Energy Resources, Economics and Environment
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Lecture 11
Utility and Social Choice- Part 4

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Okay, so now to get back to our usual analysis, when we talk in terms of creating, this figure is from Kolstad, we can do a similar kind of thing if we are looking at, let us say any goods and services if you are looking at coal or oil or natural gas, we are looking at the quantity and we have the price. So when we do this, we can create first of all, a typical demand curve. So, that means at a certain price, if you are looking at let us say coal, at a certain price, there will be zero demand for coal and as the price decreases, the quantity increases, so this is the demand curve.

On the other hand, if we look at the supply curve, we will find that there is a minimum amount of price which the supplier must get before they decide that they will supply the product. So, we will start with a minimum and as more and more quantity is demanded, more and more price, more and more price is there, more or more quantity will be supplied.

Because at higher prices there will be others will come into the market and so, you will have a supplier curve something like this. So, here, if you see, we will get this point, which is the point of intersection, which will give the price at which we will operate in the market, we can draw a straight line through this and this then becomes the quantity demanded and this is the price.

Now, what happens in this is if we look at this, you will find that, as we look at any particular amount of quantity, if we look at this point, at this point, people are willing to pay a higher price than the price here, since the market is clear that this price all the entire quantity is now available at that price.

However, if the quantity required was lower, you are willing to pay an additional price but we are getting it at this price this difference is the surplus that is available to the consumer. And when we integrate this, this total amount, this is the consumer surplus. We will define this in a bit, in a similar fashion, if you look at a producer, producer is getting this price.

Producer was willing to produce at this price as it goes on. So, at any point of time, you are getting this prize but you were willing to produce so this part shows the producer surplus and if you integrate this again over the entire range of quantities, we will get, this is the producer surplus and this total is consumer plus producer surplus.

When you look at this, the consumer if I fixed some other price, if I had the market price at some other point, we would find it, suppose we added at let us say, at a higher price, then the producer surplus would increase, the consumer surplus would decrease and the total would actually decrease. So, you can actually show that in this particular case the total surplus is maximized when we have this point as the intersection of the market clearing price. So, that is an interesting kind of aside, we can actually show that this is the case.

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Now, let us define these so, the consumer surplus as we have defined, as you can see in this case is that we have let us say consumption of q star units for a consumer, we talk about any consumer which is.

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Let us redraw this and let us know draw these curves and we can so, in general this is the quantity and this is price and this is the consumer surplus. So, you can see that this is the consumer surplus, this is p star and this is q star. So, if you look at this, it is the q star units for a consumer the area between the demand curve, this demand curve and the horizontal line p is equal to p star, this is the line p is equal to p star. This area between q is equal to 0 to q is equal to q star, this area under this curve is the consumer surplus.

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And in a similar fashion, we can show the producer surplus. So, we can draw this and here now, again we have q star and p star and this is your price and quantity. So, in this case when you define this, this is the way in which we have turned this and now, we are looking at the producer surplus as a production of q star units for a producer, which we were talking about this is the point and the area between the horizontal line p is equal to p star, this is p is equal to p star and the supply curve between q is equal to 0 and q is equal to q star, this is the producer surplus.

So, with this we have defined, formally define the consumer surplus and the producer surplus. And, to quickly sort of sum up first we have looked at the Arrows Impossibility Theorem, which says that there is no need theory of social choice which meets all the six axioms that we had. And then having said that, we then looked at the kinds of when we talk about a market.

We talked about the movement so, that we are on the Pareto frontier, no Pareto improvements are possible, there are no inefficiencies in trade and no inefficiencies in production.

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And then we said that there are these theorems of welfare economics, where we say that the competitive economy, market equilibrium is Pareto optimal. And then any Pareto optimum that we have can be achieved by the market forces, provided resources of economy are appropriately distributed before the market is allowed to operate.

We also noted that, the market says nothing about fairness or distribution of resources between individuals and equality or inequality. We then talked about the different assumptions which are there for creating a market and talked about the definition of the equilibrium, market equilibrium, the consumer surplus and the producer surplus. And we said that the equilibrium which is obtained maximizes the sum of the consumer and the producer surplus and this is the basis for saying that okay, the market is a good thing to happen.

We will see the assumptions which are there in terms of creating this analysis for the market, many of these assumptions often will not be relevant in the real world. And then there are distortions in the market, where there is a need for government intervention, there is a need for policies and we will take a look at some of this.

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You can look at more details in the book by Kolstad or the book by Webb and you can look up the Lawrence Summer Memo. We are going to now look at in the next module, we will look at the different kinds of goods and services, we will look at what are known as public goods and private goods and how do we differentiate this and then we will take that forward and look at how do we look at goods and services and the environment and try to see how we can include the environment in the calculations that we are doing for the market equilibrium.

We have seen the concepts of market equilibrium and we said that the market equilibrium gives us a Pareto optimal. It is a solution on the Pareto optimal frontier, we also said that the market equilibrium maximizes the total surplus, that is the consumer surplus and the producer surplus.

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So, let us take a simple example to illustrate the concepts that we have just learned. So let us look at an example, we have a supply curve for petrol in a country where the price is given as 10 plus 2Q. So, it is a linear supply curve and obviously, if the price is more, more of the producers will be willing to supply. So, that is a P plus is 10 plus 2Q, the demand curve on the other hand is given us P is equal 100 minus 4Q, where Q is the quantity and let us say that the P is the price in rupees per liter, this is an aggregate demand curve.

So, the Q would be for the country as a whole maybe in terms of some millions of liters or millions of tons, but we will just look at it as a unit, physical unit and P is the price in rupees per liter.

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So, the question which is asked is plot the supply and the demand curves and determine the equilibrium price and the quantity, what is the consumer surplus and the producers surplus and show these on the plot.

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So, let us just do this, let us draw first, right down the axis this is Q, this is P and when we look at the supply curve that is 10 plus 2Q. So, when Q is equal to 0, the price will be 10 and it will increase as a straight line.

And here when this is the supply curve P is equal to 10 plus 2Q. In the demand curve when Q is equal to, when the price is 100, there is no consumption and then when the price is 0, this will come to 4Q is equal to 100, so Q will be equal to 25. And we will get something like this, this is 100, this is the demand curve. This point becomes the equilibrium point and this is the, the producer is getting this price.

Let us calculate that price, let us equate the two, that is 10 plus 2Q is equal to 100 minus 4Q, let us just use another piece of paper and so you get 10 plus 2Q is 100 minus 4Q. So, we get 6Q is equal to 90 and Q is equal to 15, whatever units million tons, million liters, put this back in the price. So, the price is 10 plus 2 into 15 that is going to be 30 plus 10 that is going to be 40.

So, the price is 40 rupees per liter. And the quantity is 15 whatever million, tons. So, now, when you look at this, if you go back to the figure, this is going to be 40 and this is 15. The shaded area that we have is the surplus of the producer because the producer is getting 40 rupees per liter and for at any quantity less than 15 when we look at it you are getting 40 but we were willing to pay the supply curve says it is a smaller value.

So, at any point this is the surplus, which is the producer surplus when you sum it up over the total amount of Q this is the amount. So, if we look at what is the producers surplus, this is the producer surplus, we can find out this area, this area is going to be half, it is a triangle, half base into the height and this base is if you look at this, this is 10 half into 30 and into 15. So, producer surplus is going to be 15 into 15, 225 units.

The consumer surplus is like this at a price of 100, the consumer will not buy, there will be no demand, but at any other price, the actual willingness to pay is this value and the actual payment is only 40 rupees. So, this much is the consumer surplus, if you aggregate

it over all the consumers, this triangle which is shown here, which I am now shading, this is the consumer surplus.

So, the consumer surplus here if you look at it, if this triangle the area is going to be half into this is 40, 100 minus 40 is 60 into 15 so, this is going to be 30 into 15, 450 units. Total surplus then becomes, it is also known as the market surplus, total surplus or market surplus. Market surplus is 450 plus 225 is 675 units. So we have solved this, we have got the equilibrium point and we have got the total surplus, we have got consumer and the producer surplus.

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Now, the question is that if the government decides to fix a price of let us say rupees 50 per liter, explain what happens to a consumer and producer surplus, is this price fixing efficient from a economic viewpoint? So, in a sense, for instance, if you see actually in India today, the X refinery price of petrol, of petroleum products on that on top of that is taxes and duties.

So, the actual price that we pay for petrol is almost double of what is the price X refinery. And this is because the government uses that as a revenue mechanism, also wants to discourage the consumption of oil because we have so much oil imports, but if we now just said that let us say instead of 40 we would like to make this at 50 at this point, then what happens to the consumer surplus and the producer surplus?

Now, what would happen is in this case, if you see this area is reduced from the consumer surplus so, consumer surplus will reduce by this quantity. The actual equilibrium value of supply would reduce and we can calculate this by putting in, this point can be just calculated by looking at 100 minus 4Q is equal to 50, so Q will be 12.5, this will be 12.5.

Now, when you look at this, you will find that basically now, the consumer surplus has decreased by this amount and the producer surplus, on the other hand has now become this amount because the amount of course, presuming that all of this money is going to

the producer and not to the government as a tax. If we fix this, then this is this amount of area is increased while this is decreased and this is the total.

But as compared to the earlier case, this small triangle that we have is the dead loss and this is the inefficiency because of the price fixing and as we saw earlier, the total surplus that is producer surplus and consumer surplus is maximized at the point where we have the market equilibrium, where the points intersect and if we fix any other price, the total surplus would actually reduce.

So, you can cross check and you can calculate for 50 rupees and you can calculate this area and you will see and so, this is basically this is the reason why we say that the market is efficient and market equilibrium is the point at which we can get the Pareto optimality and the efficiency. Of course, this is subject to all the assumptions that we have made for the operation of the market.