# Management of Fixed Income Securities
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## Lecture - 58
## Fixed Income Securities Derivatives -III

Welcome back, so in the previous session we discussed about another derivatives instrument that is called the options and there are different type of options which are traded in the market.

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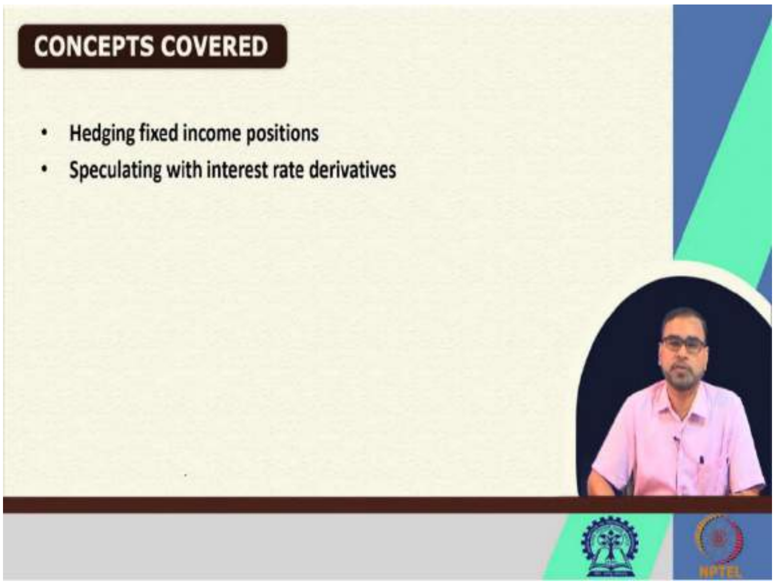


So, in today's session we will be discussing about the how these particular futures and options are generally used by the investors to minimize or to hedge their risk or to maximize their return or how the derivatives also can be used for some kind of speculative reasons. So, therefore there are two broad concepts what we are going to discuss in today's session, one is how the fixed income positions particular derivative positions are utilized for the hedging.

And another one is how the interested derivatives can be used for this speculation. So, these are the two major concepts what will be discussing in today's session.

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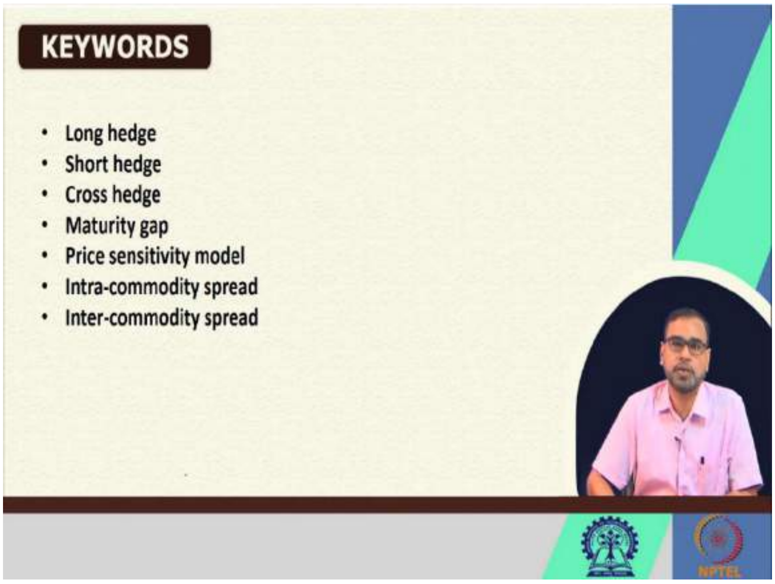


So, there are many keywords we will come across while discussing these two issues, like you have long hedge, you have short hedge, your cross hedge, your concept of maturity gap, your concept of price sensitivity model, then you have intra commodity spread, inter commodity spread all kinds of things basically. These are the major keywords that will come through or we will always see while discussing about these particular topics.

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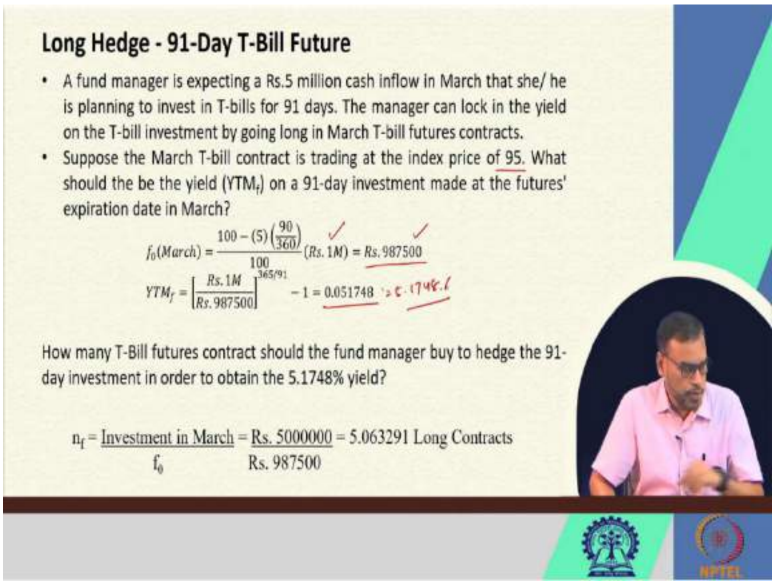


$F_0(\text{March}) = \frac{100-(5)\left(\frac{90}{360}\right)}{100}\ (Rs\ 1M) = Rs\ 987500$

$YTM_f = \left[\frac{1M}{Rs\ 987500}\right]^{365/91} - 1 = 0.051748$

$N_f = \frac{investment\ in\ march}{f_0} = \frac{Rs\ 5000000}{Rs\ 987500} = 5.063291$ long contracts

Let us start with the concept, because in the beginning what in the first session we have discussed whenever we started the discussion derivatives, one of the major uses of the futures and options basically if you see to use it for the hedging purpose. And there are two types of hedging we have discussed that one is called the long hedge another one the short hedge. So, today we will see that how this long hedge concept can be utilized using the 91 days t-bill future.

Then, gradually we can go ahead with the other fixed income securities which are available with us. Late a fund manager is expecting a 5 million cash flow in March, what he or she is planning to invest in T-bills for 91 days. So, the manager can lock the yield on the T-bill investment by going long in March T-bill future contract. Long in the sense they can buy the March T-bill future contract. Suppose, the mars T-bill contract is trading in the index price of 95.

What should be the yield on a 91-investment made at the future expiration date in March, let you are trying to find out. So, then the future price will be already you know that that is your 100 - your discount rate will be 5% that is means 5 into 90 by 360-day count convention divided by 100 into 1 million, you will get your 987500. So, now if you want to find out the yield from that the yield will be your face value will be 1 million.

And your $f_0$ will be your 987500 to the power 365 by 91 - 1 that will give you 5.1748%. So, how many T-bills future contract should the fund manager buy to hedge this 91day investment in order to get this 5.1748% yield? So, then obviously the total investment value they are going to make 5 million, the 5 million divided by the future price that is 987500 that will give you 5.063291 long contracts, approximately the 5 you can say that, but in actual sense it will be 5.063291.

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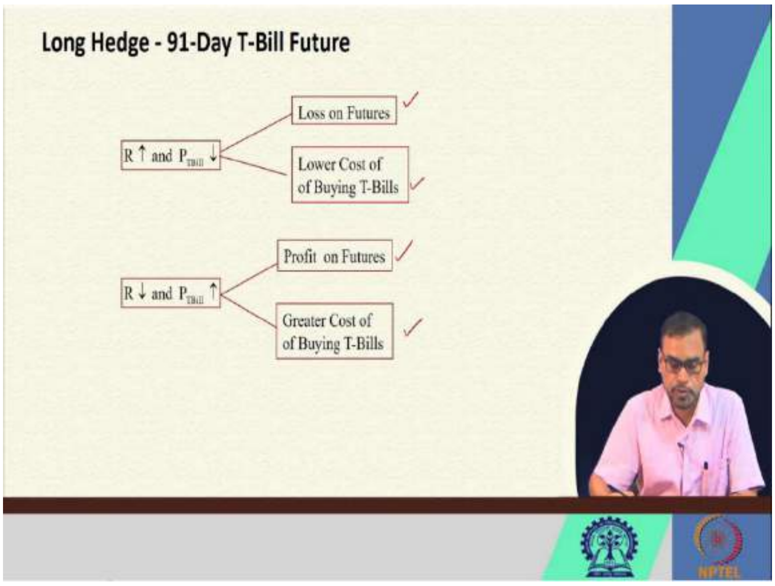

So, then what will happen what is the process, for example if there is a change in interest rate then what is going to happen to that particular position. Let this interest rate has gone up then the price of the T-bill will go down, then in that case there will be loss in the future market and there is a lower cost of buying the T-bill in the spot market. But the interest rate is declining and the price of the T-bill is increasing then obviously there will be profit in the future because they have taken a long position.

And obviously there is a greater cost of the buying the T-bills. So, they are going to lose something in the spot T-bills market. So, that is the basic logic of utilizing that particular hedging position.

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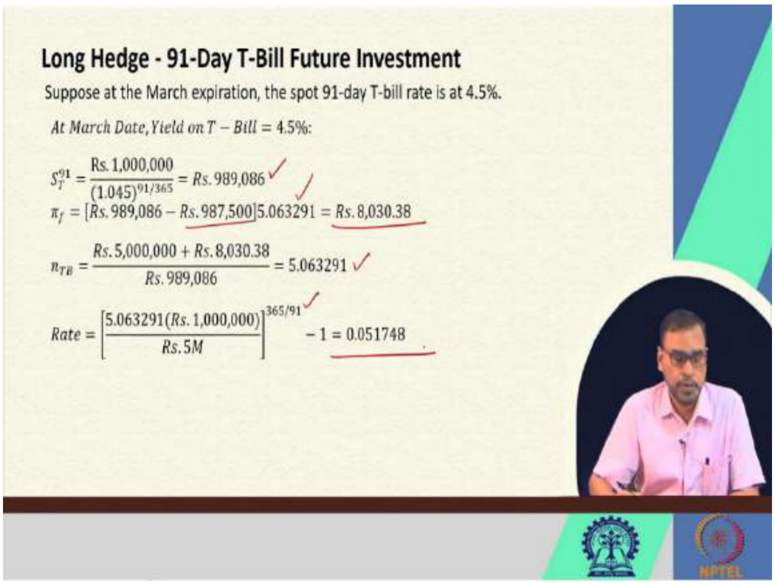


$S_T^{91} = \frac{Rs\ 1000000}{(1.045)^{91/365}} = Rs\ 989{,}086_f$

$\pi_f$= [Rs 989,086-Rs 987500]5.063291= Rs 8,030.38

$n_{TB} = \frac{Rs\ 5000000 + Rs\ 8030.38}{Rs\ 989{,}086} = 5.063291$

Rate= $\left[\frac{5.063291(Rs\ 1000000)}{Rs\ 5M}\right]^{365/91}$-1= 0.051748

So, let us if you explain it then what basically will happen? Let, we take the two-hypothetical situation. Suppose, at the March expiration this spot 91-day T-bill rate is 4.5% that means the yield on the T-bill is 4.5%. So, if you want to calculate the 91-day T-bill spot price then it will be your what we can say that 1 million divided by 1.045 to the power 91 by 365 that will give you 989086.

So, the profit will be your 989086 minus this is the $f_0$ value whatever already we have calculated that is 987500. And this is the number of contracts that is 5.063291 then, this much profit basically you can generate that is 8030.38. So, if you talk about the number of T-bills then it will be again your 5 million plus your 8030.38 divided by 989086, that will give you also 5.063291.

So, the rate if you want to calculate, yield basically whatever you are getting that is your 5.063291 into 1 million divided by 5 million to the power 365 by 91 - 1 that will give you 5.1748%.

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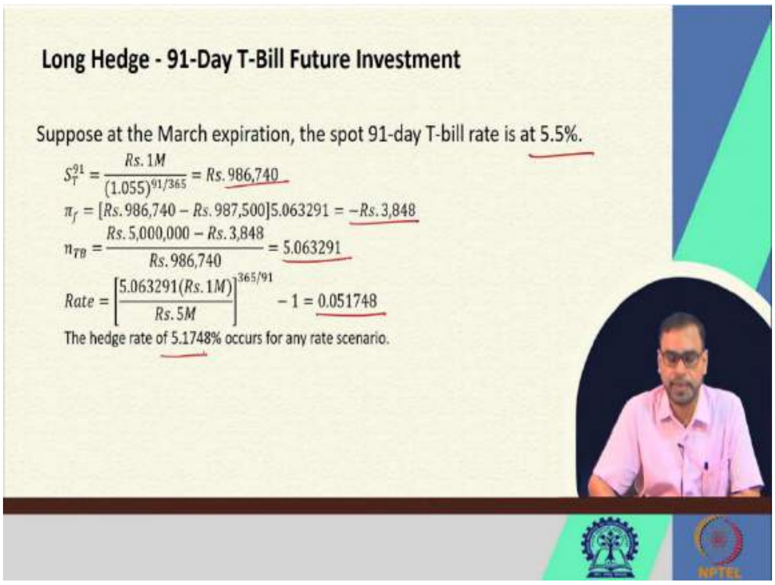


$S_T^{91} = \frac{Rs\ 1000000}{(1.055)^{91/365}} = Rs\ 986{,}740$

$\pi_f$= [Rs 986,740-Rs 987500]5.063291=- Rs 8,030.38

$n_{TB} = \frac{Rs\ 5000000 - Rs\ 3848}{Rs\ 986{,}740} = 5.063291$

Rate= $\left[\frac{5.063291(Rs\ 1000000)}{Rs\ 5M}\right]^{365/91}$-1= 0.051748

But if you take a reverse position also let the interest rate the T-bill rate become 5.5%, in this case also if you observe then your price has changed it has become 986740. Then, profit become negative then if you calculate the number of T-bills that will become also 5.063291, then your rate also exactly same that will be 5.1748. So, in either of these cases both the interest rate scenario the hedge rate will be basically 5.1748%.

So, whether your T-bill rate is going to be increasing or going to be declining both the cases basically, the yield basically is hedged out or the return is basically hedged out. So, that is what basically the concept of hedging using this 91 days T-bill future contract whatever we have taken into account.

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Then, in this example what basically the investor has done, the investor has locked in the yield on the T-bill investment by going long in the March T-bill future contract. Suppose, the investor expects higher short-term interest rate in March but was still concerned about the possibility of the lower rates. Then to gain from the higher rates and yet still hedge against the lower rate, the investor could alternatively also buy the March call options on the T-bill futures. That is also another possibility that you can always think of.

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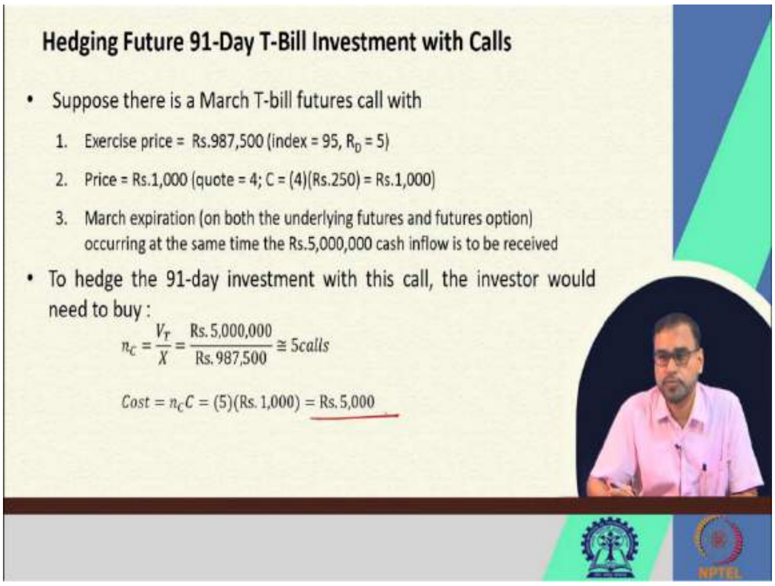

$n_c = n_{TB} = \frac{V_r}{X} \frac{Rs\ 5000000}{Rs\ 987{,}500} = 5 calls$

cost= $n_c C$= (5) (Rs 1,000)= Rs 5,000

If you are going to hedge this 91 days treasure bill investment with calls then what basically you can do suppose, the March T-bill future calls the exercise price is let 987500, index is let 95 that means your discount rate is 5% and price = let 1000 which is quote as 4 and C = that means 4 into 250 that is 1000. The March expiration occurring at the same time as the 5 million cash flow is to be received.

So, to hedge these 91 days investment with this call then investor has to buy, how many call options they have to buy your 5 million divided by 987500 that means approximately five calls. So, the cost will be basically your 5 into 1000 that is the premium basically what they are going to pay that is 5000 then, what will happen?

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If you are going the different scenario, on the basis of the different spot rates. Let the spot discount rates are changing it was 5 then it became let 4.75, 4.5, 4.25, 4, 3.75 like that accordingly, your spot price or the future price is going to be changed and the cash flows are going to be changed. Then if you are calculating the hedged investment fund that is your 5 million plus this.

Then the number of T-bills basically what they are going to always invest in that case that is basically is calculated in this case that is this divided by your column 2, then accordingly your YTM is calculated. So, the cash flow is basically nothing but five into the max of the $f_t$

minus your 987500 and 0 and YTM is equal to your number of bills into your 1 million in divided by 5 million to the power 365 by 91.

So, if you look at this particular table you will find that for the cost of the call options the investor is able to establish a floor by locking a minimum YTM on the 5 million March investment which is approximately your 5.16%. With a chance to earn a higher rate of return, if the short-term rates are increasing if the short-term rates are increasing, they may get more return.

But even if this short-term rates are declining the minimum return they are going to get from this that is 5.16%. If they will go for this utilizing these call options to hedge their interest rate fluctuations or interest rate yield or the yield what they are going to expect from this. So, mostly the yield to maturity they have logged it at 5.16%.

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Like that if you see that what basically we have explained if the T-bill were lower at the March expiration, then the investor would profit from the calls and could use the profit to defray part of the cost of the higher price T-bills. And if the spot discount rate on the T-bills is 5% or less, then the investor would be able to buy the 5.06 spot T-bills with the 5 million cash inflow and cash flow from the future calls locking a YTM for the next 91 days of approximately bills of approximately 5.16% on the 5 million investment which exclude this cost of the calls.

And other hand if the T-bill rates are higher then, investor would benefit from the lower spot prices while her losses on the call would be limited to just rupees 5000 cost of the call and for discount rates above 5% the investor or the treasurer would be able to buy more T-bills the higher rates resulting the higher yields as the rates are increasing.

So, this is what we have just now explained from the table. So, this is the way basically the calls can be utilized for this hedging purpose.

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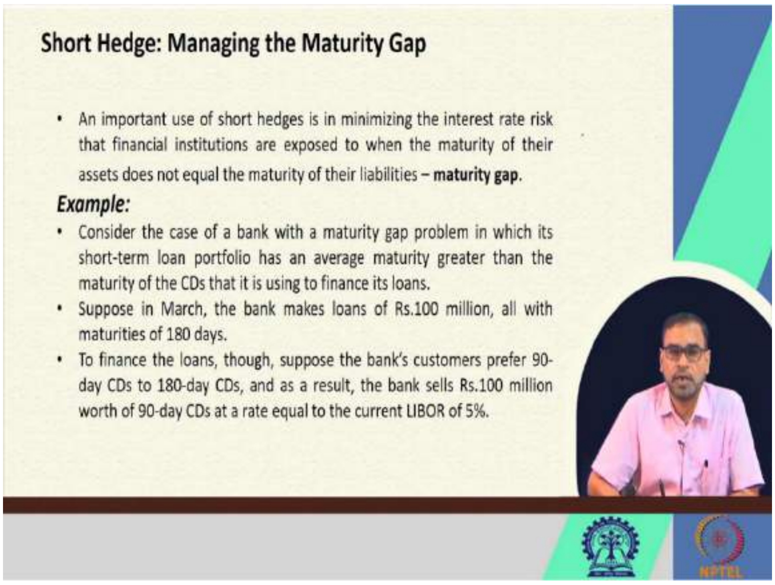


Then this is about the long hedge then we have a short hedge. Generally, the short hedge is used for managing the maturity gap. So, what exactly the maturity gap is, the maturity gap basically is nothing but when the maturity of the assets does not equal to the maturity of the liabilities. That generally happens with banks and many other financial institutions where their maturity of the assets and maturity of the liabilities never match.

So, in that case this short hedge has a kind of strategy what they can adopt to minimize the interest rate risk. For example, if you say bank with a maturity gap problem in which it is short term loan portfolio has an average maturity which is greater than the maturity of the certificate of deposits, then they are using to finance it is loans then suppose in March, the bank makes a loan of 100 million all with maturity of 180 days.

To finance these loans let suppose the banks customer prefer 90 days certificate of deposits to 180 days certificate of deposits. So, then what will happen the bank sells 100 million worth of 90-day series at a rate equal to the current LIBOR + 5%. Let we have of 5% that we have assumed.

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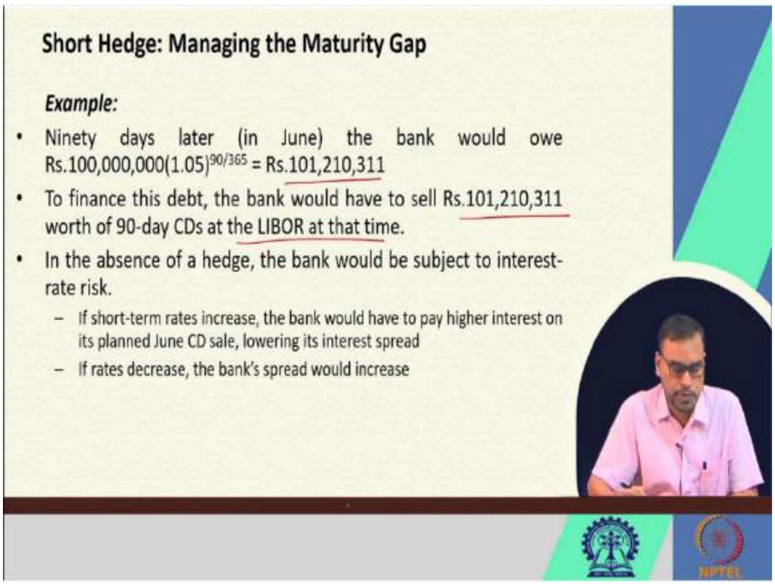


Rs 100,000,000$(1.05)^{90/365}$= Rs 101,210,311

So, then what will happen the 90 days later, let we have started in March, then in June the bank could basically owe that 100 million into 1.05 to the power 90 by 360. Then they will get this amount that Rs. 101,210,311 that is basically they will owe. To finance this debt the bank would have to sell this Rs. 101,210,311 worth of 90-day CDs at the LIBOR at that particular time. So, in the absence of a hedge the bank is basically subject to interest rate risk.

How? If the short-term rate increases, then the bank would have to pay higher interest on it is planned June CD sale, lowering it is interest rate spread. If the rates are declining, then the bank spread would basically increase. So, in that case they are exposed to certain interest rate risk in the market.

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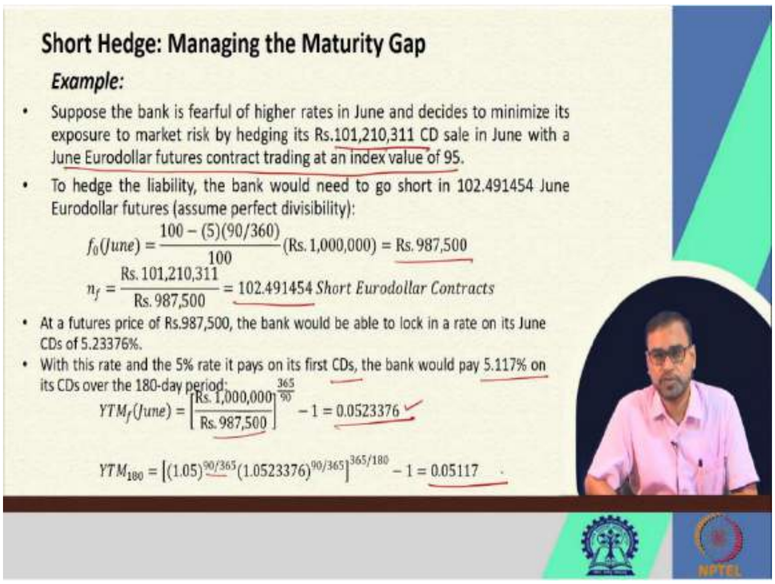

$F_0$(june)= $\frac{100-(5)\left(\frac{90}{360}\right)}{100}$ $(Rs\ 1M) = Rs\ 987500$

$N_f$= = $\frac{Rs\ 101{,}210{,}311}{Rs\ 987500}$= 102.491454 short Euro dollar contracts

$YTM_f$(June)= $\left[\frac{1M}{Rs\ 987500}\right]^{365/90}$-1 = 0.0523376

$YTM_{180}$= $[(1.05)^{90/365}(1.0523376)^{90/365}]^{365/180}$-1= 0.05117

So, to avoid that particular risk, what they can do they can always go for the short hedging. So, suppose the bank is very much fearful about higher rates in June and decides to minimize exposure to market risk by hedging this Rs. 101,210,311 CD sale in June with a June Eurodollar future contract trading an index value of 95. So, then what the bank has to do, they hedge the liability the bank would need to go short of 102.491454 June Eurodollar futures.

How we got this? That your $f_0$ will be 100 - 5 into 90 by 360 by 100 into 1 million, that will be Rs. 987500. Then, these value that Rs. 101,210,311 divided by 987500 that you will get 102.491454 short Eurodollar contracts. Then, at the future price of 987500 the bank would be able to lock in a rate on it is June certificate of deposit with a yield of 5.2337%. With this rate and the 5% rate it pays on it is first CDs the bank would pay this much percentage on it is CDs over the 180 days period.

How we got this? We got this $YTM_f$ in the month of June that is your 1 million divided by 987500 to the power 365 by 90 - 1 that will give you this 5.23376%. Then, your YTM 180 would be how much 1.05 to the power 90 by 365 into 1.0523376 into 90 by 365 whole to the power 365 by 180 - 1 that will give you 5.117%.

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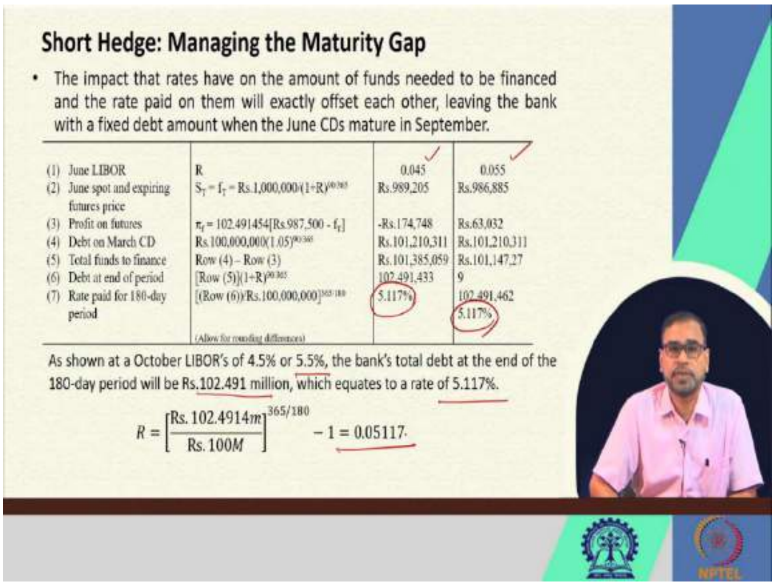

R= $\left[\frac{Rs\ 102.4914m}{Rs\ 100M}\right]^{365/180}$-1 = 0.05117

So, if you look this then the impact that the rates have on the amount of funds needed to be financed and the rate paid on them will exactly offset each other leaving the bank with a fixed debt amount when the June CDs is matured in the September. So, if you look at this calculation this let the LIBOR rate have changed from 5% to 4.5% or 5.5%. In two scenarios if you look at you will find that in both the cases you will find a yield of 5.117%.

So, at October LIBORs of 4.5% or 5.5% the banks total debt at the end of 180 day period will be 102.49 million which basically always equal to this 5.117%. So, finally the yield basically what they are expecting, they are basically getting that thing then by that they are able to hedge their particular risk in the market.

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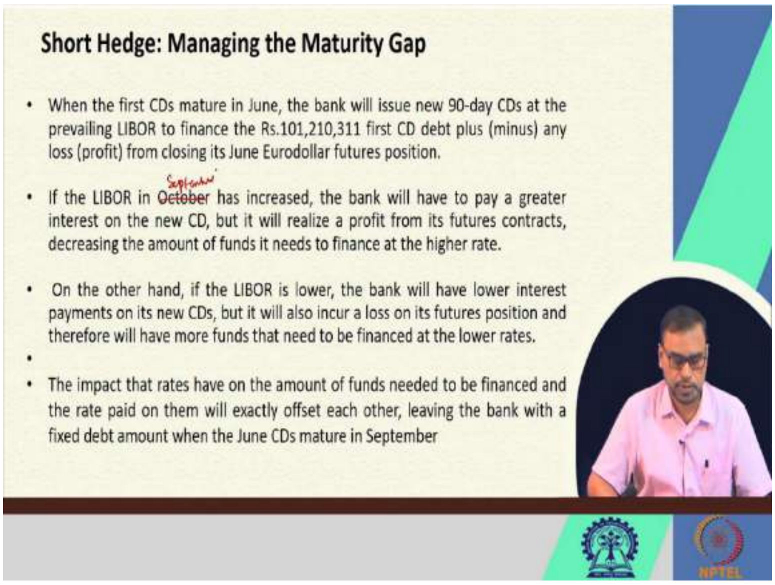


So, this is what is explained here so, when the first CD matures in June, the bank will issue the new 90 days CDs are the prevailing LIBOR to finance the Rs. 101,210,311 first CD debt plus or minus of any loss if there is anything from closing its June Eurodollar future positions. Then, in the LIBOR in October has increased then the bank will have to pay greater interest on the new CD, but it will realize a profit from it is future contract decreasing the amount of funds it needs to finance the higher rate.

On the other hand, if the LIBOR is lower then, the bank will have the lower interest payments on it is new CDs, but it will also incur a loss on future positions and therefore will have more funds that need to be financed at the lower rates. Then, the impact that have on amount of funds needed to be financed and the rate paid them will be exactly offset each other, leaving the bank with a fixed debt amount in the June CDs which will be matured in the month of September.

So, this is basically September. So, this is the way basically we have to explain that how the short hedging principal basically works in that particular case.

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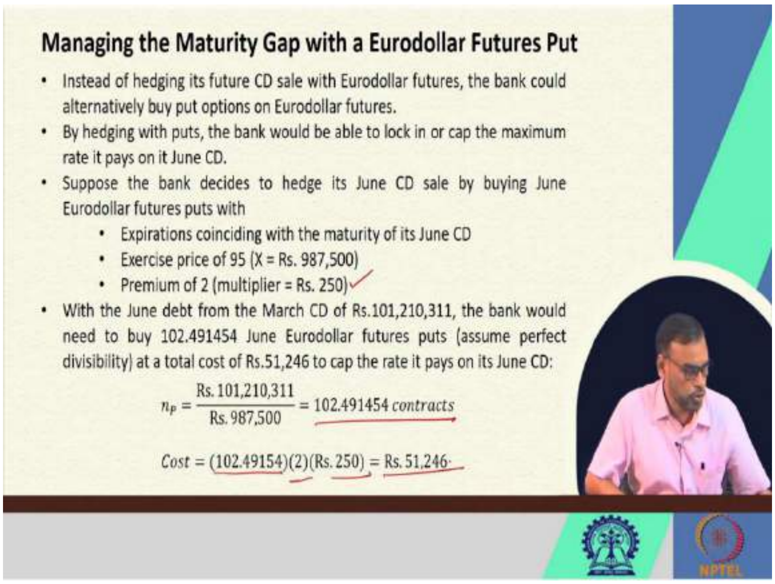


$n_p = = \frac{Rs\ 101{,}210{,}311}{Rs\ 987500} = 102.491454$ contracts

Cost= (102.49154)(2)(Rs 250)= Rs 51,246

So, this maturity gap also can be managed with Eurodollar futures put options. So, in that case the bank could alternately buy a put option on the Eurodollar futures. By hedging with puts, the bank would be able to lock in or cap the maximum rate what it pays it is on the June CDs. Suppose, the bank decides to hedge it is June CD sale by buying the June Eurodollar futures with a expiration which is coinciding with the maturity of the June CD.

Then exercise price of 95 then, your X = 987500 that already we have calculated, premium of 2 (multiplier of 250). Then how much future contracts are future puts the bank need that is Rs. 101,210,311 divided by 987500. So, this much contracts they need and what is the cost the cost is 102.491454 into 2 into 250. So, that will basically give you the 51,246, so that is basically the cost.

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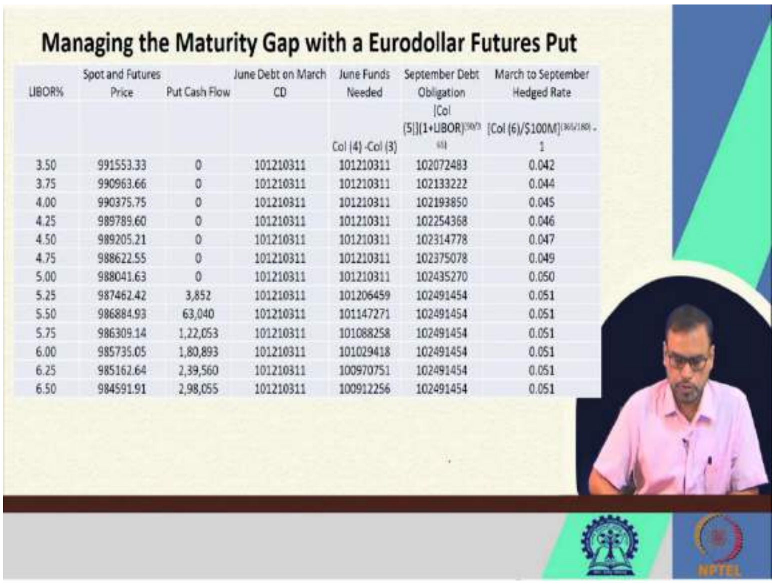


| LIBOR% | Spot and Futures Price | Put Cash Flow | June Debt on March CD | June Funds Needed | September Debt Obligation | March to September Hedged Rate |
|---|---|---|---|---|---|---|
| | | | | Col (4) -Col (3) | [Col (5)](1+LIBOR)$^{(90/365)}$ | [Col (6)/$100M]$^{(365/180)}$ - 1 |
| 3.50 | 991553.33 | 0 | 101210311 | 101210311 | 102072483 | 0.042 |
| 3.75 | 990963.66 | 0 | 101210311 | 101210311 | 102133222 | 0.044 |
| 4.00 | 990375.75 | 0 | 101210311 | 101210311 | 102193850 | 0.045 |
| 4.25 | 989789.60 | 0 | 101210311 | 101210311 | 102254368 | 0.046 |
| 4.50 | 989205.21 | 0 | 101210311 | 101210311 | 102314778 | 0.047 |
| 4.75 | 988622.55 | 0 | 101210311 | 101210311 | 102375078 | 0.049 |
| 5.00 | 988041.63 | 0 | 101210311 | 101210311 | 102435270 | 0.050 |
| 5.25 | 987462.42 | 3,852 | 101210311 | 101206459 | 102491454 | 0.051 |
| 5.50 | 986884.93 | 63,040 | 101210311 | 101147271 | 102491454 | 0.051 |
| 5.75 | 986309.14 | 1,22,053 | 101210311 | 101088258 | 102491454 | 0.051 |
| 6.00 | 985735.05 | 1,80,893 | 101210311 | 101029418 | 102491454 | 0.051 |
| 6.25 | 985162.64 | 2,39,560 | 101210311 | 100970751 | 102491454 | 0.051 |
| 6.50 | 984591.91 | 2,98,055 | 101210311 | 100912256 | 102491454 | 0.051 |

So, if you look at this particular table, you will find that in the different LIBOR rate scenario how these particular rates are or the yields are basically hedge rates are changing. So, if you analyse this particular table what basically you will find.

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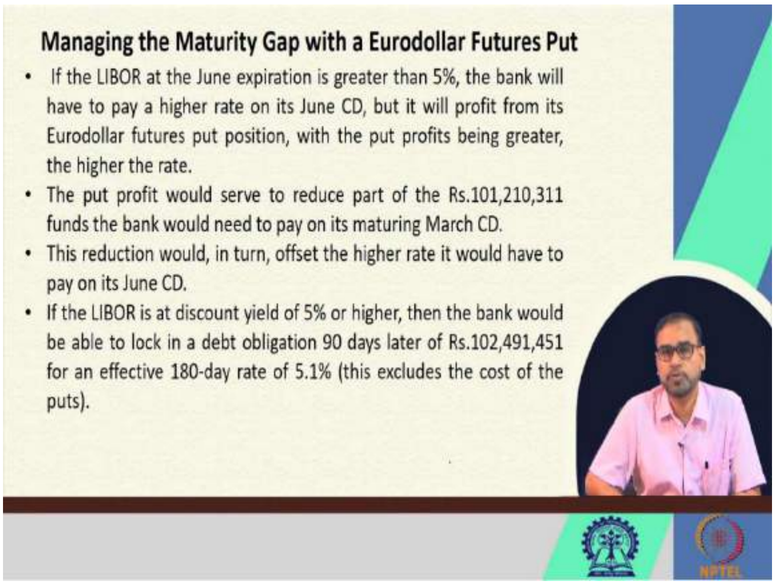


That if the LIBOR rate or the June expiration is greater than 5%, then the bank will have to pay a higher rate on it is June certificate of deposit, but it will profit from its Eurodollar future put options or future put position, with the put profits being greater, the higher is the rate. And then the put profit would serve to reduce the part of the Rs. 101,210,311 funds the bank would need to pay on its maturing March CD.

This reduction would in turn offset the higher rate it would have to pay on it is June CD. So, if the LIBOR is at discount yield of 5% or higher then, the bank would be able to lock in the debt obligation of 90 days later of Rs. 102,491,451 for an effective 180 day of rate of 5.1% which exclude the cost of the puts, that already we have calculated.

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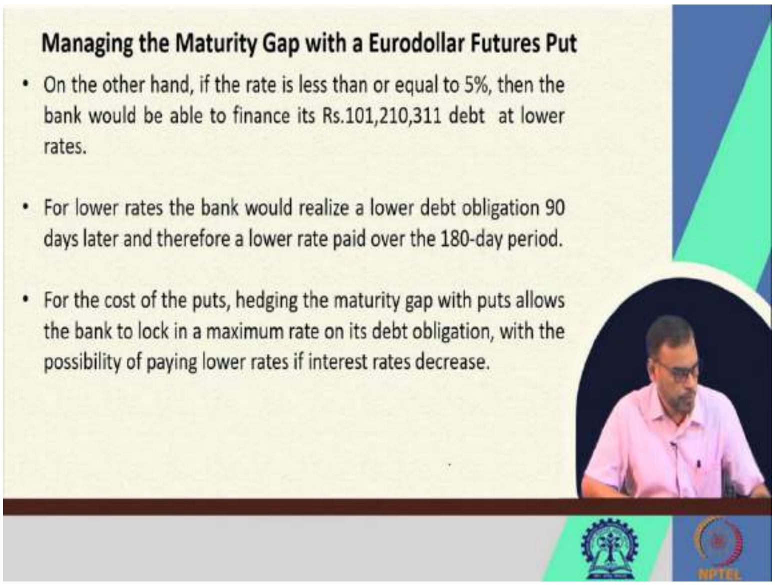


So, then what we have seen in this case if the rate is less than or equal to 5% then the bank would be able to finance this much particular money that is Rs. 101,210,311 debt at lower rates. And for lower rates the bank would realize a lower debt obligation then, the 90 days later and therefore the lower rate paid over 180-day period. For the cost of the puts, hedging the maturity gap with the puts allows the banks to lock in a maximum rate on it is debt obligation, with the possibility of paying a lower rate if the interest rates decrease.

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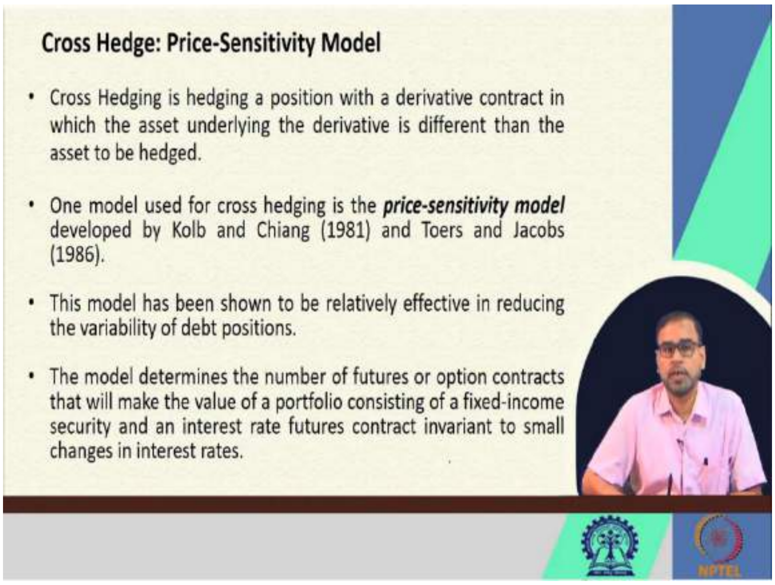


Then another concept we have that is called the cross hedge. Generally, we call it the price sensitivity model. What is cross hedge? Cross hedge is basically a hedging position with a

derivative contract where the asset underlying the derivative is different than the asset which is going to be hedged. So, this one particular model used for the cross hedging is the price sensitivity model which is developed by Kolb and Chiang and Toers and Jacobs in 1986.
The model is generally shown to be relatively effective in reducing the variability of the debt position. And this model generally determines the number of futures or option contracts that will make the value of a portfolio consisting of the fixed income security and an interest rate futures contract invariant to small changes in the interest rate.

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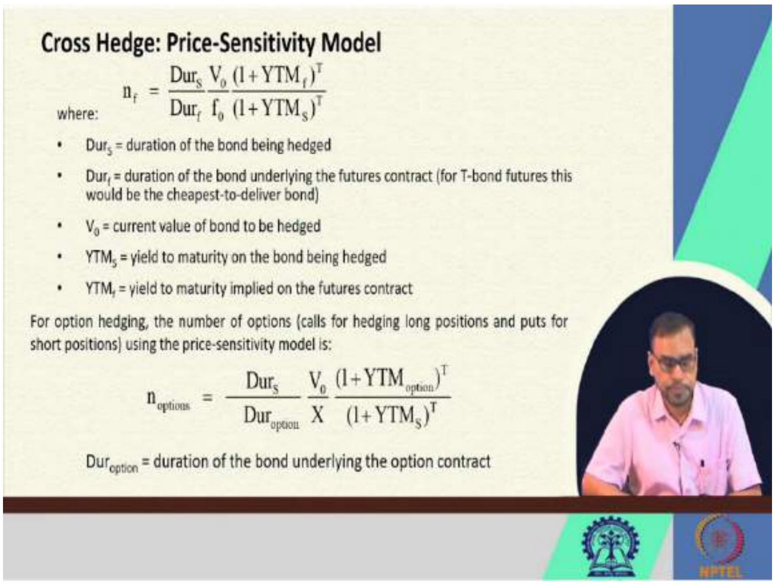


$$n_f = \frac{Dur_S}{Dur_f} = \frac{V_0}{f_0}\frac{(1+YTM_f)^T}{(1+YTM_S)^T}$$

$$n_{options} = \frac{Dur_S}{Dur_{option}} = \frac{V_0}{X}\frac{(1+YTM_{option})^T}{(1+YTM_S)^T}$$

So, what is the formula for this price sensitivity model? So, your $n_f$ basically we are trying to find out the number of contracts what we need. So, it is the $Dur_s$ into $V_0$ (1 + $YTM_f$) to the power T divided by $Dur_f$ into $f_0$ (1 + $YTM_s$) to the power T. So, $Dur_s$ means it is the duration of the bond being hedged, $Dur_f$ means duration of the bond underlying the future contract and your $V_0$ represents the current value of the bond which is going to be hedge.

And $YTM_s$ is the yield to maturity on the bond which is being hedged and $YTM_f$ is basically yield to maturity implied on the future contract. So, for the option hedging the number of options calls for hedging long position and puts for short position using the price sensitivity model if, you want to calculate. Number of options will be your $Dur_s$ divided by $Dur_{option}$ into

$V_0$ by X into (1 + $YTM_{option}$) to the power T divided by (1 + YTMs) to the power T and duration of option means duration of the bond underlying the option contract.

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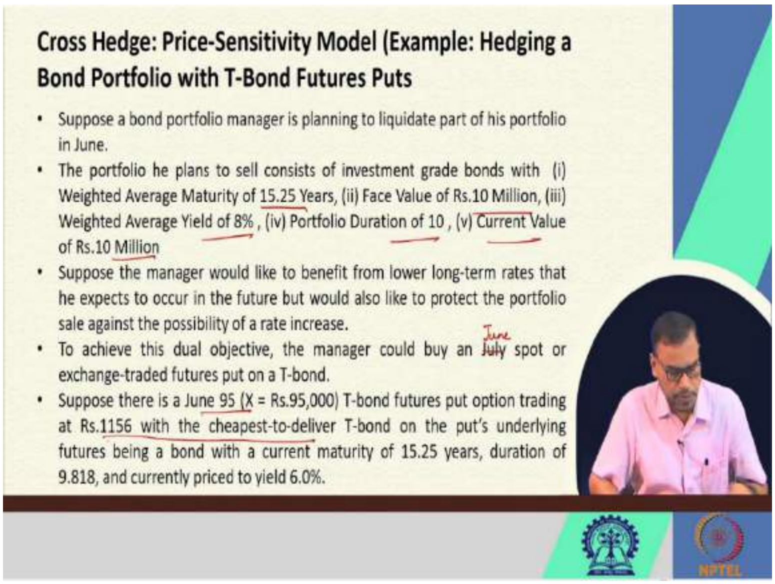


So, if you talk about the example of a bond portfolio with T-bond futures puts. Suppose, a bond portfolio manager is planning to liquidate parts of it is portfolio in June. Then the portfolio what he or she plans to sell consists of late investment grade bonds with weighted average maturity of 15.25 years, face value of 10 million and weighted average yield of 8% and portfolio duration of 10 and current value of 10 million dollars.

So, suppose the manager would like to be benefit from the lower long-term rates that he expects to occur in the future. But also, would like to protect the portfolio sale against the possibility of interest rate declining. So, then to achieve this dual objective the manager could buy on spot or extended future put on a T-bond. So, in this case suppose there is a June 95 T-bond future put option trading at Rs. 1156 with the cheapest to deliver T-bond on the put's underlying futures being a bond with a current maturity of 15.25 years.

The duration of 9.818 and currently price start price to yield of 6%. So, what basically will happen in that case here this is basically June spot. So, because we are dealing with this June T-bond future contract which is T-bond future put option which is trading in the market.

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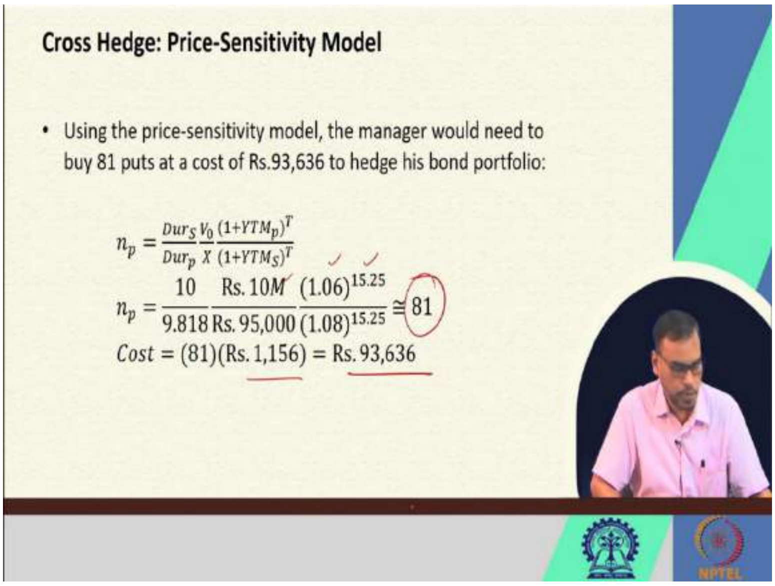


$$n_p = \frac{Dur_S}{Dur_p} = \frac{V_0}{X}\frac{(1+YTM_p)^T}{(1+YTM_S)^T}$$

$$n_p = \frac{10}{9818} = \frac{Rs\ 10M}{Rs\ 95000}\frac{(1.06)^{15.25}}{(1.08)^{15.25}} = 81$$

cost= (81) (Rs 1,156)= Rs 93,636

So, in that case what will happen? Using this price sensitivity model, the manager would need to buy 81 puts at a cost of this to hedge this portfolio. And how we call we can get this? 81 your $n_p$ is equal to your duration of the formula we can put it there. So, that will be your 10 into divided by 9.818 into 10 million divided by 95,000 into 1.06 to the power 15.25 divided by 1.08 to the power 15.25, these figures are all given to you then we got 81 then the total cost would be 81 into 1156 that will give you Rs. 93636.

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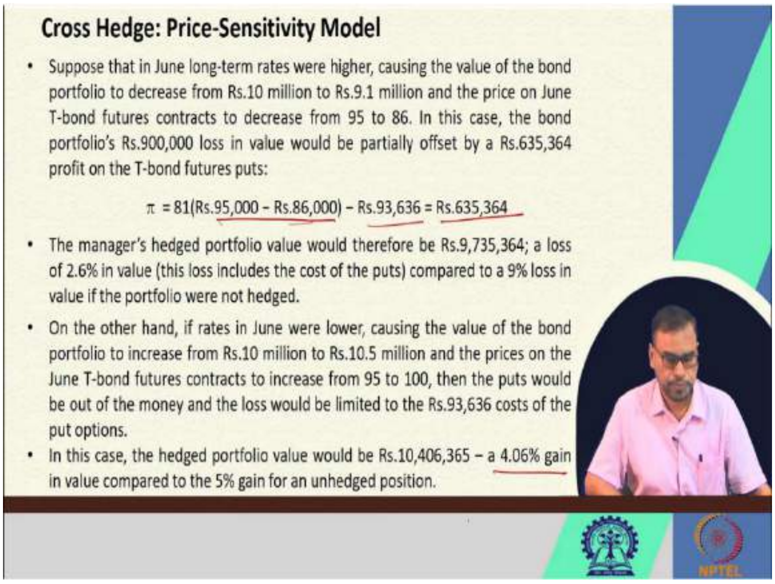


$\pi$=81(Rs 95000-Rs 86000)- Rs 93,636= Rs 635364

So, suppose the June long term rates were higher causing the value of the bond portfolio to decrease from 10 million to 9.1 million and the price of June T-bond future contract would decrease from 95 to 86. In this case the bond portfolios this 9 lakh loss in value would be partially offset by Rs. 63536 for profit on the T-bond future puts and how we can get this profit then the profit is pi = your 81 into 95,000 – 86,000 - your 93,636 that will give you 635364.

So, the manager says portfolio value would therefore be Rs. 9,735,364 a loss of 2.6% in value compared to a 9% loss in value the portfolio were not hedged. So, if the rates in June were lower causing the value of the bond portfolio to increase from 10 million to 10.5 million, then the price on the June T-bond future contracts to increase from 95 to 100 and the put would be out of the money and the loss would be limited to Rs. 93636 costs of the food option.

So, in this case the portfolio value would be Rs. 10,406,365 that means a 4.06% gain in value the compared to the 5% gain for unhedged positions.

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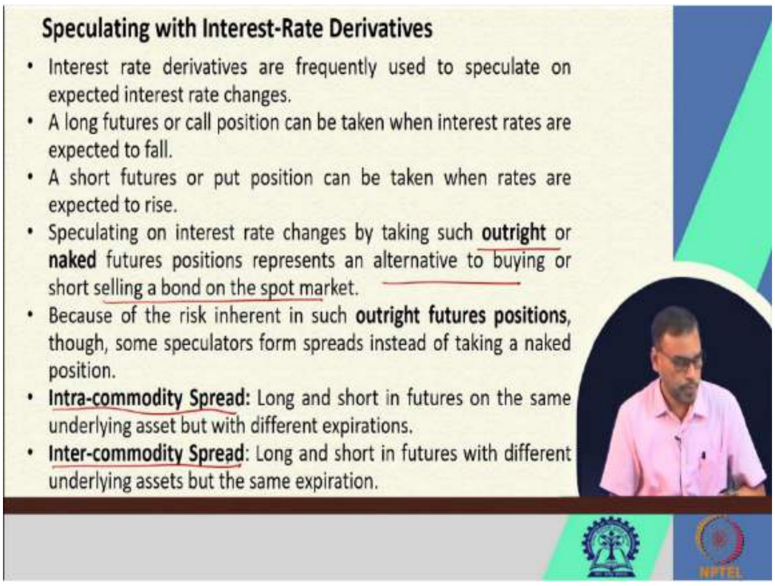


We can also use the derivative instrument for speculation. So, a long future or call position can be taken when the interest rates are expected to fall or a short future or put option can be taken when the interest rates are expected to rise. The speculating or interest rate changes by taking such outright or the naked futures positions represents an alternative to buying or selling a bond on the spot market.

Because of some risk which are inherent of such outright future positions some speculators form the spread instead of taking a naked position. These are called basically one spread is intra commodity spread another one is inter commodity spread. In case of intra commodity spread the long and short in futures on the same underlying asset what with the different expiration date.

And the inter commodity spread means long and short in futures with different underlying asset what with the same expiration.

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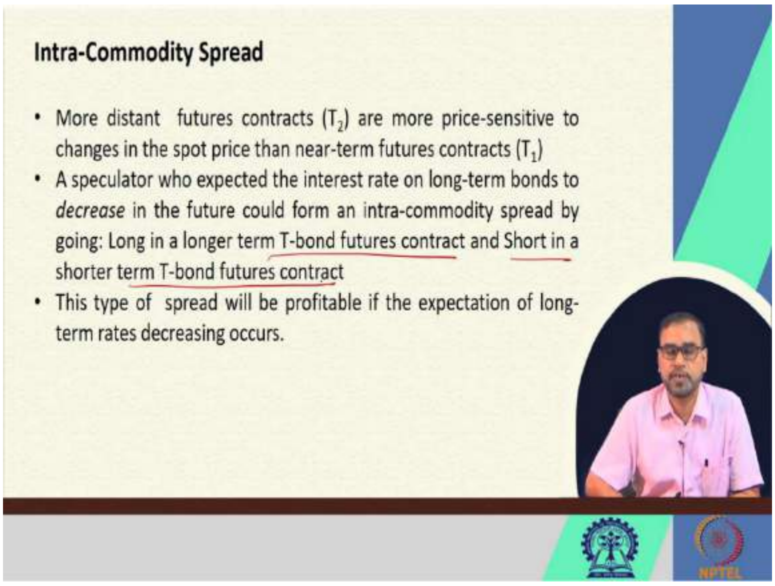


So, more distant future contracts are more price sensitive to changing the spot price than the near-term future contract. So, the speculator who expected that interest rate on a long-term bond to decrease in the future could form an intra commodity spread by going long in a longer-term T-bond future contract and short in a shorter-term T-bond future contract. So, this type of spread will be profitable if the expectation of long-term rates decreasing occurs over the time.

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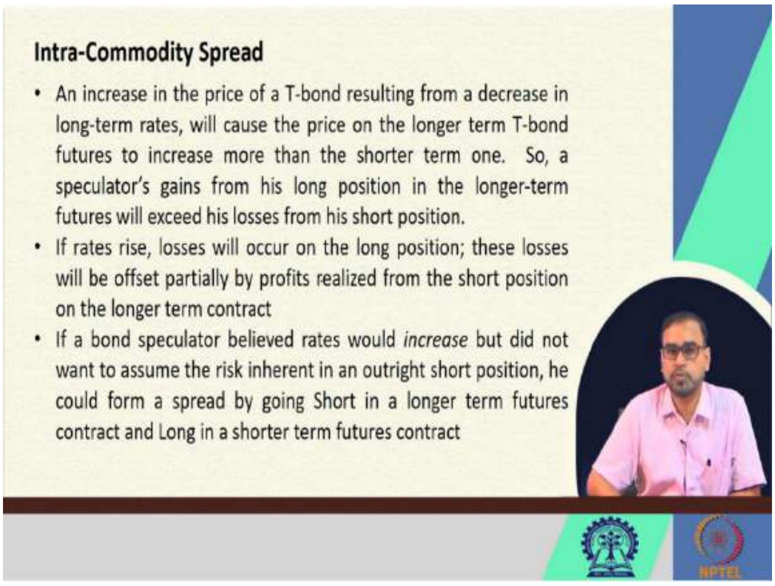


So, as an increase in the spot the price of a T-bond resulting from a decrease in the long-term rates will cause the rise on the longer-term T-bond futures to increase more than the short term bond. So, speculators gain from the long position in the longer-term future will exceed the losses from his short positions. If the rates rise, losses will occur on the long position and these losses will be offset partially by the profits realized from the short position on the longer term contract.

So, if the bond speculator believes the rates would increase but did not want to assume the risk inherent in an outright short position. Then, the investor could form a spread by going short in longer term futures contract and long in a shorter-term future contract.

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Inter commodity spread is basically consists of long and short position on future contract with the same expirations, but with the different underlying asset. Such spreads can be used to form two active bond strategies like rate anticipation swap and the quality swap. That bond strategy already to some extent we have discussed whenever you talk about the portfolio strategies for the bond investments.

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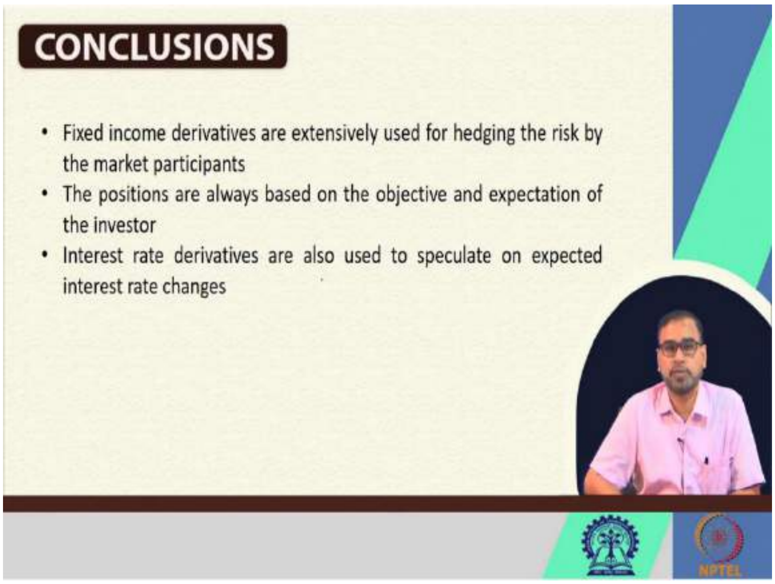


So, what basically we discussed, we discussed that fixed income derivatives are extensively used for hedging the risk by the market participants. The positions are always based on the objective and expectation of the investor and the interested derivatives are also used to speculate on expected interest rate changes. Whenever there is a change in interest rate the speculation concept also or the investor can be speculative in terms of using the derivatives instrument or always try to maximize the return by utilizing the derivatives instrument.

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So, these are the references you can see. Thank you.