Introduction to Economic Growth- I

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Lecture-9

Now, whenever we talk about proxy variables, we also have to be careful about especially limitations of proxy variables. But before we go on to the limitations, let us talk about the advantages. Now, what is the advantage of using night lights data? The biggest advantage is that we can use the night lights data at a very granular level. What is the granular level? We had mentioned that earlier at the smallest possible administrative level which say in our case is at the village level. So, if someone is doing some work where we require data on economic activity at the village level, as we said that at least till now, even if such data is there, at least it is not published or it is not in the public domain, we do not have village level GDP data. But if we are using night lights, then that data is available.

Also this is a satellite image and this is recorded on a daily basis. So, the frequency, suppose if someone wants this for, you know, at a monthly frequency, we can have that; if someone requires it for a weekly frequency, that is also accessible. So, depending upon the frequency, we can obtain such data. The other advantage is that you know the unit of comparison is homogeneous.

Recall earlier, when we were talking about the comparison of GDP, now we had to say that when we are comparing across nations, different nations have their GDP in terms of their own currency, and generally, what is done is that everything is converted to a common currency which is US dollars, right. Now, a lot can be lost in this conversion, as we know. Compared to that because this satellite image and we had seen the unit is DN and that is uniform for all countries. So, no conversion is required here. So, this is also another advantage that this unit is very much homogeneous for all countries.

There is no conversion that is required here, unlike what we had seen for the regular GDP numbers. But as we said, whenever we are using proxy variables or we are coming to any conclusion based on the proxy variables, we have to be a little careful about the limitations. For instance, in this particular case, Night light data is something known as top-coded data. As we saw, DN runs between 0 and 63. What it means is that if let us say a certain city is very brightly lit, it is a highly developed city let us say.

Now that 63 number has been assigned to it. Now over time that city grows even more. So, in terms of night light although that data it stops at 63. So this is known as top-coded data. So, that might be one disadvantage that if then looking at that particular data, it might look like even in later years as if there has been no change in luminosity, which is not necessarily the case.

And of course, another limitation that we can all think of is that night lights as the term suggests, well this is only visible at night. So, what about activities during time that might not be fully captured. Also, when we look at the GDP data in terms of US dollars or Indian rupee, we can segregate that in terms of sectoral composition. For instance, in India we talk about the GDP that comes from the agricultural sector, the GDP that comes from the manufacturing sector, the GDP that comes from the services sector. But in this particular case, it is not easy to distinguish between the different sectors.

Neither is it easy to distinguish between the amount of light that is there. Is it there because of production purposes,s or is it there for consumption purposes that is also another thing. And apart from that, because these are satellite images, you know, some might have the concern that what about cloud covers, etc., but you know, day by day, technology is becoming more sophisticated. The current sources of night lights are more sophisticated and they kind of allay this particular fear.

But another thing, as economists, you know, we find it easier to use regular GDP data because it is in terms of currency, whereas this data is not very easy to interpret because, as we saw, this is not in terms of rupee or dollar or exchange rate, etc. So, typically we have to take the help of people who are familiar with this data before we can start using this particular data. So, if we are now somewhat familiar with the night light data as a proxy for economic activity, I thought it would also be very interesting to look at what the Indian economy looks like in terms of night light data. So, here I am presenting a newspaper report, and the URL is also provided here if you would like to visit that and read the entire report because I am not presenting the entire report here, only the parts that we require to highlight. So, this is from Times of India and as the headline says growth indicator night lights up 43 percent in 10 years and 400 percent in some states.

So, this is the point that we were trying to make that how night lights is also being used to measure growth and here in this particular report this has been used to measure growth across the different states. Say for instance, as we can see written in the byline here, significant increase was observed in Bihar over 400. So, 474 percent increase, Manipur 441 percent, etc., etc. and MP 66 percent, UP 61 percent, and so on and so forth.

So they also go on to mention where this kind of data has been obtained from. The source is the same that we had seen earlier. So, as we said, this is another advantage of night lights

data that the source is the same. Whereas, for official GDP numbers, every country conducts its own GDP exercise. So, there is bound to be disparity in the process.

Compared to that, the night lights data is very homogeneous in terms of its source. So, this quick pictorial representation of the night lights in the Indian context mentions the rise in nighttime lights as we can see across states and union territories. So, a maximum number of states have registered a growth between 21 percent and 40 percent in the Indian context. And here all these growth rates they have been measured using night lights. So, this is the amount by which the night lights went up, this is the interpretation.

And I am not sure how much of a difference we can see here, but I still try to present these two differences over almost 9 to 10 years. So, on one panel we see India lit up in the year 2012. And on the other side we see India in 2021, just like we had earlier seen that for North Korea, South Korea and the Eastern European countries. This is also part of the newspaper report that I have cited here. And they also have legends like this here as we can see.

Do we see here that the term they use or the unit that is being used is the NTL radiance? So, it is a radiance factor. This is not the regular GDP, and the legends tell us that you know the different colors they stand for at different intervals. So, we do see some differences between 2012, and 2021 may be a more you know focused image would perhaps make things more clearer, but we definitely do see differences in terms of luminosity. So, this I thought since we are discussing night lights as a proxy and since there is a report on the Indian economy the states especially. So, maybe it is interesting to just see how the night lights appear for the Indian economy.

And in the last part of this week's lecture, what we are going to do will be a little bit of revision of what we have already done so far and a few things that we have to be a little mindful about when we are talking about data in general and GDP or growth-related data in particular. So, in this module, we talk about what can we learn from data. Now earlier also we had seen similar images, but those are mostly they were about per capita GDP comparisons. In this figure if you look at this very carefully, this is the annual GDP growth. So, now that we are familiar with growth.

And I suppose that you are also familiar with the different ways in which we measure growth. This is how the world looks like, remember not in terms of per capita GDP, but in terms of annual GDP growth. I would also like to draw your attention to the fact that this is not annual per capita GDP, this is absolute GDP growth. Now, this indigo shade that you know implies or as the shade of the blue gets darker that implies that these growth rates have been higher what we can see for India. and what we can also see for China mostly.

And there are a few specs or dots we can see here and there where it is in the red or the orange shade which implies that growth rates have been negative. So, again, this is about

growth rates in absolute GDP, and this is how the world looks like. Again this data has been taken from our world in data. As mentioned earlier, if you are curious, please visit the website. They have a lot of interesting information.

And again, this is about annual growth, but this time about per capita GDP. The previous one as we mentioned, this was about annual GDP growth, absolute GDP, whereas this one is about per capita GDP growth, and we see much more you know this appears more colorful which means that there is much more diversity here. But here also we see India, a few African countries, and South American zones, which are in the darkest shade of blue, which implies that per capita GDP growth, you know, has been registered to be very high in these parts of the world. And again, there are parts that are in saffron or in red marked here, which have actually registered either very low or almost negative per capita GDP growth rate. So, again, on a cautionary note, whenever we look at maps like this, be very careful about whether it is absolute GDP, is it per capita GDP, is it GDP growth in absolute terms, or is it per capita GDP growth.

Because every time the images will be different. So, if we are trying to infer anything based on the graphs that we see here, we should be very careful about what they are denoting. This is also another variant, which is the annual growth of GDP. Now, per employed person, this is something that we had also encountered while we were talking about the stylized facts and we said that GDP per employed person will be a higher number for any country compared to its per capita GDP. Why? Because per employed person, if you know, take into account the entire set of employed people, that will be less than the entire population because the entire population also consists of children and retired people who are not employed, right? So, this is again another representation of the world map in terms of annual growth of GDP per employed person.

Now, here we will see that compared to the earlier graph, where India had registered one of the highest growth numbers, here it is not necessarily so. So, herein lies the difference. This is the point I am trying to drive home that whenever we look at images like this, we should be careful about what is being denoted because of the same GDP. It can be per capita or per worker. So, instead of per employed, we can also call it per worker.

The moment we change these numbers, the representation can be very different. So, this is what we get to see here. So, growth of GDP in per capita terms versus growth of GDP in per worker terms. They are not necessarily the same for the same country. It can vary a lot, and if we are ranking countries based on their growth rates, we have to be careful whether we are talking about per capita GDP growth rate or per worker GDP growth rate.

So, that is why I have kept this module on you know what we can learn from data, because we can learn a lot from data, but also at the same time I have seen from personal experience that whenever we are talking about data, we also have to be extremely careful and cautious,

so that we do not make any incorrect inferences from there. So these are some of the things related to growth maps because most of the maps that we see is in per capita terms. We had seen some of them earlier. I will also present a few here so that we can see the correlation or the relationship between GDP and many other factors that matter in an economy. For instance, here we see the relationship between per capita GDP and something known as augmented human development index.

Augmented human development index, so you can read the byline here, it already mentions what are the four key dimensions of human development that are considered here. And what do we see from this graph? What we see is that there is a positive relationship between the two. So, in a similar vein there, we also have a graph on per capita GDP and annual working hours, and well, we have not fitted a line here, nor are we running a regression here. So, maybe we cannot be very specific, but more or less, what it appears like is that there is a negative relationship between these two variables that we see here. Another issue that is a very concerning issue in the world these days is about income inequality.

You might have studied about income inequality in development economics, income inequality. The most common measure is the Gini coefficient. So, here they have tried to plot per capita GDP with income inequality, and one of the reasons for showing this graph is that generally, from the previous graphs, especially here, the positive relationship is quite evident. As I said, even without trying to fit a line or running a regression, here also more or less a negative relationship is evident, whereas here it is not very clear. So, sometimes at least graphically because here we are not again running a regression, we are not fitting a line, that would be a different story altogether.

But if only based on images, we were trying to infer something, I think an image would not really help us in reaching a very specific conclusion. We would not be sure of the kind of relationship. So, this is the reason why I also wanted to present this particular image that sometimes, at least graphically, the relationships might not be very clear, for instance, here. Another factor mostly we have talked about is various kinds of macroeconomic or economic factors. But another factor that is gaining a lot of prominence in the literature these days especially when we try to answer the question that what are the factors that propel growth trust is emerging as a very very important factor.

I mean intuitively we have always known that that trust is very important, but now there are various kinds of data that is also available and if one plots interpersonal trust versus per capita GDP, here also we see that the two are positively correlated. More or less that is what we can conclude from here. So, these were just some of the examples, the help of which I was trying to demonstrate that even if we do not have access to data per se, but we see these kinds of images on a very regular basis in reports, in magazines, in newspapers, how are we going to interpret things like this. One important thing I would like to mention

here is what we get to see from these images, they only talk about correlations, they do not talk about causation. There is a difference between causation and correlation.

For instance, here, by looking at this, we cannot conclude that because of high interpersonal, it helps in increasing GDP. So, causality is a very different exercise altogether. All that these figures they give evidence about is just interrelations or correlations or you know the kind of relationship that the two variables have. So this pretty much brings us to the end of the session this week, and before we go, we wrap up this session by quickly summarizing all the things we have covered so far. So this week, we started with our discussion on GDP, and most of us are already familiar with that.

we just discussed those aspects of GDP that we require to understand this particular course. We talked about the different ways in which GDP growth can be measured, and then we also talked about proxy variables specifically, we just talked about the night lights data, and we also saw some evidence based on that. And lastly, we wrapped up by looking at a few images about economic growth, the world map and we also did take a note of that. That we have to be careful about whether we are talking about per capita, are we talking about per worker because depending on that the numbers are going to be very different. And we also mentioned that when we look at graphs, we should be very careful to analyze them and come to a conclusion because the graphs do not give evidence of causality.

They only talk about the kind of relationship that might exist between the two variables. Now, before we move on to next week's session, I thought it is only apt to end with this particular quote by Robert Lucas and this is his famous quote from 1985, and I thought that this is a quote that connects week 2 with what we are going to do in week 3. So, I read from here that I do not see how one can look at figures like these without seeing them as representing possibilities. Is there some action a government of India could take that would lead the Indian economy to grow like Indonesia's or Egypt's? If so, what exactly? If not, what is it about the nature of India that makes it so? The consequences for human welfare involved in questions like these are simply staggering. Once one starts to think about them, it is hard to think about anything else.

This also gives us a very clear motivation for any course like this, as he says that once we start thinking about these disparities, once we start asking ourselves the question of why we see this much difference across countries, it is really difficult to think about anything else. So, with that particular note we would be ending this week's lecture and next week we look forward to a framework of analysis. Now, this week was all about data, various representations of data, measurement of economic growth, etc., but next week, we will start with a particular framework for analysis, and we will be talking about the Solow growth model. I hope you have liked the lecture thus far and I will see you next for another lecture once again. Thank you.