Environmental & Resource Economics
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Optimum extraction of renewable resources and Tragedy of Commons Part - 5

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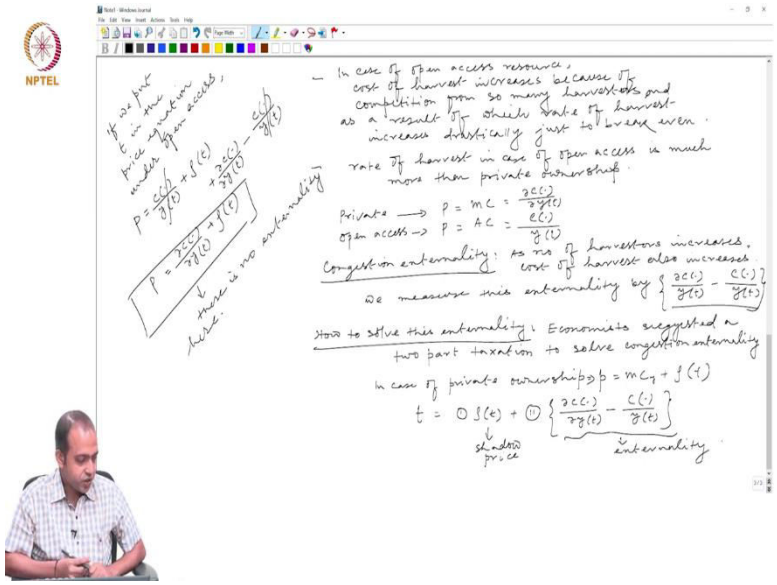

So, that means, what we see that in case of open access resource cost of harvest increases because of competition from so many harvesters. And as a result of which theft rate of harvest increases drastically just to break even. Let us price is given, cost of harvest is increasing so, obviously, I have to harvest more just to break even. That is why, we say that, rate of harvest in case of open access is much more than private ownership.

Now, in case of private ownership, what we saw that in case of private ownership, we saw that price equals to mc, and in case of open access, we saw that, price equals to average cost. So, this is basically del c dot del yt this is c dot divided by yt. So, the divergence between marginal cost and average cost pricing actually is a measure of externality, which is called congestion externality.

What is congestion externality? That as number of harvesters increases cost of harvest also increases. So, since this cost of harvest is increasing because of too many congestion too many harvesters this is called congestion externality. This is called congestion externality. And how do we measure it? We measure this externality by this del c dot del yt minus c function yt. This is the measure of condition externality.

So, I will repeat once again. Why condition externality? This is an externality created by too many harvesters in that open access resource. Too many harvesters means, cost of extraction increases due to competition, and price also becomes equals to average cost instead of being equal to the marginal cost of extraction.

Now, how to solve this externality? How to solve? So, solution economist suggested a two-part taxation to solve congestion externality. So, in case of private ownership it was a case of private ownership p equals to mc plus rho t. So, what is happening here? The moment we assume open access this rho t is no longer there, and there is a congestion externality measured by this.

So, first of all, we need to do something for the shadow price, we need to do something for this externality specifically. So, the solution is to impose a tax, and this tax should be equals to first of all two elements this rho t plus the second one which is equals to this one, del c dot del yt pluc c dot yt. This is called two-part taxation, first part and second part.

Now, if we put this t into this open access resource, then what will happen? So, if we put t in the price equation under open access then what will happen? We will get p equals to. So, what will happen in case of sorry this is negative, del c dot this is negative. P equals two c dot into yt this was the price equation for open access.

Then we will put we will put rho t then we will put del c dot dell yt minus C prime sorry C over yt. So, this and this will get cancelled. So, we will get del c dot del yt plus rho t which is basically the equation in case of private ownership, there is no externality here. So, this is the solution basically suggested by the economics.

It is quite logical, theoretically, the solution is, this solution is theoretically we can think of this type of solution what happens actually in case of private ownership in case of open access. In case of open access price becomes average cost of extraction, in case of private ownership marginal cost plus the shadow price rho t.

So, to bring back the price equation in case of private ownership, economists at the theoretical level they suggested some two-part taxation t should be equals to the first part is rho t and second part the amount of congestion externality. So, this is shadow price and this is externality.

At the microeconomics when we started microeconomics any type of externality is generally solved by taxation. Same principle is applicable here, to solve the externality we are putting tax, but this tax is a little different from what we studied earlier, this is a tax which has two components. First component is equal to shadow price, second component is equals to externality.

And if we put this two-part taxation in the context of open access resource then what we are getting p equals to c dot divided by yt plus rho t plus del c del yt plus c dot divided by yt. So, this and this will get cancelled out we will get rho t del c dot del yt plus rho t which is basically the equation in the context of private ownership when there is no congestion, when there is no congestion externality.

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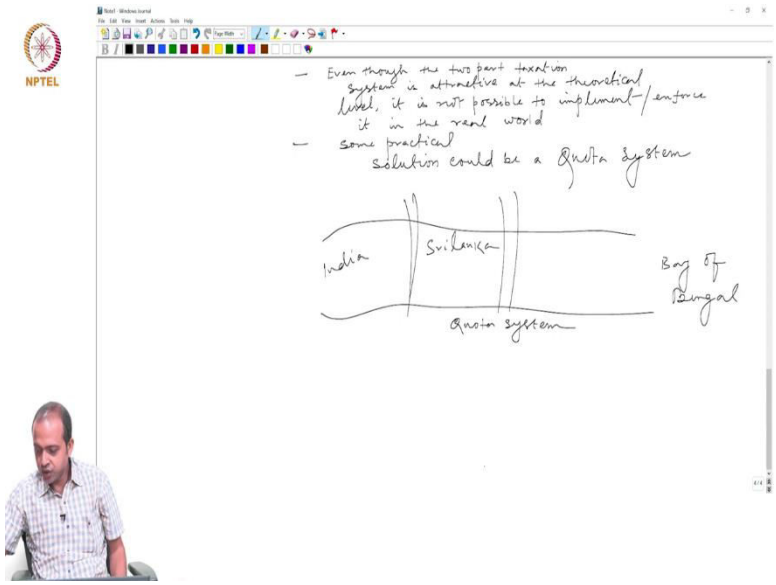

But the question is, even though the two-part taxation system is at attractive at the theoretical level it is not possible to implement or enforce it in the real world. Because we were thinking this open access resource in the context of deep sea and ocean. Now can we implement this type of two-part taxation in the context of ocean? It is not possible.

It is difficult to implement and enforce it in the real world. Then what is the solution? Some practical solution? Some practical solution could be a quota system instead of taxation. What is the quota? That means, even within the ocean within the sea also, it is possible to create a boundary. Let us say this is the ocean, so what do, we create a boundary for different countries. Let us say this part is India and this part is given to let us say Sri Lanka.

So, Indian harvesters will harvest from this part of the sea or ocean, Sri Lankan harvesters will be restricted only this part for harvesting and this is basically a quota system. So, two types of solution, one is taxation another one is quota. Just like our same microeconomic principle to solve any other type of externality.

In the context of externality economics first, they assign about the price-based quotas price-based mechanism which is called price rationing, price rationing, which is called taxation. So, two-part tariff equals to shadow price plus congestion externality. In the context of deep sea an ocean when this price-based quantity rationing fails the next alternative is the quantity rationing which is the quota.

So, we say that up to this match is assigned to India up to this match is let us say this is the Bay of Bengal. So, we create a boundary for each country and we ask the harvester to restrict themselves in this territory, this is some kind of practical solution for the congestion externality problem to solve.

So, that means, what do we have learned today, basically, in simple terms we learned that the resorts may get exhausted in case of both private ownership or private open access. However, the rate of exhaustion will be much more acute in the context of open access as compared to private ownership because the rate of extraction is much more there in open access.

Why this is so? Because in open access, since everyone is allowed to harvest, no one can be restricted, there is no benefit from the resource to be preserved for future, and as a result of which shadow price becomes 0. When shadow price becomes 0, there is no benefit from future preservation.

Then each and every individual harvesters they try to maximize their harvesting at present time. Why this is so? Again, another explanation, too many harvesters result in increase in cost of extraction. When cost of extraction increases then the harvester has to increase its rate of harvest just to break even.

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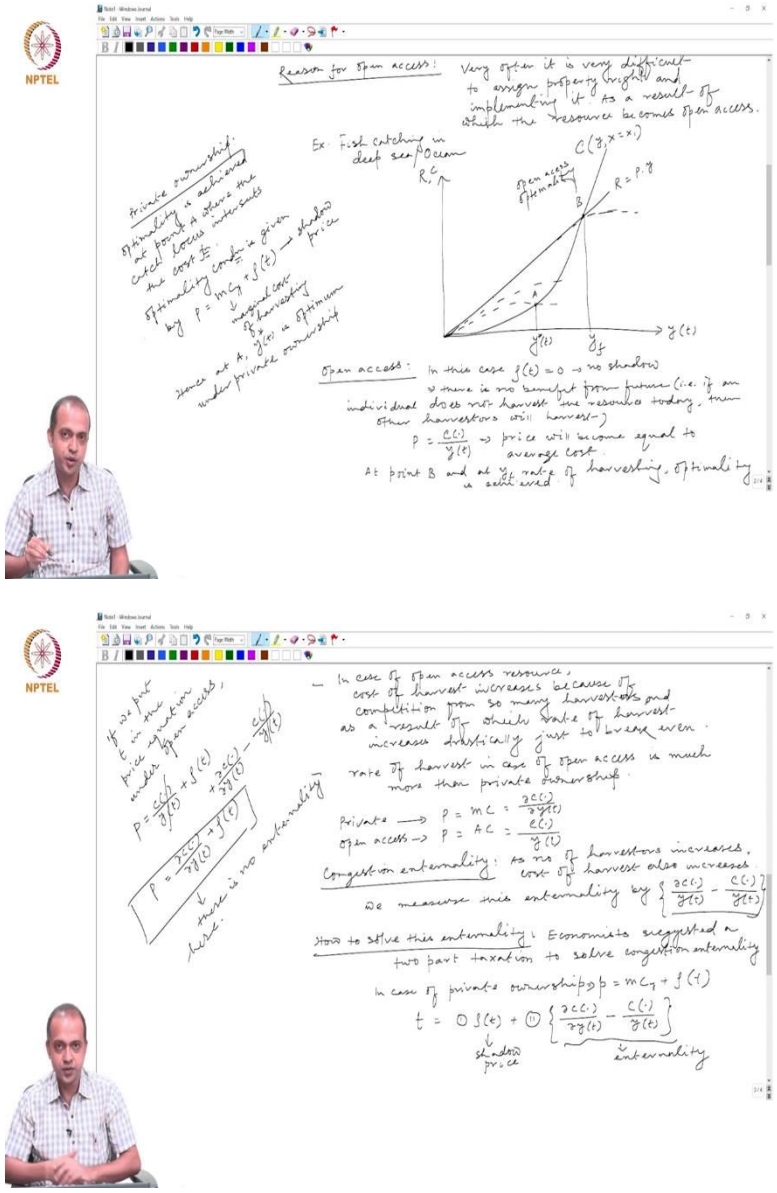

So, in terms of the previous diagram, if we think about this is the private ownership This is the open access equilibrium attached to so optimality open access where price becomes average cost. Why this is average cost?

If you look at, this is the cost function, and this line becomes tangent at this point, and catch locus is passing through here that is why this is called average cost pricing and resulting in only the breakeven for the harvester where cost equals to revenue.

This basically explain why, rate of extraction in open access is quite larger than the private ownership. This result in congestion externality because too many harvesters resulting cost of

harvest to increase and this is measured by delta, sorry, a divergence between marginal cost and average cost.

How will you solve this? By first two-part tariffs, two-part, tax system, tax would be equals to shadow price plus this. If we put this into the equation of open access pricing, we will get price equal to marginal cost plus rho t, that means, once again the externality problem is solved. But in real world, this solution is not practical.

Why this is not practical? Because to impose a tax equals to this is basically difficult in the context of deep sea and ocean. So, economists they suggest then better to go for a quota system. We will assign a particular area for a particular country and ask the harvesters, all the harvesters from that country to restrict themselves in that particular region. This is the practical solution for the congestion externality. Thank you.