Investment Management
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Lecture - 06
Present and Future Values of Investments

Hello there. Welcome back to the second week of the MOOC course Investment Management. In this session, we will discuss about Present and Future Values of Investment.

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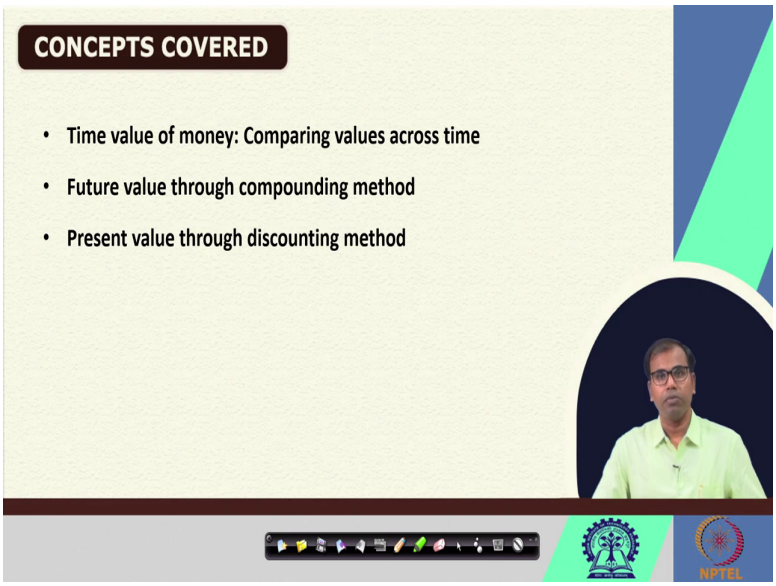

Basically, we are going to talk about the concepts such as the time value of money, where we try to understand comparison between different values of money at different points of time. This is going to be discussed with the help of finding the future value through compounding method and present value through discounting method.

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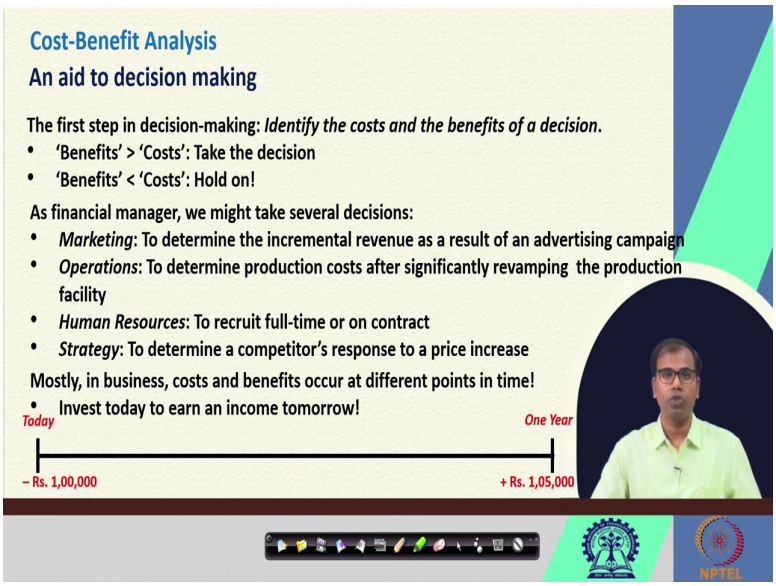

So, as we understand, most of the time investment decisions are undertaken, where some cash flows occur at present time and some other cash flows might incur in future. Basically, as we understand the investment process, we invest in present so that we can reap the benefit in future, which means cash flows might happen at different points of time.

And when we have to make a decision, we need to compare cash flows at different points of time to make a better decision. So, basically it all boils down to cost benefit analysis, where we try to understand what costs, we are going to incur in order to extract the benefits that we are going to take out of the decision.

Whenever the benefits are greater than the cost, we typically go ahead with the decision. And if benefits are less than cost, typically we assume this decision not to be taken, which means if we have to invest X amount of money in today's time and we are hoping that the benefit we

are going to get will be more than X amount of money, then we will invest otherwise we will try to hold on to that decision.

Here, if you look at this point of decision making, you could be acting on behalf of your client or customer as a financial advisor or you might be thinking in terms of your own investment decisions or the choices that you are going to make. If you look for look it from a corporate point of view, in marketing departments we have to.

For example, determine the incremental revenue as a result of an advertising campaign, where the company decides to invest certain amount of money today in the advertisement campaign and hope that the company will generate higher revenue because of this advertisement.

And this higher revenue will be compared with the cost that we are going to incur for the advertisement campaign. In let us say operations department, the company might have to incur significant amount of cost for revamping the production facility or replacing the machine or any other process through which the company expects to generate higher production volume, which will result in higher revenue or reduced cost and that is how the benefits will be compared with the cost of revamping the facility and if the benefits are higher, then definitely the decision is to be taken.

Similarly, in case of human resource decisions, suppose a company has to make a choice between recruiting full time staff or recruiting on contract, then they will have to see what cost they are going to incur when they recruit full time employees and what cost they are going to incur if they are going to recruit contractual employees. And similarly, they will compute the benefits and compare the benefits with the cost and if benefits appear to be higher than the cost, then decision is to be taken.

In case of general management decision, for example, a strategic decision where we have to determine a competitor's response to a price increase, again we will follow similar approach, we will try to understand what benefits we are going to incur and what cost we are going to incur and then we compare both the costs and benefits and if benefits appear to be higher than

the cost, then the we go ahead with the decision otherwise we try to avoid that kind of decision.

When we try to contextualize this cost benefit analysis in investment scenario, usually what happens is we see costs and benefits incurring at different points of time. Let us say for example, we invest today to earn an income tomorrow. If we are investing in stock market today, we hope that we will generate higher dividends, we will generate higher income in future, which means if we invest at this point of time today, let us say 100,000 rupees, we expect that we earn more than 100,000 rupees next period, let us say one year hence.

In one year time, if let us say rate of return on the investment is 5 percent, then we believe that the investment of 1,00,000 rupees today will turn out to be 1,05,000 rupees in one year from today's time and that is how we make comparison between the cash flows at different points of time.

Now, when we try to compare the cash flows of 100000 rupees, that is negative cash flow today and 1,05,000 rupees of positive cash flows one year hence, we cannot compare these two values in absolute because they might have different values because they are incurring at different points of time. In order to make a fair comparison, we typically deploy an approach called time value of money.

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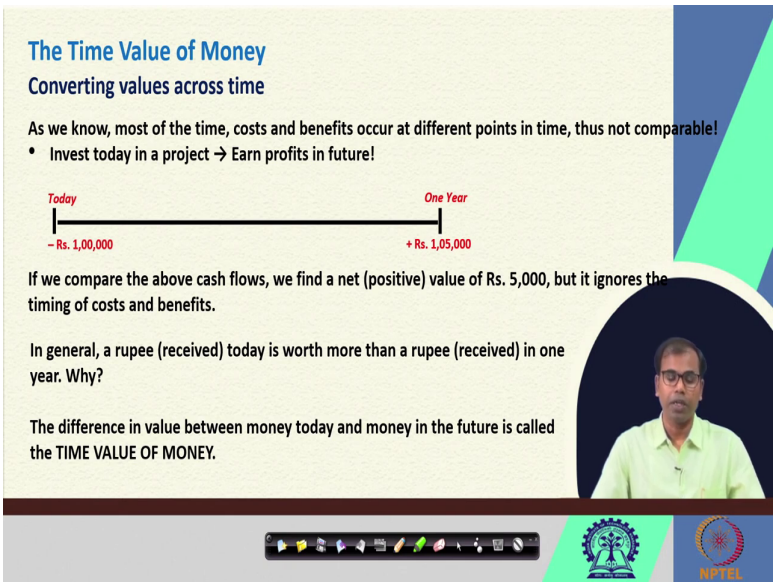

Where we try to convert values of money incurred at different points of time in order to make a fair comparison.

What we typically do is we compare cash flow happening at different points of time using either compounding approach or discounting approach through which we will try to understand the future value of money or present value of money. And then bring all the moneys at common point of time so that we can compare it and make a fair decision. This can be helpful in making decisions such as investment in projects, investment in financial instruments or investment of any sort.

As I highlighted earlier, suppose there is a decision to make about investing 100000 rupees today which is basically a negative cash flow of 100000 rupees and on from one year hence, we assume or we believe that we are going to get 5 percent of return. So, we will earn 105000

rupees, we will have to bring this 105000 rupees one year hence back to today's time. So, that we can compare it with the cost that is 100000 rupees of investment today with the benefits that we are going to generate in future in today's terms so that we can make a fair comparison.

Otherwise, what we will find is we will always have or will rather mostly we will have a positive value coming out to be higher than the initial cost or initial investment. But it does ignore the timing of costs and benefit because remember the cost or the investment that we are incurring today is 10000 rupees, but the benefit that we are going to get in one year hence that is 105000 that will happen after one year and this one year will bring in the scenario several factors that will increase the uncertainties or risk to be precise.

And this concept of finding values of money incurring at different point of time is called time value of money and this concept is also summarized as a rupee today is worth more than a rupee tomorrow, which means if we have to incur certain amount of investment today. And we are expecting to generate certain benefits tomorrow or in future point of time then we will have to bring all the future sums all the future amount of money in today's term and then only we can compare and make a decision.

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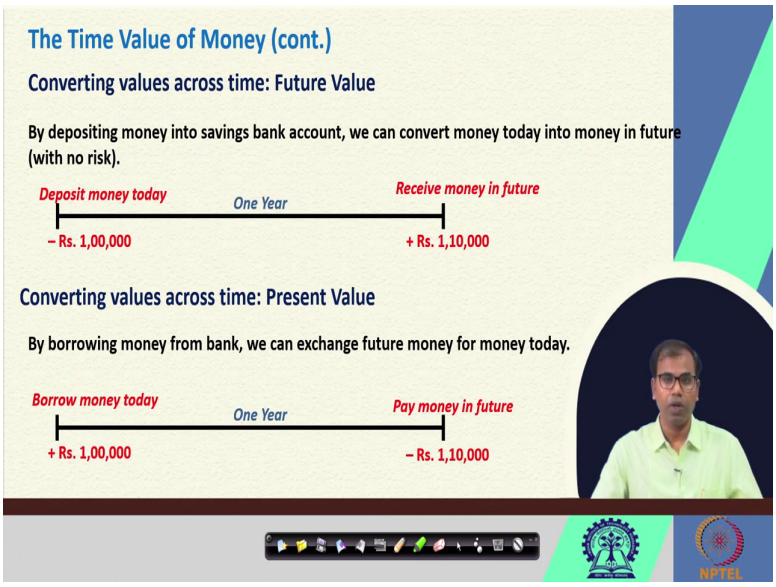

How do we do that let us try to understand. So, first we will try to understand finding the future value of money which means if we are investing today and we hope that this money will be compared with future money and then we will make a decision or after comparing the two money a two values. So, for example, let us say if we deposit some amount of money into a savings bank account we can convert that money deposited today into money that we are going to receive in future.

Let us say if we deposit 100 rupees of sum in a bank savings bank account and we expect to earn 4 percent of return annually then after one year I expect to have 104 rupees from that savings bank account which includes both interest and principal components and this is how we compare.

So, once we have the future value of money calculated then we can make a comparison with the future value that we are expecting to receive and if the investment that we have made in terms of future value is lesser than the benefit or the return that we are going to receive out of that investment in future terms is greater than we can assume that this investment decision is sensible and financially beneficial.

And if we have to do a reverse calculation which is basically bringing all the sums of money to present time so that we can make a comparison in today's terms then we will deploy the method called present value of money or we will also call it discounting approach where we try to bring all the future sums of money in today's time and then make a comparison to take decision.

So, a simple example could be let us assume that we have to borrow money from bank where we have to receive money today in positive cash flows and we have to pay money as negative cash flow in future. So, when we borrow money from bank, we are the recipient of money and one year later if we have to pay money then we have to pay money that is negative cash flow.

So, we have to compare the future money with the present money by bringing those cash flows in in one common point of time and thereby making comparison and subsequently taking a decision.

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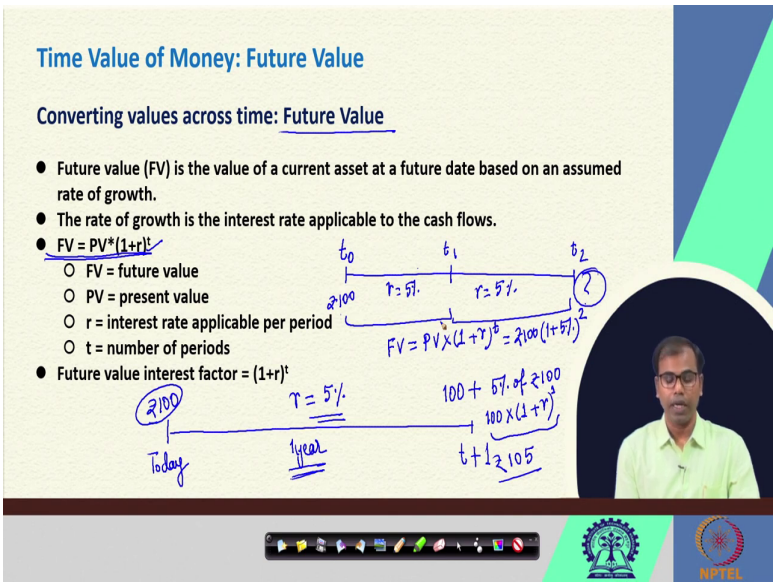

How do we do that? Continuing with that first we have to understand how do we calculate the future value of money as highlighted earlier. So, what typically we do is we try to understand it on the timeline through which we are operating. Let us assume that this is today's time and this is one year hence or future time. So, t plus 1 which essentially implies one year or one period hence.

So, if we have to find the future value. So, let us say if we have 100 rupees to of money today and we are investing in some let us say savings bank account or any other investment where we are expecting to earn a rate of interest of let us say 5 percent which means if we keep holding that money in that savings bank account for one year then we will earn 5 percent of interest and at the end of one year we will have 100 rupees of initial investment plus 5 percent of 100 rupees which is interest component.

So, basically, we will have 100 into 1 plus r and mind it this is for one year. If it is for more than one year then accordingly this component will increase. So, the to find the future value of money we apply a simple formula which is basically formula to calculate the rate of interest added to the principal component. So, here the formula suggest that future value is basically present value into 1 plus rate of interest to the power time.

So, if it is for one period or two period accordingly, we will calculate. So, here as we understand we are going to get a sum of 100 into 1 plus r to the power 1 because this is for one year. So, we get 105. So, this is how we calculate future value. Now, if we believe that this is going to bring a calculation for multiple period then accordingly we will multiply. So, if we say that suppose we have time period t which is t 0 let us say t 1 and t 2 and here rate of interest is going to be same let us say 5 percent for both periods.

So, we know that if we have 100 rupees invested today, we can calculate it for one year and then again for second year. So, we will apply the formula of future value where present value into 1 plus r to the power t or 100 rupees of investment into 1 plus 5 percent to the power 2. And this is how we calculate the future value of money for 2 years.

Here the assumption is we do not take any money out in the meantime which means once we invest 100 rupees today, we are going to get the net amount of return at the end of 2 year only. We are not going to withdraw any money at the end of first year. So, whatever we are going to earn is going to be reinvested and we are going to withdraw all the money at the end of 2 years only.

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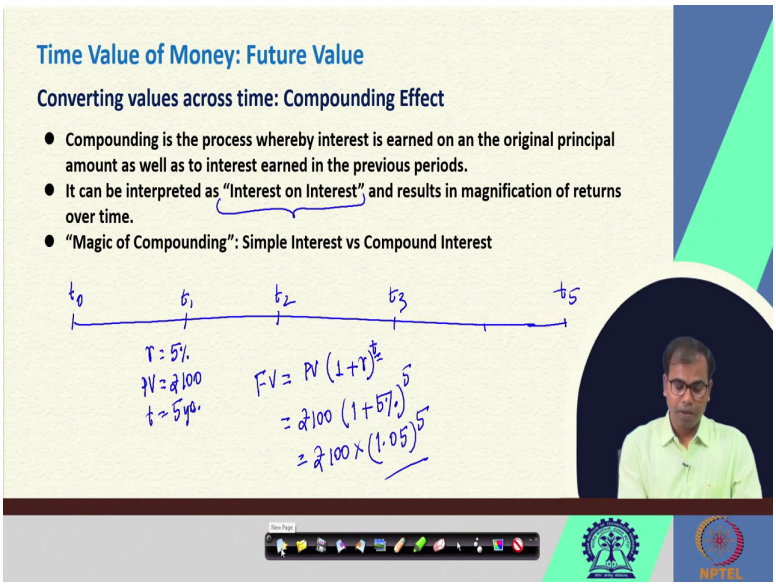

In a similar fashion we can calculate the value of money in present time. So, whatever we discussed right now is basically the approach known as compounding where we can earn interest on interest which means we are not going to take any money out of the investment.

So, you can you can imagine if we have multi-period scenario where t 0, t 1, t 2, t 3, t 4 and let us say t 5 so and for the entire period if r is going to be consistent which is 5 percent and principal amount or present value of money that is going to be invested is 100 rupees.

Let us assume that and time period here is 5 then we can find the future value by applying the same formula present value into 1 plus r to the power t. So, we have 100 rupees of present value and 1 plus 5 percent to the power 5 or 100 into 1.05 to the power 5 and this is how we calculate the present value.

Here in different textbook you might find this t to be indicated as n, but essentially it is the same time component where we have time for which the total value of present total future value of present value of money is to be calculated.

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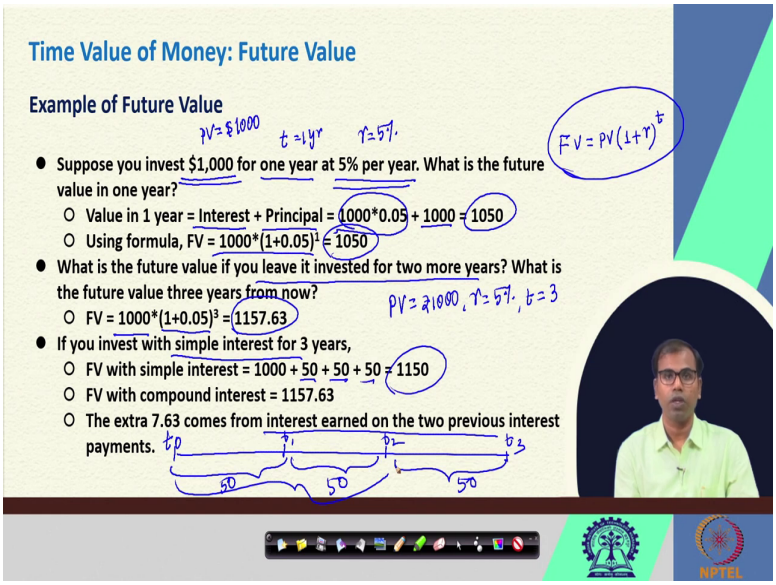

Here are some examples going ahead with the calculation of future value where we know that every time, we have some amount of present value of money and this money is to be invested in instrument of investments such as bonds or any other instrument where you are expected to earn a fixed rate of return in the form of interest. Then you can apply this formula to calculate the future value of money.

Here for example, is let us say an investment is to be made for 1000 dollars 1000 dollars for 1 year and the rate of interest that is going to be earned is 5 percent. So, we can calculate the total value of this 1000 dollar as interest component and principal component. Since interest

component is 5 percent for every year. So, we calculate the interest component as 5 percent and principal component is going to be 1000 dollars. So, total money that is due at the end of 1 year is 1050.

So, if we use the formula here the formula says future value is present value into 1 plus r to the power t where present value is 1000 dollars, t is 1 year and r is 5 percent. So, using this formula we get the future value of this 1000 dollars. If as I was trying to explain if you leave it for 2 more years then present value will be 1000 dollars, r is going to be same 5 percent and t is going to be 3 now. So, if we apply this the same formula we know that 1000 dollars kept for 3 years at the rate of 5 percent is going to be 1157.63 dollars.

If we go back and do the calculation using simple interest we know that in simple interest we do not earn any interest on the interest that we have earned which means if we have simple interest then the calculation would be let us say for 3 years t 0, t 1, t 2 and t 3. So, in case of simple interest what interest we earn here is 50 dollar because of 5 percent then another interest is 50 dollar because again 5 percent for next year and finally, 5 percent for last year. So, what we get is 1150.

So, the extra 7.63 comes from the interest that is earned on the interest that has been reinvested. So, this is the basic philosophy of compounding effect and this is one of the approaches which actually helps investors to earn more and more return, more and more money on their investment.

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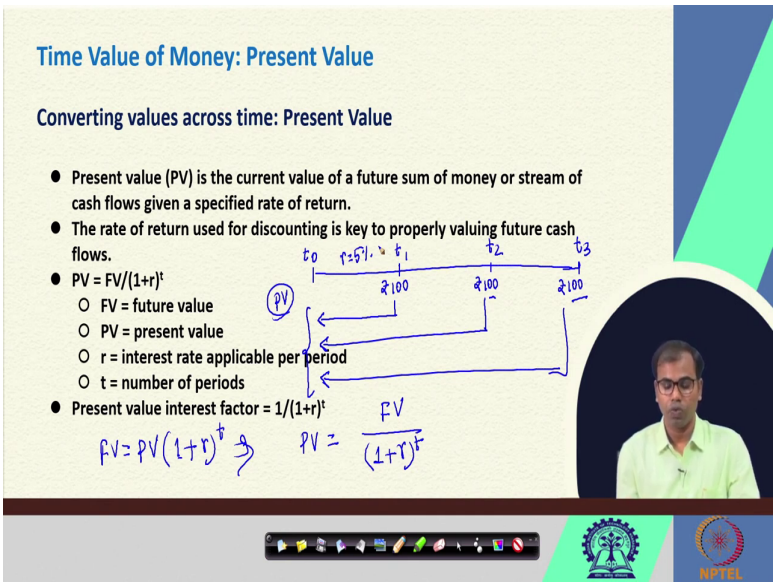

Now, to understand the complete picture let us go back to discuss the present value of money that is incurring that is that is to be received or to be paid in future. So, present value basically is the value of money that is going to be received or to be paid in future. So, essentially it is the current value of a future sum of money or a stream of cash flows at given a specific rate of return.

So, here again we are assuming that the rate of return r is given and we know that in future we are going to get some amount of money or a series of money. So, what we do is we just bring all those future cash flows to the present time to calculate their present value.

So, here the calculation approach will be slightly reversed. Let us say this is t 0, this is t 1, this is t 2 indicating different time period. Suppose you are expecting to receive 100 rupees at the

end of t 1 which is period 1, 100 rupees at the end of t 2 which is period 2 and 100 rupees at the end of period 3.

So, all we have to do is we have to bring all these cash flow to present time so that we know what is the value of these 3 cash flows occurring in future times. We understand that this cash flow is due at the end of first year, this cash flow is due at the end of second year and this cash flow is due at the end of third year. So, we want to know what will be the present value of these 3 cash flows in today's time, in today's terms.

So, the approach is simple if we can use a compounding approach to find the future value, we can use the discounting approach to find the present value which means the present value of any cash flow will be future value of that cash flow divided by 1 plus r to the power t, which means it is just reverse future value formula was present value into 1 plus r to the power t, here this is reverse to present value as the future value divided by 1 plus r to the power 2.

So, all we have to do is just take the future value, assume or given discount rate let us 5 percent or so and time period for which it is being brought back to the current time.

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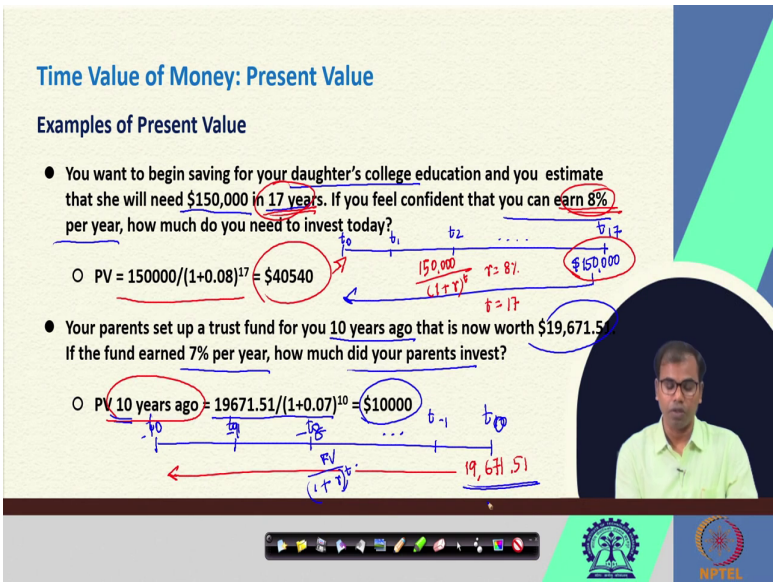

If you look at some example here, suppose an old person is saving for his daughter's college education and approaches you for some advice and you estimate that the education will require 150,000 dollars in 17 years which means after 17 years the money that is required is 150,000 and it is also given that you can earn 8 percent per year as the rate of interest.

So, all we have to do is we have to just bring that cash flow again t 0, t 1, t 2, let us believe that t 17 and in t 17 you require 150,000 dollars of investment of money. So, all you have to do is you have to find the present value of this 150,000 dollars in today's context. So, what we can do is we can just use 150,000 dollars divided by 1 plus r to the power t where r is 8 percent and t is 17 years.

So, we use this calculation and find that in today's term the person needs to save or invest 40,550 dollars today. So, that earning 8 percent of return for next 17 years the person will have 150,000 dollars at the end of 17 years for the college education.

In a similar fashion we can see, suppose there is a trust fund which was invested where some money was invested 10 years ago is now worth of 19,671.51 and the fund has earned 7 percent per year. So, what was the initial investment that was invested in that fund? We again go by the same argument this is t 0 that is today's time t 1, t 2 and let us say t 10. So, it is known that in t 10 the value of the fund is 19,671.51 and we have to find the present value today essentially it was to be calculated 10 years ago.

So, if we just modify this we know that this is going to be 0 and then this is minus 9 minus 8. So, t 0, t minus 1, t minus 2, t minus 3, 4, 5, 6, 7, 8, 9 and t minus 10. So, you need to find 10 years ago. So, you use the same approach, future value divided by 1 plus r to the power n or t and this is how you calculate the present value of that fund. So, essentially the calculation is leading us to believe that 10 years ago an investment of 10,000 dollar was made that has today become 19,671.51 dollars.

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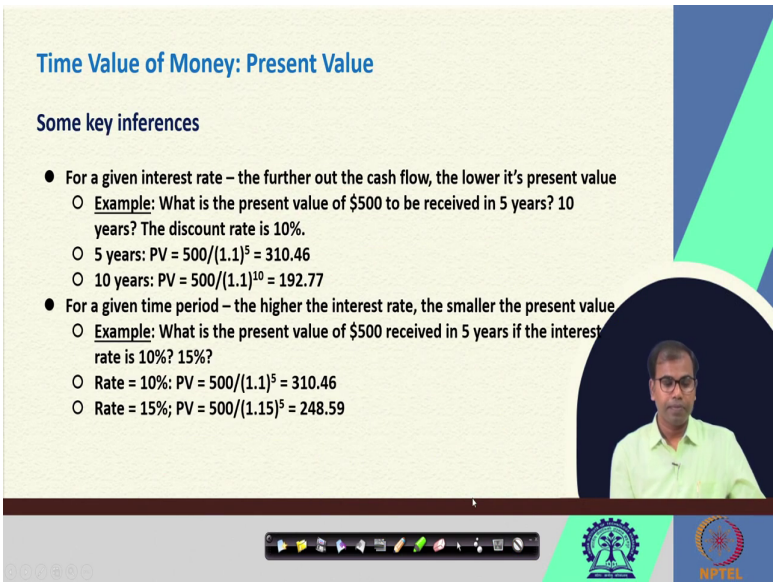

There are some further examples. So, as I was highlighting that it is the impact when we talk about future value it is the impact of compounding interest when it is about present value. Essentially it is about the discounting approach where we bring all the cash flows happening in future to the present time so that we can make a fair comparison.

Otherwise, the we cannot compare 100 rupees in 2022 and 150 rupees in 2025 as such. So, we need to find the value of 150 rupees that is going to be received in 2025 in terms of the value in 2022 and then only we can make a comparison to make a decision.

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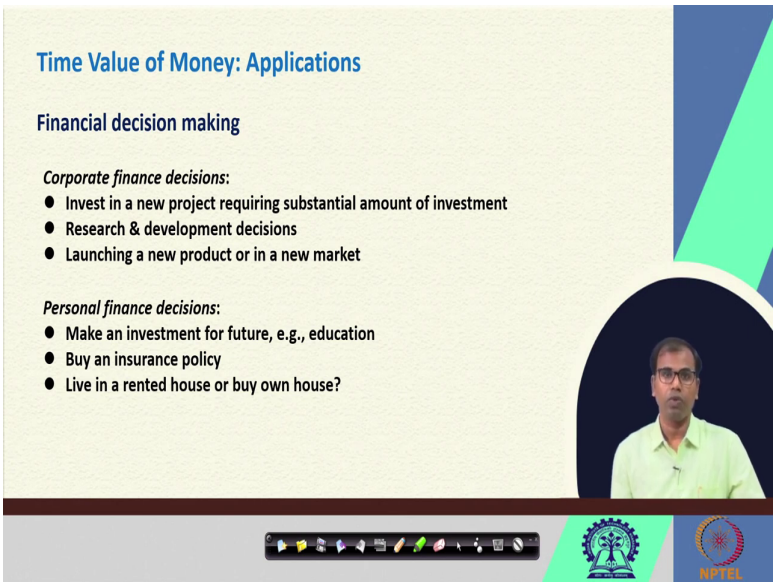

As pointed out earlier this helps in decision making particularly in corporate finance where we need to make decision about investment in projects which requires substantial amount of investment. Companies also need to invest a lot of money in R and D where the money has to be invested so that they can reap the benefit in future.

So, whether they have to compare what benefit they are going to receive as a result of investment in today's R and D. Whenever it comes to launching a new product companies again have to make decision about investing today so that they can reap benefits in future.

Since we are talking about investment management it has several implications for personal finance decisions where we can make we need to make an investment for future. For example our education buying a house, buying a vehicle, going for vacation, abroad, buy an insurance

policy, where we have to invest today in a series of cash flows and eventually we hope that we will get some coverage through the insurance policy.

At simple decisions such as living in a rented house or buy our own house would also be evaluated using this present value and future value concepts.

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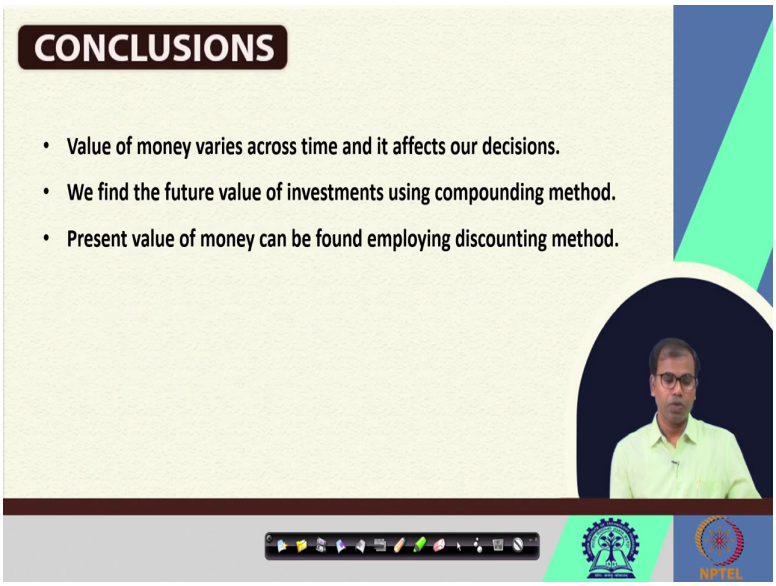

And to just to sum up we discussed in this session about the concept of time value of money which essentially highlights that the value of money across different times vary and our decisions are impacted based on the value that we calculate using a future value calculation approach or present value calculation approach also known as compounding approach and discounting approach.

Where we try to understand the future value of money using compounding method and we try to derive the present value of money using discounting method. That is all for now.

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Thank you very much.