Environmental and Resource Economics
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Policy Implications of Environmental Kuznets Curve and Economics of Sustainable Development Part – 1

Welcome to our discussion Environmental Kuznets Curve once again. So, in our last class we were discussing about the mathematical and statistical form that the EKC should take for empirical estimation.

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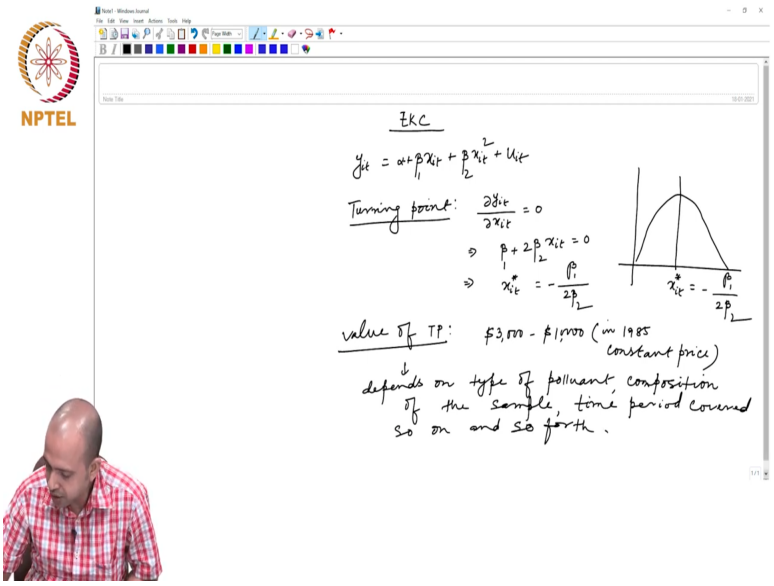

So, this is EKC that we are discussing and we say that the functional form should take this one. Yit equals to alpha plus beta 1 xit plus beta 2 xit square plus Uit; where Yit is the environmental degradation and xit is income of a country and Uit is the error term which captures the impact of omitted variables on Yit and we have discussed different cases based on the restriction what we may impose on beta 1 and beta 2.

So, after estimation depending on the sign and significance of beta 1 and beta 2; we may or may not get the inverted U shape relationship between Yit and xit and several cases we have discussed in our previous class. Now, one thing what we should get from this functional form? If the EKC takes the inverted U shape relationship; then the natural question comes to our mind,

how to get the turning point, turning point. So, if we differentiate this function with respect to xit and set it equals to 0, then we can say that this will imply that beta 1 plus 2 into beta 2 xit equals to 0.

So, that means xit we will say xit star; that means the value, the value of xit after which the environmental degradation starts declining. This should become minus beta 1 by 2 into beta 2, this is the turning point. So, that means when you draw the EKC, if this is your xit star; this is actually equals to minus beta 1 divided by 2 into beta 2.

This is how we can get the turning point after estimating the environmental Kuznets curve and in empirical literature, the value of this turning point, value of this turning point or TP; it has been found from the empirical literature that it varies from the, it varies from 3000 to 10000 USD in 1985 constant price. So, it varies from 3000 to 10000 USD that is what the empirical literature they found. Depending on which particular pollutant you consider, depending on what type of country you considered, depending on you time frame so on and so forth.

So, value of TP actually it depends on type of pollutant, composition of the sample, time period covered so on and so forth. So, depending on what type of pollutant you use, depending on what is the composition of your sample countries and what is the time period that you covered. These factors will basically determine the value of the turning point. The next question that we are going to ask is the policy implications of the environmental Kuznets curve, the policy implications.

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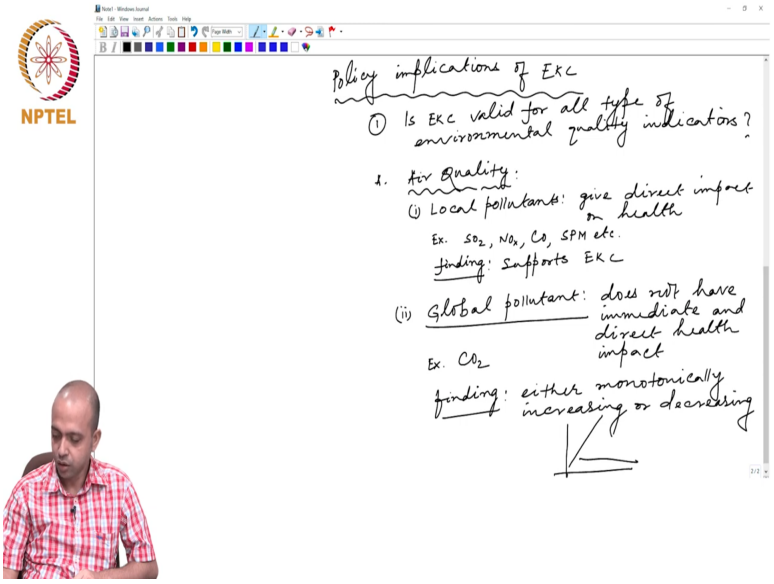

So, what we will write, policy implications of EKC. Now, environmental Kuznets curve paradigm is becoming more and more important into the mainstream policy making; particularly in the developmental policy paradigm. Why this is so? Because, environmental issues are becoming a part of overall developmental objectives; which was not there earlier. So, as environmental concerns, environmental issues are becoming a part of developmental policy prescriptions. The EKC paradigm also is taking its own role; because at the one hand growth is one of the prime objectives of the country.

And at the other hand, countries are becoming more and more concerned about what is the impact of economic growth on environmental quality and in that context the validity of the EKC hypothesis, the EKC paradigm, it is becoming more and more important. That is the reason we need to now understand what are the policy implications of environmental Kuznets curve hypothesis.

Now, when we talk about the policy implications of EKC, basically these are the questions that come to our mind. Firstly, is EKC valid for all type of environmental quality indicators? This is the question that comes to our mind and we will first try to answer this question.

Is EKC valid for all type of environmental quality indicators? To answer this question we need to understand, what are the different types of indicators that are used in the empirical literature for measuring environmental quality? First of all, the first indicator is for air quality and this air quality is again divided into two; one is called local pollutants, local pollutants give direct impact on health. These local pollutants they have direct impact on health, what are those?

Those are SO2, then NOx, CO and then suspended particulate matter etc. These are the air quality indicators which are used as local pollutant; they have direct health impact and when these type of indicators are used to measure environmental quality, the finding supports EKC.

So, that means for local pollutant the EKC hypothesis is valid and the second type of pollutant is global pollutant, global pollutant does not have immediate and direct health impact and what is the example of this? The example is carbon dioxide or CO2, which is called a global air pollutant and when you use this, then what is the finding? Finding is actually not EKC type; rather, either monotonically increasing or decreasing, this is the finding.

So, that means when we measure environmental quality by air quality indicators. There are two types of indicators; one is local pollutant, which have direct and immediate health impact, like Sulphur dioxide, NOx, carbon monoxide, suspended particulate matter etc and most of the cases, this local air pollutant actually, they support EKC type of relationship between air quality and per capita income.

But, when the global pollutant that means, which does not have direct and immediate health impact is used to measure environmental quality. Then the finding is either monotonically increasing or decreasing. So, that means in the income and environmental quality plane, either it can be this or this, increasing or decreasing.

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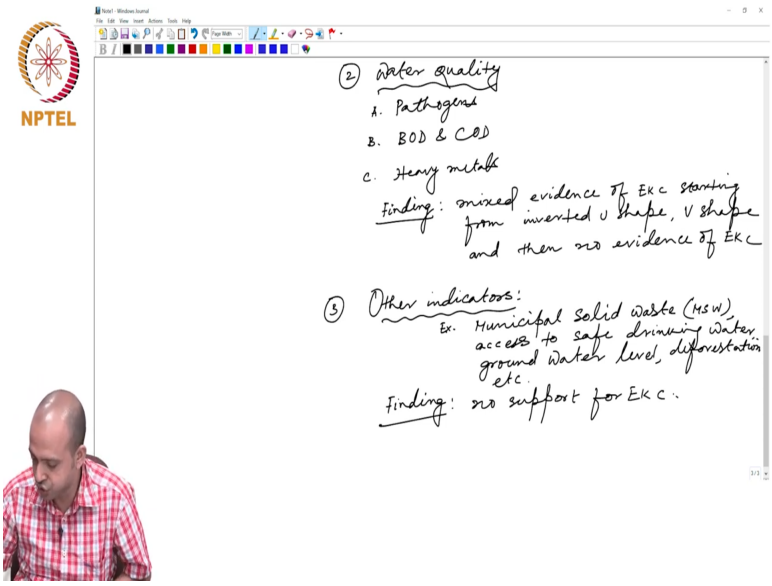

Then, the environmental quality is also measured by water quality indicators and here also we have three types, first one is called pathogens, second one is called biological oxygen demand BOD and COD. Biological oxygen demand BOD and COD and third type of is heavy metals. So, these are the main three types of indicators; that are used to measure water quality, when water quality is again used as environmental quality indicator to estimate EKC type of relationship and for this water quality indicators the finding is mixed.

That means for some of these indicators, empirical literature supports EKC type of relationship, for some of the indicators this water quality indicators that does not support EKC and in some cases the relationship is even U shaped. That is why we said mixed evidence of EKC starting from inverted U shape, then U shape and then no evidence of EKC.

And thirdly environmental quality can be measured by other indicators as well. What are the other indicators that are used to measure environmental quality? For example, Municipal solid waste, in short it is called MSW. Then access to safe drinking water it is also can be measured by ground water ground water level, deforestation etc.

These are the other indicators by which also environmental quality can be measured and when these other indicators are used finding is no support for EKC. Now, one thing is clear from this

discussion that finding for environmental Kuznets curve is quite mixed. That means for all type of environmental quality empirical literature, they do not support EKC type of relationship, it varies from indicator to indicator. So, policy formulation, while policy formulating developmental policies, policymakers must be very careful about what type of pollutants or what type of indicators, they are thinking to measure the environmental quality.

So, policies cannot be generalized that means findings from air quality cannot be applied to water quality or findings from water quality indicators cannot be applied to other indicators. So, we need to formulate environmental policies depending on what type of indicators we are thinking.

So, indicator of specific policies should be adopted by the policy makers. They should not generalize the findings, for one type of polluter pollutants and apply it universally. This is what we understood from this analysis, which says that the findings of the relationship between environmental quality and per capita income, heavily dependent on what is the indicator we are using to measure environmental quality, that is the first question.

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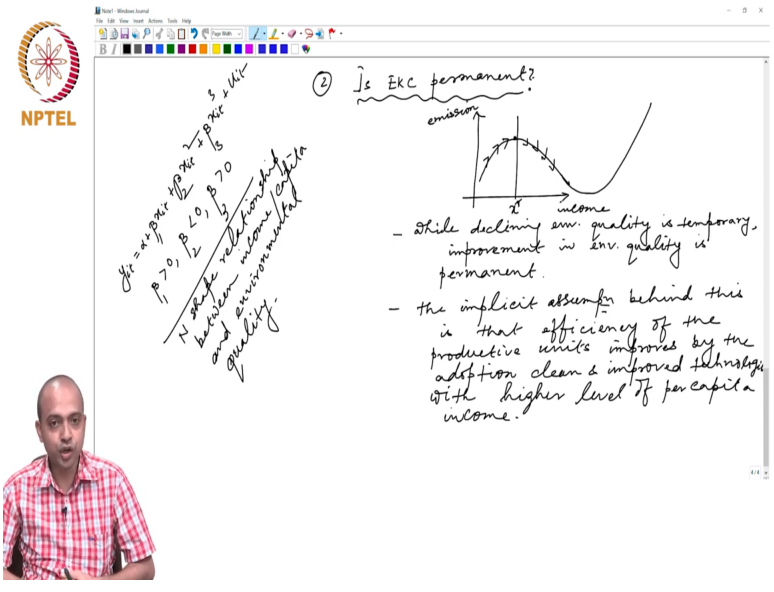

Then the next question that comes to our mind is EKC permanent? This is another important question. So, when we measure EKC by this income, this is let us say emission. So, what we

assume that as income increases, environmental quality starts declining, that means emission per capita starts increasing. But, this pressure on environment is temporary, is temporary.

So, that means it will increase only up to x star, only up to x star to this level and then it will come down. That means there would be a fall, a decline in emission level, emission per capita, and environmental quality will starts improving. So, that means what we are assuming basically here by EKC hypothesis?

We are assuming while declining environmental quality is temporary, improvement in environmental quality is permanent. That is what we assume. Once it starts declining that means downward sloping portion of the EKC is permanent and why we are assuming this, because we implicitly assume that once the economy achieves certain per capita level of income, certain changes that take place in the production process. Productive units they become more and more efficient.

That means they make more output, they produce more output with lower and lower amount of pollution and why does it happen? Because of the improved technology. So, what is the implicit assumption behind this? The implicit assumption behind this is that efficiency of the production units or productive units improves by the adoption of clean technologies, clean and improved technologies, technologies with higher level of per capita income. That is the assumption that we make.

As income increases, once the economy achieves this x star amount of per capita income, then a structural change in the production process takes place. Advanced and clean technologies are adopted by the productive units, productive units become more and more efficient, they produce more output with lower amount of pollution. So, this environmental quality starts improving and we experience the downward sloping portion of the EKC curve, which is generally permanent. But, in reality it may so happen that the structural change in the production process is actually not feasible for all type of pollutants.

Rather it may happen only for a limited number of pollutants and for other pollutants what the economy they do? Economies may go for only end of pipe treatment. End of pipe treatment that

means there is no structural change in the production process; rather pollution is controlled by abatement at the end and when cost of abatement is too high, then what will happen? When cost of abatement is too high, then this environmental quality will starts deteriorating once again. That means after getting this downward fall, you may get an upward swing, upward swing once again in the EKC, because the economy is not able to control the pollution.

Because cost of abatement is too high and structural change has not happened. It can also be explained even though the economy were able to adopt certain advanced technologies that technology will also come to its limiting end. The technology which was advanced and clean 10 years back. When you keep on producing the capacity of the technology to produce more output with lower amount of pollution will come to an end and then we need to go for next level, next level of technological innovation, which takes some amount of time.

And in that transitional period when the cost of abatement is too high, economy is still looking for next level of technological innovation. Then pollution per unit of output will again go up and we will see an upward sloping swing, upward swing in the EKC. That means what we assumed earlier that the fall in emission or the downward sloping portion of the EKC is permanent, which is actually not true, which is actually not true. So, that means we have to be very, very careful about at what level of pollution we are generating and we must keep on thinking the economy must always engaged in continuously involved in technological innovation.

So, that once a certain level of technology comes to its limiting end, next level of advancement is happen. So, this type of, this type of upward swing in the relationship between emission and income if we assume, then the functional form what we have assumed earlier Yit equals to alpha plus beta1 xit, plus beta 2 xit square. Then we have to add one cubic term also beta 3 xit cube, plus Uit. So, this should be now the functional form to represent this upward swing.

That means in this case what will happen beta 1 would be positive, then beta 2 would be negative and then beta 3 would be positive once again and if this is the case that will give an N shape relationship, N-shape relationship between income per capita and environmental quality. So, that means in empirical literature, this N-shape relationship is also possible. This is also another type of relationship that may emerge from this technological limitation. That means when there is a

limitation in technology; we may experience this N-shape relationship also. So, that means EKC is not a permanent phenomena.