**Microeconomics: Theory and Applications**
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**Lecture - 41**
**Welfare Analysis of Competitive Market**

Hi, welcome back to the lecture series on Microeconomics. So, far we have studied the short run and long run equilibrium of a firm in a competitive industry. Now, we are ready to enter what is known as theory of market. Here we are going to first start with a perfectly competitive market and then we are going to discuss more market models, where we see imperfect competition.

And, we will also would like to link this theory of market with welfare economics; because ultimately the goal of society is to find a resource allocation which maximizes social welfare. So, let us start with some assumptions which are critical behind working of a perfectly competitive market model.

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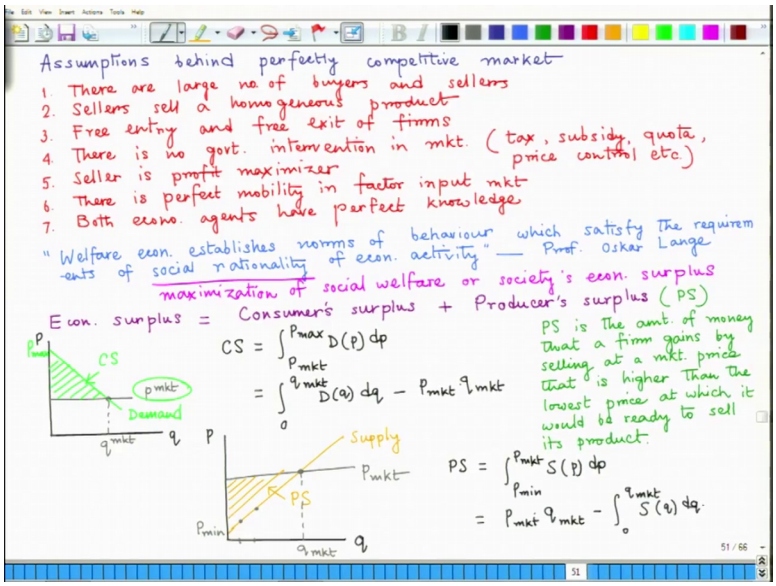


So, these are very critical assumptions and if there are violations of this there are several economic implications. So, we assume there are large number of buyers and sellers, number 2 we assume that sellers sell a homogeneous product. So, there is no quality difference. The number third assumption is there that there is free entry and free exit of firms. Number 4 is there is no government intervention in the market and by government

intervention I mean tax, subsidy, quota, price control etcetera policy measures taken by the government. Now, number fifth would be the seller is a profit maximizer ok.

Number sixth the assumption could be that, there is perfect mobility in factor input market, by that I mean if some wants to quit from the factory input market then that factor is welcome to do so. And, nobody can stop a person to join factor market like labour market. Then there is another one which talks about knowledge and here we assume that both economic agent, which are basically buyers and sellers have perfect knowledge. Now, what do we mean by that? We mean that all buyers and sellers have complete knowledge of the present economic condition and as well as the future conditions of the economy.

So, basically we mean that there is no uncertainty in our model ok. So, with these assumptions laid out now, we are going to focus on a very interesting result. We can show that the perfectly competitive market outcome can maximize social welfare, for that we have to first think about this interesting question how to measure social welfare. So, that will take us to the field called welfare economics. We are not going to study welfare economics in great detail, but we are going to at least look at the tip of the iceberg.

So, let us start with a definition of welfare economics to understand what do we mean by social welfare and how it could be maximized. So, we will start with a quotation from Professor Oskar Lange who once wrote "welfare economics establishes norms of behavior which satisfy the requirements of social rationality of economic activity" ok. Now, let us look at these phase social rationality.

So, what do we mean by that or what does Professor Lange mean about this? So, these could be taken as maximization of social welfare or society's economic surplus. So, when we studied theory of consumer behavior and theory of firm we have assumed that an individual consumer is rational when he or she wishes to maximize his or her own utility and so is for firm.

So, in the case of firm the rational firm would like to maximize profit. In fact, we have also assumed the same under the perfectly competitive market model; now these are individual behaviors. So, here we assume that society is also a rational behaved one if it

wishes to maximize its total welfare. Now, how to measure society's welfare that is a very critical question.

So, what do we mean by economic surplus, following Dupuit and Professor Marshall if we assume that there are two types of economic agents: one consumer and one producer then this economic surplus will be represented by summation over all individual consumers, net utility and sum over all producers profit. So, how do we measure economic surplus? If we follow Dupuit and Marshall we need two components: one is consumer surplus which we have already studied before and the other one is producer surplus. Now, you know following them the society's welfare or economic surplus is the sum total of all individual consumers net utility and all individual firms profit.

Now, the simplest possible way to theoretically discuss the case of economic surplus maximization is through the concept of representative firm and a representative consumer; we will adopt that approach. So, if we adopt that approach then we know that we are talking about a representative consumer and we have to talk about that consumers surplus. And, then we have a representative competitive firms or any firm for that matter it does not matter, producers a firms producer surplus right ok. So, now let me briefly recap what we have studied under consumer surplus right.

So, for that we have suppose we have a linear demand function right. And, suppose there is some price and we know that all these points on the demand functions are basically the marginal utility points from the theory of consumer behavior. And, we know that at the intersection point of this market price line is given by say p market, the consumer finds its equilibrium right.

And at that level it purchases q market amount of good right. Now, note that this consumer has a maximum willingness to pay for the commodity which is given by say P max right, but actually he pays only p market right much lower price. So, this difference between the willingness to pay and the price that the consumer actually pays gives rise to the consumer surplus. So, if we want to mathematically express that we can write consumer surplus as this is recap I know, but I hope this will help you to understand this in a better way.

So, if we have this demand function D p then we are talking about this integration right or alternatively we can also write like the following where we have q market. So, this is a

definite integral we are talking about this time we are working with D q form of the demand function and then we have p mkt times q mkt right. So, that is basically consumer surplus in mathematical formulation. So, now let us look at the definition for producer surplus which we have just introduced. So, producer surplus it could be abbreviated as PS.

So, here goes the formal definition. So, producer surplus is the amount of money that a firm gains by selling at a market price that is higher then the lowest price that at which at which it would be ready to sell its product. So, now let us see how this definition gets translated in a diagram and in mathematical language. So, we will first start with a diagram. So, here we start with a straight line supply function, we know how to derive that so, it is not new to you. So, this is basically a segment of firms upward sloping marginal cost curve right ok. So, now we say that there is some market price.

So, this shaded area is basically my consumer surplus right. So, now we start with market price at which the firm sells its product, but note that there is a minimum price at which the firm is willing to sell its output right. So, basically we can say that for this unit the firm is going to sell if the price is at least this much, which basically is equal to the marginal cost of production of those many units of the output. Similarly, if it we rises if the quantity is higher then as the marginal cost is higher for that marginal unit of output the firm will require to get at least that much of the that much price so, that it can cover its marginal cost right.

So, basically what we are talking about is the following. We talk about an area which is basically this shaded area and that is basically our producer surplus right. So, here let us point out the firms equilibrium. So, if the market price is p mkt we know that the firm decides to produce and sell q mkt right. So, here is that minimum price that firm requires right. So, this shaded area is basically my producer surplus. Now, let us concentrate on the mathematical formula producer surplus which will help me to compute.

So, if we deal with linear demand and supply functions, it is very easy to compute consumer surplus and producer surplus, because then we can use these simple main insulation formula half times base times height to derive or compute the area of the triangle that is being formed in these two cases. But, when we are dealing with non-

linear demand functions and supply functions, there we cannot use that simple formula right and alternatively we can also write ok.

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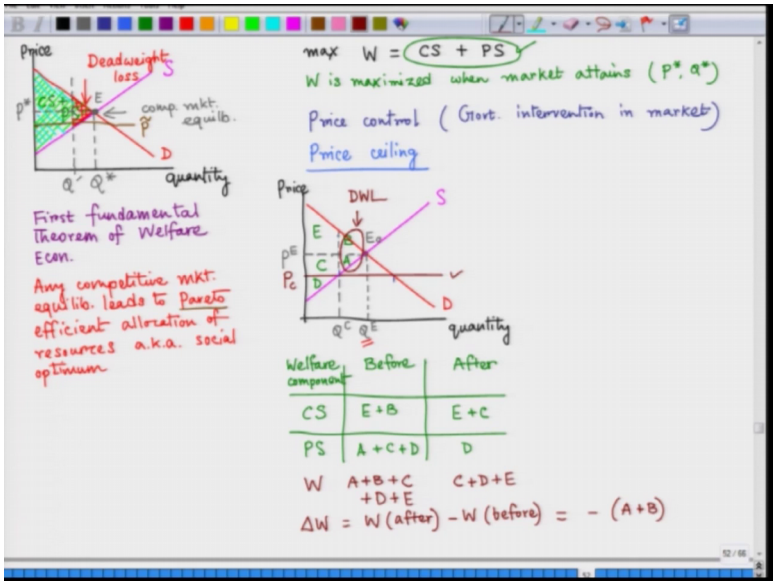


So, now let us talk about the market and not an individual firm or consumer. So, basically the problem at hand is to maximize social welfare which is given by say W and that has basically two components: consumer surplus plus producer surplus and we know what are they by now. So, now let us draw the competitive market model diagram again. So, we have this supply function and then we need to have the demand function. And, note that at the intersection the market finds equilibrium level of quantity. And, the market clearing price through Adam Smith's invisible hands mechanism, which is basically the perfectly competitive market mechanism and we note that capital Q star and P star right.

So, now we know that if we talk about the social welfare maximization, we need to find out some PQ combination in this graph where this term C plus CS plus PS is maximized right. So, the societies welfare is maximized when market attains a price quantity combination P star Q star, which is given to us by a perfectly competitive market setup. Now, we can prove by negation. So, if we get this point P star Q star and note that equilibrium by point E say, this is my competitive market equilibrium and I say that this is basically going to maximize my social welfare.

Then basically I have to show that the area of the region that is covered by producer surplus and consumer surplus is highest right. So, basically we are talking about a region which is like this shaded one. So, this basically gives me my consumer surplus plus producer surplus right ok. And, now if I deviate to any other quantity level suppose I deviate to a lower quantity level say Q prime, in that case how do we measure the consumer surplus and producer surplus? So, there we can draw a vertical line right.

So, what do we see that the new area, which is giving me the sum total of consumer surplus and producer surplus is basically this shaded area with the sky blue straight lines right. So, what do we observe there? We observe that there is a triangle which is generated here in this diagram and the society is basically losing out on the welfare, the amount which is given by the area of this triangle. So, let me now mark this area by red.

So, the society is unable to maximize its total welfare right. So, this area is known as dead weight loss right, as there is a deviation from perfectly competitive market outcome right. So, in a nutshell what do we observe? We observe that in a perfectly competitive market the laser fair or invisible hand mechanism attains some equilibrium in the model which maximizes social welfare, which is sum of producer surplus and consumer surplus.

And, we also have seen that if there is a deviation from that competitive market equilibrium position, then there is a loss in terms of societal welfare. And, the magnitude of the loss is called deadweight loss. Now, we are going to look at some cases where the government intervention creates a problem in the otherwise perfectly competitive market model, which basically restricts the society to find maximal social welfare.

So, we are going to talk about the case of price control. Price control policy measures by the government can be of two types and one here that the first one is known as price ceiling and the other one is known as support price or price floor. What is price ceiling? Now, if the government feels that P E is very high priced so, in that case government may say that I would like to put price ceiling and the producers are now dictated to sell their price at no more than P c.

So, that is basically my price ceiling line right. So, now if that is the case then what would be the market outcome? So, in that case we will see that producer would be willing to supply only Q S amount of good whereas, at this particular price P c demand

will be much higher and let us denote that by Q D right ok. So, what happens that at this output level Q S note that the buyers are willing to pay more than what the seller actually receives and let me denote that as P b ok.

So, what is the magnitude of the deadweight loss then? So, from the definition of deadweight loss or from the discussion of deadweight loss we can see that the dead weight loss is given by this area, which is shaded with red lines. Because, the market outcome Q S level of output is less than the perfectly competitive market output level Q E and that gives rise to deadweight loss right ok. So, after discussing the case of the concept of dead weight loss, now let us look at a very interesting and critical result from microeconomics, which is known as the first fundamental theorem of welfare economics.

So, here goes the statement of this theorem, any competitive market equilibrium leads to Pareto efficient allocation of resources, also known as which is also known as social optimum. So, basically we can see that a perfectly competitive market equilibrium helps us to find an answer to the basic question with which we started the course. And, the question was of resource allocation how to allocate resources of team, how to allocate scarce resources of the society optimally right.

So, now what do we mean by Pareto efficient allocation? We had some discussion regarding Pareto optimality before, but just you know let me remind you market achieves so called Pareto efficiency, when it becomes impossible to improve one party say one economic agent without making the other party worse off. So, that is basically the motion of Pareto optimality. So, in this case if you look at the diagram that we have drawn here so, if the market price is now low, say at some level P tilde which is less than the perfectly competitive market P star.

So, then we have another resource allocation. Now, at this market price the consumer is well off because, the consumer can gain some extra consumer surplus, but that extra gain in terms of welfare is basically at the expense of the welfare loss made by the producer. So, basically from P star Q star combination, you cannot make buyer well off or better off rather than sacrificing the welfare of the producer and vice versa ok. So, this is one part.

So, after having done a graphical illustration of the deadweight loss in the price ceiling case, let us now look at some more analysis which will help you to find the exact area of

deadweight loss. I marked it with this red dash, but let us now do it in another way. So, for that I have to reduce I have to erase some of these part some parts of the diagram so, that it becomes less clumsy. So, after erasing some parts of the previous diagram, we are now ready to revisit the price ceiling case from a different angle.

So, now let me assume that this is the output level corresponding to this is the market clearing output level corresponding to the price ceiling case. I denote that by Q C and now let me draw a vertical line at that output level and that line intersects the demand curve right ok. So, now let me name some of these areas. So, let me call this area A, then let me call this B, let me name this area C, this is D and lastly let me also name this area as E. So, we can call this as the initial equilibrium point E naught right fine.

So, now let us make a table to have some detailed analysis of consumer surplus and producer surplus change. So, basically what I want to do here, I want to show you the area that I have marked with red dash last time and told you that this is the area of deadweight loss. We can get the same conclusion if we want to follow a different approach that is basically my objective ok. So, here we can talk about these welfare components in the first column and they are namely consumer surplus and producer surplus right ok. And, then there are two cases right; one is basically the before case before the imposition of price ceiling and then what happens after the price ceiling is imposed right.

So, there are two different cases before and after and now from the diagram above we are going to look at how we can measure this welfare components pre and post price ceiling imposition right. So, before the price ceiling the consumer surplus should be E plus B and after the price ceiling it should be E plus C right ok. Now, PS producer surplus before the price ceiling would be A plus C plus D that area and then after price ceiling is imposed it is only D right ok.

So, basically if I now look at the welfare the total social welfare, which is basically given by W that is basically A plus B plus C. So, that is basically the before price ceiling imposition case. And, after price ceiling that would be C plus D plus E right. So, then if we talk about change in welfare delta W, then that is basically welfare after price ceiling imposition minus welfare the pre price ceiling case or situation right. So, then basically if we take the difference we get the area minus of A plus B.

So, basically we observe a deadweight loss and if we now go back to our diagram you will see that indeed we get back the same triangle, which we received earlier and marked it with red right. So, this is basically our dead weight loss from the price ceiling. So, we are done with our discussion on welfare implications of price ceiling.

So, we have just started discussing different types of violations of the perfectly competitive market assumptions and their implication on social welfare maximization problem. In the next lecture we are going to study what will happen if the government decides to impose unit tax on the commodity and if it happens then, what will be its implication on social welfare.