Behavioral and Personal Finance
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Module - 01
Behavioral Economics and Finance
Lecture - 06
Decision Making under Risk and Uncertainty
(Contd.)

Welcome back, continuing from the previous discussion on expected utility theory and risk aversion. We will discuss more about different examples where we incorporate risk aversion and a related concept known as certainty equivalent. So, here we understand that certainty equivalent is a point where the utility derived from a risky choice is equal to the choice to the utility derived from the choice if you hold on to that.

In last example, we understood that if we keep on holding the lottery ticket with two different payoffs and associated probabilities and we have an alternative choice to sell it off, we need to find a price at which the expected utility of these two alternatives are same. And, if we are able to find that price or the level at which the expected utility of these two alternatives are same that is where we become indifferent. Now, how does that translate into our decision making? Because we know that our decisions where risk and uncertainties are involved are not very linear. By linear we mean that it does not go in a very straight line fashion.

So, let me try to put this through a silly example; suppose you are a very adventurous person and you would like to do high trekking or let us say jumping from a different heights and in a game someone is offering you some payoff for jumping off from different level of heights. And if you are offered let us say 200 rupees from for jumping off; let us say 15 feet of height, would you be willing to jump from a 13 feet of heights for double the price that being offered that is 400.

So, if you understand the risk of jumping from 13 or 15 feet of heights; vis a vis the risk associated with jumping from 30 feet of heights; you would definitely not go for just double the reward from; for these two different alternatives. And, that is what we mean when we say

that the risk associated with different payoffs are not linear in nature. Let me try to show this with the help of the example where we stopped in a certainty equivalent case.

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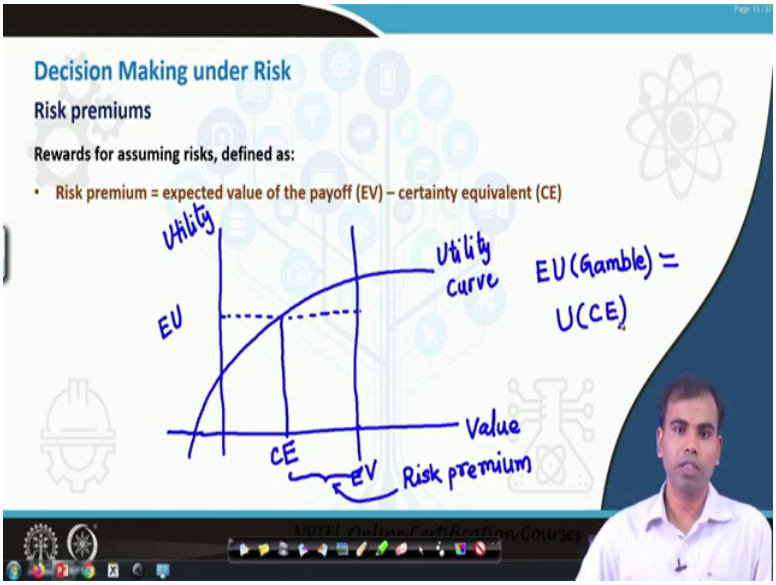

What we were trying to say here is; if we have some risky choices and we can try to find the certainty equivalent associated with that risky choices, the extra return or extra payoff or extra benefit that we are going to get because of taking the additional risk that will be known as risk premium.

So, when you are taking a jump from 15 feet of height and in a different situation you are asked to jump from a 30 feet of heights; you are taking an additional risk and that risk must be compensated for in terms of the payoff that is being offered. So, how do we compensate that additional risk can be understood with the help of the certainty equivalent example.

So, if we try to show it through a graph; suppose this is our utility and value curve. So, we have value on one axis and utility on another axis; we should be having a level where the expected payoff can be. So, this is basically the expected value of the payoff and if we try to show the curve which is basically the logarithmic utility function curve; it should look like this.

We have seen that it is typically very much similar to a curve like this and if we are able to find the certainty equivalent; so, basically this is utility curve, this particular axis can be noted as expected utility. So, we have expected utility on one axis, value at another axis. So, we have expected value at certain point and if we are able to find certainty equivalent which let us say lies here.

So, certainty equivalent is basically the value of wealth where the expected utility is equal to the value of expected utility derived from the risky choice which means the expected utility in these two cases will be similar. And, this is the point from certainty equivalent to the expected value is essentially the risk premium that is being paid off.

So, which means the expected utility derived from the risky option and the expected utility derived from the shear short option is equal where certainty equivalent point is lying which can be summarized in a way that expected utility of the gamble or the risky option is basically equal to the utility of the certainty equivalent. This is where the relationship between the expected utility of a risky choice and utility of a shear short gain can be connected.

So, this particular point is known as certainty equivalent and anything over and above this point that you are demanding is basically the risk premium for taking the additional risk in your decision making. This particular illustration can be shown with the help of another numerical example that I have here.

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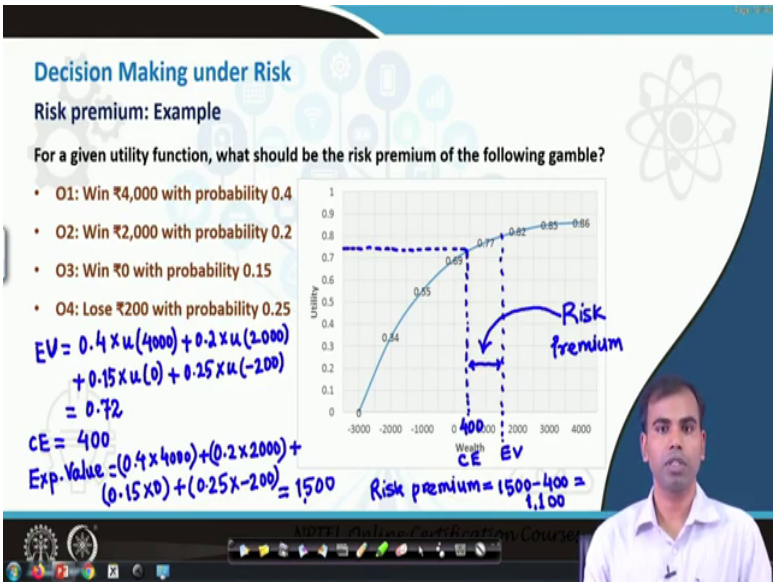

If you look at the example shown here; this is a particular case of a gamble, where there are four outcomes. Outcome 1 has 4000 rupees of gain with a probability of 40 percent. Outcome 2 has 2000 rupees of gain with a probability of 20 percent.

Outcome 3 has 0 rupee of gain, which means you will get nothing in this case with a probability of 15 percent and outcome 4 has a loss of 200 rupees with a probability of 25 percent. Now, the particular case here is being discussed in the context of a utility function curve which is given here. So, the individual for which we are trying to understand this particular process follows a logarithmic normal distribution; logarithmic utility function as shown in the graph.

If we try to calculate the utility, basically we will try to calculate the utility associated with these four payoffs and we will come up with the value of expectation which means the

expected value as shown in the previous graph. We will also try to understand the value of certainty equivalent and then we will come up with the amount as the difference between the certainty equivalent and the expected value which could be considered as the risk premium.

So, with this example we can understand two things; first we will be able to know what should be the price, if we want to trade this particular gamble right now for a certain payoff. And second we will also try to know what is the additional reward or compensation or the benefit the individual is getting for holding on to the risky choice. So, first of all we will try to calculate the value of expected cash flows which is basically 4000, 2000, 0 and minus 200. So, the way to calculate the expected value EV is as follows. So, expected value of these cash flows are 40 percent probability of having 4000, 20 percent probability of having 2000, 15 percent probability of having 0 and 25 percent probability of having minus 200.

Again, if we refer to the log normal utility function table as shown here; the value for expected cash flows would be coming out to be 0.72. So, that is the value of expectation associated with these four different cash flows given here; second step is to find the certainty equivalent. So, when we try to calculate certainty equivalent; we can refer to the graph itself. So, if we try to see the expected utility associated with these for cash flows 4000, 2000, 0 and minus 200; we have calculated the expected utility for these four cash flows as 0.72.

So if you would refer to the graph and find 0.72 as a point: where the wealth level can be determined as certainty equivalent. So, if this is a point where we have 0.72 as the expected utility, this actually gets us to the wealth level of close to 400. So, we can say that certainty equivalent is 400. Third step to explain this example would be to calculate the expected value which is basically the value of the cash flows which you will get if you hold on to the risky choice. So, expected value calculation can be done in a very standard format which is 0.4 into 4000, 0.2 into 2000; 0.15 into 0 and 0.25 into minus 200.

These numbers will take us to the value of 1500; if you do the calculation you will get 1500 here. And as discussed previously we know that if this is where you have this expected value

and this is where you have certainty equivalent; basically this is the extra reward or benefit that you are getting as risk premium.

So, this particular example helps us in understanding two things as mentioned earlier; one is how much should we ask for if you want to exchange or trade this particular gamble right now and the answer is certainty equivalent value is 400; so 400 should be the price of this gamble if you want to trade it right away. And if you hold on to this particular gamble, the expected value that we are going to get at the end of the period is 1500; out of which risk premium is basically how much? Risk premium is 1500 minus 400 of certainty equivalent that is 1100.

So, this is where certainty equivalent helps us. So, with this example we can understand that given certain risky situations what should be our approach to arrive at the value of the wealth, where the expected utility is equal to the value of the wealth if we stick to the risky choices. So, with the help of certainty equivalent and risk premium; we can understand what should be the price of certain payoff verses the price of the risky; risky payoff or risky choices and what should be the risk premium associated with different risky situations.

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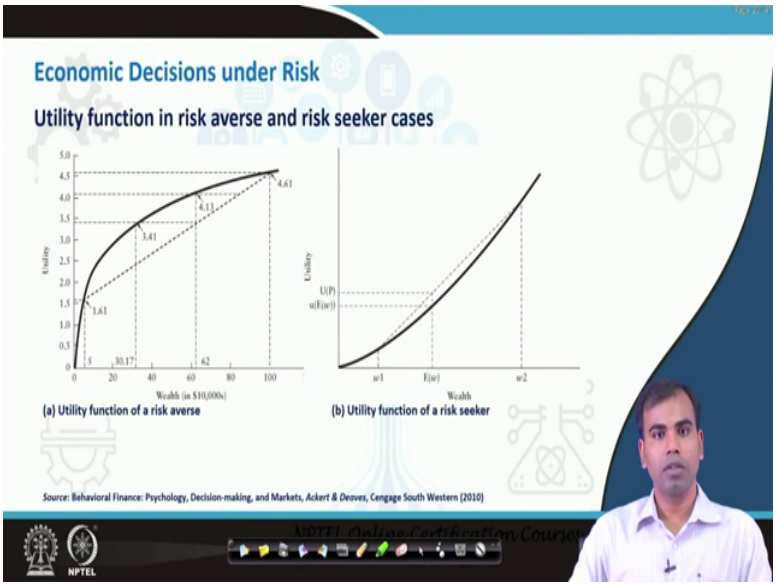

Going back to the theoretical framework of risk aversion and decision making framework under risk and uncertainty; we understand that economic agents that are basically individual decision makers or investors or corporate executives or any human being can be risk averse which means he would not like to take risk. And in a given circumstances the utility that he is going to derive typically increases with the level of increase in the wealth.

The first graph shows that utility function for a risk seeker individual; I am sorry yeah, the first graph actually indicates the utility function of a risk seek risk averse investor; where the expected utility increases with an increase in the level of wealth. Second graph shows the utility function of a risk seeker where the increase in wealth essentially increases the utility, but in a decreasing fashion.

So, it is basically a convex curve and if we continue to understand the utility and wealth relationship; we understand that for a risk neutral investor, the utility function would be a straight line something like this where the individual or the decision maker will be indifferent for different level of wealth and different levels of utility.

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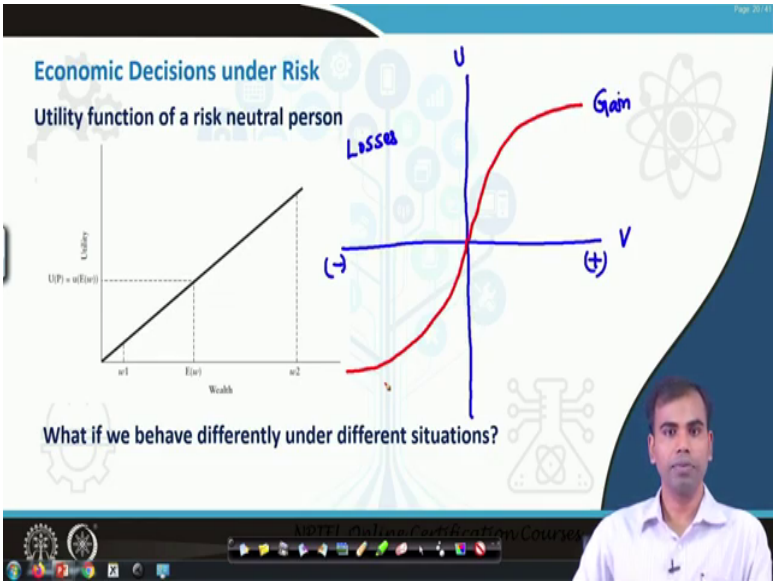

So, essentially he will not make any difference between a risky choice and a certain choice. Now, bringing all these things together in a more relevant framework is given by the prospect theory of Daniel Kahneman and Amos Tversky. What they sincerely suggested was individuals might be behaving differently under different circumstances. Essentially, it means that if it is a situation where you are likely to gain something your behavior would be different from the situation where you are likely to lose something.

If you remember the examples that we had discussed in the beginning sessions; you remember that when you are likely to lose a money or you are likely to lose something valuable; you behave as you are going to be risk seeker. Whereas, if you were likely to gain something; you tend to behave as risk averse. So, all these concepts combined together is given in the prospect theory framework; where the behavior of individuals might be different under the situations of gain and losses.

This can be shown with the help of a combined graph, where I can take clues from the research done by Daniel Kahneman and Amos Tversky and the graph is as follows. So, if this is my utility line and this is basically the wealth or value line; this particular zone is for gain whereas, this is for losses which means the value will be negative here and value will be positive here. If you refer to the utility function curve of a risk averse person; it looks something like this where you tend to behave as a risk averse. And if you are a risk seeker person, your behavior would be in a different way which is given by the utility function curve as explained earlier.

This is what is known as the prospect theory curve or the utility function for a human being which is different from homo economicus. And it indicates that the utility function for an individual would be different for situations where gains are involved and it will be different from circumstances where the losses are involved which means if you are likely to lose economic value you would behave like a risk seeker and you tend to take more risk.

And, if you are under situations where you are going to get something, you will behave like you are risk averse. And, this can be seen in examples in the stock market where people try to hold on to the stocks, where they are losing value and they sell the winners or the sell the stocks which have gained in value and this is a typical example of a prospect theory in real life.

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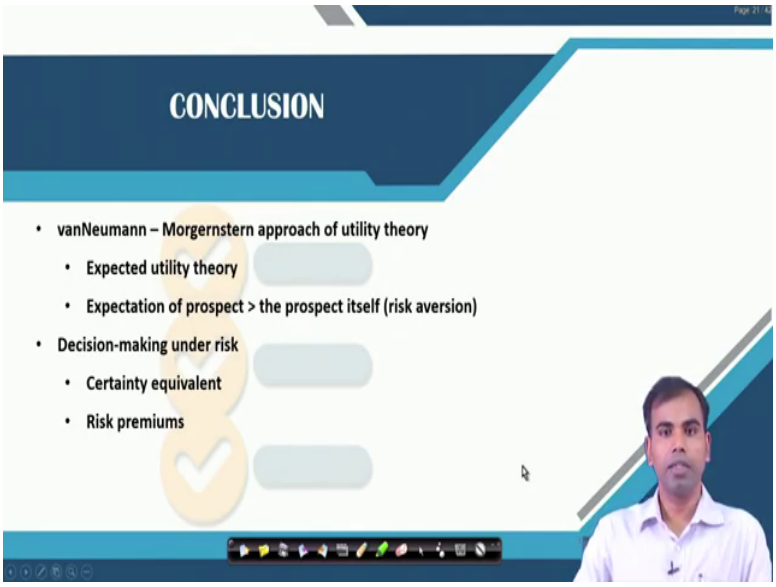

So, far we have discussed the standard utility theory. We have also incorporated the expected utility theory as proposed by VNM framework, where we understood that the expectation of the prospect is more preferable than the prospect itself. And this is where the risk aversion characteristics of individual decision makers become more important.

And further we discussed that risk aversion characteristic can be of different situations. Subsequently, we also discussed that individuals can be either risk averse or risk seeker or risk neutral under different circumstances.

And all these characteristic of individual decision makers can be clubbed to understand a better economic decision making framework; where we will try to incorporate factors such as certainty equivalent and risk premium along with the behavioral characteristics such as risk

aversion and similarly loss aversion as shown by Daniel Kahneman and Amos Tversky in their prospect theory framework. For now this is it.

Thank you very much.