Microeconomics: Theory & Application
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Lecture – 25
Consumer Choice Involving Risk (Part-2)

So, we have seen how expected utility is to be computed and what do we mean by risk averse individual. Now, let us look at a numerical example to illustrate these concepts.

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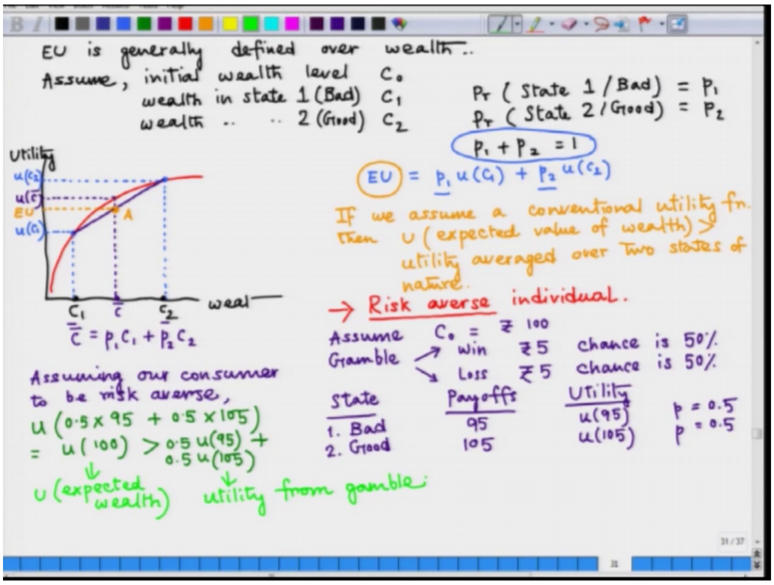

So, let us assume that there is a consumer who starts with rupees 100 and that is the initial wealth or consumption level. Now, suppose this person is facing a gamble and the gamble has two outcomes win and loss, in the case of win this consumer wins rupees 5 and the chance of win is 50 percent. Now, there is a loss there is possibility of loss also and the loss is also of rupees the magnitude of the loss is also rupees 5 and here also chance is 50 percent.

So, now, in this case there are two states of nature and the possible payoffs and then corresponding utility. So, the state 1 is a bad state as per our assumption here our consumer loses. So, he is left with 95 and then the corresponding utility would be u of 95 only and that is with probability 0.5. State 2 is a good state where our consumer wins. So, in this case he has rupees 105 and the corresponding utility is this and that is also with probability 0.5.

Now, if we assume risk averse individual we can write utility of which is basically u of 100 greater than 0.5 u times 95 plus 0.5 u times 105, right. So, this is basically the utility of expected wealth and that is greater than the utility from the gamble. So, now, let us move on to another interesting dimension of microeconomic theory regarding risk. Now, we are going to talk about insurance. Insurance is a risk coping strategy or financial instrument. Now, let us see how a consumer decides to purchase an optimal insurance cover through a very simple model.

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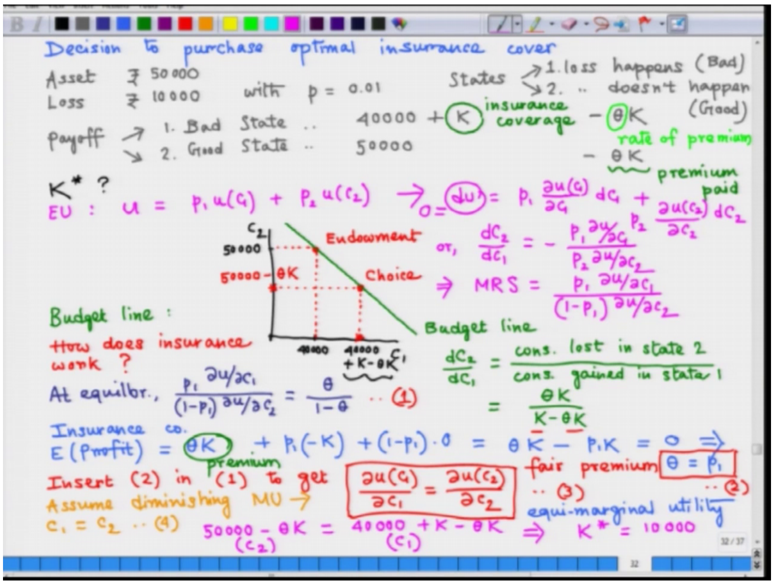

The problem of choosing an optimal insurance coverage can be best understood through a simple numerical example. So, we are going to present the story through a simple case. Suppose, we have a consumer who has some asset or wealth and the value is 50000.

Now, this consumer or this individual is facing a risk of loss and he has some anticipated value of the loss in his mind and the value of the loss is around rupees 10000 and this person also has a belief that this loss may happen with 1 percent chance. So, that is p equal to 0.01. So, there are two states again two states of nature loss happens or it does not happen, right. So, loss happens is basically our bad state. So, that is state number 1 and if loss does not happen that is state number 2. So, that is a good state.

So, now let us look at the corresponding payoffs. Now, there are so many insurance companies around. So, our consumer can purchase some insurance coverage to protect himself from the risk. So, if the consumer decides to purchase the insurance cover he has to pay a premium to the insurance company. So, if he decides to purchase insurance cover let us see what could be the payoffs in this case. So, payoff again it could be for bad state and good state.

So, in the case of bad state there will be a loss and the consumer will be or our individual will be left with rupees 40000. But, then in that case the insurance company will give him the insurance coverage money let us assume that K is the insurance coverage. We do not know the value of K actually we have to find that K. But, it does not matter whether loss happens or not, this person has to pay premium to the insurance company and theta is basically the rate of premium. Now, in good state the individual is left with the entire asset value for consumption 50000 rupees. Now, here also he has to pay the insurance premium.

Now, the question is how does our consumer chooses an optimal value of K? To find optimal value of K we are again going to go back to our basics. So, how does consumer choose an optimal consumption bundle? The consumer actually finds the tangency point between the budget line and the indifference curve, so that the first order condition for utility maximization is satisfied. Here also we are going back to the basics and we are going to follow the same principle to find the value of optimal K. Let us see how the consumer solves this puzzle.

So, we are going to start with the expected utility in this case and that is given by u as u equals to p of so, first we have to think about the indifference curve. So, we are interested to get the MRS Marginal Rate of Substitution, right. So, what do we need to do? We need to take differentiation so, we can differentiate totally to get so, this will be set to 0. So, we can write the slope as minus of p 1 times del u del C 1 p 2 times del u del C 2.

Now, if we are talking about MRS then we do not need the negative sign we can write p 1, we can also utilize the probability result and write like this. So, now, this MRS has to equal to the slope of the budget line. So, our next target would be to find the slope of the budget line. Let us first have a look at the budget line graphically after that we will talk about it is slope. So, we have consumption in bad state C 1 consumption in good state C 2 and let us assume that this is 40000 and that is basically the asset value when loss happens, but if loss happens then the insurance company will give K amount back as that was the insurance coverage, but the consumer has to also pay the insurance premium. So, in the case of a loss the consumer is left with this amount of money for consumption.

Now, in the good state 50000 would be the asset value a point which has coordinates of rupees 40000 and 50000 is basically the endowment point for our consumer. So, how does the insurance work? So, the consumer has to substitute consumption in good state for consumption in bad state. So, that is why the consumer is paying some amount of money to the insurance company to protect himself from the expected loss.

So, if the consumer now adopts insurance, so in good state he has 50000 minus theta K. So, that is basically the premium that he has to pay to the insurance company and suppose this is the value that he is left with for consumption in a good state. As he does so, in return he gets this point along the C 1 axis for consumption in a bad state. So, we get two points in the consumption plane first point is our endowment point and the second point is basically the choice that the consumer has made.

Although, we are not super imposing indifference map here but, we can get the consumers choice by choosing some arbitrary value theta and K. So, this is basically the choice point, right. So, if we join these two points then basically we get the budget line of the consumer. They are going to touch the axis, but you know as I do not have space here you know I keep them as it is. So, this is basically the budget line.

Now, let us look at the slope of the budget line which is given by dC 2 dC 1 and that shall talk about the trade off between the consumption in two states. So, as you remember the budget line slope can also be interpreted as the ratio of prices of consumption goods. So, here this will be prices of consumption goods in 2 different states. So, we can write consumption lost in state 2, which is a good state over consumption gained in state 1 which is a bad state. And, I am talking about the absolute value of the slope.

So, this is the lost money in good state because the person has to pay the insurance premium and this is what he is going to get if there is a bad state. So, the insurance company pays back the insurance coverage, but he has to pay the insurance premium anyway. So, the difference between the two is the consumption gained in that state, if the consumer purchases the insurance cover. So, now, we can say at equilibrium this MRS which is p 1 over d u C 1; so, we can write a simplified value of the slope of the budget line absolute slope of the budget line and that is going to be theta divided by 1 over theta because K cancels out. So, this is from the perspective of the consumer.

Now, there is another party in the picture and that is basically the insurance company. So, now, let us look at how the insurance company decides it is premium rate which is the price for the insurance that the consumer is purchasing. So, here as the insurance company's profit or loss depends upon the exact realization of the states of nature the company's profit is also random. So, we have to talk about the expected profit of the insurance company and if we assume that there are many insurance companies. So, there is perfect competition. If we are assuming that then basically the company will operate the no loss no gain strategy, so, it will just break even. So, if we assume this then let us see how things evolve.

So, now, we are going to talk about the insurance company. So, we have to find out expected value of the profit because profit is a random variable in this case. Note that it does not matter which state is realized the company will get this theta K amount always because that is the premium already paid to the company by the consumer.

Now, there are two states of nature; first state is basically the bad state. So, that will happen with probability p 1 and in that case the company has to pay K amount to the consumer right and there is 1 minus p chance with which the good state will we realized. So, the consumer in that case does not have to pay anything to the consumer, right. So, if that is the case then the expected value becomes expected profit becomes right. Now, we can set this to 0, so, the company is just breaking even and if that is the case then we get this result that that the premium rate theta will be the probability of loss or the probability at which the bad state happens.

This is a very interesting result and this rate of premium has a name this is known as fair premium, ok. So, now, if we insert this fair premium value theta in the consumers equilibrium condition denoted by equation 1 here. So, let me denote this by equation 2. So, insert 2 in 1 to get another interesting result and that is, right. Now, what does that mean let me denote this by equation 3.

So, the equation 3 tells that marginal utility of an extra rupee of wealth if the loss occurs should be equal to the marginal utility of an extra rupee of wealth if the loss does not occur. So, these are basically two states, right. So, we are talking about another version of equi marginal utility remember that we have already learned this before. So, we get back the same principle even in the case of risk analysis.

Now, what does that mean? Now, if you remember we are dealing with a concave to origin utility function, right. So, if that is the case we are assuming diminishing marginal utility. So, as we have assumed diminishing marginal utility equation 3 implies that we have C 1 equal to C 2. So, the consumer will choose insurance cover in such a way that its consumption in good state and in bad state will be equal, right. Then let me call this equation number 4 and let me plug values for this equation we have already got them.

So, then we can write 50000 minus theta K. So, that is the consumption in good state and then 40000 plus K minus theta K that is the consumption in bad state, right. So, this is basically our C 2 and this is our C 1, right. So, from here what do we get we get K star equals 10000.

So, here we get a very interesting and strong result. So, if we assume that our consumer is risk averse and if we assume that the insurance company behaves in a competitive manner. So, it does only breakeven. So, if these two assumptions hold then the consumer or the individual will purchase the insurance cover such that optimal insurance cover will fully insure him. So, in this case as the consumer was expecting a loss of rupees 10000 he has purchased an insurance cover of exactly rupees 10000.

So, with this our discussion on consumer theory comes to an end. In the next lecture, we are going to start discussion on the theory of firm.