Introduction to Environmental Economics
Prof. Diptimayee Nayak
Department of Humanities and Social Sciences
Indian Institute of Technology, Roorkee

Lecture – 36
Choice Experiment Method A Stated Preference Approach

Hello everyone. In the last class, we are discussed about the contingent valuation method which is a family in method of under this stated preference method. So, today we will be discussing the choice experiment method. This is the second method under this stated preference method and broadly in this in this lecture, we will be talking about what is the Choice Experiment Method. And what is the background or what is the theoretical background and history of the choice experiment method.
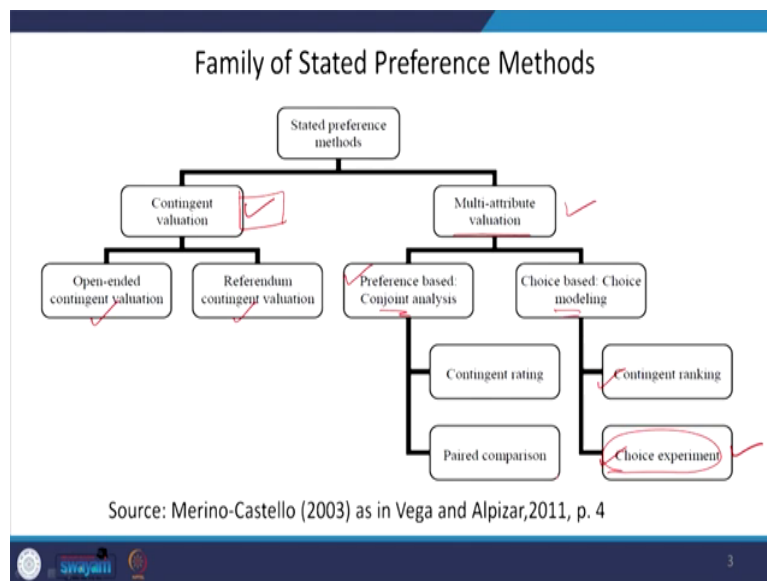
(Refer Slide Time: 00:49)

Outline
- What is choice-experiment method?
- History of choice experiment
- Steps in conducting a choice experiment
- Differences between CVM and Choice Experiment
- Limitations

And if you want to conduct a choice experiment method then what are the likely steps we need to include and then finally, we will be discussing what are the differences between this contingent valuation method and the choice experiment method.

In order to find which method is suitable is most appropriate under this stated preference method and it will be followed by the some of the disadvantages or limitations of the choice experiment method. So, before talking about what is the choice experiment method, let us have a look and the family of the stated preference method. As you understand that choice experiment is a is a one of the method under the stated preference method.

(Refer Slide Time: 01:36)

So, our focus today is explaining this choice experiment method. So, when you are talking about the stated preference method broadly it is divided into two broad categories. One is your contingent valuation method that we have already discussed and the second one is multi

attribute valuations. So, under this a contingent valuation method, we talked about what is open contingent valuation and what is the referend referendum contingent valuations.

But we have discussed only the a simplest form of contingent valuations and today, we will be discussing the multi attribute valuations. That means, we are talking about if there are multiple attributes are assigned, then how to take a decision or how to know what is the welfare implications of this particular change in the presence of multiple attributes. And under this multiple attribute valuations there are again it is divided into two parts. One is the preference based conjoint analysis and the second one is the choice based choice modeling.

And again they preference based conjoint analysis is divided into two different method. One is the contingent rating and the second one is paired comparisons. And likewise when you are saying it is the choice based method, there we will be talking their this can be of two types; one is the contingent ranking and the second one is the choice experiment. So; however, will be a will be discussing in a most common form of multi attribute valuations that is the choice experiment method.

So, under the stated preference method, we talked about the contingent valuations that is the commonly used. And under this multi attribute valuations, we will be talking about the choice experiment that is also very general commonly used in under this stated preference method.

(Refer Slide Time: 03:52)

So, now the question is why we are talking about this choice modeling or choice experiment when we have already discussed about the contingent valuation method that is one of the family a member family member method under this stated preference method. So, the challenge is that in the contingent valuation method we cannot tackle the multiple attributes in the valuation exercise.

So; that means, in the contingent valuation method what we talked about? We just talked about some hypothetical scenario if this is going to be changed, then we try to find out the valuations or economic valuations are welfare measurement. If at this conditions has been changed or it is going to be changed ah in correspondence to the original situations so; that means, in contingent valuation method we talked about two scenarios right. And there we talked about that this is the current scenario existing scenario and this will be the change

scenario in case the policy is going to be implemented and necessary changes will be done accordingly.

But when then a the there is an involvement of multiple attributes for that particular goods or service in in questions that is going to be evaluated under this policy exercise, then it is difficult to apply this contingent valuation method. Because contingent valuation method cannot deal with the multiple attributes associated with the particular policy change and how to evaluate those multiple attributes of that environmental good and service under this policy discussions.

So, therefore, in order to avoid this limitations of contingent valuation method choice this multiple or multi attribute valuation has been developed. And here this multiple or multi attribute valuations can be applied in order to avoid the limitations of contingent valuation method. So, therefore, we can say this application of the multiple or multi attribute valuations has come up as a response to the limitations that we are facing under this contingent valuation method.

And more over in general, we are saying this contingent valuation method and this multiple multi attribute method like oh we are talking about this in this context we will be highlighting the choice experiment. So, there is a difference. So, how they are different this contingent valuation method and the multiple multi attribute method? So, in case of this multi attribute method like your choice experiment these methods, they are allowing the practitioner to estimate the values for a multiple attributes of a particular product or a particular policy in discussions. And we are also measuring the a the how this multiple attributes they are traded off we are also measuring.

So, in that way we are saying this multiple attribute method, it is better than the contingent valuation method because contingent valuation method is not capable to estimate the multiple attributes of a particular good or particular product or services in discussions. And that is why we will be choosing this multiple attribute method in comparison to the contingent valuation method.

And again if the theoretical underpinnings are concerned, this this a contingent valuation this multiple attribute valuation method. So, it is based on the a Lancaster's theory so, which is known as the Lancastrian microeconomics. So, he propounded in this theory that his new Theory of Demand in 1966.
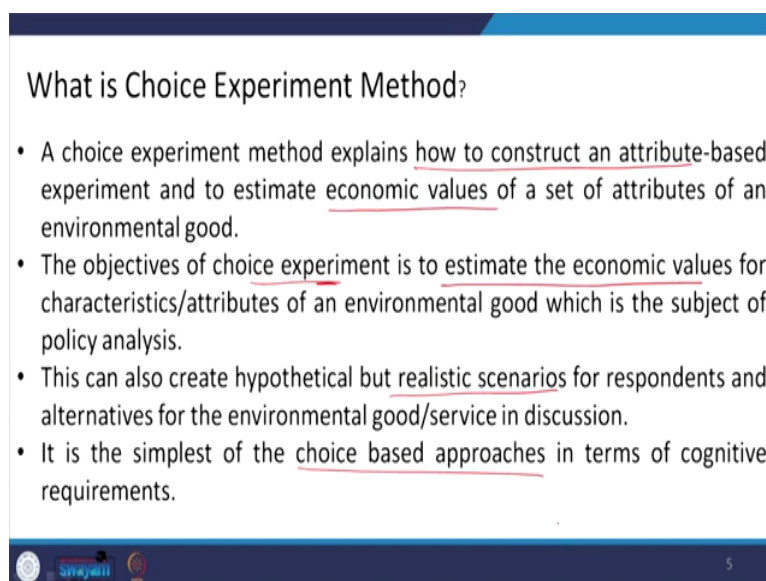
So, there he talked about that individuals, they derive the utility from the very characteristics or very variables very attributes of that particular good in discussions. So; that means, the individuals, they are not deriving the utility from that particular good in question rather individuals are deriving the utility because of the attributes associated with the good.

And that is what other point of time, it was considered it is a new theory in the demand. And moreover the this multiple attribute valuations it has also it has also taken the theoretical backbone from the a random utility theories and McFadden has got this Nobel because of this explanations under this a random utility theory.

So, here a in case of random utility theory, we are saying the utility has a very deterministic and probabilistic component. So, in that way you can say that if you want to find what is the theoretical backbone of this multi attribute valuations, then we can attributed to this broad ah two theories one is the Lancastrian microeconomics theory and the second one is McFadden's random utility theory.

So, what exactly is this choice experiment method? So obviously, it is one of the family member of the stated preference method and here this method tries to explain how to construct an attribute based experiment. So, that is why its name is choice experiment. So, we are doing whenever we are you know we are conducting this choice experiment exercises, we are actually doing an experiment by taking into account different attributes of a particular good or commodity or a service environmental service in questions that is under the consideration of the policy.

(Refer Slide Time: 10:22)

So, this choice experiment tells us how to construct and attribute based experiment and to estimate the economic values of a set of attributes of a particular environmental good or environmental services in question.

So, here it is helpful to do two things. One is how to construct and attribute based experiment and second how to estimate the economic values associated with a set of attributes of particular good or particular environmental service. And the very objectives of this choice experiment is to estimate the economic values for the characteristics or for the attributes of that good or service in questions. So, basically this goods or service in questions is a part of your policy analysis.

And a for doing this exercise that is conducting this choice experiment method, we need to actually create a hypothetical situations. But this hypothetical situation is not just like the

contingent valuation method rather this hypothetical situation seems to be very realistic. That means, we are creating the realistic scenarios although they are hypothetical nature for the respondents. And we are also creating the alternative scenarios that these are the possible scenarios if the policy is going to be sent whether you are we are going for improvement in environmental quality or we are ready to tolerate existing poor environmental quality.
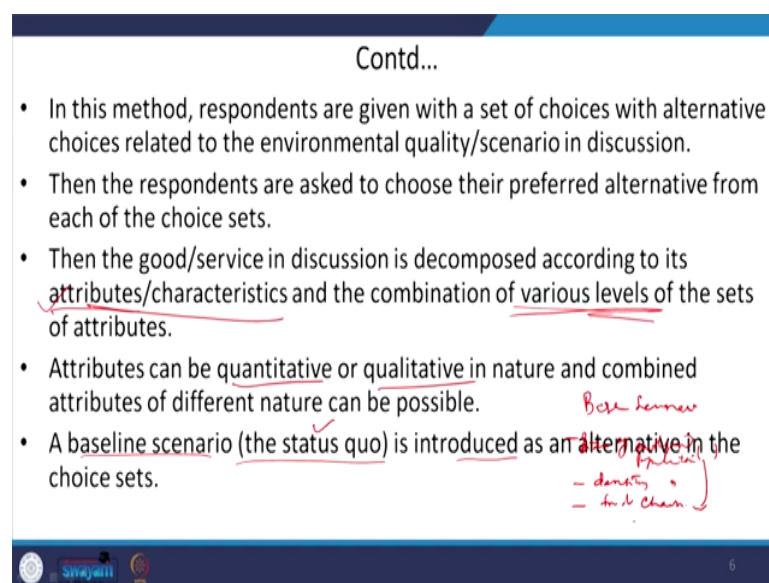
And more moreover so, far the applications concerned; so, for the understanding of the respondents are concerns so, it is one of the simplest method. So, far this choice based approaches is concerned because the respondents they can easily recognize the alternative scenarios or setup alternatives based on different attributes. So, that is why this choice experiment is one of the simplest method in terms of cognitive requirements as well.

(Refer Slide Time: 12:30)

And moreover, in this method the a the respondents are given a set of choices as you understand the very meaning of the method choice experiment. So, here a set of choices are given to the to the respondents with alternative choices right to a particular scenario and discussions and then the respondents are also choose that profound alternative from the set off choices. So, the will be directly asking that given these are the alternative choices which one is the preferred one for you.

So, now after doing this exercise then the particular good or service in in in question, it is decomposed according to the first one is attributes of characteristics and the second one is based on the levels of the attributes. So, the thing that we must understand that we need to decompose the particular good or particular service or because of which we are talking a about under a particular policy. So, we need to actually decompose this particular good or service in question into two things. The first one is we need to discuss decompose the attributes or characteristics. Then we need to talk about the various levels of attributes.

So, let us take an example if you are talking about there is the problem of the biodiversity crisis. And in order to maintain this biodiversity let us suppose say a particular endangered species is needs to be conserved and because of which policy is needed. Now, the question is that we need to find what are the what are the which one is to be conserved? So, that is say this particular x endangered species. Then we will be talking about the various attributes of this biodiversity in a particular region that how many endangered species are there or whether only one endangered species are there.

And then we will be finding the very characteristics of this particular biodiversity area. And we will be finding that there are many attributes or characteristics that is associated with this particular area right like your forest cover richness in the biodiversity or species. Then after doing all these all this are identifying these attributes or characteristics; we need to find the levels.

What levels? If you are talking about the forest cover so, what is the density? What is the size? Whether it is moderately covered or poorly cover or whether it is thick in cover? So, we

need to find out what is the level of this corresponding attributes. So, if you are taking if you are taking 10 or 20 characteristics or attributes of a particular a particular good or service in question, we need to find out what are the levels assigned to or what can be the levels of all these attributes and characteristics. And moreover, this attributes can be quantitative or qualitative.

So, when you are talking about this this biodiversity area and we are when we are talking about the attributes it can be in terms of size. So, size can being the quantitative one let us say, we are talking about how many tigers are there in particular region in that particular biodiversity area. Or if it is a more in area so, we are talking about an endangered species like olive, ridley. So, we are again counting what is the in quantitative figure how many are there and it can also be the qualitative in nature. Let us say so what is the size of this the particular species and you do not know right.

So, in that case you can say that whether it is more or less more frequently available or visible or less frequently available or visible. So, taking into account this aspect this attributes can be of quantitative or qualitative in nature. And sometimes, we can also combine this quantitative and qualitative attributes and it is also possible.
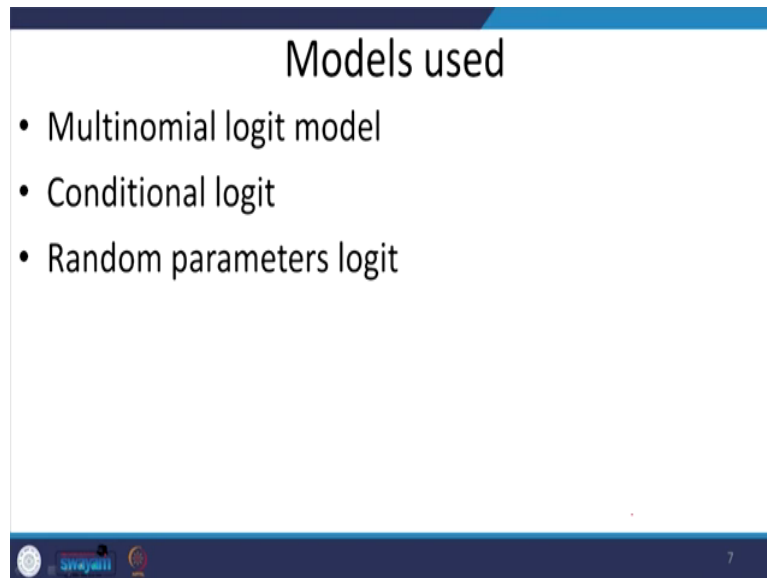
So, when you are saying that for creating this scenario, we are saying the original or what you are saying the base scenario. The base scenario let us say is the size of the population, size of this endangered population. Then you are saying the density of the populations right.

Then we can also say the food availability for them the kind of food chain and we can also combine with this quantitative attributes with this qualitative attributes. So, it is also possible. So, that is what we can say this attributes can be qualitative or quantitative and it can be of a combined nature.

And always remember that in in understanding this this choice experiment, we need to actually create the very original one that is the status quo which is known as status quo or which is also known as the baseline scenario what is their originally right now. And we are comparing this originality with some hypothetical scenarios that this could be done if some
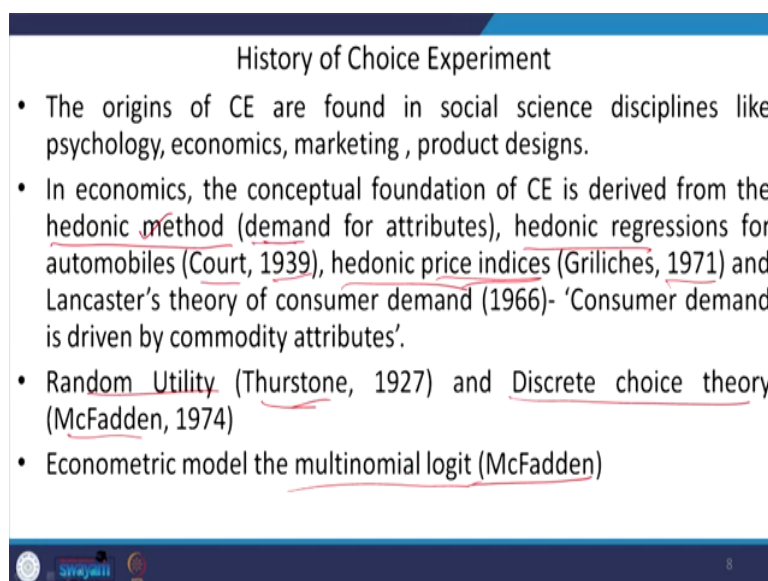
intervention is there. So, we are comparing. So, for that region this status quo is introduced as an alternative in the in the choice sets that we are creating.

(Refer Slide Time: 18:50)

And so far, the models are concerned so, what kind of models we can used for doing this choice experiments. So, we can say we can use certain econometric models you're your multinomial logit or conditional logit and random parameters logits. So, these are the popular applications of these models in the choice experiment or choice data.

(Refer Slide Time: 19:16)

So, now let us talk about the history of the choice experiment. So, is it a newly developed? Yes, it in comparison to this contingent valuation method it is nascent and its concept. But; however, this origins of this choice experiment, it is found in the in the history of the social sciences like you are psychologies, psychology and economics in product designs or marketing. We are also finding the applications of the choice experiment method. And particularly in economics because; obviously, it is a part of your environmental economics exercise. So, that is why we are more focusing on economic the application of choice experiments in in economics.

So, there we can find this conceptual foundations that is derived from the hedonic method. So, what is the hedonic method? We have already discussed this in in the reveal preference method. So, hedonic preference and there we talked about the example of the property pricing or house the house pricing. So, how the individuals are consumers, they are deciding that

which house is to is to purchase, it depends upon the very attributes of the house. So; that means, we are talking about the demand for a particular good or service it depends upon the characteristics or various attributes it is it is having.

So, this hedonic method is on the theoretical base of this choice experiment method and moreover we can find this hedonic regression and hedonic prices. So, earliest of the application you can find in Court, 1939 in automobile sectors he it was applied and also hedonic price indices it was also applied in 1971.

And we have already talked about the Lancaster's theory of consumer demand that is also one of the backbone in in in farming this choice experiment. So, we also talked about this random utility theory. Originally it was developed by this Thurstone 1927, then this fellow McFadden expanded actually got this idea of random utility and propounded the Discrete choice theory.

So, all these are the very a theoretical backbone that save the current leave what we are finding the choice experiment. And moreover this; so far the econometric model is concerned again this fellow McFadden he has developed this multinomial logit in order to trait, in order to apply this discrete choice theory or random utility theory that is dealing with the choice data.

Steps

Step 1	Characterize the decision problem
Step 2	Identify and describe the attributes
Step 3	Develop an experimental design
Step 4	Develop the questionnaire
Step 5	Collect data
Step 6	Estimate model
Step 7	Interpret results for policy analysis or decision support

Champ, P.A., Boyle, K.J. and Brown, T.C. (2017)

So, after discussing the theoretical background that what are the and very theories that are applicable and in which fields that can be applicable, now let us understand what are the various steps that we need to discuss if you have to conduct this choice experiment.

So, we need to be careful about the 7 different steps that when you must consider in in in applying this choice experiment method. The first one is the how to characterize the decision problem characterizing the decision problem or identifying the problem itself, then we will be finding the characteristics or attributes. Then the second step is identifying and describing the very attributes developing an experimental design develop the questionnaire, then collect the data estimate the model. And once the model is estimated will be interpreting, the very results for the policy analysis and decision making purposes. So, let us discuss this and this steps one by one.

So, the first step that must be followed in the choice experiment is characterizing the decision problem.

(Refer Slide Time: 23:27)

How to characterize the problem that we are talking about that the policy that is that talks about. So, there we need to talk we need to identify clearly the dimensions of the problems. So, what is the problem itself we need to identify it and there we need to oh discuss about the various scope of the problem and there we need to talk about these two things; broadly these two things that is the geographical scope of the potential changes right. If some policy attributes is going to happen and the temporal scope of the potential changes in case of this policy attributes.

So, when we are talking about this geographical and temporal, someone with questions that must be asked for example, whose values are to be included in the valuations, who is going to

be valued, whether it is the endangered to species and in the biodiversity area or who else, what is the discussion, what is the problem about?

And then we will be talking about if this is the question out of this policy who is going to be impacted? Whether it is the local villagers who are living in an around this this particular biodiversity area and how we will if they are going to be impacted, then we need to also ask the question and find that how will they be impacted out of this particular situations.

And along with this geographical and temporal scope we need to talk about the locations of this this substitute site that whether any other similar sites or substitute sites are located within that geographical boundary. And we need to also talk about the temporal considerations that over a time period how this particular scenario has been changing or it has changed or it is going to be changed.
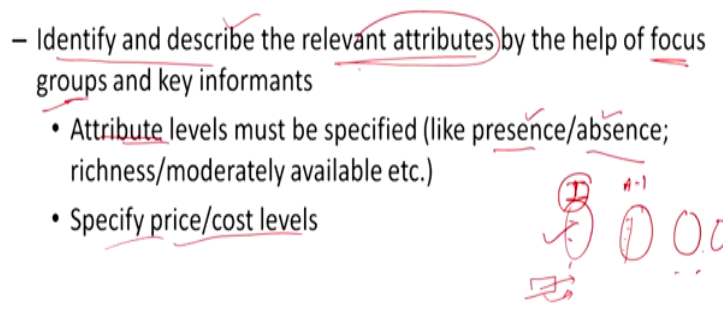
So, under this characteristics are how to characterize the decision problem, we need to actually talk about this dimensions problem. And moreover the second thing that we need to take care under this identifying the problem is what type of values that can be associated which the changes if this changes are going to be materialized right.

So, we are showing that what kind of values, then we are obliviously talking about whether the choice that we are making here or experiment that we are doing here is related to the a the use values or the non use values like your passive use values or it reflects more thing use value as well as non use value which use, we are saying that is the total economic value.

(Refer Slide Time: 26:29)

And the next step that we must follow that is once identifying the problem in discussions, then we need to find what are the attributes of the particular problem in discussion and what are the very characteristics, we need to describe it. So, here under this step we need to identify and describe the very relevant characteristics. Let us say in your case or biodiversity conservation.

And endangered species conservation and how to identify and how to describe the very attributes. So, in case of this pro conservation program or pro conservation policies in our example ah, if you have to identify and describe the relevant attributes then we must actually take the help of the focus group. So, who are the focus groups?

So, they are the stakeholders or somehow, they are related to this particular attributes or particular goods and or services and questions. And moreover, we can also ah take the help of

the key informants like your scientific communities on that particular area or your academics or your researchers or some individuals which are which expertise are there related to this particular problem. So, all these will be the part of your focus group discussions and thereby from their discussions only we can identify and describe the relevant attributes in the problem.

And in attribute levels, we can talk about whether this particular attributes is present or absent in all this scenarios. So, we are talking about a base line scenarios, then we are talking alternative fast scenario; second alternative, third alternative and likewise then we are finding in the first alternative. So, this is the base one or original one whether the particular attributes level is present or absent. In the second one, we are also in the alternative scenario. One we are also talking about whether the and the attributes if what is the level whether it is present or absent.

And after identifying the attributes then we can also interpret not only in terms of presence and absence, we can also talk about what is whether the what is the richness or what is the moderate availability of this of this particular attributes. We can use even a Likert scale if it is permissible or if the attributes are like that we can level them. And after doing this, we can also specify the price or cost level. So, how if this is in case of this original situation, so, what is the price or what is the cost level that the focus groups they are talking about and how they are going to pay for it if they need to need a better case better change.

And in in the second one also we are we are narrating all this attributes and leveling them, then we can also put specify the price or cost level associated to this alternative one scenario and likewise.

(Refer Slide Time: 29:53)

So, after doing this exercise, we can develop on develop and experimental designs. So, in developing an experimental design we need to determine the number of alternatives that is present in each choice set because you know you once you understand, these are the choices then you are dividing this into number of alternatives. This is the first alternative, second alternative, third alternative and fourth alternative on a particular thing right. And this and we also need to talk about the number of choice sets not only alternative, but also the sets.

And once the choice questions this choice are sets are determined, then the choice questions can be determined. So, choice questions can include the very status quo or base level that is the original one this is the alternative. So, it is just like a base level or status quo in each choice set and alternative indicating a change from the very original or status quo how this

particular alternative one is different from this or how this alternative two is different from this or how alternative three is displaying this different characteristics from the original one.

(Refer Slide Time: 31:20)

Then the next step will be the how to develop a questionnaire. because you need to capture the and the opinions and of though respondents. So, for questionnaire development, it is necessary for conducting the service from the from the respondents and the medium of this questionnaire or the formats, it can be in terms of emailing or which you are saying you emailed and to xyz persons. And then you are getting mail back from them on that particular survey.

It can be in terms of telephonic interactions; it can be in terms of your social media exercises just like your Facebook or Twitter. We are posting these are the questions or these are the survey questionnaires and based on your understanding you have they you need the responses

from them. We can also use this a survey using the paper pencil or computer assisted or we can also take the internet based surveys like just like you are saying this a Google spread sheet you are sharing to those concern respondents and you are getting back.

(Refer Slide Time: 32:36)

And so far the data collection is concerned, we need to be very careful and especially we need to be careful ah. So, that we can prevent the respondents from reading what is what is retain ahead of the just current one they are reading so; that means, we need to need to prevent the respondents from reading the ahead what kind of questions are there in the next pages. And even we need to be very careful in preventing that this should not actually go back to the previous questions.

And they should not be allowed to change the responses because in that way they will be actually they may change their responses by being biased. However, in in this this one is very

difficult in paper pencil survey because they the respondents they directly using this they, they are writing the their responses corresponding to do the questions post and they do have the liberty to go back and go forward in this questionnaire set.

But; however, in case of the computer based surveys like we are Google spreadsheet or some of the in person if you are doing, then its difficult it is easy to prevent this and this respondents from going back or moving forward. And after all the most of the careful care that must be actually taken into account in estimating the model because that is what the policymakers are actually emphasizing and the results are very important.
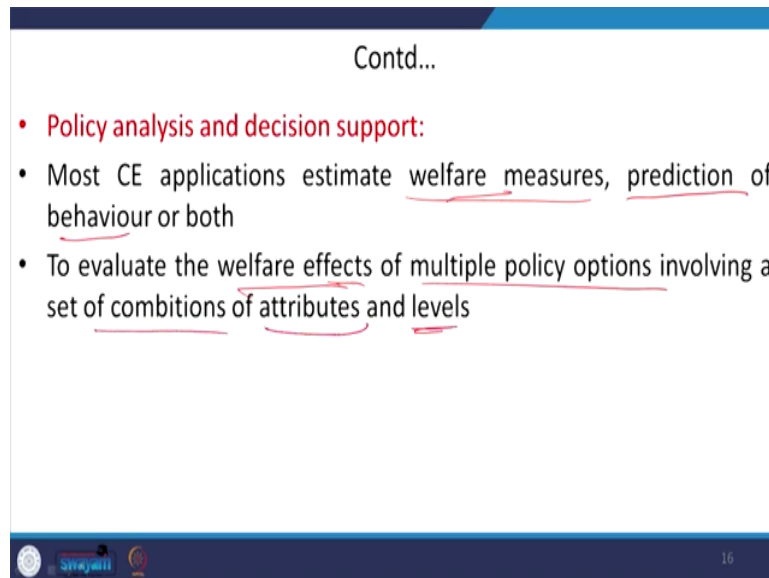
(Refer Slide Time: 34:22)

So, for estimating the model, we can use the preference parameter using this random utility model and we can also use econometric specifications that we have already talk about the legit model that is used or these are the models that we have discussed to analyze the

multinomial logits that we can also use in choice data. And so, for the policy analysis and decision support is concerned.

(Refer Slide Time: 34:46)

So, this is the last application stage that whatever the results we are estimating, now we will be using applying to the decisions or we will be based on this result we will be taking the decisions. And most of this this choice experiment applications, they estimate the welfare measures right how individuals are better off worse off in case of a policy change.

They also estimate the predictions of behavior that how the behavior gets change in case of this policy change or even estimating both these welfare measures as well as the predication of behavior. And to evaluate this welfare effects, multiple policy options are involved right involving a set of combinations of attributes and also talking about the levels.

(Refer Slide Time: 35:45)

And; however, although we are we discussed or we got to know that this choice experiment is better than the contingent valuation method, but still this choice experiment methods are apart from certain issues. The first thing is that we need to be very careful in designing the scenarios because we need to identify each of the attributes and we need to even identify the levels of a these attributes. So, we need to be very careful and sometimes we get biased or sometimes we because of misinformation or lack of information, we may avoid some of these attributes we cannot actually create the scenarios as it should have been.
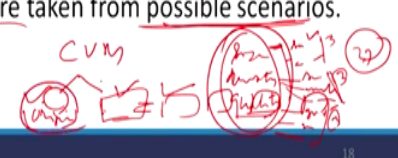
And moreover, we need to be careful in in applying the econometric treatments like how does which kind of specification econometric precautions, we need to apply for this choice experiment. So, these are some of the limitations or challenges that we have been in a choice experiment.

So, now after understanding this, now we will be having this this difference that choice experiment valuation and your contingent valuations.

So, though you can just summarize that this contingent valuation, it actually is applicable or it is producing a very single value for and this single value is for it the overall change in the policy and that is talking about whether it talks about the change in environmental good or services.

So, it is just producing estimating the single value for the overall changes. Whereas, if you are talking about this choice experiment, then it is estimating the value for each individual attributes. So, it is not just a single value for the overall changes rather we are subdividing that if these attributes of this particular good in question changes, then how what is the

welfare change. If the second attributes will be changing what will be the welfare change and likewise.

So; that means, we can actually find out the value the estimate the value for each of these individual attributes of that particular good environmental good or service in question that is under the consideration of public policy. And moreover this choice experiment is a kind of generalization of contingent valuation method rather than asking the respondents to choose between the base case that is status quo and the specific alternatives. So, in choice experiment what we are doing we are we are asking the respondents to choose between the cases not just like two alternative.

So, in CVM what we are finding we are just only having two alternatives; one is your baseline sorry you are this original or status quo scenario that is existing and the second one is the this the first alternative only that is in discussions that is only. So, there by we are saying the in CVM the respondents, they are asked to choose between the base case that is the original case and specific alternatives. This is the specific alternative in discussion which one is better and if the alternative is better than what is the welfare change.

But in case of this choice experiment, we are asking the respondents to choose between cases or different based on different characteristics or attributes by different attributes and then we are creating a dozen or set of scenarios that is taken from all possible scenarios. So, if the possible scenarios are let us say we are taking into account the attributes like your size is an size is an attribute or you are talking about the densities an attribute, we are talking about what is the quality of that particular environmental good or service. It is also an attribute.

Then from these attributes and all this level whether the size is small medium or large then if it density it is scarcely available or moderately available or it is frequently available. So, after doing this or you are talking about the quality whether it is good moderate or bad so, after identifying all this all this attributes we are leveling these attributes, then we will be having set up choices. What is the possible scenario here? So, here we can just find out the factorial

of this let us say it is 3, so for size is concerned it is 3 and your density is concern it is 3 and quality even it is 3

So, this the probably choices would be 3 into 3 into 3 9, 9, 27 sets will be there. So, out of this possible scenarios, we can take some of the scenarios that is tested here. That out of 27, let us say we are taking 7 scenarios alternative scenarios and corresponding to the original scenarios in case of choice experiment.

(Refer Slide Time: 41:01)

So, these are the suggested reading that you can follow, but follow of this one this is we most. So, this is the chapter five from this book a primer on the non market valuations.

Thank you very much.