Managerial Economics

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Lecture - 31
Oligopoly

We will continue our discussion on theory of market structure, and if you remember in the last class, we discussed about the monopolistic competition, which is an ideal mix of monopoly and perfect competitive market structure. So, in the last class, we discussed about the price, and output determination in the short run and in the long run; and if you look at its quite similar to the monopoly situation, because we have a downward slopping demand curve and downward slopping average revenue and marginal revenue curve.

Then, we discussed about a situation that, how in case of monopolistic and also in monopoly, there is a evidence of excess capacity, because the producer or the firm they generally operates in the downward slopping portion of the average cost, and not at the minimum cost, we generally happen in case of a perfect competitive output. So, there is a big gap between the output level, what the monopolistic firms are producing, and what the competitive firms they are producing and this difference between the competitive output and the monopolistic output is generally known as the excess capacity.

If you look at there is one significant feature of the monopolistic competition is that product differentiation, there are large number of firms, but each firm produce a product which is different from the other product, and that is the reason, it will find that there is non-price competition also in case of monopolistic competition.

And that non-price competition; what is the basis for that; the basis for that is the product differentiation; the basis for that is the advertising; the basis for that for the innovation. So, we will continue our discussion on that line that, if there is a non-price competition on for that basis is, and the basis for that is on the basis of advertising cost, and on the basis of the innovation; what is the cost associated with that; what is the selling cost associated with that; and when we add that in the production cost, whether there is a change in the equilibrium output; what is the gap that we will see.

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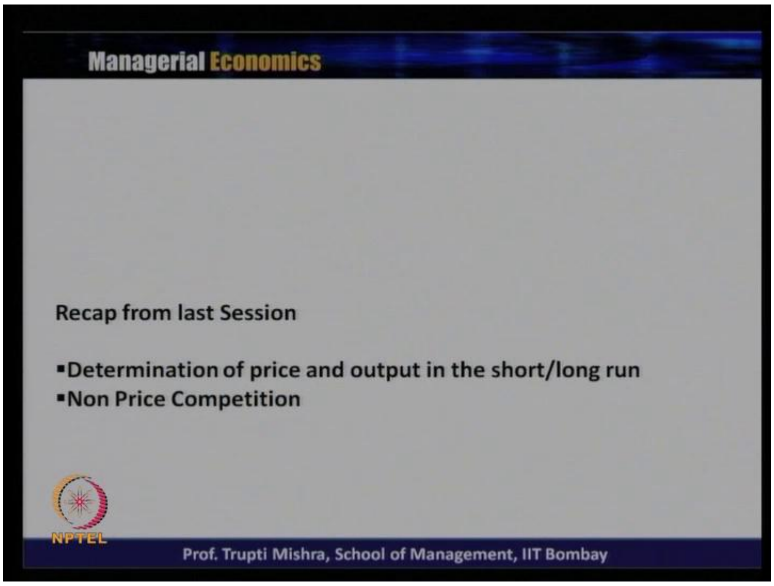

Then, we will continue our discussion on the Chamberlin's, the entire monopolistic competition, if you look at that is given by Chamberlin, and we will see, what are the short comings of this Chamberlin model, and then we will move into the; a new kind of oligopoly new kind of market structure, which is oligopoly, and if it is if you look at this is the most realistic market structure in this present day holds a situation, and we will typically in this session, we will talk about the non-collusive models of oligopoly; we will talk about cornered model; we will talk about the sweezy model and we will talk about the stacklberg model.

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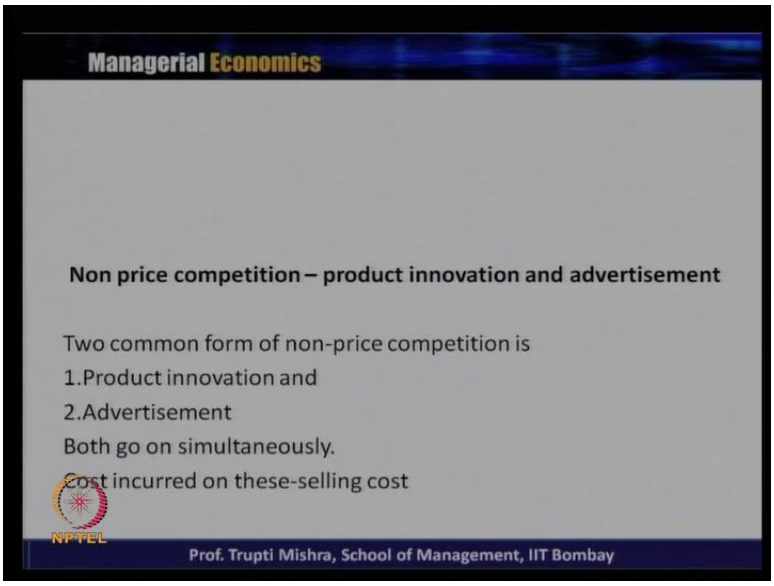

So, to start with, if you remember monopolistic competition is in case of monopolistic market structure, there is also evidence of non-price competition, and two common form of non-price competition is product innovation and advertisement. Both go on simultaneously, if the innovation takes place also there is a need for advertisement, and if there is a advertisement, or its as a innovation, there is a cost incur on this. And typically that is known as the selling cost, if it is advertisement, and if it is product innovation also there is a cost with the R and D, which also comes as a part of the selling cost.

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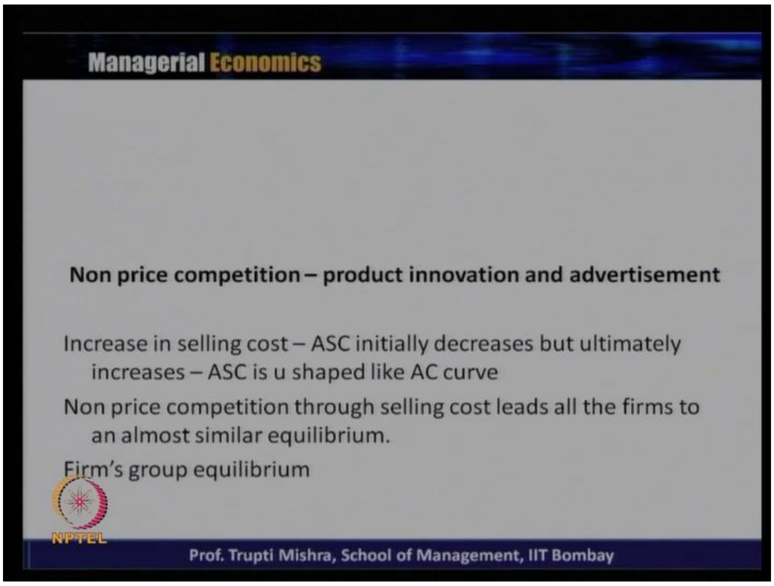

So, whenever this non-price competition takes place the firms bounds it to the innovation, the product innovation, and whenever the innovation is there, there is a need for this advertisement, both this activity involve the cost. Whenever there is a increase in the selling cost that leads to the fact that the average selling cost initially decreases, but ultimately increases, and that is the reason, we will find average selling cost is u shape like the average cost curve.

So, if you remember the shape of average cost, initially it decreases then reaches the minimum and then its increases, and generally if we give the explanation for u shape average cost is the economy of scale, initially the firm get economy of scale that is why it reduces, then it reaches the minimum, and beyond that the firm starts getting the none, the diseconomy of scale and that is why its increases, the same thing happen the same shape is also for the average selling cost, and if you look at the non-price competition through selling cost leads all the firm to almost an similar equilibrium.

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And there the firm leads to a group equilibrium, and before getting into the group equilibrium, we will see that, how this average selling cost generally added in the average product cost, and if it is not being added in the average product cost, whether there is a difference in the equilibrium or not. So, to start with we will see, we have, we will take quantity over here, we can take a average product cost, average selling cost, average revenue and marginal revenue; this is our for simplicity, we have taken average revenue is equal to the marginal revenue; this is our average product cost; this is average product cost plus average selling cost, and this is the point where again this is average product cost, and when the selling cost increases; this is average selling cost 2.

So, we get a point here; we get a point here; we get a point here; initially, if you take only the average product cost, how we decide the profit maximizing level of output, may be or how you decide the output, we do not have marginal cost over here, assume that the average product cost is equal to the M R, or average product cost equal to the A R, and we will find out this is the Q 1 level of the output.

Now, we have one more level of output Q 2; we have one more level of output Q 3, and if you look at we have may be one more level here that is Q 4. Now, what is the essential difference between Q 1 Q 2 Q 3 and Q 4, in the first case, when the average product cost is already there, may be the product output level is getting produces Q 1, when we are adding the average product cost, and the average selling cost over here, the output level is Q 2, and also it can go up to this point, here because this is where we get one more equality.

But eventually, when the average selling cost incur by all the firms, that leads to increase in the average selling cost as a whole, and that is why moved from average cost to 1 to average cost 2, and with that the average cost as a whole, which is a combination of the average product cost and average selling cost it increases and finally, they place in a particular they are tangent to this average revenue and marginal revenue curve, and if you look at this is the full capacity, where the firm is operating this is the Q 3 level of output, and this is the minimum cost looking together the average product cost and average selling cost.

So, it is like the point, what we discussed earlier also that non-price competition through selling cost leads all the firm to almost an similar equilibrium, because all the firms they have this component over here, may be someone start its now, someone start it with reaction to the rivals, but in general all the firms, they generally incur some amount the selling cost, and this is since, there is a selling cost component, if is there with the production cost of all the firm eventually this selling cost, the increase in the selling cost or though selling cost lead all the leads, all the firms to an almost similar kind of equilibrium or maybe, we can say the equilibrium, where this is minimum or the output level, where the average product cost and average. So, average selling cost is minimum.

So, if you look at this now, how this strategy works; the strategy works in a work with the point, that whenever there is a selling cost also, there is a increase in the price, and increase in the price with a justification is that this product is maybe richer than this product is qualitative than the other product, and since there is a product differentiation this strategy also works in the monopolistic competition, that you can set your own price because, you are providing a separate product; you are providing a differentiated product in the market.

Then, we will see, what may be, what is wrong or what is not acceptable to the real world, when it comes to monopolistic competition, we will see what are the criticisms associated with this Chamberlin’s theory, or what are the criticisms specifically associated with this form of market structure, that is the monopolistic market competition.

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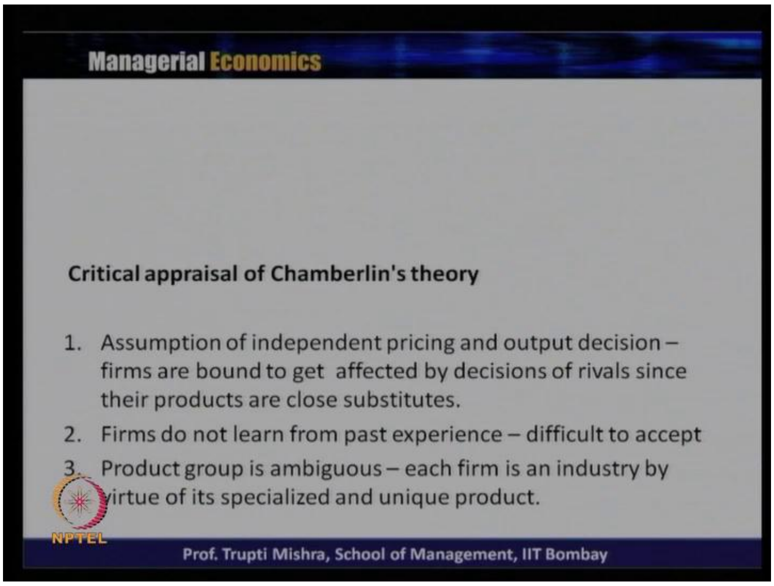

So, if you look at the there is a always a assumption of independent pricing, and output decision, and the basis for that is all the firms they are producing a differentiated product. Now, we are saying that there is no link of price and output decision of one firm with the other firm, that is what we have understood, when we have taken a basic assumption that the all the firms, they goes for independent pricing and output decision; firms are bound to get affected by the decision of rivals, since their products are close substitute; product are differentiated, but they are close substitute to each other, and that is the reason, when taking a assumption may be, when it comes to practice that typical assumption is difficult, because the products are close substitute, and the firms are they are bound to get affected by the decision of their rivals.

Then the second assumption, we say that firms do not learn from their past experience, they go on doing the same kind of mistake; they go on doing the same kind of price, and output decision, even if that went on a wrong side. So, this typical assumption is generally difficult to accept, when it comes to real world, because a manager or the entrepreneurs, it is not that they are laymen in the business, that they will not understand, if some strategy some decision is taken them into a wrong outcome still they will continue with that.

Then the product group is ambiguous, each firm is an industry by the virtue of its specialized and unique product, and within the industry again it is about talking about the product group those who are producing the similar product, or the identical kind of product its bit ambiguity is there, because each firm in an industry is the different typical in case a monopolistic competition, because each firm produce a different product from the from the product, whatever is there in the market, they are charging a price they are deciding their output on the basis of independently on the basis of on the basis or on the fact that, their product is different from the product in the market.

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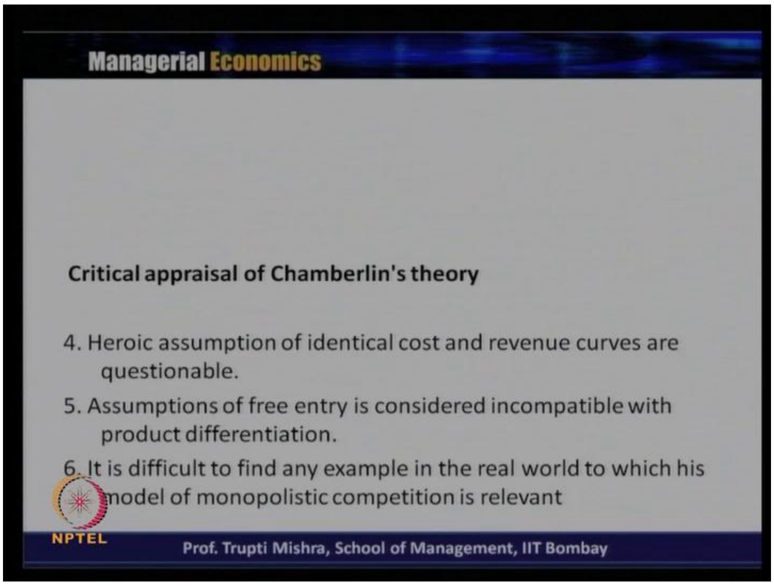

So, in this case, when you talk about a group, then there is some amount of ambiguity is always there, then there is a heroic assumption of identical cost and revenue curve for all the market, and its generally questionable, when they are producing a differentiated product; obviously, that the fact behind that they have to use the different raw material, they have to use the different technology, they have to use the different man power with a different skill set or maybe they have to use a different time line to produce it.

So, given this a diversity, when we take a assumption of identical cost and revenue curve in case of monopolistic competition, this is bit questionable, and it is difficult to also accept that, when the product is different whether the cost and the revenue condition has to be same or different.

Then there is a assumption of free entry, and we generally say that this characteristic is similar with the characteristic of a perfect competitive market structure, that there is no barrier to entry, but if you think over it, the concept of product differentiation itself create a entry, create a barrier to entry, because if any firm they want to enter into the market, and operate into the market, they have to first check their capability, whether they can provide or whether they can supply a product, which is different from the other product in the market or not.

So, in that context, if we look at product differentiation itself, it is not a case of the homogeneous product, that anyone can come and produce the same kind of product, if someone has to operate in the market, they have to also produce something different, but in the similar nature, and that is why this assumption of free entry generally consider incompatible, when it comes the; when the product is not homogeneous, when the product is differentiated.

It is difficult to find any example in the real world to which the model of monopolistic competition is relevant, but still we generally take the example of your restaurant, or we take the example of your books, or we can take the example of your DVD, or we can take the example of movies that the example of monopolistic competition like you take the example of movies, in general its similar in nature, what is the usefulness of movie, generally people they use this for their entertainment, and in the entertainment category, if you look at these are product they are similar in nature, but they are different maybe one movie comes with a philosophy; one movie comes with a comedy; one movie comes with a may be the action; one movie comes with a drama, but in general when you talk about all this movie, they are the similar product, but they are different from each other on the basis of the different from each other on the basis of the content or may be a presenting style or may be the quality associated with it.

Similarly, when you talk about a story book, when you talk about a fiction, we get fiction in the different range. So, the fiction may be again science; the fiction may be again action; the fiction will be again drama. So, when it comes to why we read the book may be fiction typically is not for its maybe not infirmity, but just to you have a series to read this when generally you read this, and may be this you do for when you have free time generally you read this. So, in this case again the usefulness of the product is same whether its action fiction, whether it is a romantic fiction, whether it is a science fiction, but when it comes to the usefulness of its theme, but when it comes to a individual product they are different from the other.

Similarly, when you talk about a restaurant generally the usefulness is that you generally go out and have food, but when it comes to the fact that whether they are different from each other or not again the question is yes, they are different from each other, but when it comes to the fulfilling the need of the consumer, they fulfill the need of the consumer, because the usefulness of the product is same there in the same range. So, closely we are not finding anything, but we can fit few of the examples as a part of the monopolistic competition.

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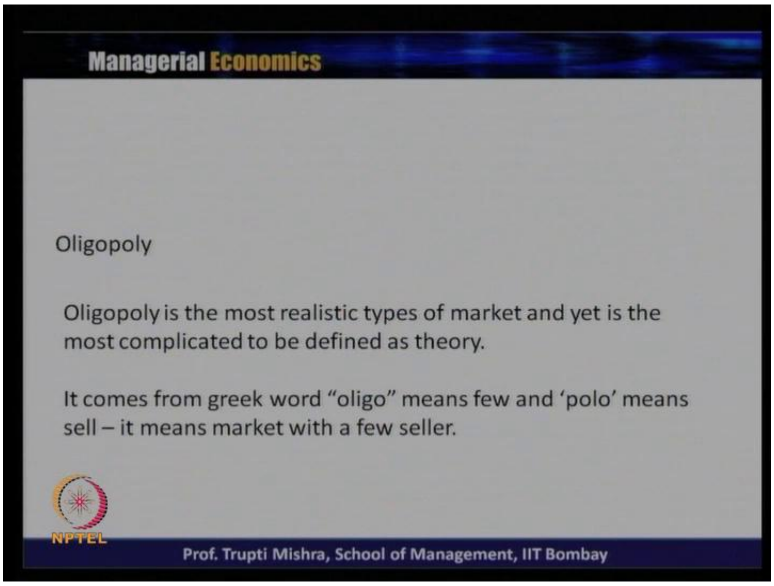

So, next we will move to a new kind of market structure, or what is last in our list that is oligopoly market structure, and if you find the most of the real world market is generally oligopoly in nature; oligopoly is the most realistic types of market, and yet it is the most complicated to be defined as theory, when it comes to theory may be we take all the model of oligopoly just taking two firms, we do never take few firms, but when it comes to the application part of it, or when it comes to the implementation of this form of market, it generally the most realistic as compared to any other kind of market structure like profit competition monopoly or monopolistic.

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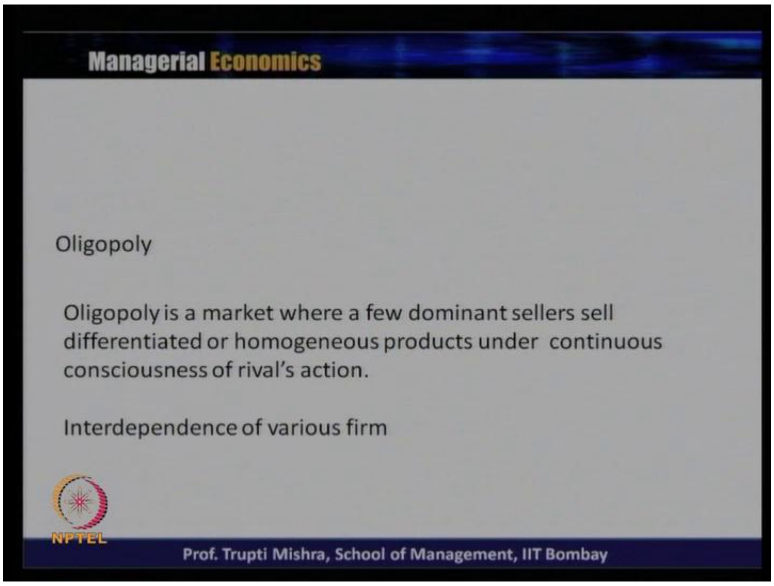

So, it comes from Greek word oligo, means few and polo means to selling. So, it means a market with few sellers is generally known as the oligopoly market. So, to say it in the not sell that oligopoly is a market with few seller; either they produce the differentiated product or homogeneous product under continuous consciousness of the rivals action.

So, here I think the main significant feature of oligopoly comes that few dominant sellers and they are under the continuous consciousness of the rival action. So, whether they produce differentiated products, or whether they produce homogeneous product for them the price output decision is always decided, what is the rivals reaction to their price and output decision, that leads to the fact that since, they consider the rivals reaction on their price and output decision, there is interdependence among the various firm in case of the oligopoly market structure.

So, there are few dominant seller, each firm either produce the homogeneous product or the differentiated product, there is they are also concerned about the consciousness of the rivals action, and there is a interdependence of the various firms typically in case of oligopoly market structure, and why this interdependence comes, because there they are reacting to the rivals action, and rivals is also reacting to their action on the price and output.

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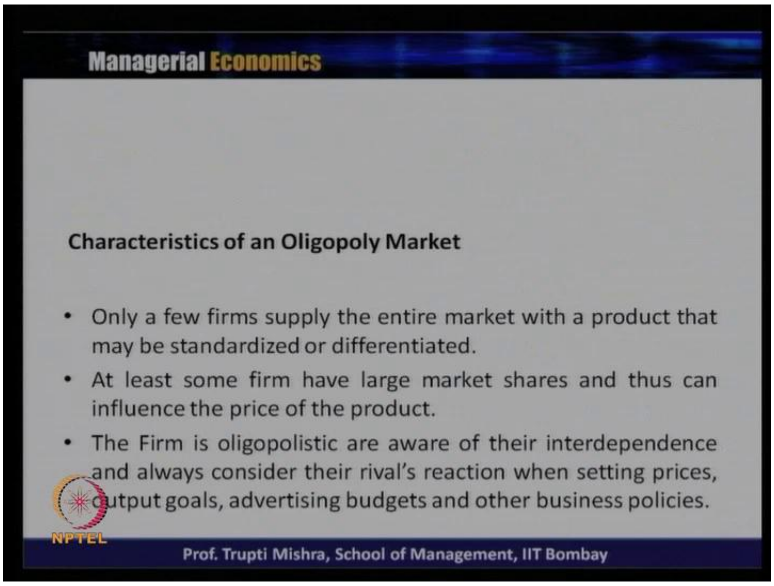

So, when it comes to the characteristic of the oligopoly market; the first characteristic is that there are few sellers. So, this is again a relative concept, whether few sellers or large seller, but in case of large seller only few of them is taking the entire market share. So, the first characteristic is only a few firms supply the entire market with a product that may be standardized or that may be differentiated. So, few firms they supply the entire market with a product, either it is homogeneous or differentiated.

The other way to analyze this that even, if there are large number of firm, still there are few firms 2 or 3 firms or 4 firms, they generally supply the entire market, and the market share of the other firms is very negligible or very insignificant, then at least some firms have large market share, and those can influence the price of product. So, continuing with the first characteristic, we can say that those who have the largest market share, they can influence the price of the product. So, it is not only one firm, there are many firm who is having the larger market share, they can influence the price of the product.

The firm is oligopolistic are aware of their interdependence and always consider the rival reaction when setting price; output goals, advertising budgets and other business policy. So, as we are talking about the interdependence of firm, there is a interdependence of firm; the firm knows that there is a interdependence between the firms in the market, and they always consider what would be the rivals reaction, when they set up their price when they decides the output, when they decide about their advertising budget, and when they talk about their policy, they talk about their strategy, they always keep this in the mind that for how the rivals is going to get react to this, and they generally set on that basis that what will be the rivals reaction.

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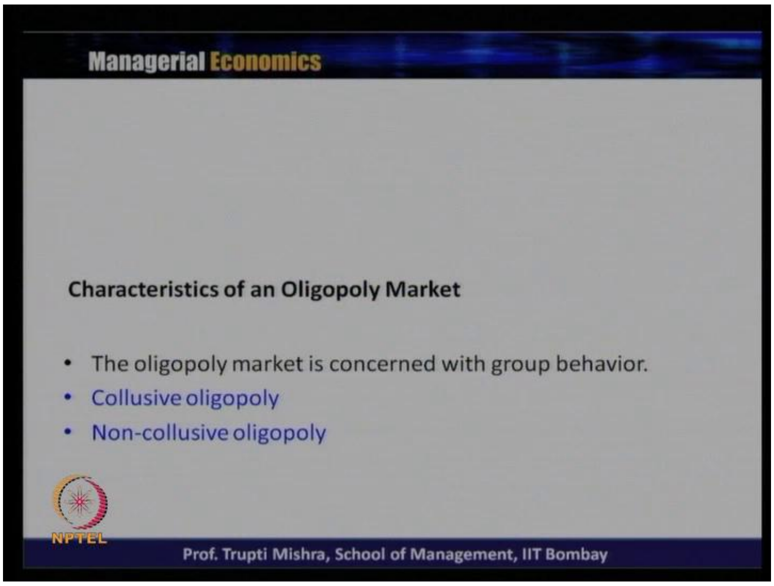

Again one more characteristic and on that basis, we can divide the total oligopoly market into two kind of market; one is collusive, another is non-collusive; collusive oligopoly is a one, where all the firms they together, they do not compete with each other, they collude with each other. So, there is no competition, and here the group dynamics or the group behavior is that all of them they collude together to maximize the profit, and this is generally known as the collusive oligopoly, and non-collusive oligopoly, when the competition takes place between the oligopolies firm, and here still they are interdependent, but they are not in collusion rather they are competing with each other.

But in case of collusion generally, it happens that they are not competing with each other, they collude they jointly decide; what should be the price output; what should be the advertising; what should be the market sharing; what should be the policy and sometimes that collision leads to a to the monopolies, because they act as a one body, when it comes to price output advertising or the business policy.

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So, two kind of market immerse from the group behavior of the oligopolies firm; one collusive oligopoly, when they collude; second non-collusive oligopoly, when they do not collude, they compete with each other in the market, there is entry barrier to the oligopoly market, and what are the entry barrier; huge investment requirement is there. So, someone should have the capacity for huge investment, if someone is trying to enter into the market, because they have to compete on the basis of product they have to compete on the basis of the price.

Strong consumer loyalty for the existing brands like there are many firms, but why only two firms they have the maximum market share, because the maximum market share is; because there is a strong consumer loyalty for those two firms, and that is the reason strong consumer loyalty for existing brand, generally posses as the entry for the other firms to enter in the market and operate in the market, then economy of scale like we are saying that there should be at least few large seller, and when they are few seller; obviously, with their scale of operation they have already achieved the economies of the scale.

So, when someone enter into the market, someone operate in the market they have to compete with them with a high cost of production, and which itself create a entry for the entry barrier for the other firms, we enter because they knows that, if they are entering in that market they have to compete with a high cost of production. So, there is interdependent decision making, as we discussed in the previous case the price and output, whether it is advertising budget, whether it is about the business policy, the firms they are dependent on each other, whether it is collusion, or whether it is non-collusion.

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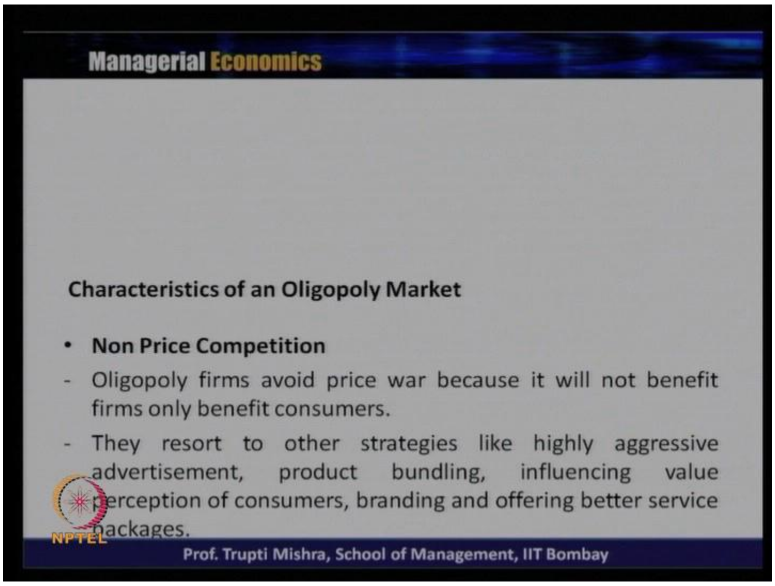
e 

Also, there is a evidence of non-price competition, generally the oligopoly firms avoid price war, because it will not benefit the firms it only benefit the consumer, and they resort to other strategy like highly aggressive advertisement, product bundling, influencing the value perception of the consumer, branding offering better service package, and generally these are the strategy to get a good amount of sale rather than the competing on the basis of price.

Generally, we will say; why how graphically we will see how this price war is not leading a benefit to the producer, rather its leading a benefit to the consumer, and that is the reason, if you look at the oligopolies firm they have heard that competing each other in term of price, rather they compete with each other on the basis of the other strategy, like capturing the consumer segment understanding their value perception, or may be creating a brand loyalty for them or the additional, where the supplementary of basis along with the along with the product.

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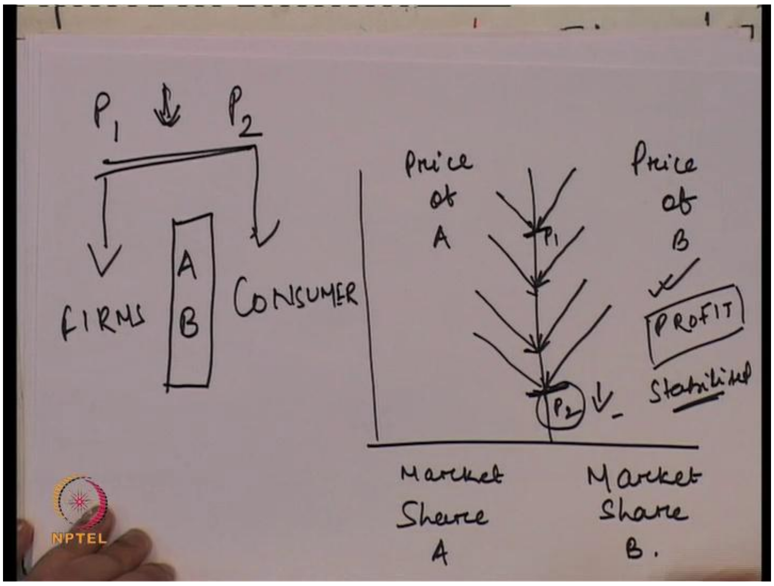

Now, when there is a non-price competition. So, if you consider this as the market share of A, and this is market share of B, suppose this, we will consider as the price of A, here consider the price of B, here A and B they are two firms, and we will see why they will not get into the non-price competition, suppose initially the price is p 1, now B will always feel that; this is the price p 1 to start with B will always feel that, if I lower the price, I will get a good market share, and since they are interdependent on each other, since B has lower the price; A has lower the price and gain a market share. Now B will follow that, and also B will reduce the price in order to increase the market share.

Now, again what will be the reaction of A, knowing that B has already reduced the price to get the market share, also A will reduce again, and reduce the price in order to get the market share, what will be the reaction of B; A has already reduced again to gain the market share, B will also reduce, this will continue again this will continued by B; this is the price p 2 now, at this point the firms A and B they will feel that, if they are going beyond this, it is nowhere getting profit for them rather they are going to make loss, and at this point, they will feel that they are not going to reduce the price below p 2 and p 2 will be generally a stabilized at this point at least the stabilized price of it, and if you are going beyond this any of the firm they are going beyond this, even if they are increasing the market share, they are not getting the profit, and since it is a oligopoly’s firm they can decide their price and output, they are not going beyond this p 2 and that is how the non-price competition, generally takes place beyond this point, because when they are competing into a price were, they are competing on the basis of the price the output not beneficial from the benefit for the producer because, the output is there is a reduction in the price from p 1 to p 2, and this is not going to benefit the firms, rather this is going to the going to benefit the consumer because of decrease in the price from p 1 to p 2.

And that is the reason, they will not get into the price competition on the basis of price, or they will not get into the price were, rather they will prefer to resort to the other strategy like aggressive, advertisement, product bundling, capturing the value perception of the consumer influence, and branding and offering better service package they will just resort to that.

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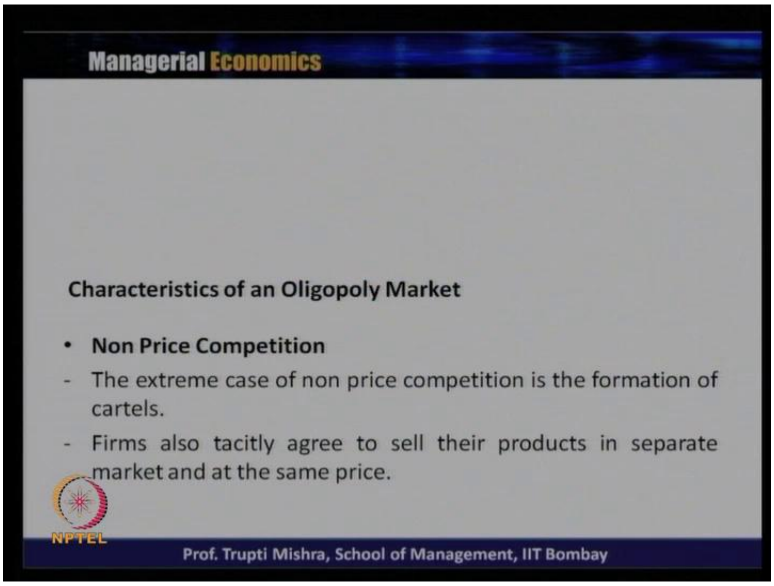

So, generally there is one more form of the non-price competition one is getting into better kind of strategy, like aggressive advertising bundling or may be better service package along with the product, but apart from this also, there is one more form of non-price competition, that is generally known as cartel, where they come together firms also tacitly they agree to sell their product in the separate market at the same price. So, generally they share the market, and its generally in the form of cartel, because they say, cartel is in the form with joint organization, joint profit maximization and they will just share the market, and they will say that you are going to sell in this market, I am going to sell in the other market, and two firms they will not get into each other market, and that way they generally maximize the profit.

So, that is the reason; this actually the extreme form of non-price competition, sometimes it is not explicit, people because sometimes, the explicit collusion is not legal. So, generally the firms they comes into an agreement, they comes into a cartel where they share the market. So, they charge the same price, but both of them, they sell in the different market, and both of them, they maximize the profit. So, the uncertainty on the raise on the rival action on the basis of your price and output decision generally goes with that.

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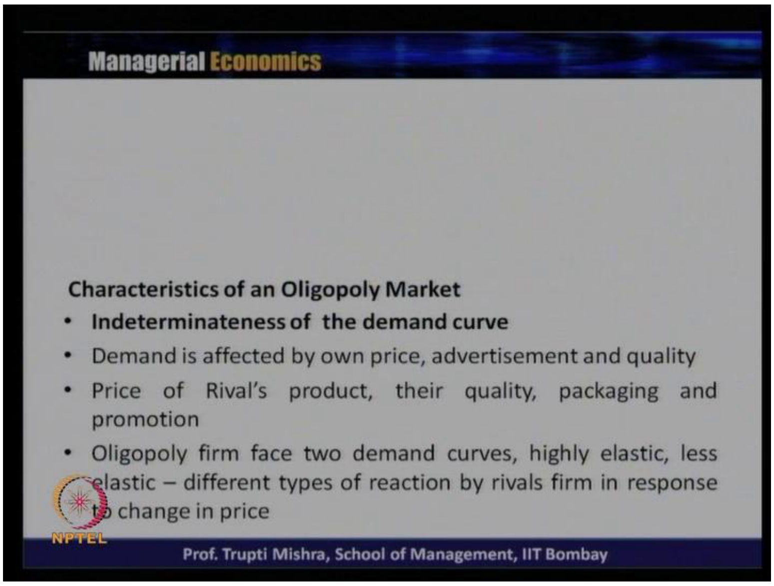

Then, the one of the interesting characteristic of demand curve, if we will find out a of oligopoly market will find out, there is no determinate demand curve, or there is no specific demand curve for the oligopoly firm; demand is affected by own price, advertisement and quality that is one point, also its get affected by the price of the rivals product, their quality packaging and promotion. So, that is the reason ,if you look at there are two kind of demand curve, we get it in case of a oligopoly firm; one which is highly elastic, and second less elastic ,and different types of reaction by rival firms in response to change in the price.

So, generally when you increase the price, rivals they will not increase the price, but when one firm decrease the price the other or they also decrease the price. So, in this case, if you look at we get one inelastic demand curve, and another elastic demand curve, and that is why there is no specific demand curve for a oligopoly's firm, because the demand gets change on the basis of in the firm's own price, advertising, and product quality, and also the rivals price product, and the advertising and other technique.

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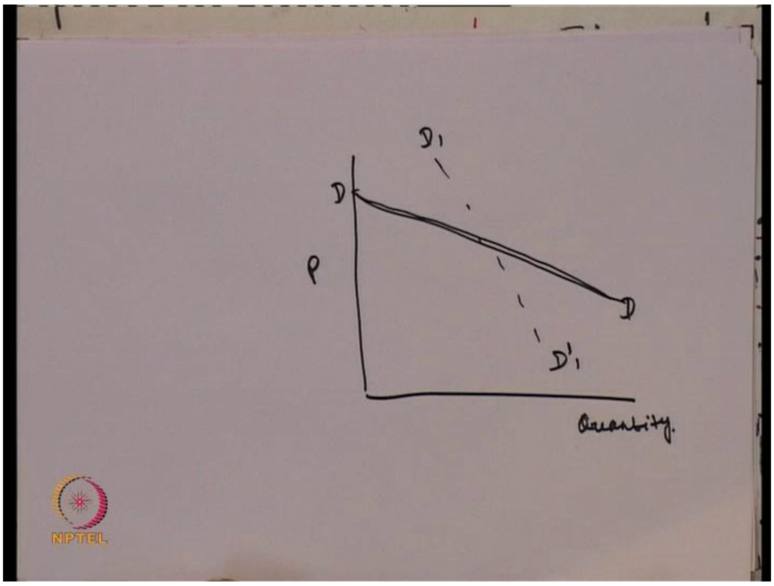

So, we will see generally, how this two demands curve appears for a firm in case of a oligopoly market structure. So, this is one elastic demand curve, and here is one inelastic demand curve, and what is the difference between this elastic, and inelastic demand curve, in case of elastic demand curve, small change in the price, consumer they will react to it, because if there are number of others, and in this case the firms generally prefer to not to increase the price, generally to decrease the price, and this is the inelastic demand curve here, whatever the change in the price, pricing then they generally less response from the consumer, and here the firm they will prefer to increase the price.

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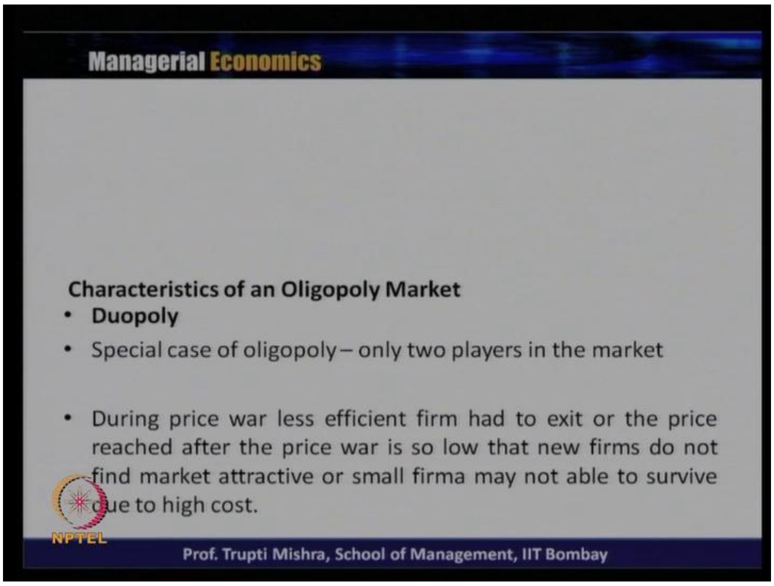

So, depends upon the rival action and reaction, we have two set of demand curve; one is elastic demand curve, and another is the inelastic demand curve, and since there are two kinds of demand curve, there is no specific determinate demand curve for the oligopoly firm, then we will talk about a special case of oligopoly that is generally known as duopoly, and in case of duopoly there are only two players in the market. So, it is a case of special case of oligopoly only two players in the market, and generally how the oligopoly firm tends into a duopoly firm, during the price war generally the less efficient firm had to exit, or the price reached after the price war is. So, low that new firms do not find market attractive, or may be the small firm may not able to survive due to high cost.

And that is the reason the oligopoly firm leads into a duopoly firm, because if it is inefficient firm during price war they prefer to exit the market, or after the price war the price is. So, less that it is they find difficult to survive in the market and even. So, high cost of production is not suitable for the small firm, and they prefer to leave the market.

So, if you look at whatever the oligopoly's model, we have taken into consideration in maximum cases, we have analyzed this with the help of two firms typically not in oligopoly market, rather in a duopoly market. So, duopoly is a special case of oligopoly, it is a kind of market structure, where there are only three firms, and there are three players in the market, and they compete on the basis of price, on the basis of non-price to survive in the market and to get the market share.

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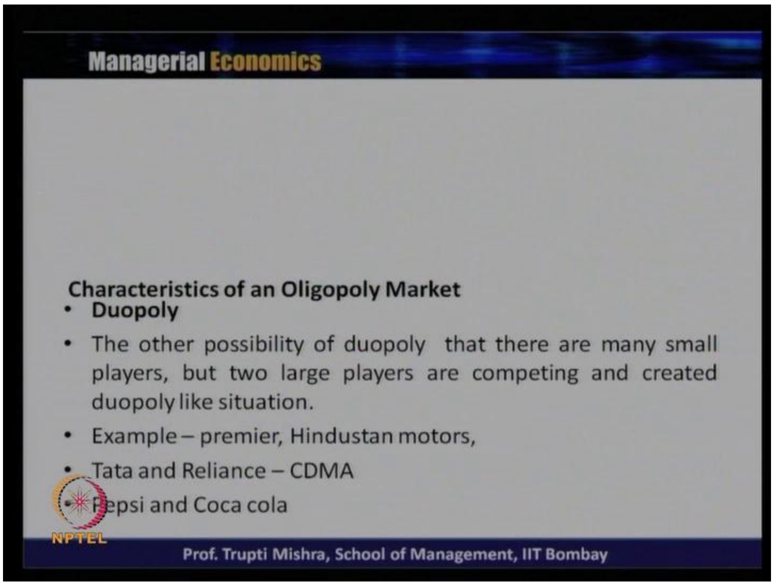

The other possibility of duopoly is that there are many small players, but two large players are competing and created a duopoly like situation. So, there are may be many small players, but when it comes to the market share, there are only 2 large player, they are competing and created a duopoly like a situation. So, if you look at before this Maruthi Suzuki came into picture, before this Maruthi udhyogh limited came, or before this joint venture started, there were two specific or the significant company in case of a car industry, that is premier and Hindustan motor similarly, when you talk about a CDMA technology there are only two major player; one is Tata and Reliance, but still opportunities are many there are many more players is coming into the market.

And the classic example in this case, we take duopoly is the Pepsi and Coca Cola over the year, they are just it they have just made this market as a duopoly market, because they are having the maximum market share similarly, if you take about talk about the news paper industry, there may be many news paper industry, but when it comes to which one the significant, or which one the specific, there may be only a we talk about the Times of India, we talk about the telegram and against the reason specific in Mumbai may be it is a Times of India or DNA or may be when it comes to Chennai, its again Times of India is Hindu, you go to Delhi may be again its Times of India, and some other. So, there are two players generally, they take a maximum market share, or the largest market share, and they turn the oligopoly market into a duopoly market.

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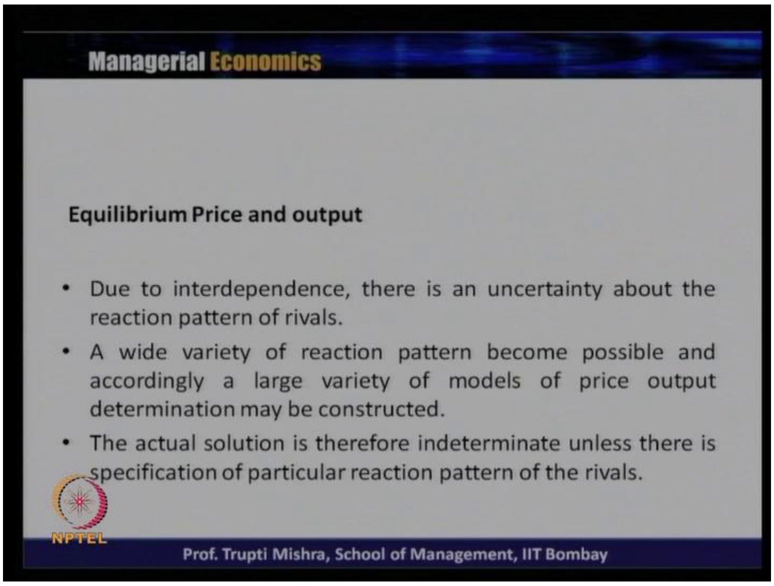

Now, what happens to the equilibrium price and output, since there is a interdependence , there is uncertainty about the reaction patterns of the rivals, may be sometimes it follow, sometimes it do not follows. So, there is interdependence that leads to uncertainty about the reaction pattern of rivals, there are wide variety of reaction pattern can be possible, and accordingly for each type of reaction pattern, we have different variety of model of price and output determination, or it may be constructed. So, this reaction pattern goes in this direction, what should be the price and output determination, if the reaction pattern goes in a different direction, what should be the price and output determination.

However, the actual solution is therefore, in determinant unless there is a specification of particular reaction pattern of the rivals. So, there is nothing generic price and output equilibrium price and output case in case of your oligopoly market structure, it is all situation specific, and the situation is dependent on, how the rivals they are reacting to change in the price of the, or the change in the output change in the advertising change in the business coal of the other firm.

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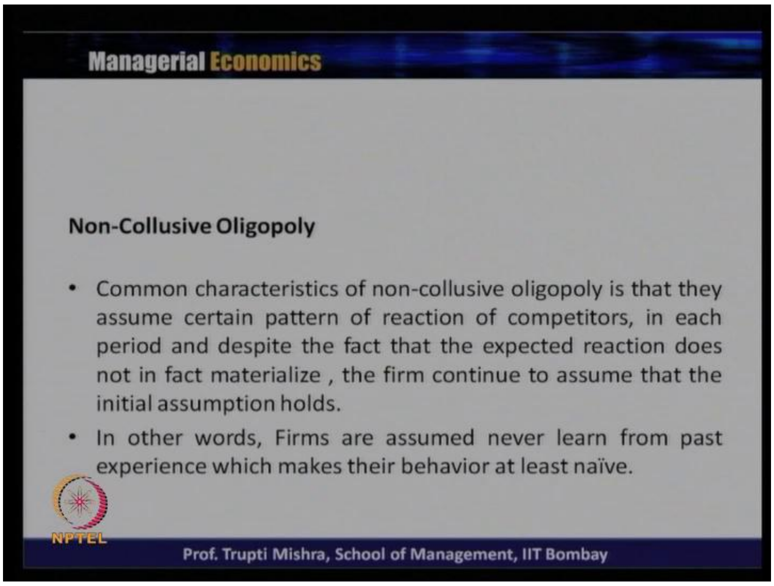

So, with each pattern of action and reaction, there can be separate price and output determination and each kind of price, and output determination, we can explain through a model at least few of them. So, what is the common, we will start with our discussion in case of a non-collusive oligopoly, few models in case of non-collusive oligopoly, and what is the common characteristic of a non-collusive oligopoly, the common characteristic of non-collusive oligopoly that they assume certain pattern of reaction of the competitor, in each period they assume that this is how the rivals is going to behave, if this is my action, and in each period and despite the fact that the expected reaction does not in fact materialize, the firm continue to assume that the initial assumption hold.

So, in one period, if they assume that reaction should be like this, and if it is not happening also, next period still the firm feels that the firm is continuing to assume in the initial assumption about the reaction pattern, to put it in a simple word, firms are assume never learn from past experience which makes their behavior at least naïve. So, they known's that the reaction sometimes does not match, whatever the expected reaction, what the firm thought of about the rivals, that they do not matches, but still they assume the same pattern of reaction in the next time period also and to put it simply, we can say that oligopoly firm, they never learn from their past mistake, and they acted as a naïve, and they start it again that this should be the reaction pattern of the rivals.

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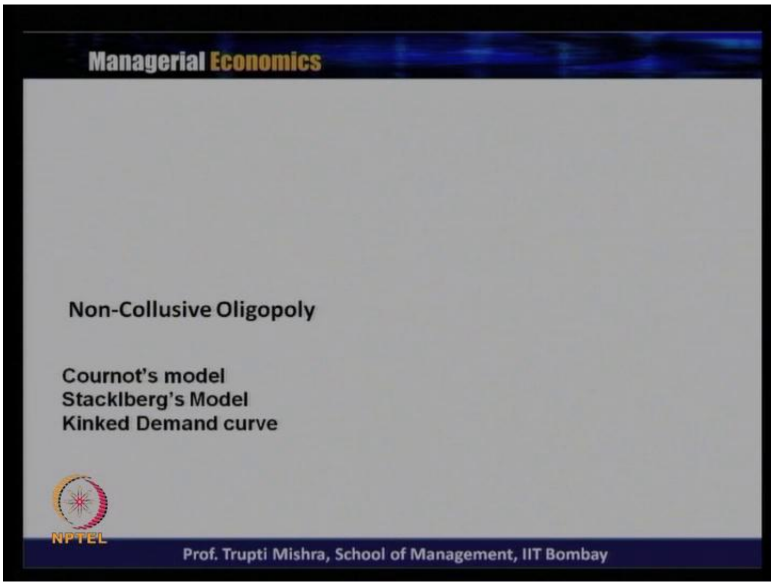

So, we will talk about three different model, in case of a non-collusive model, and we will start with the Cournot model, and whether its Cournot model, whether its Stacklberg model, or whether its Kinked demand curve model, in all these three models, we have not taken a case of your oligopoly market structure, in general rather we have taken it is a special case of duopoly, but there are only two firms, and we will see how the price output determination is done in this specific scenario under cournot model, under Stacklberg model, or under kinked demand curve model.

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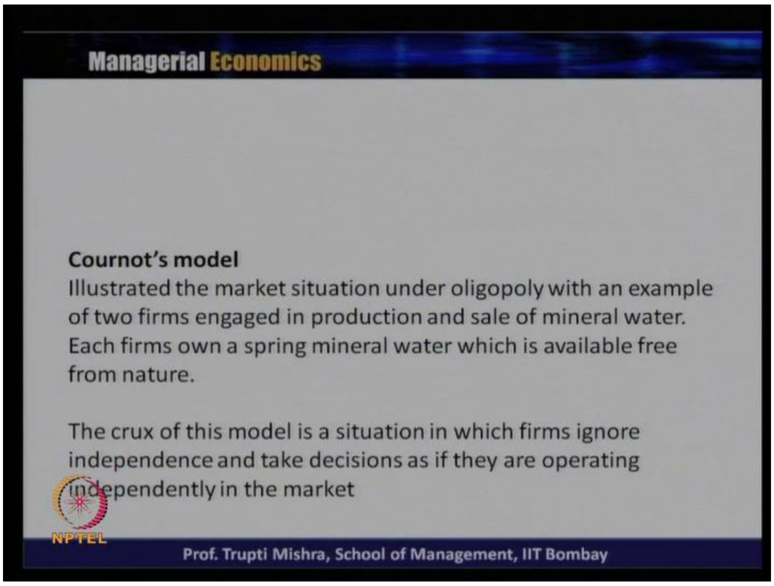

So, what is cournot model to start with, if you look at this cournot model illustrated a market situation under oligopoly with an example of two firms engage in production and sale of mineral water. So, there are two firms in the market, it is a two duopoly firm, it is a duopoly market two firms, and both the firms, they engage in the production, and the sale of the mineral water each firms own a spring mineral water, which is available freely from nature. So, they are into the business of production and sale of mineral water, each firm own a spring mineral water, which is available free from nature, they are not incurring any cost for this spring mineral water.

The crux of this model is a situation in which firms ignore independence and take decision as if they are operating independently in the market. So, there is a correction here, that in which firms ignore interdependence not that they both the firm, they are related to each other and they behave independently, and when they behave independently they hang into a situation, where they are not they are not getting the maximum profit, rather they would have got more profit, if they are taking the decision interdependently rather independently.

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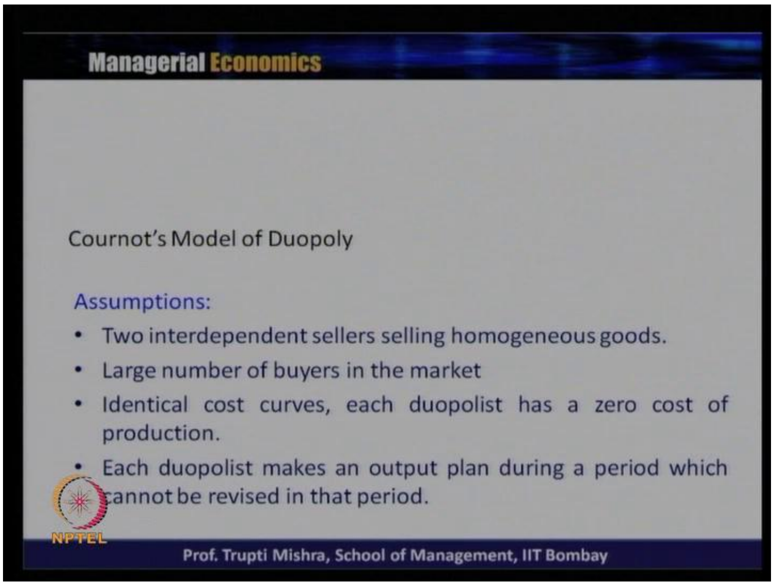

So, we take few assumptions to understand this cournot model of duopoly, two interdependent sellers selling the homogeneous good; the homogeneous good is the spring water over here, and there is large number of buyers in the market. So, if it is two sellers, but there is large number of buyers in the market; identical cost curve, or we can say in this case since the mineral spring they are getting it from the nature as free, it has a zero cost of production. So, this is a very specific case that we are getting something in zero cost of production, but here this is one of the assumptions that each duopolist has a zero cost of production.

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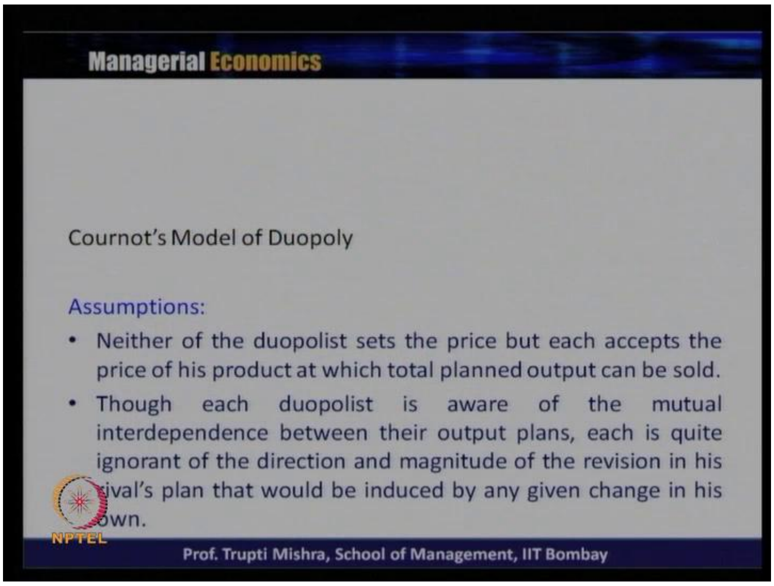

And since they have a zero cost of production ideally they have the identical cost curve, each duopolist makes an output plan during a period, which cannot be revised in that period. So, whatever the output plan for them in that particular period that cannot be revised in that period at least, if they want to revise they can do it in the next period, but that period they have to just go ahead with the whatever the output plan.

Neither of the duopolist set the price, but each accept the price at which total planned output can be sold. So, they are not the price take, price maker rather than the price taker, and they accept the price of each product at the which the total plan output can be sold, each duopolist, each firm is aware of the mutual interdependence between their output plans, but each is quite ignorant about the direction and the magnitude of the revision in which the rivals plan that would be induced by any given change in his own.

So, they knows that they are interdependent between each other, when it comes to output plan, but they are ignorant about the fact that, if he changing his plan if one firm is changing his output plan, what would be the revision in the rival plan, what with respect to the change in each plan. So, they are quite ignorant about the direction and the magnitude of the revision of the rivals plan, whenever they are doing any change to the plan.

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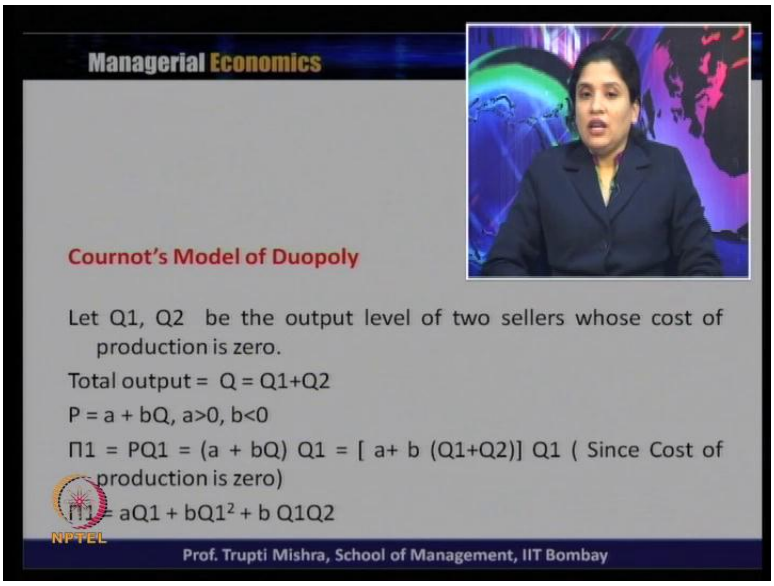

So, we will assume that Q 1 and Q 2 output level of two sellers, whose cost of production is 0. So, total output will be equal to Q, which is equal to Q 1 plus Q 2 demand function or price function is that is equal to a plus b Q, where a is greater than 0, and b is less than 0 now, to find the profit of 1 that will come in the form of pi 1, we will get only P Q 1, because the cost of production is 0. So, whatever the total revenue that has to be the profit. So, P Q 1 is the a plus b Q multiplied by Q 1 that is equal to a plus b Q 1 plus Q 2 multiplied by Q 1 and pi 1 comes as a Q 1 plus b Q 1 square plus b Q 1 Q 2.

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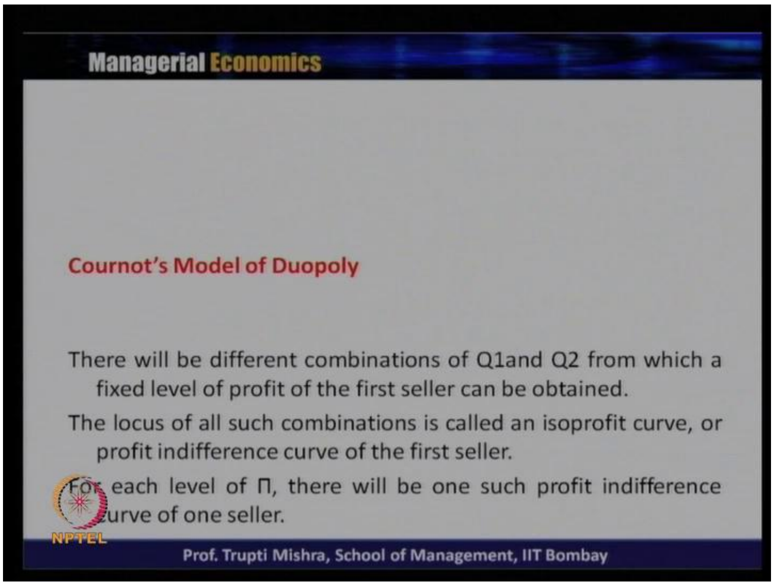

There will be different combination of this Q 1 and Q 2 from which a fixed level of profit of the first seller can be obtain, you get different combination of this Q 1 and Q 2, the locus of all such combination is called isoprofit curve, or the profit indifference curve for the first seller. So, locus of all such combination of Q 1 and Q 2, where the fixed level of profit will come that combinedly lead to a isoprofit curve for the first seller, or the first firm or the first duopolist, for each level of profit there will be one such profit indifference curve for one seller. So, if the profit level is different, they will get different isoprofit curve for the seller. So, first we find out the price then, we find out the revenue then, we find out the profit function, from the profit function, we get the level of profit by taking different combination of Q 1 and Q 2, and the combination of Q 1 and Q 2 which will give the fixed level of profit to the seller, that is generally known as the isoprofit curve.

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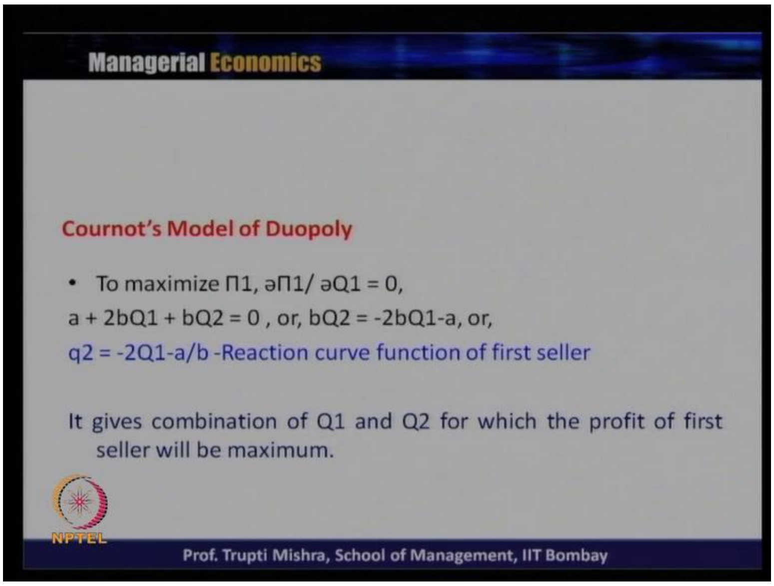

And for different level of profit, we will get a different level of isoprofit curve, to maximize this profit 1, we will take the first order derivative of the profit function that is del pi 1 by del Q 1 has to be equal to 0. So, that is a plus 2 b Q 1 plus b Q 2 is equal to 0, simplifying this b Q 2 is equal to minus 2 b Q and minus a, or Q 2 is equal to minus 2 Q 1 minus a minus a by B, and this is generally known as the reaction curve function for the first seller, and why this is known as the reaction curve function of the first seller because it gives a combination of Q 1 and Q 2 for which the profit of the first seller will be maximum. So, this reaction curve function gives the combination of Q 1 and Q 2 for which the profit of the first seller will be maximum.

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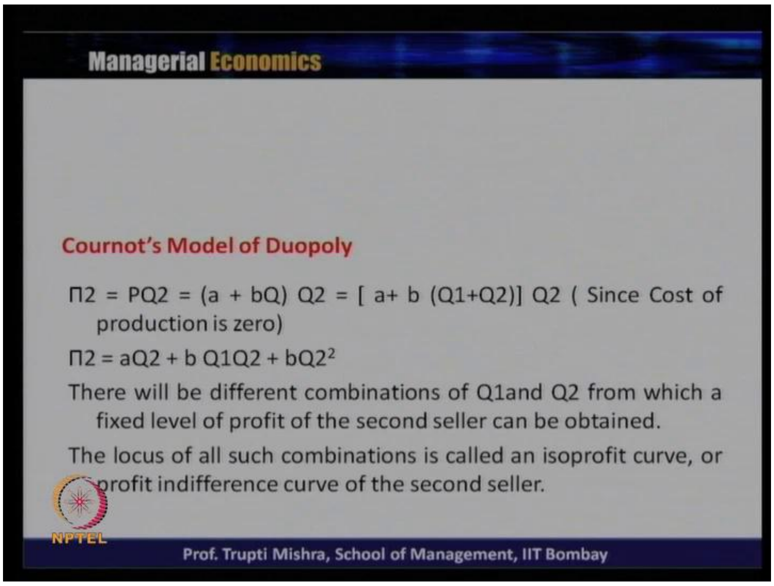

Similarly, we will find out the isoprofit curve for the second seller and the reaction curve function for the second seller. So, pi 2 is p Q 2; p is a plus b Q multiplied by Q 2 simplifying this a plus b Q is Q 1 plus Q 2 multiplied by Q 2, and this will be also the profit because cost of production is 0, pi 2 is a Q 2 plus b Q 1 Q 2 plus b Q 2 square, there will be different combination of Q 1 and Q 2 from which this fixed level of profit of the second seller can be obtained, and the locus of all such combination of Q 1 and Q 2 is called as the isoprofit curve, or the profit indifference curve for the second seller.

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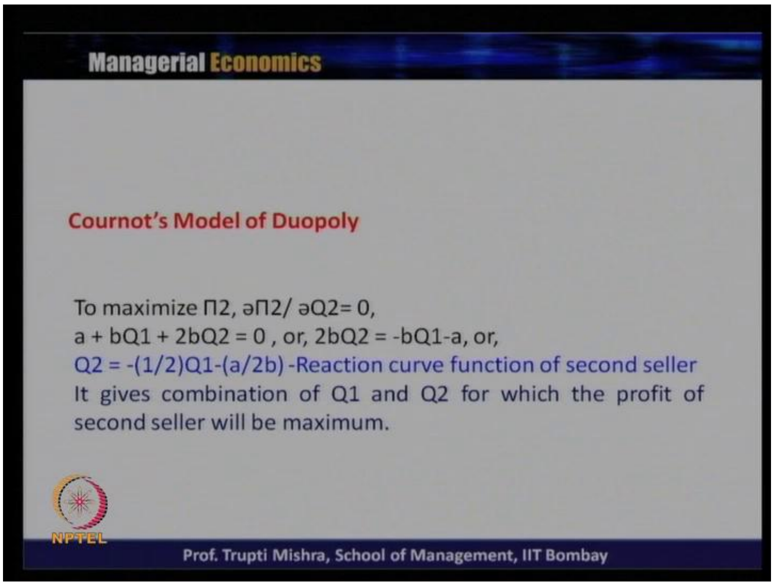

Then to maximize the pi 2 again, we will follow the same format that del pi 2 with respect to Q 2 has to be equal to 0; a plus b Q 1 2 b Q 2 that has to be equal to 0; 2 b Q 2 is equal to minus b Q 1 minus a and Q 2 is equal to minus half Q 1 a by 2 b. So, reaction curve function for the second seller, and what is the reaction curve function of the second seller, it gives a combination of Q1 and Q 2 for which the profit of the second seller is maximum.

So, we have now isoprofit curve of the seller one, seller two, isoprofit curve gives the different combination of Q 1 and Q 2 which gives the equal level of profit, and reaction function gives us the level of different combination of Q 1 and Q 2 where the profit level will be maximum. So, we have set of reaction function and isoprofit curve for both the seller one and seller two.

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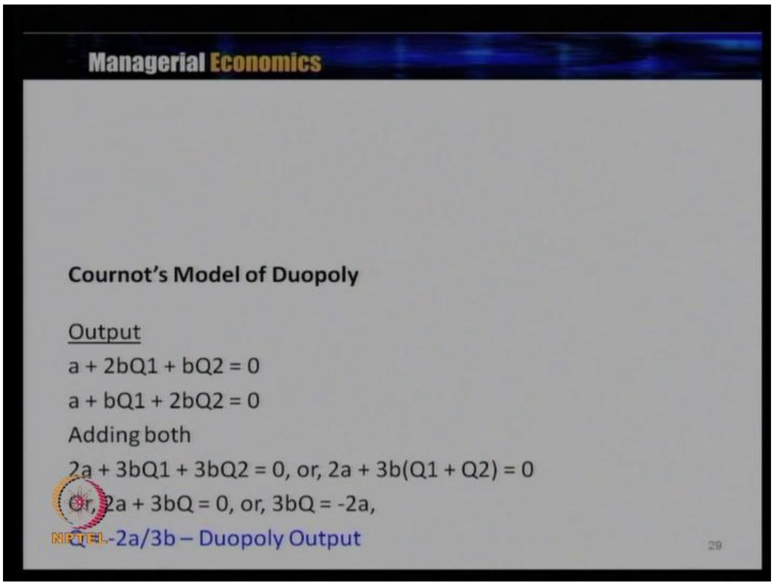

Now, how the output is dealt in case of the cournot model of duopoly; a plus 2 b Q 1 plus b Q 2 is equal to 0, that is our output; that is p Q; that is the whatever the output, we got it from our previous equation, a plus b Q 1 plus 2 b Q 2 is equal to 0, if you add both then it comes to 2 a plus 3 b Q 1 plus 3 b Q 2 equal to 0, or this is the profit maximizing level of output. So, that is 2 a plus 3 b Q 1 plus Q 2 is equal to 0. So, 2 a plus 3 b Q is equal to 0 3 b Q is equal to minus 2 a simplifying this finding out the value of Q; Q is equal to minus 2 a by 3 b; this minus 2 a by 3 b is duopoly output.

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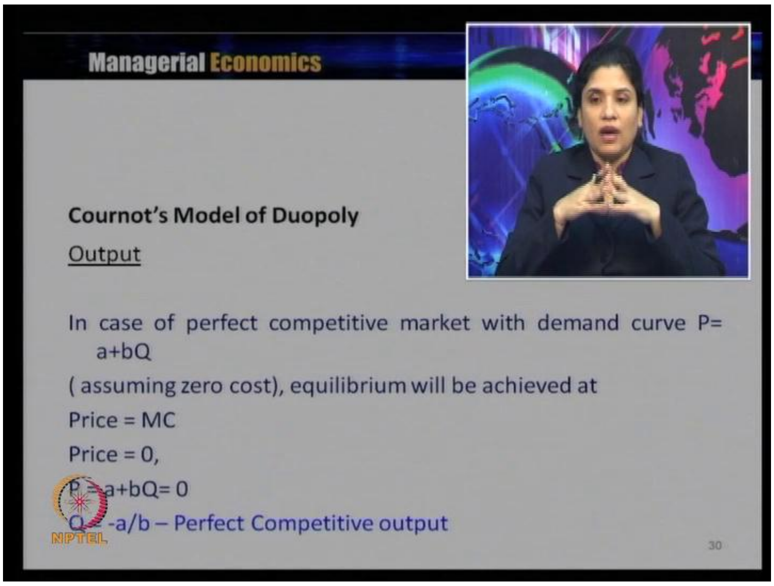

Now, if it is a case of a perfect competitive market with a demand curve P is equal to a plus b Q assuming zero cost, equilibrium will be achieved at the price is equal to M C. So, price is equal to 0. So, p is equal to a plus b Q is equal to 0. So, since marginal cost is equal to 0, we get price equal to 0, and price is a plus b Q that is equal to 0 and simplifying or solving it for a Q that will give us minus a by b; this is perfect competitive output. So, minus 2 a by 3 b is the duopoly output minus a by b is the competitive output.

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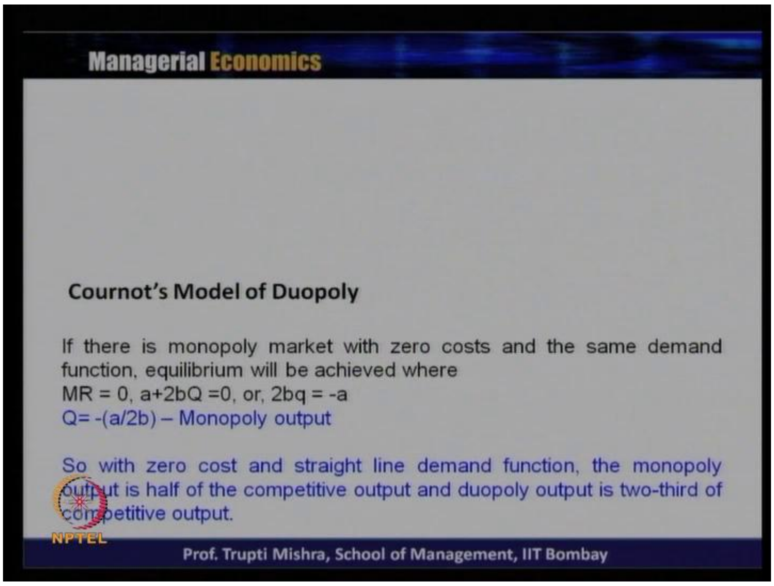

Then we will see the same demand function with a zero cost, what will be the monopoly output. So, if there is a monopoly market with zero cost and the same demand function equilibrium will be achieved, where marginal revenue is equal to marginal cost, since marginal cost is equal to 0, then marginal revenue has to be equal to 0, marginal revenue is a plus 2 b Q, which is equal to zero 2 b q is equal to minus a and Q is equal to minus a by 2 b which is the monopoly output.

So, duopoly output is minus 2 a by 3 b, competitive output is minus a by b, and monopoly output is minus a by 2 b. So, with zero cost and straight line demand function the monopoly output is the half of the competitive output and duopoly output is the two-third of the competitive output. So, if there is a zero cost, and with a straight line demand function, the monopoly output is the half of the competitive output, and the duopoly output is the two-third of the competitive output

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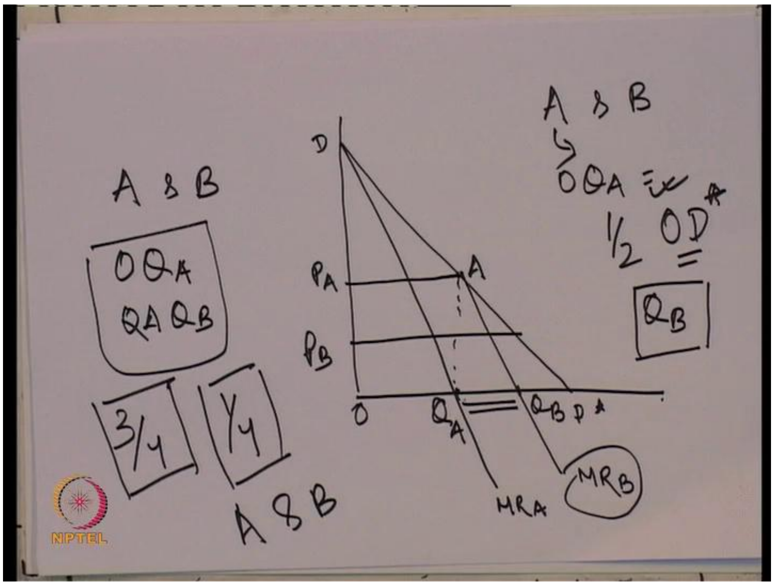

So, with then, we will see this graphical representation of this cournot model, how this becomes the, how it comes to the equilibrium situation, or how generally this equilibrium is stable in case of the Cournot’s model. So, this is D D star corresponding there, we have marginal revenue of A; this is B; this is marginal revenue of B; this is Q A; this is Q B this is price of A; this is price of B.

Now, how this equilibrium takes place in case of cournot model, there are 2 firms A and B; firm A enter, they produce till marginal revenue is equal to marginal cost; demand curve is D D star; marginal revenue is through this we find this is the Q A level of output O P A is the price now, this Q A is the half of the total output O D star, if you look at this O Q A is the half of total output O D star. So, A produce O Q A that is half of the total demand now, firm B will enter, and assume that A will continue to produce one half of the total this 0, this total demand of the market and that will come as the O Q B.

So, what the firm B they will do now, firm will be D, firm D will produce only Q B because they know that firm a is going to produce half of the total market demand now, what is the market demand available, market demand is available as Q A D star. So, you will just take half of it will produce assuming that the rest will get produced by the firm A now, what is the demand curve for the firm B, Q A D star that is the output, and A D star is the demand curve for the firm B, and corresponding marginal revenue curve for B is M R B.

So, what is the output of Q B, they will produce at the point where marginal revenue and marginal cost as to be equal to 0. So, b will produce this Q A Q B this is the amount is going to produce, price is O P B. So, now, combining this A and B together, how much they are producing; A produce O Q A, and B produce Q A Q B, and B assume that since A is producing half of it is only produce the half of it. So, together this is only the three-forth of the market still there is one-four remaining.

So, this one-four remain not produced by either A or B, and next we will see that generally, how this one-forth remain not produce, when you take in the different time period, simply because that the firm B is not changing his assumption, or firm A is not changing in assumption, whenever there is doing a revised plan they are not looking into the rival action and reaction.

So, we will continue our discussion on cournot model in next class, again the graphical explanation of reaching to the equilibrium, we will take an example to understand this, and we will discuss about the Stacklberg model and Paul Sweezy kinked demand model in our next session.