Business Analytics for Management Decision

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Lecture - 60
Decision Analytics (Contd.)

Hello everybody, this is Rudra Pradhan here. Welcome to BMD lecture series. Today we will continue with the Decision Analytics and the topic of discussion is the value of information and utility theory. We have already discussed couple of you know problems where we need actually decision making process through which you can address the business problems as per the particular requirement. We have analyzed various business problems by using different you know decision making criteria like a aggressive strategy, conservative strategy and also we try to visualize all these you know outcomes corresponding to the particular you know business requirement through a concept called as you know decision tree.

So; that means, we have discussed you know several a criteria, several structure through which we can you know bring the business problems in a kind of you know environment where we can pick up a particular outcome as per the particular business requirement. So, now, to add value to this particular you know process. So, we like to address 2 different components, one particular component is called as you know value of information and the second one is called as you know utility theory.

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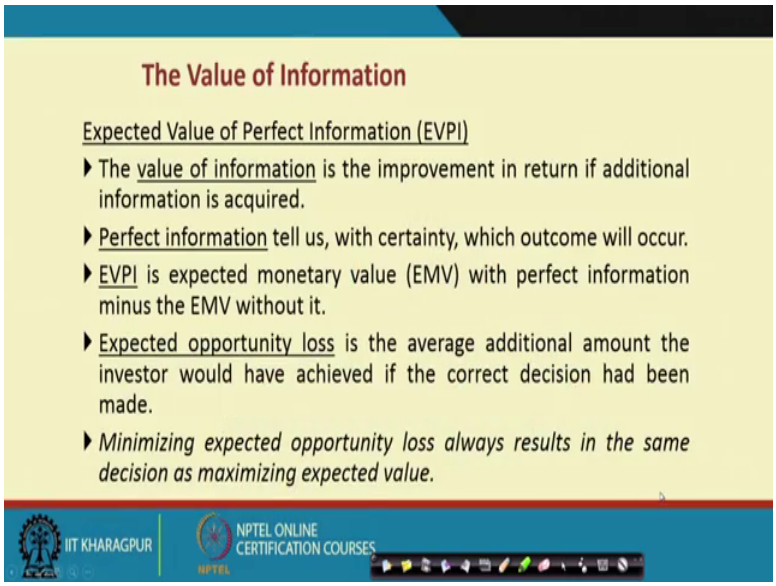

So, now, how the value of information and utility theory will again help us to analyze the business problems and then come with a kind of you know decision making process through which we can visualize the business problem more effectively and more accurately.

So, in the case of you know value of information the particular concept which you like to target is called as you know EVPI that is the expected value of perfect informations and the value of information is something called as you know the improvement in return if additional information is required and perfect information tell us which certainty which outcome will occur. Then finally, EVPI that is the expected value of perfect information that is the it is expected a monetary value that is called as a EMV; with perfect information minus, the EMV without it right. So, the expected opportunity loss is the average additional amount the investor would have achieved if the correct decision had been you know made.

So, that means, what I like to say it is a decision, decision making process; so corresponding to various alternatives and different situation. So, we have a plenty of you know flexible outcomes a particular outcome you know we have to pick up which can address the business problem or the make the decision making process more effective; that means, technically our management decision should be very effective corresponding to the particular you know business problem. That is why we are discussing various you

know tools and the kind of know techniques, the kind of you know structure through which a the decision should not be something called as you know wrong. So, it should be a correct specifications, correct identifications you know that to as per the particular you know business requirement.

So, any misjudgment or the kind of you know any kind of you know lagging. So, the entire decision making process will be ineffective. So, as a result the business problems cannot be address as per the particular you know requirement. So, the corresponding to the concept called as a expected value of perfect information. So, we have a concept called as you know expected opportunity loss which is the average additional amount the investor would have achieved if the correct decision had been made so; that means, technically. So, if the decision is correct then by default there is no problems so; obviously, everything will be in the correct space you know correct requirement, but the structure is that if any wrong decision then the entire you know decision making process will fail.

So, that is how you we must be very careful how to you know address this business problems, how to pick up a particular outcome, what kind of you know technique which you have to use. So, that you know you know the particular you know decision making process will be very efficient and very correct one. The thing is that you know we have a different criteria corresponding to different alternatives and different situation and we find you know different criteria gives you know different kind of you know results. So, that is why so when you pick up a particular you know outcome to address the business problem, it is better to go through these problems or to analyze this problem with you know more than one technique, then we like to check whether the particular outcome is a kind of you know having consistency.

So; that means, this is a kind of you know robustness. So, if you say that this particular outcome is the best corresponding to various other alternatives which can address the business problem more effectively. Then by default, so, this should be also consistent with you know other different techniques. Of course, the objective must be or the criteria must be very consistent you know on in the process of you know management decision. So, then you know after, after having the kind of you know flexibility, the kind of you know situations, then the kind of you know outcomes then we have to apply a particular

you know technique and pick up a particular outcome which can address the business problem more effectively.

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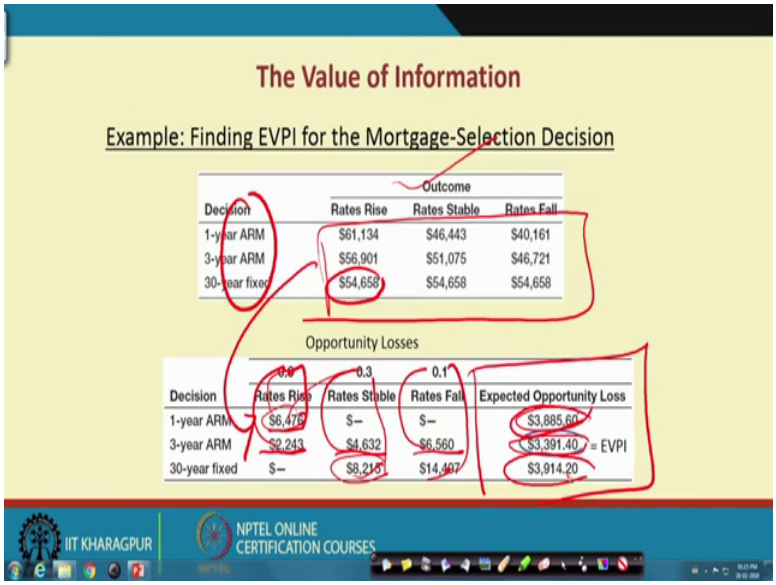

So that is how the value of information is very accurate and for to highlight this particular concept we try to you know connect the same examples. So, the example is with respect to you know decision making of you know 3 different financial investment and that to 3 different situations. So, as a result we have a 9 different possible outcomes, one particular outcome need to be you know targeted which can address the business problems as per the particular you know requirement or the kind of you know need.

So, here is we start with you know opportunity loss strategies. So, where this idea is that you know we have to find out minimum among you know all the columns individually. So, then we try to subtract the minimum element against you know all elements in that particular column. As a result the particular matrix will transfer into this matrix then after that we try to find out expected opportunity loss. So, for that we try to find out actually you know you know means we try to connect these you know opportunity lost with corresponding probability, then we find out you know EVPI that the expected value kind of you know opportunity loss.

So, that means, technically. So, in this case we have 6476 and that need to be connected with the corresponding probability 0.6 which can generate 3885.6 and similarly in the case of you know 3 year ARM, we have 2243 we have 4632 and we have 6560. So, this

multiplied by 0.6 this multiplied by 0.3 this multiplied by 0.1. So, this will give you this much so; that means, it is nothing, but you know kind of you know weighted average, weighted average of all these you know 3 possible outcomes against 3 year ARM. Similarly, against 30 year fixed we have 2 different outcomes and that to 8200 215 against 0.3 and then 14497 against 0.1.

So, this will give you the average figure 3914.2. So, then we try to apply some you know you know technique maximization technique or minimization technique to find out which one is the final one to address this business problem.

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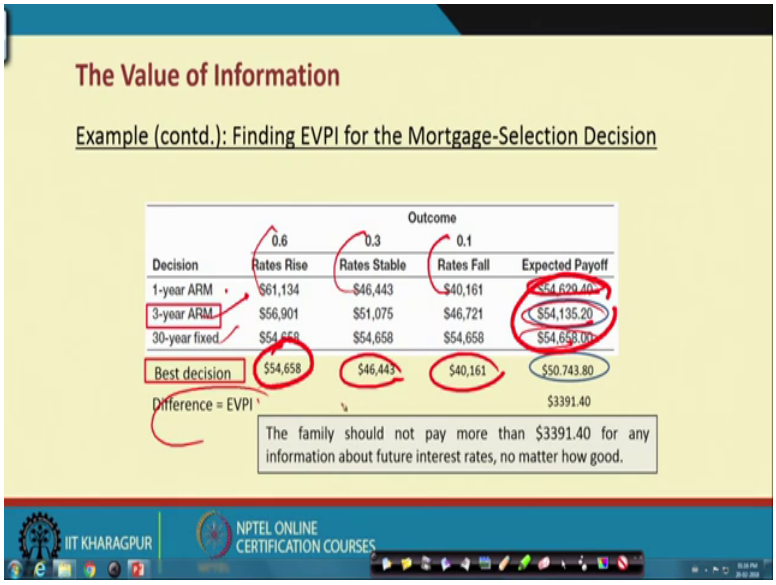

So, that means, the EVPI is the typical you know structure through which we can actually you know try to bring a kind of you know outcome means to find out a particular outcome label through which you can you know you know come with a kind of you know effective management decision and that to as per the you know typical problem requirement. So, the thing is that you know the best decision will be here. So, let us assume that you know this is the minimum you know criteria which you can apply here.

So, this is the minimum of you know first columns and this is the minimum of a second column and this is the minimum of you know third column and then we have already expected payoff. So, this is nothing, but actually in this multiplied by this probability, this multiplied by this probability and again this multiplied by this probability. So, we

will have this past this is the expected payoff against 1 year ARM and this is expected payoff for 3 year ARM and then this is expected payoff for 30 year fixed. Then the best decision will be the minimum of minimum of each column against rate increase rates stables and rates fall and then finally, the difference is equal to EVPI which is nothing, but actually 3391.44 you know 40.

So; that means, technically the family should not pay more than 3391.4 for any information about the feature interest rate no matter how good whether it is you know the kind of you know 1 year ARM, 3 year ARM or you know 30 year fixed so; that means, technically. So, it is a kind of you know effective kind of you know scenario through which you know we can address the business problem more effectively as per the you know the you know business need or the business requirement.

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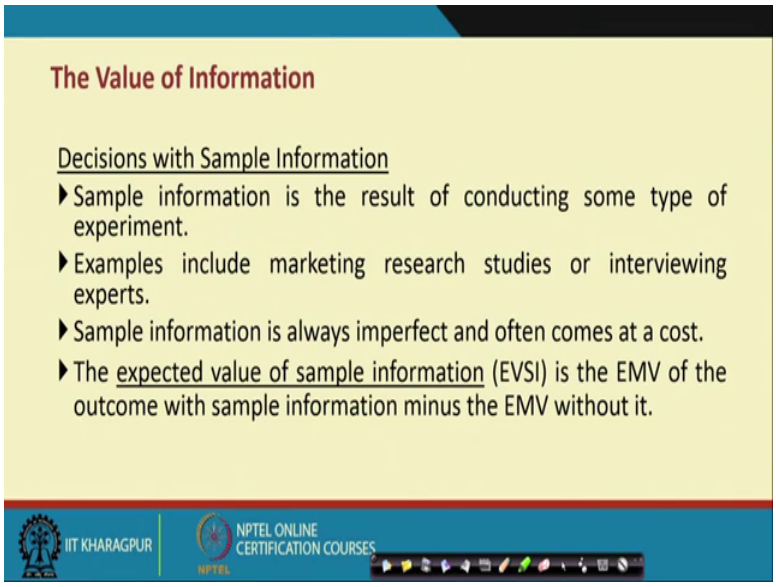

So, the value of information's is nothing, but you know decision with the sample information, the sample information is that the results of conduct conducting some type of you know experiment; obviously, it is a kind of an experimental process and examples includes you know like marketing research studies or interviewing experts.

So, sample information is always imperfect and sometimes it comes at a cost and the expected value of sample information is the EMV of the outcome with sample information minus the EMV without it. So, that is how the process which we have already derived here. So, that is the summary which we have address you know here.

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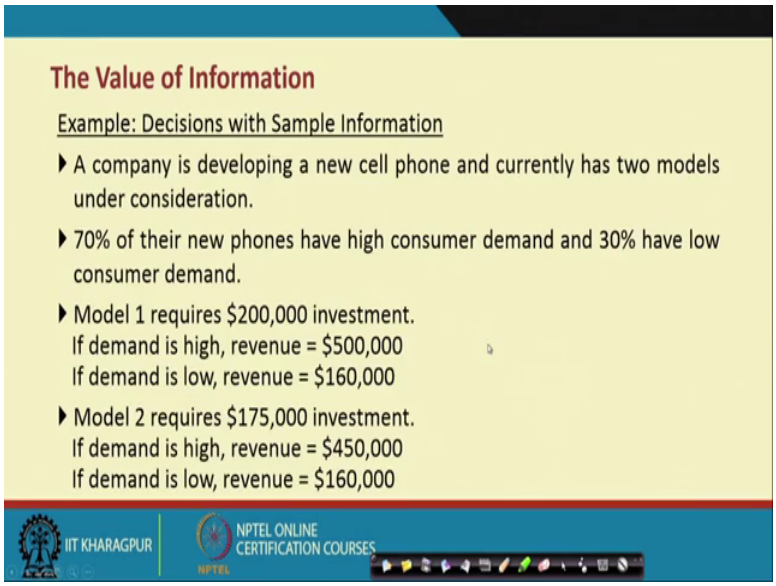

And in order to address the value of information more effectively more accurately, so, we can start with another examples. A company is developing new cell phones and currently has 2 models under the consideration and 70 percent of their new phones have high consumer's demands and 30 percent have low consumers demand.

So; that means, we have 2 different alternatives and then Model 1, these are the input descriptions and Model 2, these are the input descriptions. In the Model 1 the investment requirement is 200000 dollar and in the Model 1 2 case, it is a 175000 dollar investment. So, in both cases there are 2 different you know you know kind of you know structure. One particular structure is called as a demand is high and second one is the demand low. So; that means, we can have a decision tree having 2 different branches. So, Model 1, Model 2 and against Model 1 we have high demand low demand, again Model 2 we have high demand and low demand and of course, the possible outcomes are already given here and then we like to check which particular feasibility is the best for this particular you know requirement and for that we can you know use this particular value of information to take the decisions and then apply as per the particular requirement.

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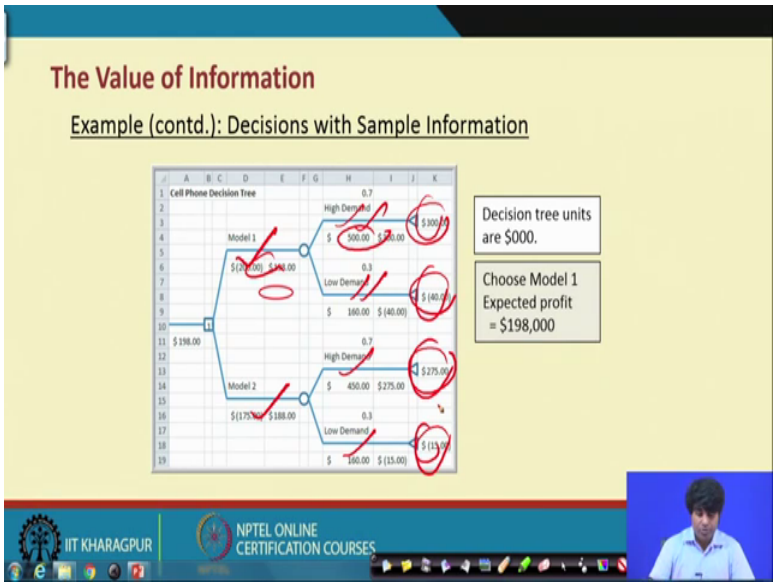

So, what I have mentioned? We can actually have a decision tree. So, this is Model 1 and Model 2, each case we have 2 different nodes with high demand and low demand. Again Model 2 with high demand and low demand and these are all possible outcomes and then finally, we can find out expected value and then we can. So, ultimately we have 4 different outcomes, so we have to pick up a particular outcome which can address this business problem more accurately. So, that is how the EVPI structure or the kind of you know need through which you can actually deal this business and see continue with you know similar kind of you know structures.

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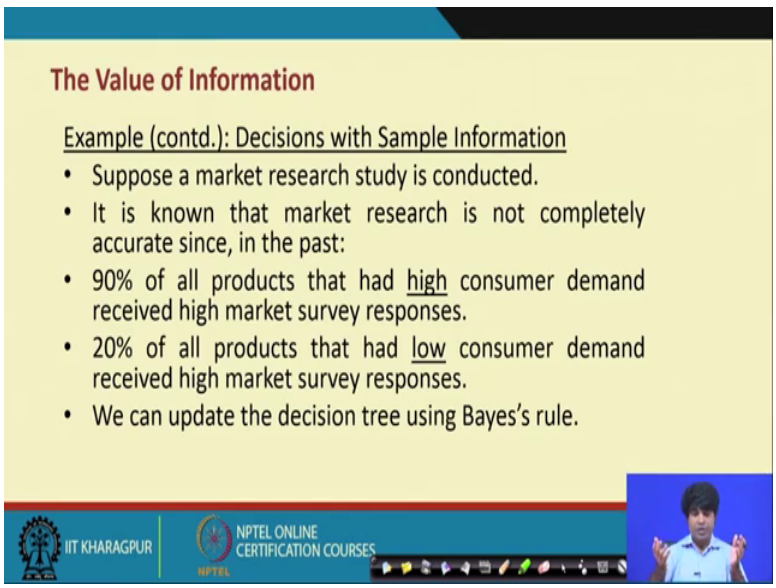

So, here the some more information can be connected and then the output can you know the output levels or the outcomes levels can be expanded.

So; that means, the there will be more number of flexibility if you put you know further constraints and the moment you put further constraints then; obviously, because it is a uncertain kind of you know environment we have again probability. So; that means, slowly slowly the value of output will be reduced. Then finally, we have to take a kind of you know decisions, like you know it is completely like you know BBM, which you have discussed in the case of you know prescriptive analytics.

So, depending upon the kind of you know situation we have a different kind of you know branching and under each branchings we have a flex you know different kind of you know alternatives and the kind of you know options through which the particular outcome can be generated. And then our job is to find out which particular outcome is the best requirement for the business need or the you know the business you know requirement.

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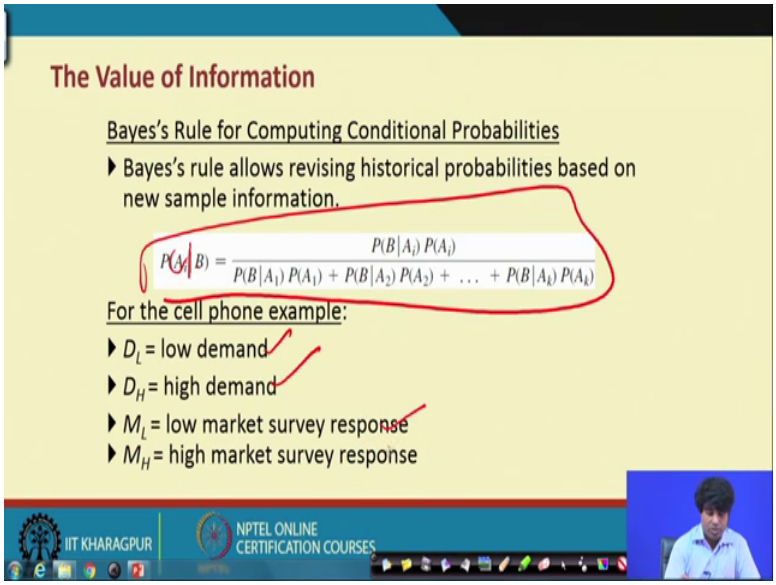

So, the best you know structure through which you can you know analyze this problem is through Bayes's theorem and here you know it is the question of you know conditional probability because our particular target is there. For instance the general form of Bayes's theorem is like this. So, here so we have actually this is the general structure of you know Bayes's theorem. So, we need actually probability of A given B means, so, we

try to target a particular you know node corresponding to the condition of you know other node, for instance Model 1 high demand. So, the Model 1 high demand means this is how the conditional issue and then we are we are trying to find out what is the expected payoff you know with you know Model 1, then high demand Model 1 with low demand. Similarly, Model 2 with high demand model 2 with a low demand.

So, likewise we have a different kind of you know structure. So that means, this will extend depending upon the number of you know constraints. So, now, in this case we have a 2 different you know structures. So, law demand and high demand and low market survey response and high market survey response. Then we try to prepare a decision tree corresponding to these you know information and the final choice you know about a particular requirement depends upon the best theorem requirement.

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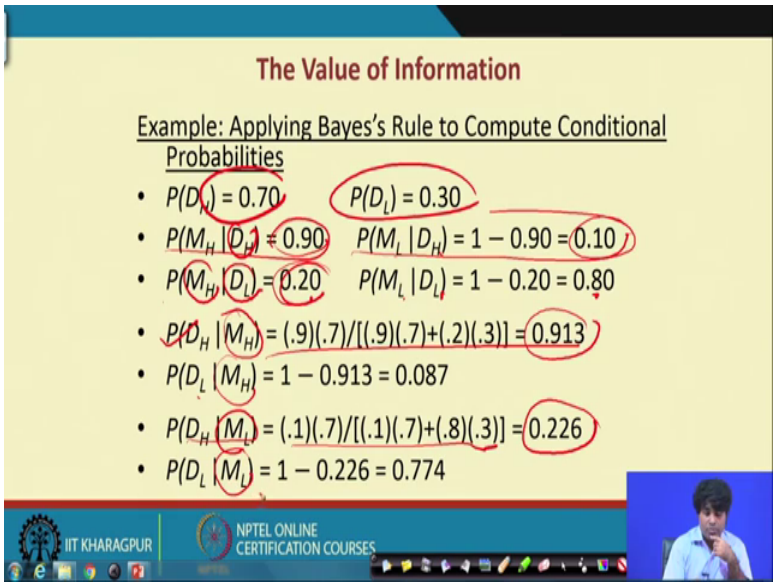

So, that means, technically having these information's we have different level of you know outcomes. And so, the high demand the probability of high demand is 0.790, probability of low demand is 0.30. So now probability of one particular conditional case is 0.90 another particular condition is the by default 0.10. So, this means there is a high demand, market demand and you know low market demand and; that means, technically if you, if you go to this particular you know structure. So, that means, L stands for low demand H stands for high demand.

So, D L stands for low demand; D H stands for high demand. So, M L stands for low market survey, M H stands for you know high market survey. So, accordingly so the conditional probability is like this you know high market, this is actually high market corresponding to high demand and that the probability is 0.90 and then high market corresponding to low demand, that is 0.20. Since total probability is equal to 1, so, against you know high market with you know high demand if it is 0.90 by default low market with high demand by default will be 0.10 that is 1 minus 0.90 and similarly in the case of you know high market with low demand if it is 0.20 then low market with the low demand, so this will be 0.80.

So, that means, it how you know total probability always equal to 1. So, if you prepare a kind of payoff metrics. So, the row wise summation and column wise summation exactly equal to 1. So, that you know the typical structure can be addressed more effectively. And as corresponding to this one o, we can derive probability of you know high demand against high market structures. So, this is the conditional probability structure which is coming actually 0.913 and similarly probability of you know low demand against high market o, by default it is 1 minus 0.913. Similarly, probability of high demand against low market condition so, which is coming actually through conditional probability that is 0.226. By default probability of you know low demand against you know low market so that will be 1 minus 0.226 that is 0.774.

So, that means, so the value of information's connecting to this particular you know business deal with respect to various alternatives and situation can be effectively addressed through you know, you know value of information concept and then it will be more accurately address with the help of you know Bayes's theorem.

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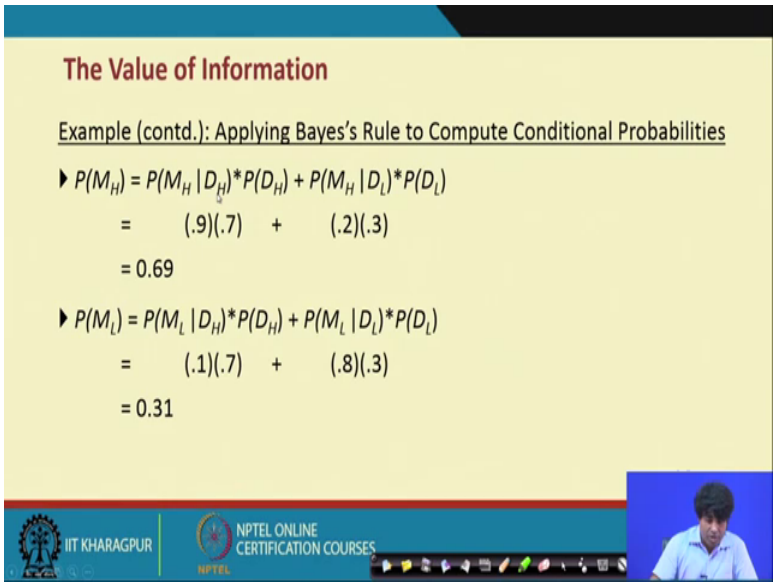

So, now, the final requirement is the actually to compute conditional probability that is how the high market demand. So, which is nothing, but high market demand with, you know high demand, multiplied by you know probability of you know high demand. Similarly, probability of you know high market with you know low demand against low demand multiplied by probability of you know low demand. So, this is coming altogether 0.9 and similarly a probability of you know low market is nothing but probability of low market against high demand multiplied by you know probability of you know high demand. Similarly probability of low market with low demand multiplied by probability of low demand that is coming actually 0.13.

So, this is actually it is a mixture of you know conditional probability, marginal probability and the joint probability. That is how the best theorem is all about and the decision making process which we have discussed till now is a kind of you know conditional structures and it is exclusively the kind of you know, you know connections through which you know various nodes are you know connected.

So, where if you like to analyze a particular you know situations with respect to different flexibility you know alternatives and the kind of you know situation. You will find it is the connection of you know connection of you know joint probability, marginal probability and conditional probability and because all these you know nodes and the kind of you know outcomes are connected with the various levels of you know

probability. So, accordingly when you when you need a particular you know requirement then by default you know the issue of you know conditional or the situation of conditional probability will be coming into the picture then you have to analyze as per the particular you know requirement. So, applying the conditional probability you can get to know what is the particular level of outcome through which the particular business problem is more effective.

So; that means, so there will be the kind of you know the kind of you know you know situation where we have a various alternatives depending upon the kind of you know flexibility and the kind of you know situations and then we pick up a particular you know out comes with respect to the you know business need. For instance here the need is you know the prediction about you know high market, probability of high market and with the with the help of you know whatever information's that is you know probability of a high demand, probability of you know low demand, probability of you know high markets here, probability low markets here, then the joint probability is.

So, so; that means, technically we have a some kind of you know inputs in inbuilt inputs and then we can you know analyze the particular situation and then come with a particular level of outcome, where we can you know address the business issue more effectively and then come with a kind of you know management decision as per the particular you know requirement.

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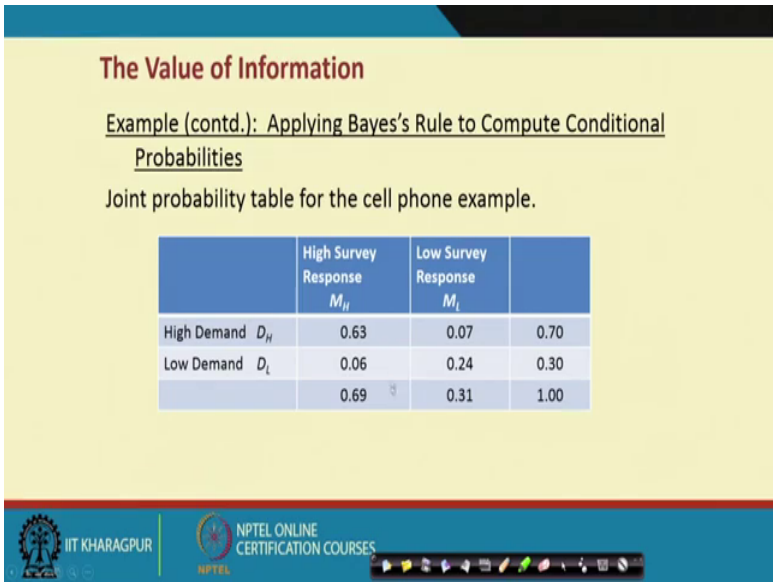

So, likewise this is how the summary sit, you know we have we have all these you know kind of you know conditional kind of situation and through which you can address the business problem.

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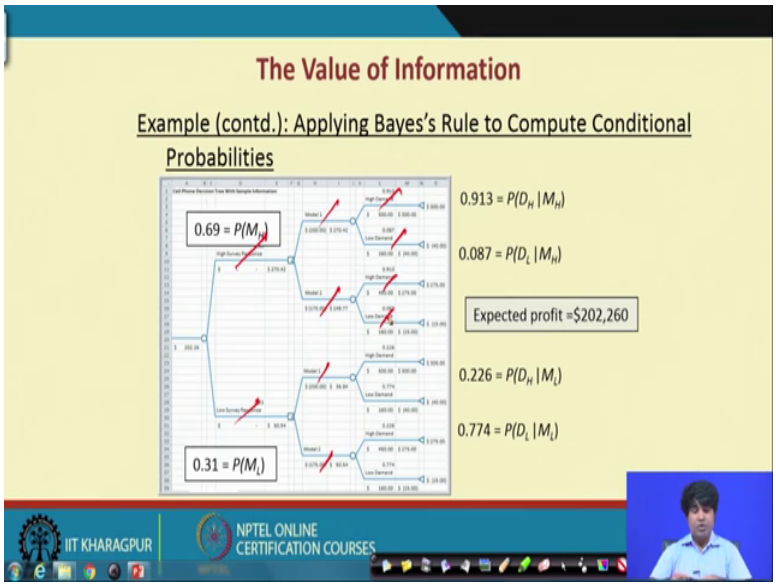

And likewise what we can do? We can prepare a decision you know decision tree depending upon the different situations where you know we start with you know simple here the kind of you know structures. Let us say this is the you know first end decision structure and then the particular you know classification high survey response, low survey response, Model 1, Model 2, again Model 1, Model 2 with high demand, low demand, high demand, low demand.

So; that means, you know depending upon different you know cluster and structuring will have a different kind of in options and every options will give you some kind of you know output and which can address the business problem more effectively. So, that is how the value of information can be considered as a you know as an effective tools to address the business problems and come with a management decision through which you can you know generalize the situation and then you can indicate some kind of you know strategy through which you can you know forecast the business problem more effectively.

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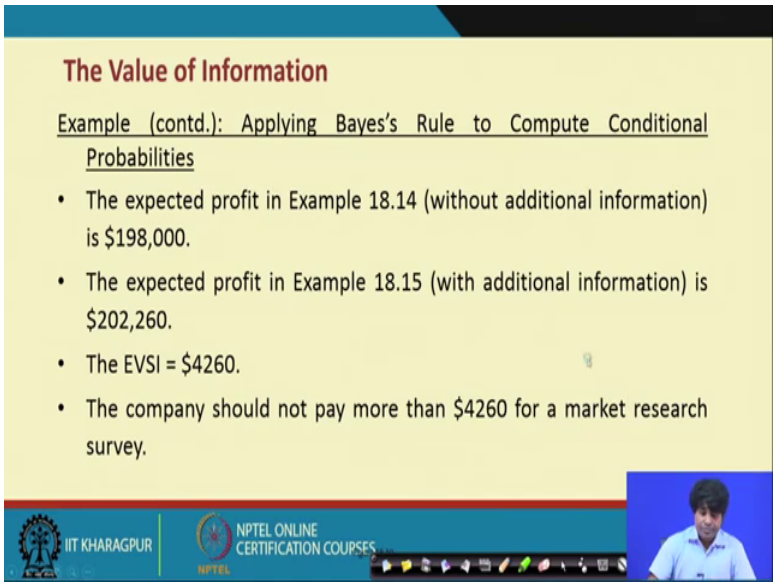

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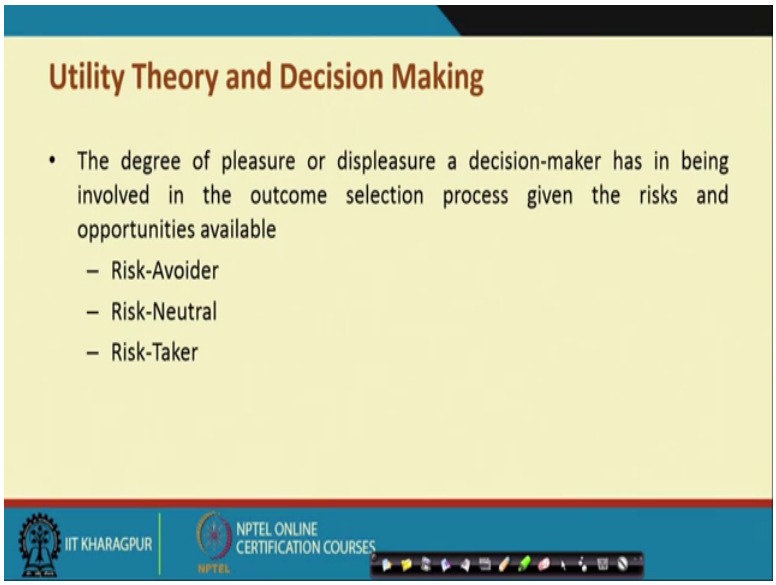

This is another problems connecting to this you know value of information's and corresponding to the value of information, the next component which you can you know connect to this you know decision analytic is a utility theory and how utility theory can be applied in the decision making process and that too under the decision analytics you know structure. The first of all what is exactly the utility theory? The degree means it is the degree of you know pleasures or displeasure a decision makers has in being involved in the outcome selection process given the risk and opportunities available.

So, that means, we since in that it is a question of you know utility. So, there is a issue of you know satisfaction and dissatisfactions and we have a different level of you know outcomes depending upon the you know risk uncertainty, then the kind of an alternatives different situations and any particular you know outcomes which may give you know satisfaction to the decision makers, not give you a satisfaction to the decision maker. So; that means, we have you know on different options where the decision makers will be satisfied and not satisfied and because ultimately a it is not in your hand.

So, it typically depends upon the business environment and the kind of situations and the alternatives. So, under the particular you know situations and alternatives we have to find out what is the kind of you know expected out outcome corresponding to the business problem and then we come with a kind of decision. So, there are 3 different you know you know utility decision corresponding to the addition you know opportunity. So, risk avoider, risk neutral and risk taker, so; that means, these are all you know different kind of you know structuring in the utility theory and that too in the decision making process.

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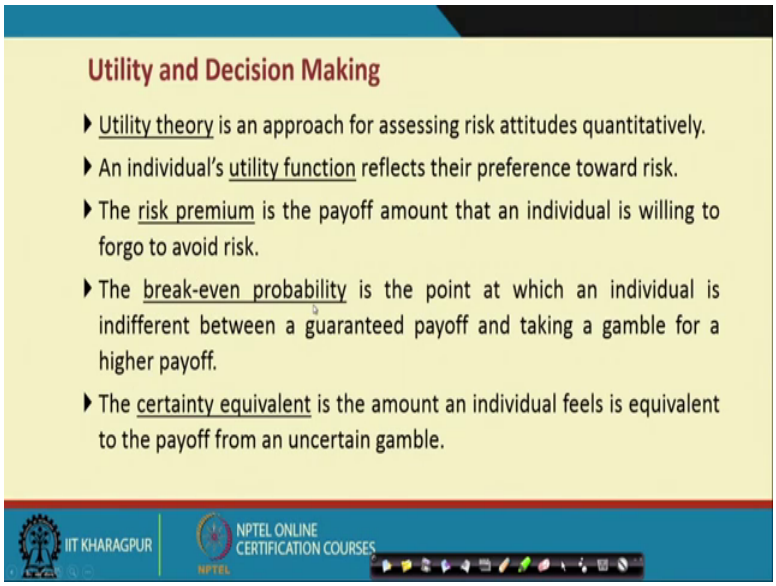

So, what I have mentioned you know utility theory is an approach for assessing risk attitudes in a quantitative way and individuals utility function reflects the preference towards this risk and the risk premium is the payoff amount that an individual is willing to you know forgot to avoid the risk. And then finally, the break even probability is the point at which an individual is indifferent between a guaranteed payoff and taking a

gamble for a higher payoff. And the certain in a certainty equal equivalent is the amount an individual feel is equivalent to the payoff from an uncertain gambling. So, that means, it is a kind of you know flexible kind of you know structure through which you know you will be find you know different level of outcomes where once, one way you try to satisfy the decision makers and through which we are you know searching the kind of you know outcomes which can deal the business problem more effectively and to understand these we can you know start with a simple example here and it is a personal investment decision.

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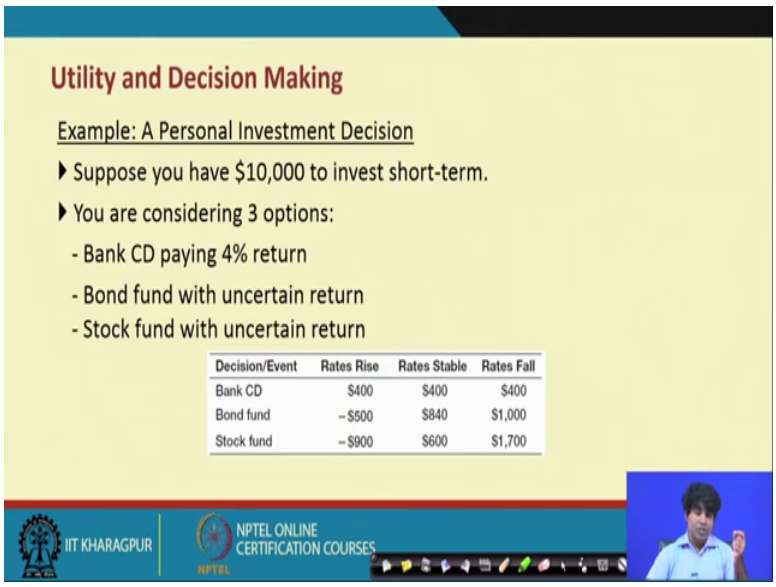

Suppose you have 10000 to invest in the short terms and that to you have 3 different options. So, bank CD, bank fund sorry bond fund and stock fund and as a result we have 3 different options; rates increase, rates stables and rates fall.

So, under each case we have a different return and some it is a average returns and then so we have here 400 minus 500 and 900. So, that means, technically we have the payoff metrics corresponding to this you know different options and the kind of you know investment plans. So, now, we like to see how the outcome is you know will be used and the kind of you know structure you have to bring. So, that you know the decision will be very effective as per the particular you know requirement.

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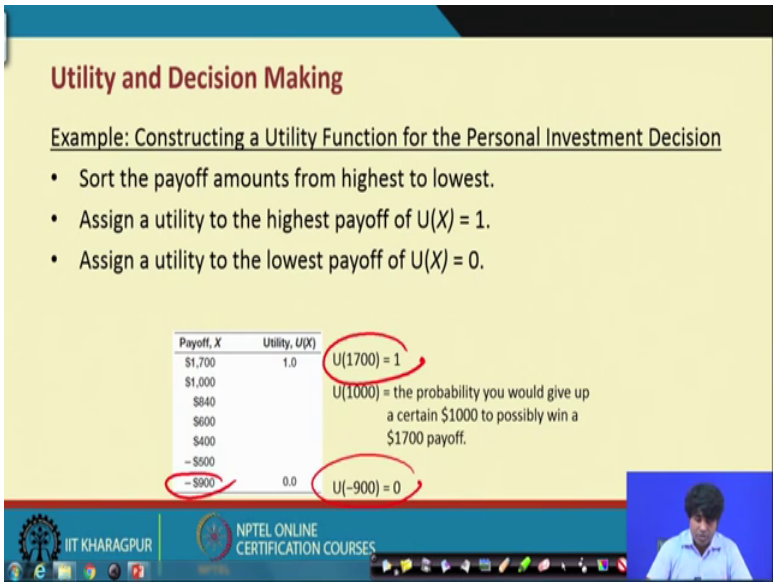

So the so, what we will do? You know we tried to construct a utility functions here it is another kind of you know personal investment decisions where we like to assign a utility to the highest payoff where you can put u of x equal to 1 and assign utility to the lowest payoff where u of x equal to 0.

So, as a result so if you put you know 1700 that is the highest payoff. Then this will be utility 1 and against the lowest payoff is here minus 900. So, the utility of minus 900 equal to 0; so that means, we need some kind of you know quantifications because it is utility is a kind of you know qualitative concepts. So, we need some kind of you know quantification to address the problems and then come with a kind of you know decision which can you know satisfy the decision makers as per the particular you know business requirement.

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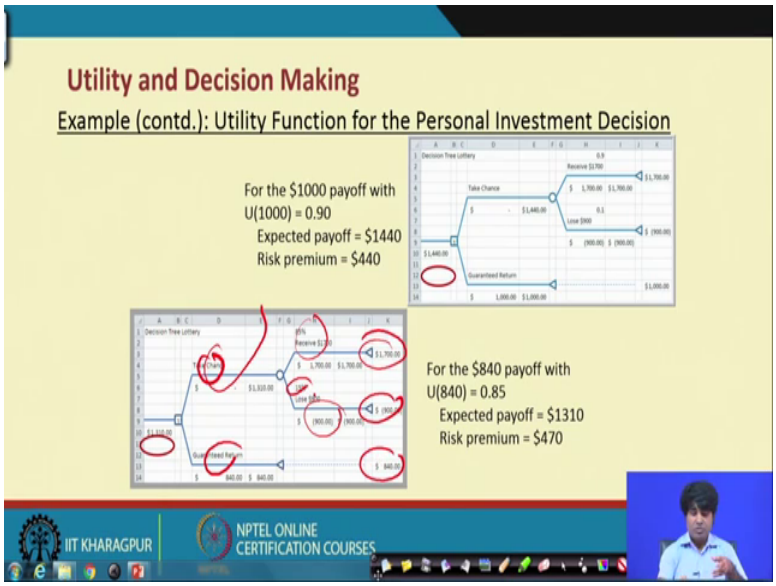

So, ultimately so this is a kind of you know structure through which you can analyze and similarly so, the entire structure against can be addressed through you know decision tree and here the investment structure will be like this. So, this is actually starting node and it has two different kind of you know options and the first option is with you know take a chance and guaranteed returns. That is how the risk will be appearing here. And as a result we have 2 different options; in one case we have 85 percent another case we have 15 percent.

So, as a result we have two different levels of output and corresponding expected value is like this and here also expected levels corresponding to the loss you know 15 percent and then again here in the guaranteed returns we have you know expected way. Then finally, we have three different levels of outcome and we can apply the conditional outcomes or we can try to find out which one is the best outcome you know with respect to all possible outcome and that too for this you know personal investment decision.

So, likewise we have a different kind of you know structure through which you know we address this you know business problems as per the particular requirements.

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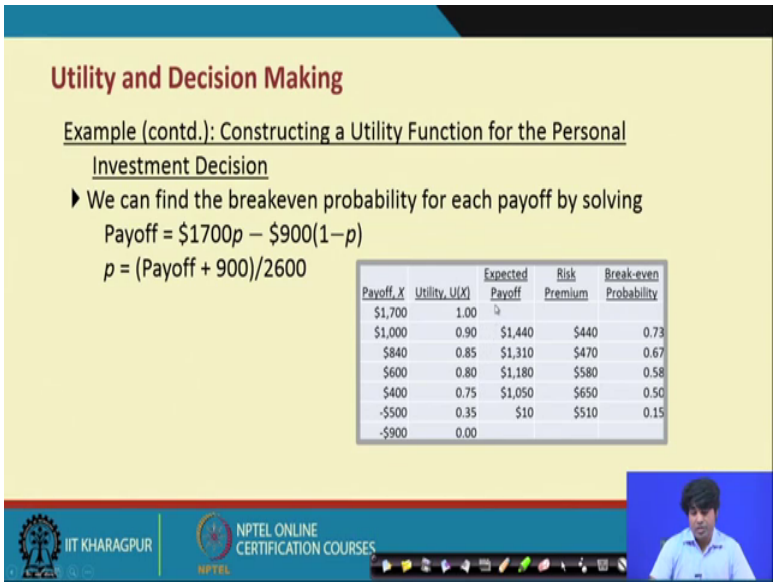

So, this is how you know corresponding to the previous examples. Now we have analyze in the case of you know utility highest utility and lowest utility but in the mean times if you apply all these values. So, we can find out the utility level in between and then expected payoff, risk premium, then finally, the break-even probability.

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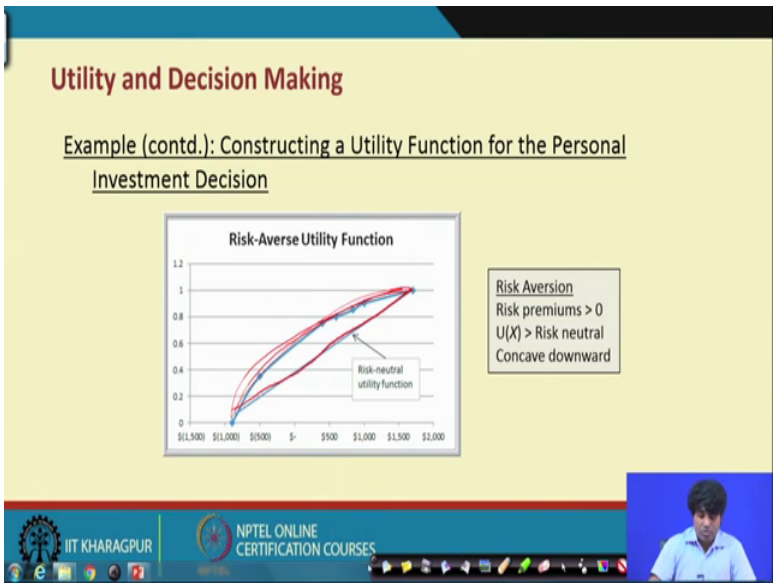

So, now, if we will a plot these then you will find the kind of you know structure will be like this. So, this will be the kind of you know neutrality options and this corresponding to the actual happenings; that means, the kind of you know situation where risk premium

is greater than 0. That means, utility of X is greater than 2 you know risk neutral and look like you know concave function and that means, the decision is not actually in a kind of you know linear safe, technically yes there is increasing, but the kind of an increase is little bit you know ups and downs.

So, ultimately it depends upon you know the kind of you know situation to situations and that too with you know business environment.

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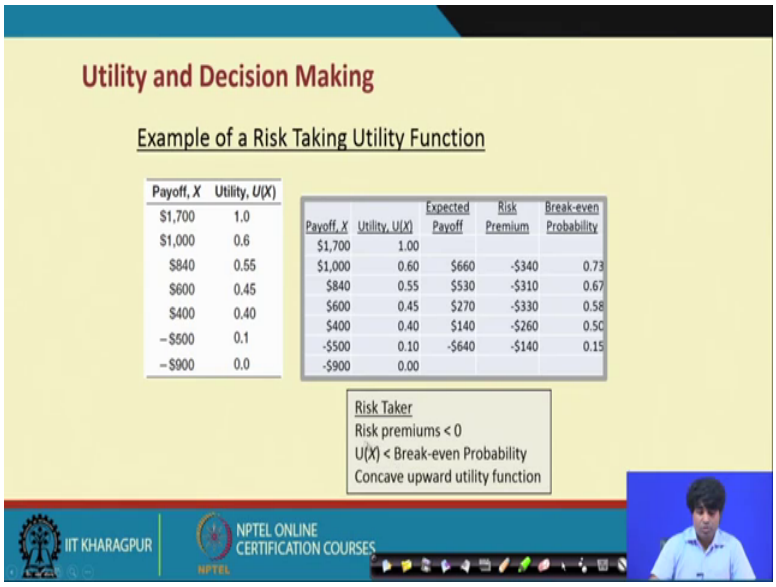

So, this is how the entire utility functions and again in this case the risk premiums is less than 0. So, that means, the utility of x is less than breakeven probability and as a result the structural you know concave type of you know situation.

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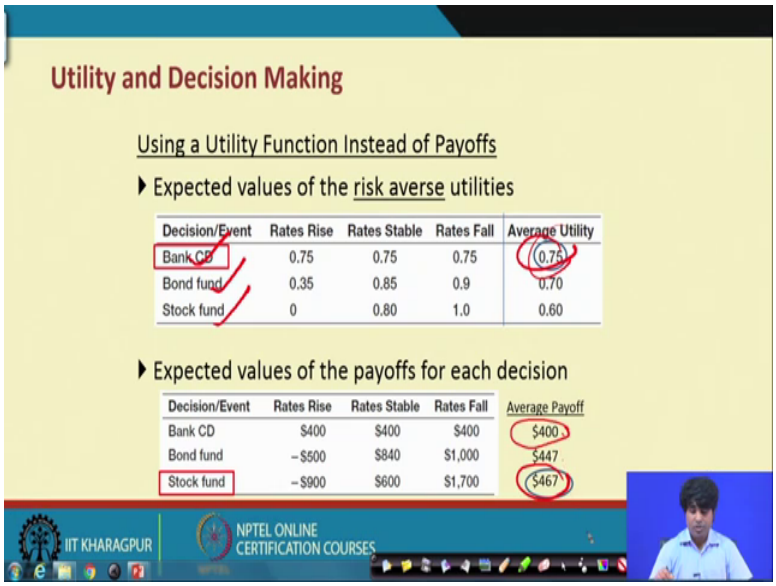

So, now corresponding to these you know problems, so, what we can you know do here? So, we have again a kind of you know problems where we have three different of alternatives. So, the bank CD, bank you know bond fund, then you know stock fund as per the previous examples and against we have actually outcomes corresponding to rate increase, double rate and rate decrease and then we can find out the average utility and find out to the maximum of average utility.

Similarly, if you apply the expected value you know concept then again so, we can find out average payoff corresponding to the particular you know probability and then we have to take a decision which can give you, you know more effective result. For instance out of these three so, we can actually choose the particular one which is nothing but you know 467 dollars compared to 400 and 447. So; that means actually, so these are the various you know mechanisms through which you can you know you know give you better understanding or the kind of you know better clue to find out a particular level of outcomes through which you can address the business problem more effectively.

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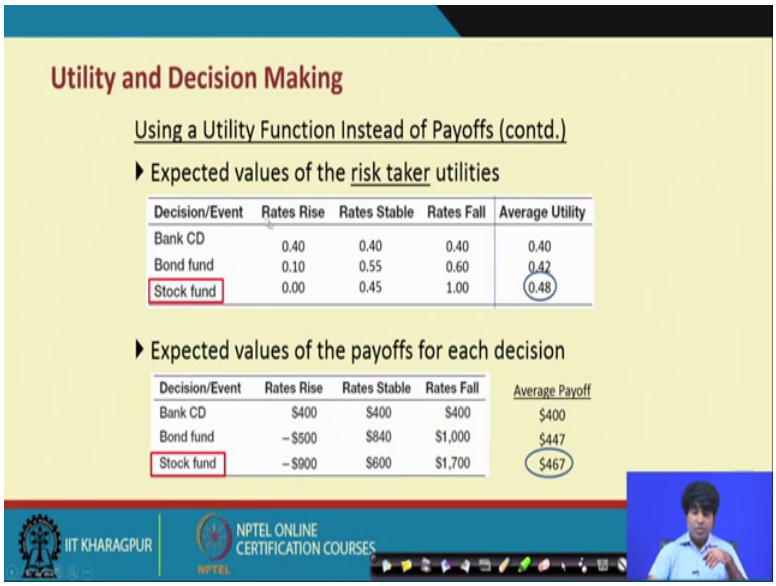

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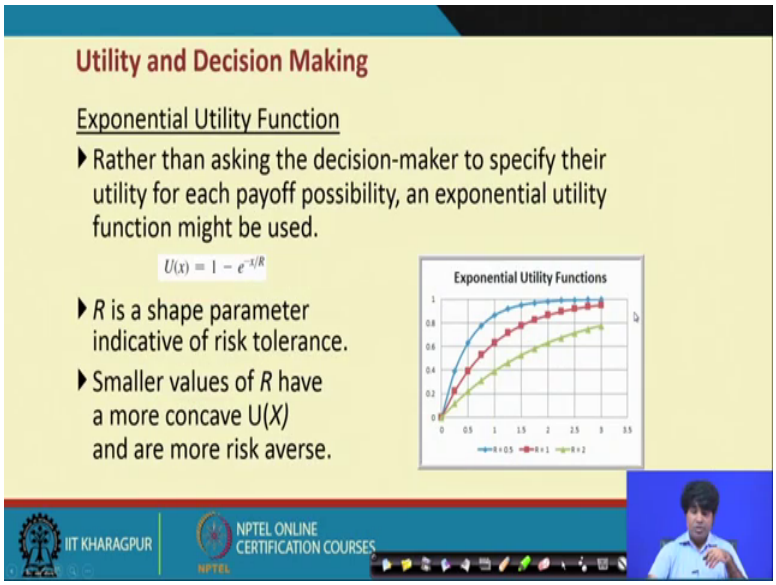

So, these are all you know various different kind of you know requirement and against if you know start with the kind of you know structure of the utility functions you will find corresponding to this utility function you have actually different kind of you know structure where, you know on the shape of parameter, you know is a indicative of you know risk tolerance and smaller the value of you know R, have a more concave of you know utility function and as a result there is you know more risk you know averse in nature.

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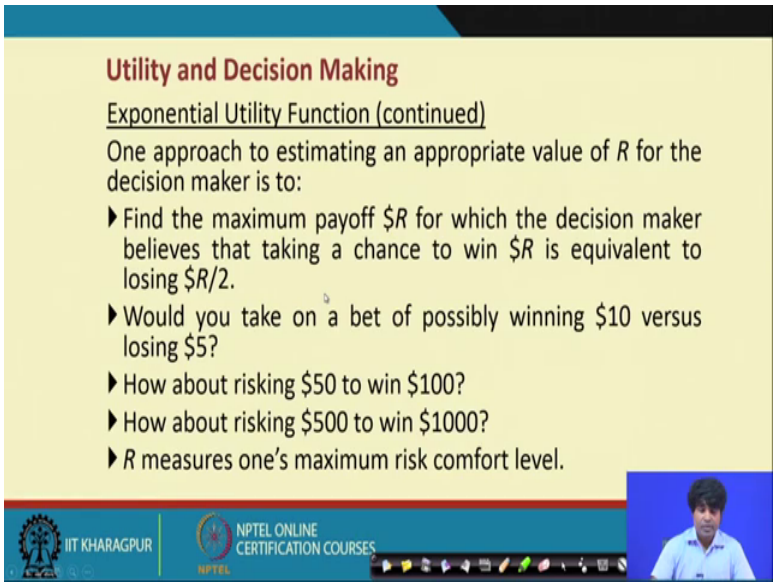

So, now so these are the you know typically you know kind of examples through which the utility function can be analyzed.

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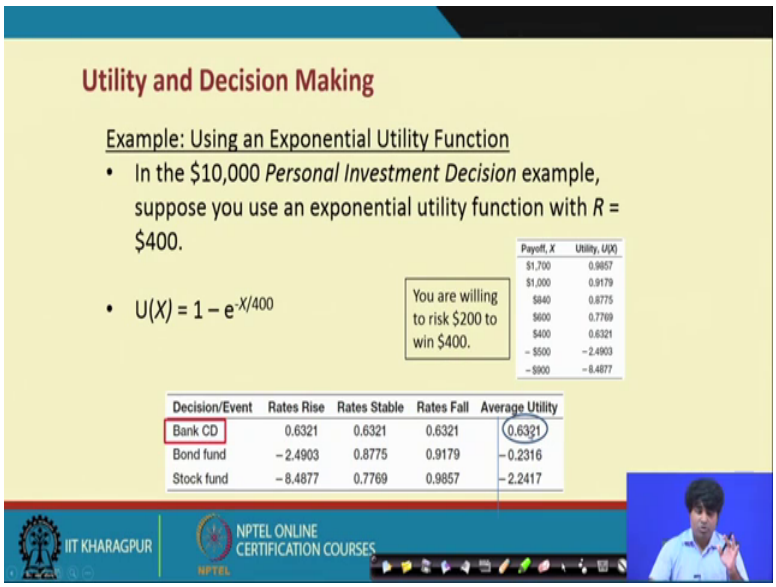

So, now, here in the in the another examples the same personal investment where you know the utility function is nothing but you know exponential type and against corresponding to these various payoffs we have a utility and against the utility we have a different kind of you know decision making process depending upon you know three different investment plans. A bank CD, a bond fund and the stock fund and then you

know different rates increase, rates stables and rates falls and then finally, you can find out the average and then take the decision. Since, here the best average is a 0.63 to corresponding to the minus 0.2316 and minus 2.2417.

So; that means, technically this can be the best outcomes you know separation this personal investment decision is concerned.

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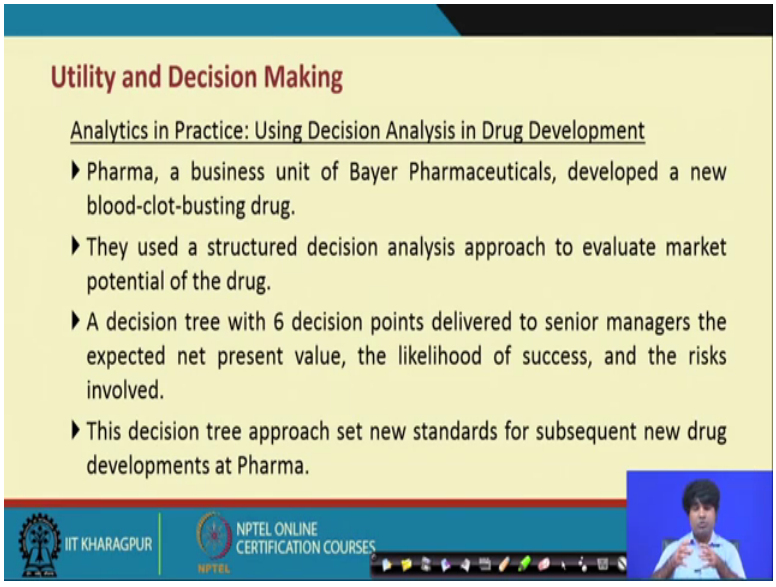

And likewise actually, so, when say in practice that is an analytic practice using this analysis is a very practical kind of you know or you know very accurate kind of you know process through which you know we can you know bring the different level of you know outcomes with respect to different alternatives and different situation and this will give you some kind of you know flexibility to the business problems and to the decision making process. And the decision makers rule is to find out which particular outcome is very effective with respect to a particular condition or with respect to a particular you know requirement. So, that means, you know the decision tree or the kind of in decision analytics will give you some kind of you know more flexibility corresponding to different situations and you know different requirement.

So; that means, technically we have a different level of you know outcomes depending upon the particular you know alternative, depending upon a particular you know situation and the kind of you know criteria and. So, we can pick up or the decision makers can pick up a particular outcome to address the business problems as per the

particular you know the typically requirement. For instance if you have a three alternative corresponding to a particular alternative with a you know particular options, you can you know strictly a pick up a particular outcome which can you know address the business problem more effectively.

So; that means, technical this is another problem through which you know we can address the business problem more effectively.

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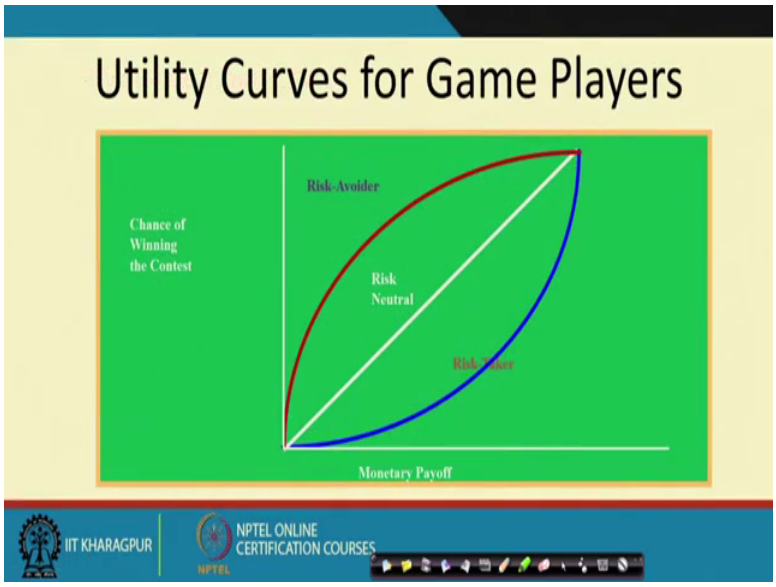

So, that means, technically if you connect with you know the kind of you know utility theory corresponding to the decision analytics, so, there are three different you know options, behaviors. So, the line which we have here is called as you know Risk Neutral and this is actually Risk Takers that is the convexity of this particular you know utility functions and Risk Avoider it is a kind of you know concavity of the particular you know utility functions.

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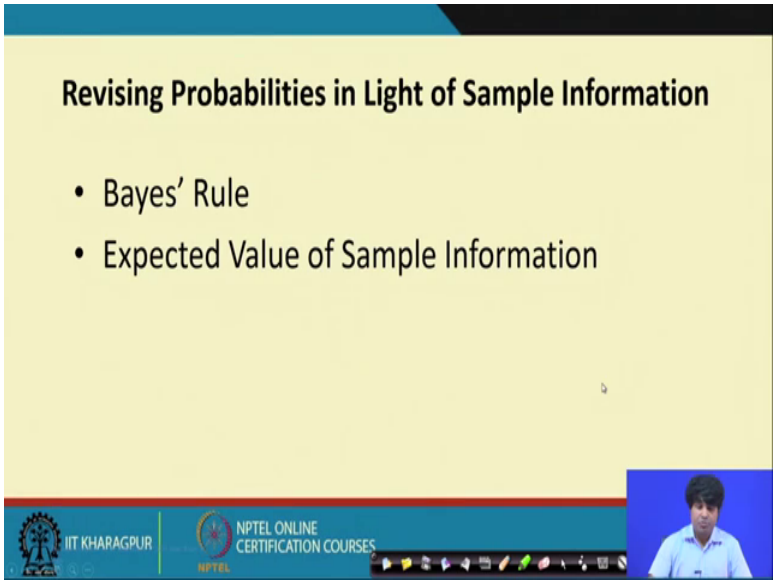

So; that means, technically so these are the various natures of you know utility functions corresponding to a particular you know business problem. And what we have already mentions, we use you know typically Bayes theorems to address these kind of you know problems and deal with the business problems which can you know generate some kind of you know better results as per the particular you know requirement.

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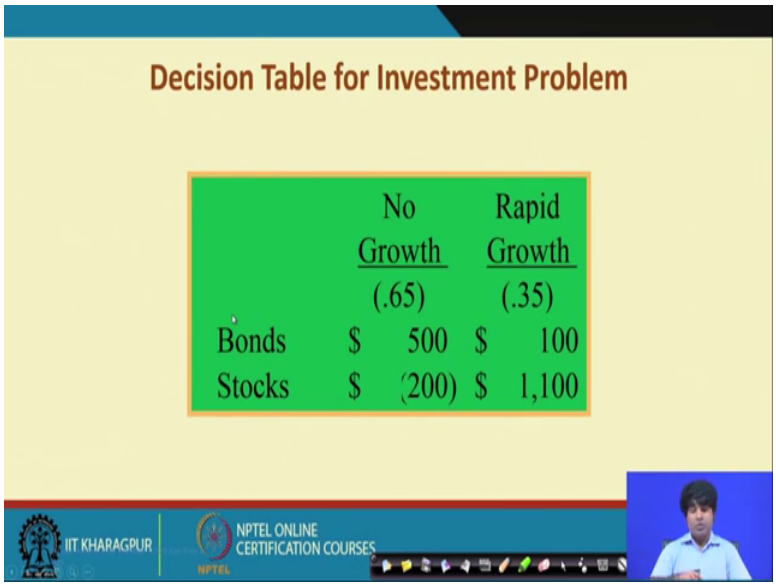

So, now, we can start we can connect with this with you know another examples. Here we have two different you know financial instruments, bonds and stocks and we have two different situations no growth and rapid growth.

So, then in the no growth say situation we put the or we assign the probability 0.65 and in the case of you know rapid growth we are putting the probability of 0.35. Then corresponding to two different financial instrument and two different situation by default we have four different outcomes that these are all in say these are all here 500, 200, then 100 and 1100.

So, these are all you know so; that means, now we have here the kind you know conditional kind of you know things; that means, if you like to you know choose the option of you know bond with no growth situation then the outcome will be 500 and against if you choose you know stocks with you know no growth then the outcome will be 200.

So, likewise we have a different you know options and flexibility to address this kind of you know business problems and then come with a kind of you know decision making through which you know we can you know analyze the particular you know business problem more effectively. And likewise so what we can do?

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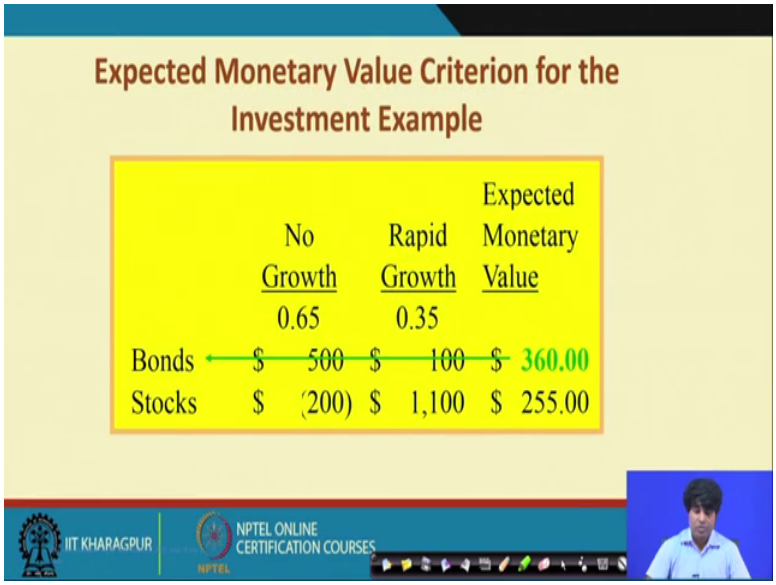

So corresponding to these inputs input matrix, so, we have a different you know criteria against to apply and then to analyze the problem. So, if you go by you know you know simply kind of an expected monopoly criterions then you know corresponding to this you know probability just you know you can find out the expected value and since it is a kind you know investment decisions where you will get you know highest a expected value.

So, that will be the final choice. Then here with respect to bonds we have two different options and stocks we have two different options.

So; obviously, if there is a choice between bonds and stocks then the first end choice will be the the investments should be in the bond site and that really generate here in this case 360 dollars. So, likewise we have a different options and that to address this particular you know business problem.

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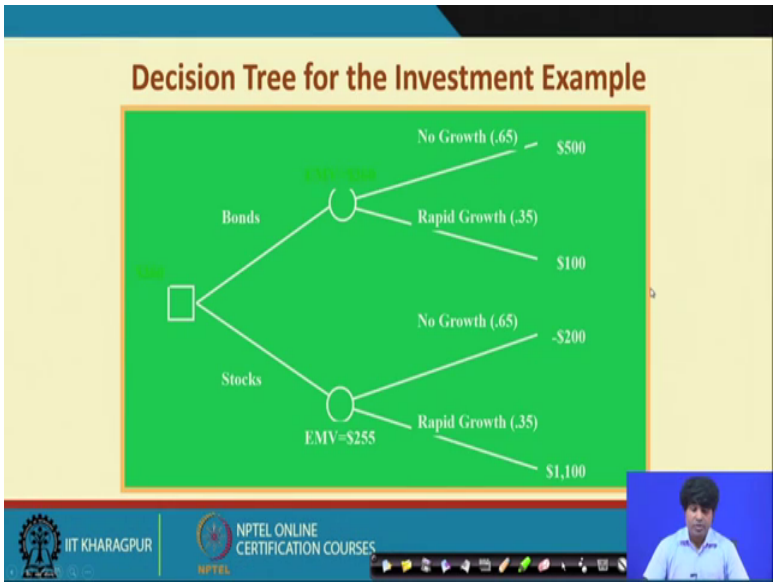

And this is how the decision tree you know can analyze more effectively. And corresponding to this you know you know output so, what we will have? We can prepare a decision tree which we have actually bonds and you know stocks and again bonds we have a two different options; growth and rapid growth. Similarly for stocks we have a no growth and rapid growth and accordingly. So, against you know bonds, no growth we have outcome 500, again bonds with rapid growth we have outcome 100, then again stocks with the rapid growth that is you know 1100, stocks with no growth which you have you know minus 200. Now having different probability, so you can find out the expected value and then try to find out which particular outcome under you know different situations.

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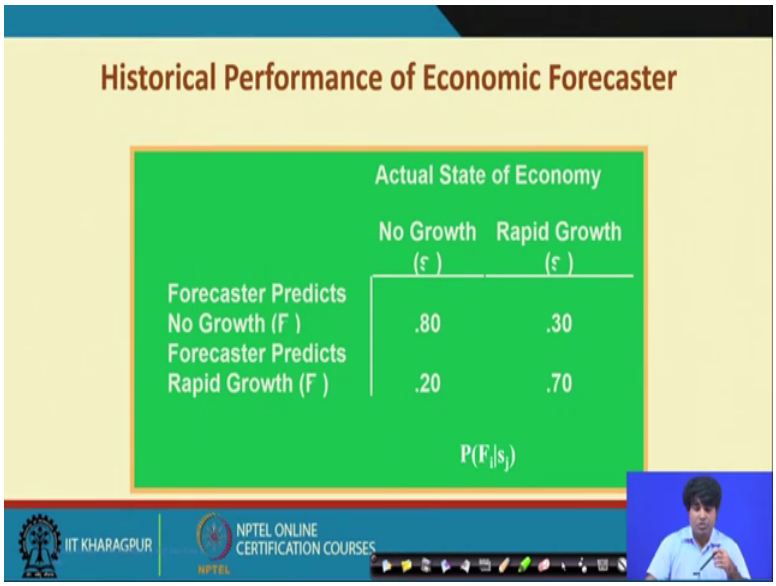

So, likewise you know different probability we have and then we can analyze the situation. This is another kind of you know structure through which you can address this particular you know business problems.

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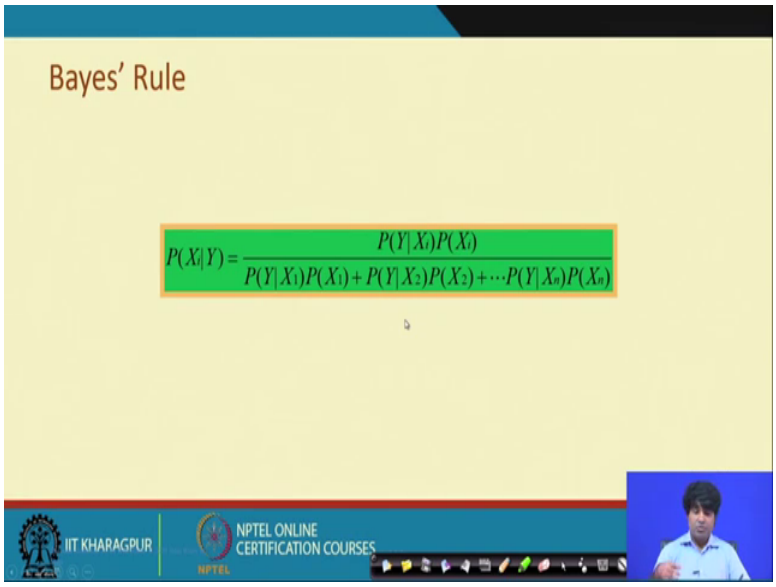

Same Bayes theorems can be apply to try to explore the different you know possibilities depending upon the different situations and which you have already discussed corresponding to the previous problems.

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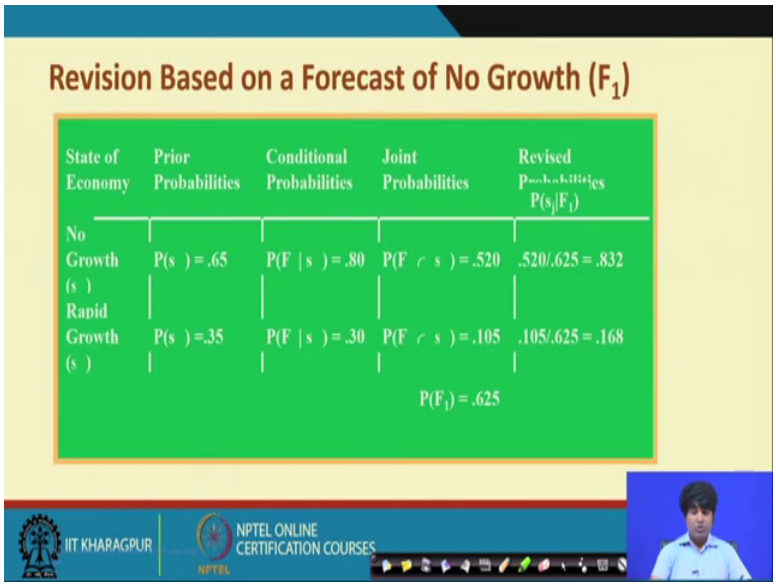

So, now, we have actually two different situation and then against corresponding to the different you know a financial investments. So, we have some kind of you know you know joint structure and conditional structure through which you can address the business problem.

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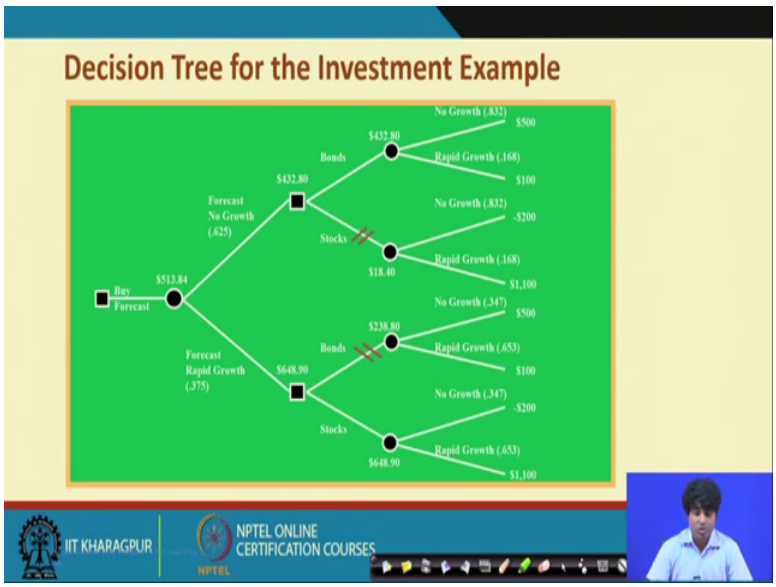

So that means, in order to justify this one, so, this will be the another kind of you know structure here. So, the you know no growth situation and the a growth situation; so that means, technically. So, this is how the investment structure where this is no growth

situation and this is growth situations, then bonds and stocks, again bonds and stocks, again here no growth situation, rapid growth situation, again no growth situation rapid growth situation.

So, likewise we have a different options and that means, the whole idea is actually the you know we like to know that you know different option we have to address this you know business problem.

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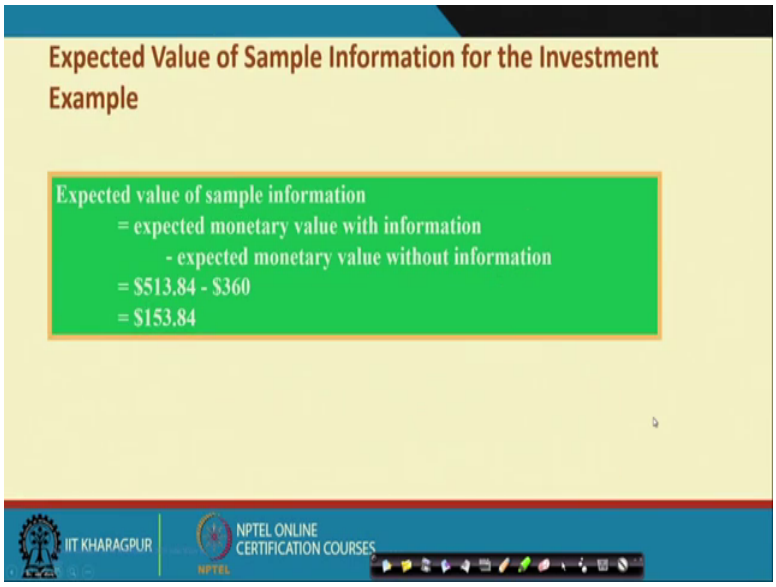

And; that means, technically the particular structure gives you know different kind of you know options through which you can you know address the business problem more accurately.

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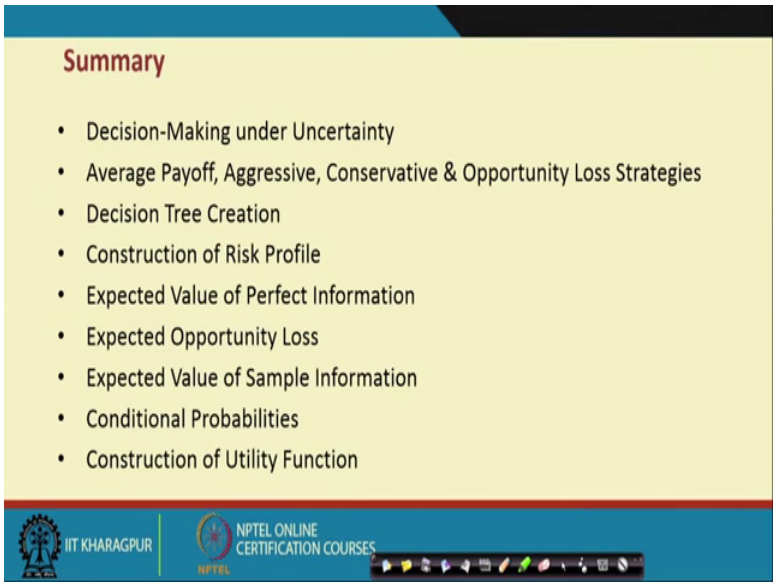

That means, technically in the design analytics we have already discussed you know various tools and you know techniques and the kind of you know criteria through which we can being different levels of you know outcome depending upon the various alternatives and various you know constraints. And then we can try to select a particular outcome as per the as per the particular you know business objective or you know a particular business requirement.

In some we have discuss you know various analytics you know structures starting with the descriptive analytics, predictive analytics, prescriptive analytics and decision analytics and under each heads we have discussed various techniques, tools and connected with the various business problems. And then we try to find out you know how the business problem can be addressed and we try to find out various alternatives and against each alternatives we try to bring you know sensitivity structure, robustness structures.

So; that means, what I like to say that you know business analytics is a kind of you know tool baskets where we have a plenty of you know analytics tools through which we can analyze a business problem as per the particular you know business requirement. So, depending upon the problem, depending upon the particular requirement the need is that you know we try to find out various alternatives in the process of robustness, in the process of simulation, in the process of sensitivity, structure then you know. That means,

technically a we try to extract you know as much as possible you know information to address the business problem more effectively.

So; that means, you know if I like to summarize. So, the business analytics is a kind of you know tool baskets where we have a plenty of you know business analytics tools and that too we can apply as per the particular you know business requirement and then if a your particular you know tool is a very perfect as per the particular business requirement, then we come with a kind of you know outcome which can address the business problem more effectively, more efficiently, more accurately. Then we can apply the management decision as per the particular you know management requirement.

With this we will stop here.

Thank you very much. Have a nice day.