Infrastructure Finance
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Lecture - 40
Context of infrastructure development

Welcome back to this course on Infrastructure Finance, this is lecture 40, and this will be the final lecture on this course. And we will continue our discussion on the Context of infrastructure development that we have been seen so far, in the last couple of lectures.

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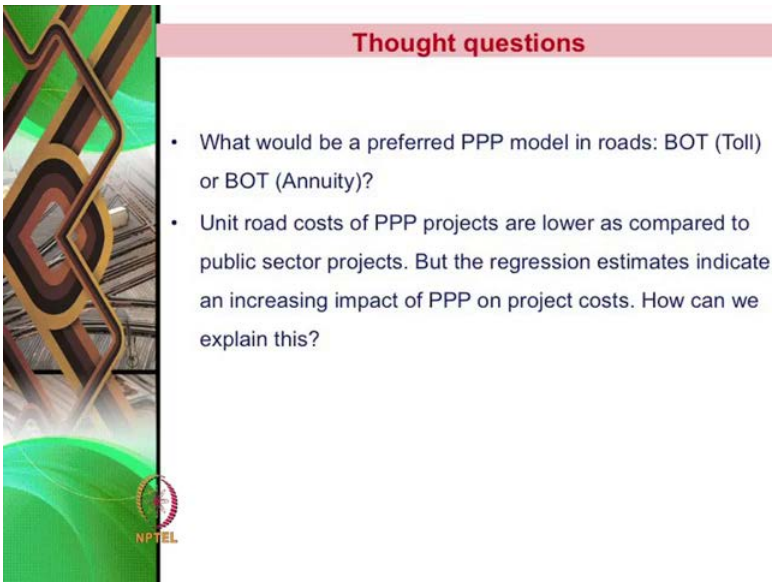

And before we actually do that, let us try and discuss the questions that we add in the previous lecture. So, we have two questions, the first question was what would be a preferred PPP model in roads, whether it is going to be the BOT toll roads or is going to be BOT annuity. So, if we re-collect, we broadly saw that there are two types of PPP approaches in the road project.

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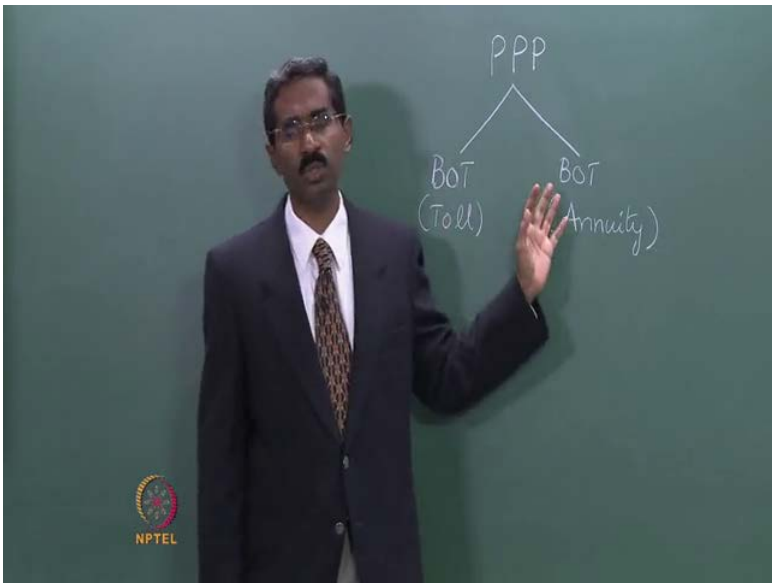

So, PPP in roads most of them can be classified into two categories, BOT toll and the BOT annuity, I am talking about this terminologies is specific reference to the Indian case. If you look at worldwide, they may not really have BOT toll or a BOT annuity, it may be referred to by different name. But, for the purpose of this course, let us try and stick to what is the common language that is providing into India. So, what is the major difference between these two, in a BOT toll arrangement in the private investors gets his revenue by way of charging toll to the uses of the road.

I mean there are other source of revenue as well, such as land development rights and so on, but primarily the major source of revenue is going to by way of toll collections. So, this means that, there is a expectations that, there is going to be substantial traffic flow in the road, and without the traffic projections, could be easily done and under this road is going to play a major role, in terms of boosting the economy. And therefore, people are willing to pay to travel on the road and so on.

Now, let us look at the BOT annuity approaching, in a BOT annuity approach the government actually pays the fees to the private investor, in the sense that it is going to be very difficult to either estimate are the traffic flow or thereby the toll collections. Or second the people were actually using the road might not have the wherewithal to the actually pay to the toll collections, and might be a lot of resistance from uses for the road to actually pay the toll collections.

And inspire of that, if the project charges a toll, then they might be no uses for the road. So, therefore, it can actually prevent economic development from happening, if a toll is being charge on the users. So, therefore, the government normally decides in such cases, not to actually charging any tolls on the users of the road, but instead provide an annuity kind of a payment to the a private investors. Now, what an annuity payments we have seen it in the beginning of this course; annuity payment is payment that occurs that regular intervals and the payment is are determined are upfront.

So, the payments are equal and it comes at specified intervals in the future, so that is an annuity payments. So, we see this kind of a arrangement where the economy is not well developed and the road can actually play very important role in catalyzing economic development of the region. For example, if you look at poorly developed region such as Northeast, we do not really have many toll roads, most of the roads are actually let by the government. And when the government does not really have the capital upfront, when the government is not able to invest as much amounts as needed, then it can actually bring in private operators.

So, the private operators puts in the investment upfront, and the government repays the private investors over a period of time. So, that is basically the difference between the BOT toll on the BOT annuity kind of role. Now, the question is what will be a preferred PPP model between these two approaches, now it depends on what is that will trying to achieve in PPP approach. If you are trying to achieve in a risk management, in the sense that the private investor should actually bear adequate amount of risk, then that toll road will be the most appropriate approach.,

Because, in the toll roads the private investors assumes are responsibility of on the traffic risk, you have assumes the responsibility of revenue risk so on. So, in terms of having the risk transferred to the private sector, BOT toll road will actually go have a higher rank is compare to BOT annuity kinds of arrangement. In fact, if you look at from the government prospective, there default PPP arrangement is always BOT toll roads option, only when the toll roads options does not work out, will the government look at the BOT annuity option. In fact, there are recent term policy announce guidelines that actually indicate clear shift towards the BOT toll, and minimize the actual use of BOT annuity arrangements.

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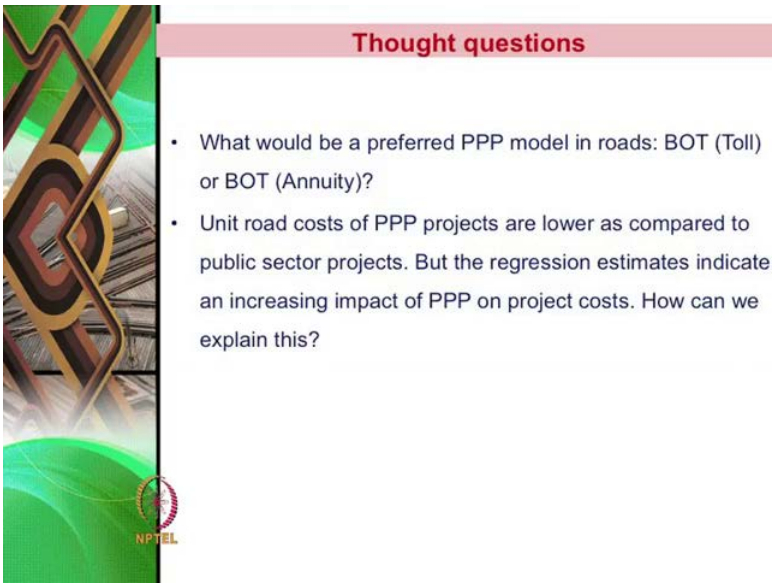

Now, let us go to the second question that we had that kind of previous lecture, and the question was unit road cost of PPP projects or lower, as compared to public sector projects. But, the regression is estimates indicate on increasing impact of PPP on road costs, how can we actually explain that. So, now, we need to understand little bit about road projects, and the first term is the unit road costs of PPP road projects, what do we actually mean by unit road costs.

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Let us say, if you look at cost of a road project dependent on, so many factors the mainly it is a function of the length of the road. If the road is of a longer length, then that obviously, it will costs more of a as compare to the road project which is of the shorter length, so it is a function of length. And it is also function of the width of the road, if there are 6 lanes in a road that is going to be more expensive as compared to 4 lane road, so the function of length lanes.

It is also function of the terrine that throw which the road passes though, and is if it is a hostile (( )), there is a lot of mountains, and the mountains needs to be rocks needs to be cotton so on. It going to be more expanses, similarly this going to be more bridges that needs to be constructed again it may have to be more expensive, it also depends on terrains, so there are so many factors, in a determined cost of a road projects. So, therefore, we cannot directly compare costs of a two projects and then, make any conclusions.

Simply because of the fact that, the two road projects might have very different characteristics and therefore, it might be in appropriate to compare to these two road projects. So, to actually compare in our two different road projects, we need to have exact road projects that are very, very having exactly the same characteristics, and in real life you may not able to find such projects, two projects having the same characteristics. So, we need to actually find out some ways in which we can actually compare road costs.

So, if you assume that, the most of the road costs are influenced by and the length and the lanes, so we need to compare unit costs of a road projects make. That means, how much does it costs to construct per kilometer, if your assume the unit is the kilometer, how much does a costs is actually construct per kilometer per lane of road. So, unit costs is therefore, is nothing but cost per kilometer lane of the road projects, so this is your unit costs.

This is how much cost to construct kilometer lane of a particular road, now the first part of the question indicates that, if you compare the unit cost of PPP projects viz-a-viz public sector road project, and you public sector road projects. So, you find the unit costs of a PPP project to be lower as compare to public sector project, public sector project has higher unit costs. Now, people might actually come back and say that actually this is as per expected trend, private investment is suppose to bring into lot more efficiency, and

therefore, having a lower unit costs for a PPP road is nothing surprising, it is as per expected trends.

So, there is nothing that you need to be a excited about, this is as per expected trends, but the second part of the question indicates that, the regression modeling seems to indicate an increasing impact of PPP or a project cost, how do you explain this. So, this is where I am going to explain some of the research that we have done at IIT Madras, and hopefully this explanation will also help you to understand little bit more about the context of road development in general.

So, what the question state that, if this is the case then the regression analysis showed also substantial fact that PPP will result in lower project cost. But, the regression analysis seems to indicate otherwise, what could be the reasons for this, so now we will look at some of our research finding to see, why it could be the case.

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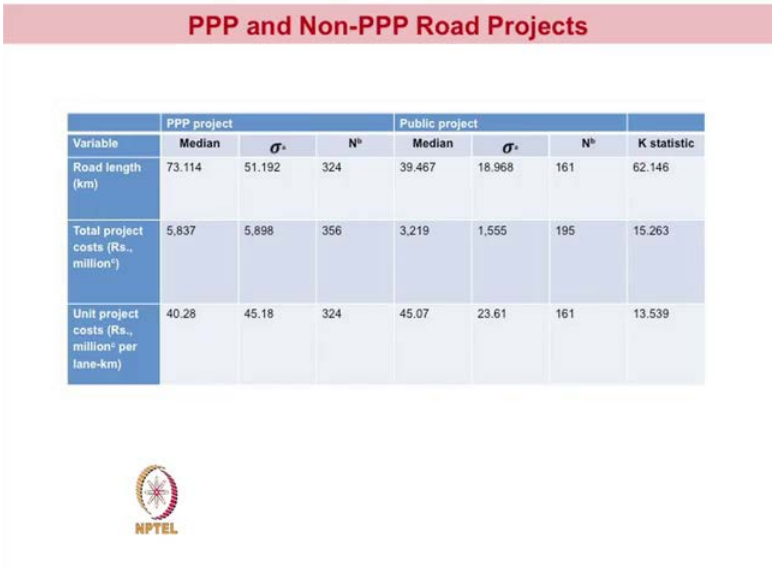

I am actually going to show a small table that compares PPP and non-PPP road projects. So, basically we will try and compare these on the different dimensions, so this is called as this is variable. So, if a variable look at it, you have the variable and there are three different variable that we are comparing the PPP and the public project. The first is you are road length, and what we are done is that actually given the median values for each of the three variables, simply because the fact that, the variables did not actually have normal distribution.

And the versus like includes, so therefore, we actually use that comparing median rather than the mean, so we look at the median the road length of the PPP project is about 73.114 Kilometers, but if you look at a public sector project, it is 39.467 Kilometers. So, essential if you look at it PPP projects are actually much longer roads stretches as compare to public sector. So, that the first difference that you should be aware of, normally PPP roads are much longer as compare to a public sector road.

The second is there were total project cost that is how much does it actually take to construct that particular stretch of road, and the total project cost is 5837 million for a PPP projects whereas, it is 3219 million for a public sector projects. Now, this is nothing very in a surprising about it, because of the fact that PPP roads are obviously longer and cost also is going to be longer. So, therefore, the cost is higher for a PPP project as compare to a public sector project, next we actually look at the unit project cost, which is what I was mentioning the unit road costs.

If you look at the unit project cost, the PPP projects are actually having a lower unit costs as compare to a public project, a public project actually has a higher unit costs. Now, the first impression that you made actually get is obviously, PPP is more efficient and therefore, their actually having a lower unit project cost, but we also need to a remember that, you are trying to attribute what could be the reason for having a lower cost in a one could be the economics of scale. So, that is a as we actually construct the road of a longer length, the unit costs becomes lesser and lesser.

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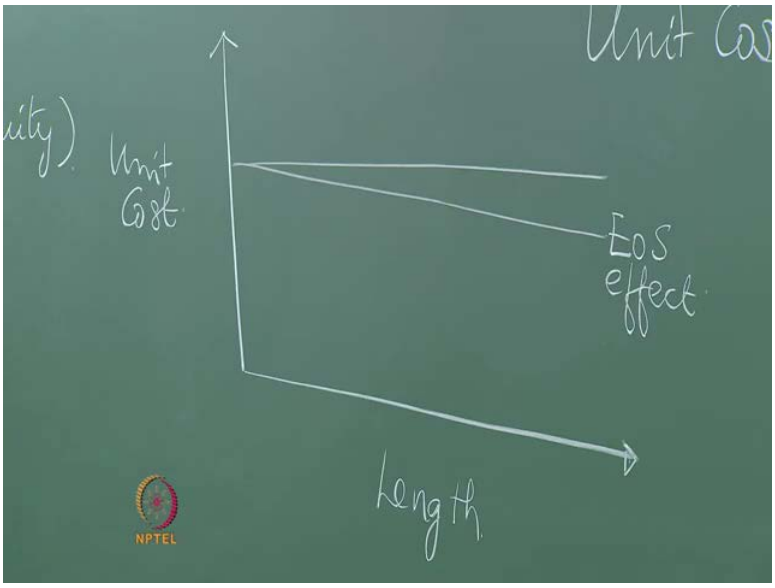

Let us say for example, this is your length and this is your unit cost, so if we actually have the unit cost to be the same, irrespective of whatever the length is, then it will be just a straight line, whatever the length of the road is the unit cost is the same. But, in real life you do not really see such a trend in a most infrastructure projects, which actually a exhibits economic of scale, the cost reduces if the capacity increases. So, therefore, if the length increases the unit cost can actually come down, so this is your economics of scale, so if the length increases the unit cost can actually come down.

So, this is your economics of scale effect, so if we construed the economics of scale to prevalent in road construction, then what you made actually feels that, yes because PPP roads are longer the unit costs is also lower. We also look at some other differences between the PPP and the non-PPP road projects.

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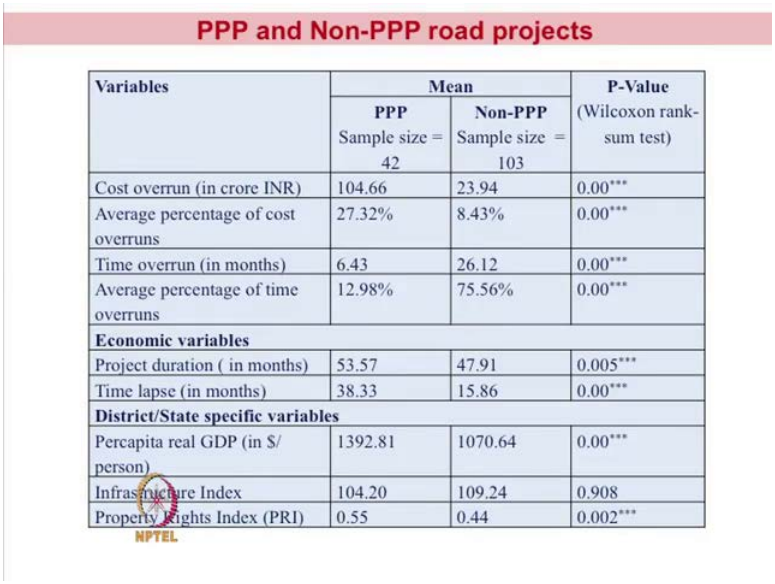

Variables	Mean		P-Value
	PPP Sample size = 42	Non-PPP Sample size = 103	(Wilcoxon rank-sum test)
Cost overrun (in crore INR)	104.66	23.94	0.00***
Average percentage of cost overruns	27.32%	8.43%	0.00***
Time overrun (in months)	6.43	26.12	0.00***
Average percentage of time overruns	12.98%	75.56%	0.00***
Economic variables			
Project duration (in months)	53.57	47.91	0.005***
Time lapse (in months)	38.33	15.86	0.00***
District/State specific variables			
Percapita real GDP (in $/ person)	1392.81	1070.64	0.00***
Infrastructure Index	104.20	109.24	0.908
Property Rights Index (PRI)	0.55	0.44	0.002***

An important variable in construction projects is to really look at a overruns, so overruns can been in two dimensions, one is they can be overruns terms of cost that is the final cost of a the project will be higher than what was actually initial estimator, so that is called as your cost overrun. Or the overruns can also be in terms of time, the actual time it is taken to implement the project was higher as compare to what was estimators, so that is ever time overrun. So, essentially overruns is in terms of how much was the actual different from, what was initially estimators.

So, in most cases overruns are positive that is actually is more than what was estimated, but there are instances where the overruns are negative, that is the project has been implemented faster; and it has been implemented in lower cost than what it has been budgeted. So, technically speaking overruns can be positive or overruns can be negative, now we try and look at the overrun numbers and PPP and the public sector projects, so also determine how efficient the PPP as been.

So, if really look at the cost overrun in PPP projects, the cost overrun as been 104.66 crores whereas, in the case of non-PPP the cost overrun as been 13.94. So, there is been a substantial difference in cost overrun, PPP project have higher cost overrun as compared to or non-PPP projects. So, if you really look at the fourth column gives you the results of the statistical test done, to find out whether the difference in the means is actually the statistically significant.

Remember, we cannot simply concluded trend by looking at the means, simply because the fact that, the mean might not be a good reflector of underlying trend. So, we need to really check, whether the difference in mean is actually statistically significant and when we do statistical test, we find and the case of a cost overrun and the means are statistically significant. So, that means, the cost overrun the PPP project is higher, next we also look at the average percentage of cost overruns, average percentage of cost overrun is nothing but the total cost overruns divided by a the total project cost.

Again the average percentage of cost overruns is higher for a PPP project, as compare to non-PPP projects and the difference is a statistically a significant. Now, let as look at the time overrun that is how much it is actually taken, how much more time is actually taken to complete the project as compare to what is budgeted. If you look at the time overrun non-PPP projects actually have a higher time overrun is compare to of PPP projects, and if you really look at the average percentage of time overruns, again non-PPP projects have a average higher number as compared to PPP project.

Now, if you really look at it, in both the cases of time overrun in the differences statistically significant, so one interesting trend that you may actually observed is that, the opposing tendencies between the cost and time overruns. If you look at the cost overrun, an a PPP projects have the higher cost overruns, but if you look at the time overrun public sector project have a higher time overruns. So, there are some differences between PPP projects and public sector projects, we cannot say that PPP is actually better in all dimensions as compare to public sector projects.

In some dimensions is may be better, but whereas there are other the dimensions the public sector projects might be a better of. So, that is the first thing that we have to realize, a PPP is not a cure for all the else for prevail in the systems, it helps to bring gain such amount of efficiencies, but it may not be able to remove all the elves that be seeing the system today. Next we have what is called as certain amount of economic variables, so these variables help us to understand the other factor that influence private sector investments in the road sector, or in general in any infrastructure sectors.

So, first variable is your project duration, if really look at it project duration of a PPP projects is higher as compared to a non-PPP projects and the differences come statically significant. So, that means PPP projects are bigger and therefore, the duration of the

project is also a longer, so it as actually in confirmation to the existing trend. Then we look at time lapse, the time lapse the indicates, how much time it is actually taken from a compare to particular base year, and more is a number for time lapse we find that, the influences that most of the project has been recent.

So, therefore, we really look at it the time lapse 38.33 months of a PPP projects as compare to 15.86 in the case of non-PPP projects. So, what is that indicates, this indicates that most of the PPP projects has been implemented in recent years, there is a growing trend of road projects being implemented in PPP as compare to a public sector. And this also indicates that private sector is actually getting a lot more comfortable in implementing a PPP projects in a road sector in India.

So, essentially this kinds of a indicates that time actually plays a very important role, in earlier years of this study when there is very little experience of having private sector participation. And there is not much of investment coming in, but with an experience, the government getting experience with the private sector getting more experience, and in the growth in the economy. So, today there is lot more comfort for the private sector to invest in the road sector, and next we look at certain contextual variable.

So, this contextual variable, this is another indicators as to what was the different factors, other than the project characteristics, rather than the economic characteristics, they can have actually play a role in influencing private sector investment. The first variable that we have under this category is called as you are per capita or real GDP, so per capita are real g d p indicates what is called as a underlying development and it also indicates underlying the wealth of a particular state.

If the per capita or real g d p is high, so that means, the state is well developed and the people or generally have as comparatively more richer as compare to state with a lower per capita GDP. Now, if you look at these two per capita or real g d p for PPP projects or non-PPP projects, we actually find a PPP projects have higher per capita real GDP. So, what is the inference, the inference is that private investment at actually happened in those states, which are having a higher per capita g d p and the differences significance.

So, that means, if states economic in how potential these state economic level or the economic status a plays the very important role in attracting private sector investments. And states that are more prosperous, states that are doing better are having a higher

probability of attracting a private sector investment. And the second a context variable is what is called as your infrastructure index, so the infrastructure indexes indicates the level of infrastructure development in the particular state.

And we need to once checked out the existing infrastructure level and capacity plays a role in attracting further private sector investment. So, if you actually look at it, the infrastructure index is not very different between PPP projects and non-PPP projects. So, the statistical test is not indicate any significant difference, so that means, the existing level of infrastructures the state that does not seems to play any role, in terms of attracting private sector investments. The prosperity of state matters, but it does not really matter what is the existing state of infrastructures in the status.

And the third is your property rights index, now the property rights index is take an to indicates the level of protection for private property in the state. That means, how much the state government is willing to protect the property rights of the private investors, so if you property rights indexes is very high, so that means, the private investors the feel that investment is more safer from the governmental action in the particular state. So, if you look at the property rights index, it is higher value in case of PPP projects as come back to non-PPP projects and the differences is statistically significant.

So, that means, what private investments actually plays in those states, which can actually gave a higher in a protection of property rights to the private investor, this is natural. And the inference from the finding is that, state that are desired of getting private sector investment should actually facilitate higher property rights is protection for the private investors. So, if they are able to do that, then if they will be able to attract private sector investments as compare to otherwise.

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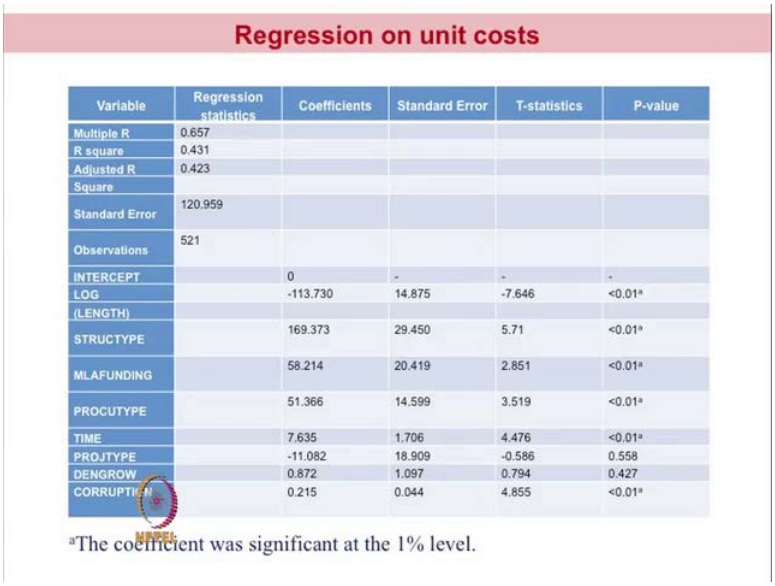

Now, I will presence the result of the regression of estimates, the first regression estimates is on unit costs, so remember when we look at the previous a comparison of unit cost, between PPP and non-PPP projects. We found that there is a significant difference in the unit cost of PPP projects viz-a-viz a public sector projects. Now, we trying do a regression estimates on unit cost to actually determined, whether the difference in unit costs is, because of how we actually procure the projects.

Remember, we talked about cost of a road projects as the function of different variables, different dimensions, we need to know whether PPP projects we actually plays a role in reducing a unit cost. So, one way to actually do it is, to do a regression of different variables that can actually impact project cost, so in this estimation we have used the following variables. So, we have actually use the length of the road, you are known that the cost that actually determined is based on the length of the road is look at a length which is called as your log length.

And then we have a structures type, so remember in a roads can actually play in road or that can be different types of road projects, it can be like a flyovers, it can be the road over bridges, it can be bridges and tunnels and so on. So, each of them have a different types of cost structure, a tunnel is going to be far more expensive as compare to a road projects. So, we need to between different types of road projects, so therefore, we have use this variable cost structure type.

The structure type is more of dummy variables that is it takes a value of 0, if it is a level road and it takes a value of 1 if it is having complex structures like bridges and tunnels and road over bridges flyover and so on. The third variable that we have is your MLA funding and this is you are Multilateral agency funding, when we actually have funding from Multilateral agency World Bank and Asian development bank, what actually is the impact on a project cost.

Thus funding from Multilateral agencies reduced or increased projects cost, so that is what we need to find out, because these agencies actually have a provide capital at very low interest rates. So, therefore, technically speaking this presence of this agency should actually reduced a project cost, whether this is actually the case we needed to find out, and that is why we (( )) reduces as a variable. The fourth is all those your procurement type, so this again is the a dummy variable, which takes a value of 0 or 1.

So, this is the variable where we test the impact on PPP, so we assume that the project can be procured by the one of the two ways that is it can be a PPP projects, or it can be public sector projects. And when the procurement type takes a value of 0, so that means, it is a public project and if it is actually takes a value of 1, then it actually as a PPP project. So, this will tell the coefficient will tell the impact of using an PPP on you need project costs and then, we talk about time.

So, the time indicates when the project has been implemented, it actually accounts for the time factor, whether the project is actually is more expensive in recent years, as compare to the previous year, so that is the time factors. And then we have what is called as you are project type, the project type can be, let us say Greenfield project or it can be a expansion it will be totally new project or it can be project expansion, or it can be a renovation. So, this actually gives variable is to capture for that, and then we have what is called as your density growth.

So, that means, we look that road network density of a particular state, and how it is actually grown over period of time. And this density growth is actually it is indicate the level of road development in that particular state and whether, the existing the road development actually plays any role in the unit project costs. And finally, we have what is called as you are variable for corruption, corruption indicates the level of corruption

that is prevalent in the states, in the government. And wanted to check the weather this actually plays any role in unit cost.

So, after doing the regression estimates we have the coefficients for the different variables that we have as just described. So, if you look at the coefficient for a log of length and the coefficient actually has negative sign, and the variable is also significant and coefficient is also significant. So, this indicates that as the length increases, since a coefficient as a negative sign in therefore, the unit cost will reduced the length increases. So, this clearly demonstrate the economies of scale effect, if you really look at the structure type, the structure type actually has a positive coefficient.

Remembers, structure type is the dummy variable, it takes a value of 0, if it is a level road and it takes a value of 1, if it is as a complex structure. Complex structures are naturally going to be more expansive, so therefore, the structure type variable having a positive coefficient, indicates the validates the fact that, when we actually have road over bridges and tunnels or flyovers, it results in increase in unit costs. Then we will actually have Multilateral agency funding, and Multilateral agency funding again as a positive coefficient, which indicates that when we have funding from Multilateral agency, it tends to increase the unit projects cost.

So, this in a sense is probability a surprising in finding, but the rationale behind this could be, when we actually have in a funding from in such institutions they actually putting place from lot of processes. And say for example, they has to be adequate amount provided for resettlement and rehabilitation of people and so on so forth, which can actually increase your project costs. That could be rational this is variable having a positive coefficient, and next we come to the variable which is of interest to us, which is your procurement type.

And the procurement again as a coefficient which is positive, so that means, this is a dummy variable which as a value of 0 for a public sector project. and a value of one for a PPP projects. So, therefore, if this variable takes a value of 1, this actually results in an impact of increasing the unit project cost, because the coefficient is positive. If the coefficient as been negative, the PPP would have actually resulted in having a lower unit project cost, but because the coefficient is positive we actually find that the PPP, actually leads to an increase in project costs. And then time and again is positive, and the values

of a significant, so that means, with increase in time and the unit project cost is actually increasing.

So, therefore, the improvements that we could have achieved have over a period of time by way of getting more and more experienced, does not seems to be effected in the project costs, project cost seemed to be increasing in recent time. And then finally, we look at corruption variable, because the project time and the density growth does not a really having any strategically significant.

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So, if you look at the corruption again, we are seen a positive coefficient that is though the coefficient magnet on the coefficient is very small, a clearly indicates that when the levels of corruption is higher in a particular state, it all so needs to increase a unit project cost. So, therefore, for a state government, this is a very clear any tightening or any increase in governance, can actually playing an important role in terms of reducing costs of infrastructures projects. So, now let us discuss, we are seeing in the regression estimation that, PPP projects trend to increase a unit cost, but earlier we actually see that, unit costs of a PPP projects are actually lower.

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So, how can we actually explain the difference, so the difference can be explain by the fact that, we are talking about unit PPP across being lower there, simply because the private sector is able taking advantage of the economics of scale. They are simply better position to manage larger projects as compared to public sector. So, public sectors does not streams to have the management capability to implement a longer projects, but if you compare like to life, that is if you compare to projects of similar starches, then a public sector seen to have a better advantage in terms of the unit cost as per our estimation.

So, the real impact of having a private sector participation in the roads is, in terms of bringing in private sector management capability and efficiency. Because of this higher levels of management capability, a private sector is been able to build longer road project as compared to a public sector.

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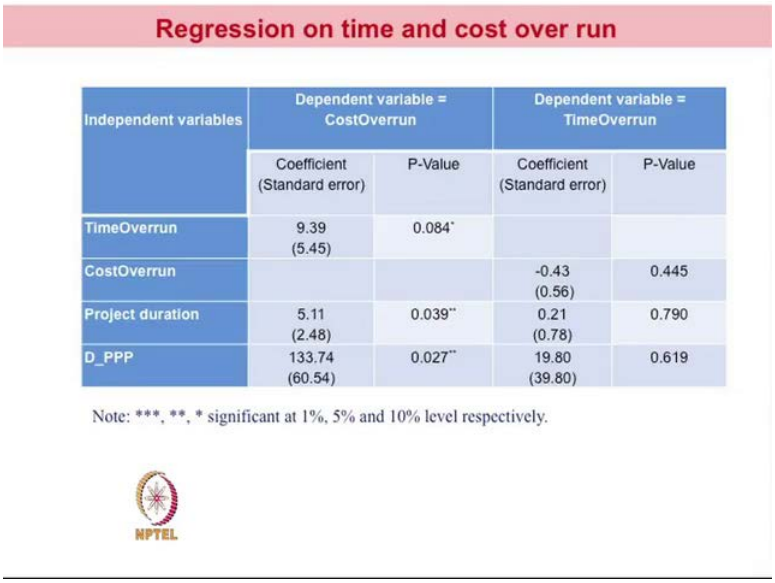

Next we look at the impact of PPP on time and cost overrun, so the results that we have shown here is a truncated regression, because we has several variables. So, therefore, have kind of showing only those results that are interesting for our discussion, so this regression an indicates the regression estimations on cost overrun and time overruns. So, this actually is a three stage least squares regression, which you are done to account for, the dual cost salty between time overrun and cost overrun.

Let us say for example, we always observed that whenever there is a time overrun it invariably leads to cost overrun, and sometimes whenever we have cost overrun it can also result in an increasing in time overrun, so these two variable are interrelated. So, because of the fact that they are interrelated we cannot do a simple regression, we have to do what is called as your three stage least squares regression to handle what is called as your simultaneity bias.

Nevertheless, we are trying to interpret the results in the same manners that we did for the simple regression, so the first regression is on the cost overrun. So, when we actually find, the regression the cost overran and we looked at four variables, we have time overrun, we have cost overrun, and then we have project duration, and then we also d PPP. D PPP is dummy variable to indicate, whether the project is PPP or not, and if the project is PPP it actually takes the value of 1, if the project is not PPP, then in actually takes a value of 0.

So, in the regression equation on cost overrun, we actually find time overrun is significant and coefficient is positive, so that means, and occurrence of time overrun actually increases the cost overrun. Whenever there is increases in time taken, as compare to what was budgeted it also time to increase the project cost. Second variable is project duration, in the project duration coefficient is again positive and the coefficient is significant. So, that means, as the project duration and increases a tends to increase the cost overrun that means, the a long duration projects have higher cost overrun as compare to short duration projects.

So, this is also as per in a what we tend to expect in the sense that, in a complex projects have higher tendency of incurring overruns. And then we talk about the PPP variables, the PPP variable is interestingly having a positive coefficient, so that means, PPP projects having a higher probability of cost overrun. PPP projects are associated with higher cost overrun in as compared to non-PPP projects, so this actually supports the results that we have seen in the earlier means comparison.

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PPP and Non-PPP road projects

Variables	Mean		P-Value (Wilcoxon rank-sum test)
	PPP Sample size = 42	Non-PPP Sample size = 103	
Cost overrun (in crore INR)	104.66	23.94	0.00***
Average percentage of cost overruns	27.32%	8.43%	0.00***
Time overrun (in months)	6.43	26.12	0.00***
Average percentage of time overruns	12.98%	75.56%	0.00***
Economic variables			
Project duration (in months)	53.57	47.91	0.005***
Time lapse (in months)	38.33	15.86	0.00***
District/State specific variables			
Percapita real GDP (in $/ person)	1392.81	1070.64	0.00***
Infrastructure Index	104.20	109.24	0.908
Property Rights Index (PRI)	0.55	0.44	0.002***

Remembers, when we look that the earlier means comparison in this table, we find that PPP projects are actually having higher cost overrun.

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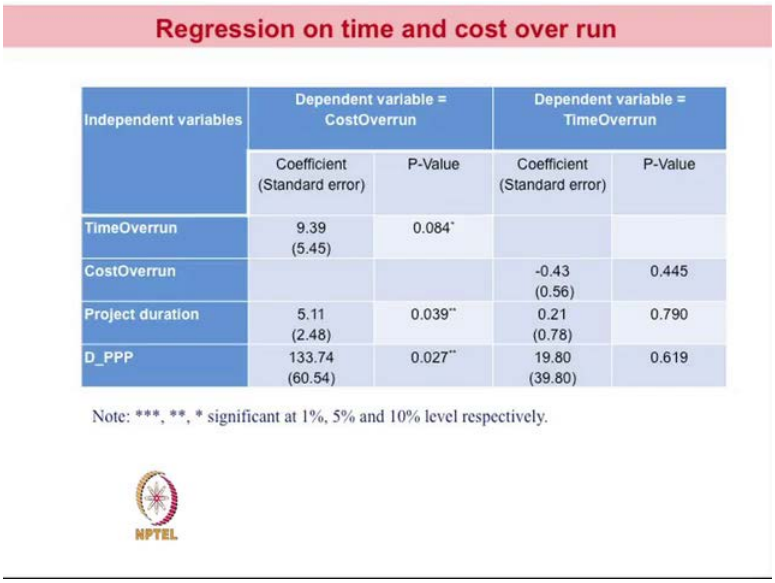

Next we look at the regression estimation on a time overrun, if you really look at the regression estimation on time overrun, you do not find any variables on that is significant. Cost overrun the coefficient is negative, but it is not significant and the project duration is positive, but again it is not significant and variable d PPP is again a positive, but it is not significant. In the sense that in a PPP project as a tendency to have higher time overrun, but it is not significant, so we cannot really attribute causality to PPP in the case of time overrun.

So, what we can actually conclude is follows, that seems to be no significant difference between PPP and non-PPP projects in the case of time overrun. But, PPP projects is definitely have higher cost overruns as compared to public sector projects. So, all set and done we still need to find out a better ways of the implementing PPP projects, simply because of the fall that, there is a need to actually control cost overruns in the case of PPP projects.

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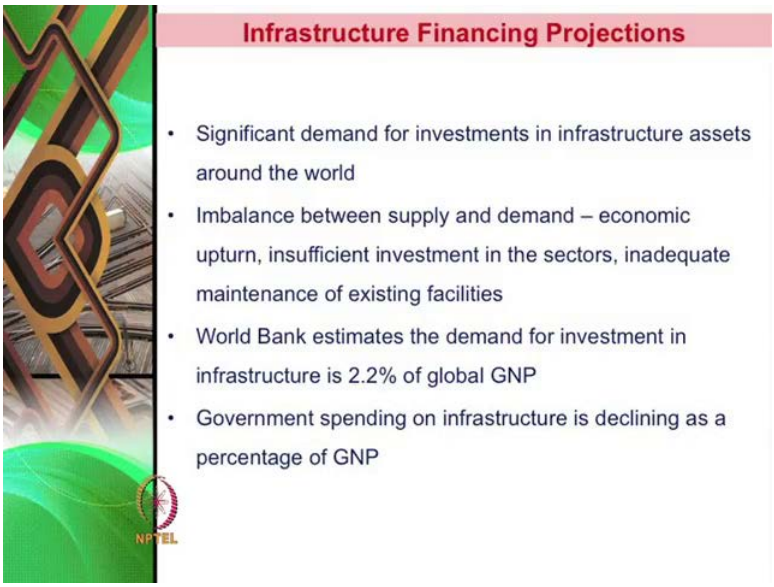

Now, quickly try and summarize, in the last few points of this course, first is there is significant demand for investments in infrastructure assets around the world. And whether we this kind of universally understood that, there is going to be a lot of demand for infrastructure in a coming years. And when there may be this descript, in terms of how much is actually investment for example, one steady might actually given different number, the other steady might actually is given totally different number.

But, nevertheless there is complete agreement that the investment needed in infrastructures are significant, and it is also kind of general agreement that is, there is mean in imbalance between supply and demand. Let us say for example, that the imbalance the created by various events for example, that is been in economic upturn, so therefore, the has been a sudden increase demand for infrastructure as it is and so on. And second is throughout the last several years, we have actually not made investments in infrastructures has needed, this always been a short fall in the investment that is made infrastructures.

So, this shortfall as built up over the years, and three (()) is inadequate maintenance of existing facilities, whatever investment is been made in basically, in terms of construction new year facilities, there is been very little attention been given to the maintenance of existing facility. So, because of this that has been in the imbalance of supply and demand, that as actually widened over the years. So, World Bank has made

some estimates, in terms of the demand for investment in infrastructure, and it is about 2.2 percent of the global glass national products.

So, this is both for new investments as well as for maintaining the existing facilities, so this is a very very large number in terms of demand. The others trend that is been seen across several countries is that, the government spending on infrastructure declining has percentage of GNP, there can be various reasons, why it is actually happening, but both in developed countries and in developing countries over the last several years, the government spending and infrastructure as shown declining a trend.

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Again the several projections that are been by various studies; for example, one very prominent study done by OECD. So, in a report titled called infrastructure 20 30 is estimated that, the global investment needed infrastructure between 2007 to 2030 is a talking about approximate 25 years is about 60 trillion. So, 60 trillion is a fairly large amount of money that has been projector and if you looking at developed countries, in the OECD member countries, and they are expect to investment about 500 to 600 billion year in electricity the road, rail and water supply or the next 25 years.

So, it is each and every year we are talking about investment of 500 six 600 billion which is substantial amount of investment (( )) in the next 25 years. Another secular trend that is been seen is that, the shore of private infrastructure investment has steadily increased in recent years. We are talking about government infrastructure spending

coming down, and at the same time the share of the private sector investments is increasing.

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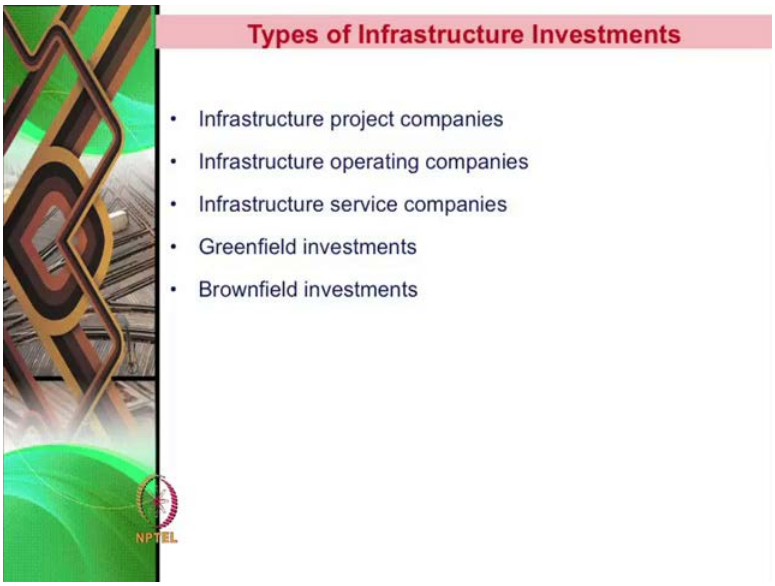

If you look at the type of the infrastructure investment, they can be broadly classified under the following heads. So, when we see have infrastructure project company, so infrastructure project companies are let us say, they have a specific project to operate, it can be a particular toll road, it can be a particular plant. And then the life depends on the project, so this kinds of companies have a defined life time, so for example, for a toll road company, the life of the project is over in the concession period expires.

Similarly for a power purchase, for a power plant the life of the project is over, when the power purchase agreements expires and so on, so these are all infrastructures project companies. So, they are essentially operating infrastructure projects, but they actually have a defined life, then will next you have infrastructure operating companies. So, these are companies that are very similar to conventional corporations; that means, these are ongoing concern, so they do not really have in life.

So, supposed to operate forever, so an example for such an infrastructure operating companies could be the BSES, Bombay Suburban Electricity Supply in Bombay. So, this is actually in private sector entity, and they actually provide electricity supply are to consumer in Bombay and there is no end life to that, so we are supposed to be operating forever, so that is example of an infrastructure operating company. In the several

infrastructural companies in the public sector, where there are not type to a particular project life.

And we are now seeing several such examples in the private sector as well, and next we have what is called as the infrastructures service companies. So, infrastructure service companies are those, that provide actually service to the infrastructure sector, now it could be for example, providing construction services to the infrastructure company. It could be in terms of providing facilities management to the infrastructure companies and so on. So, they do not directly, let say own are operators infrastructure assets, but they actually provide some kind of service to the companies, that operating in infrastructures sector.

And next is we have broadly any infrastructure project being classified, you are talking about infrastructure projects here, being classified into two different categories, one is a Greenfield investment, the other is your Brownfield investment. Let us say if any project is developed from scratch, it is completely new development, in terms of planning, development, design, construction and so on. If it is a completely new project and then, it is called as a Greenfield investment, and the other hand if the project involves, let us say a renovation, re-publishment are expansion on of existing facility. Then it is called as a is Brownfield investment, and an example of a green field investment is you are Bangalore International Airport project.

So, there was an existing airport in Bangalore, which was a smaller capacity and when the new airport being constructed in Bangalore, they actually decide a constructed in a new location, so this was a completely a new project, so that was a Greenfield project. On the other hand, if you look at a the airports in Mumbai and Delhi, this involves expansion of the existing facilities, in the case of Delhi it was constructing a new terminal in the existing airport location. Similarly, in the case of Mumbai, it was a expansion of the existing airport, so therefore these are all Brownfield investment.

Similarly, in case of Chennai, Chennai again trying to build a new terminal in the existing airport location, so that is the Brownfield investments. So, we need to be aware of the difference between a Greenfield investment and the Brownfield investment, why because the levels of risk in a Greenfield project is supposed to be not higher as compare to a brown field investment. Why because there are several things that need to be

acquired for the first time if for example, we need to actually several permits, we need to have environmental clearances and so on and so forth.

In a Brownfield projects many of this clearances would have already being obtains, so to that extent and the time taken for getting some of this is going to be lower. Second the kind of big problem today we have a infrastructure projects, which is in terms of land acquisition might not really as big a problem, in the case of the Brownfield investment. Simply because the existing land available alongside the project and may not be any need to acquire a fresh lands. So, in terms of risk Brownfield investments have a lower risk profile as compared to a Greenfield investments.

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Finally, we need recognize that, today infrastructure seen as a separate as assets class. So, what is an assets class, so different really look at investments can be in different types of assets. So, for example, if you look at real estate, you look at stock markets, you can look at bond markets, you can look at timber, we cannot look at commodities, so there are different types of assets classes. And today there is a realization that infrastructure is a emerging as a separate assets class, and why because it is having the following characteristics.

It supposed to be features actually, it has corrected inelastic demand that is even though appraise might increased, the demand for infrastructure product or service might not actually reduce, so much. Because, people see that the essential service for the today life,

and second infrastructures sector supposed to have stable and foreseeable incomes steams. And many of the cases and there is a long-term agreements in a PPA there is a long-term prospects agreement, sometimes you may be able to a predict the traffic in a particular road, for a longer duration.

So, the incomes is not as risky as we seen the conventional sector, it is very stable and unforeseeable. And third is it act as a inflation edge, simply because the revenues are frequently linked with the changers to inflation. So, whenever the inflation increase the toll charges also corresponding device, so it act as an inflation edge. And fourth is that is little co-relation to other asset classes, so that means, it actually helps to diversify be the investment portfolio.

Remember, one of the important thing in finances relationship between risk and return. So, if the risk increases, then the investor should be eligible to get correspondingly higher returns, diversification helps to reduce the risk while maintaining the level of returns, so that is very important to understand. And the infrastructure is essentially help the diversify.

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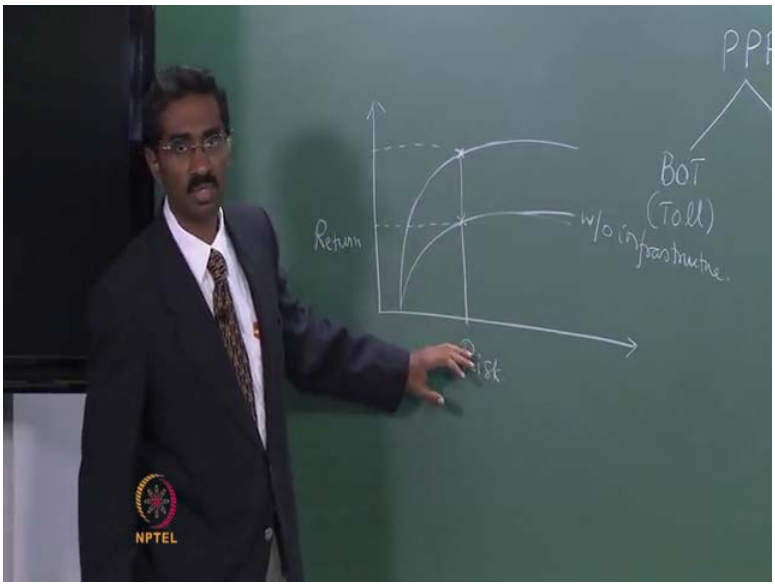

Let us say for example, you talk about let us say the efficiency frontier is there without infrastructure assets, so this is a efficiency of frontier portfolio of assets, for again the level of risk and the return. Now, if you actually have infrastructures in the portfolio and then, it can actually comes something like these. So, what we actually see is at for the

same level of risk, infrastructures might actually give a higher returns, diversifying an infrastructure might actually give a higher level of returns as compare to not having any diversification and infrastructures.

So, people see this has good way of diversifying risk, because of the fact that as little co-relation to the other asset classes, but more recent results that indicated that, it may not really a total a new asset category, but it actually has characteristics that is the hybrid of real estate private equity, and fixed income asset categories. Fixed income asset categories it is like your bonds, and then we are private equity which is actually making high special category of institutions investments in the unlisted infrastructure sectors.

And then we all real estate, which we are all familiar, which is the investing a property, but at the same time infrastructures cannot be consider the subcategory of existing assets classes. So, what we actually sees, it may not actually have an entirely new characteristics, it is a hybrid of real estate bonds fixed income and private equity categories. And at the same time it is really different that it cannot be considered as a subcategory some of the others existing assets classes.

And results it also indicated that having infrastructure in the portfolio investments, increasing the diversification and also reduced you are risk return portfolio, remember this is what I have been talking about. I having infrastructures increases your return, but in the same time reduced is your risk, or for a given level of risk it is increases your return. So, because of all of these infrastructure is emerging as an is a very important assets class with several investors for example, many of pension funds and Australia and Canada are having significant percentages of investment in an infrastructure assets. So, in of the prospects is very clear, there is a lot of investments is needed in infrastructures, and we are going to see is increasing levels of a private sector participation. And investors can also seeing benefits of investment in infrastructure assets, simply because in helps to diversify and helps to improve the risk return profile.

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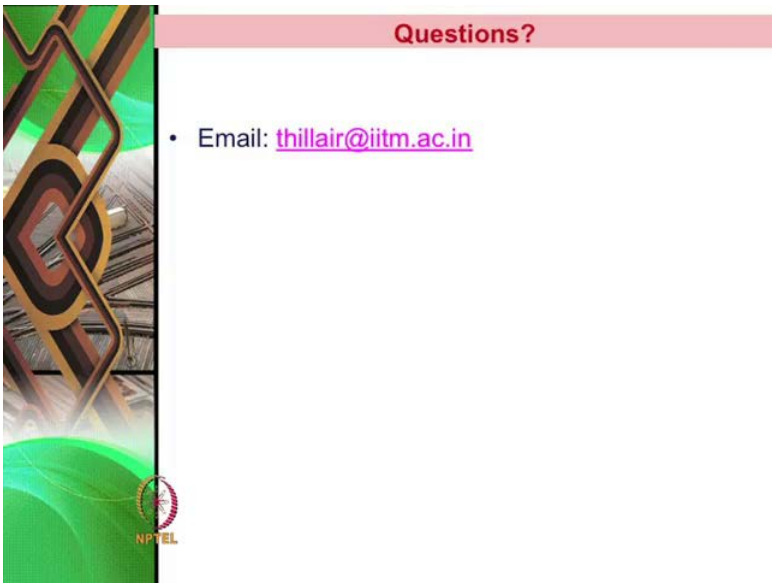

So, with this final thought, I am going to end this lecture and if you have any questions, that is probably not been addressed in this course, feel free to E-mail me at this E-mail address.

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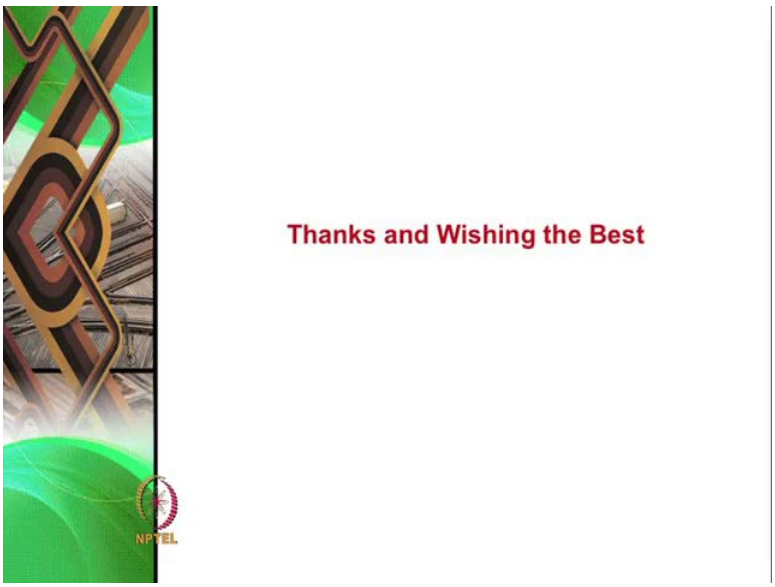

And with these a thank you, and wish you the very best.