Management of Fixed Income Securities
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Lecture - 50
Bond Investment Strategies - V

So, in the previous class we have discussed about the passive bond strategy there we discussed about the concept of the bond indexing and as well as the cell matching strategy then as well as the cash flow matching strategy.

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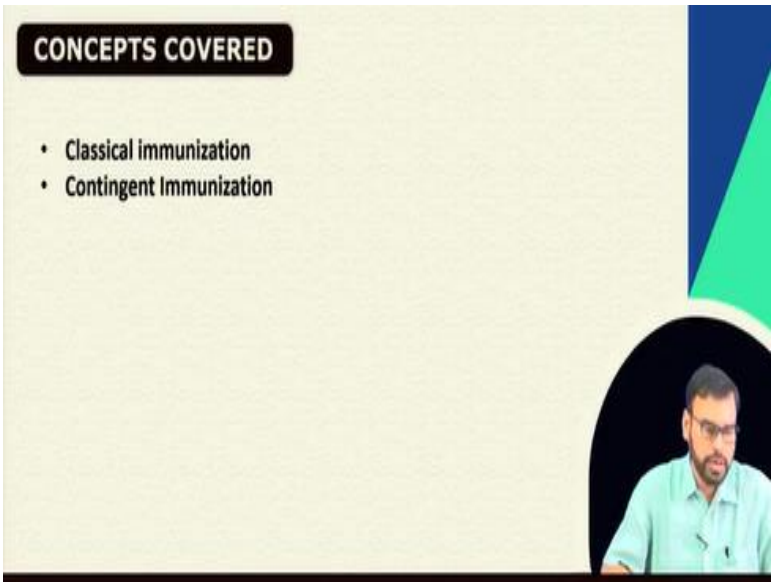

Then today we will be discussing about the concept of the classical immunization that is also another type of strategy. Then we have the contingent immunization. So, these are the two things what we will be discussing. These are a part of the passive and as well as active part that's why we call them the hybrid strategy. Immunization is a part of the passive strategy but the contingent immunization is a part of the hybrid strategy.

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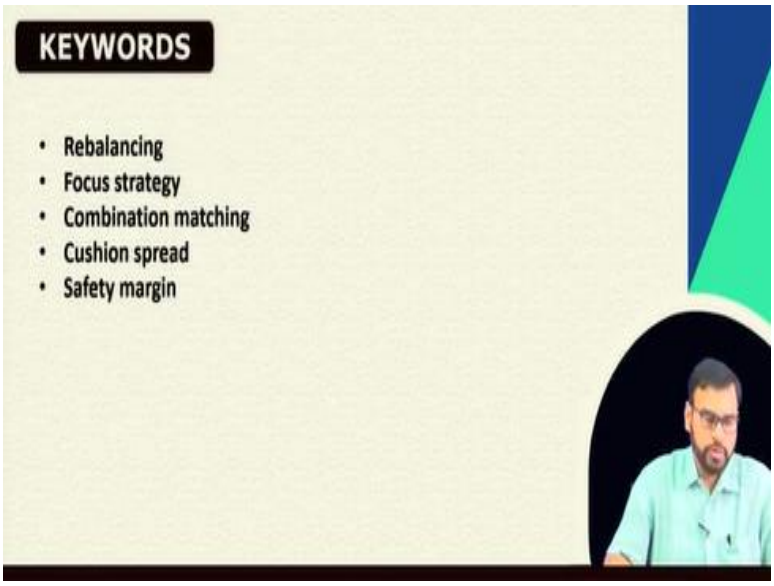

So, you will come across certain keywords like rebalancing, focus strategy, combination matching, cushion spread, safety margin all kinds of keywords generally will come across while discussing about these issues or these topics.

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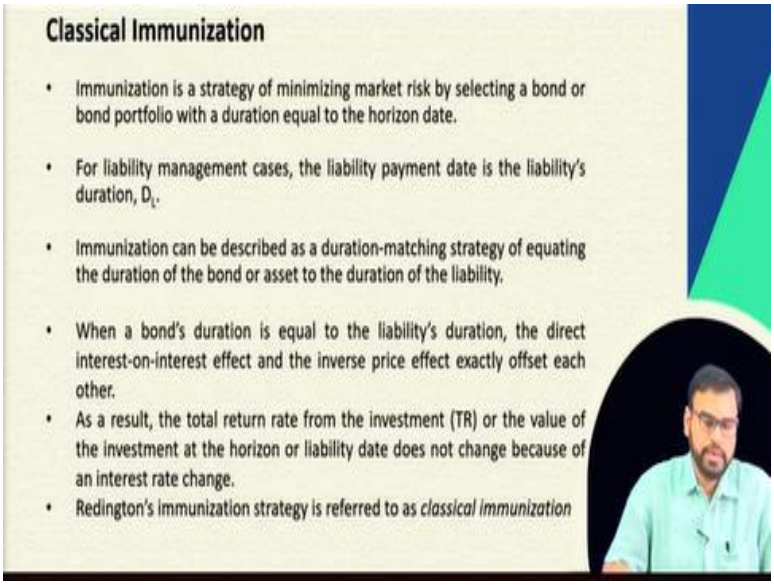

So, let us first understand what exactly the classical immunization is all about. Already if you recall we have discussed about the concept of the interest rate risk. So, there what we have discussed there are two types of risk or there are two components of the interest rate risk, one is price risk other one is the reinvestment risk. So, depending upon that which risk is dominating other one.

So, if there is a change in interest rate accordingly the total return will be getting changed. So, immunization basically a kind of strategy which basically minimizes this market risk or the interest rate risk by selecting a bond or a bond portfolio with a duration which is equal to the horizon date. The duration of the bond and the investment horizon period of that particular investor should be same.

For the liability management case the liability payment date is the liability's duration that is your D_L. And immunization also can be described as a duration matching strategy you keep in the mind that is also called a duration matching strategy which basically equates the duration of the bond or asset to the duration of the liabilities your $D_B=D_L$ duration of the bond is equal to duration of the asset is equal to the duration of the liability.

So, when the bond's duration is equal to the liability's duration the direct interest on interest effect and the inverse price effect exactly offset each other. What does it mean? If there is interest rate will increase it will have a direct interest on interest effect because the interest income will be better the coupon can be reinvested at a better rate. And it will have an inverse impact on the price because if interest rate will increase the price will go down, the price of the bond will go down.

But if the bond's duration is equal to the liability' duration, then what will happen that exactly the two effects will offset each other. So, that's why will not basically find any kind of total return differences for from that particular bond. So, that's why the total return from the investment or the value of the investment or the horizon date does not change because of the interest rate changes. This concept was given by the scholar Redington.

So, that's why generally we call it the Redington's immunization strategy and popularly it is known as the classical immunization.

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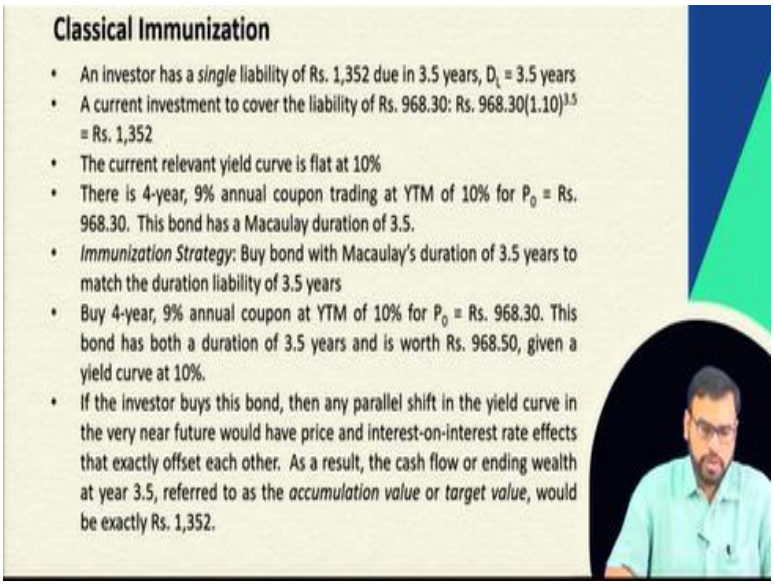

So, let us take one example how this classical immunization basically works. Let the investor has a liability of Rs.1352 which is in due in 3.5 years that means D_L =3.5 years. So, that's why to get this, 1352 in 3.5 years how much money the investor should invest now how we can get it. Exactly if you find that your 968.30 into 1.1 to the power 3.5 that is 1352.And here we are why we are talking about 1.1 because we are assuming that the interest rate in the market is 10%.

So, that's why the investor has to cover the liability of 968.30 to cover of that total liability that is 1352 that means he said he has to invest 968.30.So, let there is a four years maturity bond coupon rate is 9% yield to measure it is 10% then for that one we find the price of the bond is 968.30 and the bond has duration of 3.5 so, then how the immunization strategy will work here.So, by the bond whose duration is 3.5 years to match the duration of the liability that already you know that that is 3.5 years.

Because after 3.5 years you need this 1352 rupees. So, in that case what you can do by the four years 9% coupon at YTM of 10% and the price will be 968.30 and this bond has both duration of 3.5 years and is worth is 968.3 which basically given the yield curve off of the 10% real curve is 10%.So, if the investor buys this bond, then any parallel shift in the yield curve in the very near future will definitely have an interest on interest effects.

And also, there is impact on the price. But if there is a change if you are holding this kind of bond then the price and interest rate effects will exactly offset each other. So, in that case the

cash flow or the ending wealth after the 3.5 years that generally we call it the accumulation value or the target value that would be exactly equal to 1352.Then how basically this happens?

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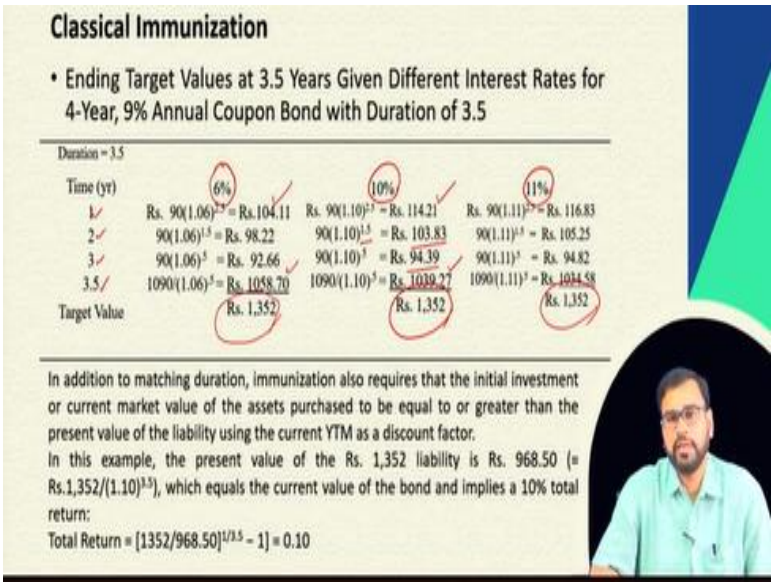

Let us see this particular thing in this particular calculation. Here your ending target value at 3.5 years will be 1352.And your maturity period of the bond is four years coupon is 9% and duration already we know that for this bond is 3.5 years. So, the duration is 3.5 let we have taken this different period that is let 1, 2, 3 and 3.5.So, then these are the different interested scenario here it is 10% it can increase up to 11% it can also decline up to 6%.

So, whenever the interest rate becomes flat it is remains same at 10%, then what is the ending value of the bond? The ending value of the bond will be your 90 into 1.12 to the power 2.5. 90 rupees you got and you have reinvested it for 2.5 years you got 114.21 then next 90 rupees you got you can discount it for 1.5years you got this, then again 0.5yearsyou got this, then end of the year basically you got this.

Then the total value basically you are getting 1352.So, even if the interest rate has come down to 6% if you look at the cash flow 90 to 1.06 to the power 2.5, 104.11 and so on. In the end you got 1058.70 that also if you add up it will be approximately equal to 1352.And in the 11% case also it will be 1352.So, in this case whenever we are going for this matching this duration between your liability period and as well as the bonds duration.

It also requires that the initial investment or the current market value of the asset purchases to be equal or to greater than the present value of the liability using the current YTM as a discount factor.So, in this case the present value of 1352 liability is 968.30.And which generally equals the current value of the bond and implies a 10% total return that means your 1352 divided by 968.30 to the power 1 by 3.5-1 that will be 10%.So, that condition also you have to keep in the mind.

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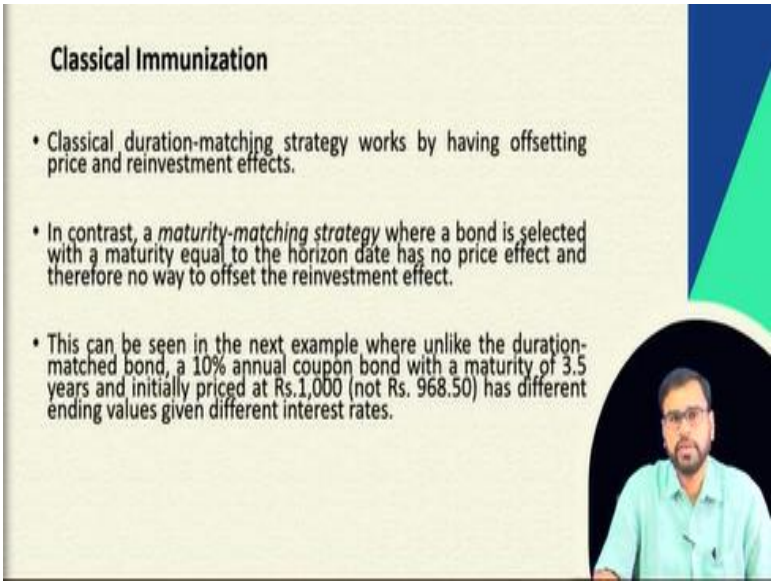

Then let us see that if instead of going for the duration matching if you go for your maturity matching is there any differences. So, here what we have seen that the classical duration matching strategy generally works by having offsetting the price and the reinvestment effects. But in contrast the maturity matching strategy where the bond is selected with a maturity which is equal to the horizon date has no price effect and therefore no way of the offsetting the investment effect.

Basic price effect and investment effect basically do not offset. So, in this case if you see the next example what we are going to see in this particular context how you will find that the differences also exist in that particular case.

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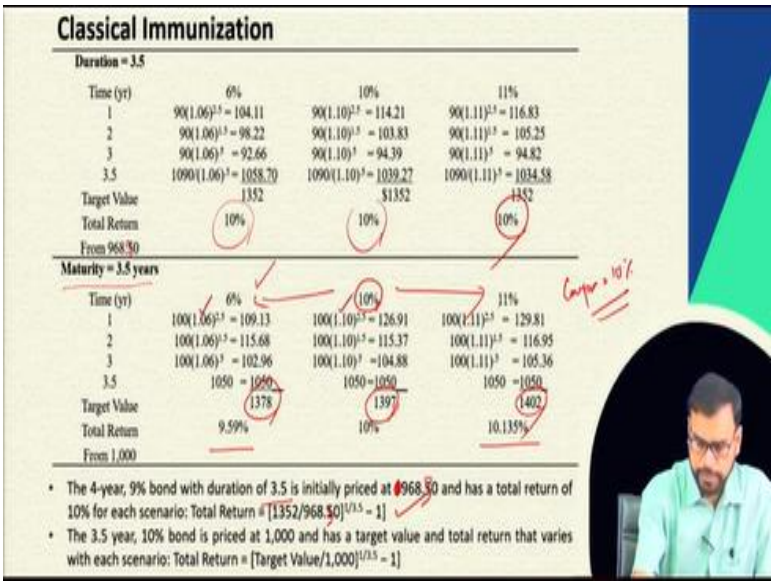

Let us see this how basically it works. Let in the first case already we have discussed just now in every cases your total return you are getting 10%.So, here everywhere it is 968.30 only, you keep that thing in the mind. But if you are holding a bond which maturity period is 3.5 years then what will happen.

In this case let all the scenarios if you are considering it was 10% going back to 6% or going up to 11%.Then if you see that, that how the total returns of these particular bonds are basically changing. So, here if you observe that in this case this is a first case this is a 4 year bond 9% coupon and duration is 3.5 which was initially priced at 968.30 and at a total return of 10% in each scenario. That already we have explained it.

Second case if you see, you are holding a bond which maturity period is 3.5 years and your face value of the bond is 1000.So, in that case what basically you can observe that every cases let the bonds coupon rate is 10% in that particular case then every cases you will find that your total values or accumulated value is changing. So, if the interest rate is declining up to 6% you will find the total return is 9.59.

If it is increasing to 11% it is total return becoming 10.135%, why basically this thing is happening? This thing is happening it is because that one particular effect is dominating the other effect. There are two effects price effect and the reinvestment effect. So, in this case if you observe that one effect is basically dominating the other effect. So, because of this, this return difference is coming across this different type of interest rate scenario.

Whenever this interest rate is going down because of the price effect the price of the bond is increasing. But in that particular case the reinvestment rate is going down so that's why the depending upon which effect is dominating you can find the total return accordingly. And here also because the 10% bond this is a 3.5 years maturity, coupon is basically 10%, we are considering and these are the basically the discount rates the 6%, 10%, 11% these are the discount rate.

So, the 3.5 year 10% bond which is priced at1000 has a target value and total return that varies which in each scenario and the total return is already you know how it is calculated this is the target value divided by your price of the bond.That is here in this case it is 1000 to the power 1 by 3.5-1.

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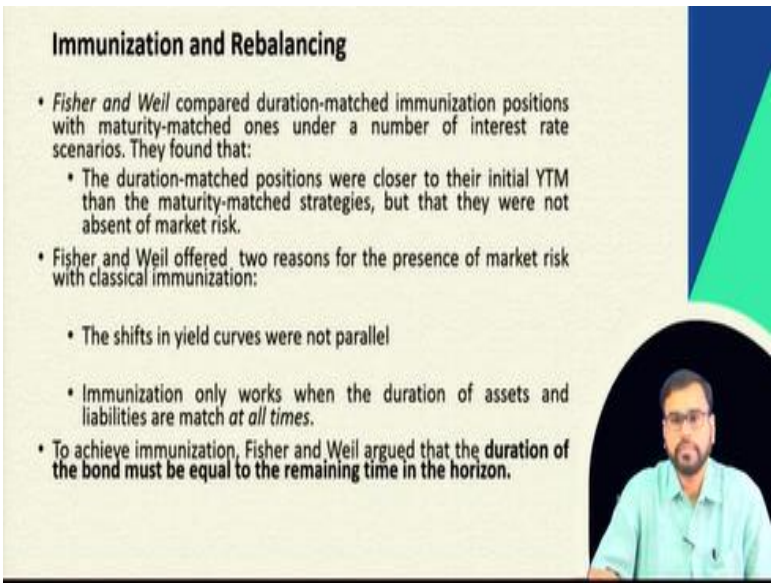

So, then what we have observed in this case that if you are going for a particular kind of strategy where your duration is or the total horizon period is matching with the term to maturity that is not going to basically reduce this market risk for the investors. After this the fisher and weil there are two authors, they have compared the duration matching immunization positions with the maturity matching positions under a number of interest rate scenarios.

And what is the findings they got they find the duration matched positions were closer to their initial YTM than the maturity match strategy. But they are not completely absent, there is still a market risk involved in that particular case. And why basically there is a market risk involved in

that case? According to Fisher and Weil the shift in the yield curve is not always parallel and immunization only works when the duration of assets and liabilities are matched all the time.

But that also may not same. So, to achieve this immunization they have argued that the duration of the bond must be equal to the remaining time in the horizon. The duration of the bond must be equal to the remaining time of the horizon instead of talking about the duration of the bond should be equal to the duration of the total liabilities. That is what the concept the Fisher and Weil has given.

So, that is why that concept is popularly we discussed immunization and rebalancing. So, then you have to rebalance this particular calculation or rebalance this particular portfolio.

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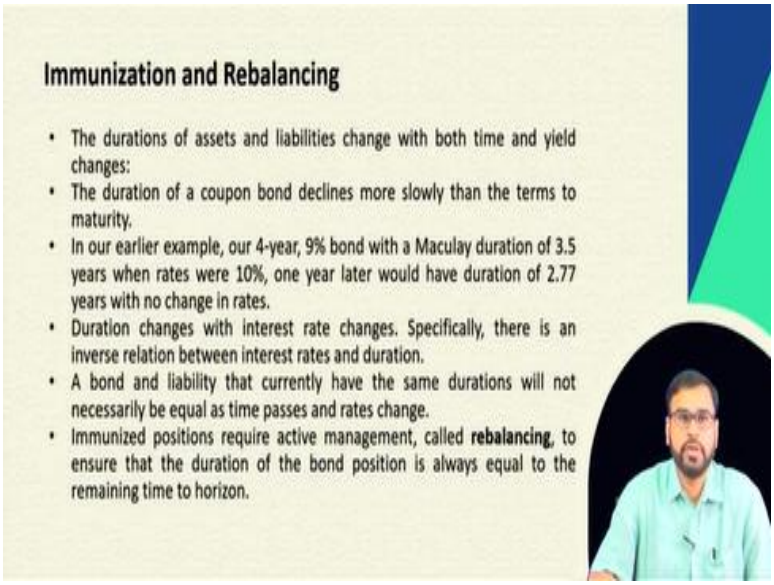

So, how this immunization rebalancing works? So, the duration of assets and liabilities change with both time and yield changes. But already we have discussed this part the duration of a coupon bond declines more slowly than the term to maturity. For example, if you see in our previous example whatever we have taken if there is a 4 year 9% bond where the Maculay duration is 3.5 years.

When the rates were 10%, one year later if there is no interest rate change then your duration will come down to 2.77.So, whenever it was 4 years duration was 3.5 years but for remaining 3 years the duration become 2.77 years. So, that's why the duration is changing more slowly than the

maturity. Duration also changes with interested changes. Specifically, there is an inverse relationship between interest rates and the duration.

There is an inverse relationship between the interest rates and duration that already we discussed whenever we discussed about the properties of the duration and all. So, a bond and a liability that currently have the same duration will not necessarily be equal as time passes and the interest rate change. So, one thing is the duration basically declines more slowly and there is an inverse relationship between duration and the interest rate.

So, in that case a bond and the liability that currently have the same duration will not necessarily be equal as time passes and the interest rate change. So, therefore the immunized positions require the active management frequent changing. So, that's why the immunization and rebalancing that is a part of the hybrid strategy. Some part is basically passive and some part is basically active. So, that process is basically called the rebalancing.

To ensure that the duration of the bond position is always equal to remaining time to the horizon. So, instead of talking about the total liability equal to the total duration of the bond we should always ensure that the duration of the bond position is always equal to the remaining time to the horizon. That is called immunization with rebalancing because of certain limitations with the classical immunization this particular concept was established.

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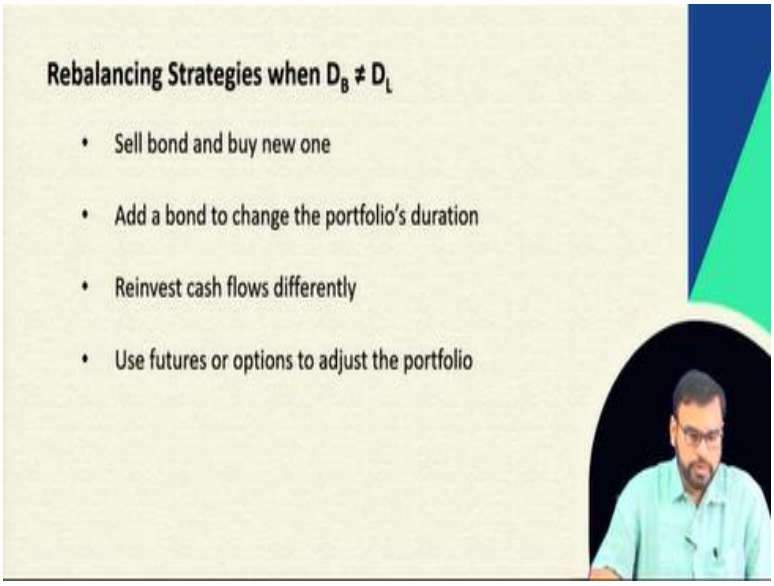

So, then how to make this rebalancing strategy when the duration of the bond is not equal to the duration of the liabilities? What kind of strategy you can adopt? Sell the bond; buy a new one how you can match them. So, that bond may not be an ideal candidate whatever you are holding to fulfil those particular conditions. So, that's why you can sell the bond, buy a new one or add a bond to change the portfolio duration which can satisfy these conditions.

Or reinvest this cash flows differently whatever periodic cash flows you are receiving that you can reinvest in the market with a different rates or you can use the derivatives like futures and options to adjust this portfolio. So, either of these different approaches or different strategies you can adopt whenever this kind of rebalancing is required or whenever the duration of the bond is not equal to the duration of the liabilities.

That is what basically what we can see whenever we are talking about the immunization with the rebalancing.

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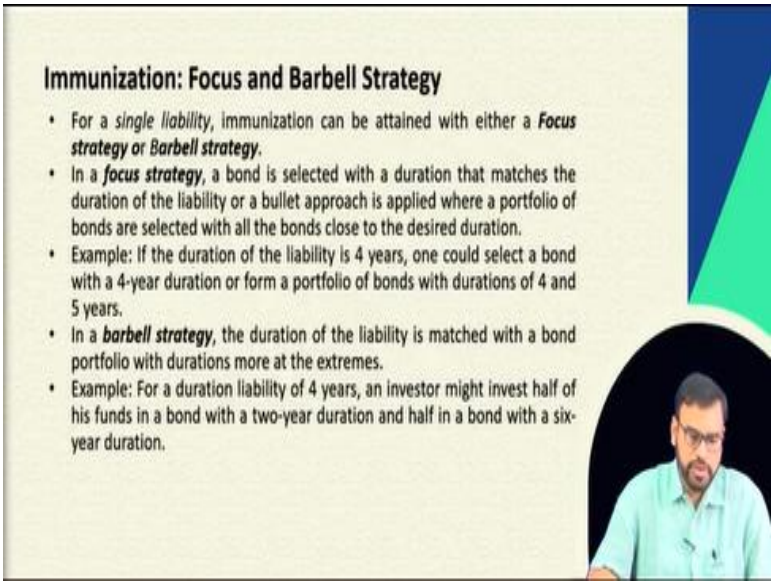

So, then the question here is that if you are going for an immunization. Let us see that let you assume that is a single liability. If there is a single liability then immunization can be attained with either a focused strategy or a barbell strategy. Immunization can be achieved or attained with a focused strategy or a barbell strategy. Then what do you mean by this focus strategy? In a focused strategy the bond is selected with duration that matches the duration of liabilities.

In a focused strategy a particular bond is selected with a duration that matches the duration of liability or a bullet approach is applied when a portfolio of the bonds are selected with all the bonds which are close to their desired duration. Because you know that in the bullet strategy, we generally hold these particular bonds with a specific maturity. Depending upon the economic scenario or depending upon the forecasting of the interest rate.

So, where basically we can accumulate that particular bonds that will be decided on the basis of the bullet strategy? So, if the duration of the liability is four years for example one could select a bond with a four years duration or form a portfolio of the bonds with the duration of the four and five years. If you are going for a single bond then you always go for selecting a bond with 4 years duration but if you are constructing or you want to hold a portfolio of the bonds, then always you can think of the portfolio of the bonds with duration of the 4 years and the 5 years. But if you are going for a barbell strategy the duration of the liability is matched with a bond portfolio with durations more than the extremes. That means for a duration liability of the 4 years the investor might invest half of his funds in a bond with a two years duration and half of the bonds with a six years duration.

Barbell strategy; already all of you know that we are basically dividing these particular bonds into the different maturity pockets. So, if your duration liabilities of 4 years then the investor can invest half of his funds with a bond with a two years duration and half of its particular bonds in a 6 year duration. So, on an average the total duration of the portfolio will be 4 years or the average duration of the particular bond portfolio will be 4 years.

So, either they can go for a focus strategy or they can go for a bullet strategy or they can go for a barbell strategy. So, bullet strategy and barbell strategy that largely we have discussed in the previous class and that particular strategy was a part of the active management and here whenever you are going for the immunization that concept also can be brought into this particular picture or this particular analysis.

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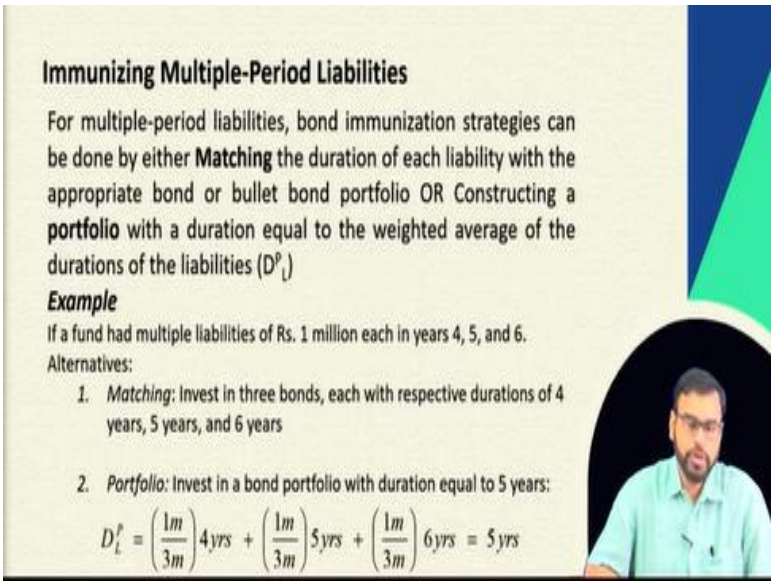

So, if you are immunizing a multiple period liability, then how you do that? So, for multiple period liabilities the bond immunization strategies can be done either matching the duration of each liability with the appropriate bond or bullet bond portfolio or constructing a portfolio with a duration equal to the weighted average of the duration of the liabilities. Three ways match the duration of each liability with the appropriate bond.

Or you can construct a portfolio using the bullet strategy or you can construct a portfolio with a duration which will be equal to the weighted average of the duration of the liabilities of that particular bond. For example, if a fund has multiple liabilities that one million each in your 4, 5 and 6.Then what are the alternatives? If you are going to match this duration of assets with duration of liabilities.

Then invest in all these three bonds each with respective duration of the four years, five years and six years. But if you are constructing a portfolio then invest in a bond portfolio with duration equal to the five years. That means your duration of the portfolio will be your total investment will be three million in three different periods 1 million +1 million +1 million.

$$D_L^P = \left(\frac{1m}{3m}\right)4yrs + \left(\frac{1m}{3m}\right)5yrs + \left(\frac{1m}{3m}\right)6yrs = 5yrs$$

.So, you can either go for a different bonds with the different durations or which perfectly match with that periods liability with that duration of the bond or you can go for a portfolio which is basically is perfectly matching with the total duration of that particular liability which is nothing but the weighted average of the duration of the liabilities.

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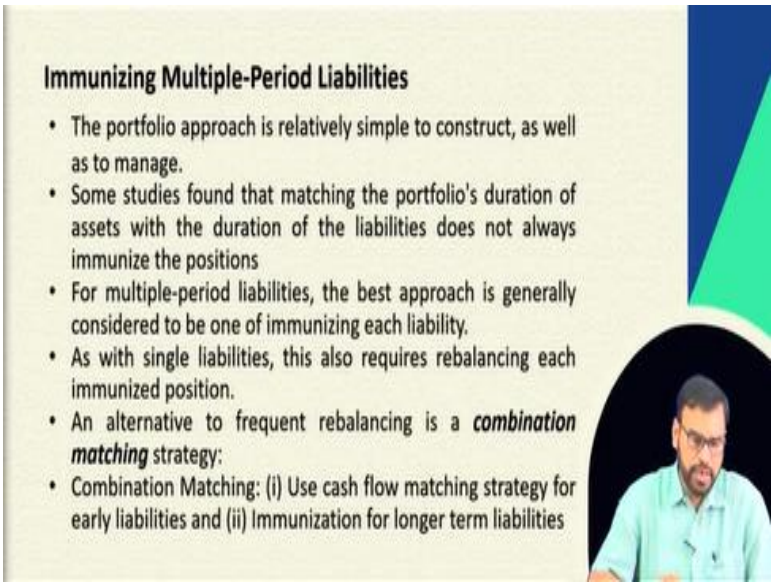

So, then here the portfolio approach is relatively simple and also easy to manage and some studies found that matching the portfolio duration of assets with the duration of liabilities does not always immunize these positions. So, for multiple period liabilities the best approach is generally considered to be one of the immunizing each liability, the first alternative what they are talking about.

So, with single liabilities this also requires rebalancing each immunized positions and an alternative to the frequent rebalancing is the combination matching strategy. So, what is combination matching? Use cash flow matching strategy for each liability and immunization for the longer term liabilities. Use the cash flow matching strategy for each liability what already we have discussed and immunization for the longer term liabilities.

Then we have another approach called the contingent immunization. The contingent immunization is an enhanced approach immunization strategy basically which combines the active management to achieve the higher returns and the immunization strategies to ensure the

floor the minimum one. So, here the let the client of an investment management fund with a specified horizon agrees to accept a potential return below on immunized total return.

So, the low potential return generally is referred to as the target rate and the difference between the immunized market rate and the target rate generally called the cushion spread. So, the acceptance of a lower target rate means that the client is willing to take the horizon target value which is known as the minimum target value and generally it is lower than the fully immunized value.So, that means one part is sure another part is basically they are taking certain risk and are taking basically the active positions to get some better return.

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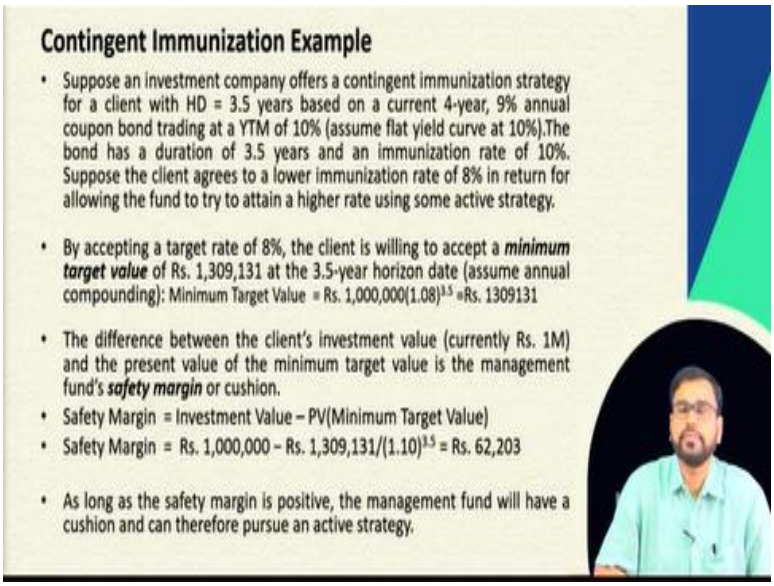

And how basically it works? Suppose the investment company offers a contingent immunization strategy for a client who the horizon period is 3.5 years based on the current four years bond9% annual coupon which is trading at yield to maturity of 10%.So, the bond has a duration of 3.5 years let the immunization rate total return they are expecting that is 10%.But suppose the client agrees to lower immunization rate of 8%.

In return for allowing the fund to try to attend a higher rate using some active strategy.He has allowed the fund manager to do that. So, then by accepting a target rate of 8% the client is willing to accept a minimum target value that can be calculated as :

$Rs1000000(1.08)^{3.5}=$ Rs1309131

So, the difference between the client's investment value which is one million and the present value of the minimum target value of the management fund that is called the safety margin or the cushion.

Safety margin= Rs100000- 1309131/$(1.10)^{3.5}$= Rs62,203

So, that is the safety margin what the fund manager has. So, as long as the safety margin is positive the management fund will have a cushion and therefore pursue an active strategy. So, they are a free hand to go for some active strategy.

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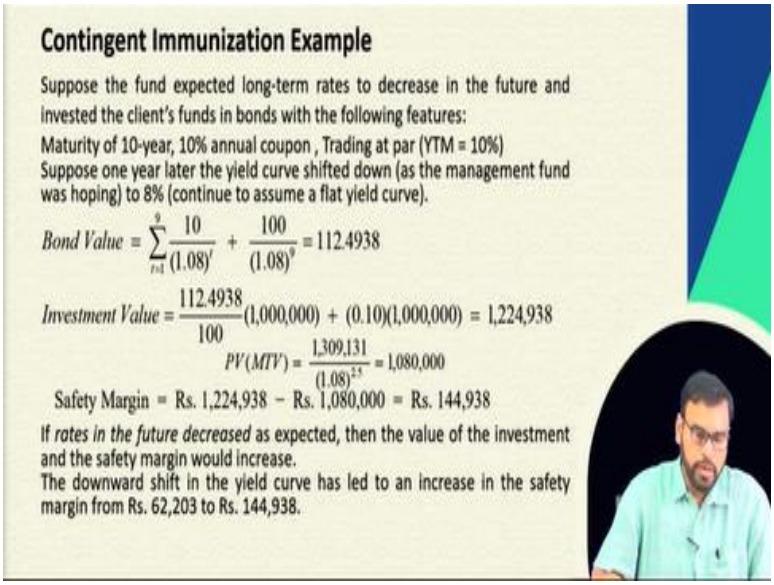

Suppose the long term interest rate to decrease in the future and investment the client funds is in the bonds with following features. Let maturity 10 years coupon become 10% bond is trading at par suppose one year later the yield curve shifted down to 8% then,

Bondvalue= $\sum_{t=1}^{9} \frac{10}{(1.08)^t} + \frac{100}{(1.08)^9} = 112.4938$

Investment value= $\frac{112.4938}{100}(1000000) + (0.10) + (1000000) = 1224938$

PV(MIV)= $\frac{1309131}{1.08^{2.5}} = 1080000$

Safety margin= RS1224938-Rs 1080000= Rs. 144938

So, if the rates in future decreased as expected then the value of the investment and safety margin would increase. And the downward shift in the yield curve has led to one increase in the safety margin from 62203 to 144938.But the reverse thing will happen then obviously the safety margin will go down.

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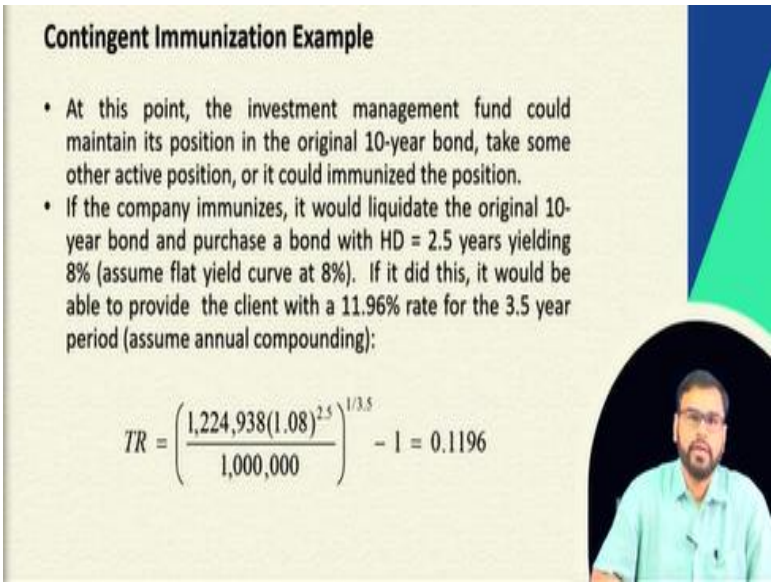

So, at this point the investment management fund could maintain its position in its original 10 year bond takes some other active positions or it could immunize that particular position.If the company going for immunization, then it would liquidate the original 10 years bond and purchase a bond with horizon period 2.5 years which will be yielding 8% and if you did this then it would be able to provide the client 11.96% rate for the 3.5 years period.

$TR= \left(\frac{1224938\ (1.08)^{25}}{1000000}\right)^{1/3.5} -1 = 0.1196$

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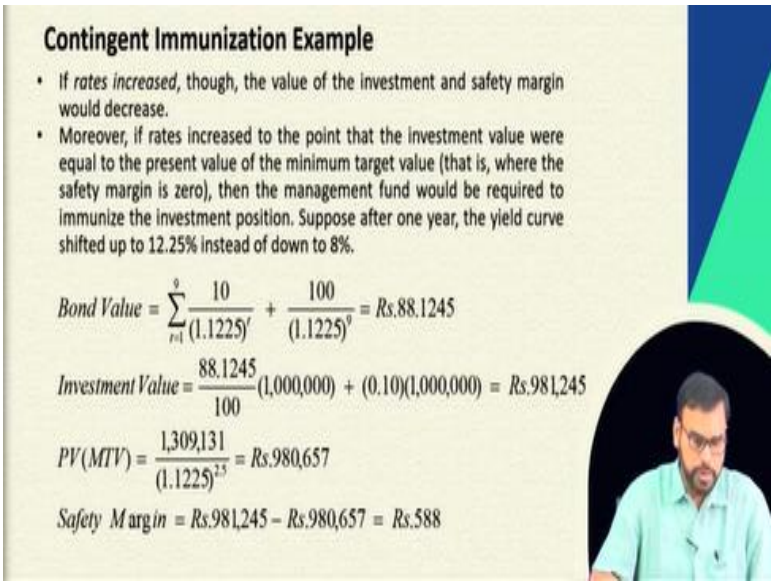

Bond value= $\sum_{t=1}^{9} \frac{10}{(1.1225)^t} + \frac{100}{(1.1225)^9} = Rs88.1245$

Investment value= $\frac{88.1245}{100}(1000000) + (0.10) + (1000000) = Rs\ 981245$

PV(MIV)= $\frac{1309131}{(1.1225)^{2.5}} = Rs980657$

Safety margin= RS981245-Rs 980657= Rs.588

So, if the rates will increase then you will find that the safety margin will come down to 588.Here, we have assumed that this interest rate has increased from 10% to 12.25% so, in this case the safety margin has come down to 588.

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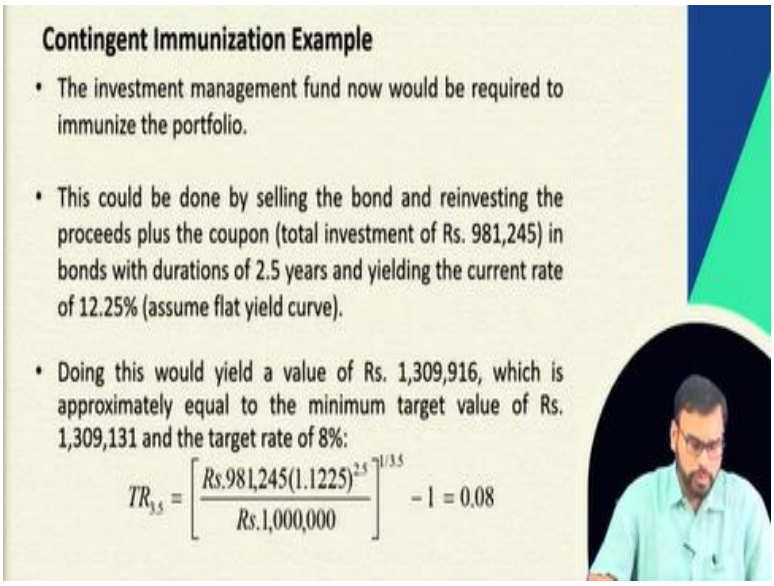

So, what basically we have seen here if they are going for the immunization strategy then their total return, they are getting 8%in that case. So, the investment management fund now would be required to immunize the portfolio. If they want to immunize the portfolio the total return the investor is going to get that is basically 8%.

$TR_{3.5} = \left(\frac{Rs\ 981245\ (1.1225)^{25}}{1000000}\right)^{1/3.5} - 1 = 0.08$

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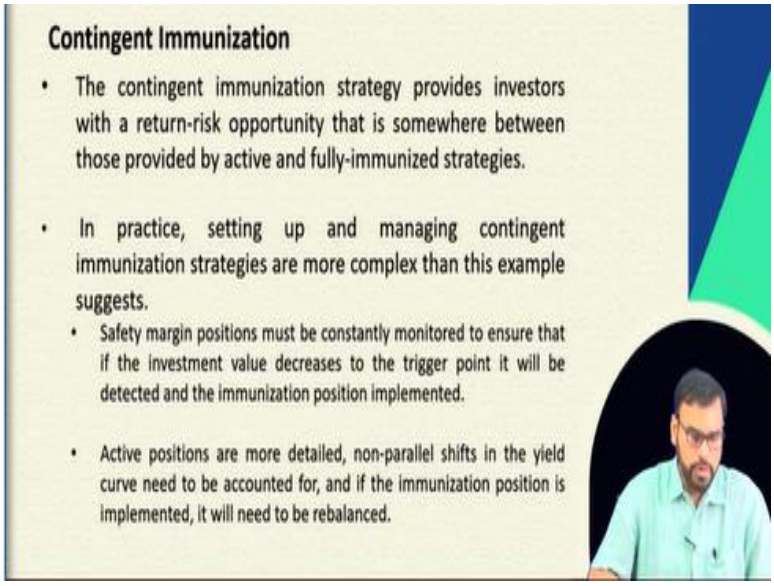

So, this basically provides the investor with a return risk opportunity that is somewhere between those provided by the active or fully immunized strategy. In practice setting up and managing the contingent immunization strategies generally are more complex than the example whatever we

have considered here. So, the safety imagine positions must be constantly monitored to ensure that if the investment values decreases to the trigger point it will be detected and the immunization position will be implemented.

And active positions are more detailed non parallel shift in the yield curve need to be accounted for also. So, if the immunization position is implemented it will also need to be rebalanced. If the yield curve is not basically shifting of the yield curve is not parallel.

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So, what we have discussed immunization basically is a strategy of minimization of the market risk which will offset the price risk with the reinvestment risk. Immunization positions require some active management which is called the rebalancing to ensure that the duration of the bond position is always equal to the remaining time to the horizon. Then the contingent immunization is an enhanced immunization strategy which combines the active management strategy to achieve the higher returns and immunization strategies to ensure a floor.

That is what about this particular passive or we can say that hybrid strategy what generally we use for the bond investment.

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These are the references. Thank you.