest possible iso-profit curve of firm A when reaction curve of firm B is given. Firm A decides monopolist output i.e, Qa (shown in figure), and firm B, according to its reaction curve, produces Qb output. Clearly, leader firm produces higher output and follower firm produces lower output as compare to Cournot's

equilibrium. In nutshell, stable equilibrium is reached when one firm is leader and another is follower.

Mathematical explanation of model:

Let total output of the industry is

$Q = q_1 + q_2$ where Q_1=output of firm A

Q_2= output of firm B

Suppose firm A is the leader firm and chooses profit maximization output. Each firm knows market price which depends upon total output in industry. The leader assumes that its rival firm wants to maximize profit as well. Hence, this is an profit maximization problem for rival firm.

Therefore,

$$\text{Max } p(q_1 + q_2)\, q_2 - c_2(q_2)$$

For profit maximization, firm B equates its MR and MC equal.

$$MR_2 = MC_2$$

$$P(q_1 + q_2) + \frac{\Delta p}{\Delta q2} = MC_2$$

When firm B expand its output, its revenue increases as more output at market price. But it further reduces price by Δ p, and hence profit will decrease.

For firm B, quantity follower, leader firm's output is predetermined. In other words, leader firm's output is constant for its rival firm B. therefore,

$$q_2 = f_2(q_1)$$

the above function shows the profit-maximization output of firm B when firm A (leader firm) output is given. This is also called as the reaction function of the firm. Total cost is zero and inverse demand function is given by:

$$P(q_1 + q_2) = (a - b(q_1 + q_2))q_2$$

Hence, profit function of firm 2 is given by:

$$\pi_2(q_1, q_2) = (a - b(q_1 + q_2))q_2 \quad \text{or}$$

$$\pi_2(q_1, q_2) = aq_2 - bq_1q_2 - q_2^2$$

The above two equations gives iso-profits curve for firm B. for firm B profits are constant, hence,

$$aq_2 - bq_1q_2 - q_2^2 = \overline{\pi 2}$$

hence, $MR_2(q_1, q_2) = a - bq_1 - 2bq_2$

for profit maximization, MR = MC

$$a - bq_1 - 2bq_2 = 0$$

by solving above equation, we get reaction curve of firm B:

$$q_2 = \frac{a - bq_1}{2b}$$

Similarly, reaction curve of leader firm can also be derived.

Profit- maximization problem of leader firm is:

$$\max p(q_1 + q_2)\, q_1 - c_1(q_1)$$

where, $q_2 = f_2(q_1)$

hence,

$$\max p(q_1 + f_2(q_1))\, q_1 - c_1(q_1)$$

profit function is:

$$\pi_1(q_1 + q_2) = p(q_1 + q_2)\, q_1 = aq_1 - bq_1^2 - bq_1q_2$$

Again output of firm B depends upon A's output. Hence,

$$\pi_1(q_1 + q_2) = aq_1 - bq_1^2 - bq_1 f_2(q_1)$$

$$\pi_1(q_1 + q_2) = aq_1 - bq_1^2 - bq_1 \frac{a - bq_1}{2b}$$

Hence, above equation becomes:

$$\pi_1(q_1 + q_2) = \frac{a}{2} q_1 - \frac{b}{2} q_1^2$$

MR function is given by:

$$MR = \frac{a}{2} - bq_1$$

As, MC=0

Therefore,

$$q_1^* = \frac{a}{2b}$$

the above equation gives the reaction curve of firm A. putting the value of q_1^* in reaction function of firm B, then it becomes:

$$q_2^* = \frac{a - bq_1^*}{2b} = a/4b$$

hence, total industry output= $q_1^* + q_2^* = 3a/4b$.

In this model, leader behaves differently as in Cournot model. But, this is not sure that leader is producing more output and gets higher profit than its rival. Here, total production is higher and prices are lower but this requires correct market information before making strategy.

Stackelberg equilibrium is stable equilibrium like Cournot equilibrium in a static model but in a dynamic context, the models need to be reconsidered.
To illustrate the Stackelberg model, take an example; assume Firm 1 is the first mover with Firm 2 reacting to Firm 1's decision. Market demand is P = 30 - Q where Q is total output; where Q is total production of both firms: i.e, $Q = Q_1 + Q_2$ and both firms have zero cost of production i.e, $MC_1 = MC_2 = 0$. Find reaction curves and Stackberg's equilibrium.

We calculate Firm 2's reaction curve in the same way as we did for the Cournot Model. i.e,

$$Q_2 = 15 - ½\ Q_1$$

To calculate Firm 1's optimal quantity, we look at Firm 1's total revenues.

$$TR_1 = PQ_1 = (P = 30 - Q_1 - Q_2)\ Q_1$$

$$= 30\ Q_1 - Q_1^2 - Q_2Q_1$$

Given, Firm 1 knows that Firm 2 will act along its reaction curve, which varies with Q_1. Firm 2's quantity very much relies on Firm 1's choice of quantity. Firm 1's Total Revenue can thus be rewritten as a function of Q_1 :

$$TR_1 = 30\ Q_1 - Q_1^2 - (15 - 1/2\ Q_1)\ Q_1$$

$$= 15\ Q_1 - ½\ Q_1^2$$

For profit maximization; $MR_1 = MC_1$

$$MR_1 = \Delta\ R_1 / \Delta\ Q_1$$

$$= 15 - Q_1$$

Given $MC_1 = 0$

Therefore, $15 - Q_1 = 0$

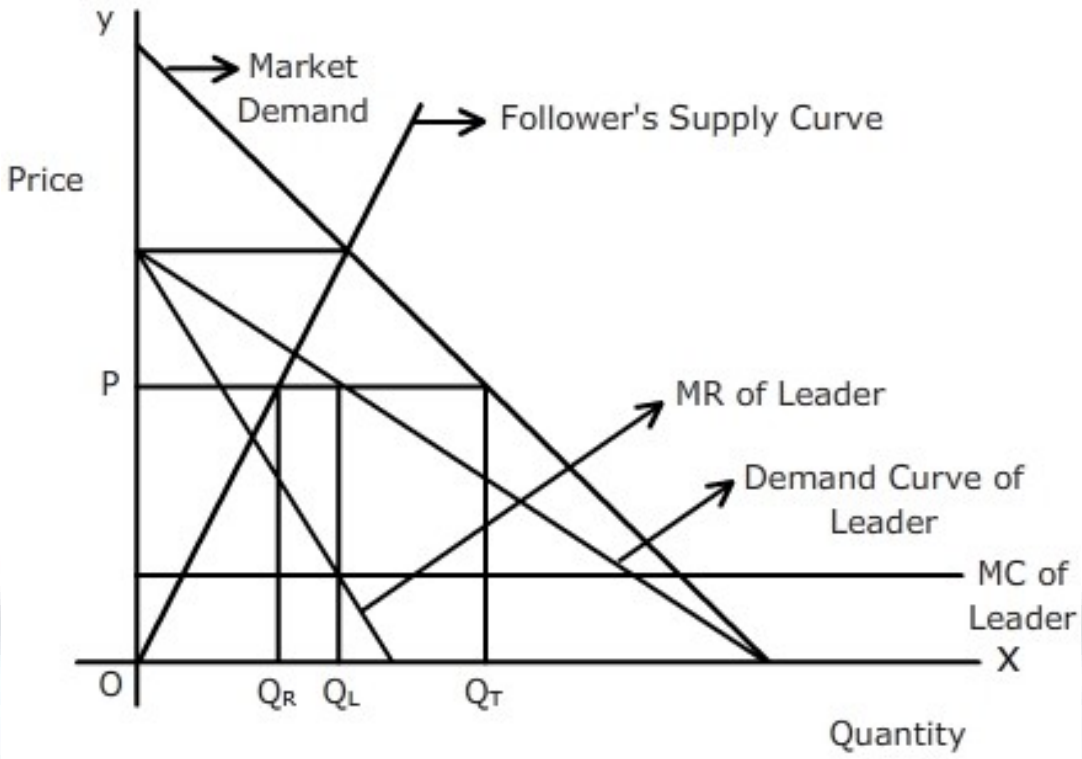
$$Q_1 = 15$$

$$Q2 = 15 - ½ * 15$$

$$= 7.5$$

8. Price Leadership

In this model, leader sets the prices and rivals will follow that prices, i.e, same price is charged by the whole industry. Model assumes that there are two firms producing homogenous products. Here, leader set price where it's MC and MR curve intersects i.e, profit maximization price and chooses its profit maximization output. The other firm is price taker and normally they will not maximum profit at the price set by the leader.



The demand curve facing is the linear residual demand curve which is the difference between market demand curve and the follower's supply curve (as shown in diag 5). Leader equates MR and MC curves and set price 'p' in the market. At this profit maximization price, leader firm sell OQ_L quantity in the market. Follower firm takes and sells OQ_R quantity in the market. The total supply in the market is $OQ_R + OQ_L = OQ_T$. Hence, dominant firm capture larger market share as compare to its follower.

9. Game theory

Game theory is a mathematical tool of analyzing the nature of inter-dependence among the firms. It was developed by Von Neumann and Oskar Morgenstern in 1944. It helps to understand the role of uncertainty in the price and output decisions. Game theory explains how intelligent player interact with each other to achieve their own goals. i.e, the outcome for each player depends upon the strategies of others. In zero-sum games the

outcome of the players confront totally, such that one player's gain is always other's loss. On the other hand, in non-zero sum game, gain of one player is not equal to the loss of another player.

Payoff Matrix

The payoff of a strategy is the net gain of a firm for any opposite strategy of its rival. The pay-off matrix of a firm is a table showing the pay-offs of a firm as a result of each possible pairs of strategies adopted by both of the firms. Suppose there are two firms playing simple game so that each firm has only two strategies. Firm A either produces 1/2 or 2/3 of total output. Similarly, firm B either produces 1/2 or 2/3 of total output. Table below gives payoff matrix of the firms.

		B's output	
		1/2	2/3
A's output	1/2	20, 20	10, 25
	2/3	25, 10	15, 15

A's production is given towards left side of the table and B's production is given at the top. The values given in the table shows the pay-offs or profit of the two firms. If both firm produces 1/2 of the total market output then each firm would gain of $ 20. This is only possible if both firms are operating in cooperation. If firm A starts producing 2/3 of market output then firm A's profit increases to $25 whereas

Nash equilibrium is a set of choices for which each player's choices is optimal, given the choices of the other players.

firm B's profit decreases to $ 10. The reverse is true if firm B produces 2/3 and firm A produces only 1/2 of total output. This is called as non-competitive strategy.

Otherwise, if both the firms produce 2/3 of the total output then profit of each firm will be 15. This is called as Nash equilibrium or Non- cooperative equilibrium. The main motive of Nash equilibrium is to find out best decision when there is no cooperation among the firms.

The Nash equilibrium is similar to the Cournot equilibrium. Here each firm chooses its output level by taking other firm's output as given. Cournot equilibrium point is where one firm is maximizing its profit when other firm strategy is already given and this is also given by the Nash equilibrium.

There are some drawbacks of Nash equilibrium. Sometimes, a game might have more than one Nash equilibrium and sometimes there is no Nash equilibrium in a game.

Mixed Strategies

When each player is making its choice and remains stick to that choice is called as pure strategy. However, sometimes probability is assign to each strategy. For example, if firm A chooses 1/2 output 50 percent and 2/3 output 50 percent of time, whereas firm B chooses 1/2 output 50 percent of time and 2/3 output 50 percent of time. This is called as mixed strategy.

Hence, Nash equilibrium in case of mixed strategy is equilibrium where each player chooses its optimal frequency with to play his strategies given frequency choices of another player.

Prisiner's Dilemma:

Sometimes the Nash equilibrium of a game is not a pareto efficient outcomes. Consider the following example given in Table III:

		Prisoner B	
	A \ B	Confess	Do not Confess
Prisoner A	Confess	6, 6	0, 7
	Do not Confess	7, 0	1, 1

There are two criminals arrested after committing bank robbery but the evidence is not adequate to make robbery charge stand until at least one of them confess. There is lack of communication between them as both suspects are interrogated in isolation. During interrogation both prisoners have been told that no punishment for the suspect who confesses and heavy punishment of 20 years for other. They will be free if both suspects do not confess and if both confess then they will get 10 years of imprisonment. Therefore, both the suspects have two strategies: confess and not confess and they faced with dilemma. The essence of dilemma is that neither criminal knows whether other criminal will confess or not in relation to payoffs shown in matrix but because of lack of communication between them and uncertainty as to the loyalty of other, prefers to adopt second strategy i.e, to confess so that both will get 10 years of sentence. This situation is the best of the worst situations but clearly, this situation is worse as compared to the 'no confession' strategy when both will get freedom. The strategy of no confession is Pareto efficient, remains unstable

Prisoner's dilemma model provides good perspective on strategic behavior in oligopoly. The problem faced by two individuals in prisoner dilemma is similar to the problem faced by oligopoly firms because of interdependence. The best strategy is reached when both firms cooperate. Since, there is an uncertainty of rival action, they each firm would choose opposite strategy.

> Dominant strategy equilibrium is a set of choices for which each player's choices are optimal regardless of what other player choose.

This can be explained with the help of an example given in table IV.

		Firm B	
	A \ B	Advertise	Not to Advertise
Firm A	Advertise	60, 80	100, 30
	Not to Advertise	30, 100	85, 90

Here firm A gets higher profit if it advertise regardless of the choice of firm B. Firm A's profit will be 60 if firm B chooses to advertise and its profit will be 100 if firm B chooses not to advertise. In both cases, firm A will be better off if it chooses to advertise. Therefore, this strategy of firm A, is called as dominant strategy. Similarly, firm B's dominant strategy is to advertise.

If each firm chooses its dominant strategy, then they will choose to advertise. Firm A will get 60 whereas firm B will get 80. If both firms cooperate then they are better off by choosing not to advertise and they will

get 85 and 90 payoffs respectively. Hence one strategy is based on competition and opposite strategy on cooperation. This is called as prisoner's dilemma.

Conclusion:

Due to many reasons, Oligopolistic industry is inefficient and wasteful prices are much higher than marginal cost, which results in under production in the society. Due to strategic behavior of Oligopolistic firms, resources are wasted because of price and market share war. Differentiating products and advertising have been the topics to debate on. Ambiguity over these still remain and prevents us from getting a solution or a specific successful way in which Oligopolistic firm may behave to maximize their profits. Oligopolistic firms are interdependent and hence there is uncertainty to avoid this, firms made a group and jointly decides the price and output of the market. This type of group of firms is called as Cartel, e.g. OPEC (Organization of Petroleum Exporting Countries). When the firms jointly make decisions then they can earn Monopoly profits.

Collusions can be explicit or implicit. When the firms explicitly reached to an agreement then it is called explicit collusions (like Cartels). When the firms end up fixing price without a specific agreement it is called as implicit collusion (like Tacit collusion).

10. Questions for Review

1.Describe the oligopoly market structure and give some examples.

2.What is the essential difference between the Cournot and Stackelberg models?

3.How do reaction curves of the duopolists help in determining the Cournot's equilibrium?

4. What do you understand by Prisoner's Dilemma? Why do oligopolistic firms find themselves in a Prisoner's Dilemma?

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