Environmental and Resource Economics
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Policy Implications of Environmental Kuznets Curve and Economics of Sustainable Development part – 6

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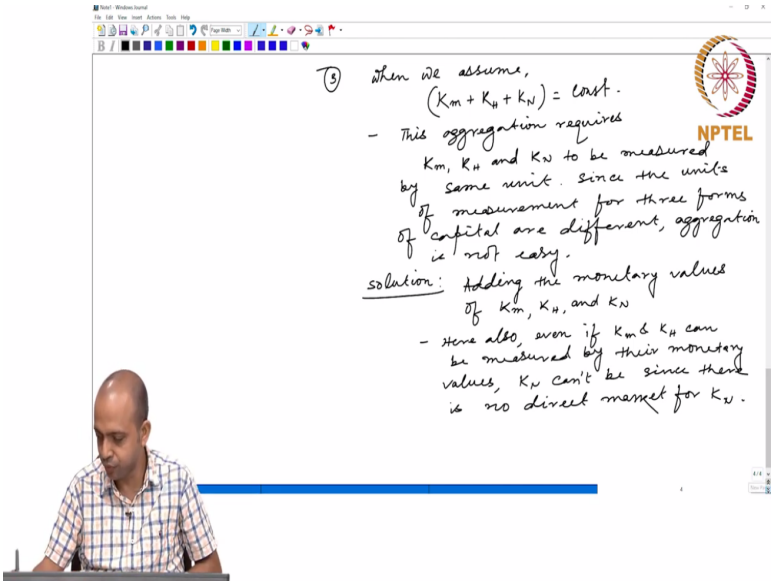

The limitation number 3 what it says that when we assume Km plus KH plus KN equals to constant. So, that means, we are trying to get the aggregated value of different forms of capital. Now this aggregation requires Km, KH and KN to be measured by same unit, if they are not measured in same unit, how is it possible for us to aggregate them, but if we think Km manmade capital for example, when we are trying to add manmade capital with natural capital that means, we are trying to add forest, wetland, oil and coal with computer, projector, factories so on and so forth.

So, and then again that we are trying to add with the knowledge and skill that is endowed with the labor force. So, these three forms of capital they are measured in quite different units as a result of which aggregation of Km KH and KN is actually not possible. So, since, since the units of measurement for three forms of capital are different aggregation is not easy.

Then what is the solution? Some economists or they say when different forms of capital, what is the solution then? Solution is how do you solve the aggregation problem? The solution is when

different forms of capital are measured in different units they say that we need to arrive at their monetary value and then we can easily had these monetary values of different forms of capital.

So solution is adding monetary values of Km KH and KN, but again if we try to get the monetary values while getting monetary values for Km and KH also to some extent is possible getting a monetary value for KN is again difficult because there is no direct market for natural capital. So, that means here also even if Km and KH can be measured by their monetary value KN cannot be since there is no direct market for KN.

There is no direct market for most of the environmental goods and services. Then how do you overcome that problem? That problem can be overcome by constructing hypothetical market under the stated preference approach. So, that means, either you use by stated preference approach or you use the reveal preference approach or production function approach to arrive at some kind of value for this natural capital as well.

So, that means, there are several problems there are several solutions also. So, we need to think about the problem holistically things are not so black and white. So, these are the different issues that different problems, different type of problems that we may encounter while aggregating Km, KH and KN and we need to keep in mind that in social science, we are basically not looking for a unique answer for each and every problem rather we are trying to learn, how the issue can be viewed from different dimension and from different angles.

Here the answer is less important and more important things are different approaches, different dimensions to approach the problem. So, this is the third problem of Hartwick's rule of sustainability. Then there is another problem which is called fourth problem.

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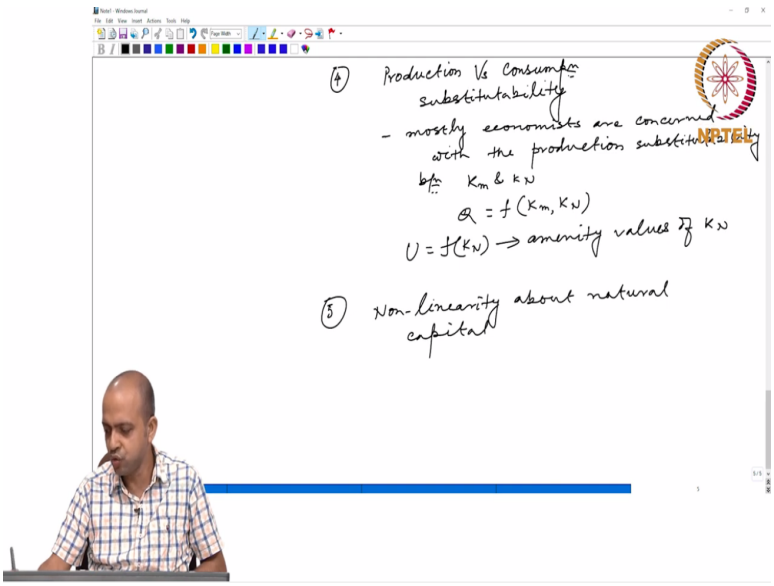

Production versus consumption substitutability. What is this? When we talk about substitution, when we try to measure elasticity of substitution mostly economists are concerned with the production substitutability between Km and KN. So, that means, we assume that output is basically a function of manmade capital and natural capital.

So, we try to think how far this manmade capital is substitutable to KN in the process of production, but apart from being utilized in production, natural capital it has another utilization as well, this natural capital may enter into our utility function, where utility is a function of natural capital basically, we are talking about the amenity value. If you recall in one of our initial lectures we said that environment basically has three services to provide. First one is the supplier of energy and material.

Now, when we say supplier of energy and material, that energy and material is used for production, second one is the absorptive capacity that means it environment can be used as a dustbin also and third one is called amenity value. So, that means the nature, the beauty of the nature it interest directly into our utility function and we derive satisfaction from its amenity value.

Now, manmade capital can be thought of, as a substitution for natural capital as far as production substitutability is concerned, but manmade capital cannot be considered as a substitute to provide amenity value, we can always construct a bridge, we can always a multi storey building in a place, where there is a wetland, but that wetland a river, a water body, hilly regions they give lot of other satisfaction that means we derive amenity value and we cannot get the same amenity value just by looking at a multi storey building like what we were deriving by looking at the river by looking at the wetland or the beauty of the hilly regions.

So, that means while production substitutability to some extent is possible. Consumption substitutability is not, so that means, here in the utility function since in the utility function, the amenity value what we derive that cannot be provided by Km we are not allowed for this type of substitution that is another limitation. So, we can only replace its production possibility, we can always substitute the natural capital for its production purpose, but we cannot replace any way by no means we cannot substitute the amenity values of the natural capital that is another problem.

These are the problem major problems of Hartwick rules of weak sustainable development. Weaker version of sustainable development there are mainly four limitations, which we must keep in mind while defining about this sustainable, weaker version of sustainable development. So, when this is not possible, then a group of other economists they came up with and also there is one more limitation, which is non-linearity about natural capital.

So, that means, what we assume that we can always replace natural capital by manmade capital, but there are a lot of nonlinearities exist in the existence of natural capital, we do know after some point of time, the amount of natural capital what we get left after utilization may not be irreversible. So, that means, the nonlinearity, the uncertainty about the ecosystem, natural capital so on and so forth. It prevents substitution between manmade capital and natural capital.

So, after some point of time the stock of natural capital may be such that we cannot get it repaired, we cannot reverse that stock what we were having earlier. So, these five reasons, these are basically the limitations of weaker version of sustainable development and now, since this is not possible, we need to think about the second one where.

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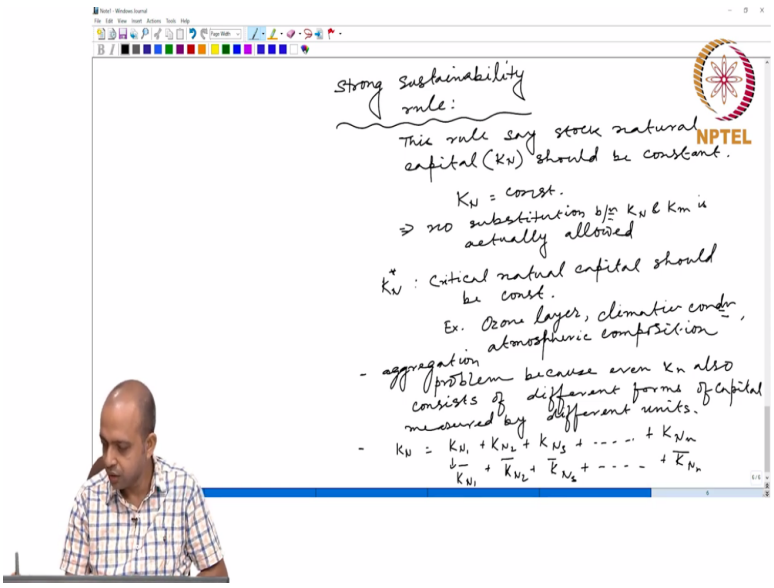

Which is called strong sustainability rule. This rule says, stock of natural capital that means KN I would say stock of natural capital denoted by KN should be constant. Now, what does it indicate when I say KN equals to constant that means, it implies no substitution between KN and Km is actually allowed. So, that means, strong sustainability rule says that natural capital is no way a substitute for manmade capital.

So, we must keep the stock of natural capital constant to ensure sustainable development, this is called strong because this imposes a stronger restriction on maintaining capital stock, earlier version was weaker version because it allows substitution, the restriction is less stringent compared to this and within this strong sustainable development school there is even more stringent rules available where it says that KN star should be constant, which is called critical capital, critical natural capital should be constant.

So, that means they say that what is this critical natural capital? For example, let us ozone layer or let us say climatic condition or let say atmospheric composition. So, this is called critical natural capital. Why they are called critical because they are required for the very survival of human being. So, if the ozone layer is depleted, then we can understand the consequence. We cannot survive.

So, that is why while strong sustainability rule says that stock of KN should be constant, here it says the KN star should be constant, where KN star is basically the critical natural capital that should be constant. Now, here also again within the category of KN there are different forms of natural capital, we have forest, we have wetland, we have ozone layer, then we have wetlands so on and so forth.

So, how do we again aggregate? So, aggregation problem because even KN also consists of different forms of capital measured by different unit to avoid this aggregation problem or the economics they say that basically we need to compartmentalize even the natural stock of capital also. So, that means let us say we will compartmentalize KN into KN1 I would say that, let us say KN1 plus KN2 plus KN3 plus, let us say there are KNN.

So, these are different categories and each and every type of natural capital should be constant. So, KN1 bar, this is KN2 bar, bar means it is fixed KN3 bar. So, instead of ensuring summation of KN constant, we must ensure each and every element of this natural capital must be constant. Number of wetlands should be constant, amount of forest cover should be constant, amount of oil deposits should be constant, amount of coal should be constant or non-declining, I am using these two terms non-declining, it is good if the stock is increasing.

So, non-declining and constant using interchangeably. So, to solve this problem, the economist they say that we must compartmentalize the stock of natural capital also and we will ensure each and every compartment of this natural capital is constant in the process of economic development, then only will say that yes, the process is sustainable development and economy is on the trajectory of sustainable development. Now, what is the implication of this strong sustainable development.

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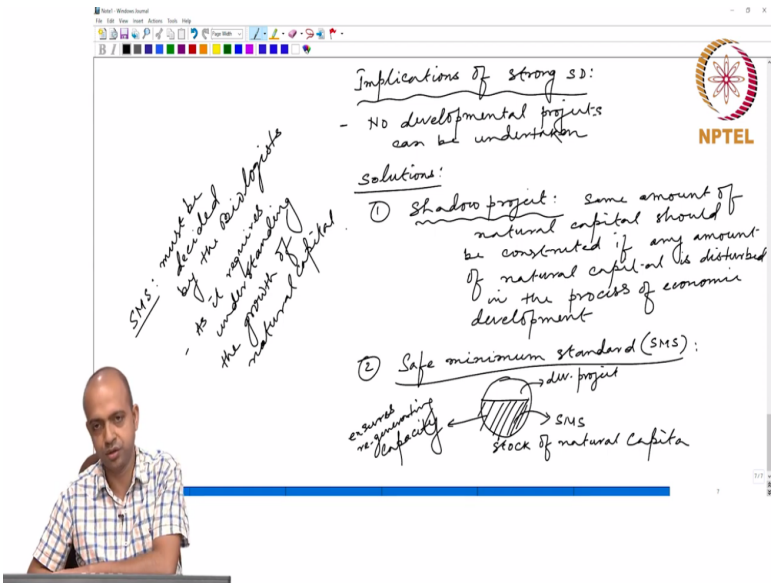

Implications of strong SD. No development projects can be undertaken. Since stronger version of sustainable development ensures that we cannot disturb any element of the nature it implies no developmental project can be undertaken, we cannot construct a railway line, we cannot construct a overbridge, we cannot construct a highway, no developmental project if you think of.

If you try to undertake any developmental project some way or the other, we must disturb the environment, without disturbing the environment in some way or the other, no developmental project can be undertaken, because each and every type of developmental activities it must have some impact on the environment or on the nature. But no developmental project is not a solution because for our living, we need forest, we also need a railway line we also need overbridge, we also need a multi storied apartment, then what is the solution?

The solution is there are basically two solutions that the economists they have provided. First solution they have given by shadow project what is the idea? The idea is in the process of economic development, in the process of undertaking developmental projects. If we deplete some amount of natural capital, then we must construct the same amount of natural capital in some other place.

For example, if we need to construct a highway by deputing some amount of forest in place A, same amount of trees should be replanted in place B, that is called shadow project. So, a similar project should be undertaken in another area, if we disturb the environment in certain areas, so that the shadow project should come up with the equivalent amount of services. This is the idea.

So, that means the shadow project basically says same amount of natural capital should be constructed, if any amount of natural capital is disturbed in the process of economic development. But there is a problem with this idea of shadow project also for example, when we deplete a forest consisting of hundreds or even 500 years of let us say banyan trees and we replant some trees in place B, we can understand how many years these trees will take time.

How many years of time, these trees will take to provide the equivalent amount of services over this old banyan trees and oak trees were providing in place A. So, that means even though the idea of shadow project is theoretically it sounds good, practically it is actually not a good idea to have this shadow project because of this limitations, economics they come up with another idea which is called maintaining safe minimum standard or SMS.

What they say, that since natural capital is very hard to replace, instead of depleting the entire stock of natural capital in the process of economic development. Let us say that this is the stock of natural capital. Let us say this is a forest. So, instead of disturbing the entire amount of forest, what do we do? We must ensure a safe minimum standard let us say, this is the SMS.

This is the SMS, why it is called SMS, because this match of minimum amount of natural capital is adequate to ensure its regenerating capacity.It ensures regenerating capacity and you undertake developmental project in this area. So, this idea sounds good instead of depleting the entire stock of natural capital, we first ensure what is the safe minimum standard for this forest and then the rest of the area you can actually use for your developmental projects and who will decide about SMS? Economists has no role here, the same minimum standard must be decided by the biologist.

Because it requires understanding the growth of natural capital. So, we must understand what is the growth process of this forest, depending on that, the biologist will decide the safe minimum standard and developmental project would be allowed on the rest of the amount.

So, this is how economists they come up with some type of solutions, when strong sustainable development rule they impose, it imposes a stringent restriction on the developmental project. In our next class, what we will do, we will discuss about the other sustainability rules that different economists they have come up with over a period of time. Thank you.