Environmental and Resource Economics
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Effectiveness if Incentive design and Economic valuation of Environmental goods and service Part: 1

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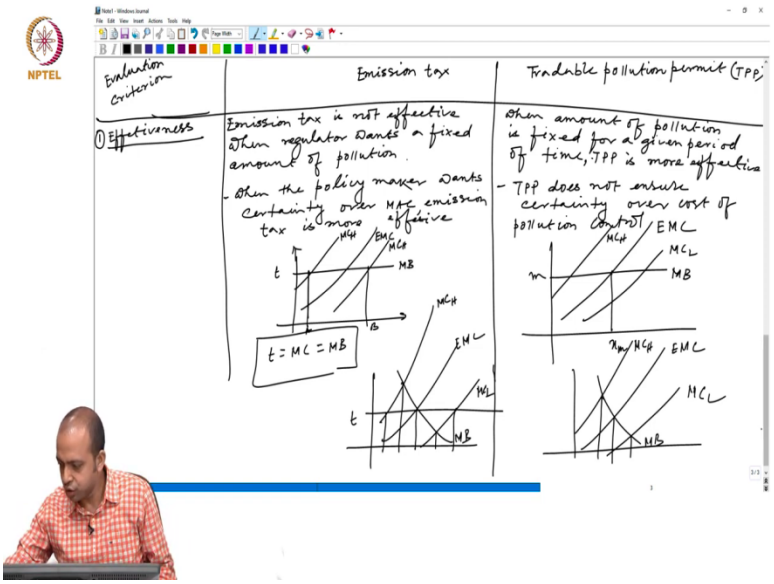

So, let us first talk about effectiveness. So, this is emission tax and this is tradable pollution permit. So, when you are evaluating these two policies, emission tax and tradable pollution permit what is the evaluation criteria, this is let us say this is evaluation criteria. So, the first evaluation criterion is let us say effectiveness.

And now what I told that effectiveness depends on objective. Now, let us assume that policymakers objective is to design a policy which will result in a known amount of pollution in a given period of time. So, policymaker wants a fixed amount of pollution to come out from an industry in a given period of time.

So, when amount of pollution is given, pollution is fixed for a given period of time what we know that tradable pollution permit is this is let us say, tradable pollution permits or TPP in short. TPP is preferred, TTP is more effective. So, effectiveness depends on the objective and if we assume the policymakers objective is to design a policy which will result in a known amount

of pollution in a given period of time, then tradable pollution permit is preferred compared to emission tax.

Because in emission tax policymaker does not know at the end, how much pollution all the forms will actually generate. So, emission tax is not effective when a regulator wants a fixed amount pollution, this is not effective. On the other hand, let us say that regulators objective is not to get a fixed amount of pollution rather the objective is to design a policy which will ensure certainty as far as control cost is concerned.

So, when the policymaker wants certainty over control cost or I would say that marginal abatement cost emission tax is more effective. Because in that case policymakers design the tax rate and policymakers know that what is the control cost marginal cost of control that is t but here what would be the control costs that is unknown. There is no certainty because policymakers has assigned the permits.

Now what would be the price of the permit in the market that is unknown a priori that it depends on the demand and supply of permits which is unknown. So, that means at the end, there will be lot of uncertainty about the marginal cost of abatement because if firm does not know what would be the price of the permit in the market if I fall sort of certain permits. In that case, if the policymakers objective is to remove the uncertainty about the control cost, then emission tax is preferred, not the tradable permit.

Similarly, when the policymakers objective is to design a policy which will ensure a fixed amount of pollution tradable permit is preferred, not the mission tax. TPP does not ensure certainty over cost of pollution control. So, these are the two alternative cases. And we have also discussed alternative scenarios, if you remember alternative scenarios, when the marginal benefit is known, but marginal cost is unknown, then the pollution tax is more effective, because even if it is higher or lower, at each point, t equals to MC equals to MB is achieved.

At this point, let us say this is A, this is B at both the points A and B, t equals to MB equals to MC achieved however, in this case when this is known, this is M depending on if this is MC low and this is MC high we said that none of this point is effective, because once you assign proper

certain permits, the permit system is not flexible enough. The permit system is not flexible enough to take additional permits back or to supply more permits in the system.

As a result of which when the marginal cost is unknown, an MBs flat straight line emission tax is fully effective. While w tradable permit system is not and on the other hand we have also discussed when this is marginal benefit is steep straight line and let us this is expected marginal cost then this is MCH. This is MC low. This is tax. So, we will say that there is a divergence between what the society wants MB equals to MC and what the private firm will do.

So, there will be a divergence. However, in this case when MB is steep straight line and this is MB and let us this is MC expected marginal cost. This is MC low and this is MC high, we say that the effectiveness of tradable pollution permit increases when marginal benefit is steep straight line. So, these are alternative cases.

So, basic thing is then what we need to understand as far as effectiveness is concerned, if the policymakers objectives to ensure certainty over marginal cost of abatement, then emission tax is preferred to TPP if the policymakers objective is to get a fixed amount of pollution in a given period of time, then tradable pollution permit is preferred to emission tax. So, first we have to fix the regulators objective then only we can understand their relative effectiveness.

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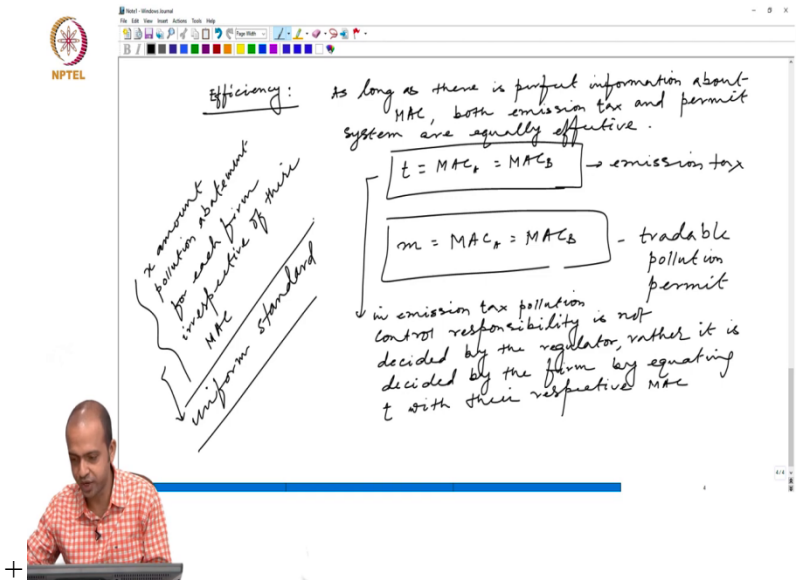

Then let us talk about efficiency. So, efficiency the economists they say that as long as there is perfect information about marginal cost of abatement or marginal abatement costs both emission tax and permit system are equally effective and optimum the condition is t is equals to marginal abatement cost let us say there are two forms equals to marginal cost of abetment B firm A and firm B, this is the optimality condition. And in case of permit system, this is in case of emission tax and so we need to know what is the marginal abatement cost of each form.

So, each form is equating their marginal cost of abatement with a given tax rate or with the permit price. So, as long as this MAC A and MAC B marginal abatement cost, they are known with complete certainty, both the policies are equally efficient. But the challenge arises as I said, when there is asymmetric information between the regulator and the firms about their true marginal cost of abatement.

Now, we said here that when this is completely certain about the marginal cost of abatement, then emission tax is if is efficient that means, indirectly we can say that imposing emission tax is better then imposing some kind of uniform standard in this case, I am not asking the firms that you should abide this much and you should abide that much regulator is not asking any amount of pollution control from the firms rather, regulator is only deciding about the tax rate firms they themselves they are deciding about their respective pollution control responsibility.

So, in emission tax pollution control responsibility is not decided by the regulator rather it is decided by the firms by equating t with their respective marginal cost of abatement. Now suppose instead of imposing emission tax the regulator is equally distributing the pollution control responsibility. So, that means the regulator is asking each and every firm in that industry that everyone should control x amount of pollution for each firm irrespective of their marginal cost of abatement if that is the case that is called uniform standard.

So, we need to now prove that this emission tax is better than uniform standard as far as cost of pollution control is concerned. So, our next task is to prove that emission tax is efficient. So, that means if we can prove that uniform standard is not efficient, then we can prove emission tax is efficient and it is better than the uniform standard. Let us prove that.

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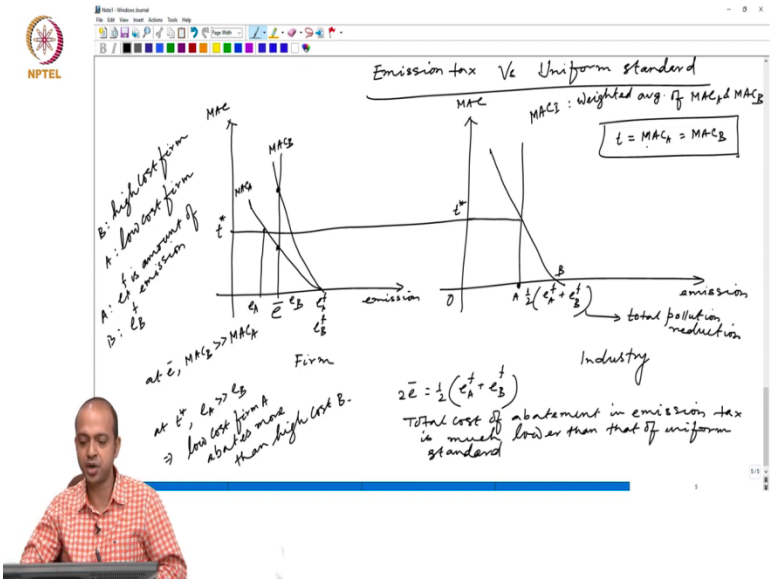

So, here we are discussing emission tax verses uniform standard. Let us say that we are drawing two simple diagrams in the left hand side this is for the firm level this is for the firm and this is let us say for the industry in the x-axis we are measuring emission, in the y-axis what we are measuring is marginal abatement cost.

Now, let us say that there are two firms A and B, and this is let us say MAC A, this is MAC B. So, we can understand very well that MAC B is higher than MAC A that means, firm B is a high cost firm. So, B is high cost firm and A is low cost firm and both these MACs that means they both are generating e f A.

So, that means this is e e f A and e f B. So, that means both are generating this amount of emission. So, for firm A e f A is amount of emission and for B this is e f B. Now, let us say that this is MAC industry level and that is the weighted average of MAC A and MAC B. Let us now suppose the regulator wants this amount of pollution control, which is half of E f A plus e f b. I will draw this diagram a little differently instead of this let us say that this is done.

So, this is the amount half of e f A and half of e f B is the total amount of pollution that the regulator wants to reduce. So, this is the amount OA. Let us say this is O, let us say A let say this is B. So, half of e f A and half plus half of e f B is the total amount of pollution reduction for

both the forms at the industry level. Regulator is now let us say imposing an uniform standard which is given by e bar.

So, that means 2 of e bar equals to half of e f A plus e f B. So, regulator is asking both the firms A and B to reduce their pollution by amount e bar, is that clear? So, if I take twice of e bar then my total amount of this is half of e f A this is called this is total amount of pollution reduction which is achieved by imposing uniform standard e bar.

Now, what is happening when the e bar amount of control responsibilities distributed among A and B. At e bar marginal cost of pollution abatement for firm B is much higher than the marginal cost of abatement perform. So, at e bar MAC B is much higher than MAC A. So, that means, we are imposing a policy at which form these marginal cost of abatement is much higher than the firm A.

That is why this is not a cost effective system rather what we should do if we want to achieve the same half of e f A plus e f B amount of pollution reduction, the regulators should first decided tax rate decided here by equating the industry marginal abatement cost with a vertical line which is deciding about the pollution reduction then the same tax rate is given to the firm.

Now, each firm will now equate this tax rate with their respective MAC. So, what will happen then firm A will reduce this much pollution reduction. This is pollution reduction for let us say e A and the pollution reduction for firm B would be e B. So, that means we can now easily understand since at t star e A is much greater than e B.

So, that means low cost firm A abides more than high cost and that is why emission tax is more effective. Because we are redistributing the control responsibility from high cost to low costs. Then, the society is achieving same amount of pollution control at a lower cost is this clear when the uniform standard is imposed firm these cost of abatement is much higher than firm A.

So, total cost of abatement in this scenario when uniform standards is imposed is much higher than a situation when the tax is imposed. Because when the tax is imposed a high cost firm B is abating less amount. What is the amount? This is the amount of pollution reduction. For firm A, what is the reduction? This is the amount. So, firm A since firm A is low cost firm.

Firm A is abating much more than the high cost firm B and as a result of wage total cost of abatement in uniform standard that means what we are saying, in emission tax is much lower than that of uniform standard and that is why we say that emission tax is more efficient compared to the uniform standard. Because emission tax has that type of capacity to redistribute the pollution control responsibility from high cost firm to low firm.

Emission tax achieved this particular condition t equals to MAC A equals to MAC B. So, each firm is equating their MAC with the tax rate and then deciding about their how much of emission they should reduce at optimality. But in uniform standard that is not the case I am asking everybody irrespective of their cost of abatement that you should reduce same amount that is why uniform standard is not efficient as compared to emission tax.

Emission tax achieves the same amount of pollution control at a much lower cost compared to the uniform standard. This is how we can prove the efficiency of emission tax and same thing same way we can prove that even tradable pollution permit is also equally effective, efficient, but we are not discussing the same mechanism here.

The only objective is to contrast this market based instrument against some uniform standard which we generally considered as command and control. Because policymaker is simply fixing an amount from the outside no flexibility is given to the firms to decide their amount of pollution control based on their marginal cost abatement which is the case in here in the context of emission tax.

So, with this, we are closing our discussion today and remaining portion we will discuss in our next class about the incentive design. Thank you.