Managerial Economics
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Lecture - 33
Oligopoly (Contd…)

We will continue our discussion on theory of Oligopoly, typically the Oligopoly form of market structure. And if you remember in last session we discussed, this is the most realistic form of market structure although when it comes to theory and when we talked about the determination equilibrium price and output, it is easy. It is not very certain like in case of perfect competitive market structure or monopoly market structure. So, in the previous session, we discussed about the features of Oligopoly. And one of the significant features of Oligopoly is that when one price one firm decides the price and output, generally they keep in mind that what will be the rival's action with respect to the change in their price and output.

And second is, even if they know that there is interdependence, but sometimes they ignore or they just assume the plan that has to be before and they never consider the revised plan into their action whenever they are fixing up this price and output. The different kinds of models are there on the basis of that how, what is the group behavior of the Oligopoly is. When they collude work for joint profit, generally we call it is a collusive Oligopoly and when they compete with each other on the basis of price or on the basics of non-price, like other factor than price, it is called as non collusive Oligopoly.

And in the context of non collusive Oligopoly, in previous class we discussed about the Cournot models, we discussed about the Stackelberg model, and we also discussed about the Kinked demand curve model. To sum up, we can say that Cournot model is one where two main outcome emerged from there; one is always the individual firm thinks that, they are not the rivals is not going to change their plan with the revised period, but practical that does not happen and that leads to a situation where may be one-third of the market is untapped; it is not being produced or supplied by any of this firm, if it is the case of a duopoly, specifically. And Secondly, the second outcome comes from Cournot model is that when linear demand curve and the cost of production is zero, generally the monopoly output is half of perfect competitive output and duopoly output is two-third of competitive output.

Then, we discussed about the Stackelberg model, and to sum up to Stackelberg model, we can say that it is a leader follower models. Once the firm gets sophisticated, they know that what is the revise plan of the or what is the reaction function of the other firms, how they are going to react to it, and generally they also consider the reaction when they are considering their own price and output plan. And in that process, they become the leader and the other firm has to follow it; but in the long run, if both the firms try to be leader, they get into the price war and in the last firm, it becomes a cartel when they feel that price war is not at all profitable.

Here, to note that oligopolies know that the price war is not going to benefit the benefit the producer or the seller; rather, it is going to benefit the consumer and that is the reason if you look at, they never get into price war and even if they are getting into price war, they stop at a point; they stabilize at a point beyond which they feel that if they are not covering the normal profit what is associated with the product.

Then we discussed about the kink demand curve and kink demand curve talks about two different kind of group behaviors of the oligopolies: One - when one firm decreases the price, other follows it and that is why we get the demand curve as the in elastic demand curve for specific firm. Because when others follow it, there is no more change in the quantity demanded and they have to even… if there is a change in the price, the consumer, they feel that other firm also they have changed their price. So, there is no significant increase in the quantity demanded of that particular firm.

And the second type of group behavior is that when one firm increases the price, other hardly follows it and in that case, the firm encounters a elastic demand curve. So, taking together this inelastic and elastic demand curve with respect to two situations, one increase in the price and second decrease in the price, the firm generally gets a kink demand curve which is kink between two different segment of the elastic and inelastic demand curve.

Corresponding to the kink, since there is a kink in the demand curve we get two level of marginal revenue curve: one with respect to the elastic segment of the demand curve and second with the respect to the inelastic segment of the demand curve. And since there is a kink and we get two kinds of m r curves, in between there is a gap between two m r curves and generally the marginal cost pass through that segment where there is no m r curves and that is the reason, even if there is increase in the cost still the equilibrium price and the output never changes. So, this typical model talks about the price rigidity as a part of the group behavior of the Oligopoly's firm and how generally it affects the how generally it does not affect the equilibrium price and output. So, this is about the price or the non-price competition in case of the non collusive Oligopoly.

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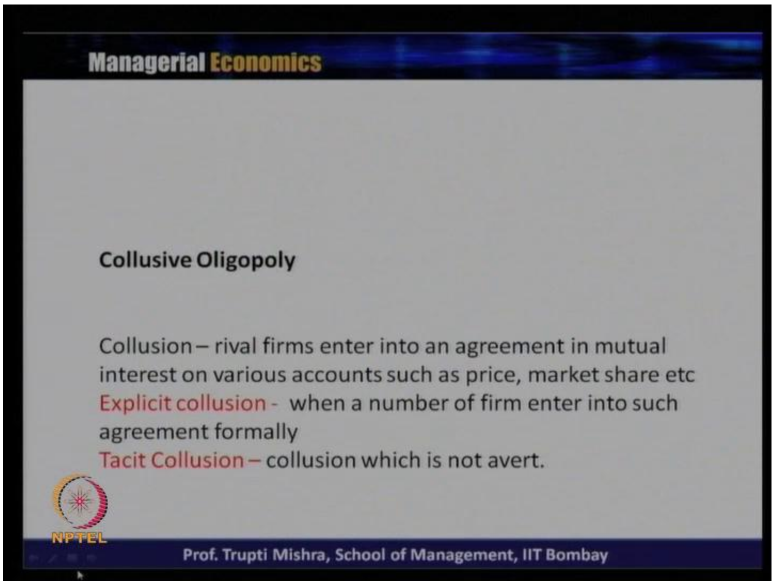

Today, we will discuss about the collusive Oligopoly. We will talk about two kinds of arrangements: one it is a cartel and second it is a price leadership model. In both these cases, it is a case of collusive Oligopoly model where the firms join together in order to maximize the joint profit.

Before getting into the model, let us understand what does it mean when you talk about collusion. So, collusion, when rival firms or all firms or all firms they enter into an agreement in mutual interest on various accounts such as price, market share. So, it is a, in a simple language to understand collusion, we can say it is an agreement where all the firms come together and they jointly decide about what is the price to be followed in the market and what should be the market share.

Two kinds of collusion may happen: One is explicit collusion and second one is the tacit collusion. Explicit collusion is one where a number of firms enter into such agreement formally; and secondly, a tacit collusion is collusion which is not avert, but still they are into the collusion. And why this tacit collusion comes into picture because if you look at it, there is no legalized version of collusion; typically, after cartel if you will find out opaque as a cartel, after that we will find out there is no legal form of cartel exists, whatever the form of collusion exists, that is in the form of tacit form.

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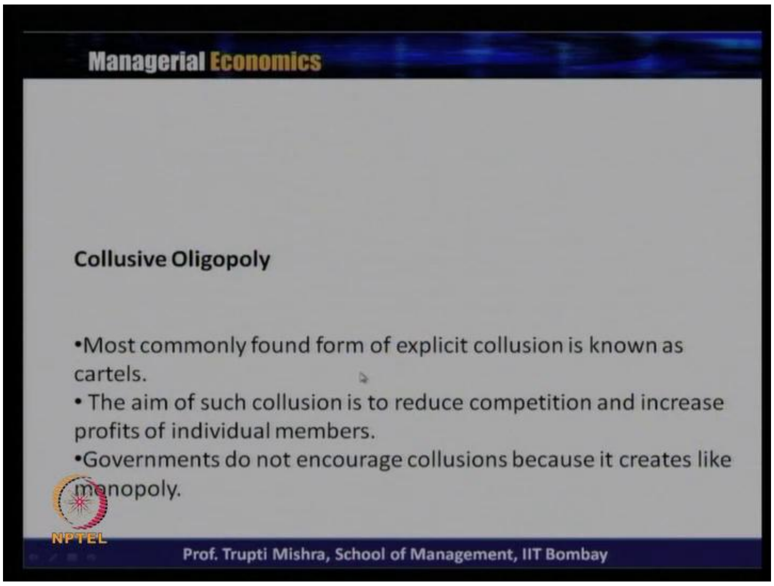

So, one, where formally they agree into collusion, formally they agree into a group and they work together for the joint profit maximization and output maximization and the other one is a tacit collusion where collusion which is not avert. So, most commonly if we will find form of explicit collusion, it is generally known as cartel. So, whatever the commonly found explicit collusion is known in cartel and what is the aim of this kind of cartel? The aim of such collusion is to reduce competition and increase profit of the individual member. So, obviously, when they collude together, work together for the profit maximization, that reduces the competition and increases the profit of the individual member.

So, basically, the individual firms those who were not able to get profit, those who were not able to maximize profit, they were now in a position to maximize the profit because the firms work for the joint profit maximization; they fix up a price which gives at least some amount of profit to each of this firm. Government do not encourage collusion because it creates like monopoly and kills competition and when if there is no competition, that reduces the generation of employment and income and reduces also the innovation. So, explicit form of collusion is generally known as cartel and what is the outcome of cartel? If you look at the outcome of the cartel in the positive segment, it reduces the competition, reduces the competition, and the individual firm generally they get some profit out of it; earlier were not able to generate any amount of profit.

Generally, Government or the authority, they, never encourage this form of cartel or this form of collusion because ideally when the cartel goes for a long period of time, in the long run, they become a monopolist which is not beneficial for the consumer. It reduces the competition; it reduces the innovation; it reduces, also to some extent, the income and employment generation and that is why you will find authority, they, always put a restriction on the creation of the collusion or the creation of a cartel.

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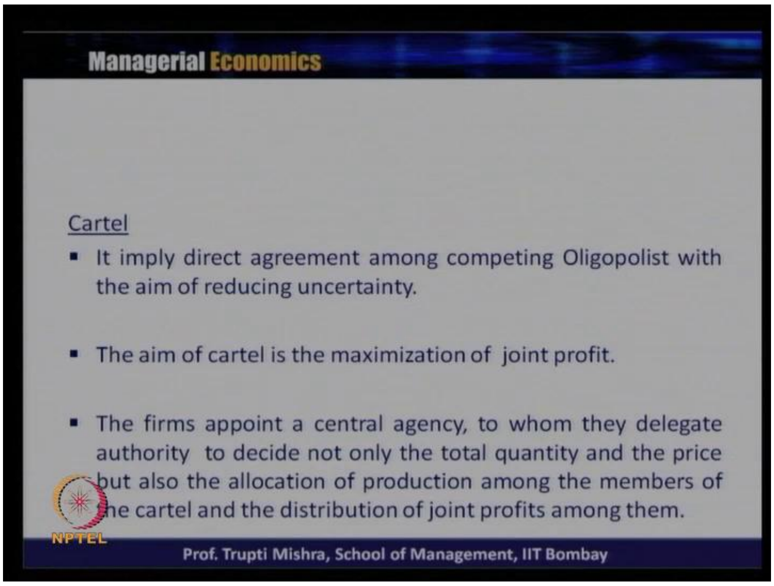

So, cartel, as we know, it is a direct agreement among the competing Oligopolist with the aim of reducing uncertainty. Now, what is the optimization problem for the Oligopolist over here? The optimization problem for the Oligopolist is to reduce the uncertainity. Aim of cartel is to maximize the joint profit. And how do they function? They appoint a central agency to whom they delegate the authority to decide not only the total quantity that is the output, the price, but also the allocation of production among members of the cartel and the distribution of joint profit among them.

So, the aim to form the cartel is to reduce uncertainty; objective is to maximize joint profit. And how do they function? They generally appoint the central agency in the consultation with all the firms. Whom they consider as the central agency and what is the role of central agency? The central agency decides: what should be the total market output, who should produce how much, what should be the total, what should be the price charged for the product, and also when the industry as a whole, market as a whole, they are getting profit, how it has to be distributed among the individual firms. So, the role of central agency is to decide about the price, output, and market share of the different firms and also how the distribution of the joint profit will take place between the different firms.

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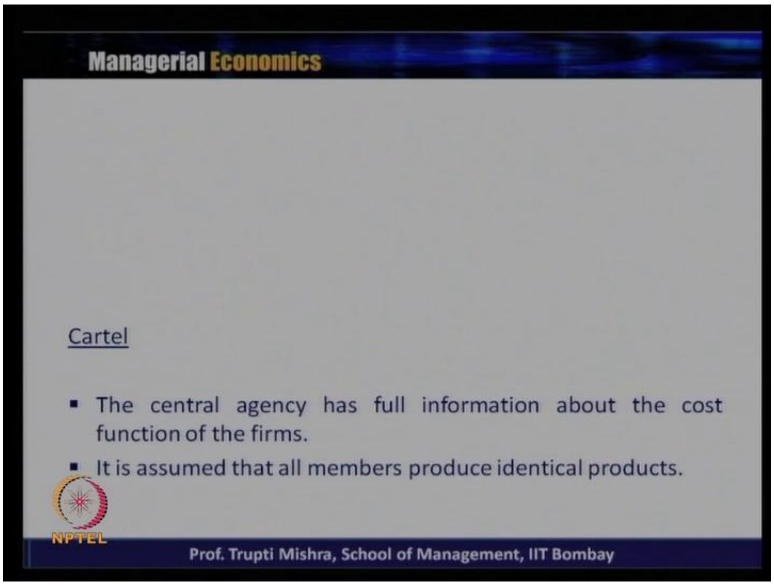

Now, what is the prerequisite for here to the central agency? The prerequisite for here if the central agency is they have full information about the cost function of the firm. How it helps when we talk about the cost function of the firm? How it helps because if they know the cost function, accordingly they will look at how much amount they have to produce by each of this firm. So, it is assumed that all members produce the identical product because if they are producing homogeneous product, the difficulty again comes here that who should produce which kind of product.

And since we are assuming here that, typically in case of cartel, this is assumed that all the firms, they produce the identical product and the central agency; they have the full information about the cost function of the individual firm: which one is high cost firm, which one is the low cost firm, who which firm is operating in which stage of the average cost, the firm is whether they are operating at the decreasing portion of the average curve, they are operating at the full capacity, they are operating at the minimum cost of the average cost, or they are operating at the increasing portion of the average cost curve.

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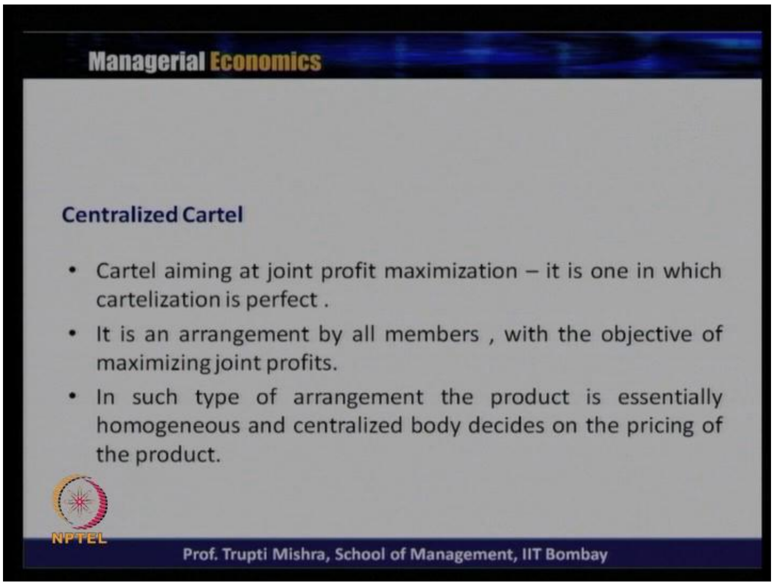

So, cartel aiming at joint profit maximization: It is one in which cartelization is perfect. So, we call about a perfect kind of cartelization where cartel made joint profit maximization. It is an arrangement by all members with an objective to maximize the profit and in such type of arrangement the product is essentially homogeneous. centralized body decides the pricing of the product.

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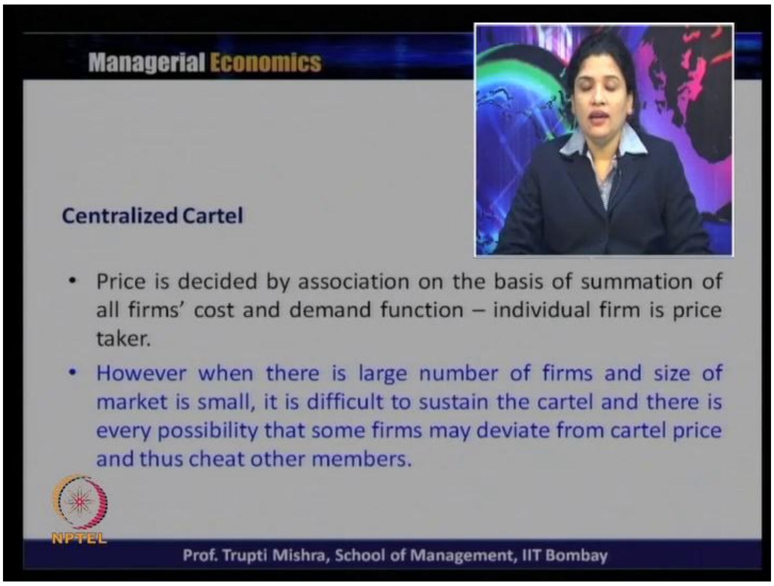

Price is decided by the association or the central agency on the basis of the summation of all firms' cost and demand function. And in this case, individual firms - they are not the price maker; individual firms they are the price taker. What price they take? They take the price that is decided on the basis by the central agency on the basis of firms cost and demand function. However, when there are large numbers of firms and size of market is small, it is difficult to sustain the cartel and there is every possibility that some firms may deviate the cartel price and thus cheat other members.

So, when the market size is small and there are large numbers, when it comes to the allocation of the production, generally it becomes very insignificant. And in this case, generally people, the firms they get motivated to charge a different price and cheat other firms. In that way, generally the cartel never sustains for a longer period of time because till the time that agreement is there; the trust among the firm is there that everyone has to, everyone is just following the central agency guideline regarding output and the price; till that time cartel will sustain; otherwise cartel will not sustain.

So, we will see that graphically. When we talk about the summation of the cost and revenue decides the price or they identify the price or they find the price on the summation of the marginal cost function and the revenue function, we will see that how this price is decided, how the price is going to be followed by both the both the firms or may be the number of firms in the market and what is the allocation, how the allocation takes places on that basis and what is the profit.

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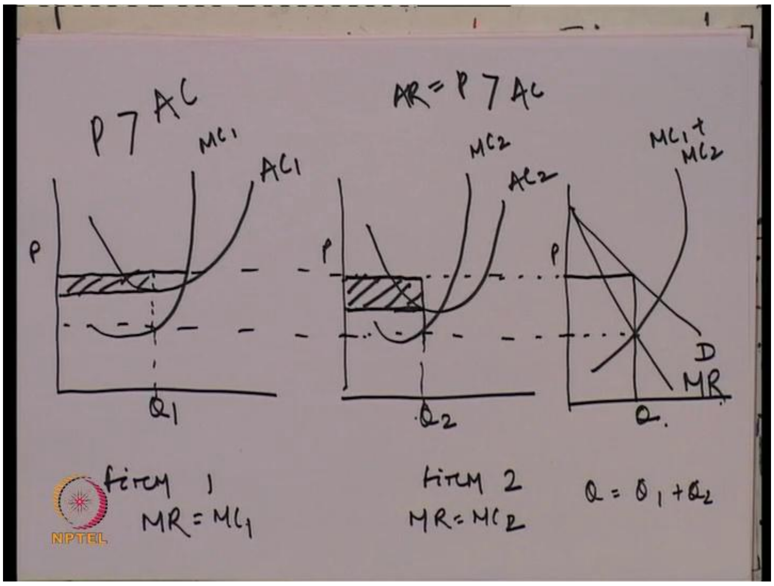

So, we will just have a graphical explanation of this entire cost and output determination or the price and quantity determination in case of a centralized cartel. So, we will just take a case of a duopolist to make it simple to understand. So, this is the demand curve; this the marginal revenue curve; this demand curve is the demand curve for the entire firm; marginal revenue curve is the summation of the marginal revenue curve of all the firms. This is the marginal cost function which is summation of marginal cost 1 and marginal cost two.

And how the price is determined in the market? We take the point where marginal cost is equal to the marginal revenue leads to the of equilibrium price or equilibrium output; so this is the Q and this the p; same p is going to followed by both the firms. So, this is the price that has to be followed by both the firms. So, we can call this is firm 2..

And firm 1 now, we get the average cost function for firm 1 and we get the cost function for firm 2. Then we get the marginal cost function for 1. We get the marginal cost function for 2. Now corresponding to this, we look at this M R. How this marginal cost function for the individual firms generally and on that basis we can find out what is the output level. So, output level is q 2 here; output level is q 1 here; this is the price; this is the price (Refer Slide Time: 16:25).

So, price is decided on the basis of marginal revenue and marginal cost and in order to identify the quantity because whatever the price determined, that is followed by both the firms. Now, how the output will be allocated? Output will be allocated on the basis of the marginal revenue and marginal cost to 1; that will give the output level for firm firm 2. This will be the output level for firm one.

So, this in that following this, we get q 1 is the level of output for firm 1 and q 2 is the level of output for firm 2 and q is q 1 plus q 2. So, how it happens in case of a profit maximization or a cartel aiming at profit maximization? The price is decided on the basis of the marginal revenue and marginal cost, and that price is followed by all the firms in the market. Here, specifically we have taken the example of duopoly to make this understand simple and on the basis of the marginal revenue and marginal cost of the specific firm we are finding out the level of output.

Now, what happens when this price is followed and this output is being produced by it? Now, in this case, this is the price. And corresponding to this level of output, what is the cost? The cost is this much because this is the average cost; this is the price. So, since corresponding to this level of output, average revenue or price is greater than average cost the firm gets this much amount of the profit.

Similarly, for this level of output, this is the average cost; this is the price. So, in this case also, price is greater than average cost and that is why the firm is getting profit. So, whether it is a case of high cost firm, that is compared to both the firm if you look at, firm 1 is the high cost firm and high cost firm still they are getting some amount of the profit and firm 2 they are low cost firm as compared to firm 1 and they are also getting the profit.

So, the basic objective of the cartel gets fulfilled here that even if the cost function of the firms in the cartel they are in the different they are in the different kind of cost function or they are in the different level, but when it comes to the maximization of the joint profit, all the firms at least get some amount of the profit. We will just take a numerical to understand this, that how this joint profit maximization happens. You are taking a specific demand function and cost function of the firms.

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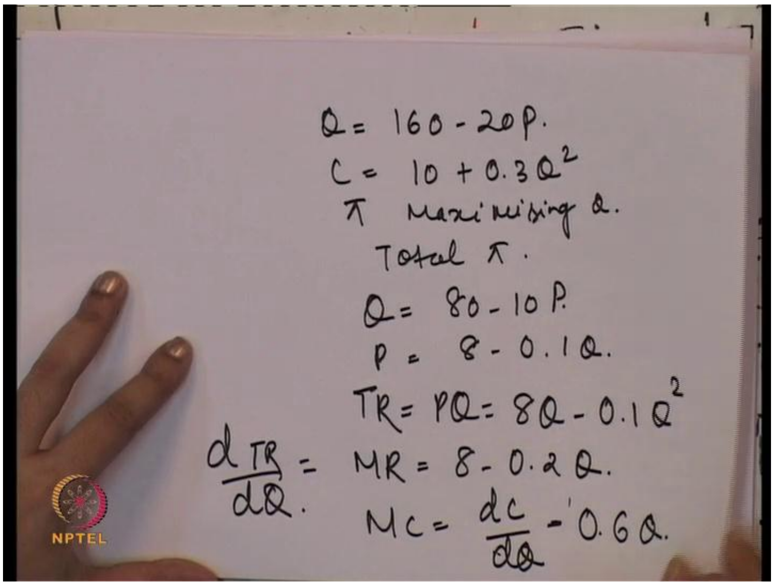

So, q is equal to 160 minus 20 p and c is equal to 10 plus 0.3 q square. Now, we find how, what is the profit maximizing output and what is the total profit. So, we can find out q is equal to 80 minus 10 p; so we can get p is equal to 8 minus 0.1 q. Total revenue is p q; so we get 8 q minus 0.1 q square. Marginal revenue is 8 minus 0.2 q. So, marginal revenue is nothing but d t r with respect to d q and marginal cost is d c with respect to d q; so that comes to 0.6 q.

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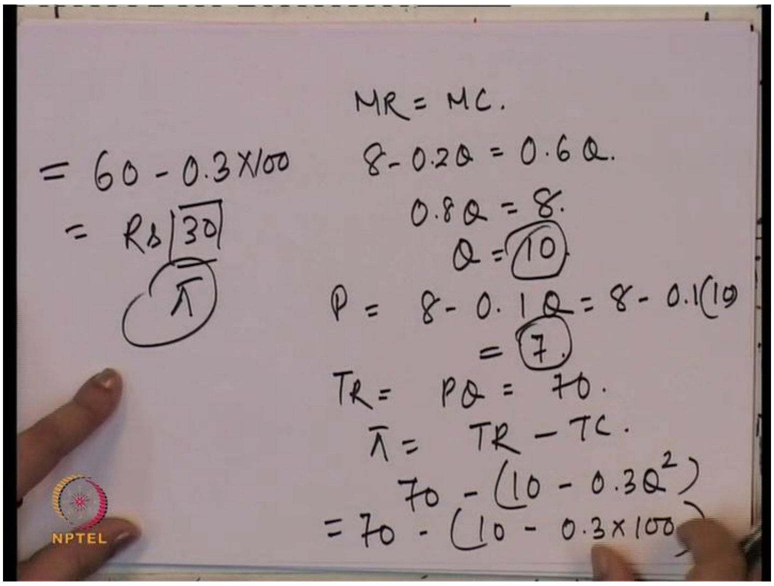

Now, to find out the profit maximizing level of output, we need to follow the MRMC rule. So, MR has to be equal to MC. So, 8 minus 0.2q is equal 0.6q. Simplifying this, 0.8 q will be equal to 8 and q will be equal to 10; so p is equal to 8 minus 0.1q. So, 8 minus 0.1 10 and that comes to 7 and total revenue is pq. So, it has to be 70. Profit is total revenue minus total cost; so 70 minus 10 minus 0.3q square. So, this is 70 minus 10 minus 0.3 multiplied by 100; so that comes to 60 minus 0.3 multiplied by 100; so that comes to Rupees 30. So, this is the profit, this is the price and this is the quantity.

So, now, what are the problems in case of centralized cartel or any form of the cartel? The basic aim is to maximize the joint profit and that they do by finding out a price on the basis of the marginal revenue and marginal cost, assessing the total cost function and total revenue function for all the firms. Now, what may be the problem when you if they are estimating the summation of the total cost or when they are estimating the summation of the total revenue for all the firms?

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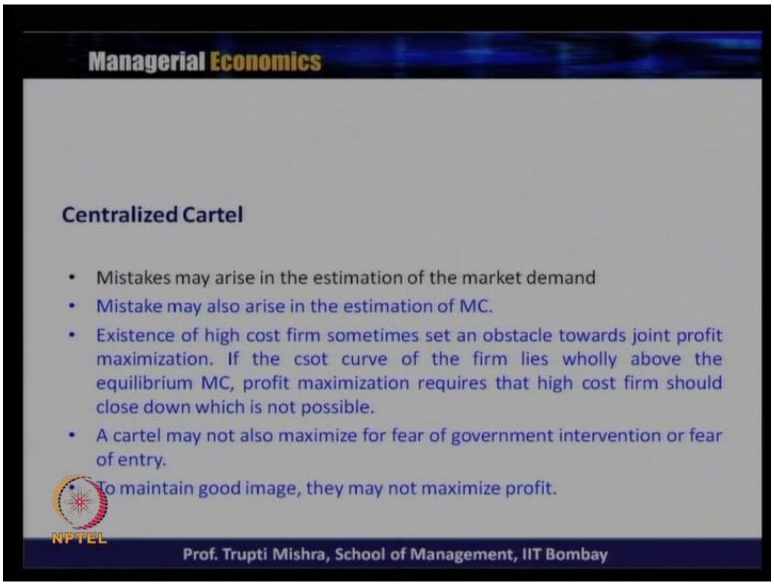

So, there may be a potential problem that there is may be a mistake may arise in the estimation of the market demand. It may also arise in the estimation of marginal cost. And whenever there is an existence of high cost firm, sometimes it sets an obstacle towards the joint profit maximization and if the cost curve of the firm lies only above the equilibrium marginal cost, profit maximization requires that high cost firm closed down which is not possible.

So, a cartel may not also maximize for fear of Government intervention or fear of entry; that is one more potential problem. And also sometimes the cartel to maintain good image, they may not maximize the profit. So, one is fear of Government; second one is to maximize the profit. And they feel that it is not going to create a good image for them and that is why they do not maximize the profit. Sometimes they feel that when they are maximizing the profit, when they are getting super normal profit, other firms may enter into the market. So, to make this is a entry barrier, they generally charge a low price and they do not maximize the profit. And also fear of Government regulation, they generally do not maximize the profit. So, as a whole, when the basic objective is to maximize the profit, but there are certain problems or certain inherent problems where the cartel, typically the Oligopolist, they are not maximizing the profit.

Now, we will come to the other type of market that is market sharing cartel. So, in a typical explicit collusion, one is cartel where it is a centralized cartel maximizing at the joint profit, then we have market sharing cartel, and here generally the collusion is to share the market and that is on the basis of the agreement on quota or some other basis on the geographical basis. In that case, they may charge same price; they may charge different price.

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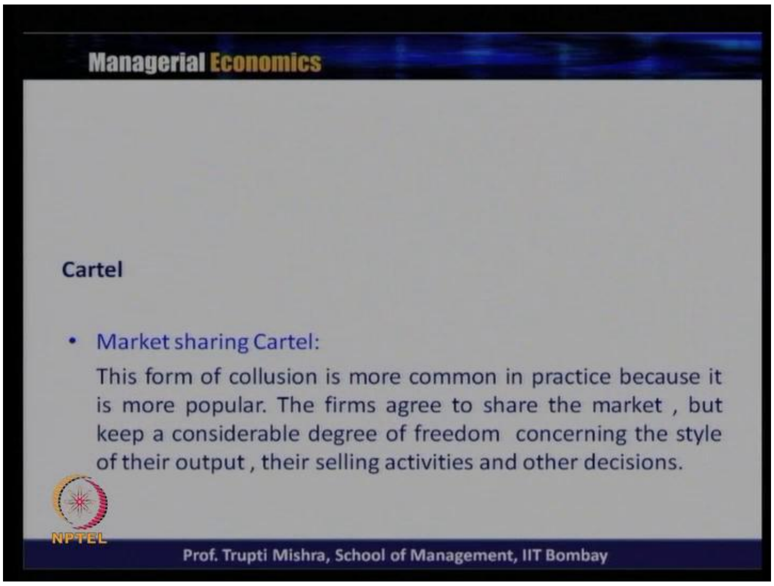

So, in case of market sharing cartel, if you look at this form of collusion is more common in practice because it is more popular. The firm agrees to share the market, but keep a considerable degree of freedom concerning the style of their output, their selling activity and other decision. So, they share the market, but still they keep some amount of freedom on the basis of their selling activity; how they are styling their output or may be some advertising advertisement strategy; they want to keep some freedom about that. So, they share the market, but they are they are also having some freedom when it comes to market their product; whether its selling whether its advertising or whether it is the presenting style of their output.

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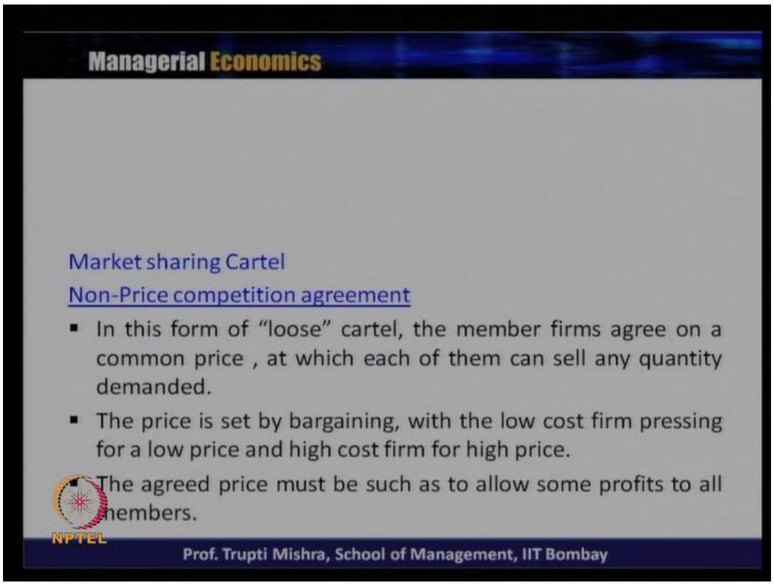

So, market sharing cartel, is again, it has two kinds: One is non-price competition agreement and second is market sharing sharing on the basis of the quota. So, in the typically the first kind where market sharing cartel when there is a non-pricing agreement competition agreement, in this form it is a loose cartel generally; the member firms agree on a common price at which each of them can sell any quantity demanded. So, member agree on a common price and there is no restriction that what quantity, what they are going to sell in the market.

Generally, this is known as a loose cartel because... We will see why this is considered as a loose cartel bit later after looking at the characteristic of a cartel in case of a non-price competition. The price is set by bargaining low cost firm pressing for a low price; high cost firm pressing for a pressing for a high price. So, the strength of bargaining decides how the price is going to be formulated. So, always the low cost firm, they press for a low price and high cost firm they press for a high price. The agreed price must be such that it allows some profit to all the members. So, whatever is the price decided by the market, at least it should give some amount of profit to both the high cost firm and the low cost firm. So, it has to be agreed commonly by both the high cost firm and low cost firm so that they get some amount of profit.

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The firms generally they agree into the fact that they are not going to sell at a price below the cartel price. Whatever the price decided by the cartel, they are not going to sell before below any price below the cartel price; however, they are free to vary their style, their product, and their selling activity because they have some amount of freedom over there.

So, here the firm they are, even if they are in the collusion, they are competing on a non-price basis. Then what is non-price basis here? Non-price basis is when they are competing with each other on the basis of style of their product, their selling activity; may be it is even if they are the same, even if it is a same price, when the output pricing style is different, the consumer may get attracted to may be the firm 1 or firm 2 where in particular case they like the product.

By keeping their freedom regarding the quality, appearance of the product, as well as the advertising and other selling policy, each firm hopes that it can attain a higher share of market. So, even if they are charging the same price, they always feel that, since there is a freedom regarding the quality and appearance of the product, their selling activity and also with respect to the advertisement and selling policy, they always feel that they can attain a higher share of market, they can attract the consumer through all this non-price factor and they will capture a higher share in the market.

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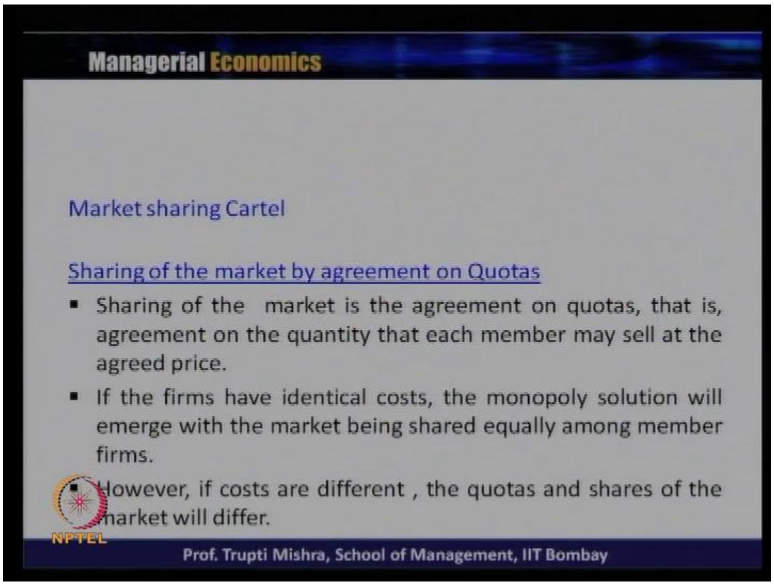

So, here if we look at, collusion is only on the basis of the price; for rest of the activity, there is no collusion; they can compete with each other on the basis of non-price factors. Then the second case, when the sharing of the market is on the agreement of the quotas; so here it is not non-price competition; here the market is share on the basis of the agreement on the quota. So, sharing of the market on the basis of agreement and quota is agreement on the quantity that each member may sell at a agreed price.

So, price is decided; there is a cartel price. And what is the again what is the collusion here? One is with respect to the price and second is what quantity each member is going to sell. So, here the collusion is with respect to price and also with respect to the market share. So, if the firm has identical cost, the monopoly solution will emerge with the market being share equally among the member firm. How this will become a monopolist if there is a identical cost, there are 10 firms in the market? 10 firms come into collusion and they decide two common things: one - what is the price to be followed in the market and second - what is the total quantity they are going to sell in the market.

So, if the entire market is divided into 10 segments and if they are going to continue that for a longer period of time, that segment one is by firm 1, segment two is by firm 2, segment n is by segment n. So, that segment 1 becomes in the segment 1 firm 1 become a monopolist because there are no competition for segment 1. Segment 10 firm 10 becomes monopoly because there is no competition, competitive firms entering into the segment 10. So, in long run generally monopoly monopoly solution emerges in case of a sharing a market on agreement on quotas or agreement on the quantity.

However, if the costs are different, the quota quota and share of the market will differ and this quota is not uniform or the share of the market is not uniform. Basically, the low cost firm they will get a higher share and the high cost firm they will get a lower share because low cost firm is attaining the cost efficiency; they can produce a higher amount of the output at a lower cost. So, they will always bargain for a highest market share and they can get the profit through the more market share rather than the increase increase or decrease in the price because of price cartel price is remain cost and all the firms, they have to follow it.

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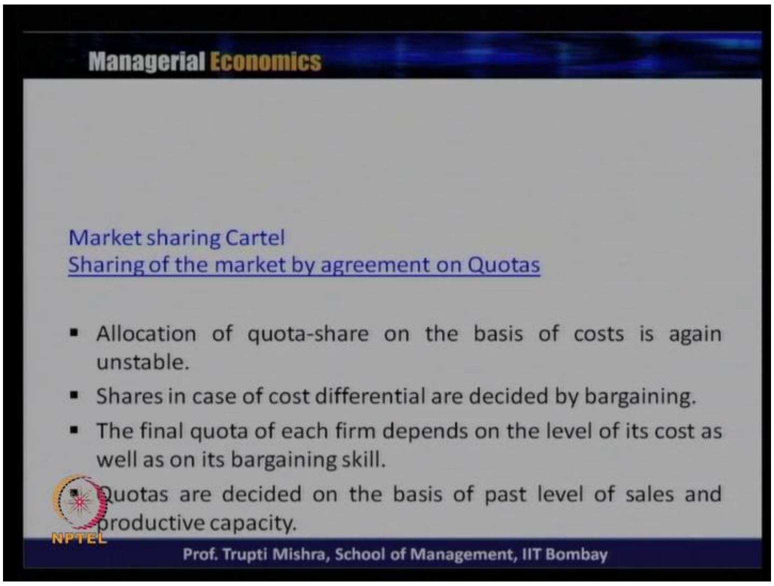

So, in this case, when the allocation is done, the allocation of quota or the share on the basis of the cost is again unstable. So, if we look at, if it is identical cost, the share is all right, if the allocations are equal. But if it is not uniform cost, if the cost differential is there, generally this share on the basis of cost is again unstable, because in the time in the deferent time period the possibility is that the cost function of the firms will change. The high cost firm in a long run they may become the low cost firm and if the allocation is on the basis of the cost, it may not suite them or they may not like to be the part of the cartel.

So, share in the case of cost differential are decided by bargaining and the final quota of each firm depends on the level of its cost as well on its bargaining scale. So, when it comes to the final share, what the market should get or what the firms should get individually, that depends up on the bargaining skill. So, one is the cost function; second in second one is that what is bargaining skill of the firm? If the bargaining skill of firm is good, they get a higher share and if even if they have a good cost function, if the bargaining skill is less, generally, they get a lowest market share.

So, there are two factors here to decide the market share. It is not solely on the basis of the cost function; also, it is on the basis of the bargaining power of the firm. The quotas are again decided on the basis of the past level of sales and their productive capacity. So, productive capacity is decided on the basis of the cost function and the cost function and how cost effectively they are producing, and second is what is their past level of sales. They generally look at the trail of the sales; what they have done in the previous years because that gives the credibility of the firms to produce and sell in the market. So, the when the market share is decided for the different firm, the cost function, how productive is that firm, what is their past level of sales because that gives the credibility of the firm in the previous period, and also what is the bargaining skill of the firm.

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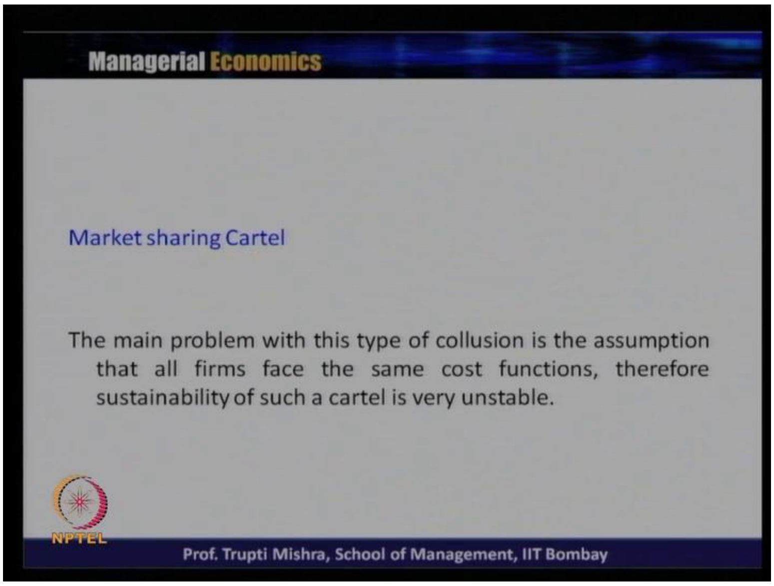

So, on this factor, on this by on this basis of this factor, generally, the share of the market is decided, but what is the main problem with this kind of collusion? The main problem with this of collusion is that all the firms, they face the same cost function. Therefore, the sustainability of such cartel is very unstable because as we are discussing before couple minutes that the cost function cannot be identical for all the firms, because all the firms they have entered into the market in the different time period. So, some of them, they are operating in the short run; some of them operating in the long run. Those who are operating in the long run, if you look at, they are almost started to operating as the low cost firm because they have achieved the economy of scale through the scale operation, but those who have entered it later, they will always operate it at a high cost firm.

And also about the productivity of the firm, that decides that what type of cost function they are operating. So, when the sharing is on the basis of the cost, it remains unstable and this cannot be, this cartel cannot be sustained for a longer period of time. Then we will see, we will just a graphical explanation of this market sharing cartel and then we will discuss few factors which which talk about that; what is the requirement or what generally goes wrong if the cartel is not sustainable for a longer period of time .

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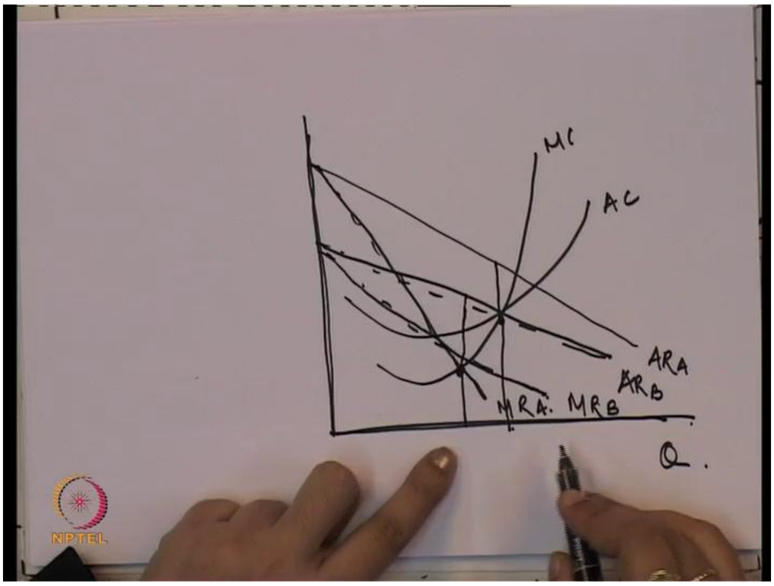

We are assuming a case of duopolist here, for graphical explanation in case of market sharing cartel. This is our marginal revenue for the firm A, this is the average revenue of B and correspondingly we also get the marginal revenue of B. So, average revenue A and marginal revenue A is the average revenue and marginal revenue for firm A; average revenue B and marginal revenue B is the average revenue and marginal revenue for firm B. Then we will look at the average cost which is common to the firm, common to both the firms because we assume the identical cost and we look at the marginal cost function and we will identify two points where marginal cost function is marginal cost function is intersecting the marginal revenue function.

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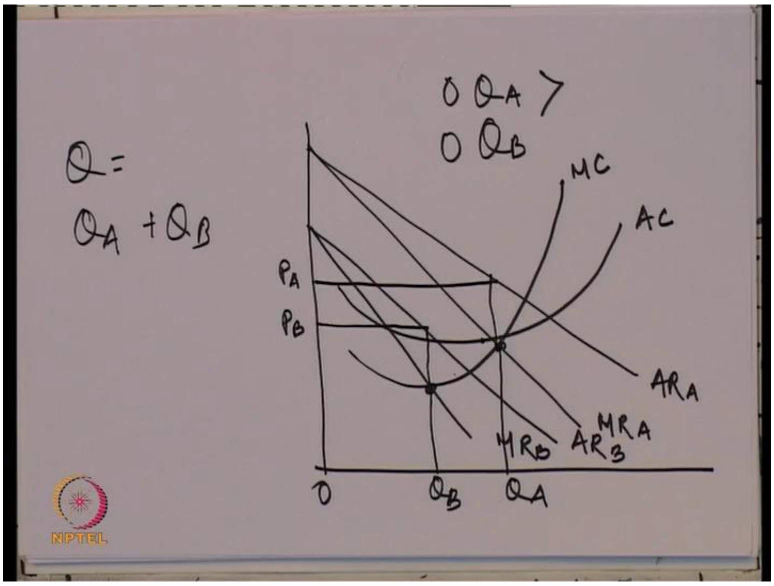

So, correspondingly we get two points and also the two levels of price. So, we get this is marginal revenue of A. We will just change the figure; its looks a bit clumsy; we will just start it fresh. So, we have average revenue of A. We have marginal revenue of A; then we have average revenue of B; we have marginal revenue of B. We have the average cost which is common to both marginal revenue and common to both firm A and firm B. Then we have marginal cost which is again common to firm A and B.

We will now identify two points: one where marginal cost is equal to marginal revenue A; second, when marginal revenue is marginal revenue is equal to marginal cost is equal to marginal revenue of B. Correspondingly we get one B here price and we also get one more price that is on the basis of the marginal revenue of A. So, this is price A; this is price B. So, if you look at, here this is Q B here it is Q A. So, firm A is producing Q A firm B is producing Q B; the total output is equal to Q A plus Q B.

Now, same cost function, but if you look at, firm A is producing more than firm B. Why it is producing more as compared to B because it is at a different cost function, it has a different revenue function as compared to the B; so cost function is same; identical cost function. On the basis of their bargaining skill, on the basis of the past level sale, on the basis of their productive capacity, they are producing a producing a higher level of output, as compared to the lower level of output.

Now, this price if you look at, price is again two different levels. So, this may be the price will come in between that is P A is the price decided by firm A; P B is the price decided by firm B, but neither P A or P B can be the cartel price; the cartel price has to be decided on the basis of bargaining power of both Q A and Q B, and the cartel price is such that at least it will get some amount of profit. So, market sharing cartel is one, where it is, the share is on the basis of the share is on the basis of the productive capacity of the firm, the cost function of the firm, and what is the bargaining power of the firm.

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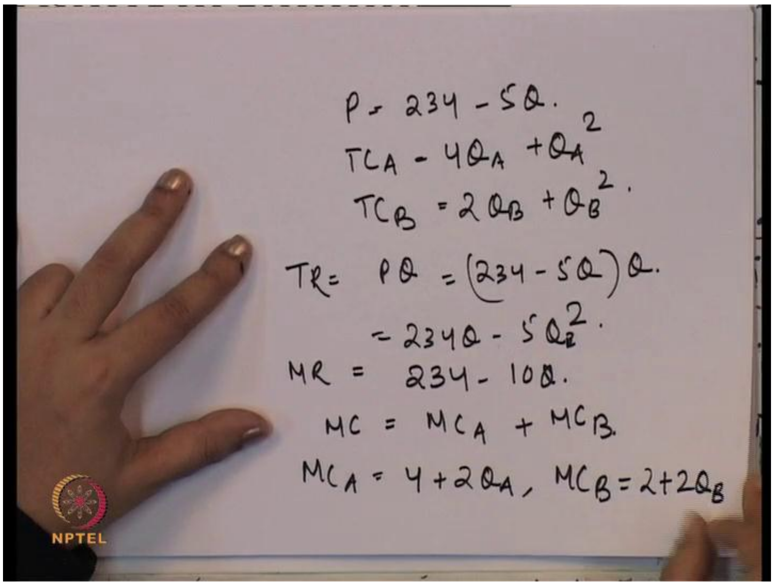

Then, we will take a numerical to understand this market sharing cartel. This is the demand function. We will take a separate function cost function here for Q A plus Q A square, this is 2 Q B plus Q B square; total revenue should be equal to P Q. So, this is 234 minus 5 Q multiplied by Q. So, that comes to 234 Q minus 5 Q square and marginal revenue is equal to 234 minus 10 Q. Then will find out the marginal cost; marginal cost, ideally it should be equal to marginal cost A plus marginal cost B. So, marginal cost A is marginal cost marginal cost A is 4 plus 2 Q A and marginal cost B is 2 plus 2 Q B.

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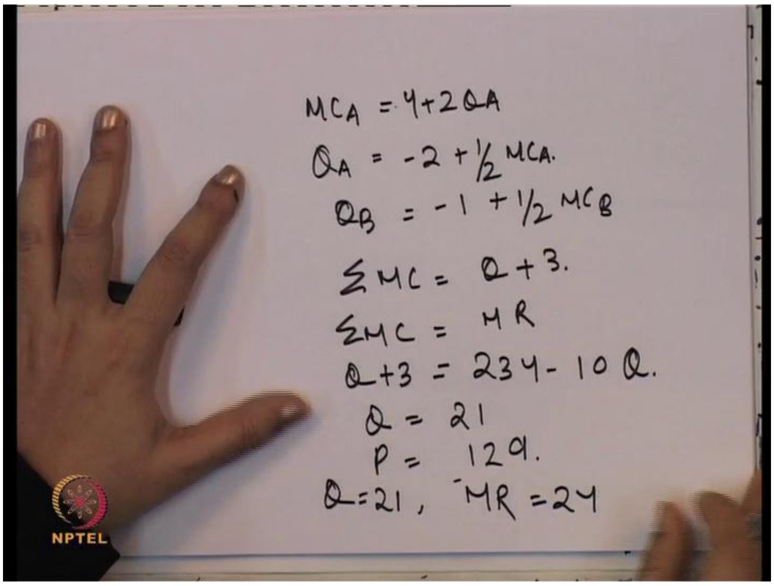

So, we have marginal revenue, we have marginal cost 1 and marginal cost 2. We can find out the total marginal cost by taking the summation marginal cost 1 and marginal cost 2. Then we can equalize with M R to find out the output level, to find out the price and also to find out what is the output level of both the firms. So, if M C A is equal to 4 plus 2 Q A, then Q A can be equal to minus 2 plus half marginal cost of A; Q B equal to minus 1 plus half M C B and since marginal cost is equal to this 2. So, this has to be Q plus 3 and equalizing marginal cost equal to the marginal revenue Q plus 3 is equal to the marginal revenue which is equal to the 234 minus 10Q, what we have calculated earlier. So, will get Q is equal to 21 and p is equal to 129; so Q is equal to 21; M R equal to 24.

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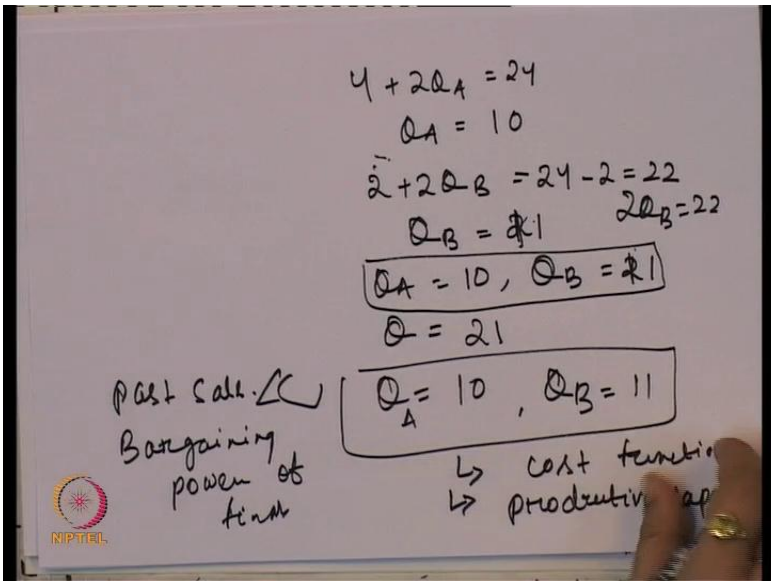

Then, we will find out the marginal cost of A and marginal cost of B equal to M R. So, 4 plus 2 Q A is equal to 24; Q A equal to 10; similarly, for marginal revenue, marginal cost B, we will find marginal cost which is 2 plus 2 Q B which is equal to 24 and Q B is equal to 21. So, Q A is equal to 10, Q B is equal to 21 and Q equal to as whole… this is Q B equal to Q B equal to 11 because this is 24 minus 2 is 22; so 2 Q B is equal to 22; Q B equal to 11. So, if Q B is equal to 11 and Q A equal to 10, then Q A plus Q B has to be equal to 21. So, now, if you look at, Q A is just producing 10 and Q B is just producing 11, but still they are in the same cartel because they are agreed to share their market, and so Q A will go producing 10 till the time the revised output plan is not there from the cartel and Q B is going on producing 11 units.

And how they get 10 units or 11 units? This is again on the basis of their cost function, at what cost they are operating, on the basis of the productive capacity and also on the basis of their past sales, how much they have sold in the last time period and also in the main important is the bargaining power of the bargaining power of the firm. So, if we look at, the market sharing cartel is one where there are the two types of market sharing cartel: one is non-price competition and second is marketing share on the basis of the agreement on the quota. So, in the case of non-price competition, they generally compute each other on the basis of non-price because they have the common price is agreed, the cartel price is agreed by all the firms, but they have some freedom with respect to the style of the output, their selling activity, advertisement. So, some activity which is non-price factors there, they have some freedom regarding that. So, generally they will compete on the basis of the non-price factors in case of the non-price competition, and whatever the price decided on by the market that has to be same.

The second case, where there is a market share on the basis of the quota by different firms, the quota is decided on the basis of the cost function, on the basis of the productive capacitive of the firm, on the basis of the bargaining power, on the basis of that on the basis of that typically what is the past level they have, what is the past experience in selling the product. And on that basis when the quota is decided, generally it leads to monopoly kind of situation in the longer run because the same person is get by sold by the or get capture by the similar of firm for a longer period of time, and that leads to a monopoly situation in that segment, because it is a since this is a common agreement that that share is given to typical firm; none of the other firms will enter into the market even if that firms is getting a super normal profit or the environment of the market is conducive for the other firms to enter into the market.

So, in case of collusive Oligopoly, we discussed two kinds of models; one is cartel and second one is the second second is cartel, and in the case of cartel we got two type of cartels; one is centralized cartel and second is the market sharing cartel. Let us discuss that why the cartel is not considered legal and why cartel is, particularly if we look at, why it never sustain for a longer period of time.

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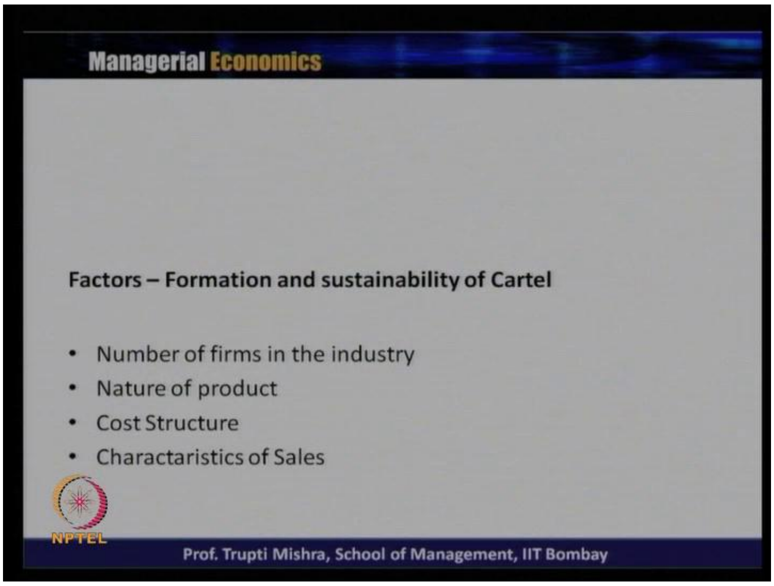

There are some factors that generally contribute to the formation and the sustainability of the cartel; the first factor - the number of firms in the industry. If there are more number of firms in the industry, generally forming a cartel and also the sustainability of the cartel is also questionable because a small group can work together; a large group working together is difficult because they operate in the diverse conditions when it comes to demand, when it comes to revenue, when it comes to cost, when it comes to their inputs, when it comes the raw material.

So, since there is diverse conditions emerge from the large number of firms in the market, when the number of firms is more in the market, forming the market and even sustainability of the cartel is also difficult. Then second factor for the responsible for the formation in sustainability of cartel is the nature of the product. If the nature of the product is homogenous, generally the cartel goes for a longer time period, and, but if the nature of product is not homogenous, if it is different from each other, in this case generally again forming the cartel is difficult and also sustaining the cartel is also difficult.

Cost structure: If it is in the same range, it is uniform range, again formation is easy and the cartel will sustain for a longer period of time, but if the cost function are different and they have to accept a price what is decided by the cartel, generally the cartel goes into the loose end because the high cost firm always feel that the difference between the price and cost of production which is getting narrow down and they will try to cheat the other firm in the market and they will try to sell their product a higher price and with the some product differentiation and that is why the cartel may end.

And also it may happen that some low cost firm, if the price is set on the basis of a higher deference between the cost of production, and cost of production and the price, they generally try to break the cartel price and sell it at a lower price so that they can get a good amount of market share and which will maximize the profit. Then last factor is the characteristic of sales, and characteristics of sales depends on what kind of sales of this product or what is the activity followed or what is the strategy followed; that leads to the formation and also that will decide what is the sustainability of the cartel.

Till now, if we look at, there is only one legalized form of cartel in the world economy and after that you find there is number of tacit collusion, but when it comes to explicit collusion, it is not legal; may be company they form, they collude, they form a cartel, but that is not explicit, rather that is tacit, but the one one example, till now that is valid in case of explicit in case of collusion is the opaque that is organization of petroleum and petroleum of producing country.

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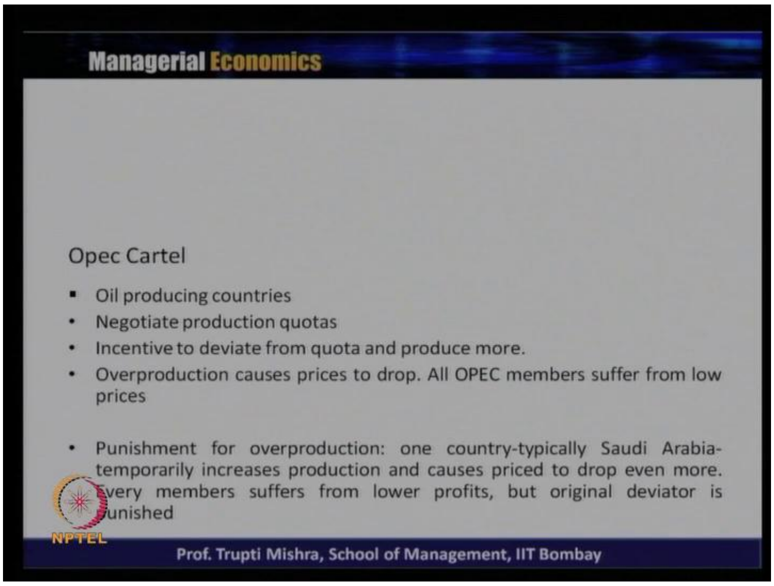

And this cartel is generally the group of people, those who are producing the oil. These are oil producing countries; they form a cartel; they negotiate on the production quotas. Typically, it is market sharing cartel and there is an incentive to deviate from quota and produce more in the form of market, in the form of cartel to found that there is a incentive to deviate from quota and produce more and that leads to the factor there is over production, over production in the market which reduces the price. All though OPEC members have to suffer the low price and generally the cartel broke over there. So, initially, the cartel was formed as a market sharing cartel where all though firms there will never share the quota and they will only produce that much amount of the oil.

But in the longer run, it happens that there will, there was incentive deviate from the quota and produce more. And some of the members, when they followed that, and when the member they followed that, that lead to over production. And over production, whenever there is a overproduction, that leads to the mismatch within the supply and demand; that lead to the drop in the price.

As a whole, all the OPEC member has to suffer the lower price and that is the time the cartel actually broke down. OPEC, as famous cartel is OPEC, that has broken down and the punishment for over production is one country, typically in Saudi Arabia, temporally increased a production in cost and price to drop even more; even member, suppose lower profit and the original deviatory is punished.

So, at the end, may be the punishment is different part, at the end the cartel did not continue. The cartel could not sustain because of the group behavior of the firms; Oligopolies firm in the cartel. They did not trust each other; they were trying to debate from the quota; they did the over production which mismatched the demand, supply and reduces the price, in general reduces the profit of all the firms in the market. So, will stop here today and will discuss the other type of collusive model, that is typically the price leader, same model which is low cost firm high cost firm. That is in our next session.