Economic Growth and Development

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Lecture – 14
Measures of Inequality

Hello and welcome to lecture 14 of the NPTEL MOOCS course on Economic Growth and Development. This is lesson 3 of week 5; in the first lesson of week 5 that is lecture 12; we examined issue of growth and inequality and in this lecture 12 we dealt in some detail the issue of the an inequality index.

And we saw that there are certain principles that guide the measure of inequality in index. We also looked at the issue of world income inequality or how inequality is defined variously based upon the paper by Branko Milanovic.

In today's class we will look at two important Measures of Inequality that is the Lorenz curve and the Gini coefficient and we will see how these two inequality measures are some of the most widely used measures of inequality. And how they confirm to the very basic principles of what of what an inequality index should qualify.

Now by now we are clear about this fact that inequality and poverty although they are being examined together in many cases; they mean different things ah. Poverty refers to a certain group of population; it is looking at the life conditions of the poorer groups of population versus with the richer groups of population. So, the concentration is more on what are the living standards of people of a certain group of population who have not had access to the very bare a minimum whereas, inequality may be examined within the context of the richer groups of population or the poorer groups of population or across the entire set of population.

So, when we are looking at inequality it is defined over an entire population, we are looking at how a different groups of population are different between each other with respect to certain given indicators say income or wealth or we are also looking at how the entire population is distributed with respect to a certain indicator say income, wealth or any other social indicator.

So, in that sense in inequality and poverty are referring to two different issues although they are discussed together. And as such because they are referring to two different sets of issues, there are different measures of poverty and inequality and often there is some sort of a confusion that poverty and inequality measures mean the same thing let us look at this slide here.

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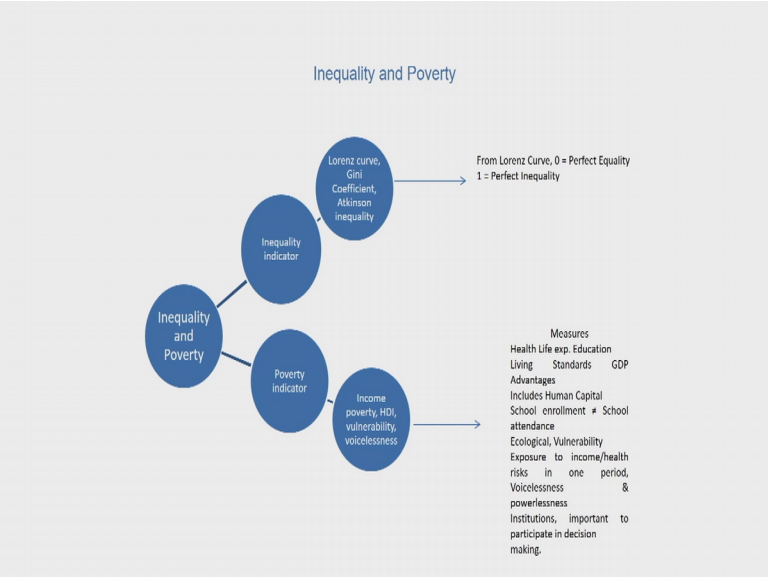

In when we are looking at the when we are examine the examining the issue of poverty; we come across various poverty indicators, some of them being say the human development index or various other poverty indicators by with respect to a vulnerability, income, voicelessness and so on.

So, accordingly you will find measures that a estimate life expectancy, education, living standards it may include human capital, school enrollments, school attendance, vulnerability indices and so on. But when we are looking at inequality, there are various measures of inequality that are used for examining economic issues. However, the two most important that we will be considering in this class is the Lorenz curve and the Gini coefficient.

Now, if you let us also revise some of the principles that we had done in the last class in lesson 1 of this week when we were saying that a good inequality index usually satisfies these principles. Now before that when we are examining inequality indices what are we

doing? We are basically permitting ranking of income or wealth distributions in two different situations.

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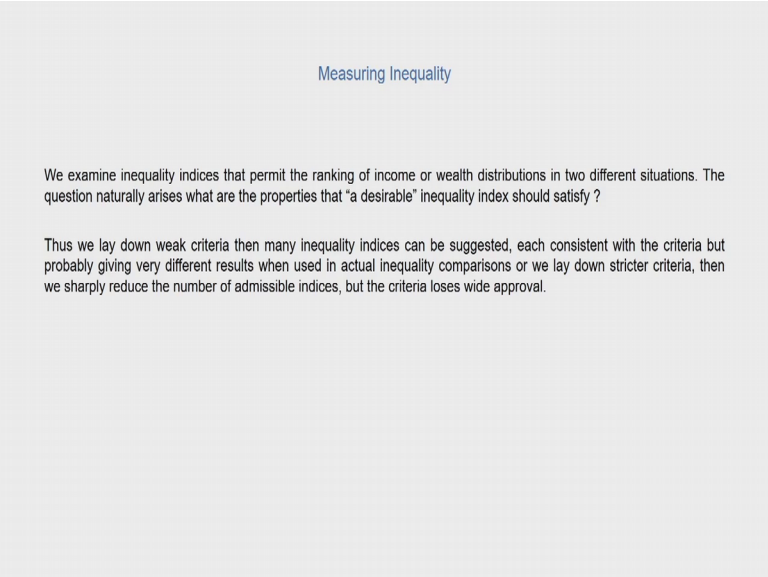

So, the question naturally arises what are the properties that are desirable inequality index should satisfy? And therefore, we lay down weak criteria that many inequality indices can be suggested; based upon which many inequality indices can be suggested. And each consistent with the criteria, but probably giving very different results when used in actual inequality comparisons; let us briefly revise the inequality the principles which should be satisfied by an inequality index which we had done in lesson 1 of this week.

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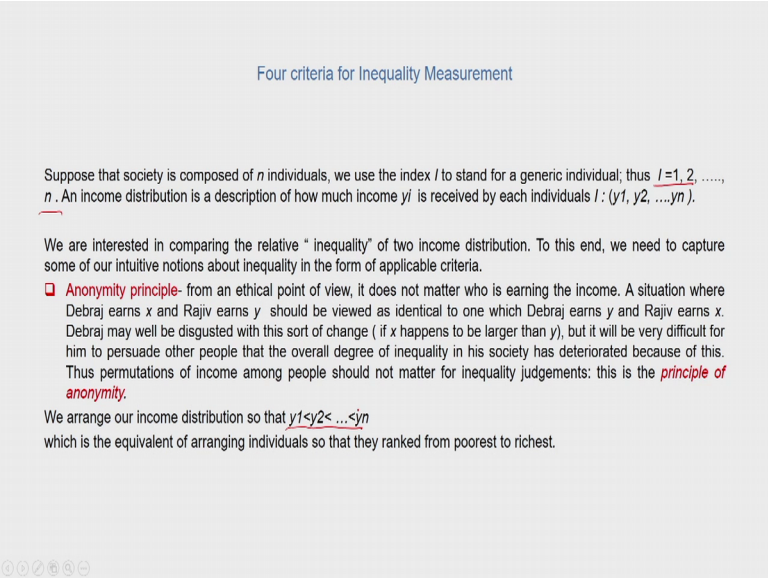

So, suppose a society is composed of n individuals we use the index I to stand for a generic individual. So, I comprises of these individuals 1 to n and income distribution is a description of how much income yi is received by each individuals y 1, y 2, y n.

So, we are interested in comparing the relative inequality of two income distributions and to this n we need to capture some of our intuitive notions about the about inequality in the form of an applicable criteria. And one of the first principles is the anonymity principle that we had discussed in the in lecture 12. Now, what is this mean? From an ethical point of view it basically says that it does not matter who is earning the income.

When we are measuring an inequality when we are coming up with an inequality index based upon the anonymity principle; we are basically looking at the overall inequality in a country and it does not matter to us who which individual is earning how much income, as long as we are able to order the individuals in terms of their levels of incomes.

So, from an ethical point of view it does not matter who is earning the income; a situation where say Debraj earns x and Rajiv earns y; should be viewed as identical to one in which Debraj earns y and Rajiv earns x. So, different permutations of incomes are allowed based upon the anonymity principle. Now Debraj may well be disgusted with this sort of change because if x happens to be larger than y, but will be very difficult for him to persuade other people that the overall degree of inequality in his society has

deteriorated because of this. So, when we are measuring the overall levels of inequality; it does not matter to us who earns how much income as long as we are able to order the levels of income based upon some kind of an some kind of a sequence.

So, permutations of income among people should not matter for inequality judgments and that is the principle of anonymity. So, we are arranging our income distribution based upon this principle where y 1 is less than y 2 and so on. The incomes are arranged sequentially in an increasing order which is the equivalent of arranging individuals so that they are ranked from poorest to richest.

So, an individual earning y 1 has the lowest income and the individual learning y n has the highest. So, an individual earning y 1 has the lowest income and the individual earning y n has the highest income and so on. So, that is the anonymity principle.

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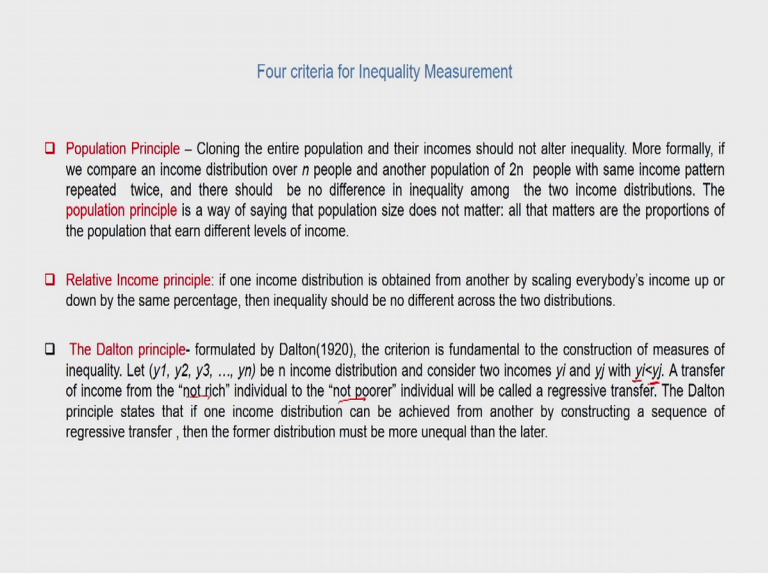

The second principle that we had studied was the population principle which is also equally important when we are trying to come up with an inequality index. Now what does the population what did the population principle tell us? It tells us that cloning the entire population and their incomes should not alter inequality.

So, more formally if we compare an income distribution over n people and another population of 2 n people with same income pattern repeated twice, there should be no difference in inequality among the two income distributions. And this population

principle is basically a way of saying that population size does not matter; all that matters are the proportions of the population that earn different levels of income.

The third principle was a relative income principle which said that if one income distribution is obtained from another by scaling everybody's income up or down by the same percentage; then inequality should be no different across the two distributions. The fourth principle was the Dalton principle which was formulated by Dalton in 1920 and this criterion is fundamental to the construction of measures of inequality.

So, it says that let there be y 1, y 2, y 3, y n let these be the income distribution and let us consider two incomes yi and yj where yi is less than yj. And let us say that transfer of income takes place from the not rich individual to the; not poorer individual which will be and this and then this will be called a regressive transfer.

So, here the not rich individual earning income is yi and the not poorer is yj. Notice the usage of the term not poorer and not rich instead of using the term poor and rich for these two here. Because largely when we are looking at inequality when we are looking at distribution of incomes or when we are when we are examining the issue of inequality we are mostly concerned with we are mostly using the term relative income rather than absolute incomes and therefore, the usage of the terms not so rich or not so poor and so on and so forth.

So, here when the transfer of income takes place from the not rich individual to the not poorer individual, it will be called a regressive transfer. And the Dalton principle states that if one income distribution can be achieved from another by constructing a sequence of regressive transfers, then the former distribution must be more unequal than the later. So, based upon these principles we tried in economics we try to come up with an inequality index which will help us answer some of the questions with less bias.

In this context there are two measures of inequality which are highly discussed one is the Lorenz curve and the second is the Gini coefficient. We will presently see how to read a Lorenz curve and how to read a Gini coefficient. And the calculation of the Lorenz curve and the Gini coefficient are the some of the most easiest calculation procedures. And; however, it is they are very significant in the sense that they reflect a lot of inequality across regions as well as within the regions.

So, in that since these are the two highly used measures of inequality let us begin with the Lorenz curve.

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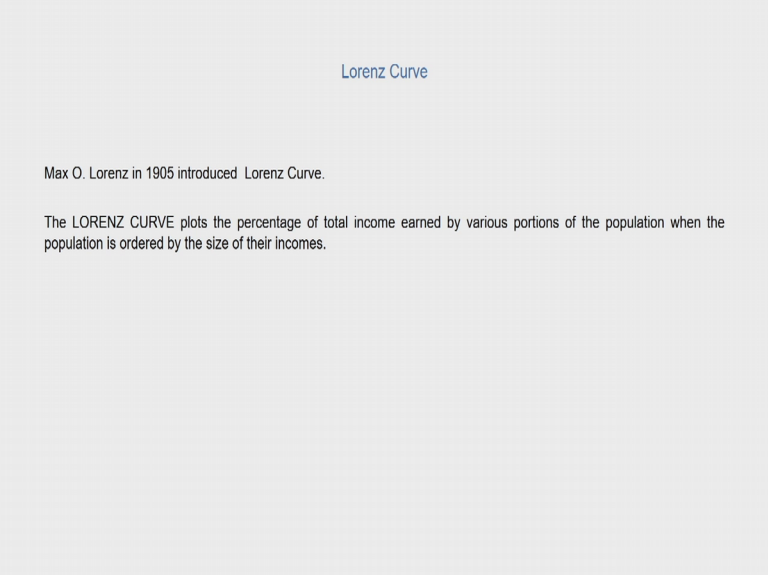

The Lorenz curve was first introduced in 1905 by a Max O Lorenz and it basically plots the percentage of total income earned by various portions of the population when the population is ordered by the size of their incomes. So, what is this basically doing? It is a graphical representation of income inequality or wealth inequality and this was developed by the American economist Max Lorenz.

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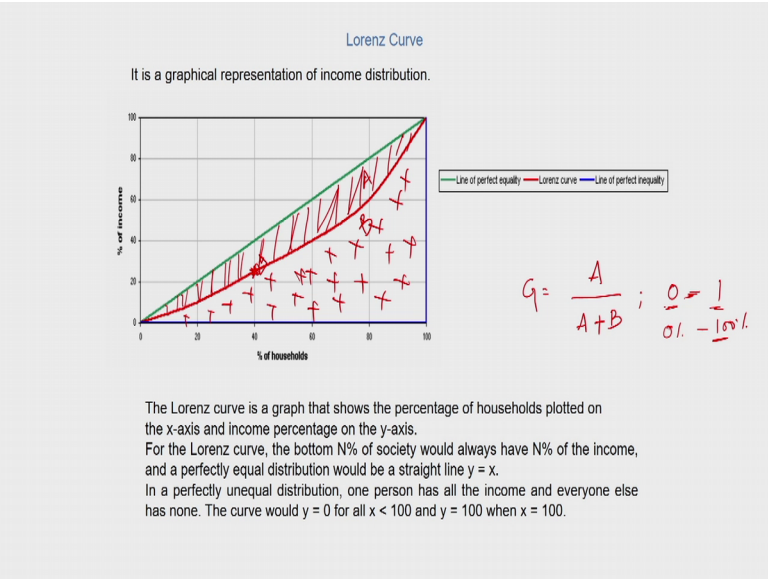

What it does is that if you look at this graph here in the slide which showing presently, it basically shows the graph the Lorenz curve graph plots percentiles of population according to income or wealth on the horizontal axis. So, this is how the Lorenz curve looks like; this is the x axis here and this is the y axis here. On the x axis the cumulative the percentiles of population or households are plotted and it plots cumulative income or a wealth on the vertical axis.

So, in this diagram if the x value is 40 and an x value of 40 and a y value of let us say around 24 would mean that the bottom 40 percent of the population controls about 24 percent of the total income or wealth. So, if we are plotting they value here let us say which is say about 24 which is about let us say 24, then what we are essentially saying is that a 40 percent of the households control about 24 percent of the total income or wealth.

And the Lorenz curve is often accompanied by a straight diagonal line; as you can see here with the slope of 1, which represents a perfect equality in income or wealth distribution. And the Lorenz curve when it is plotted when the percentage of households are plotted according to the; percentages of income that they control, we come up with this Lorenz curve here which is plotted against the line of equality. So, the Lorenz curve lies beneath the line of equality showing the actual distribution of income across all of these households; this is one of the most simplest Lorenz curves here and this shows that.

So, there are two things that are being showed here the area between the straight line and the Lorenz curve. So, this is the area between the line of equality and the Lorenz curve which shows that by how much the households are earning below the line of equality and from the Lorenz curve, we generally come up with the Gini coefficient.

So, the Lorenz curve is a graph that shows the percentage of households plotted on the x axis and income percentage on the y axis. So, for the Lorenz curve the bottom N percent of society would always have N percent of the income and a perfectly equal distribution would be a straight line where y is equal to x.

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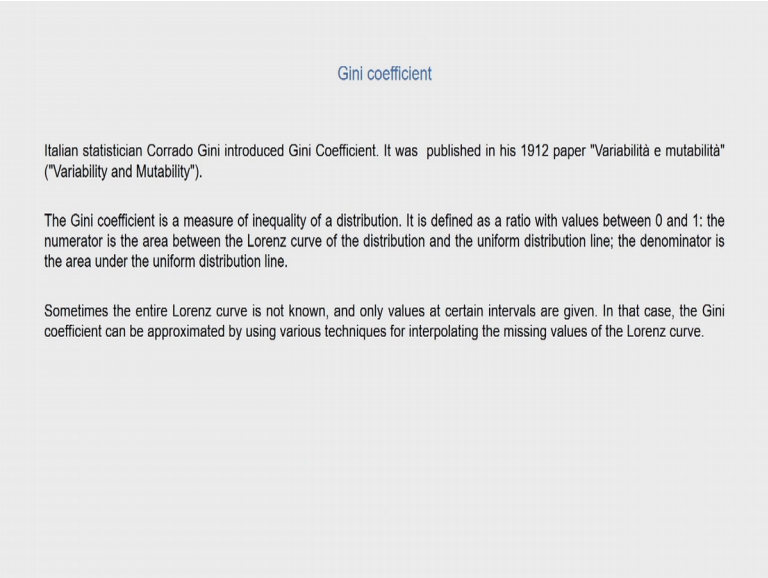

Now, the Gini coefficient is drawn from the Lorenz curve; it was introduced by an Italian Statistician called named Corrado Gini and he introduced the Gini coefficient it was published in his 1912 paper Variability and Mutability ah. It is a measure of inequality of a distribution and it is defined as the ratio with values between 0 and 1; the numerator is the area between the Lorenz curve of the distribution and the uniform distribution line, denominator is the area under the uniform distribution line. And sometimes the when the entire Lorenz curve is not known and only values at certain intervals are given in that case the Gini coefficient can be approximated by using various techniques for interpolating the missing values of the Lorenz curve.

So, for being able to calculate the Gini coefficient; let us denote this area between the line of equality and the Lorenz curve as say A and let this area below the Lorenz curve we denoted as B. So, based upon this distribution the Gini coefficient is basically a ratio of A by A plus B and it ranges from 0 to 1 and sometimes is also shown in the form of percentages ranging between 0 percent to hundred percent. So, when the Gini coefficient is close to 0; we say that it is a more unequal society or the income distribution well distribution is more unequal. And when it is closer to 1 or closer to 100 percent then we say that it is a more equal society.

So, the higher the values of Gini coefficient; the more equality there is and the lower the value of the Gini coefficient the more inequality there is.

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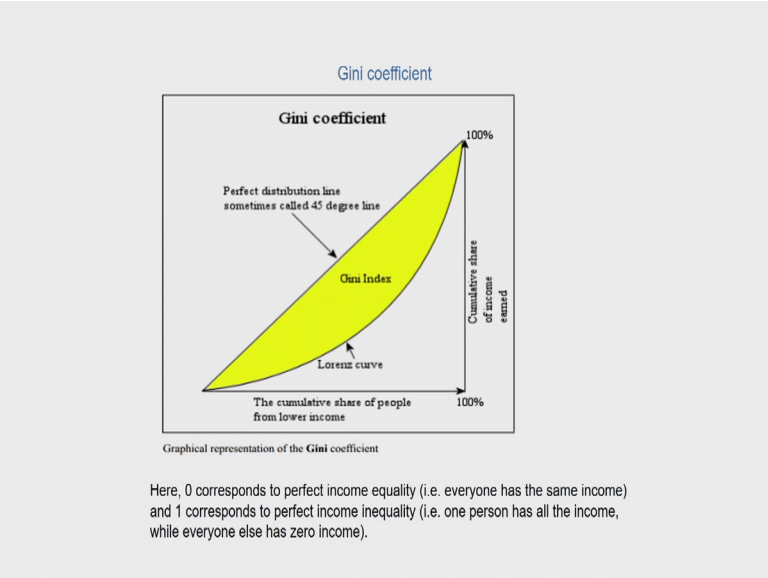

So, this is how the Gini index shows 0 corresponds to perfect income inequality, 1 corresponds to perfect income inequality that is 1 percent has all the income while everyone else has 0 income.

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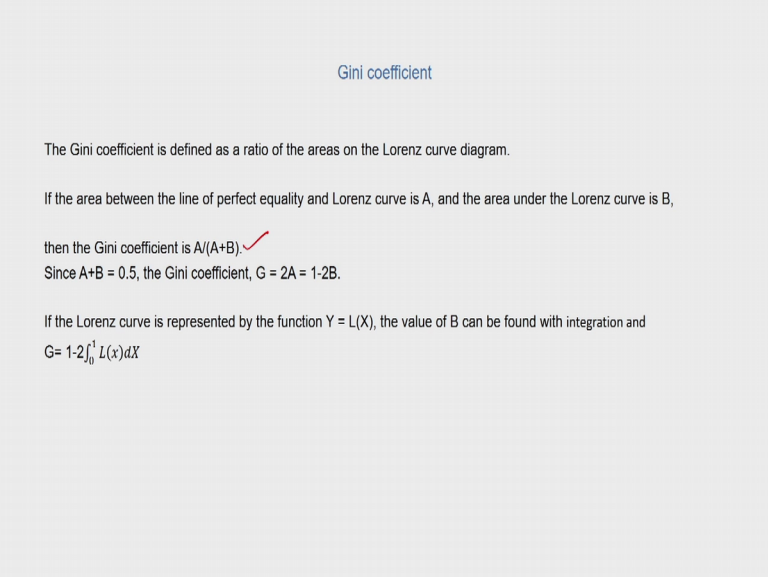

So, it is defined as the ratio of the areas on the Lorenz curve if the area between the line of perfect equality and Lorenz curve is A and the area under the Lorenz curve is B; then the Gini coefficient is given by this ratio A by A plus B. And since A plus B is equal to 0.5 the Gini coefficient g is equal to 2 A that is equal to 1 minus 2 B.

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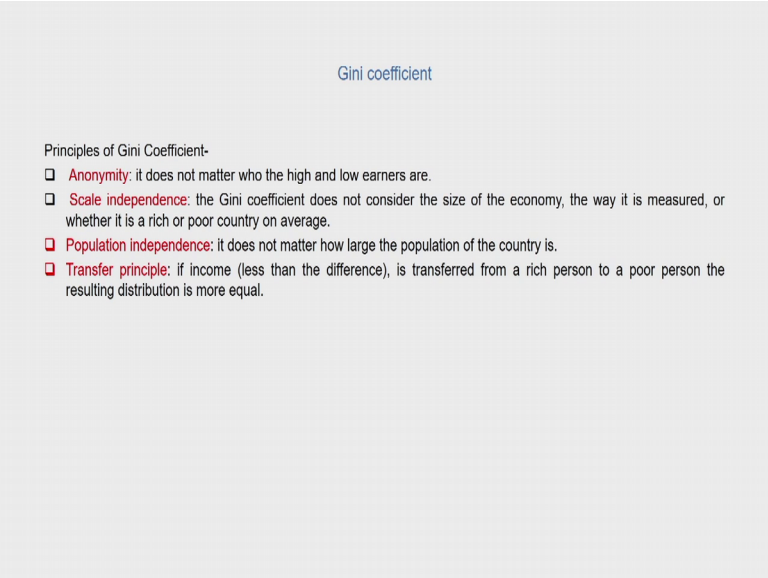

And it is important to note here that one of the reasons why the Gini coefficient is most widely used measure of inequality in economics is that; it satisfies most of the principles of that that provide us the guidelines for how an inequality measures should look like.

It satisfies the principles of anonymity ah, scale independence, population independence and the transfer principles. So, it does not matter who the high and low earners are to be able to estimate the Gini coefficient. The Gini coefficient does not consider the size of the economy the way it is measured or whether it is a rich or poor country on average and it does not matter how large the population of the country is. And if income is transferred from a rich person to a poor person the resulting distribution is more equal. So, it satisfies all of these principles because of which the Gini coefficient is the highly used measure of inequality.

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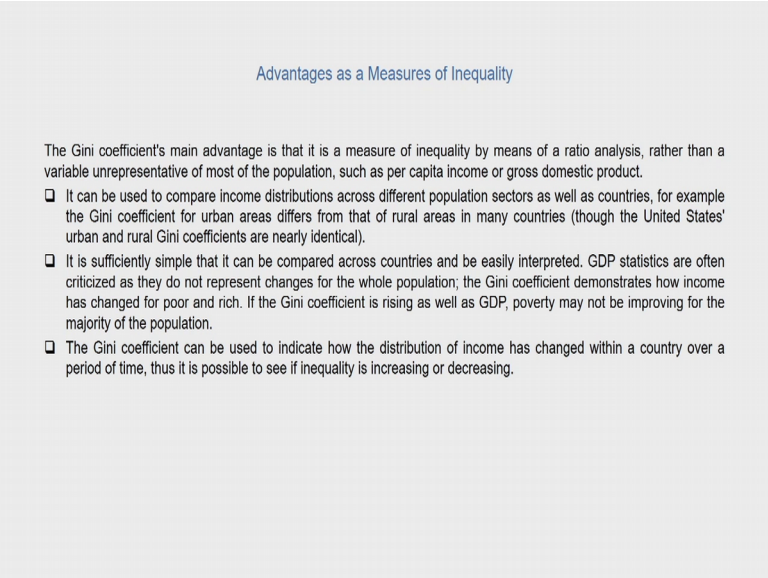

Now, let us pin point what are some of the main advantages of using Gini coefficient as a measure of inequality? It is a ratio analysis and rather than a variable and representative of most population such as per capita income or GDP. So, when we are using the gross domestic product of per capita income as a measure of inequality; we have already seen in the earlier classes how the inherent limitation of GDP or per capita income is that it does not take into account or does not account for inequality within a country or a region.

And therefore, even though the per capita income or GDP measures are very robust; it does tell us what is the overall level of income within a country; it does not qualify as a significant indicator that can explain the very huge levels of inequality existing within our country. And it is in that sense that the Gini coefficient becomes a more representative indicator of inequality.

So, it can be used to compare income distributions across different population sectors as well as countries. For example, the Gini coefficient for urban areas differs from that of rural areas in many countries in the for example, United States urban and rural, but the United States urban and rural Gini coefficients are nearly identical.

Now, this is one of the structural characteristics of the advanced countries vis a vis the low developed countries or the underdeveloped countries. Because the rural urban dichotomy in the advanced countries has been bridged ah; therefore, the inequality the

differences in inequality between rural and urban areas are not high in these countries as we see in the developing countries or in the so called underdeveloped countries.

It is also sufficiently simple that it can be compared the Gini coefficient is sufficiently simple that it can be compared across countries and be easily interpreted ah. GDP statistics are often criticized as they do not represent changes for the whole population and the Gini coefficient demonstrates how income has changed for a poor and rich. So, the Gini coefficient is rising as well as GDP poverty may not be improving for the majority of the population.

And this is this point is something which is very important where the calculation of Gini coefficient for the incomes income distribution within the population will give us a sense of how far the economy has progressed. Often we look at only the GDP indicator which tells us that the GDP growth rate in this country has been such and such. A 7 percent or an 8 percent GDP growth rate within a country will not mean much; if inequalities within a country has been rising over a period of time it is if it is closer to 100 percent. If only a very fewsections of the population have access to large amounts of income within a country then probably that rise in GDP may not mean much.

So, the GDP story tells us half the story and the Gini coefficient completes the story by telling us by how much the GDP growth rate has trickle down to the to the vulnerable sections of the population as well. So, in that sense if the Gini coefficient is rising as well as the GDP poverty may not be improving for the majority of the population. Thirdly the Gini coefficient can be used to indicate how the distribution of income has changed within a country over a period of time, thus it is possible to see if inequality is increasing or decreasing ah.

In the previous slide I showed you here that in the usually when we are calculating the Gini index or the Lorenz; when we are plotting the Lorenz curve we take households on the x axis and percentages of income or wealth on the y axis. But when these kinds of plot curves can also be constructed for various other indicators, which can be representative of wealth inequality within a country. So, instead of income, we can also have asset inequality; when we are looking at a distribution of land holdings within certain a region or a country or a state or a locality; then those kinds of distributions can also be plotted on the Lorenz curve here.

So, instead of percentage of income we can also show the percentage of land holdings on the y axis here; which will tell us, what is the correlation between the percentage of households and the percentages of land holdings? So, in that sense this is a very good indicator of the levels of inequality within a country with respect to income wealth or any other assets that may be. So, Gini coefficient can be used to indicate how the distribution of income has changed within a country over a period of time. So, it is possible to see if inequalities increasing or decreasing.

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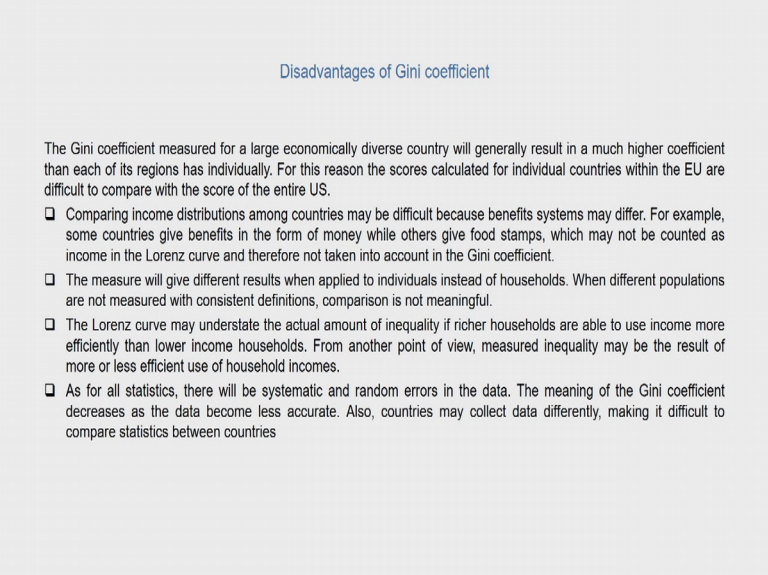

Now, there are certain disadvantages of the Gini coefficient as well the Gini coefficient when it is measured for a large economically diverse country; it will generally result in a much higher coefficient than each of its regions has individually. And so for this reason the scores calculated for individual countries within the EU are difficult to compare with the score of the entire US say for example.

Now, this is particularly true of developing countries such as India; where we see a large rural urban dichotomy. And not just that as I have also already pointed out in the earlier classes that we have a very small formal sector and a very large informal sector. So, which means that the incomes of a large section of population is not being reported in the GDP estimates.

So, the GDP estimate in that sense is not at all representative of the entire population of a country as vast as India; in which a majority of the population still works in the informal

sector. A large sections of the section of the population is in agriculture that is not report regular income earnings or does not have regular sources of incomes. So, in that sense the Gini coefficient can actually fail to provide a representative picture of the entire population.

So, when we are looking at the Gini coefficient based upon the GDP estimates of a country; we cannot very conclusively say that inequality within India has been rising over a period of time or declining over a period of time because incomes have been rising. Because anyway we are not accounting for the incomes of a very of different sectors or segments within the Indian economy.

There is an inherent limitation when we are considering a diverse country which has diverse population and which has large numbers of population working in different sectors that are not being accounted for formally in the national income accounts. So, the first disadvantage of Gini coefficient is that is this and comparing income distributions among countries may be difficult because benefits systems may differ. So, for example, some countries give benefits in the form of money while others give food stamps which may not be counted as income in the Lorenz curve and therefore, not taken into account in the Gini coefficient.

To give an example which is very specific to country such as India you would know that in India we have India is a welfare state and therefore, we have various kinds of welfare programs running within the country. So, for example, in a in let us take the take an example of say Assam and let us say there is a program called the public distribution system which is functioning in Assam or the national food security act which is being implemented in Assam. And various people have access to what is called ration cards or BPL cards and therefore, they have access to food grains say rice or wheat from the ration shops.

Now, while these are benefits that are accruing to individuals or households within a region it is very difficult to translate these benefits in terms of incomes. So, these are doles which are been given out to households to meet their specific consumption requirements. Say for example, children going to primary schools have access to the mid day meal program and therefore, they are getting meals within the schooling system;

such that they can continue with the schooling system as well as get nourishment out of it.

But when we are accounting for incomes of the households the accounting system would generally take only those incomes which are being reported as part of the national income accounts statistics. But these benefits do not get translated into actual incomes in terms of the accounting purposes. So, in that sense the Gini coefficient may not give a very clear picture; it may not represent the it may not translate itself into the real story with respect to the expenditures or the benefits that the incomes and the benefits that the households and the individuals are getting within a within an economy.

Secondly, the measure will give different results when applied to individuals instead of households where different populations are not measured with consistent definitions comparison is not meaningful. This is one of the very important limitations of the Gini coefficient because in a country such as India; we have seen that there is a large scale intra household inequality in distribution of resources. So, when we are saying household income we the; this income need not necessarily be equally distributed among all the members of the household.

So, in that sense when we are measuring Gini coefficient by households; it leads it gives a misleading picture of the levels of inequality. Because the levels of inequality that shows of this way may actually be much more higher if we take into account the individual incomes rather than the household incomes. Because generally the household incomes are much higher, but when we when we peg the household income to each of the members within the family, we would see that some members within the family earn much less or have very less to partake from the entire in household income.

So, this is why the measure gives very different results when it is applied to individuals instead of households. So, when different populations are not measured with consistent definitions; comparison is not meaningful. Thirdly the Lorenz curve or the Gini coefficient may understate the actual amount of inequality; if richer households are able to use income more efficiently than lower income households. From another point of view measured inequality may be the result of more or less efficient use of household incomes.

Fourthly, as for all statistics there will be a systematic and random errors in the data. So, the meaning of Gini coefficient decreases as the data becomes less accurate. So, countries may collect data differently making it difficult to compare statistics between countries. And this is one of the major limitations again when we come to comparability of data across countries.

So, the statistical systems of the country have a lot to do, there is a lot lacking within the statistical systems within a country. Often the data that is collected from various sources let us say from agriculture or from industry or from based upon household surveys are not consistent from year to year, there are definitional changes from year to year and there is a lot of data discrepancy because of various issues. And this data discrepancy may become one of the important barriers to coming up with a good index of inequality.

So, the plottings of Lorenz curve may not be accurate because there is a lot of data discrepancy and data inaccuracy and this is one. Number two because there are different systems of data collection in different countries. So, a Gini index which is calculated for a country A may not be strictly comparible to a Gini index which is calculated for country B ah. Therefore, we cannot with a lot of surety say that the Gini based upon the Gini index alone ah; the inequality comparisons between all countries can be made very conclusively.

If you recall the paper that we studied in the in lesson 1 of this week; you will see the Branco Milano which has made extensive use of the Gini coefficient for being able to calculate world inequality. Now one of the important things is that in the absence of any other better indicator of inequality; Gini coefficient still continues to be one of the most representative indicators in spite of it's limitations.

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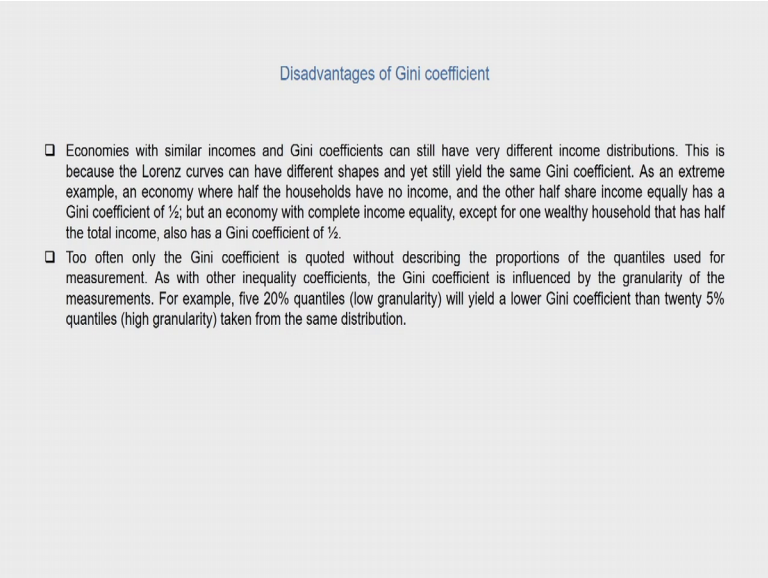

The next disadvantage is that economies with similar incomes and Gini coefficients can still have very different income distributions. And this is because the Lorenz curves can have different shapes and yet still yield the same Gini coefficient. So, as an extreme example an economy where half the households have no income and the other half share income equally has a Gini coefficient of 0.5. But an economy with complete income inequality except for one wealthy household that has half the total income also has a Gini coefficient of 0.5.

Now what is important in this is that the shape of the Lorenz curve in the Gini coefficient both matter. So, we are while we need to see what is the overall inequality index by looking at the overall Gini coefficient; it is also equally important to know what is the proportion of population that is below the line of inequality. And therefore, the Lorenz curve and the Gini coefficient always needs to be studied together, they need to be examined together to be able to come up with a more meaningful conclusion with respect to inequality poverty and inequality within a country.

So, the shape of the Lorenz curve is very important ah; it need not necessarily be a perfectly shaped Lorenz curve. The shape of the Lorenz curve may be such that the there may be a lot of people; there may be the large numbers of households or proportion of households may be located in the middle, where they have access to large share of wealth or income within an economy compared to the rest.

So, when we are examining the issue of inequality the shape of the Lorenz curve and the Gini coefficient the index both of them need to be examined together. And that is what this point means that economies with similar incomes and Gini coefficients can still have very different income distribution. So, the kind of distribution studying and examining the kind of income distribution is very important.

Now, too often only the Gini coefficient is quoted without describing the proportions of the quantiles used for measurement; as with other inequality coefficients Gini coefficient is influenced by the granularity of the measurements. So, for example, five 20 percent quantiles will yield a lower Gini coefficient than 25 percent quantiles taken from the same distribution. So, these are things that needs to be kept in mind that quoting a Gini coefficient without describing the proportions of the quantiles used for measurement will not be a very fruitful exercise.

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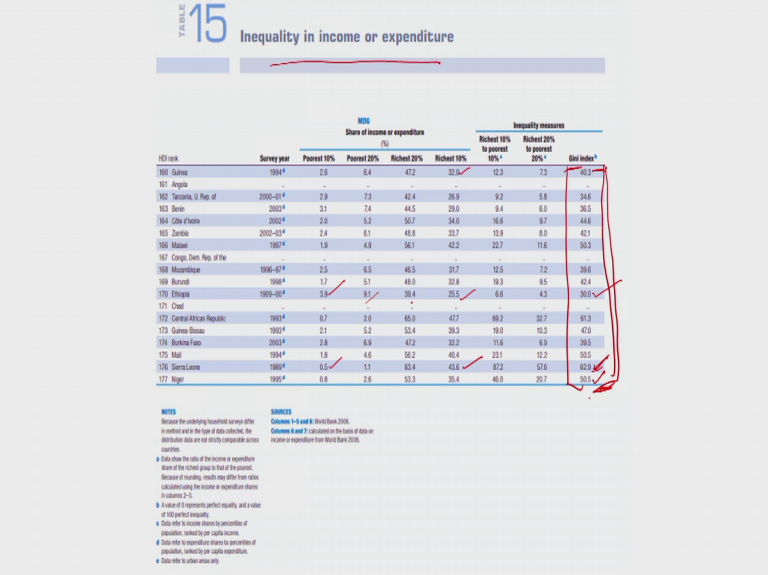
TABLE 15 Inequality in income or expenditure

HDI rank	Survey year	MDG Share of income or expenditure (%) Poorest 10%	Poorest 20%	Richest 20%	Richest 10%	Inequality measures Richest 10% to poorest 10% [a]	Richest 20% to poorest 20% [a]	Gini index [b]
160 Guinea	1994 [d]	2.6	6.4	47.2	32.0	12.3	7.3	40.3
161 Angola	..	..	..	..	..	..	..	..
162 Tanzania, U. Rep. of	2000–01 [d]	2.9	7.3	42.4	26.9	9.2	5.8	34.6
163 Benin	2003 [d]	3.1	7.4	44.5	29.0	9.4	6.0	36.5
164 Côte d'Ivoire	2002 [d]	2.0	5.2	50.7	34.0	16.6	9.7	44.6
165 Zambia	2002–03 [d]	2.4	6.1	48.8	33.7	13.9	8.0	42.1
166 Malawi	1997 [d]	1.9	4.9	56.1	42.2	22.7	11.6	50.3
167 Congo, Dem. Rep. of the	..	..	..	..	..	..	..	..
168 Mozambique	1996–97 [d]	2.5	6.5	46.5	31.7	12.5	7.2	39.6
169 Burundi	1998 [d]	1.7	5.1	48.0	32.8	19.3	9.5	42.4
170 Ethiopia	1999–00 [d]	3.9	9.1	39.4	25.5	6.6	4.3	30.0
171 Chad	..	..	..	..	..	..	..	..
172 Central African Republic	1993 [d]	0.7	2.0	65.0	47.7	69.2	32.7	61.3
173 Guinea-Bissau	1993 [d]	2.1	5.2	53.4	39.3	19.0	10.3	47.0
174 Burkina Faso	2003 [d]	2.8	6.9	47.2	32.2	11.6	6.9	39.5
175 Mali	1994 [d]	1.8	4.6	56.2	40.4	23.1	12.2	50.5
176 Sierra Leone	1989 [d]	0.5	1.1	63.4	43.6	87.2	57.6	62.9
177 Niger	1995 [d]	0.8	2.6	53.3	35.4	46.0	20.7	50.5

NOTES
Because the underlying household surveys differ in method and in the type of data collected, the distribution data are not strictly comparable across countries.
a. Data show the ratio of the income or expenditure share of the richest group to that of the poorest. Because of rounding, results may differ from ratios calculated using the income or expenditure shares in columns 2–5.
b. A value of 0 represents perfect equality, and a value of 100 perfect inequality.
c. Data refer to income shares by percentiles of population, ranked by per capita income.
d. Data refer to expenditure shares by percentiles of population, ranked by per capita expenditure.
e. Data refer to urban areas only.

SOURCES
Columns 1–5 and 8: World Bank 2006.
Columns 6 and 7: calculated on the basis of data on income or expenditure from World Bank 2006.

Now this is a snapshot of the inequality in income or expenditure across countries as reported in one of the human development reports. I have brought it here on the slide to give you an example of how the Gini index is reported. If you look at the last column here; this last column here shows the Gini index of income or expenditure in some cases it is income in some cases it is expenditure and it shows these are in percentage terms. So, which means if the Sierra Leone has 62.9 percent Gini index and Niger has 50.5 which means that Sierra Leone is a more unequal country than Niger.

Similarly, here if you look at this series here the your country which has these are mostly the Sub Saharan African countries. And among the Sub Saharan African countries the country which has the lowest Gini index is Ethiopia and the highest is Sierra Leone here which means that among these groups of countries Ethiopia is relatively an unequal country compared to Sierra Leone.

If you note here that this inequality is calculated across incomes or expenditures. And this is something probably I have touched upon in one of the earlier classes where I have mentioned and if some of you have missed out it basically means that many countries the statistical databases of many countries or some countries collect data on incomes, where as some countries collect data more on expenditures. And often expenditure is treated as a proxy for income because the idea is that if you have been come you will spend on service on basic services; so, we say on food or non food expenditures.

So, sometimes it becomes it is more it makes more sense to collect data on expenditures than on income to be able to come up with proper translations of how much development has taken place. So, some countries have income data, some countries have expenditure data and this is something that I have we have seen in Branco Milano which paper also, where he has collected data based upon a household service done in various parts of the world, various countries across the world where some countries give data on incomes and some countries give data on expenditures and they have been collated together to be able to come up with the Gini coefficient.

So, here in the human development reports also; the inequality indices are being calculated and it shows us how many poorest 10 percent, poorest 20 percent, richest 20 percent, richest 10 percent and what is the share of their income or expenditure. So, for example, in Gini here the poorest 10 percent have access to only 2.6 percent of their share in total income is only 2.6 percent. Whereas, the richest 10 percent share in income or expenditure is 32 percent and this is the significance of being able to calculate the Gini coefficient or the plotting the Lorenz curve. It tells us what is the proportion of population within a country that has access to income and wealth? And this gives us a sense of the social justice within the country and what are the different kinds of plans and policies that can be designed keeping this in mind?

Similarly, if you see the country which showed highest inequality here Sierra Leone you will see the poorest 10 percent ah; the share of the poorest 10 percent in total income and expenditure is only 0.5 percent. Whereas, share the richest 10 percent is 43.6 percent; so it make sense to say that this country is relatively more unequal than the rest in these group of Sub Saharan African countries. Similarly if you look at Ethiopia the poorest 10 percent have a share in the total income and expenditure; the poorest 10 percent have only about 4 percent share, the richest 10 percent have about 26 percent share. The poorest 20 percent share about 9.1 percent, the richest 20 percent have a share of about 39 percent.

So, which means that the poorer countries exhibit very high levels of inequality; the poorer countries are poor because the richer sections of the population have more access to incomes, have more access to basic services, have more access to the resources within the country than the poorer sections of the population. So, in this class we made a slight detour into looking up to major measures of inequality, the Lorenz curve and the Gini coefficient.

We looked at how to interpret the Lorenz curve and the Gini coefficient, how to plot the Lorenz curve and how to estimate the Gini coefficient and in looking at the advantages and disadvantages of the Gini coefficient and the Lorenz curve. We also tried to see why and how the Gini coefficient continues to be one of the most important indicators or most important estimates of being able to measure inequality within a country or a region.

We also looked at we also saw that the Gini coefficient satisfies most of the principles that qualify to be a good measure of inequality. And we ended with how the most important reports such as the UNDPs human development reports also makes extensive use of the Gini index to be able to tell us what is the proportion of population that has access to different levels of incomes and wealth within a country and how different policies and welfare programs can be designed based upon these findings.

Thank you.