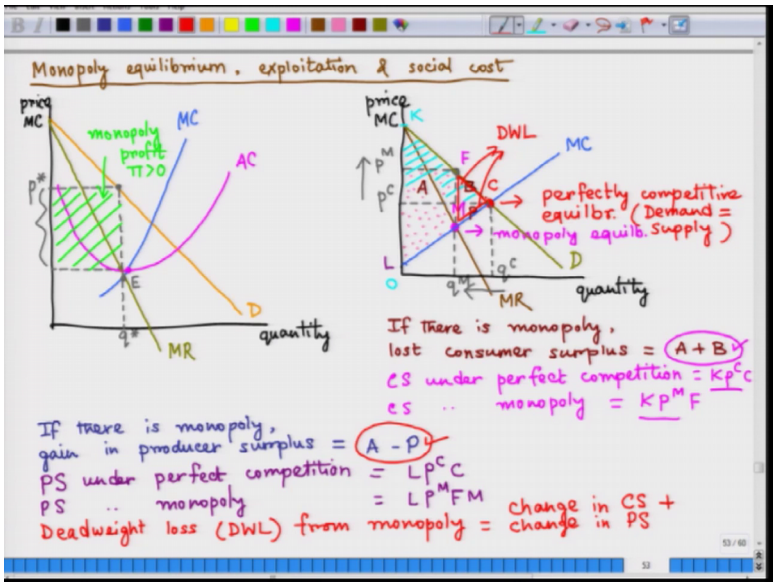
Microeconomics: Theory & Applications
Prof. Deep Mukherjee
Department of Economic Sciences
Indian Institute of Technology, Kanpur

Lecture –45
Monopoly (Part-2)

Hello welcome back to the lecture series on Microeconomics; let us now continue with our discussion on Monopoly. So, far we have derived of monopolists profit maximizing first order and second order conditions and we have seen that to be MR equal to MC. So, at that intersection point where MR curve and MC curve meets the monopolist find its equilibrium output level. And, when it plugs back that value of output level in the demand function it can set the market price from that demand function. So, this is what we have seen. Now, we are going to look at the monopolist equilibrium in greater detail to find out how graphically we can figure out the profit level of a monopolist and what is the social cost associated with monopoly.

(Refer Slide Time: 01:12)



So, let us revisit that monopoly equilibrium diagram. So, we have the quantity and then price and marginal cost measured along the axis. So, now here I am going to first draw the linear demand function as usual ok. Next we are going to draw the marginal revenue function which can be derived from the demand function itself, marginal revenue is drawn. Now, I am going to draw the average cost of production and we know that

through the minimum point of average cost production curve the marginal cost curve passes through.

So, one can have the marginal cost of production right. Now, note that at the intersection point of this MR curve and MC curve this point here denoted by say equilibrium point E, the monopolist equilibrium is determined. So, in that case we determine the equilibrium output level at q star and we know how to get the market price. Monopolist will plug this value of q star in the market demand function to see what would be the price that it can charge the consumers. And, this is the price that it decides to charge which comes from the demand function right this point corresponding to the q star quantity level.

Now, note that if we want to measure the profit then I have to get the point on the average cost curve which corresponds to the q star level of output. And, this point on the average cost curve will give me the average cost of production for this level of output. So, this difference between the average cost of production per unit of output for production level q star and the price the monopolist charges this gap, this is basically my per unit profit that the monopoly earns right. So, this area shaded with this lime blue lines is basically the monopolist profit ok. So, monopoly profit is basically pi positive right. So, monopolist earns supernormal profit.

Let us now, compare a monopolist equilibrium with the perfectly competitive equilibrium and see what is the difference in these two. We have earlier told that monopoly is basically the violation of the assumptions that we make for a perfectly competitive market and hence the fast welfare theorem. So, if there is a violation of the perfect competition assumptions, the fast welfare theorem result does not hold and there is dead weight loss; we have seen this earlier. Now, let us going to study this case of dead weight loss in the context of a monopoly; again we will take the aid of a graph. So, we are going to start with a linear demand function then of course, associated with that we are going to have a linear marginal revenue curve right. Now, let us also assume straight line marginal cost curve with a intercept on the price axis.

So, now let us first mark the perfectly competitive equilibrium which gives the highest social welfare. So, this big red dot mark by point C gives me my perfectly competitive equilibrium. Why is this so, because at this point C demand meet supply and that is the condition to obtain a perfectly competitive equilibrium right. Now, let us study what is

happening with a monopoly. So, for monopoly we have mathematically derived the profit maximization condition is MR equal to MC. So, this is basically my monopoly equilibrium given by this point M. So, this is my monopoly equilibrium right, now let us compare these two.

So, first let us find out the perfectly competitive output level which is given by say q c and at the intersection point the perfectly competitive price is also determined. And, let me call this p c right and for monopoly we have to use the point M and q M is basically my monopoly output level. And, we need to find out the price corresponding to that output level from the demand function right. So, we get to see a much higher monopoly price p M. So, here we can see two things. So, first my market price is much higher compared to the perfect competition in the case of monopoly. And, my quantity of output produced and supplied to the market is also less in monopoly compared to the perfectly competitive market.

Now, there is some degree of exploitation by the monopolist as it charges the higher price and produces lower level of unit lower level of output for the society. So, what is the dead weight loss associated with the lower amount of production. So, here we can say that let me mark some areas. So, basically let me mark this rectangle, I marked by A then this small triangle I marked by B and finally, this small triangle here I marked by say P fine. So, if there is monopoly then the lost consumer surplus is equal to A plus B. Why is the case? Because note that in the case of perfect competition the consumer surplus earlier; so, under the assumption of perfect competition the consumer surplus is given by this large triangle which is let me let me call this point O and let me call this intercept point some point say K fine.

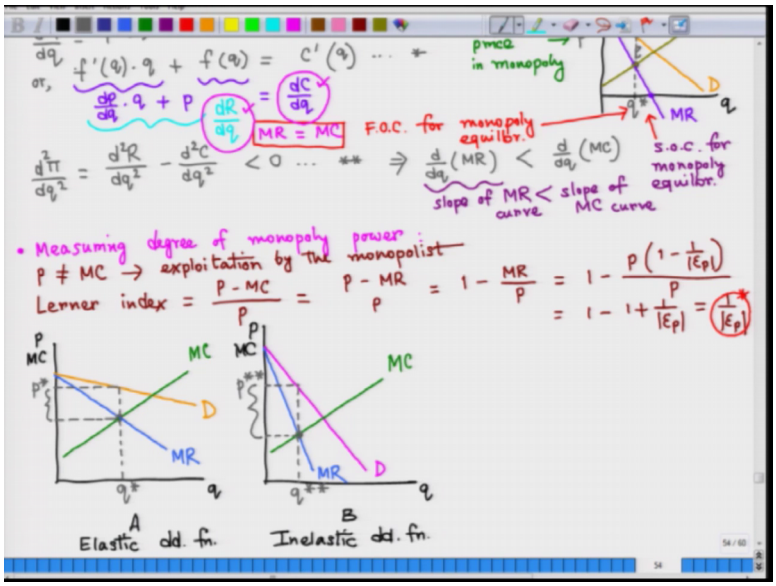
So, suppose this demand function has an intercept O K on the price axis ok. So, if that is the case then let us write down the consumer surplus CS under perfect competition equal to K p c and C, this large triangle right. Now, in the case of monopoly the consumer surplus simply reduces to so, let me name this point as F K p M F, a much smaller triangle right. So, the difference between these two triangles is basically this area A plus B right; now let us look at the case of producer surplus. So, now, again in if there is monopoly, there is a gain in producer surplus and that is equal to A minus C, A minus P ok. Now, how come we can prove that? So, for that let us assume CS under perfect competition will be, let me name this point as L here. So, the perfect under perfect

competition sorry producer surplus under perfect competition and that would be this large area L p c C right. Now, producer surplus under monopoly would be equal to L p M F M right. So, this is basically the area that currently I am marking with pink dots right ok.

So, basically what we observe here, we observe that the monopolist earns this area A, but loses out on this small triangle P right. So, that is basically the gain in the producer surplus. We say that this is gain because here from the graph it seems that the rectangle area A of this rectangle is higher than this area of this triangle marked by P right. So, basically now we can say that my dead weight loss which is abbreviated as DWL from monopoly is equal to change in consumer surplus plus change in producer surplus. So, now, let us look how we can point the dead weight loss area in the diagram that we have just drawn. So, here we see that these two areas are basically contributing to the dead weight loss. So, the small triangle B and the small triangle P and these are basically contributing to my dead weight loss right.

So, basically dead weight loss is the area of this joint triangle. So, now we can observe that there is a difference between the marginal cost of production and the market price charged at the equilibrium quantity level. So, there is some exploitation in terms of higher price charged in the market and this is why it is important to find out what degree of exploitation the monopoly enjoys. So, for that there are several measures of degree of monopoly which are available in theoretical literature, but we are going to now study the simplest of all of these measures and that is known as Lerner's index.

(Refer Slide Time: 17:54)



So, the deviation from perfect competition rises because, P is not equal to the marginal cost in this case and that basically gives rise to the exploitation by the monopolist right. So, Professor Lerner has proposed a very simple measure which is nowadays known as Lerner index and that is equal to P minus MC divided by P. So, now, we are going to rewrite this expression or index to see whether we can relate this index to a concept which we have already seen. So, we know that MC equal to MR at the monopolist equilibrium right. So, we can definitely write this ok. So, now, note that this will become 1 minus MR divided by P. Now, also note that we have found an expression for marginal revenue just some time before, we have found an expression for marginal revenue and that is 1 minus 1 over mod value of the elasticity of demand right this is divided by P.

So, now, note that we get 1 minus 1 plus 1 over this elasticity value. So, in a nutshell we get this; so, this is also a very interesting result. So, we get to see that there is an inverse relationship between the degree of monopoly power and the absolute value of the elasticity of demand. So, if we estimate the elasticity of demand for a particular commodity, then we have some idea about the degree of monopoly power if there is a monopoly in practice. Let us graphically explore the inverse relationship between the own price elasticity of demand and degree of monopoly power. So, we are going to have two panels of diagram panel A and panel B.

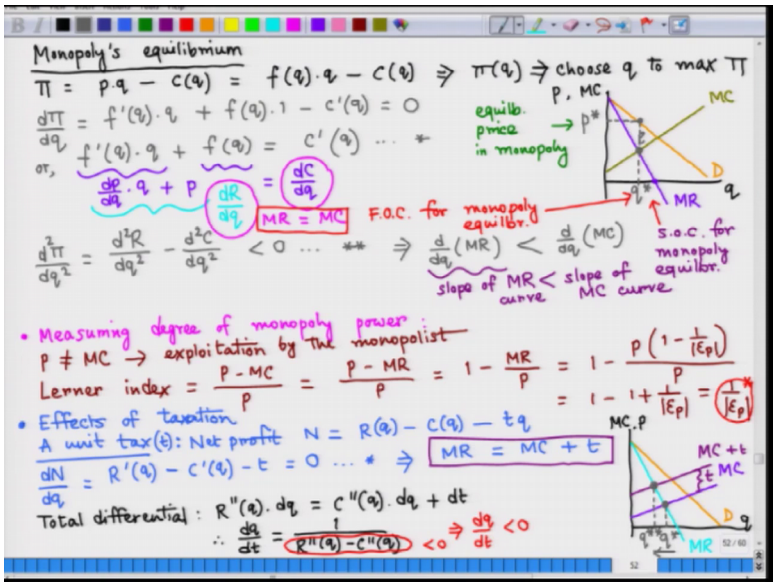
So, in panel A we are going to deal with an elastic demand function and in the panel B we are going to deal with an inelastic demand function right ok. So, now, let us quickly draw some demand functions. So, here we are going to draw a very flat demand function denoted by D and we are going to draw a very steep demand function in this case compared to the panel B right. So, we will have correspondingly the marginal revenue functions. So, suppose this is the MR curve for the elastic demand function case and this is going to be the MR function for the inelastic demand function case. Now, let us going to super impose the marginal cost functions right. So, here we are going to assume the marginal cost curve with same slope and same intercept.

So, we are going to have a simple straight line marginal cost curve in panel B and we are going to keep the same slope and the same intercept and this is going to be the marginal cost in the case of the inelastic demand function case. Now, let us quickly look at the monopoly equilibrium and the price charged by the monopoly. So, this is the monopoly equilibrium, where the MR curve intersects the MC curve. And, we know what to do we have to get down to the quantity axis, we get q star level of monopoly output. And, then we have to go to the demand function right and we get to see the market price. Now, note that this is the difference between the marginal cost and price. Now, note here in the inelastic demand function case the intersection point between MR equal to MC gives the monopoly equilibrium output level.

So, we come down to the output axis, mark the equilibrium output now go up and we heat the demand function to set the market price here right. So, here let me see so, the new market price is p double star, say this is q double star level of output. Now, see that here the gap between the marginal cost corresponding to the equilibrium output level and the market price charge is much higher in compared to the case A, which is the elastic case right. So, we have seen that as the market demand curves become elastic the degree of monopoly power actually falls down and it rises when the market demand curve becomes more inelastic.

So, a monopoly is basically exploiting the consumers. So, in that case the government may think why do not we tax the monopoly and reduce the monopoly profit. So, if government decides to tax a monopoly, how that is going to change the monopolist equilibrium. This is going to be the topic that we are going to study next.

(Refer Slide Time: 25:45)



So, we think about a unit tax. So, that is basically the tax that government charges per unit of quantity being produced and sold by the monopolist right. So, if we assume that then how that is going to change my profit expression. So, now, the monopolist has to pay a tax to the government. So, it is concerned with its net profit right and the net profit is defined as capital N equals revenue minus the cost of production minus t times q, when the t is basically the unit tax rate right. So, now, the monopolist will take the aid of differential calculus to maximize its profit and find the new equilibrium output level right.

So, it will have this expression marginal revenue minus marginal cost minus tax rate right and that has to be equal to 0. So, this is basically my new first order condition right. So, if we rewrite this that will be equal to marginal revenue equal to marginal cost plus the unit tax right. So, this is the interesting first order condition that we get. So, basically now let us see if the firm attains a new first order condition, how that is going to impact the output level. Let us first study that mathematically. So, we will first take a total differential and that will lead to R double prime q times dq equals C double prime q times dq plus dt right ok.

So, we can rearrange to get dq dt equals 1 over R double prime q minus C double prime q right ok. Now, note that by virtue of second order condition or profit maximization problem of a monopoly this is less than 0 right. So, this implies that dq dt will be

negative; that means, that if there is a unit tax imposed by the government that will bring down the market output level; so, now let us going to look at the same thing graphically. So, we have the common diagram for the monopoly case I would put and then we measure MC and P right.

So, in this case again we start with a demand function downward sloping say D, then we have the marginal revenue function downward sloping and becoming negative in the inelastic part of the demand. Now, we have to impose the marginal cost function which can be given by this line right. So, the first or initial equilibrium will be given by this output level right. So, if there is unit tax so, in that case the marginal cost curve actually shifts up parallelly and the gap is basically my value of t the unit tax.

So, this parallelly shifted curve can be written as MC plus t and hence, from the calculus we see that this is the new first order condition that is to be derived by the monopolist. Hence, the monopolist will produce lesser units of the commodity say q star. So, there will be a reduction in quantity level, quantity output level. So, we will continue with our discussion on monopolies equilibrium in the next lecture.