Introduction to Economic Growth- I

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Lecture-7

So, since we are talking about GDP, this might be a slight digression, but it is worth digressing in that direction for a while. If we ask ourselves a question that why is GDP so important? So, by now we have covered the definition of GDP. We did take a look at some of the basic data about GDP, and we also see how, for comparison purposes, we can compare GDP in various ways and use the different terms that are associated with comparing part of GDP. Now, one of the reasons why GDP is so important also as an indicator and why we are spending time in trying to understand how GDP is represented. Is there a very, very strong correlation between GDP and standard of living? What do you mean by the standard of living? The standard of living is very much about the quality of life, okay? Now, Income is required to have a good quality of life, but it is not important that or it is not necessary that a high income will also guarantee a high quality of life. Now, what I mean by quality of life? In general, and when we are talking about the standard of living from the point of view of the macro economy.

It is pretty much the same as how we talk about the standard of living as an individual, okay? So, as an individual or, as you know, family members, we are not just concerned about the income of the family. Of course, that is very important, and a lot of things hinge upon income. But what is also important is where we live, what kind of environment we have, what kind of schools we send our kids to, and what kind of roads we drive down because all these things represent what we call the quality of life, okay? So, GDP is very closely related with this quality of life or standard of living even for a nation. So, not just at the individual level, income is important because, in most cases, we see that with higher income or better income, generally, we have access to better things that ensure a higher quality of life.

Now, what about this at the national level? Now, when we talk of quality of life at the national level, the indicators are fairly similar to what we just mentioned about what we are concerned about at an individual level. Apart from that, there are also some macro indicators that tell us about quality of life, and these are also known as development indicators. Say for instance, life expectancy. When we are looking at a nation, we also look

at what is the life expectancy. So, here this is another chart that is plotting life expectancy and per capita GDP for the year 2021.

So, on the x-axis, what we have is per capita GDP, as we can see from here, starting from 1000 dollars and going up to 100,000 US dollars, and on the y-axis, what we have is life expectancy. What do we see here? There are many bubbles. These bubbles by the way they represent the different countries, and if you are wondering why is the size of the bubbles different or if they are varying, this varies because of population. In fact, that is the reason why you see the bubbles for India and China are much bigger compared to other countries because these are the two most populous nations. So, what do we get to see here? What we see here is, you know, as we move from the origin of the x-axis towards the right-hand side, we see that more or less income increases, and here I am talking of the income of a nation.

So, this is per capita GDP with which we are familiar by now as per capita GDP increases. So, as we keep moving along the x-axis, we see that these bubbles are also generally moving upward; in most cases, that is. In other words, as per capita GDP increases, we also see that life expectancy increases, right? So, we know Japan is very well known for its very high life expectancy numbers, but apart from that, what we can see in this chart is also a country like Norway. Has a very high life expectancy of about 85 years. So, now one thing I would also like to mention here is that from this graph, we cannot infer whether high income leads to high life expectancy.

This is a different one can say branch within economics where we deal with such questions. Which we call causality. So, here, just from this graph, we cannot infer causality. As I said, we cannot say for sure that because of the high income of the nations, life expectancy has gone up. Why? Because one way one can argue is If income is high, then people have access to a better health care system, people have access to, say, more nutritious foods and, you know, better medicines, advanced medicines, and maybe that is why people live longer.

Well, one can argue like this. But when we have numbers, you know, it is not just about this kind of a verbal general argument. When we argue with numbers, we have to, or we get into the realm of what we call causality. So, the point that we are trying to make here is from these graphs, we can only talk of correlation. All that we get to see here is that, yes, there is a strong positive correlation between income and life expectancy, but we cannot infer from here whether it is due to high income there is higher life expectancy.

So, we have to be a little careful about that. So, here is again another graph on public health expenditure in developing countries, and here also we see that with higher income, you know, these expenditures are also higher. So, we are talking about these things in terms of

standard of living. Or the quality of living. So, it is not just about health; there is similar evidence about education as well.

In fact, there is a lot of evidence; I am only showing a few of those here as an indication. So, here, for instance, is about education, which is also about quality of living or standard of living. So, here it is showing us what share of children. They are not able to read with comprehension by the end of primary school age. And here what do we see? This red bar, the horizontal one which corresponds to low-income countries, means that about 90 percent of the children in low-income countries are not able to read with comprehension by the end of primary school age, okay? Whereas for high-income countries, only about 9 percent of children in high-income countries, are not able to read with comprehension by the time they graduate from primary school, okay? So, the global average is about 48 percent, which is very high.

And in best-performing countries, this is, you know, less than 3 percent. So, what it means is in the best-performing countries here, only less than 3 percent of children who graduate from primary school cannot read properly. So, this is also another indication that how in low income countries. Not only is the income level low, but other factors that are associated with living quality or the quality of life, like health and education, how also get impacted adversely by lower income. And not just health and education when we talk about the quality of living.

Quality of living also depends on the way we live life and corruption is one such thing, okay? So, this also is a part of the quality of living. Again, another instance here of something known as a Corruption Perceptions Index. And what this is showing us is there are scores that have been assigned to different countries based on how corrupt these countries are. And here the rank number 1 goes to Denmark because it scores very low on corruption. So, here the ranking is not from most corrupt to least corrupt, here the ranking is one for the least corrupt country.

So, here also, if we take a look at the countries which are least corrupt, here are Denmark, Finland, New Zealand, Norway, and Singapore, which are all again high-income countries, okay? So, this kind of gives us evidence, as I said, it is a slight digression from what we are talking about, but it is worth, you know, moving away slightly from our regular discussion here because when we talk of GDP, when we talk of growth, it is not just about income. Because a lot of things are related with income. The way we live life depends on income. The quality of life, quality of living, standard of living, all these are very closely related to income. That is why understanding why certain countries have high incomes and other countries have low incomes, or are stagnating makes a lot of sense, right? Okay.

Now we come to I find this both very interesting and intriguing at the same time because this also gives us an opportunity to work with data a little bit here, okay? And now we

come to this question that well how do we measure economic growth? So far, we have seen different graphs, but these are graphs generated by different agencies or different authors so as to see, but suppose I give you some data and ask you to find or measure economic growth; how will you do that? So, this is more of a practical exercise. Now, just to before we actually go on to the methods, a very simple thing that is how do we actually define economic growth, okay? So, the growth rate, in general, is the general definition; this is the average annual percentage change, okay? I am a little careful here because many times I have seen when we grade the copies and when we give similar questions in exams that, people just miss out on the percentage change part; people just concentrate on the change part. So, it is not just change, it is percentage change. Say for instance, let us look at the example here. If you are given the GDP numbers for the year, so GDP for the year 2022 is given and GDP for the year 2021 is given and you are asked to find out the growth rate of GDP.

How will you find it out? Because this is percentage change not just change. So, in the numerator it is GDP for the current year minus the GDP of the past year that is the numerator. The whole thing is divided by the GDP of the past year, and since we generally express it in percentages, we multiply it by 100. So, the number comes in percentage terms. So, this is true for all calculations that we do.

So, as long as we have numbers, I hope that all of us can find this number here. We should be comfortable doing this. So, if you are familiar with excel, you can do this on a calculator as well. But if you are familiar with Excel, you can very quickly calculate it in Excel, right? So, this is how we measure. This is just a very basic calculation, okay? So, if I give you the data for two consecutive years and ask you to find out the growth rate, then you should be able to do this calculation and express it in percentage terms, right? I hope you are going to go.

But now let us suppose instead of data for two consecutive years which we just saw here. Suppose I give you data on GDP. for the entire time period between 1960 and 2022, okay? So, you have GDP numbers for 1960, you have GDP numbers for 1961, and GDP for 1962, and it continues till GDP till 2022. And I ask you that for this economy find out the growth rate between the years 1960 and the year 2022. Now how are you going to do that? Now there are different ways to do this.

It is not necessary that all of us we follow the same method. I am going to mention some of the methods here, okay? One method is and perhaps this will be the simplest way to do this, is to compute the growth rate for each year and then just take an average. What we mean by that? So, if we go back to this slide here, we employ this particular formula. for 2 consecutive years. So, employing this you can find the growth rate between 1961 and 1960.

Again, you can find the growth rate between 1962 and 1961, right? So, if you are working on Excel, you will have a parallel column where you have generated the growth rates, right? And then, because the question is to find out the growth rate between 1960 and 2022, finally, what you have to do is you have to take an average, okay? So, you can call that as the average growth rate between 1960 and 2022. Is this making sense? So, this is one way in which we can do this. Are there other ways in which we can do this? Yes, definitely. The most common way, and sometimes we might have come across this term as well, is known as CAGR, Compound Annual Growth Rate. What is the compound annual growth rate? With the same data, what we can do is we can find out the growth rate and what is the formula that we will use.

We will no longer use this formula. This is used for yearly. For compound annual growth rate, let me test you a little bit here. The formula that we use is the same formula that we use to find out the compound interest rate. So, this is an exercise for you that find out the formula for compound annual growth rate which is the same formula that we use in school remember to calculate the compound interest rate.

So, the idea is the same. So, instead of going or taking yearly figures here, we will consider the compound annual growth rate number. Sometimes, in headlines, we come across the term CAGR, which is compound annual growth rate. There is also another interesting rule known as the rule of 70 which we will also discover. And if you are familiar with regression, you can also use regression to find out the growth rate. However, which method are we using? As we said, there are multiple methods, but which method we are using depends on data availability.

What do you mean by data availability? So, let us say, so I am showing here the table that we have seen earlier from RBI. You can see that this is at constant prices. So, this is real GDP, right? And the last row that we see here is gross domestic product or GDP. So, here we have GDP data starting from 2016-17 till 2020-23, okay? Also, I hope you know why it is represented as 2016-17 because our financial year runs from one calendar year to the other. So, that is why data in the Indian context is generally written like this.

So, you can just do this as an exercise. So, I am showing you the data here. So, if someone asked to find out the growth rate for the Indian economy between the years 2016 and 2022, all the data is here, right? So, you have to refer to the last row here. How do we find that out? Two methods that we have already discussed. One we can first use the yearly growth rate method and then take an average, okay? So, try doing that, and the second is to remember to use the compound interest, you know, formula, which is the formula for compound annual growth rate.

You can employ that formula directly, and you can find out the growth rate between 2016 and 2022. So, try and do this as an exercise and see what kind of answers you get here.

Both methods are correct and yes, what did we mean by which method is to be used? That is a very important decision that we have to take. Now, if we have data for all the years. So, in this case say for 2016 we have data, 2017 we have data.

If we have all the data points, I feel it is best to make use of all the information that is available. Then the first method perhaps I would opt for the first method. But you know sometimes there are data gaps, there is missing data. Say for instance here suppose we are looking at this table and suddenly we find that for 2019 or for 2018. The data point is missing; the data point can be missing for several reasons.

If the data points are missing in between, then we cannot employ the first method right; in that case, then, the compound annual growth rate makes more sense. So, this is what I had meant by the last bullet here that data availability is going to be the deciding factor, which method we are going to use to calculate the growth rate. The data is actually going to determine that. If you have all the data then you are free to use any method here. Although the answers might and will vary slightly, as long as you mention which method you are using, you should be good to go, okay? Another method that is sometimes used is known as the rule of 70.

By the way, there is also a rule of 70 for investments. So, maybe some of you are already familiar with that. Now, what does this rule state? It states that growing at a constant rate of G percent every year, GDP will double approximately every 70 over G years. So, this is known as the rule of 70. So, how are we going to calculate that? So, I have marked that here in both red and blue. So, the rule of 70 is;

$$\text{The number of years to double} = 70/G$$

Where G is the constant growth rate, okay? So, if we rearrange that, remember what is it that we are going to find out? This is the growth rate we are going to find out. So, G is the unknown here. G is equal to 70 divided by years to double. You might recall in the first lecture where we were discussing the stylized facts, there was also another column on years to double.

Remember, we had seen that earlier. So, if you have that information like we have that information from those tables. So, actually, just take that information from there. So, 70 divided by the number of years to double whatever we find will be the growth rate. Again, where is it that we might be using this rule? So, imagine here we might be using this because we might not have any information on GDP. Contrary to here, this particular case where we did have data on GDP, you see here to employ the rule of 70, we actually do not require any information on GDP.

The only information we require is years to double. If we have this information, then we can find out the growth rate. So, this is what we meant by data availability. So, imagine we are in a scenario where we do not have specific GDP data. forget about even yearly GDP data, we do not have that. But the only information we have is the number of years the country takes to double its GDP.

If we have that data, then we can then find out the growth rate, right. Do we see why different methods are there? Because it depends on data availability. So, you can try this here, I have given you two examples. So, if a country is growing at a rate of 2 percent, then it is doubling every 35 years. If a country is growing at a rate of 5 percent, it is doubling every 14 years.

If a country is growing at a rate of 10 percent, so you see how the growth rate is increasing, then you can find out you know how many years that country will take to double. The last one I have left is blank for you; you should be solving this. And how do we solve these problems? So, I have also mentioned here that we simply have to employ the rule of 70 years to double is equal to 70 over G. So, for the last one, I hope just by listening to this video at this time itself and by employing this formula, you can very quickly find out how a country that is growing at a rate of 10 percent, how long will it take to doubles.

I hope you have found it out. Yes, you must have found it out. So, then let us move on to the next slide here. Now, I also find this particular, you know, information or slide very motivational in the sense that when we discuss, you know, why we study economic growth, this also shows the power of economic growth. So, for instance in South Korea, so I have also left another blank for you, so another exercise for you here. Say for instance in South Korea, since 1960 it has grown at a sustained rate of 6 percent.

So, using the rule of 70, you should be able to find out that it has doubled every how many years? Have you found it out? You must have done that by now. What it means? This meaning is very important. What it means is the current generation or the present generation is richer than the grandparents, okay? Which is the story in most cases for most countries, by the way. But there are also instances like in Haiti we see here which has registered a negative growth rate for 50 years. You remember for those stylized facts we did see there were countries where growth had stagnated, in fact growth disasters had occurred where growth rates were in negative.

So, Haiti is one such country. Here, Haiti has registered a negative growth rate for 50 years. What that implies is that the present or the current generation is actually poorer than the grandparents, okay? So, this is the tremendous power of economic growth. So, economic growth in other words is like compound interest. Very small differences in growth rates, they compound over time to generate enormous differences in income. It is

one thing that we cannot feel the power of economic growth, you know, over a period of just 1 or 2 years or even 3 or 4 years.

As it mentions here, very small differences. It might look like a very small difference, but it compounds over time. So, I thought that maybe you know a similar parallel that we can draw is by using this SIP calculator. Some of you who might be familiar with investments and SIPs, you might have seen these kind of calculators. There are many interfaces to do that now. So, what I am demonstrating here is, of course, I am calculating the SIP here, but you know, economic growth pretty much works in a similar manner.

So, I will also take this opportunity to draw the parallel between all these different concepts that we use. How is it? In one panel, so in both cases, if you look at this slide carefully, the monthly investment is the same, okay? Which is 25,000 rupees, okay? And the time period is the same. So, we are investing 25,000 rupees every month for a period of 30 years. This is same in both the cases or scenarios here, but in one panel you see the expected return is 12 percent.

So, imagine this is the growth rate. And in another scenario, the expected return is 14 percent. So, imagine this is a country with a growth rate of 14 percent. Now, come down to this part that is talking about the invested amount and estimated returns, and total value. What we see across the two panels is the case where the rate of return is 12 percent.

Look at its total value; it is about 8.82, right? Whereas, the expected returns where it was 14 percent, now it might look like, well, I mean, 12 and 14 is not very different, right? I mean slightly higher; that is how we are generally tuned to thinking. But look at the difference that has finally generated in terms of total value compared to 8.82, this is 13.89 right. And remember, in both cases, the time period is the same, but simply because of the rate of growth.

So, here, this is an SIP calculator, which is why it is showing the expected rate of return, like the rate of interest or just replacing it with the rate of growth. So, the point we are trying to you know demonstrate here is that it might look like a small difference in growth rate. As we said 12 percent and 14 percent we might feel oh it is not that greater difference, but look at what it leads to ultimately. This is the point that we are trying to make here. In fact, very interestingly, between 1870 and 2000, also remember because we are talking of economic growth, it is about performance over a period of time.

So, this is between 1870 and the year 2000. The UK grew at an average rate of 1.4 percent per year. Whereas US was growing at a rate of 1.9 percent.

So one might just shrug and say that not a big deal of difference, 1.4 and 1.9. But look at what it has done over a course of time. In 1870, UK was 33 percent richer in per capita

terms compared to US. And today in 2003, because this data stops at 2000, UK was poorer compared to US by 27 percent.

This is the power of economic growth. It does not manifest over a very small period of time, okay? Not even maybe a decade or two. It manifests over a very long period of time, but the results can be very, very drastic and different. So, this is why, again, we study economic growth because it can make a real difference to the fate of nations.