Exploring Survey Data on Health Care

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Lecture - 40
Regression Discontinuity Method

Welcome friends, once again to our module on Exploring Health Care Survey Data as part of the NPTEL program. This has been one of the successful ventures of the ministry of human resource development or the ministry of education. This has given a wonderful platform to the scholars, especially during the Covid 19.

We have tried our best to cater to the need of our students as well as our researchers. I have tried my best to read, go through and shape documents with the help of our team. In this team, we have Mr. Milind and Mr. Kamal, who have been continuously supporting in making PPTs. In supporting a document, and in the supplementary document, running software, operating some of the programming of it.

This time we have focused on the healthcare data and we know that healthcare is too important in the present day and it needs special attention from the researchers and the policymakers. Based on that we have structured our program in such a manner that we can get used to the data.

In the end, we will try to give the icing on the cake that is the application part where you guys will be able to link your data for direct policymaking. Most of the research papers, nowadays in their review get the comment on how far your result is linked to the reality or how far it is implicating the society.

That is why we are discussing policy valuation in healthcare, though detailed practical sessions are not possible because this consumes time as well as requires certain expenditures to run or some pseudo experiments. So, we have not done that, but at this moment we have come up with conceptual clarity with some practical examples.

So, now this is in fact our last lecture. Here we will be emphasizing the latest module that is used by the researcher called Regression Discontinuity Method. Discontinuity means as if something is going on there is some sort of sporadic changes, some sort of deviations.

When you have captured a specific point, like a poverty line for example. From that line how far changes are observed whether those who are very close to the poverty line or are above the poverty line.

What kind of changes are there? So, the regression basically going to estimate these coefficients that are deriving those changes. Accordingly, we might have different policy implications.

So, based on that logic we have come up with the presentation before you and I know that this is the last lecture. But that is not completing, we will also come up with a detailed version of it next time. So, let us go for it.

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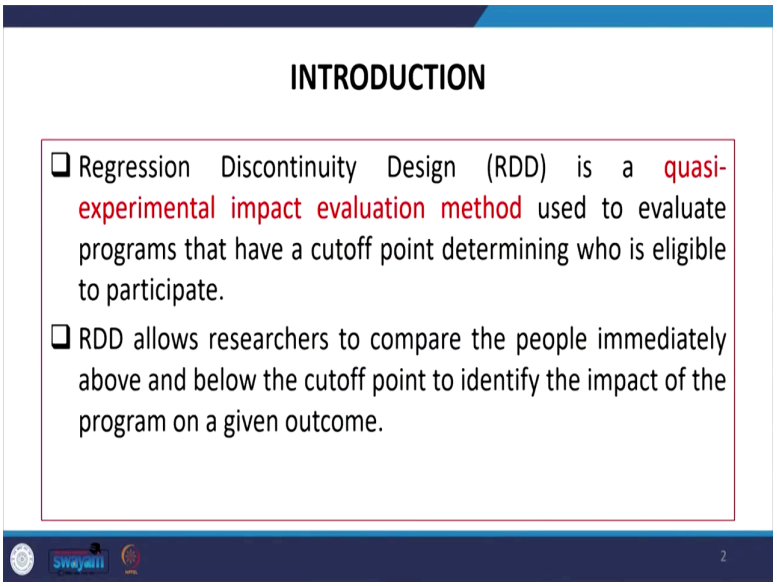

Here it is regression discontinuity design short called RDD is a quasi-experimental impact evaluation method, and this is used to evaluate programs which have a cutoff point determining who is in fact eligible to participate in a program or not.

This RDD allows researchers to compare the people immediately above or below the specified cutoff point to identify the impact of the program on a given outcome.

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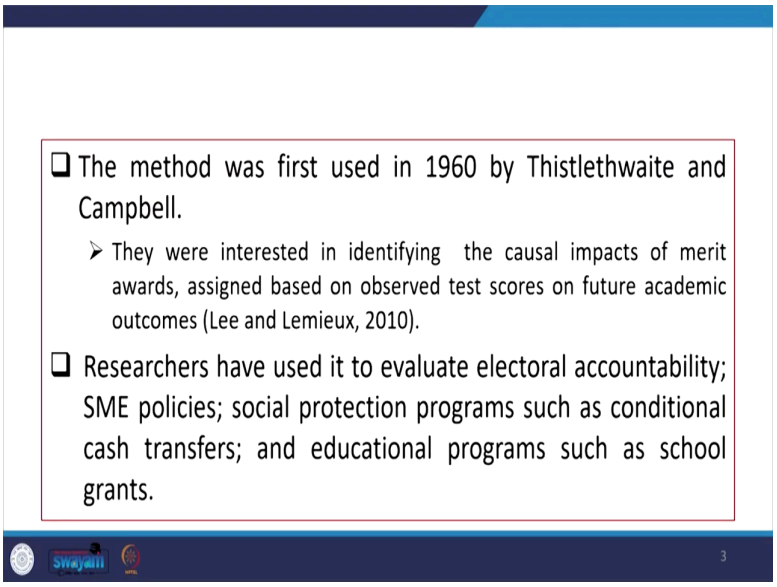

The method was first used in 1960 by Thistlethwaite and Campbell. They were interested in identifying the causal impacts of merit awards, assigned based on observed test scores on future academic outcomes.

I repeat that these authors have interested in identifying the causal impacts of merit awards, assigned based on the observed test scores on future academic outcomes. Basically, the test scores on the basis of that whether it has impacted the future academic outcome or not have been checked and also cited by Lee and Lemieux, 2010 paper.

Researchers have used it to evaluate electoral accountability; SME policies; social protection programs such as conditional cash transfers; and educational programs such as school grants.

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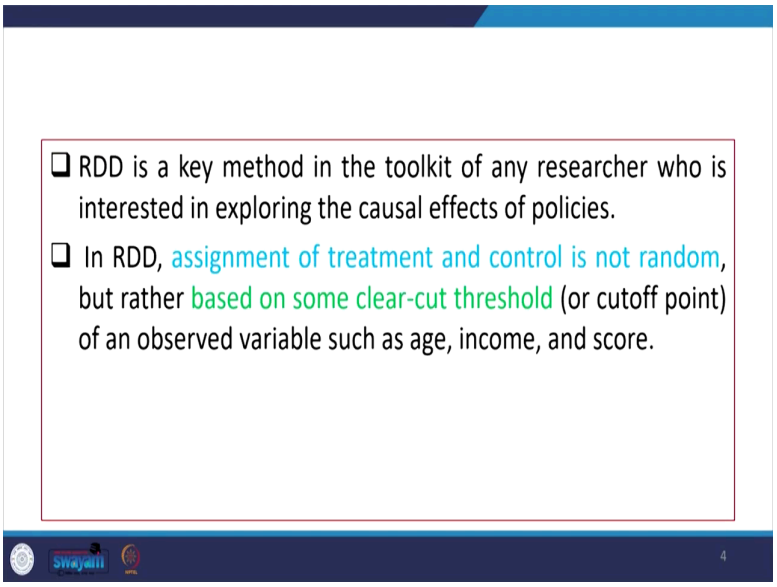

RDD is a key method in the toolkit of any researcher who is interested in exploring the causal effects of policies. Now this time the Nobel prize has been awarded to the persons who worked on causal inferences.

So, therefore, you can also read the document along with this basic guidance. In RDD, the assignment of treatment and control is not random but rather based on some clear-cut threshold. So, this is not random since it is focusing on the cut off threshold point. So, it cannot be random. The cutoff point is based on the observed variable such as income, age, and score.

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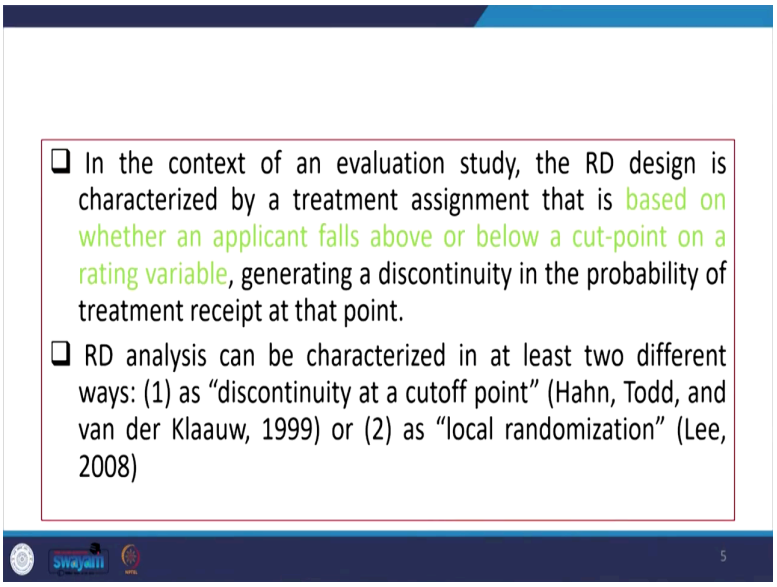

In the context of an evolution study, the RD design is characterized by a treatment assignment that is based on whether an applicant falls above or below a cut-off point on a rating variable. This generates a discontinuity in the probability of treatment receipt at that particular point.

So, RD analysis can be characterized in at least two different ways: 1st is called "discontinuity at a cutoff point" and 2nd is "local randomization". Those are suggested by the author we have cited here, you may just read and you can also go through their reading in detail. So, a 1st one is called the cutoff point 2nd one is local randomization.

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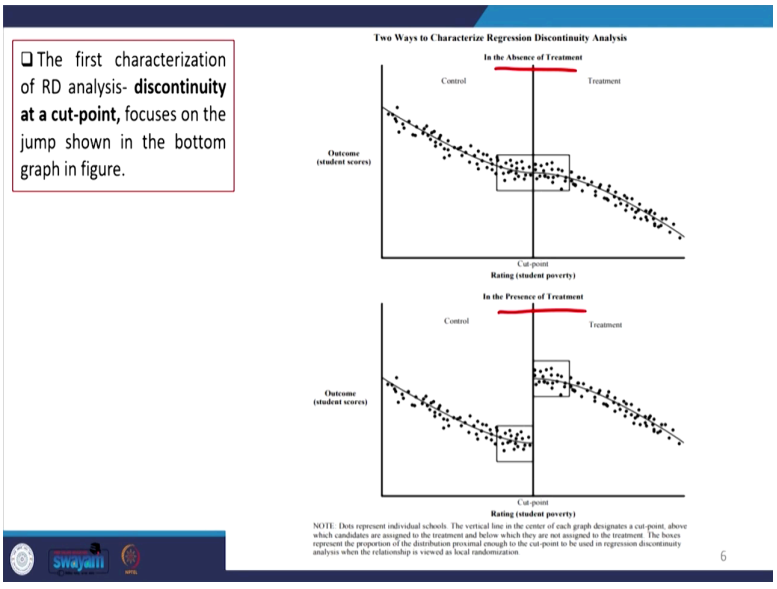

The first characterization of RD analysis is called discontinuity at a cutoff point. So, that focuses on the jump shown in the bottom paragraph in this particular figure. So, you can just see how there is a clear-cut jump, from the cutoff point and these two way characterizations of discontinuity analysis are presented. The first case is in the absence of treatment and the second one is in the presence of treatment when there is an absence of treatment.

How in the absence of treatment we see that there is no such sporadic change or deviation whereas in the case of treatment there is a clear cut-off jump and that is what is important to be discussed.

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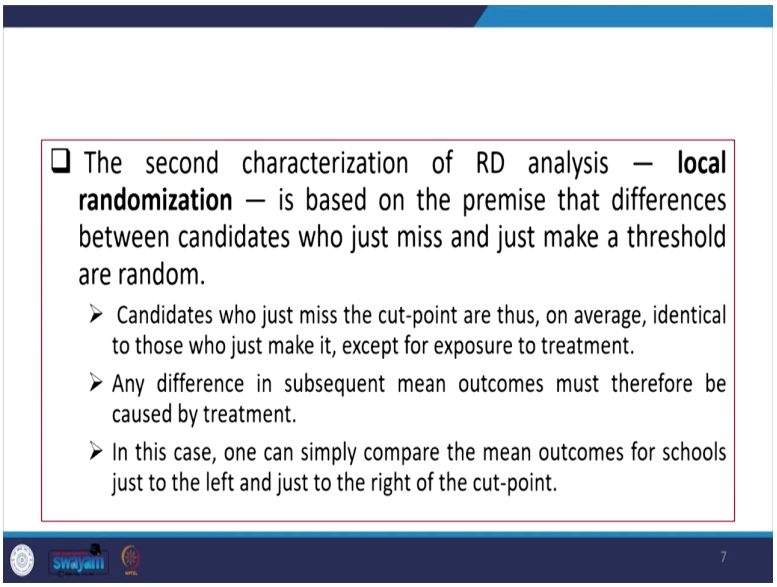

The second characterization of RD analysis is called local randomization which is based on the premise that differences between candidates who just miss and just make a threshold are random.

So, they just make a threshold at a random point, but in the previous case, those are not at all random. Candidates who just miss the cutoff point are thus, on average identical to those who just make it, except for exposure to treatment.

Any difference in subsequent mean outcome must therefore be caused by treatment. In this case, one can simply compare the mean outcomes for schools just to the left and just to the righter from the cut-off point.

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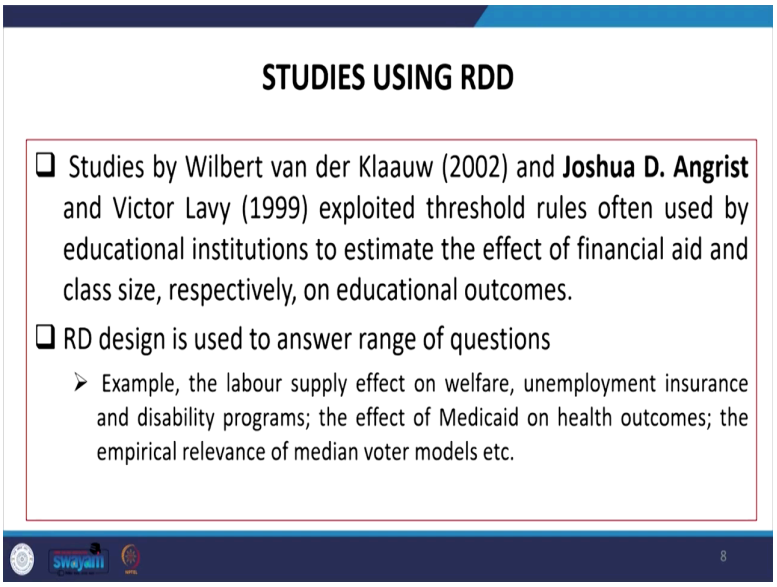

Now, we are citing studies that are using RDD like Wilbert van der Klaauw (2002) and Joshua Angrist and Victor Lavy (1999) are quite famous in this particular approach.

They exploited threshold rules which are often used by local educational institutions to estimate the effect of financial aid and class size, respectively, on educational outcomes. RD design is used to answer a range of questions, for example, the labour supply effect on welfare, unemployment insurance and disability program.

The effect of Medicaid on health outcomes; the empirical relevance of median voter models etc are usually tested. RDD for health policy evaluation is quite important.

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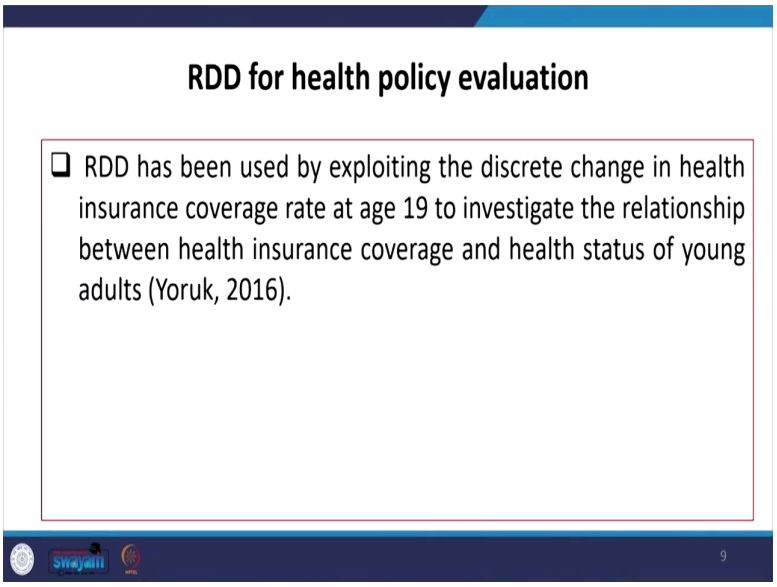

RDD has been used by exploiting the discrete change in health insurance coverage rate at age 19 to investigate the relationship between health insurance coverage and the status of young adults. As you can also read in the paper by Yoruk 2016.

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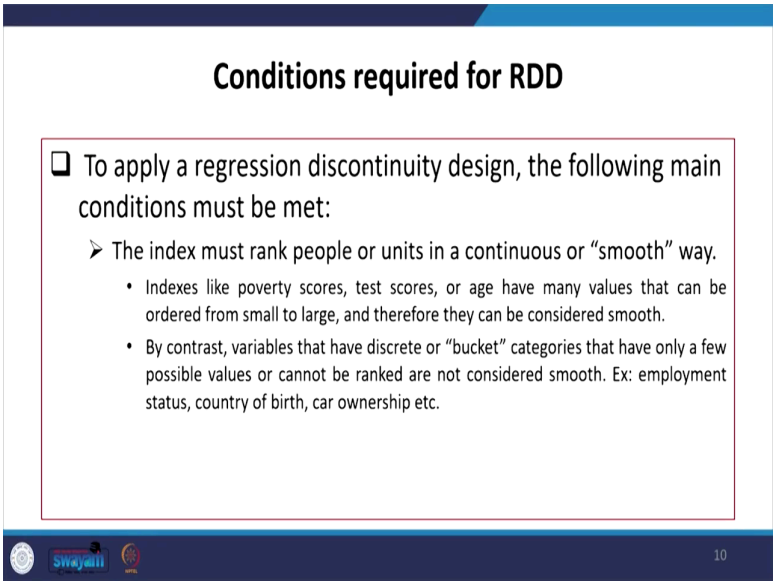

There are some conditions required for the RDD to be effective or to be applied. To apply RDD the following main conditions must have been met: that is the index must rank people or units in a continuous or "smooth" way.

Indexes like poverty scores, test scores, or age have many values that can be ordered from small to large, and therefore they can be considered very smooth. The second one is by contrast variables that have discrete or "bucket" categories that have only a few possible values or cannot be ranked are not considered smooth. So, these may be smooth or not smooth like employment status, country of birth, car ownership, number of doctors etc.

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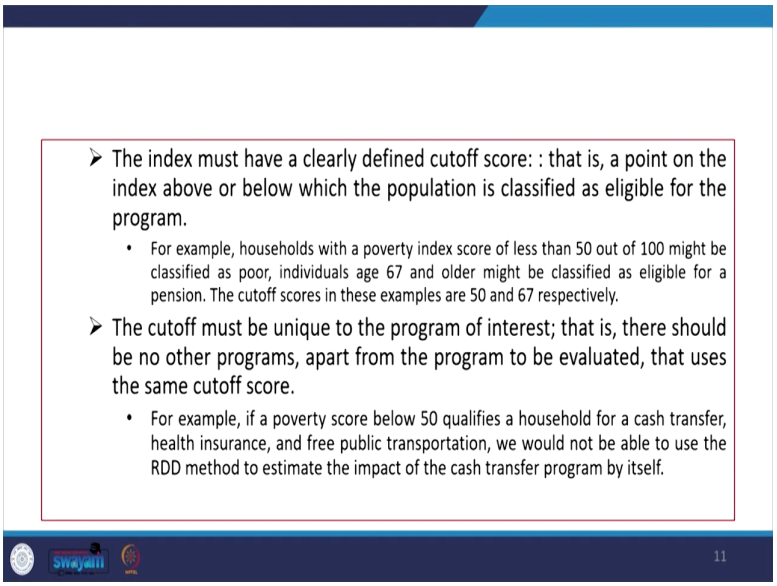

The index must have a clearly defined cutoff score: that is a point on the index above or below which the population is classified as eligible for the particular program. Here we are citing one example a household with a poverty index score of less than 50 out of 100 might be classified as poor, and individuals with age 67 and older might be classified as eligible for a pension.

Some countries might state 67 and above. The cutoff scores in these examples are 50 and 67 accordingly. So, based on the program where you want to find the impact of their changes you can also check, for example, the healthcare treatment, where people can go for it, you may check through their standard of living.

Based on your estimates or based on the prior experience you can set a standard of living and from that benchmark what kind of changes are observed, whether they are actually going for treatment or a different type of treatment or not from that cutoff point.

So, the cutoff point must be unique to the program of interest that is therefore, there should be no other programs apart from the program to be evaluated that use the same cutoff score. So, simultaneously another program that is being studied should not be actually compared and should not be mixed.

For example, if a poverty score below 50 qualifies a household for a cash transfer, health insurance, free public transportation, or a free public transformation we would not be able to use the RDD model to estimate the impact of the cash transfer program by itself.

Because, if you are simultaneously looking at more than one program, the RDD program may not capture the changes very clearly; the discontinuity cannot be captured. The score of a particular individual or unit cannot be manipulated by the enumerator potential beneficiary, program instructor, or politician.

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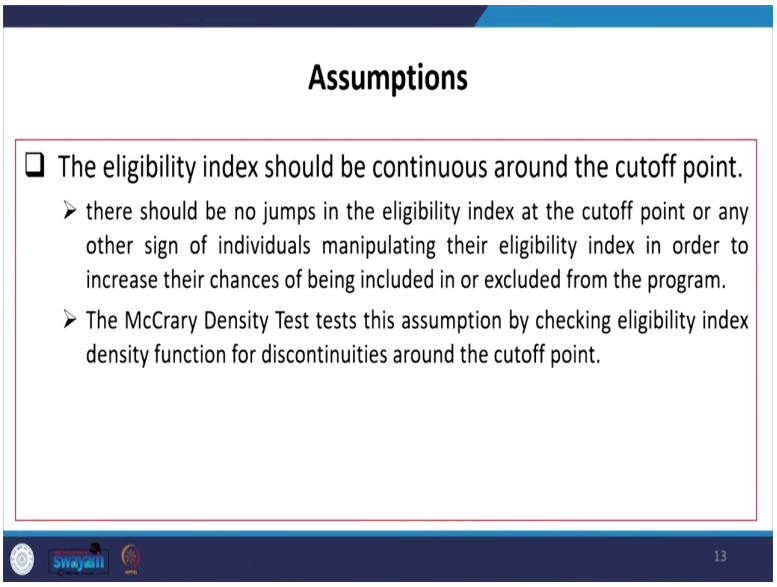

Therefore, we have certain assumptions to validate the cutoff points. The eligibility index should be continuous around the cutoff point. So, the data that we are referring to near in by the cutoff point must be continuous enough. There should be no jumps in the eligibility index as the cutoff point or any other sign of individuals manipulating their eligibility index in order to increase their chances of being included or excluded from the program.

When we are saying the poverty line, people should not be clearly excluded in order to mark the differences. If you are saying age group of a particular age when these ages are

completely separated out and you have to stick to a particular age group to differentiate, then probably you are not capturing the right direction of your evaluation.

So, you have to take a cutoff point that should not by assumption differentiate these two. So, there must be certain continuity in the expected frequencies. The McCrary density test this assumption by checking the eligibility index density function for continuity around the cutoff point. You can also follow this McCrary Density test.

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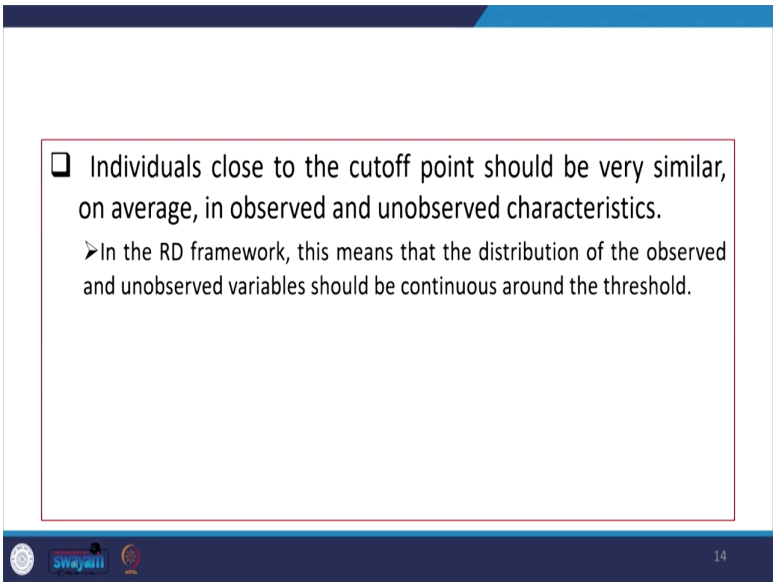

Individuals close to the cutoff point should be very similar, on average in observed and unobserved characteristics as well. In the regression discontinued framework, this means that the distribution of the observed and unobserved variables should be continuous around the threshold point.

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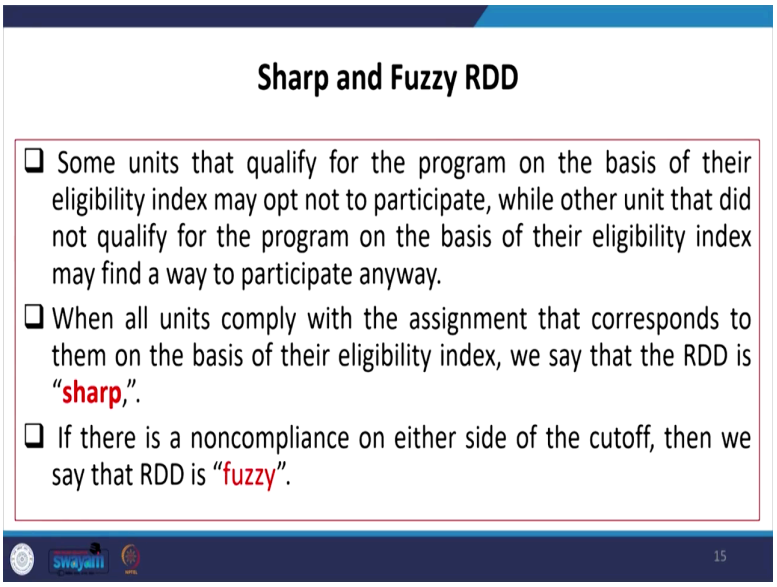

Now, we are differentiating two important types of RDD. One is called Sharp RDD another is called Fuzzy RDD. So, some units that qualify for the program on the basis of their eligibility index may opt not to participate, while other units that did not qualify for the program on the basis of their eligible index may find a way to participate anyway.

So, for example, we have a group which is not eligible, but we have forced them to be eligible another one is actually eligible, but our cutoff point is defined. So, say that they now ultimately end up with non-eligibility. So, that may create a certain problem. When all units comply with an assignment that corresponds to them on the basis of their eligibility index, we said that RDD is in fact very "sharp".

When we comply with all these assumptions following the way we wanted to define like eligibility and the exact acceptability of that cutoff point. If there is a non-compliance on either side of the cutoff, then we say that RDD like you have defined the cutoff point, but actually is not compliant with the portions that have been considered. So, that way it is called "fuzzy."

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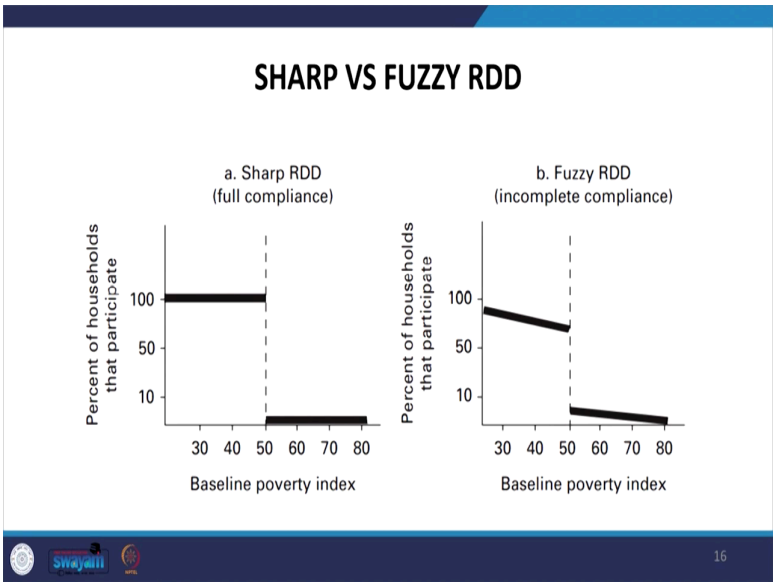

Here is the chart that clarifies the first one in both the case we are trying to explain through the baseline poverty index. The first one is sharp RDD, where full compliance has been covered because it has very clear whether they are part of the program or whether they are not part of the program from the cutoff point.

It is a clear binary series, where in the next one related to fuzzy, there is an increasing or decreasing trend in either of the axis they are not clearly defined.

The fuzzy RDD is called incomplete compliance. The way we wanted to cover is not clearly close to one. So, 100 percent or 0 is not well defined, but in the fuzzy, it is not defined correctly as I already said.

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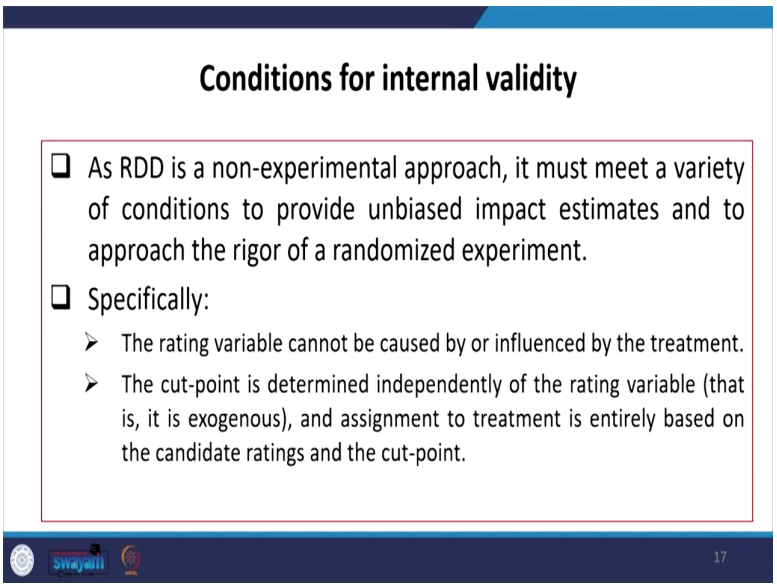

Now, I am coming to the clarification, let to the conditions for the internal validity of that compliance. As RDD is a non-experimental approach, it must meet a variety of conditions to provide unbiased impact estimates and to approach the rigor of a randomized experiment.

Specifically: the rating variable cannot be caused by or influenced by the treatment. So, the rating variable should not be actually caused by this treatment. The cut-off point is determined independently of the rating variables, which should be exogenous, and assignment to treatment is entirely based on the candidate's rating and the cut-off point.

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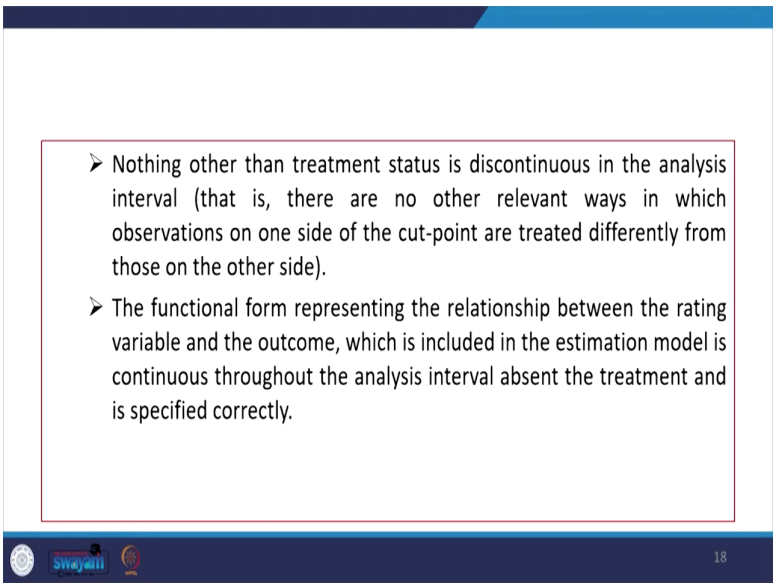

Nothing other than treatment status is discontinuous in the analysis interval that is, there are no other relevant ways in which observations on one side of the cut-off point are treated differently from those on the other side. The functional form representing the relationship between the rating variable and the outcome which is included in the estimation model is continuous throughout the analysis interval absent the treatment and is specified very correctly.

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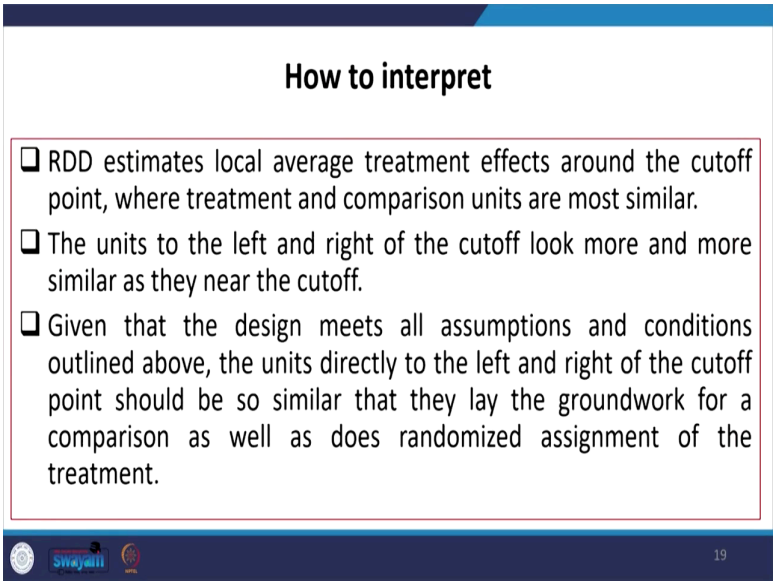

Now, how to interpret all those differences. RDD estimates local average treatment effects around the cutoff point. So, that is what we have given the disjoint chart where around the cutoff point is interpreted with local average treatment effects, where treatment and comparison units are most similar. The units to the left and to the right cutoff look more and more similar as they near the cutoff.

Given that the design meets all the assumptions and conditions outlined above, the units directly to the left and directly to the right of the cutoff point should be so similar that they lay the groundwork for comparison as well as does randomize assignment of the treatment.

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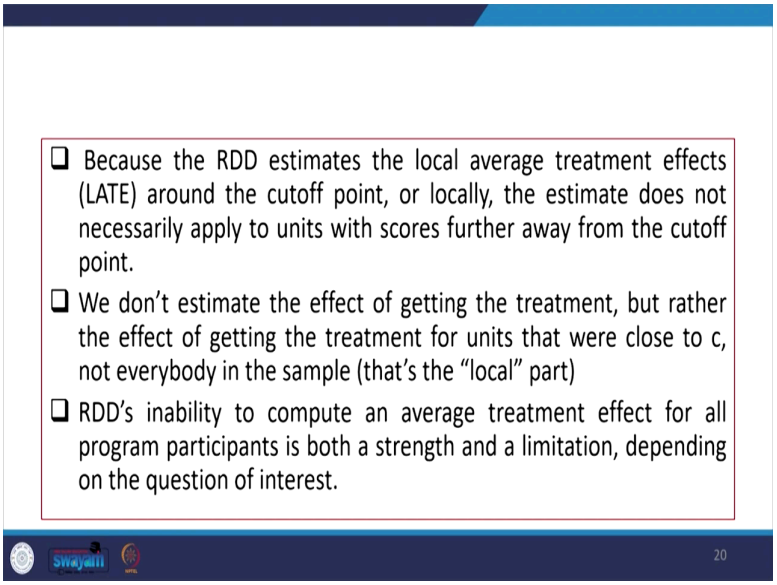

Because the RDD estimates the local average treatment effects, that is late around the cutoff point, or locally, the estimate does not necessarily apply to units which score further away from the cutoff point. So, away from the cutoff point not necessarily going to be applied the way we are explaining at the cutoff point.

We do not estimate the effect of getting the treatment, but rather the effect of getting the treatment for units close to c, that is the cutoff point. Not everybody in the sample those are at maximum to the "local" point extreme to the cutoff point are discussed.

RDD's inability to compute the average treatment effect for all the program participants is both a strength and a limitation, depending on the question of interest. Since it is not covering all participants. So, it has its strength, and it is its limitations as well.

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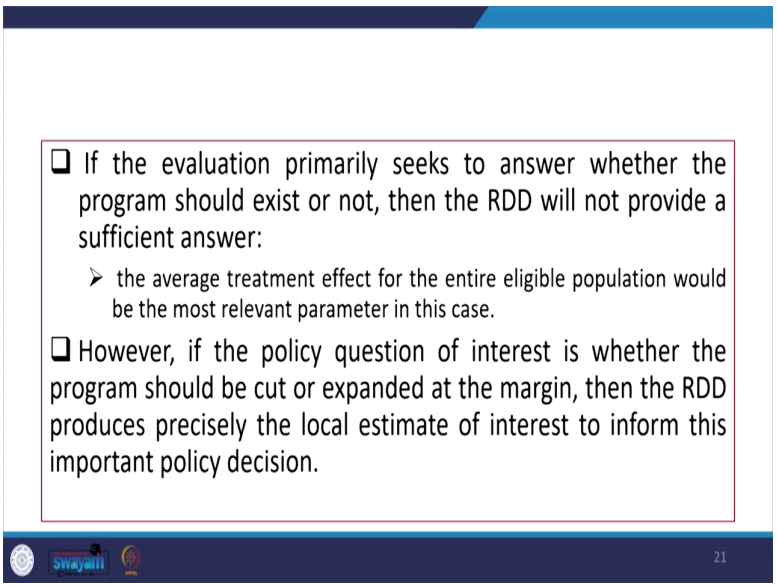

If the evaluation primarily seeks to answer whether the program should exist or not, then the RDD will not provide a sufficient answer. It is not giving a complete evaluation of the model. It is giving a particular focus, whether it has been implicated at the cutoff point or not at a specific people or not.

The average treatment effect for the entire eligible population would be the most relevant parameter in this case for estimation. However, if the policy question of interest is whether the program should be cut or expanded at the margin, then the RDD produce a precise estimation regarding the local estimate of the interest to inform this important policy decision.

Therefore, we say that if policy decisions are very focused and very pointed that they give an explanation at the margin, then the result would be quite appropriate through the RDD. Otherwise, you need not apply this technique. So, these are all for our lectures. So, for now, I am just giving a snapshot of what I have discussed. So, far in the entire 40 lectures.

There are different weeks. We have 8 weeks' module from the starting weeks we try to get attention on how to develop a research paper, understanding the basics of research, then we tried developing your understanding on what are the different healthcare data available in India, and we emphasize longitudinal data as well.

Including NFHS data and NSS data, then we tried our best to give a detailed explanation of survey tools, and survey techniques. Their missing records entered data in different formats and also discuss the questionnaire and schedules. After that, we also emphasize different

types of data and how they are stored, what are their measurement techniques, and sampling design is very correctly.

How to take a small sample out of the total sample; after that, we explained different stata tools. We reviewed all the commands and then we talk about the qualitative dependent variable modules and the quantity modules.

We discuss all possible degrees of fitting the module like the base feed and how we can define whether r square, R square and r bar square etc. We also try to develop your interest in explaining and comparing each of the models and their R square values.

Then last two weeks we tried to focus on the panel estimations. Panel estimations and program evaluations, this week as we already have seen it is completely on program evaluation. The previous one is on the panel estimation. We have focused our best to give you the right direction in the healthcare data to understand which panel model should be applied.

I think these are all in two-three minutes' capsules. I have tried my best to say in your mind. Our team is quite dedicated to give you the right direction further in our live sessions. I suggest everyone raise their pen and start writing to us in our query section.

Also, we will be very happy to address all your queries in our live session as well. I am sure that you will cover all the units very carefully and can be able to score well and go for the test good luck.

Thank you.