**Environmental and Resource Economics**
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Economic Valuation of Environmental Goods and Services - Different Valuation
Approaches – Part 6

Welcome to our discussion on Economic Valuation of Environmental Goods and Services. In our last class, we were discussing about contingent valuation method. And we have almost completed our discussion on Contingent Valuation Method CVM. And we said that our next valuation method that we are going to discuss is basically, Choice Experiment.

But before we move on to choice experiment, let me discuss in today's session, some important issues in the context of contingent valuation itself, which is to explain the disparity between willingness to pay and willingness to accept, for same amount of change in environmental quality. So, we are going to discuss about the difference or disparity between willingness to pay and willingness to accept compensation. How do you explain that?

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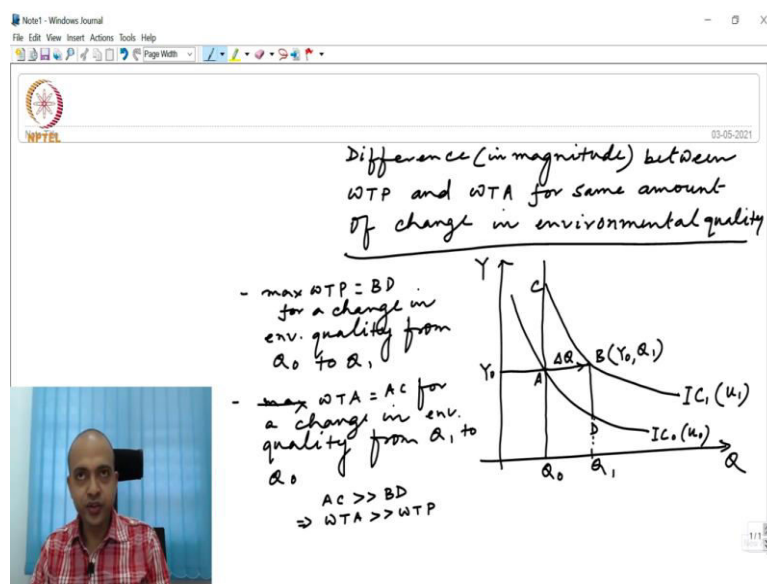
Difference in magnitude between willingness to pay WTP and WTA, for same amount of change amount of change in environmental quality. So, we said that willingness to pay is relevant, when there is a potential positive change in environmental quality. We ask the individuals to pay for that. For example, let us say individuals are enjoying 10 liters of water, drinking water per day and if they are supposed to get 20 liters of water per day, then it is called a positive change. So, we ask the individual, what would be their maximum

willingness to pay, for this additional change in environmental quality or service, which is from 10 to 20.

But willingness to accept compensation is relevant, when there is a change in environmental quality in a negative direction. For example, when the individuals are already enjoying 20 liters of water per day. And that service is going to be reduced from 20 to 10, we ask, how much compensation would you like to accept for this or reduction in drinking water by 10 liters. So, since the change is same, in terms of magnitude, that means it is always 10 liters either in the positive side or on the negative side, the willingness to pay or willingness to accept compensation amount should converge.

But in empirical studies, what we found that it is not only different but the difference is huge. And we are going to discuss, what are the reasons behind this huge disparity between willingness to pay and willingness to accept. So, before we explain the reasons, let us first try to understand using a simple indifference curve analysis. What is willingness to pay and what is willingness to accept.

So, let us say that in the x axis we are measuring environmental quality, which is measured by q and then in the y axis we are measuring composite good, which is y. So, utility is basically a function of y and q, and we assume a standard utility function or standard preference, for which indifference curve is downward sloping and convex to the origin.

So, let us say that this is the tat standard utility function, so as you know from your understanding of basic microeconomics that indifference curve is nothing but different combination of these two goods, here environmental quality and composite income, that gives the individual same amount of utility or satisfaction.

Let us say that this is IC0, which gives the individual u0 amount of utility, right, u0 amount of utility. So, we take a specific point on this indifference curve, let us say A, and we say that initially individual are enjoying q0 amount of environmental quality and this is let us say y0 amount of income, which leads to u0 amount of utility for satisfaction.

Now let us assume, there is an environmental quality change in positive direction by some amount, let us say this is the amount. So, obviously, when income is same as y0 and then there is a change in environmental quality from q0 to q1, the individual will move on to

higher indifference curve, leading to higher level of satisfaction. So, this is IC1 leading to u1 amount of utility.

Now, if we ask the individual, for this change in environmental quality from q0 to q1, so this is basically, this is the change, delta q. This is the change in environmental quality, this is by delta q. So, what would be your willingness to pay, for the change in environmental quality from q0 to q1, which leads to utility u0 to u1. We are asking the individual, what would be your maximum willingness to pay?

Now, while deciding about the maximum willingness to pay, conceptually, individual will pay in maximum that amount, so that after payment, individual's utility would be as good as what they are enjoying earlier. Is not it? So from A to B, let us say this is point A and this is point B. So, at B, individuals are actually enjoying y0 amount of income and q1 amount of environmental quality, okay. So, individual will pay that much amount from y0, so that after payment individual would be as good as what they are enjoying earlier. That means, after payment individuals should at least get u0 amount of utility that is very simple.

So how will you determine that? It is very easy. We have to draw a perpendicular from point B to this old indifference curve IC0. Let us say this is D. So, BD is basically the maximum willingness to pay. So, maximum willingness to pay WTP equals to BD amount. Because if the individual pays BD amount, the individual moves back to the old difference, old indifference curve. So, that should be the maximum willingness to pay, okay. For a change in environmental quality from q0 to q1, this is q1, this is the change, okay.

Now, let us assume that individual is initially at point B, enjoying y0 amount of income and q1 amount of environmental quality. But then there is a reduction in environmental quality from q0 to q1. So, that means there is a degradation in environmental quality from q1 to q0. Obviously when there is a reduction or degradation in environmental quality, we will ask the individual, what is the maximum compensation you would like to accept for this type of environmental degradation.

So then, we will ask to determine the maximum willingness to accept, how the individual will determine. Individual would like to get that much compensation so that when environmental quality degrades, with additional income, individual will like to go back, at least to his or her previous utility, okay. So, that means, when there is a change in environmental quality from B to A, that means when there is a reduction in environmental quality from q1 to q0,

individual will come to the point A and individuals utility will get reduced from u1 to u0, for which individual will like to accept compensation.

An individual would like to get that much compensation, so that with that compensation individual goes back to his or her previous utility level u1. How will you determine then? Same logic, from A, we will draw a perpendicular up to his or her previous utility function. So, that means this would be like this. Let us say this is AC.

So that means maximum willingness to accept or there is no limit for willingness to accept, this is actually minimum willingness to accept equals to AC amount for a change in environmental quality from q1 to q0. And from the diagram it is very clear that AC is actually, AC is much greater than BD, which implies willingness to accept compensation is much higher than willingness to pay.

So this is how we can understand the concept willingness to pay and willingness to accept, using the simple indifference curve analysis. Now let us try to understand the reason behind this disparity between willingness to pay and accept. So, first of all first of all the way we have drawn the indifference curve which is convex and convex to the origin.

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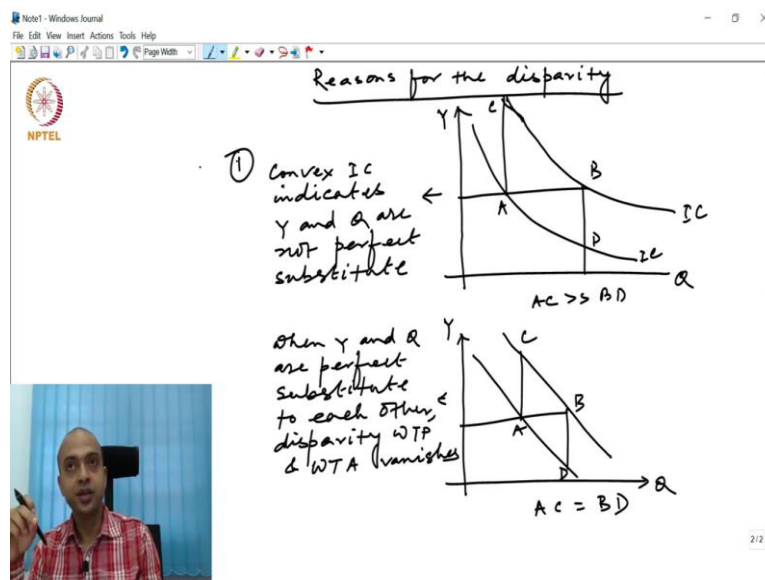
So reasons for this, we have drawn the indifference curve in this way, so that is why BD and this is let us say AC, AC is greater than BD. Now suppose I am drawing the indifference curve in this way, this is y this is q, I am drawing indifference curve which is straight line.

So, in this case let us say this is A, this is B, this is D and this is C. So, AC is equals to BD, okay.

So, that means the difference can be explained by the shape of the indifference curve itself. What is the meaning of this indifference curve, when it is convex to the origin? When the indifference curves are convex to the origin, what does basically the slope of the indifference curve indicate?

If you recall, slope of the indifference curve indicates the marginal rate of substitution between the two commodities MRS q for y. And since the indifference curves are convex to the origin, this MRS is actually not constant along the IC. So, MRS is actually getting higher and higher, if you go down to the indifference curve.

So, that means initially, for every additional unit of q, individual would like to pay more amount, but as q increases, then individual would like to pay less and less, for this additional improvement in environmental quality. Why this is so? Because individual gets saturated because of diminishing marginal return. You understand what I am saying?

So, when to start with, for a small change in environmental quality, individual would like to pay a greater amount, but as we keep on increasing environmental quality, individual's willingness to pay becomes lower and lower. Why this is so? Because of the diminishing marginal utility. Every additional improvement in environmental utility, gives lower and lower level of satisfaction. That is why individual's willingness to pay also goes down.
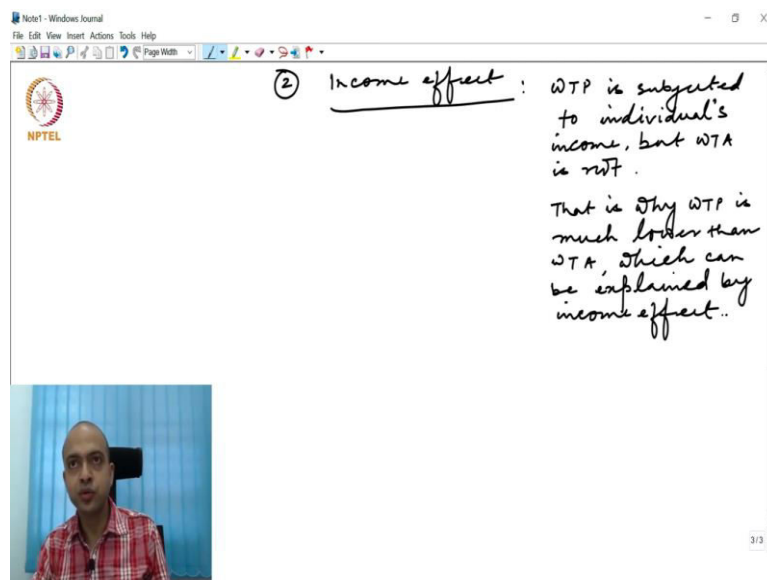
So, that means basically what we are saying that, this y composite income, composite commodity and environmental good, they are actually not perfect substitute. So, that means from this, what we can say for this type of convex indifference curve indicate, y and q are not perfect substitute to each other.

So, when I am getting extra environmental quality, I am paying something, but this environmental quality, environment and income, they are not perfect substitute. Since they are not perfect substitute that itself explains the disparity between willingness to pay and willingness to accept.

When the individuals are facing a preference, which is perfect substitute, so that means when the indifference curve is downward sloping straight line, you see from the diagram, there is no divergence, there is no disparity between willingness to pay an accept.

So that means, when goods are perfect substitute, when y and q are perfect substitute to each other, disparity between willingness to pay and willingness to accept vanishes. Willingness to pay converges to willingness to accept. So, this is the first reason. This we can say reason number one, which we can explain. So, reason number one, for the disparity between willingness to pay and willingness to accept, is basically by the very fact that they are not perfect substitute to each other. There is a that is why, okay.

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Now, second reason. Reason number two. The reason number two is explained by income effect. When we ask the individual the question of willingness to pay, obviously willingness to pay is based on individuals income, individual's willingness to pay is subjected to individual's income but willingness to accept is not.

Willingness to accept, when I say, how much would be your willingness to accept compensation for this amount of environmental change in negative direction. Obviously, everyone wants to get as much as they want, as much as they can. So, there is no limit in willingness to accept, because willingness to accept is not subjected to the income. That is why, willingness to pay is much lower than willingness to accept, which can be explained by income effect.

So second reason, behind the disparity between willingness to pay and willingness to accept is, income effect, since willingness to pay is subjected to income, while willingness to pay is not. We can say that this is much willingness to pay is much lower and willingness to accept compensation. But the point here is, even if we consider the income effect in our study, the divergence between willingness to pay and accept, still exist. So, that means even though income effect can explain a portion of the disparity between WTP and WTA, it cannot explain fully.

That is the reason, economist they try to explain even more. So, that means they believe, there is something beyond this income, which can explain the disparity between WTP and WTA. This income is, basically income based explanation is, purely from the traditional new classical paradigm, which says that as income increases, individual gets less amount of utility and that is why, when it is subject to income, they are, they pay less and when it is not subjected to income, they want to accept more compensation.

Since income effect cannot explain the disparity between WTP and WTA fully, behavioral economists, they came to some new explanation for this disparity. So, what we say that when income effect cannot fully explain the disparity between willingness to pay and willingness to accept then behavioral economists, they came up with a new theory, to explain this huge disparity between WTP and WTA, which is observed in empirical studies.

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And this theory is known as Prospect Theory, which is given by Daniel Kahneman in 2002 and for which, this theory is so powerful, based on individual psychology this theory was so

powerful, that he got even the Nobel prize in economics for this Prospect Theory. So, the Prospect Theory is based on, basically, this is based on loss aversion. Loss aversion.

And what is loss aversion? Loss aversion is again is a type of asymmetric form of risk aversion. Asymmetric form of risk aversion. Why this is called asymmetric form of risk aversion? So that means when the individuals are subject to a potential gain and a potential loss, their type of risk aversion is different. For example, in the context of potential gain, when the individuals are subject to a potential gain, then they become risk averse.

On the other hand when the individuals are subjected to potential losses, they become risk lover. So, that means gains and losses they are valued differently, based on the individual's context. It is not symmetric. In that sense we say that individuals, they become, the individual's risk aversion is asymmetric. So, that means we can say that when they faced with a potential gain, faced with a potential gain, from a risky choice, okay, faced with a potential gain, individuals are risk averse, and they prefer a solution.

They prefer a solution that lead to lower expected utility, lower expected utility in short I am writing Eu, which is expected utility but higher certainty equivalence. So, that means, this is basically purely based on a risk averse nature of the individual, wherein the value function is concave, concave to the origin, which basically says, individual will prefer a solution in which they will get lower expected utility but higher certainty equivalence.

Facing with a risky choice, let us say lottery, they will prefer that type of solution, wherein individuals will get a higher amount with certainty but a higher certainty equivalence than lower expected utility. So, that is a pure form of risk aversion.